Appendix A

Initial Study/Notice of Preparation

Appendices

This page intentionally left blank.

California Environmental Quality Act – Notice of Preparation

Date: November 8, 2012
To: Responsible Agencies and Interested Parties
Subject: Notice of Preparation of an Environmental Impact Report and Public Scoping Meeting for the Town of Yucca Valley General Plan Update

---

NOTICE IS HEREBY GIVEN that the Town of Yucca Valley has prepared an Initial Study for the Town of Yucca Valley General Plan Update and has determined that an Environmental Impact Report (EIR) is necessary. Pursuant to Public Resources Code Section 21165 and the California Environmental Quality Act Guidelines (CEQA Guidelines) Section 15050, the Town of Yucca Valley is the Lead Agency for the project. The purpose of this notice is (1) to serve as a Notice of Preparation (NOP) of an EIR pursuant to the CEQA Guidelines Section 15082, (2) to advise and solicit comments and suggestions regarding the scope and content of the EIR to be prepared for the proposed project, and (3) to notice the public scoping meeting. Copies of the Initial Study are available for review at the following locations:

Town of Yucca Valley, Planning Division,
58928 Monterey Business Center Drive
Yucca Valley, CA 92284

Yucca Valley Branch Library
57098 29 Palms Highway
Yucca Valley, CA 92284

The document can also be accessed online at http://www.yucca-valley.org.

Notice of Availability: Pursuant to Public Resources Code Section 21080.4 and CEQA Guidelines Section 15082, the Initial Study will be available for a 30-day public review beginning on Thursday, November 8, 2012, through December 10, 2012. The Town, as Lead Agency, requests that responsible and trustee agencies respond in a manner consistent with Section 15082(b) of the CEQA Guidelines. All comments and responses to this Notice of Preparation should be submitted in writing to Shane Stueckle at the Town address above by **Monday, December 10, 2012**.

Scoping Meeting: The Town will conduct a public scoping meeting in conjunction with this NOP in order to present the project and the EIR process and to receive public comments and suggestions regarding the scope and content of the EIR. The meeting will be held:

Wednesday, December 5, 2012, at 5:00 p.m.
Yucca Valley Community Center
57090 29 Palms Highway
Yucca Valley, CA 92284

CLERK OF SUPERVISORS
12 NOV -7 AM 10:46
COUNTY OF SAN BERNARDINO
CALIFORNIA

CLERK OF THE BOARD
Received on: 11/7/12
Remove on: 12/11/12

Planning
(760) 369-6575 x317
Public Works
(760) 369-6579 x308
Building and Safety
(760) 365-0099 x302
Code Compliance
(760) 369-6575 x301
Engineering
(760) 369-6575 x308
Building and Safety
Inspections
(760) 365-1339
FAX (760) 228-0084

The Town of
Yucca Valley
COMMUNMITY DEVELOPMENT/PUBLIC WORKS DEPARTMENT
58928 Business Center Drive
Yucca Valley, CA 92284

Project Title: Yucca Valley General Plan Update

Project Location: The Town of Yucca Valley is near the southern boundary of the central portion of San Bernardino County, approximately 20 miles north of downtown Palm Springs in neighboring Riverside County. The Town is also near the City of Twentynine Palms, Joshua Tree National Park, and the unincorporated communities of Joshua Tree, Pioneertown, and Morongo Valley. State Route 62 traverses the Town from east to west while State Route 247 crosses the northern half of the Town from north to south.

Project Description: The project is an update to the Town of Yucca Valley General Plan. The Yucca Valley General Plan Update is intended to shape development within the Town for at least the next 20 years and involves reorganization of the current General Plan into the following elements: Land Use, Circulation, Safety, Noise, Open Space and Conservation, and Housing. The General Plan Update will also revise the General Plan land use map. Buildout of the Yucca Valley General Plan Update would result in a population of 64,543, 27,276 residential units, 20,964,487 square feet of nonresidential development, and 34,927 employees in the Town.

Environmental Issues: Based on the Initial Study prepared for the proposed project, the Town anticipates several potential impacts that will need to be addressed in the EIR:

- Aesthetics
- Air Quality
- Biological Resources
- Cultural Resources
- Geology & Soils
- Greenhouse Gas Emissions
- Hazards & Hazardous Materials
- Hydrology & Water Quality
- Land Use & Planning
- Noise
- Population & Housing
- Public Services
- Recreation
- Transportation &Traffic
- Utilities & Service Systems

The Draft EIR will address the short- and long-term effects of the General Plan Update on the environment. Mitigation measures will be proposed for impacts that are determined to be significant.

Project Sponsor: Town of Yucca Valley
Consulting Firm: The Planning Center|DC&E

Date: November 8, 2012

Signature:

Shane Stueckle
Deputy Town Manager

CLERK OF THE BOARD
Received on: _____
Remove on: _____

Planning
(760) 369-6575 x317
Public Works
(760) 369-6579 x308
Building and Safety
(760) 365-0099 x302
Code Compliance
(760) 369-6575 x301
Engineering
(760) 369-6575 x308
Building and Safety
Inspections
(760) 365-1339
FAX (760) 228 [illegible] 84

The Town of
Yucca Valley
COMMUNMITY DEVELOPMENT/PUBLIC WORKS DEPARTMENT
58928 Business Center Drive
Yucca Valley, CA 92284

INITIAL STUDY FOR:

YUCCA VALLEY

GENERAL PLAN

UPDATE

prepared for:

TOWN OF YUCCA VALLEY

Contact:
Shane Stueckle
Deputy Town Manager

prepared by:

THE PLANNING CENTER|DC&E

Contact:
Nicole Vermilion
Associate Principal

NOVEMBER 2012

INITIAL STUDY FOR:

YUCCA VALLEY GENERAL PLAN UPDATE

prepared for:

TOWN OF YUCCA VALLEY

57090 29 Palms Highway
Yucca Valley, CA 92284
Tel: 760.369.6575

Contact:
Shane Stueckle
Deputy Town Manager

prepared by:

THE PLANNING CENTER|DC&E

3 MacArthur Place, Suite 1100
Santa Ana, CA 92707
Tel: 714.966.9220 • Fax: 714.966.9221
E-mail: information@planningcenter.com
Website: www.planningcenter.com

Contact:
Nicole Vermilion
Associate Principal

TYV-01.0L

NOVEMBER 2012

Table of Contents

Section **Page**

1. INTRODUCTION 1

1.1 PROJECT LOCATION 1
1.2 ENVIRONMENTAL SETTING 1
1.3 PROJECT DESCRIPTION 13
1.4 TOWN ACTION REQUESTED 21
1.5 RESPONSIBLE AGENCIES 21
1.6 REVIEWING AGENCIES 21

2. ENVIRONMENTAL CHECKLIST 23

2.1 BACKGROUND 23
2.2 ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED 24
2.3 DETERMINATION (TO BE COMPLETED BY THE LEAD AGENCY) 24
2.4 EVALUATION OF ENVIRONMENTAL IMPACTS 25

3. ENVIRONMENTAL ANALYSIS 37

3.1 AESTHETICS 37
3.2 AGRICULTURE AND FORESTRY RESOURCES 38
3.3 AIR QUALITY 39
3.4 BIOLOGICAL RESOURCES 40
3.5 CULTURAL RESOURCES 42
3.6 GEOLOGY AND SOILS 43
3.7 GREENHOUSE GAS EMISSIONS 45
3.8 HAZARDS AND HAZARDOUS MATERIALS 45
3.9 HYDROLOGY AND WATER QUALITY 47
3.10 LAND USE AND PLANNING 49
3.11 MINERAL RESOURCES 50
3.12 NOISE 50
3.13 POPULATION AND HOUSING 51
3.14 PUBLIC SERVICES 52
3.15 RECREATION 53
3.16 TRANSPORTATION/TRAFFIC 53
3.17 UTILITIES AND SERVICE SYSTEMS 55
3.18 MANDATORY FINDINGS OF SIGNIFICANCE 56

4. REFERENCES 59

5. LIST OF PREPARERS 61

LEAD AGENCY 61
THE PLANNING CENTER|DC&E 61

Table of Contents

List of Figures

Figure		Page
Figure 1	Regional Location	5
Figure 2	Townwide Aerial	7
Figure 3	Existing Land Uses	9
Figure 4	Current Land Use Plan	17
Figure 5	Proposed Land Use Plan	19

List of Tables

Table		Page
Table 1	Existing Land Use Summary	3
Table 2	Current General Plan Land Use Designations	12
Table 3	Proposed General Plan Land Use Designations	15

1. Introduction

The Town of Yucca Valley is circulating for public review and comment this Notice of Preparation (NOP) and Initial Study (IS) for the Town of Yucca Valley General Plan Update (proposed project). This Initial Study has been prepared in accordance with the California Environmental Quality Act (CEQA), as amended, to determine if approval of the discretionary actions requested and subsequent development would have a significant impact on the environment.

As defined by Section 15063 of the CEQA Guidelines, an Initial Study is prepared primarily to provide the lead agency with information to use as the basis for determining whether a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report (EIR) would be appropriate for providing the necessary environmental documentation and clearance for the proposed project.

1.1 PROJECT LOCATION

The Town of Yucca Valley is near the southern boundary of the central portion of San Bernardino County, approximately 30 miles (driving distance) north of downtown Palm Springs in neighboring Riverside County (see Figure 1, *Regional Location*). As shown in Figure 1, the Town is surrounded by portions of unincorporated San Bernardino County and is near the City of Twentynine Palms and the unincorporated communities of Morongo Valley and Joshua Tree. The southern boundary of Yucca Valley is adjacent to Joshua Tree National Park. State Route 62 (SR-62) traverses the Town from east to west, and State Route 247 (SR-247) crosses the northern half of the Town from north to south. The Town's sphere of influence (SOI) has the same boundaries as the Town (see Figure 2, *Townwide Aerial*). These boundaries are generally the same as those established in the current General Plan, adopted in 1995, except for a one square mile area on the northern edge of the Town that was annexed in 1996.

1.2 ENVIRONMENTAL SETTING

1.2.1 Existing Land Use

The Town of Yucca Valley encompasses 25,492 acres (or 39.8 square miles). As shown in Table 1, *Existing Land Use Summary*, and Figure 3, *Existing Land Uses*, the vast majority of Town land is either single-family land uses (24.0 percent) or vacant (65.4 percent). This is due to the Town's low density residential character and isolated, high desert location. With a few exceptions, existing commercial and industrial uses are generally within ½ mile of the SR-62 corridor and concentrated in the Old Town and Mid-Town areas. Yucca Valley does not contain any major water bodies. The Town's abundant vacant land generally consists of undeveloped desert saltbrush scrub, Joshua tree woodland, and pinyon-juniper woodland. The majority of roadways in the less developed portions of the Town are unimproved (i.e., dirt roads).

1. Introduction

This page intentionally left blank.

Table 1
Existing Land Use Summary

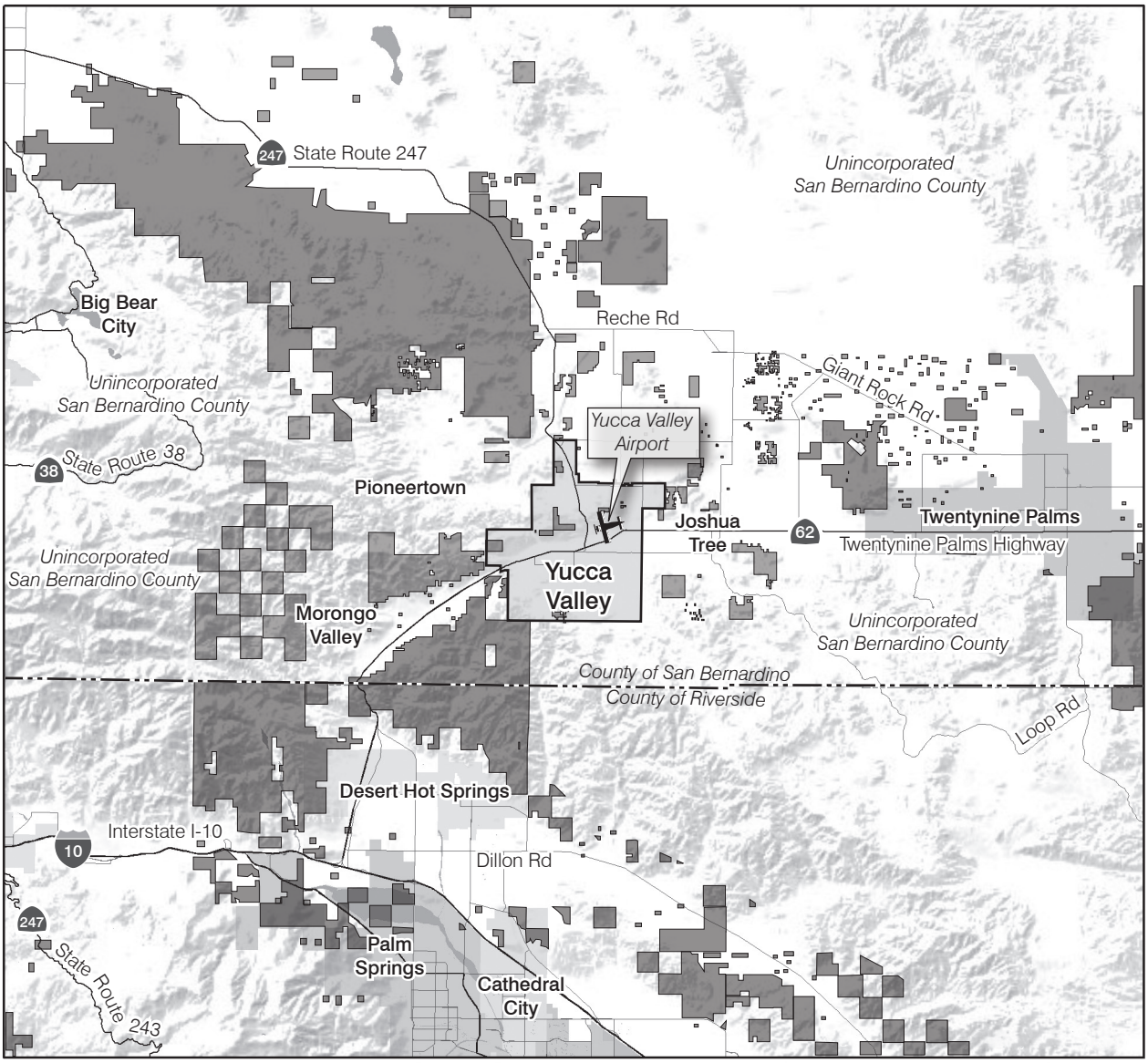
Land Use	Acres	% of Total	Dwelling Units	Population	Total Square Feet[1, 2,3,4]	Employment[5]
Residential						
Single-Family[6]	6,113	24.0%	7,754	18,417	-	-
Mobile Homes[7]	115	0.5%	772	1,834	-	-
Multifamily[8]	93	0.4%	932	2,214	-	-
Subtotal	**6,321**	**24.8%**	**9,458**	**22,464**	**-**	**-**
Commercial, Mixed Use, and Industrial						
Other Commercial	22	0.1%	-	-	188,892	540
General Office	51	0.2%	-	-	556,350	1,590
Government Office	30	0.1%	-	-	259,643	865
Heavy Industrial	25	0.1%	-	-	109,658	110
Hotels and Motels	11	0.0%	-	-	95,957	192
Light Industrial	6	0.0%	-	-	26,778	38
Major Medical Facility	5	0.0%	-	-	45,277	91
Manufacturing	62	0.2%	-	-	271,008	271
Open Storage	2	0.0%	-	-	-	36
Retail Stores and Commercial Services	225	0.9%	-	-	1,961,692	3,269
Special Care Facilities	1	0.0%	-	-	11,896	30
Wholesaling and Warehousing	8	0.0%	-	-	33,167	28
Subtotal	**449**	**1.8%**	**-**	**-**	**3,560,317**	**7,001**
Miscellaneous						
Agriculture	27	0.1%	-	-	-	-
Airport	62	0.2%	-	-	-	-
Communication Facilities	9	0.0%	-	-	-	-
Educational Institutions	150	0.6%	-	-	-	310
Electrical Power Facilities	3	0.0%	-	-	-	-
Fire Station	2	0.0%	-	-	-	10
Improved Water Floodways	56	0.2%	-	-	-	-
Maintenance Yard	2	0.0%	-	-	-	-
Open Space and Recreation	106	0.4%	-	-	-	-

Table 1
Existing Land Use Summary

Land Use	Acres	% of Total	Dwelling Units	Population	Total Square Feet[1, 2,3,4]	Employment[5]
Parks and Open Space	26	0.1%	-	-	-	-
Park and Ride Lots	6	0.0%	-	-	-	-
Public Facilities	78	0.3%	-	-	-	130
Religious Facilities	57	0.2%	-	-	-	113
ROW	1,442	5.7%	-	-	-	-
Water Storage Facilities	37	0.1%	-	-	-	-
Vacant	16,661	65.4%	-	-	-	-
Subtotal	**18,723**	**73.4%**	**-**	**-**	**-**	**563**
TOTAL	**25,492**	**100%**	**9,458**	**-**	**3,560,317**	**7,565**

[1] Commercial building square footage was generated using a FAR of 0.20 that was based on the average from a sample of retailers along Highway 62.
[2] Office building square footage was generated using a FAR of 0.25 that was based on the average from a sample of offices along Highway 62.
[3] Government office building square footage was generated using a FAR of 0.20 to reflect open space on the Town Hall site.
[4] Industrial building square footage was generated using a FAR of 0.10 that was based on an average from a sample of industrial and manufacturing uses across the community.
[5] Employment generation rates are in employees per building square footage and were developed by The Planning Center | DC&E.
[6] Low density residential parcels were built out at the maximum density except for R-S-5, which was built out at 3 DU/AC instead of 5 DU/AC. Medium density residential parcels were built out slightly lower than the maximum densities (6 DU/AC in R-M-8 and 8 DU/AC in R-M-10).
[7] The number of mobile home units was provided by the California Department of Housing and Community Development online database in September 2012 (https://ssw1.hcd.ca.gov/ParksListing/faces/parkslist/mp.jsp).
[8] Multifamily residential parcels were built out at a density of 10 DU/AC.

Regional Location



Yucca Valley Town Boundary

County Boundary

Bureau of Land Management (BLM)

0 8
Scale (Miles)

Source: ESRI 2012

1. Introduction

This page intentionally left blank.

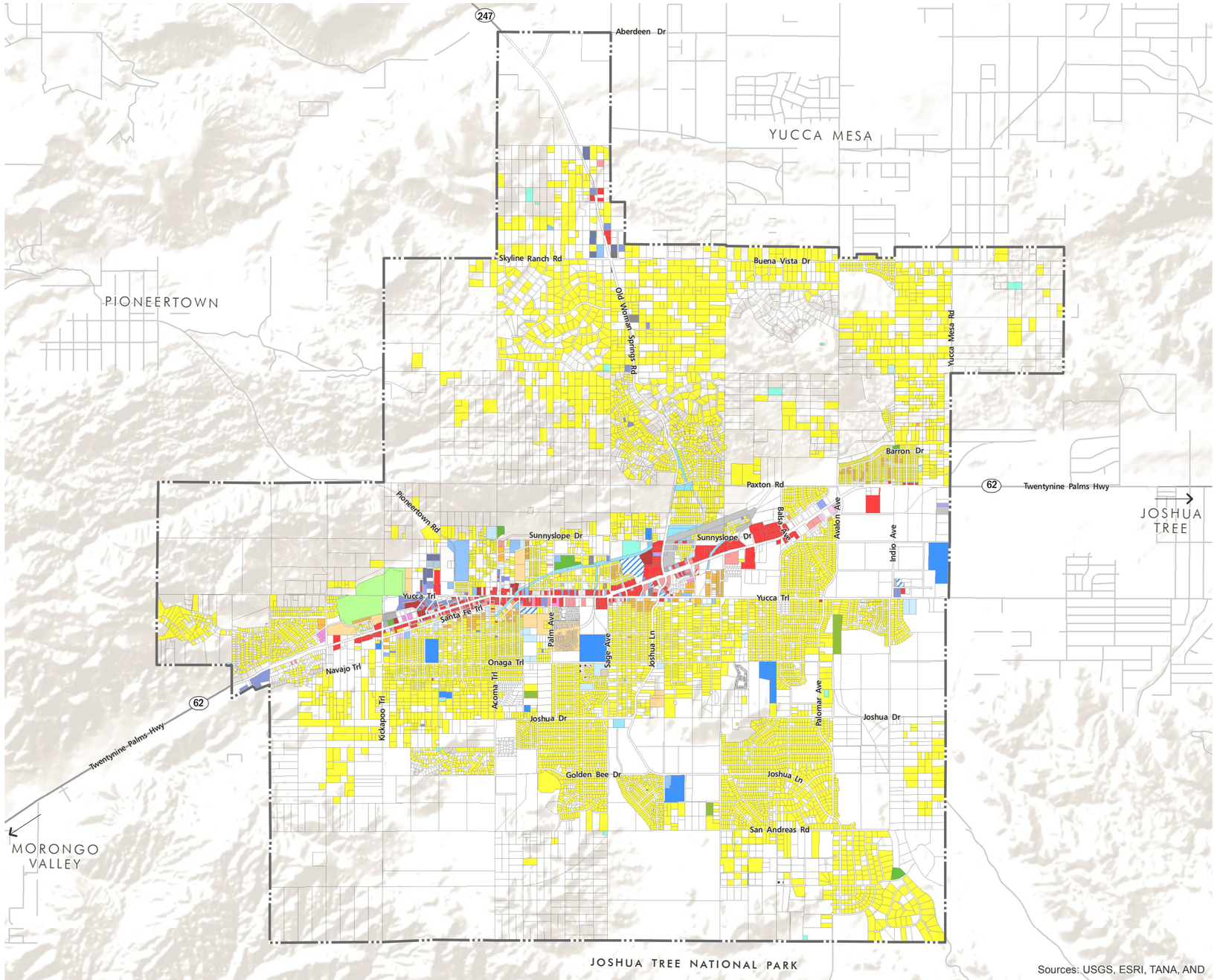
Townwide Aerial

0 0.5 1
Miles

1. Introduction

This page intentionally left blank.

Existing Land Uses



EXISTING LAND USE

- Town Limits
- 1110, Single Family Residential
- 1120, Multi Family Residential
- 1130, Mobile Homes and Trailer Parks
- 1210, General Office Use
- 1220, Retail Stores and Commercial Services
- 1230, Other Commercial
- 1233, Hotels and Motels
- 1240, Public Facilities
- 1252, Special Care Facilities
- 1241, Government Offices
- 1323, Open Storage
- 1414, Park and Ride
- 1440, Maintenace Yards
- 1243, Fire Station
- 1244, Major Medical Health Care Facility
- 1245, Religious Facility
- 1260, Educational Institutions
- 1310, Light Industrial
- 1311, Manufacturing, Assesmbly and Industrial Services
- 1320, Heavy Industrial
- 1321, Manufacturing
- 1340, Wholesaling and Warehousing
- 1411, Airports
- 1420, Communication Facilities
- 1431, Electrical Power Facilities
- 1434, Water Storage Facilities
- 1437, Improved Flood Waterways
- 1700, Under Construction
- 1810, Open Space and Recreation
- 1820, Local Parks and Recreation
- 1880, Other Open Space and Recreation
- 2000, Agriculture
- 3000, Vacant

0 0.5 1
Miles

1. Introduction

This page intentionally left blank.

1.2.2 Surrounding Land Use

The Town of Yucca Valley is largely surrounded by undeveloped areas of the Mojave Desert. As shown in Figure 2, *Townwide Aerial*, the Town is bordered by a mixture of undeveloped and low density residential areas to the north and east, including the unincorporated communities of Pioneer Town and Joshua Tree; Joshua Tree National Park to the south; and undeveloped areas to the west.

1.2.3 Current General Plan

The current Yucca Valley General Plan was adopted on December 14, 1995, and contains 22 elements, organized into four broad issue areas:

Community Development

- Land Use Element
- Circulation Element
- Housing Element
- Parks, Recreation and Trails Element
- Community Design Element
- Scenic Highways Element
- Economic Development Element

Environmental Resources

- Biological Resources Element
- Archaeological and Historic Resources Element
- Water Resources Element
- Air Quality Element
- Open Space, Mineral, Energy and Conservation Element

Environmental Hazards

- Seismic Safety Element
- Slopes, Sediment Control and Soil Conservation Element
- Flooding and Hydrology Element
- Noise Element
- Hazardous and Toxic Materials Element

Public Services and Facilities

- Fire and Police Protection Element
- Schools and Libraries Element
- Emergency Preparedness and Health Services Element
- Public Buildings, Facilities and Utilities Element
- Arts, Culture, and Humanities Element

1. Introduction

Table 2, *Current General Plan Land Use Designations*, presents a breakdown of current General Plan land use designations in Yucca Valley. As shown in Table 2 and Figure 4, *Current Land Use Plan*, 20 land use designations currently regulate development in the Town. The three largest land use designations within the Town boundaries are Rural Residential 2.5 (RR-2.5), Rural Living 5 (RL-5), and Hillside Residential (HR), which together make up approximately 59 percent of the land area in the Town. Residential land use designations, in general, represent 89 percent of the Town. Commercial, public, and other nonresidential land use designations represent a small percentage of the Town's land area.

Table 2
Current General Plan Land Use Designations

Land Use Designation	*Acres*[1]	*% of Total*
Residential		
Hillside Residential (HR)	4,349	18.0%
Rural Living 10 (RL-10)	132	0.5%
Rural Living 5 (RL-5)	4,653	19.3%
Rural Residential 2.5 (RR-2.5)	5,153	21.4%
Rural Residential 1 (RR-1)	2,113	8.8%
Rural Residential 0.5 (RR-0.5)	3,295	13.7%
Low Density Residential (LDR)	1,251	5.2%
Medium Density Residential (MDR)	52	0.2%
Medium High Density Residential (MHDR)	368	1.5%
Subtotal	**21,366**	**88.6%**
Commercial, Mixed Use, and Industrial		
Commercial (C)	605	2.5%
Mixed Use (MU-TC)	195	0.8%
Mixed Use (MU-CC)	-	-
Industrial (I)	897	3.7%
Subtotal	**1,697**	**7.0%**
Westside Special Policy Area (WSPA)		
Residential	-	-
Commercial	-	-
Industrial	-	-
Open Space Recreation	-	-
Public/Quasi-Public	-	-
ROW	-	-
Subtotal	**0%**	**0%**
Old Town Specific Plan		
Old Town Commercial/Residential (OTCR)	57	0.2%
Old Town Highway Commercial (OTHC)	56	0.2%
Old Town Industrial/Commercial (OTIC)	39	0.2%
Old Town Mixed Use (OTMU)	29	0.1%
Subtotal	**181**	**0.8%**

Table 2
Current General Plan Land Use Designations

Land Use Designation	*Acres*[1]	*% of Total*
Miscellaneous		
Open Space – Conservation (OSC)	363	1.5%
Open Space – Recreation (OSR)	141	0.6%
Public/Quasi-Public (P/QP)	238	1.0%
Airport (AP)	50	0.2%
ROW	75	0.3%
Subtotal	**867**	**3.6%**
TOTAL	**24,111**	**100%**
Population[2]	62,223	NA
Employment[3]	27,370	NA

[1] Acres are given as adjusted gross acreages, which do not include the rights-of-way for major roadways, flood control facilities, or railroads.
[2] A vacancy rate of 5% was assumed for population projections, adjusted down from the 13% vacancy rate identified by the California Department of Finance (2012) to account for housing market improvements.
[3] Employment generation rates are in employees per building square footage and were developed by The Planning Center | DC&E. Employment estimates in the Public/Quasi-Public land use designation are customized to each use. For example, drainage areas do not generate employment, but schools do. For facilities like schools, employment estimates were created through Internet searches for each facility. The Town of Yucca Valley provided employment estimates for Town facilities.

1.3 PROJECT DESCRIPTION

The proposed project is an update to the Town of Yucca Valley General Plan. The Yucca Valley General Plan Update is intended to shape development in the Town for at least the next 20 years. The update is guided by a set of community values that were developed by the Yucca Valley Town Council with input from the community and adopted by the Town Council on March 20, 2012. These values are:

- Small town atmosphere
- Balanced growth
- Safe and established neighborhoods
- Fiscal sustainability
- Diverse range of community services
- Efficient infrastructure
- Strong economy
- Desert environment and natural resources
- Arts and culture
- Community pride and participation

1.3.1 Proposed General Plan Elements

The General Plan Update involves reorganization of the current General Plan into the following elements:

The **Land Use Element** describes objectives, policies, and programs for areas within Yucca Valley's boundaries in both narrative and graphic terms and establishes development criteria and standards, including building intensity and population density.

The **Circulation Element** addresses the identification, location, and extent of existing and proposed major thoroughfares, transportation routes, trails, multimodal transportation options, and local public utilities and facilities. It serves as an infrastructure plan and is correlated with the land use element.

The **Safety Element** identifies seismic, geologic, flood, and wildfire hazards, and establishes policies to protect the community.

The **Noise Element** provides guidance related to noise conditions and identifies goals and policies aimed at mitigating and adapting to nuisance noise in Yucca Valley.

The **Open Space and Conservation Element** focuses on natural resources. It provides a plan for the long-term preservation of open space and addresses the use of resources, including water, forests, hillsides and natural landforms, soils, waterways, wildlife, and mineral deposits. It specifies plans and measures for preserving open space for natural resources, managing the production of resources, outdoor recreation, and public health and safety.

The **Housing Element** analyzes housing needs for all income groups and demonstrates how to meet those needs. State law requires that this element be revised, at a minimum, every eight years.

1.3.2 Proposed Land Use Designations

Table 3 outlines the proposed land use designations and summarizes the acreage and total percentage of each land use designation. Proposed land uses are also shown in Figure 5, *Proposed Land Use Plan*.

Table 3
Proposed General Plan Land Use Designations

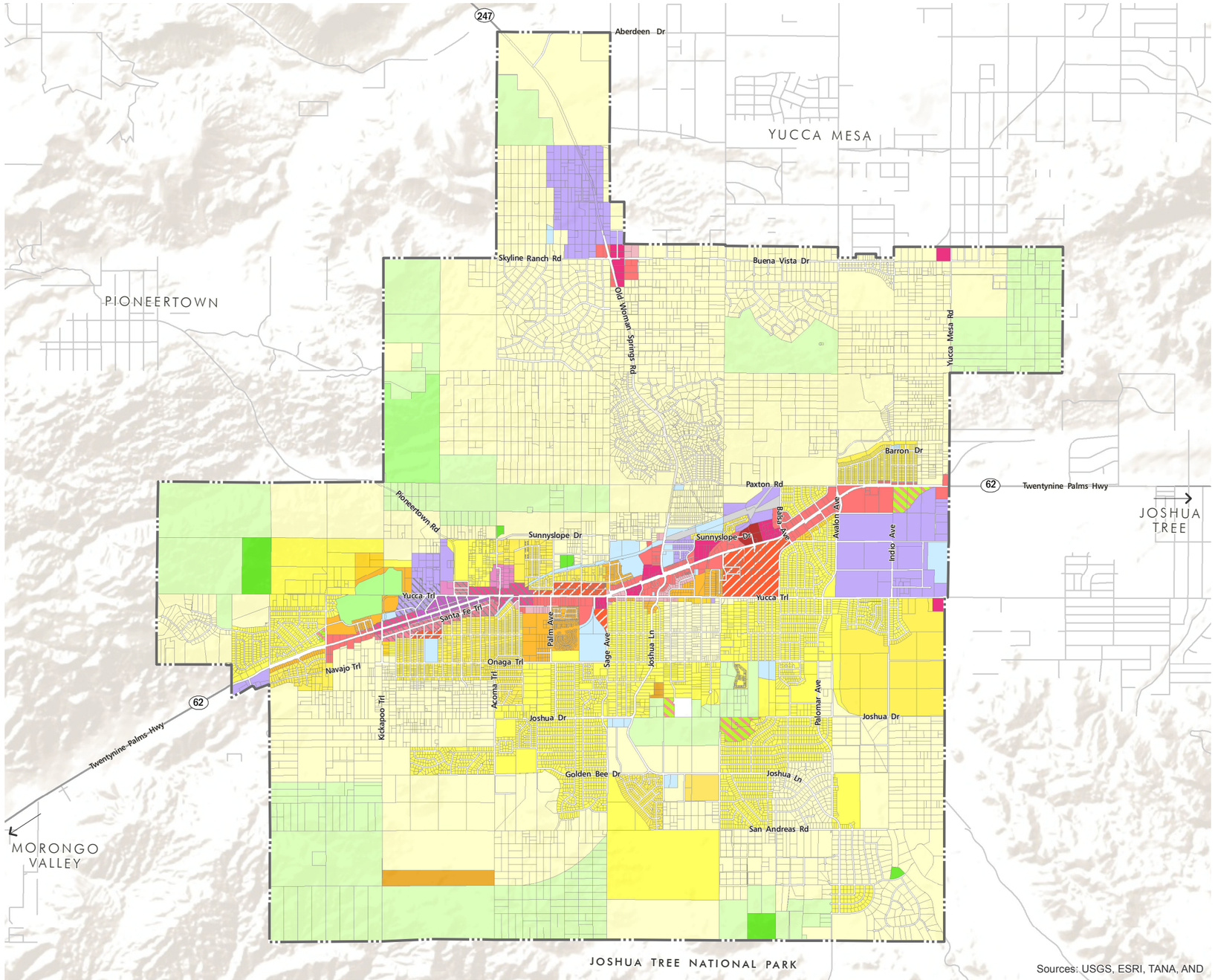
Land Use Designation	Acres[1]	% of Total	Units[2]	Population[3]	Total Square Feet[2]	Employment[4]
Residential						
Hillside Residential (HR)	4,008	15.7%	200	476	-	-
Rural Living 10 (RL-10)	79	0.3%	8	19	-	-
Rural Living 5 (RL-5)	4,842	19.0%	968	2,300	-	-
Rural Residential 2.5 (RR-2.5)	4,917	19.3%	1,815	4,311	-	-
Rural Residential 1 (RR-1)	1,801	7.1%	1,789	4,248	-	-
Rural Residential 0.5 (RR-0.5)	3,331	13.1%	6,657	15,811	-	-
Low Density Residential (LDR)	1,453	5.7%	5,087	12,082	-	-
Medium Density Residential (MDR)	248	1.0%	1,478	3,510	-	-
Medium High Density Residential (MHDR)	326	1.3%	3,260	7,743	-	-
Subtotal	**21,006**	**82.4%**	**21,263**	**50,499**	**-**	**-**
Commercial, Mixed Use, and Industrial						
Commercial (C)[5]	491	1.9%	1,679	3,987	6,011,947	10,889
Mixed Use (MU-TC)[6]	142	0.6%	510	1,210	2,466,629	4,111
Mixed Use (MU-CC)[7]	96	0.4%	412	876	1,632,884	3,207
Industrial (I)[8]	752	3.0%	10	23	7,099,897	10,143
Subtotal	**1,481**	**5.8%**	**2,611**	**6,098**	**17,211,357**	**28,350**
Westside Special Policy Area (WSPA)[9]						
Residential	625	2.5%	2,153	5,113	-	-
Commercial	42	0.2%	77	183	346,141	636
Industrial	47	0.2%	-	-	506,385	723
Open Space Recreation	99	0.4%	-	-	-	-
Public/Quasi-Public	4	0.0%	-	-	-	-
ROW	160	0.6%	-	-	-	-
Subtotal	**976**	**3.8%**	**2,230**	**5,296**	**852,526**	**1,359**

Table 3
Proposed General Plan Land Use Designations

Land Use Designation	Acres[1]	% of Total	Units[2]	Population[3]	Total Square Feet[2]	Employment[4]
Old Town Specific Plan[2]						
Old Town Commercial/Residential (OTCR)	57	0.2%	413	981	699,769	1,166
Old Town Highway Commercial (OTHC)	56	0.2%	-	-	889,684	1,483
Old Town Industrial/Commercial (OTIC)	39	0.2%	238	565	551,834	854
Old Town Mixed Use (OTMU)	29	0.1%	465	1,104	759,317	1,266
Subtotal	**181**	**0.7%**	**1,116**	**2,651**	**2,900,604**	**4,769**
Miscellaneous						
Open Space – Conservation (OSC)	386	1.5%	-	-	-	-
Open Space – Recreation (OSR)	19	0.1%	-	-	-	-
Public/Quasi-Public (P/QP)	330	1.3%	-	-	-	449
Airport (AP)	52	0.2%	-	-	-	-
ROW	1,063	4.2%	-	-	-	-
Subtotal	**1,849**	**7.3%**	**-**	**-**	**-**	**449**
TOTAL	**25,492**	**100%**	**27,219**	**64,543**	**20,964,487**	**34,927**
Current GP Total	24,111	-	24,401	62,223	17,633,100	27,370
Difference	1,381	-	2,818	2,320	3,331,387	7,557

1 Acres are given as adjusted gross acreages, which do not include the rights-of-way for major roadways, flood control facilities, or railroads.
2 The total number of units and square footage of retail and nonretail uses for Specific Plans were taken directly from the approved land use plans associated with each Specific Plan document.
3 A vacancy rate of 5% was assumed for population projections, adjusted down from the 13% vacancy rate identified by the California Department of Finance (2012) to account for housing market improvements.
4 Employment generation rates are in employees per building square footage and were developed by The Planning Center | DC&E.
5 The Commercial properties are assumed to be 80% retail and 20% office, except in the Corridor Residential Overlay where 60% retail and 40% residential uses were assumed.
6 The Mixed Use Town Center Mall properties are assumed to be 60% retail, 20% office, and 20% residential.
7 The Mixed Use Civic Center properties are assumed to be 80% retail and 20% residential.
8 The buildout for Industrial properties assumed a 90% industrial and10% office mix of uses except in the Rural Mixed Use Special Policy areas north of Skyline Ranch Road, where 10% office, 80% industrial, and 10% residential was assumed to accommodate home-based businesses.
9 The Westside Special Policy Area is listed separately to reflect an assumed development opportunity above the capacity provided by underlying land uses. The WSPA allows for additional development potential (units, hotel rooms, and retail and non-retail building square footage) above the maximums that can be developed with the underlying land use designations. Properties in this area can be developed according to the underlying land uses depicted on the General Plan Land Use Map, or, at the discretion of the property owner, can be developed with different or more intense uses if the additional criteria identified in the General Plan for the WSPA can be met and the maximum buildout thresholds identified in this table are not exceeded. A detailed breakdown of buildout assumptions for the WSPA is provided in the Land Use Element.

Current Land Use Plan



CURRENT GENERAL PLAN

GENERAL PLAN DESIGNATION

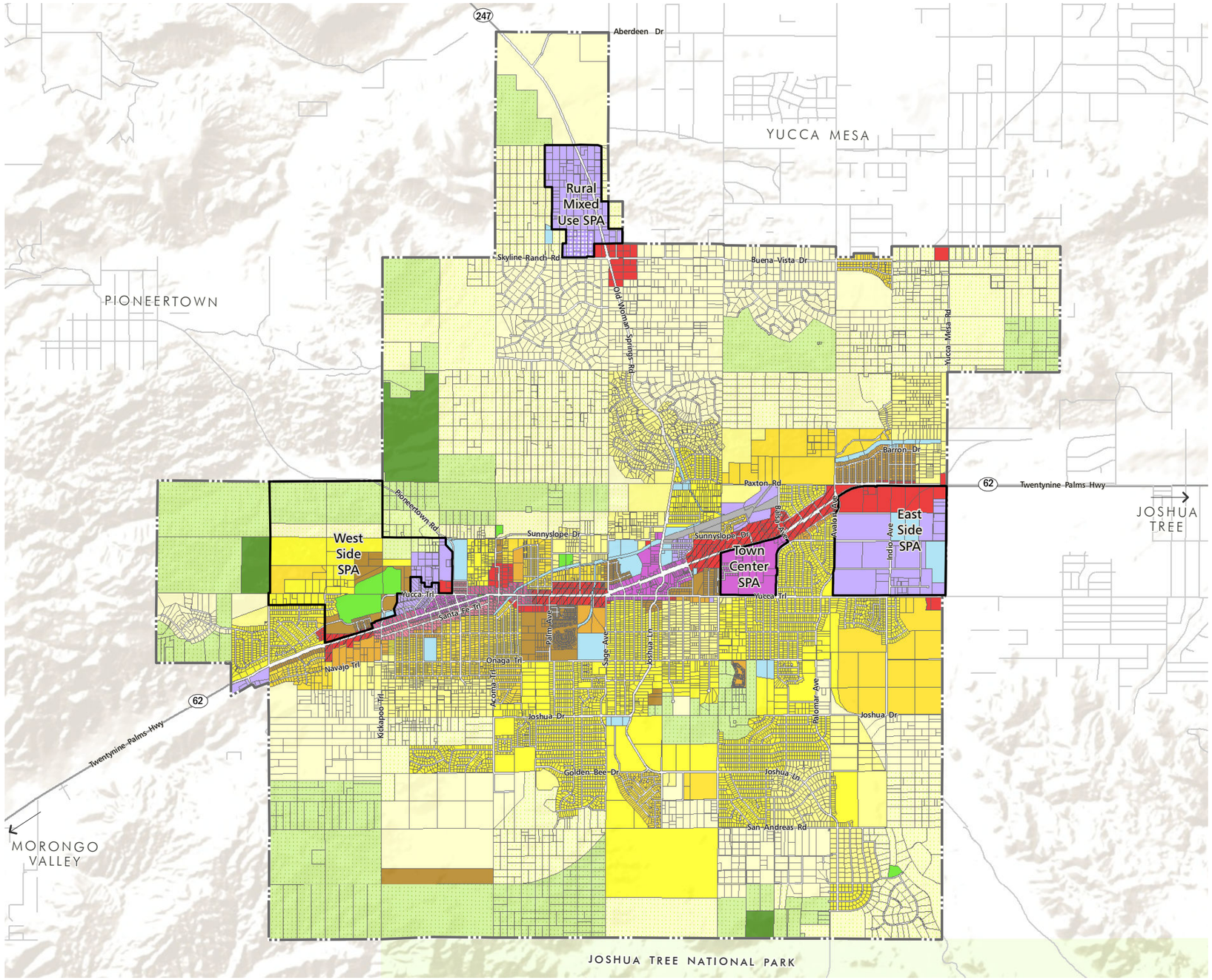
- R-HR, Hillside Reserve 0-1 du/ac
- R-L-10, Rural Living 1 du/10 ac
- R-L-5, Rural Living 1 du/ 5 ac
- R-L-2.5, Rural Living 1 du/ 2.5 ac
- R-L-1, Rural Living 1 du/1 ac
- R-S-2, Single Family Res. 0-2 du/ac
- R-S-3.5, Single Family Res. 3.5 du/ac
- R-S-5, Single Family Res. 5 du/ac
- R-S-5 Senoir, Single Family Res. Senior 0-5 du/ac
- R-M-4, Multi-Family Residential 0-4 du/ac
- R-M-8 Multi-Family Residential 0-8 du/ac
- R-M-10 Multi-Family Residential 0-10 du/ac
- R-M-14 Multi-Family Residential 0-14 du/ac
- C-MU Mixed Use Commercial
- C-S Service Commercial
- C-N Neighborhood Commercial
- C-G General Commercial
- C-C Community Commercial
- C-O Office Commercial
- C-RR Resort/Recreation Commercial
- I Industrial
- P/QP Public/Quasi-Public
- AP Airport
- OTMU, Old Town Mixed Use
- OTC/R, Old Town Commercial/Residential
- OTHC, Old Town Highway Commercial
- OTI/C, Old Town Industrial/Commercial
- O-S-P Public Parks
- O-S Open Space
- Town Limits

0 0.5 1
Miles

1. Introduction

This page intentionally left blank.

Proposed Land Use Plan



PROPOSED GENERAL PLAN

GENERAL PLAN DESIGNATION

- Hillside Residential (HR) 20 ac min
- Rural Living (RL-10) 10 ac min
- Rural Living (RL-5) 5 ac min
- Rural Residential (RR-2.5) 2.5 ac min
- Rural Residential (RR-1) 1 ac min
- Rural Residential (RR-0.5) 0.5 ac min
- Low Density Residential (LDR) 2.1-5.0 du/ac
- Medium Density Residential (MDR) 5.1-8.0 du/ac
- Medium High Density Res. (MHDR) 8.1-14.0 du/ac
- Commercial (C)
- Mixed Use (MU)
- Industrial (I)
- Open Space - Conservation (OSC)
- Open Space - Recreation (OSR)
- Public/Quasi-Public (P/QP)
- Airport (A)

Old Town Specific Plan

- Old Town Industrial/Commercial (OTIC)
- Old Town Mixed Use (OTMU)
- Old Town Commercial/Residential (OTCR)
- Old Town Highway Commercial (OTHC)

General Plan Overlay

- Corridor Residential Overlay
- Rural Mixed Use SPA - Business Park
- SPA - Special Policy Area
- Town Limits

0 0.5 1
Miles

1. Introduction

This page intentionally left blank.

1.4 TOWN ACTION REQUESTED

The Yucca Valley Town Council is the Town's legislative body and the approving authority for the Town of Yucca Valley General Plan. In order to implement the General Plan, the Town Council must take the following actions:

- Certification of the Town of Yucca Valley General Plan Update EIR
- Adoption of findings of fact (and Statement of Overriding Considerations, if required)
- Adoption of a Mitigation Monitoring and Reporting Program
- Adoption of the Town of Yucca Valley General Plan Update

1.5 RESPONSIBLE AGENCIES

A public agency other than the lead agency that has discretionary approval power over a project is a responsible agency, as defined by CEQA Guidelines. Adoption of the Town of Yucca Valley General Plan does not require permits or approvals from any other agency, with the exception of the Housing Element. The Department of Housing and Community Development (HCD) approves the Town's Housing Element; and therefore, is also a responsible agency for the proposed project.

1.6 REVIEWING AGENCIES

Reviewing agencies do not have discretionary powers to approve or deny the proposed project or actions needed to implement it, but may review the environmental document for adequacy and accuracy. Potential reviewing agencies include:

Federal

- US National Park Service, Joshua Tree National Park
- US Army Corps of Engineers (Corps)
- US Fish and Wildlife Service (USFWS)
- US Environmental Protection Agency (EPA)
- Bureau of Land Management (BLM)
- Marine Corps Air Ground Combat Center (MCAGCC)

State

- California Highway Patrol (CHP)
- California Department of Transportation (CalTrans), District 8
- California Department of Fish and Game (CDFG)
- California Department of Conservation (CDC)
- California Department of Forestry and Fire Protection (CAL FIRE)
- California Housing and Community Development (HCD)
- Native American Heritage Commission (NAHC)

Regional/Local

- Mojave Desert Air Quality Management District (MDAQMD)
- Mojave Water Agency
- Morongo Band of Mission Indians
- Morongo Basin Transit Authority
- San Bernardino County Airport Land Use Commission (ALUC)

- San Bernardino Association of Governments (SANBAG)
- San Bernardino County Board of Supervisors, 3rd District Office
- San Bernardino County Fire Department
- San Bernardino County Flood Control District
- San Bernardino County Planning Department
- San Bernardino Sheriff's Department
- San Bernardino County Transportation Department
- Southern California Association of Governments (SCAG)
- City of Twentynine Palms
- Copper Mountain Community College
- Hi-Desert Memorial Health Care District/Hospital
- Hi-Desert Water District
- Morongo Unified School District

2. Environmental Checklist

2.1 BACKGROUND

1. **Project Title:** Yucca Valley General Plan Update

2. **Lead Agency Name and Address:**
   Town of Yucca Valley
   57090 29 Palms Highway
   Yucca Valley, CA 92284

3. **Contact Person and Phone Number:**
   Shane Stueckle, Deputy Town Manager
   (760) 369-6575, ext. 305

4. **Project Location:**
   The Town of Yucca Valley is in the Mojave Desert, in the Morongo Basin region of San Bernardino County, approximately 70 miles to the east of San Bernardino and approximately 30 miles to the north of Palm Springs (driving distance).

5. **Project Sponsor's Name and Address:**
   Town of Yucca Valley
   57090 29 Palms Highway
   Yucca Valley, CA 92284

6. **General Plan Designation:** Various General Plan designations throughout the Town. See Section 1.2.3.

7. **Zoning:** Various zoning designations throughout the Town.

8. **Description of Project:** A detailed description is included in Section 1.3.

9. **Surrounding Land Uses and Setting**
   The Town of Yucca Valley is bordered by low density residential uses to the north and east, and undeveloped desert to the south and west, including Joshua Tree National Park, which spans the majority of Yucca Valley's southern boundary.

10. **Other Public Agencies Whose Approval Is Required** (e.g., permits, financing approval, or participation agreement): None.

2. Environmental Checklist

2.2 ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact," as indicated by the checklist on the following pages.

- ☒ Aesthetics
- ☒ Biological Resources
- ☒ Greenhouse Gas Emissions
- ☒ Land Use / Planning
- ☒ Population / Housing
- ☒ Transportation / Traffic
- ☐ Agricultural and Forest Resources
- ☒ Cultural Resources
- ☒ Hazards & Hazardous Materials
- ☐ Mineral Resources
- ☒ Public Services
- ☒ Utilities / Service Systems
- ☒ Air Quality
- ☒ Geology / Soils
- ☒ Hydrology / Water Quality
- ☒ Noise
- ☒ Recreation
- ☒ Mandatory Findings of Significance

2.3 DETERMINATION (TO BE COMPLETED BY THE LEAD AGENCY)

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☒ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Signature	11-6-12 *Date*
Shane R. Stueckle *Printed Name*	Town of Yucca Valley *For*

2.4 EVALUATION OF ENVIRONMENTAL IMPACTS

1) A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors, as well as general standards (e.g., the project would not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

2) All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.

3) Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.

4) "Negative Declaration: Less Than Significant With Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Than Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level.

5) Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration. Section 15063(c)(3)(D). In this case, a brief discussion should identify the following:

   a) **Earlier Analyses Used.** Identify and state where they are available for review.

   b) I**mpacts Adequately Addressed.** Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.

   c) **Mitigation Measures.** For effects that are "Less than Significant with Mitigation Measures Incorporated," describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.

6) Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated. A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

7) Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

8) This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.

9) The explanation of each issue should identify:

   a) the significance criteria or threshold, if any, used to evaluate each question; and

   b) the mitigation measure identified, if any, to reduce the impact to less than significant.

Issues	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
I. **AESTHETICS**. Would the project:				
a) Have a substantial adverse effect on a scenic vista?	X			
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	X			
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	X			
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	X			
II. AGRICULTURE AND FORESTRY RESOURCES. In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?				X
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?				X
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?				X
d) Result in the loss of forest land or conversion of forest land to non-forest use?				X
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?				X

Issues	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
III. AIR QUALITY. Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	X			
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	X			
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	X			
d) Expose sensitive receptors to substantial pollutant concentrations?	X			
e) Create objectionable odors affecting a substantial number of people?	X			
IV. BIOLOGICAL RESOURCES. Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	X			
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	X			
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	X			
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	X			

Issues	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	X			
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	X			
V. CULTURAL RESOURCES. Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in § 15064.5?	X			
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5?	X			
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	X			
d) Disturb any human remains, including those interred outside of formal cemeteries?			X	
VI. GEOLOGY AND SOILS. Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	X			
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map, issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	X			
ii) Strong seismic ground shaking?	X			
iii) Seismic-related ground failure, including liquefaction?	X			
iv) Landslides?	X			
b) Result in substantial soil erosion or the loss of topsoil?	X			
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	X			
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	X			

Issues	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	X			
VII. GREENHOUSE GAS EMISSIONS. Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	X			
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	X			
VIII. HAZARDS AND HAZARDOUS MATERIALS. Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	X			
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	X			
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	X			
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	X			
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	X			
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	X			
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	X			

Issues	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	X			
IX. HYDROLOGY AND WATER QUALITY. Would the project:				
a) Violate any water quality standards or waste discharge requirements?	X			
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	X			
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in a substantial erosion or siltation on- or off-site	X			
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	X			
e) Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?	X			
f) Otherwise substantially degrade water quality?	X			
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	X			
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	X			
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	X			

Issues	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
j) Inundation by seiche, tsunami, or mudflow?	X			
X. LAND USE AND PLANNING. Would the project:				
a) Physically divide an established community?	X			
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	X			
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	X			
XI. MINERAL RESOURCES. Would the project:				
a) Result in the loss of availability of a known mineral resource that would be a value to the region and the residents of the state?			X	
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?			X	
XII. NOISE. Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	X			
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	X			
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	X			
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	X			
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	X			
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	X			

Issues	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
XIII. POPULATION AND HOUSING. Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	X			
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	X			
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	X			
XIV. PUBLIC SERVICES. Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
a) Fire protection?	X			
b) Police protection?	X			
c) Schools?	X			
d) Parks?	X			
e) Other public facilities?	X			
XV. RECREATION.				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	X			
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	X			
XVI. TRANSPORTATION/TRAFFIC. Would the project:				
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	X			

Issues	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	X			
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?				X
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	X			
e) Result in inadequate emergency access?	X			
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	X			
XVII. UTILITIES AND SERVICE SYSTEMS. Would the project:				
a) Exceed waste water treatment requirements of the applicable Regional Water Quality Control Board?	X			
b) Require or result in the construction of new water or waste water treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	X			
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	X			
d) Have sufficient water supplies available to serve the project from existing entitlements and resources or are new or expanded entitlements needed?	X			
e) Result in a determination by the waste water treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	X			

Issues	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	X			
g) Comply with federal, state, and local statutes and regulations related to solid waste?	X			
XVIII. MANDATORY FINDINGS OF SIGNIFICANCE.				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	X			
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	X			
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	X			

This page intentionally left blank.

3. Environmental Analysis

Section 2.4 provided a checklist of environmental impacts. This section provides an evaluation of the impact categories and questions contained in the checklist, and identifies mitigation measures, if applicable.

3.1 AESTHETICS

a) Have a substantial adverse effect on a scenic vista?

Potentially Significant Impact. The Town's physical setting in the Morongo Basin region affords scenic views of the San Bernardino Mountains, Little San Bernardino Mountains, Sawtooth Mountains, Mojave Desert (including Joshua Tree National Park to the immediate south), and other undeveloped areas. Future development in accordance with the General Plan Update would allow for development of currently undeveloped parcels and intensification of other areas, which have the potential to impact scenic vistas in Yucca Valley. This issue will be addressed further in the EIR.

b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?

Potentially Significant Impact. According to the California Scenic Highway Mapping System of the California Department of Transportation (Caltrans), there are no state-designated scenic highways in or near Yucca Valley (Caltrans 2007). However, State Route 62 (SR-62), which bisects the Town north to south (see Figure 2, *Townwide Aerial*) is considered an "Eligible State Scenic Highway – Not Officially Designated" by Caltrans. State Route 247 (SR-247), which bisect the north half of the Town in an east to west direction, carries the same distinction. Impacts to scenic resources along these two eligible state scenic highways may occur and will be further analyzed in the EIR.

c) Substantially degrade the existing visual character or quality of the site and its surroundings?

Potentially Significant Impact. Future development in accordance with the General Plan Update has the potential to impact the overall visual character of Yucca Valley and its surroundings. Impacts to the existing visual character are potentially significant, and additional analysis will be provided in the EIR.

d) Create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area?

Potentially Significant Impact. Future development in accordance with the General Plan Update would allow for development of currently undeveloped parcels and alteration, intensification, and redistribution of existing land uses. Future development has the potential to introduce new sources of light and glare that could adversely affect day or nighttime views in Yucca Valley. In addition, the communities that surround Yucca Valley could be affected by light and glare generated by future development. The EIR will evaluate the potential light and glare impacts to the aesthetic environment of Yucca Valley as well as to sensitive receptors. The EIR will also address consistency between the General Plan Update and the Town's "Outdoor Lighting" ordinance.

3.2 AGRICULTURE AND FORESTRY RESOURCES

In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:

a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?

No Impact. As shown in Figure 3, *Existing Land Uses*, agriculture uses represent less than 1 percent of existing land uses in Yucca Valley. Additionally, according to the California Resource Agency's Department of Conservation 2010 Important Farmland Maps (California Department of Conservation 2012), no portion of the Town is designated Prime Farmland, Farmland of Statewide Importance, Unique Farmland, or Farmland of Local Importance. Therefore, no impacts to designated farmland would result from development in accordance with the General Plan Update and further analysis is not required. This topic will not be evaluated in the EIR.

b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?

No Impact. Williamson Act contracts restrict the use of privately owned land to agriculture and compatible opens space uses under contract with local governments. In exchange, the land is taxed based on actual use rather than potential market value. The Town of Yucca Valley does not designate any land within the Town for agricultural uses. Additionally, no areas in the Town are under Williamson Act contracts (DLRP 2007). Therefore, future development in accordance with the General Plan Update would not result in the conversion of areas zoned for agriculture uses to nonagricultural use, and further analysis is not required. This topic will not be evaluated in the EIR.

c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?

No Impact. Implementation of the General Plan Update would not cause the rezoning or conflict with the existing zoning of forest land or timberland as defined by Public Resources Code sections 12220(g) or 51104(g). Yucca Valley does not have any areas designated forest land or timberland for production or resource management, so the proposed General Plan Update would not cause any impacts to such areas. This topic will not be evaluated in the EIR.

d) Result in the loss of forest land or conversion of forest land to non-forest use?

No Impact. State and county maps of wildlife habitats compiled by the California Department of Forestry and Fire Protection identify that some of the undeveloped areas in Yucca Valley contains Joshua tree woodland, juniper woodland, and pinyon/juniper woodland. However, these areas are not heavily forested and do not

meet the definition of "forest land."[1] Implementation of the General Plan Update would not convert forest to nonforest use. Impacts to forest land will not be examined in the EIR.

e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?

No Impact. As discussed above, the Town of Yucca Valley does not have agricultural or significant forest resources. No impacts would occur and this issue will not be addressed in the EIR.

3.3 AIR QUALITY

Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:

a) Conflict with or obstruct implementation of the applicable air quality plan?

Potentially Significant Impact. Yucca Valley is in the Mojave Desert Air Basin (MDAB), which is a nonattainment area for the federal and state air quality standards (AAQS) for ozone (O_3), fine inhalable particulate matter ($PM_{2.5}$) (California AAQS only), and coarse inhalable particulate matter (PM_{10}). The federal and California clean air acts require areas designated nonattainment to reduce emissions until standards are met. Buildout of the Yucca Valley General Plan would result in short-term construction-related and long-term air pollutant emissions that have the potential to affect local and regional air quality. Further evaluation is necessary to determine whether the proposed project would conflict with the Mojave Desert Air Quality Management District's (MDAMQD) air quality management plans. The EIR will assess the General Plan Update's consistency with applicable air quality management plans and will recommend mitigation measures as appropriate.

b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?

Potentially Significant Impact. As noted above, Yucca Valley is in the MDAB, which is a nonattainment area for the federal and state ambient air quality standards for O_3, $PM_{2.5}$ (California AAQS only), and PM_{10}. The federal and California clean air acts require areas designated nonattainment to reduce emissions until standards are met. Air pollutant emissions generated by short-term construction activities and long-term operation associated with future development accommodated by the General Plan Update could generate emissions that exceed MDAMQD's significance thresholds and cumulatively contribute to the nonattainment designations of the MDAB. Impacts to air quality standards will be examined in the EIR.

c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?

Potentially Significant Impact. Yucca Valley is a nonattainment area for O_3, $PM_{2.5}$ (California AAQS only), and PM_{10}. Air pollutant emissions generated by short-term construction activities and long-term operation of future development accommodated by the General Plan Update could generate emissions that cumulatively

[1] Forest land is land that can support 10 percent native tree cover of any species, including hardwoods, under natural conditions, and that allows for management of one or more forest resources, including timber, aesthetics, fish and wildlife, biodiversity, water quality, recreation, and other public benefit. (California Public Resources Code, section 12220)

contribute to the nonattainment designations of the MDAB. Criteria air pollutant increases and associated impacts will be examined in the EIR.

d) Expose sensitive receptors to substantial pollutant concentrations?

Potentially Significant Impact. Localized concentrations refer to an amount of pollutant in a volume of air and can be correlated to potential health effects. Air pollutant emissions generated by short-term construction activities and long-term operation associated with future development accommodated by the General Plan Update could generate emissions that exceed MDAMQD's significance thresholds and cumulatively contribute to the nonattainment designations of the MDAB. The EIR will evaluate the proposed land use changes and the potential air quality impacts of these uses on sensitive receptors.

e) Create objectionable odors affecting a substantial number of people?

Potentially Significant Impact. Residential development and commercial uses do not typically generate objectionable odors that affect a substantial number of people. However, some industrial uses, including the future wastewater treatment plant, have the potential to generate objectionable odors. The EIR will evaluate potential sources of odor generated by future development accommodated by the General Plan Update and their potential to affect a substantial number of people.

3.4 BIOLOGICAL RESOURCES

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?

Potentially Significant Impact. The majority of the area within Yucca Valley's boundaries is undeveloped. Natural communities in and around Yucca Valley include desert saltbush scrub, Joshua tree woodland, and pinyon-juniper woodland environments. Several species of special concern are found in or near Yucca Valley, including the northern red diamond rattlesnake, yellow warbler, Nelson's bighorn sheep, burrowing owl, triple-ribbed milk vetch, Parish's daisy, western yellow-billed cuckoo, willow flycatcher, red-tailed hawk, golden eagle, turkey buzzard, and several species of bat. The desert tortoise, a federally threatened species, is also found in and near Yucca Valley. Therefore, future development under the General Plan Update may impact sensitive species habitats. The EIR will evaluate sensitive species, current regulatory requirements, and potential impacts to sensitive species and habitat. As a part of the EIR, a biological resources technical report will be prepared.

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?

Potentially Significant Impact. Riparian habitats occur along the banks of rivers and streams. Sensitive natural communities are natural communities that are: considered rare in the region by regulatory agencies; known to provide habitat for sensitive animal or plant species; or known to be important wildlife corridors. According to the U.S. Fish and Wildlife Services (USFWS) National Wetlands Inventory, small areas of Yucca Valley are designated wetlands, including parts of the Water Canyon Wash, Yucca Wash, and several small retention ponds and basins. These areas potentially feature riparian habitat. The EIR will identify sensitive natural communities within Yucca Valley and current regulatory requirements and evaluate potential impacts of the General Plan Update. As a part of the EIR, a biological resources technical report will be prepared.

c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

Potentially Significant Impact. As noted above in Response 3.4(b), the USFWS National Wetlands Inventory has designated a number of small wetlands in Yucca Valley. Implementation of the General Plan Update would allow for development near areas that could contain wetland habitat. The EIR will assess impacts to wetlands within Yucca Valley. As a part of the EIR, a biological resources technical report will be prepared.

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

Potentially Significant Impact. Undeveloped areas throughout the Town could provide areas for wildlife movement. Additionally, sensitive species may be found in Yucca Valley, as noted above. Future development in these areas under the General Plan Update may impact migratory or wildlife species or corridors. The EIR will evaluate these potential impacts. As a part of the EIR, a biological resources technical report will be prepared.

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

Potentially Significant Impact. Certain native plants in Yucca Valley are protected by the Town's Native Plant Ordinance, which is currently under review. The current version of the ordinance requires that a Native Plant Permit be obtained before any identified native plant is moved, transplanted, trimmed, or destroyed. Protected plant species include mesquite, Joshua tree, California juniper, desert willow, pinyon pine, palo verde, manzanita, and plants protected by the California Desert Native Plants Act. As part of the EIR, a biological resources technical report will be prepared. The EIR will analyze impacts related to compliance with local policies protecting biological resources. Mitigation measures will be identified as necessary.

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

Potentially Significant Impact. The entire Town of Yucca Valley is in the plan area for the proposed Desert Renewable Energy Conservation Plan Natural Community Conservation Plan (NCCP) / Habitat Conservation Plan (HCP) and the proposed West Mojave Plan HCP. The proposed Desert Renewable Energy Conservation Plan was established to conserve and manage rare, threatened, and endangered plant and wildlife species while streamlining the review and approval of renewable energy projects in California's desert areas (California Energy Commission 2012). The Bureau of Land Management's (BLM) West Mojave Plan is a proposed multiple-species HCP aimed at protecting nearly 100 federal- and state-listed plant and wildlife species and their habitats, including the desert tortoise, a federally threatened species residing in Yucca Valley. The Town is a participant in the West Mojave Plan. Assuming the Town becomes a signatory to the Plans, development projects approved pursuant to the proposed General Plan Update would be required to comply with habitat assessment and survey requirements proposed in West Mojave Plan HCP and the Desert Renewable Energy Conservation Plan NCCP/HCP, where applicable. The EIR will evaluate any potential conflicts of the General Plan Update with applicable conservation plans.

3.5 CULTURAL RESOURCES

a) Cause a substantial adverse change in the significance of a historical resource as defined in § 15064.5?

Potentially Significant Impact. Section 15064.5 defines historic resources as resources listed or determined to be eligible for listing by the State Historical Resources Commission, a local register of historical resources, or the lead agency. Generally a resource is considered to be "historically significant" if it meets one of the following criteria:

i) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

ii) Is associated with the lives of persons important in our past;

iii) Embodies the distinctive characteristics of a type, period, region or method of construction, or represents the work of an important creative individual, or possesses high artistic values;

iv) Has yielded, or may be likely to yield, information important in prehistory or history.

Known potential historical resources in Yucca Valley include but are not limited to Desert Christ Park, the Yucca Valley Elks Club, Warren's Well, and a historic school house at Wamego and Yucca Trail. Other historic resources could also exist within the Town. Changes to policies and land use designations in the General Plan Update may impact these and other historical resources. A historical records search will be conducted and analysis of potential impacts to historic resources will be included in the EIR.

b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5?

Potentially Significant Impact. Yucca Valley was first inhabited by the Serrano and Chemehuevi Indians, who occupied the San Bernardino Mountains during summer and the warmer Coachella Valley in the winter. Artifacts and petroglyphs from these early inhabitants can still be found in and around Yucca Valley today. Nearby Joshua Tree National Park includes over 500 archaeological sites. Development in accordance with the proposed General Plan Update may cause the disturbance of archaeological resources, including those mentioned above. Building construction of undeveloped areas or redevelopment that requires excavation to depths greater than current foundations would potentially cause the destruction of unknown archaeological resources. The EIR will evaluate potential impacts of the General Plan Update on sensitive archeological resources. As a part of the EIR, a records search of archeological resources will be conducted.

c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Potentially Significant Impact. Unique paleontological resources may be present in Yucca Valley, especially in areas of undetermined significance where sedimentary formations are exposed. The EIR will evaluate potential impacts of the General Plan Update on unique paleontological resources and geologic features. As part of the EIR, a record search for paleontological resources will be conducted.

d) Disturb any human remains, including those interred outside of formal cemeteries?

Less Than Significant Impact. California Health and Safety Code Section 7050.5, CEQA Section 15064.5, and Public Resources Code Section 5097.98 mandate the process to be followed in the event of an accidental

discovery of any human remains in a location other than a dedicated cemetery. Specifically, California Health and Safety Code Section 7050.5 requires that in the event that human remains are discovered within the project site, disturbance of the site shall remain halted until the coroner has conducted an investigation into the circumstances, manner and cause of any death, and the recommendations concerning the treatment and disposition of the human remains have been made to the person responsible for the excavation, or to his or her authorized representative, in the manner provided in Section 5097.98 of the Public Resources Code. If the coroner determines that the remains are not subject to his or her authority and if the coroner recognizes or has reason to believe the human remains to be those of a Native American, he or she shall contact, by telephone within 24 hours, the Native American Heritage Commission. Although soil-disturbing activities associated with development in accordance with the General Plan Update could result in the discovery of human remains, compliance with existing law would ensure that significant impacts to human remains would not occur. This topic will not be evaluated in the EIR and no mitigation measures are required.

3.6 GEOLOGY AND SOILS

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning map, issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.

Potentially Significant Impact. The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazards of surface faulting and fault rupture to built structures. Active earthquake faults are faults where surface rupture has occurred within the last 11,000 years. Surface rupture of a fault generally occurs within 50 feet of an active fault line. There are numerous Alquist-Priolo fault zones in and near Yucca Valley, many of which were identified as active after three large earthquakes occurred in the region in 1992 (CGS 2007a). These fault zones include the Johnson Valley Fault, Homestead Valley Fault, Eureka Peak Fault, Burnt Mountain Fault, and the Pinto Mountain Fault which lies directly under central Yucca Valley (CGS 2007b). Several major faults are located in the region surrounding Yucca Valley, including the San Andreas Fault, which lies approximately 10 miles south and southwest of Yucca Valley in the Coachella Valley. Hazards from surface rupture of a known active fault would be potentially significant and will be evaluated in the EIR.

ii) Strong seismic ground shaking?

Potentially Significant Impact. Yucca Valley is subject to relatively high seismic hazards. The primary hazard is ground shaking produced by earthquakes generated from regional faults that are within or near Yucca Valley. The most probable sources of earthquakes that might have a potential for causing damage in Yucca Valley are the Pinto Mountain Fault that traverses the middle of Yucca Valley and the San Andreas Fault, approximately 10 miles to the south and southeast. Based on this proximity, the potential for ground shaking in Yucca Valley is very high. The state regulates development in California through a variety of tools that reduce hazards from earthquakes and other geologic hazards. The 2010 California Building Code (CBC; California Code of Regulations, Title 24, Part 2) contains provisions to safeguard against major structural failures or loss of life caused by earthquakes or other geologic hazards. Future development that would be accommodated by the General Plan Update would be required to adhere to the provisions of the CBC, which are imposed on project developments by the Town during the building plan check and development review process. Compliance with the requirements of the 2010 CBC for structural safety during a seismic event would reduce hazards from strong seismic ground shaking. Despite the required application of these

safety measures, impacts resulting from strong seismic ground shaking would remain potentially significant. Therefore, this topic will be further evaluated in the EIR.

iii) Seismic-related ground failure, including liquefaction?

Potentially Significant Impact. Certain areas of Yucca Valley may be susceptible to ground failure, including liquefaction. The potential for impacts from liquefaction will be addressed in the EIR.

iv) Landslides?

Potentially Significant Impact. Future development on or near hillside areas could be impacted by landslides. The EIR will evaluate the potential impacts from landslides.

b) Result in substantial soil erosion or the loss of topsoil?

Potentially Significant Impact. Yucca Valley includes hilly areas that surround the central part of the Town in all directions. Hillside areas and areas consisting of sandy soils are susceptible to soil erosion, especially where there is limited vegetation to protect the topsoil when infrequent but intense storms create flood conditions. Soil erosion may also occur during construction-related ground disturbance from clearing, grading, and excavation. Future development in accordance with the General Plan Update may result in soil erosion and/or loss of topsoil. The EIR will evaluate these potential impacts.

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

Potentially Significant Impact. Future development accommodated by the General Plan Update may occur on soil that is unstable. Although the topography and soil types within the Town limits are not prone to landslides, a powerful earthquake could cause rockfall in the hilly terrain in the northern and western regions of the Town. Rockfall was observed in Yucca Valley following the 1992 Landers earthquake. The potential for impacts as a result of lateral spreading, subsidence, liquefaction, or collapse will be addressed in the EIR.

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?

Potentially Significant Impact. Expansive soils could be present within Yucca Valley. Future development accommodated by the General Plan Update may be proposed and/or located on expansive soils. The hazard of expansive soils is potentially significant and will be evaluated in the EIR.

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

Potentially Significant Impact. Although a sewer system and wastewater collection and treatment facility is being planned for the Town, residents of Yucca Valley currently rely on septic systems for wastewater disposal. For this reason, groundwater contamination is a major concern in the Town. Soils incapable of supporting septic tanks or alternative waste water disposal systems may be present within the Town. Future General Plan development may need to rely on septic tanks or other alternative wastewater disposal systems until the proposed sewer system and associated facilities are in place. This issue will be evaluated in the EIR.

3.7 GREENHOUSE GAS EMISSIONS

a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

Potentially Significant Impact. Implementation of future development projects pursuant to the General Plan Update would increase land use intensities, generating additional traffic volumes and new direct and indirect sources of greenhouse gas (GHG) emissions throughout Yucca Valley. An analysis will be prepared as part of the EIR to determine the General Plan Update's potential GHG impacts.

b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Potentially Significant Impact Assembly Bill 32, the Global Warming Solutions Act of 2006 (AB 32) requires the state to reduce GHG emissions to 1990 levels by 2020. The California Air Resources Board (CARB) adopted the Scoping Plan to identify state regulations and programs that would be adopted by state agencies to achieve the 1990 target of AB 32. In addition, Senate Bill 375, the Sustainable Communities and Climate Protection Act of 2008 (SB 375) was adopted by the legislature to reduce per capita vehicle miles traveled and associated GHG emissions from passenger vehicles. The Southern California Association of Government's (SCAG) 2012 Regional Transportation Plan/Sustainable Communities Strategy identifies the per capita GHG reduction goals for the SCAG region. The EIR will evaluate consistency of the General Plan Update with the overall GHG reduction goals of AB 32 and SB 375.

3.8 HAZARDS AND HAZARDOUS MATERIALS

a) Create a significant hazard to the public or the environment through the routine transport, use or disposal of hazardous materials?

Potentially Significant Impact. Implementation of the General Plan Update would accommodate the development of commercial and industrial land uses, which may manufacture, transport, store, use, and dispose hazardous materials and waste. The transport of hazardous materials along the Town's highways and local roads creates potential risks for spills or leaks from nonstationary sources. The alteration, intensification, and redistribution of land uses may also contribute to public exposure and environmental hazards during transport, use, or disposal of hazardous materials. The EIR will evaluate impacts of the General Plan Update relative to hazardous materials.

b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

Potentially Significant Impact. The General Plan Update would accommodate the development of commercial and industrial land uses. These land uses have the potential to manufacture, use, store, and/or transport hazardous materials; therefore, such new land uses in Yucca Valley could create some risk of accidental release of hazardous materials. This topic will be addressed in the EIR.

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

Potentially Significant Impact. There are five public schools within Yucca Valley and numerous small private schools. Future development in accordance with the General Plan Update would involve development of land

uses that involve the use of hazardous materials or generate hazardous emissions within on-quarter mile of a school. This impact is potentially significant and will be addressed in the EIR.

d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

Potentially Significant Impact. The following databases of hazardous materials sites were searched for listings of hazardous materials within Yucca Valley: Geotracker, State Water Resources Control Board (SWRCB 2011); EnviroStor, Department of Toxic Substances Control (DTSC 2007); and EnviroMapper, US Environmental Protection Agency (USEPA 2011). These databases listed a number of hazardous material sites in Yucca Valley, including commercial land uses such as gas stations. Future development in accordance with the General Plan Update could lead to a significant hazard to the public or environment. This impact will be addressed in the EIR.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles or a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?

Potentially Significant Impact. As shown in Figure 2, *Townwide Aerial*, Yucca Valley Airport is in the Mid-Town area of Yucca Valley. Therefore, the airport's influence area and safety compatibility and noise contour zones fall within Town boundaries. Future development in accordance with the General Plan Update could potentially increase or intensify development near the airport. The EIR will evaluate potential airport-related hazards to people residing or working within Yucca Valley.

f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?

Potentially Significant Impact. There are no private airstrips within the Town boundaries of Yucca Valley. However, Southern California Edison's privately owned Yucca Valley Service Center Heliport is in Mid-Town Yucca Valley, approximately 500 feet south of the western end of the runway of Yucca Valley Airport. New development or redevelopment near this private heliport may put the public at risk. Impacts are potentially significant and this issue will be discussed in the EIR.

g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

Potentially Significant Impact. The General Plan Update calls for changes to land use designations within Yucca Valley that would affect its overall land use patterns. The street layout would not be altered except in areas of substantial redevelopment or new development. With the increase in development growth and the expansion or alteration of local roadways, the implementation of emergency management plans may be affected by the proposed project. Impacts are potentially significant and additional analysis is required in the EIR.

h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

Potentially Significant Impact. In September of 2007, the California Department of Forestry and Fire Protection (CAL FIRE) released its draft Fire Hazard Severity Zones maps for the Local Responsibility Areas of various counties and cities throughout the state for their review and comment. The Fire Hazard Severity Zones (Very High, High, Moderate, and Other) were developed by CAL FIRE based on an evaluation of fuels, topography,

dwelling density, weather, infrastructure, building materials, brush clearance, and fire history. Portions of Yucca Valley are within and adjacent to areas that are identified as wildfire hazard zones. Specifically, the central, west-central, and southern parts of Yucca Valley are designated areas of high and very high hazard (CAL FIRE 2007). Development in these areas as proposed under the General Plan Update could place structures and people at risk for wildland fires. Impacts are potentially significant and this issue will be addressed in the EIR.

3.9 HYDROLOGY AND WATER QUALITY

a) Violate any water quality standards or waste discharge requirements?

Potentially Significant Impact. The US Environmental Protection Agency (EPA) establishes national water quality standards. Pursuant to Section 402 of the Clean Water Act, the EPA has also established regulations under the National Pollution Discharge Elimination System (NPDES) program to control direct stormwater discharges. In Yucca Valley, the Colorado River Basin Regional Water Quality Control Board administers NPDES permitting programs and is responsible for developing waste discharge requirements. Construction and operation of planned development per the General Plan Update has the potential to discharge sediment and pollutants to storm drains and receiving waters. The EIR will discuss potential water quality impacts.

b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?

Potentially Significant Impact. The Hi-Desert Water District provides water supply to residents and businesses in Yucca Valley via multiple sources of water, including groundwater. The General Plan Update may result in the intensification of land uses and the development of vacant land throughout the Town, increasing the number of residents. Therefore, total domestic water demand for the Town could rise, and this could contribute to the overall demand for local and regional groundwater supplies. Additionally, development of vacant land could interfere with groundwater recharge. Impacts to groundwater supplies and recharge potential due to implementation of the General Plan Update will be evaluated in the EIR.

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in a substantial erosion or siltation on- or off-site.

Potentially Significant Impact. Although Yucca Valley has no perennial rivers or streams, the Town features broad desert washes and drainage channels that carry sediment-laden water and other materials during infrequent but violent storms common in the region. Implementation of the General Plan Update would alter the existing land use designations within Yucca Valley. Development in accordance with the General Plan Update may alter drainage patterns, increase erosion, and discharge sediment to watercourses. The EIR will evaluate impacts to drainage patterns within Yucca Valley.

d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

Potentially Significant Impact. See response to Section 3.9(c), above. Future development in accordance with the General Plan Update would alter existing land uses in Yucca Valley. Increased urbanization may increase the amount of runoff from impervious surfaces and result in flooding on- or offsite. The EIR will evaluate potential impacts to drainage and surface runoff within the Town.

e) Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?

Potentially Significant Impact. Development in accordance with the General Plan Update would involve alteration, intensification, and redistribution of land uses. Increased urbanization may increase the amount of runoff and discharge sediments and pollutants to stormwater drainage systems. The EIR will evaluate potential impacts to stormwater systems.

f) Otherwise substantially degrade water quality?

Potentially Significant Impact. Development in accordance with the General Plan Update would involve the alteration and redistribution of land use designations and would include development in the undeveloped areas. Current and future uses may result in discharge of sediment and pollutants to existing stream courses, which in turn could affect water quality. The EIR will evaluate potential impacts to water quality.

g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

Potentially Significant Impact. Parts of Yucca Valley are within 100-year flood zones designated by the Federal Emergency Management Agency (FEMA), including areas along Water Canyon, Yucca Wash and their tributaries extending to the south. Parts of the community are susceptible to flooding during heavy downpours, which are a common element of the region's unpredictable seasonal rainfall. Brief but intense storms can overwhelm these drainage channels, pushing water and sediment over low-lying areas and making dirt roads impassable. Development in accordance with the General Plan Update would include additional housing units in Yucca Valley, with some potentially located in or near flood hazard areas. Flood hazards will be discussed in the EIR.

h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?

Potentially Significant Impact. As noted above, parts of Yucca Valley are within 100-year flood zones designated by FEMA. Future development in accordance with the General Plan Update may place structures in or near flood hazard areas. Flood hazards will be discussed in the EIR.

i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

Potentially Significant Impact. The Town of Yucca Valley is not within a dam inundation area. However, levees are present along the eastern portion of the Water Canyon Channel and Burnt Mountain Wash. There are also planned and existing detention/debris basins in the Town that contain stormwater on a temporary basis. Implementation of the proposed General Plan could expose additional population—generated by additional residential, commercial and industrial uses—to flood hazards. The EIR will address the potential impact to people and structures of flooding from levee failure.

j) Inundation by seiche, tsunami, or mudflow?

Potentially Significant Impact. A seiche is a surface wave created when a body of water is shaken, usually by earthquakes. Seiches are of concern relative to water storage facilities because inundation from a seiche can occur if the wave overflows a containment wall, such as the wall of a reservoir, water storage tank, dam, or other artificial body of water. Seiches may occur within 15 aboveground water tanks maintained by the Hi-Desert Water District and located within Yucca Valley. A sixteenth aboveground water tank is in the Yucca Mesa area northeast of the Town. Many of these tanks were constructed 20 years ago or more, before the adoption of

newer earthquake design standards. Older tanks may not meet the new construction requirements for safety, lacking the flexible joints and other seismic upgrades that can help limit the damage that a failed water tank could cause to areas downstream.

Tsunamis are large ocean waves caused by underwater seismic activity. When tsunamis hit the coast, they can cause considerable damage to property and put the public at risk. Yucca Valley is approximately 80 miles from the Pacific Ocean and is well outside the tsunami hazard zone.

Mudflows are associated with landslides and heavy rainfall. Much of Yucca Valley is located on or near the base of hillsides and is downstream from canyons that have the potential to convey mudflows.

Overall, there would be no impacts related to tsunamis in Yucca Valley because it is not in a coastal area. Potentially significant impacts may occur, however, from mudflows and seiches with the implementation of the General Plan Update. Seiches and mudflows will be discussed in more detail in the EIR.

3.10 LAND USE AND PLANNING

a) Physically divide an established community?

Potentially Significant Impact. Implementation of the General Plan Update would involve development of vacant land and the intensification of redevelopment of other areas of Yucca Valley. These changes have the potential to physically divide established communities within the Town. The EIR will evaluate the impacts of the proposed project on existing land use patterns.

b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?

Potentially Significant Impact. The proposed project would replace the current Yucca Valley General Plan and would modify land use designations in Yucca Valley. The EIR will evaluate the consistency of the General Plan with other land use plans, policies, and/or regulations governing Yucca Valley.

c) Conflict with any applicable habitat conservation plan or natural community conservation plan?

Potentially Significant Impact. The entire Town of Yucca Valley is in the plan area for the proposed Desert Renewable Energy Conservation Plan Natural Community Conservation Plan (NCCP) / Habitat Conservation Plan (HCP) and the proposed West Mojave Plan HCP. The proposed Desert Renewable Energy Conservation Plan was established to conserve and manage rare, threatened, and endangered plant and wildlife species while streamlining the review and approval of renewable energy projects in California's desert areas (California Energy Commission 2012). The Bureau of Land Management's (BLM) West Mojave Plan is a proposed multiple-species HCP aimed at protecting nearly 100 federal- and state-listed plant and wildlife species and their habitats, including the desert tortoise, a federally threatened species residing in Yucca Valley. The Town is a participant in the West Mojave Plan. Assuming the Town becomes a signatory to the Plans, development projects approved pursuant to the proposed General Plan Update would be required to comply with habitat assessment and survey requirements proposed in West Mojave Plan HCP and the Desert Renewable Energy Conservation Plan NCCP/HCP, where applicable. The EIR will evaluate any potential conflicts of the General Plan Update with applicable conservation plans.

3.11 MINERAL RESOURCES

a) Result in the loss of availability of a known mineral resource that would be a value to the region and the residents of the state?

Less Than Significant Impact. Mineral deposits within San Bernardino County are not only important to the economic well-being of the County, but many industries outside the County depend on them as well. The nonrenewable characteristic of these mineral deposits necessitates careful and efficient management to prevent waste, careless exploitation, and uncontrolled urbanization. However, the Town of Yucca Valley likely does not contain mineral resources of statewide or regional importance. The Town lies outside of areas that have been mapped by the California Geologic Survey for mineral resource classification and the United States Geologic Survey does not identify any mines, processing plants, or locations of potential mining resources within Town (USGS 2012). Therefore, it is unlikely that development associated with buildout of the General Plan Update would result in the loss of important mineral resources. This topic will not be evaluated in the EIR and no mitigation measures are required.

b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?

Less Than Significant Impact. See response to Section 3.11(a), above. The current Yucca Valley General Plan states that sand and gravel deposits in the area represent an important economic resource, but acknowledges that Yucca Valley contains relatively few valuable or strategic mineral resources. Sand and gravel are prevalent in the Mojave Desert region, and development associated with buildout of the General Plan Update would not result in the loss of availability of locally important mineral resources. This topic will not be evaluated in the EIR and no mitigation measures are required.

3.12 NOISE

a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Potentially Significant Impact. The General Plan Update would involve the alteration, intensification, and redistribution of land uses, which may result in temporary, periodic, or permanent increases in ambient noise or in noise levels in excess of standards established in the Town's General Plan or Municipal Code. The General Plan includes an update to the Noise Element. A technical noise analysis will be conducted, and issues relating to noise will be further evaluated in the EIR. Emphasis will be placed on the major noise sources in Yucca Valley, including traffic on SR-62 and SR-247, traffic on major arterial streets, general aviation operations at Yucca Valley Airport, military aviation operations related to Marine Corps Air Ground Combat Center Twentynine Palms, and scattered stationary sources.

b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

Potentially Significant Impact. The General Plan Update would involve the alteration, intensification, and redistribution of land uses. Implementation of these land use changes may result in excessive short- and/or long-term groundborne vibration or noise. An analysis will be conducted and issues relating to groundborne vibration and groundborne noise will be evaluated in the EIR. No specific sources of substantial vibration, such as heavy machinery and rail operations, are anticipated to be included as part of the implementation of the General Plan. As a part of this impact assessment, attention will focus on the construction phases of new development accommodated under the General Plan Update.

c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

Potentially Significant Impact. Development pursuant to the General Plan Update may result in a permanent increase in ambient noise above existing levels from stationary and transportation-related noise sources, particularly in undeveloped areas. As discussed in response a), a noise analysis will be conducted and the EIR will evaluate the proposed project's potential increase in ambient noise levels.

d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

Potentially Significant Impact. Development pursuant to the General Plan Update may result in a temporary or periodic increase in ambient noise above existing levels, particularly in undeveloped areas. A noise analysis will be conducted and the EIR will evaluate the proposed project's potential impact on ambient noise levels. Attention will focus on the construction phases of new development accommodated under the General Plan Update.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

Potentially Significant Impact. As shown in Figure 2, *Townwide Aerial*, Yucca Valley Airport is within the Town boundaries. Portions of the Town, including residential and commercial land uses, fall within the airport influence area of this airport, in which noise and safety issues related to the development of land uses and aircraft operations must be considered. Future development in accordance with the General Plan Update could potentially increase or intensify development near the airport and could, therefore, expose people residing or working in the area to excessive noise levels from airport activities. The EIR will evaluate potential airport-related noise impacts to people residing or working near the airport.

f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

Potentially Significant Impact. There are no private airstrips within the Town boundaries of Yucca Valley. However, Southern California Edison's privately owned Yucca Valley Service Center Heliport is in Mid-Town Yucca Valley, approximately 500 feet south of the western end of the runway of Yucca Valley Airport. New development or redevelopment near this private heliport may expose people residing or working near the heliport to excessive noise levels. This issue will be discussed in the EIR.

3.13 POPULATION AND HOUSING

a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?

Potentially Significant Impact. The existing population of the Town of Yucca Valley is estimated to be approximately 22,464 (see Table 1, *Existing Land Use Summary*). The proposed General Plan Update would allow the construction of new housing in a variety of densities and employment-generating businesses throughout the Town. General Plan buildout is estimated to increase the population of the Town to 64,543, approximately triple the existing population. General Plan buildout would also increase the amount of nonresidential land uses in the Town and is estimated to generate approximately 34,927 total employees (see Table 3, *Proposed General*

Plan Land Use Designations). The EIR will evaluate population growth related to development allowed in the proposed General Plan Update.

b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?

Potentially Significant Impact. The Town of Yucca Valley is estimated to contain approximately 9,458 dwelling units (see Table 1, *Existing Land Use Summary*). The proposed General Plan Update would allow a total of 27,219 residential units (see Table 3, *Proposed General Plan Land Use Designations*). The potential for development and redevelopment pursuant to the proposed General Plan Update to displace existing housing will be analyzed in the EIR.

c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?

Potentially Significant Impact. The potential for development and redevelopment projects approved pursuant to the proposed General Plan Update to displace existing residents will be analyzed in the EIR.

3.14 PUBLIC SERVICES

Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:

a) Fire protection?

Potentially Significant Impact. Fire protection services are provided in Yucca Valley by the San Bernardino County Fire Department, which currently has one fire station in the Town of Yucca Valley (Station 41) and two fire stations outside Yucca Valley that also provide service to the Town (Stations 38 and 42). The alteration of land uses and new development could potentially increase the demands on fire department personnel and equipment. The EIR will evaluate impacts of the General Plan Update on fire protection services.

b) Police protection?

Potentially Significant Impact. The San Bernardino County Sheriff's Office, through a contract with the Town, provides police protection in Yucca Valley. The county's Morongo Basin substation in the community of Joshua Tree serves as the area's regional headquarters for provision of police services. A satellite law enforcement facility is in the Yucca Valley Community Center. The alteration of land uses and new development could potentially increase the demands on police department personnel and facilities. The EIR will evaluate impacts of the General Plan Update on police protection services.

c) Schools?

Potentially Significant Impact. The Morongo Unified School District provides service to Yucca Valley. Public school facilities in the Town include Yucca Valley and Onaga Elementary Schools, La Contenta Junior High School, Sky Continuation High School, and Yucca Valley High School. The alteration of land uses and new development would likely increase the need for school services and facilities. The EIR will evaluate impacts of the General Plan Update on school services and facilities.

d) Parks?

Potentially Significant Impact. The General Plan Update would designate approximately 405 acres for parks and open space, more than triple the amount of acreage currently used for parks and open space (132 acres). However, population increase associated with the General Plan Update would increase overall demand on parks and on recreational services and facilities within Yucca Valley. The EIR will evaluate the provision of additional park space in Yucca Valley and impacts to parks services and facilities.

e) Other public facilities?

Potentially Significant Impact. Library services in Yucca Valley are provided by the Yucca Valley Branch Library, which is operated by the County of San Bernardino. The library has a collection of over 43,000 items. Population increases associated with the General Plan Update would increase demands on library facilities and services. The EIR will evaluate impacts on library services.

3.15 RECREATION

a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities, such that substantial physical deterioration of the facility would occur or be accelerated?

Potentially Significant Impact. The General Plan Update would accommodate the development of new housing at a variety of densities, which could increase the use of neighborhood and regional parks and recreational facilities. The EIR will address the potential impacts of the General Plan Update to parks and recreational facilities.

b) Does the project include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?

Potentially Significant Impact. The General Plan Update would include approximately 504 acres of parks and open space. However, population increase from future development associated with the General Plan Update would increase overall demand on parks and recreational services and facilities within Yucca Valley. The EIR will evaluate the provision of additional park space in Yucca Valley and impacts to parks services and facilities.

3.16 TRANSPORTATION/TRAFFIC

a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?

Potentially Significant Impact. The General Plan Update would allow for development of currently undeveloped parcels and for alteration, intensification, or redistribution of existing land uses. These changes could result in an increase and redistribution of vehicle trips, which may conflict with local plans, policies, or ordinances regarding vehicular traffic efficiency or mass transit, bicycle, and pedestrian routes within the circulation system. A traffic analysis will be conducted to assess the exiting conditions and future forecast traffic conditions. The traffic analysis will include a roadway operations analysis, a level of service analysis for study-area roadway segments and freeway locations, and an analysis of regional transportation performance measures, including total vehicle trips and vehicle miles traveled for daily conditions. Impacts related to compliance with

plans and policies that establish measures of effective performance of the circulation system would be potentially significant, and this issue will be discussed in more detail in the EIR.

b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?

Potentially Significant Impact. The Congestion Management Plan (CMP) in effect in San Bernardino County was approved by the San Bernardino Association of Governments (SANBAG) in 2007 and is currently being updated. All freeways and selected roadways in the County are designated elements of the CMP system of highways and roadways. This system includes two highways in Yucca Valley: SR-62 and SR-247. Traffic impacts to these roadways and their intersection that would result from implementation of the General Plan Update will be analyzed in the EIR.

c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?

No Impact. As shown in Figure 2, *Townwide Aerial*, the general aviation Yucca Valley Airport is located in Mid-Town Yucca Valley, directly east of SR-247. Seven other general aviation airports are within 30 miles of Yucca Valley—Banning Municipal, Hi-Desert, Johnson Valley, Bermuda Dunes, Big Bear City, Roy Williams, and Twentynine Palms Airports. Palm Springs International Airport, a public airport served by 11 commercial airlines, is approximately 30 miles (driving distance) south of Yucca Valley. Air space in the region is also used for military aviation operations related to Marine Corps Air Ground Combat Center Twentynine Palms. Future development in accordance with the General Plan Update may place additional residential, commercial, and industrial uses near the Yucca Valley Airport. However, those land use changes would not result in a change in air traffic patterns at Yucca Valley Airport. This topic will not be evaluated in the EIR.

d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

Potentially Significant Impact. A traffic analysis will be conducted for the EIR. The EIR will evaluate the potential hazards that may result from future planned circulation features or alteration of land uses.

e) Result in inadequate emergency access?

Potentially Significant Impact. Future development in accordance with the General Plan would involve alteration, intensification, and redistribution of land uses. These changes could result in changes to circulation patterns and emergency access routes. The EIR will evaluate the General Plan Update's impacts to emergency access.

f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?

Potentially Significant Impact. Future development in accordance with the General Plan Update would increase traffic in Yucca Valley. Increased traffic may affect public transit facilities, including bus, pedestrian, and bicycle facilities, by worsening the safety of these facilities or by increasing their use. Impacts to public transit policies, plans, or programs for public transit facilities are potentially significant. General Plans of California cities and counties are required under the Complete Streets Act to include planning for complete streets: that is, streets that meet the needs of all users of the roadway, including pedestrians, bicyclists, users of public transit, motorists, children, the elderly, and the disabled. Additionally, SCAG's Regional Transportation Plan/Sustainable

Communities Strategy calls for smart growth planning principles, including the creation of walkable communities and the provision of a variety of transportation choices. The EIR will consider the policies and programs of the General Plan Update and evaluate the consistency with adopted alternative transportation plans and programs.

3.17 UTILITIES AND SERVICE SYSTEMS

a) Exceed waste water treatment requirements of the applicable Regional Water Quality Control Board?

Potentially Significant Impact. All land uses in Yucca Valley currently rely on individual septic systems to treat wastewater. On November 1, 2011, the Colorado River Basin Regional Water Quality Control Board (RWQCB) amended its Basin Plan to prohibit discharge from septic systems in the Town of Yucca Valley. The prohibition will be phased, with areas of the Town prohibited from discharging beginning in 2016, 2019, and 2022. A wastewater treatment and water reclamation system that would collect, treat, and reclaim wastewater in a majority of Yucca Valley is currently being developed. The system, which is projected to begin construction in 2016, includes a sewer collection system, a wastewater treatment plant, and water reclamation recharge ponds (Hi-Desert 2012). Future development in accordance with the General Plan Update would increase residential and nonresidential development and associated wastewater flows into the proposed wastewater treatment and water reclamation system and may exceed wastewater treatment requirements set forth by the Colorado River Basin RWQCB. The EIR will evaluate impacts to wastewater treatment requirements.

b) Require or result in the construction of new water or waste water treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?

Potentially Significant Impact. See response to Section 3.17(a), above. Future growth in accordance with the General Plan Update may necessitate expanded water and wastewater collection and treatment facilities. The EIR will evaluate the impacts to water and wastewater facilities.

c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?

Potentially Significant Impact. The San Bernardino County Flood Control District is responsible for regional stormwater management in Yucca Valley. Yucca Valley and the surrounding area often experience brief but intense storms that can overwhelm drainage channels and improved gutters, pushing water and sediment over low-lying areas of the Town. Increased development in Yucca Valley under the General Plan Update would create additional impervious surfaces and stormwater runoff, which could require additional stormwater facilities and expansion of existing facilities. The EIR will evaluate impacts of the General Plan Update to stormwater drainage facilities.

d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?

Potentially Significant Impact. Yucca Valley's water supply consists primarily of groundwater from the Warren Valley and Ames Valley groundwater basins, but is supplemented by State Water Project water as needed. The Hi-Desert Water District (HDWD), which owns and operates 13 active wells, provides water supply to residential and nonresidential land uses in the Town. The Town's groundwater supply is supplemented by water from the Mojave Water Agency, the State Water contractor in the region and supplier of the HDWD's State Water Project water allocation. Future development and population growth in accordance with the General Plan Update would generate an increase in water demand within Yucca Valley. The EIR will address impacts to water supplies.

e) Result in a determination by the waste water treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?

Potentially Significant Impact. See response to Section 3.17(a), above. Buildout of the updated General Plan may require additional wastewater capacity from the HDWD to serve projected population demands. The EIR will evaluate the General Plan Update's impacts to wastewater treatment capacity.

f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?

Potentially Significant Impact. Solid waste collection and disposal services in Yucca Valley are provided by Burrtec Waste Industries. However, property owners and residents are not required to contract with the local waste management service and are allowed to dispose of refuse at local landfills or recycling centers themselves. Burrtec Waste Industries disposes solid waste at seven landfills in Southern California, including the Landers Landfill located approximately four miles north of Yucca Valley. Future development in accordance with the General Plan Update may increase the amount of solid waste generated in Yucca Valley and may require expansion of landfills or the adoption of alternative methods for solid waste disposal. The EIR will evaluate long-term regional landfill capacity.

g) Comply with federal, state, and local statutes and regulations related to solid waste?

Potentially Significant Impact. Future development in accordance with the General Plan Update may increase the amount of solid waste generated in Yucca Valley and may require expansion of landfills or the adoption of alternative methods for solid waste disposal. The EIR will evaluate the General Plan Update's conformance with federal, state, and local regulations related to solid waste.

3.18 MANDATORY FINDINGS OF SIGNIFICANCE

a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?

Potentially Significant Impact. Future development pursuant to the General Plan Update would involve alteration, intensification, and redistribution of land uses in Yucca Valley. These changes have the potential to degrade the quality of the environment and could cause potentially significant impacts to biological resources, including areas of native habitat, and to cultural resources, including archeological and paleontological resources. Impacts would be potentially significant and these issues will be discussed in more detail in the EIR.

b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)

Potentially Significant Impact. Implementation of the General Plan Update and its land use changes could result in cumulative impacts to aesthetics, air quality, biological resources, cultural resources, geology and soils, greenhouse gas emissions, hazards and hazardous materials, hydrology and water quality, land use and

planning, noise, population and housing, public services, recreation, transportation and traffic, and utilities and service systems. Impacts would be potentially significant and these issues will be discussed in the EIR.

c) Does the project have environmental effects, which will cause substantial adverse effects on human beings, either directly or indirectly?

Potentially Significant Impact. As discussed in this Initial Study, the General Plan Update and its associated land use changes would potentially have harmful effects on the environment, which would affect humans either directly or indirectly. These impacts include air quality, greenhouse gas emissions, hazards and hazardous materials, hydrology and water quality, and noise. Impacts would be potentially significant and these issues will be discussed in the EIR.

This page intentionally left blank.

4. References

California Department of Conservation. 2012. Farmland Mapping & Monitoring Program – 2010 County Important Farmland Maps. http://www.conservation.ca.gov/dlrp/fmmp/Pages/Index.aspx

California Department of Forestry and Fire Protection (CAL FIRE). 2007. Southeast San Bernardino County FHSZ Map. http://frap.cdf.ca.gov/webdata/maps/san_bernardino_se/fhszl_map.63.pdf

California Department of Toxic Substances and Control (DTSC). 2007. EnviroStor. http://www.envirostor.dtsc.ca.gov/public/.

California Department of Transportation (Caltrans), Division of Design. California Scenic Highway Mapping System. http://www.dot.ca.gov/hq/LandArch/scenic_highways/.

California Energy Commission. 2012. Desert Renewable Energy Conservation Plan. http://www.drecp.org/index.html

California Geologic Survey (CGS). 2007a. Alquist-Priolo Earthquake Fault Zone Maps. http://www.quake.ca.gov/gmaps/ap/ap_maps.htm.

———. 2007b. Fault Activity Map. http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html

Division of Land Resource Protection (DLRP). 2007. Williamson Act County Maps. http://www.conservation.ca.gov/dlrp/Pages/qh_maps.aspx

Hi-Desert Water District. 2012, June. Wastewater Treatment and Water Reclamation Project: Questions and Answers.

State Water Resources Control Board (SWRCB). 2011. Geotracker. http://geotracker.waterboards.ca.gov/.

United States Environmental Protection Agency (USEPA). 2011. EnviroMapper. http://www.epa.gov/emefdata/em4ef.home.

United States Geological Survey (USGS). 2012. Mineral Resource Data System. http://mrdata.usgs.gov/mineral-resources/mrds-us.html

Yucca Valley, Town of. 2011. Municipal Code.

———. 1995. General Plan.

4. References

This page intentionally left blank.

5. List of Preparers

LEAD AGENCY

Shane Stueckle, Deputy Town Manager

THE PLANNING CENTER|DC&E

William Halligan, Esq., Principal, Environmental Services

Nicole Vermilion, Associate Principal

Fernando Sotelo, Senior Planner

Kim Herkewitz, Associate Designer

Michael Milroy, Associate Planner

Ryan Potter, Assistant Planner

Cary Nakama, Graphics

5. List of Preparers

This page intentionally left blank.

Appendix B

Initial Study/Notice of Preparation Comments

Appendices

This page intentionally left blank.

STATE OF CALIFORNIA

GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH

STATE CLEARINGHOUSE AND PLANNING UNIT

EDMUND G. BROWN JR.
GOVERNOR

KEN ALEX
DIRECTOR

Notice of Preparation

November 7, 2012

To: Reviewing Agencies

Re: General Plan Update
SCH# 2012111021

Attached for your review and comment is the Notice of Preparation (NOP) for the General Plan Update draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Shane Stueckle
City of Yucca Valley
58928 Business Center Drive
Yucca Valley, CA 92284

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Director, State Clearinghouse

RECEIVED
NOV 14 2012
TOWN OF YUCCA VALLEY
PUBLIC WORKS

Attachments
cc: Lead Agency

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044

Document Details Report
State Clearinghouse Data Base

SCH# 2012111021
Project Title General Plan Update
Lead Agency Yucca Valley, City of

Type NOP Notice of Preparation

Description The proposed project is an update to the Town of Yucca Valley General Plan. The Yucca Valley General Plan Update is intended to shape development within the Town of twenty years and beyond, and involves reorganization of the current General Plan into the following elements: Land Use, Circulation, Safety, Noise, Open Space and Conservation, and Housing. The General Plan Update will also revise the General Plan use map.

Lead Agency Contact

Name Shane Stueckle
Agency City of Yucca Valley
Phone 760 369-6575 **Fax**
email
Address 58928 Business Center Drive
City Yucca Valley **State** CA **Zip** 92284

Project Location

County San Bernardino
City Yucca Valley
Region
Cross Streets Various
Lat / Long 34° 07' 27" N / 116° 25' 05" W
Parcel No. Various
Township 1N,S **Range** 5,6E **Section** Variou **Base** SBB&M

Proximity to:

Highways
Airports
Railways
Waterways
Schools
Land Use Various

Project Issues Aesthetic/Visual; Agricultural Land; Air Quality; Archaeologic-Historic; Biological Resources; Drainage/Absorption; Economics/Jobs; Flood Plain/Flooding; Forest Land/Fire Hazard; Geologic/Seismic; Minerals; Noise; Population/Housing Balance; Public Services; Recreation/Parks; Schools/Universities; Septic System; Sewer Capacity; Soil Erosion/Compaction/Grading; Solid Waste; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wetland/Riparian; Growth Inducing; Landuse; Cumulative Effects; Other Issues

---

Reviewing Agencies Resources Agency; Department of Conservation; Cal Fire; Department of Parks and Recreation; Department of Fish and Game, Region 6; CA Department of Public Health; Office of Emergency Management Agency, California; Native American Heritage Commission; Caltrans, Division of Aeronautics; Department of Housing and Community Development; Caltrans, District 8; Department of Toxic Substances Control; Regional Water Quality Control Board, Region 7

Date Received 11/07/2012 **Start of Review** 11/07/2012 **End of Review** 12/06/2012

NOP Distribution List

County: San Bernardino SCH# 2011111021

Resources Agency

- [x] Resources Agency
  Nadell Gayon
- [ ] Dept. of Boating & Waterways
  Nicole Wong
- [ ] California Coastal Commission
  Elizabeth A. Fuchs
- [ ] Colorado River Board
  Gerald R. Zimmerman
- [x] Dept. of Conservation
  Elizabeth Carpenter
- [ ] California Energy Commission
  Eric Knight
- [x] Cal Fire
  Dan Foster
- [ ] Central Valley Flood Protection Board
  James Herota
- [ ] Office of Historic Preservation
  Ron Parsons
- [x] Dept of Parks & Recreation
  Environmental Stewardship Section
- [ ] California Department of Resources, Recycling & Recovery
  Sue O'Leary
- [ ] S.F. Bay Conservation & Dev't. Comm.
  Steve McAdam
- [ ] Dept. of Water Resources Resources Agency
  Nadell Gayon

Fish and Game

- [ ] Depart. of Fish & Game
  Scott Flint
  Environmental Services Division
- [ ] Fish & Game Region 1
  Donald Koch
- [ ] Fish & Game Region 1E
  Laurie Harnsberger
- [ ] Fish & Game Region 2
  Jeff Drongesen
- [ ] Fish & Game Region 3
  Charles Armor
- [ ] Fish & Game Region 4
  Julie Vance
- [ ] Fish & Game Region 5
  Leslie Newton-Reed
  Habitat Conservation Program
- [x] Fish & Game Region 6
  Gabrina Gatchel
  Habitat Conservation Program
- [ ] Fish & Game Region 6 I/M
  Brad Henderson
  Inyo/Mono, Habitat Conservation Program
- [ ] Dept. of Fish & Game M
  George Isaac
  Marine Region

Other Departments

- [ ] Food & Agriculture
  Sandra Schubert
  Dept. of Food and Agriculture
- [ ] Depart. of General Services
  Public School Construction
- [ ] Dept. of General Services
  Anna Garbeff
  Environmental Services Section
- [x] Dept. of Public Health
  Jeffery Worth
  Dept. of Health/Drinking Water
- [ ] Delta Stewardship Council
  Kevan Samsam

Independent Commissions,Boards

- [ ] Delta Protection Commission
  Michael Machado
- [x] Cal EMA (Emergency Management Agency)
  Dennis Castrillo
- [x] Native American Heritage Comm.
  Debbie Treadway
- [ ] Public Utilities Commission
  Leo Wong
- [ ] Santa Monica Bay Restoration
  Guangyu Wang
- [ ] State Lands Commission
  Jennifer Deleong
- [ ] Tahoe Regional Planning Agency (TRPA)
  Cherry Jacques

Business, Trans & Housing

- [x] Caltrans - Division of Aeronautics
  Philip Crimmins
- [ ] Caltrans - Planning
  Terri Pencovic
- [ ] California Highway Patrol
  Suzann Ikeuchi
  Office of Special Projects
- [x] Housing & Community Development
  CEQA Coordinator
  Housing Policy Division

Dept. of Transportation

- [ ] Caltrans, District 1
  Rex Jackman
- [ ] Caltrans, District 2
  Marcelino Gonzalez
- [ ] Caltrans, District 3
  Gary Arnold
- [ ] Caltrans, District 4
  Erik Alm
- [ ] Caltrans, District 5
  David Murray
- [ ] Caltrans, District 6
  Michael Navarro
- [ ] Caltrans, District 7
  Dianna Watson
- [x] Caltrans, District 8
  Dan Kopulsky
- [ ] Caltrans, District 9
  Gayle Rosander
- [ ] Caltrans, District 10
  Tom Dumas
- [ ] Caltrans, District 11
  Jacob Armstrong
- [ ] Caltrans, District 12
  Marlon Regisford

Cal EPA

Air Resources Board

- [ ] Airport/Energy Projects
  Jim Lerner
- [ ] Transportation Projects
  Douglas Ito
- [ ] Industrial Projects
  Mike Tollstrup
- [ ] State Water Resources Control Board
  Regional Programs Unit
  Division of Financial Assistance
- [ ] State Water Resources Control Board
  Student Intern, 401 Water Quality Certification Unit
  Division of Water Quality
- [ ] State Water Resouces Control Board
  Phil Crader
  Division of Water Rights
- [x] Dept. of Toxic Substances Control
  CEQA Tracking Center
- [ ] Department of Pesticide Regulation
  CEQA Coordinator

Regional Water Quality Cont Board (RWQCB)

- [ ] RWQCB 1
  Cathleen Hudson
  North Coast Region (1)
- [ ] RWQCB 2
  Environmental Document Coordinator
  San Francisco Bay Region (2)
- [ ] RWQCB 3
  Central Coast Region (3)
- [ ] RWQCB 4
  Teresa Rodgers
  Los Angeles Region (4)
- [ ] RWQCB 5S
  Central Valley Region (5)
- [ ] RWQCB 5F
  Central Valley Region (5)
  Fresno Branch Office
- [ ] RWQCB 5R
  Central Valley Region (5)
  Redding Branch Office
- [ ] RWQCB 6
  Lahontan Region (6)
- [ ] RWQCB 6V
  Lahontan Region (6)
  Victorville Branch Office
- [x] RWQCB 7
  Colorado River Basin Region (
- [ ] RWQCB 8
  Santa Ana Region (8)
- [ ] RWQCB 9
  San Diego Region (9)

- [ ] Other _____

- [ ] _____ Conservancy

Last Updated 8/14/2012

UNITED STATES MARINE CORPS
PUBLIC AFFAIRS AND COMMUNITY PLANS
MARINE CORPS AIR GROUND COMBAT CENTER
BOX 788100
TWENTYNINE PALMS, CALIFORNIA 92278-8100

5726
5
DEC 07 2012

Mr. Shane Stueckle, Deputy Town Manager
Town of Yucca Valley, Planning Division
58928 Monterey Business Center Drive
Yucca Valley, CA 92284

Re: Notice of Preparation of an Environmental Impact Report

Dear Mr. Stueckle:

The Marine Corps Air Ground Combat Center (MCAGCC) is interested in ensuring all new developments are compatible with its mission. Since 1952, the remoteness of the High Desert area has ensured MCAGCC's ability to train Marines in their critical competencies essential to mission success and saving lives. However, a recent increase in incompatible developments now threatens the long-term sustainability of MCAGCC operational ranges and military training. This letter provides the Town of Yucca Valley general information regarding how the proposed Environmental Impact Report and General Plan Update may become more compatible with the long-term military training mission of MCAGCC.

Due to the Town of Yucca Valley's location, businesses and property owners will experience noise and vibrations from military activities. Therefore, at minimum businesses and property owners should be informed, in writing, of the unique aspects of locating near a military installation. A sample letter is enclosed as enclosure 1. We highly encourage the Town of Yucca Valley to utilize this letter as official disclosure to inform businesses and property owners that MCAGCC is their neighbor and that they will be located near a military installation. We respectfully request this disclosure letter become a part of the Town's General Plan.

The Town of Yucca Valley lays directly under several designated military flight routes (see enclosure 2). Uninterrupted use of these routes is an essential part of military training. Additionally, military convoys and equipment travel State Route 62 and Highway 247 on a regular basis. Continued, unrestricted use of these California highways is essential to the mission of MCAGCC.

MCAGCC requests the Environmental Impact Report address the following areas of concern: 1) any changes to the General Plan update that would affect military convoys frequenting the roads of the Town of Yucca Valley; and, 2) any changes to the General Plan land use designations located under the designated military flight routes that could impact military use.

Thank you for providing us the opportunity to comment. Any questions regarding this matter may be directed to Bob Johnson at 760-830-3446 or robert.a.johnson2@usmc.mil.

Sincerely,

J. M. RICKER
Assistant Chief of Staff, G-5
Community Plans Liaison Office

UNITED STATES MARINE CORPS
PUBLIC AFFAIRS AND COMMUNITY PLANS
MARINE CORPS AIR GROUND COMBAT CENTER
BOX 788100
TWENTYNINE PALMS, CALIFORNIA 92278-8100

5726
5
DEC 07 2012

Dear Business and/or Property Owner:

Welcome to the neighborhood! We hope your move went smoothly. By way of introduction, the Marine Corps Air Ground Combat Center (MCAGCC) is your neighbor and an essential resource for defending our country. MCAGCC conducts large-scale, sustained, combined arms (air and ground), live-fire and maneuver training for Marines. To prepare our Marines for future conflicts, we carry out realistic training with military munitions, both day and night. As a result, Military aircraft fly over the area, and military vehicles drive on and off the base every day.

Your neighbors understand the unique aspects of living near our installation, and they may tell you about the influence our activities have on their daily lives. This is very important information because your business and/or property is located directly under our designated military flight route. Consequently, you should expect to hear military training, see low-flying military aircraft, and encounter other experiences associated with our important mission here.

We encourage you to learn more about MCAGCC at www.29palms.usmc.mil, or to contact our Community Plans Liaison Office at 760-830-3446 for further questions. As a resident of the Morongo Basin for 58 years, the Marines and Sailors of MCAGCC would like to welcome you to our desert community.

Sincerely,

J. M. RICKER
Assistant Chief of Staff, G-5
Community Plans Liaison Office

California Natural Resources Agency
DEPARTMENT OF FISH AND GAME
http://www.dfg.ca.gov
Inland Deserts Region
3602 Inland Empire Blvd., Suite C-200
Ontario, CA 91764
(909) 484-0167

EDMUND G. BROWN, JR., Governor
Charlton H. Bonham, Director

December 7, 2012

Mr. Shane Stueckle
Town of Yucca Valley, Planning Division
58928 Monterey Business Center Drive
Yucca Valley, CA 92284

Re: Notice of Preparation of Environmental Impact Report for the Town of Yucca Valley General Plan Update

Dear Mr. Stueckle:

The Department of Fish and Game (Department) appreciates this opportunity to comment on the Notice of Preparation for the Draft Environmental Impact Report (DEIR) for the Town of Yucca Valley General Plan Update. The Department is responding as a Trustee Agency for fish and wildlife resources [Fish and Game Code Sections 711.7 and 1802 and the California Environmental Quality Act (CEQA) Guidelines Section 15386], and as a Responsible Agency regarding any discretionary actions (CEQA Guidelines Section 15381), such as a Lake or Streambed Alteration Agreement (California Fish and Game Code Sections 1600 *et seq.*) and/or a permit for Incidental Take of Endangered, Threatened, and/or Candidate species [California Fish and Game Code Sections 2080 and 2080.1].

PROJECT DESCRIPTION AND LOCATION

The Town of Yucca Valley is located near City of Twentynine Palms, Joshua Tree, Joshua Tree National Park, Morongo Valley, and Prioneertown. State Route 247 crosses the northern half of the Town from north to south. The Town is located near the southern portion of San Bernardino County.

The Project is an update to the Town of Yucca Valley's General Plan. The General Plan is intended to shape development with the Town for the at least the next 20 years. The buildout will result in a population of 64,543, 27,276 residential units, and 20,964,487 square feet of nonresidential development.

Biological Impacts and Mitigation

The Department has the following recommendations, in addition to the recommendations in the later portion of this letter and requests that these issues be addressed in the CEQA document.

1. Provide a complete Project description that lists all the activities covered by this Project, including on- and off-site development;
2. Any biological assessments or focus surveys be conducted within one year of the distribution of the CEQA Document;
3. Any biological reports should be included in the CEQA Document;
4. A jurisdictional delineation of State waters should be included in the CEQA Document, if warranted;
5. Sensitive plant surveys should be conducted according to the Department's November 2009 guidance for Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities.

Implementation of the proposed Project has the potential to impact desert tortoise (*Gopherus aggassizzi*, DT), which is listed as threatened under the California Endangered Species Act (CESA); and the burrowing owl (*Athene cunicularia,* BUOW), which is a Species of Special Concern and protected under Fish and Game Code Section 3503.5.

1. Please provide a complete assessment of the flora and fauna within and adjacent to the Project area, with particular emphasis upon identifying endangered, threatened, and locally unique species and sensitive habitats.

    a. Please provide a thorough assessment of rare plants and rare natural communities, following the Department's November 2009 guidance for Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. The guidance document can be found at the following link: http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/Protocols_for_Surveying_and_Evaluating_Impacts.pdf

    b. A thorough assessment of sensitive fish, wildlife, reptile, and amphibian species. Seasonal variations in use of the Project area should also be considered. Focused species-specific surveys, conducted at the appropriate time of year and time of day when the sensitive species are active or otherwise identifiable, are required. Acceptable species-specific survey procedures should be developed in consultation with the Department and the U.S. Fish and Wildlife Service.

    c. Rare, threatened, and endangered species to be addressed should include all those which meet the CEQA definition (See CEQA Guidelines, 15380).

    d The Department's California Natural Diversity Data Base in Sacramento should be contacted at (916) 327-5960 to obtain current information on any previously reported sensitive species and habitat, including Significant Natural Areas identified under Chapter 12 of the California Fish and Game Code.

2. A thorough discussion of direct, indirect, and cumulative impacts expected to adversely affect biological resources, with specific measures to offset such impacts.

    a. CEQA Guidelines, 15125(c), direct that knowledge of the regional setting is critical to an assessment of environmental impacts and that special emphasis should be placed on resources that are rare or unique to the region. Section 15125(d) requires the EIR so discuss any inconsistencies between the propose project and applicable general plans, specific plans and Regional plans.

    b. Project impacts should be analyzed relative to their affects on off-site habitats. Specifically, this should encompass adjacent public lands, open space, adjacent natural habitats, and riparian ecosystems. In addition, impacts to and maintenance of wildlife corridor/movement areas, including access to undisturbed habitat in adjacent areas, should be fully evaluated and provided.

    c. The zoning of areas for development projects or other uses that are nearby or adjacent to natural areas may inadvertently contribute to wildlife-human interactions. A discussion of possible conflicts and mitigation measures to reduce these conflicts should be included in the environmental document.

    d. A cumulative effects analysis should be developed as described under CEQA Guidelines, 15130. General and specific plans, as well as past, present, and anticipated future projects, should be analyzed relative to their impacts on similar plant communities and wildlife habitats.

3. A range of alternatives should be analyzed to ensure that alternatives to the proposed Project are fully considered and evaluated (CEQA Guidelines 15126.6). A range of alternatives which avoid or otherwise minimize impacts to sensitive biological resources should be included. Specific alternative locations should also be evaluated in areas with lower resource sensitivity where appropriate.

    a. Mitigation measures for Project impacts to sensitive plants, animals, and habitats should emphasize evaluation and selection of alternatives which avoid and/or otherwise minimize Project impacts. Off-site compensation for unavoidable impacts through acquisition and protection of high-quality habitat should be addressed.

    b. The Department considers Rare Natural Communities as threatened habitats having both local and regional significance. Thus, these communities should be fully avoided and otherwise protected from Project-related impacts.

4. A CESA Permit must be obtained, if the Project has the potential to result in "take" of species of plants or animals listed under CESA, either during construction or over the life of the Project. CESA Permits are issued to conserve, protect, enhance, and restore State-listed threatened or endangered species and their habitats. Early consultation is encouraged, as significant modification to the proposed Project and mitigation measures may be required in order to obtain a CESA Permit. Revisions to the California Fish and Game Code, effective January 1998, require that the Department issue a separate CEQA document for the issuance of a CESA permit unless the Project CEQA document addresses all Project impacts to listed species and specifies a mitigation monitoring and reporting program that will meet the requirements of a CESA permit. For these reasons, the following information is requested:

   a. Biological mitigation, monitoring, and reporting proposals should be of sufficient detail and resolution to satisfy the requirements for a CESA Permit.

   b A Department-approved Mitigation Agreement and Mitigation Plan are required for plants listed as rare under the Native Plant Protection Act.

<u>State Jurisdictional Waters</u>

5. The Department is concerned about the continuing loss of jurisdictional waters of the State and the encroachment of development into areas with native habitat values. The CEQA document should contain sufficient, specific, and current biological information on the existing habitat and species at the Project site; measures to minimize and avoid sensitive biological resources, and mitigation measures to offset the loss of native flora and fauna and State waters. If the Project site contains Federally- or State-listed species, the CEQA document should include measures to avoid and minimize impacts to these species as well as mitigation measures to compensate for the loss of biological resources. The CEQA document should not defer impact analysis and mitigation measures to future regulatory, discretionary actions, such as a Lake or Streambed Alteration Agreement, CESA Permit or Federal Endangered Species Act (FESA) Permit.

   a. Under Section 1600 *et seq.* of the California Fish and Game Code, the Department requires the Project applicant to notify the Department of any activity that will divert, obstruct or change the natural flow or the bed, channel or bank (which includes associated riparian resources) of a river, stream or lake, or use material from a streambed prior to the applicant's commencement of the activity. Streams include, but are not limited to, intermittent and ephemeral streams, rivers, creeks, dry washes, sloughs, blue-line streams, and watercourses with subsurface flow. The Department's issuance of a Lake and Streambed Alteration Agreement for a project this is subject to CEQA will require CEQA compliance actions by the Department as a responsible agency. The Department, may consider the local jurisdiction's (lead agency) Negative Declaration or Environmental

Impact Report for the project. However, if the CEQA document does not fully identify potential impacts to lakes, streams, and associated resources (including, but not limited to riparian and alluvial fan sage scrub habitat) and provide adequate avoidance, mitigation, monitoring, and reporting commitments, additional CEQA documentation will be required prior to execution (signing) of the Streambed Alteration Agreement. In order to avoid delays or repetition of the CEQA process, potential impacts to a lake or stream, as well as avoidance and mitigation measures need to be discussed within this CEQA document. The Department recommends the following measures to avoid subsequent CEQA documentation and project delays:

i. Incorporate all information regarding impacts to lakes, streams and associated habitat within the DEIR. Information that should be included within this document includes: (a) a delineation of lakes, streams, and associated habitat that will be directly or indirectly impacted by the proposed Project; (b) details on the biological resources (flora and fauna) associated with the lakes and/or streams; (c) identification of the presence or absence of sensitive plants, animals, or natural communities; (d) a discussion of environmental alternatives; (e) a discussion of avoidance measures to reduce project impacts, (f) a discussion of potential mitigation measures required to reduce the Project impacts to a level of insignificance; and (g) an analysis of impacts to habitat caused by a change in the flow of water across the site. The applicant and lead agency should keep in mind that the State also has a policy of no net loss of wetlands.

ii. The Department recommends that the Project applicant and/or lead agency consult with the Department to discuss potential project impacts and avoidance and mitigation measures. Early consultation with the Department is recommended since modification of the proposed reject may be required to avoid or reduce impacts to fish and wildlife resources. To obtain a Streambed Alteration Agreement Notification package, please visit our website at: http://www.dfg.ca.gov/habcon/1600.html.

This particular Project has the potential to have significant environmental impacts on sensitive flora and fauna resources, including Federally- and State-listed endangered species. Therefore, the CEQA document should include a cumulative impact analysis **and an** alternatives analysis which focuses on environmental resources and ways to avoid or minimize impacts to those resources.

Thank you for this opportunity to comment. Please contact Heather Weiche at (909) 980-8607, if you have any questions regarding this letter.

Sincerely,

Rebecca Jones

Rebecca Jones
Senior Environmental Scientist Acting

cc: Heather Weiche, CDFG, Ontario

Mojave Desert Air Quality Management District
14306 Park Avenue, Victorville, CA 92392-2310
760.245.1661 • fax 760.245.2699
Visit our web site: http://www.mdaqmd.ca.gov
Eldon Heaston, Executive Director

November 27, 2012

Shane Stueckle
Town of Yucca Valley
58928 Business Center Drive
Yucca Valley, CA 92284

Re: Town of Yucca Valley General Plan Update

Dear Mr. Stueckle:

The Mojave Desert Air Quality Management District (MDAQMD) has reviewed the Initial Study for the Town of Yucca Valley General Plan Update. The General Plan update is intended to shape development within the Town for at least the next 20 years and involves reorganization of the current General Plan into the following elements: Land Use, Circulation, Safety, Noise, Open Space and Conservation, and Housing. The General Plan Update will also revise the General Plan land use map. Buildout of the Yucca Valley General Plan Update would result in a population of 64,543, 27,276 residential units, 20,964,487 square feet of nonresidential development and 34,927 employees in the Town.

Based on the information provided in the Initial Study, the District agrees with the proposed assessment of potential impacts to be addressed in the Environmental Impact Report. District attainment plans and California Environmental Quality Act guidelines are located at http://www.mdaqmd.ca.gov/rules_plans/rules-plans.htm for your information and review. The District also recommends that the Town of Yucca Valley not allow the creation of new unpaved roads, and develop a long term capital improvement program to eliminate unpaved roadways when practical and feasible; such development is expected to produce cumulative and regional environmental benefits.

Thank you for the opportunity to review this planning document. If you have any questions regarding this letter, please contact me at (760) 245-1661, extension 6726, or Tracy Walters at extension 6122.

Sincerely,

Alan De Salvio
Supervising Air Quality Engineer

RECEIVED
NOV 28 2012
TOWN OF YUCCA VALLEY
PUBLIC WORKS

AJD/tw Town of YV General Plan Update

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-6251
Fax (916) 657-5390
Web Site www.nahc.ca.gov
ds_nahc@pacbell.net

RECEIVED
NOV 14 2012
TOWN OF YUCCA VALLEY
PUBLIC WORKS

November 9, 2012

Mr. Shane Stueckle, Planner
City of Yucca Valley
58928 Business Center Drive
Yucca Valley, CA 92284

Re: SCH#2012111021; CEQA Notice of Preparation (NOP); draft Environmental Impact Report (DEIR) for the **"City Yucca Valley General Plan Update;"** located in the City of Yucca Valley; San Bernardino County, California

Dear Mr. Stueckle:

The NAHC is the State of California 'Trustee Agency' for the protection and preservation of Native American cultural resources pursuant to California Public Resources Code §21070 and affirmed by the Third Appellate Court in the case of EPIC v. Johnson (1985: 170 Cal App. 3rd 604).

This letter includes state and federal statutes relating to Native American historic properties or resources of religious and cultural significance to American Indian tribes and interested Native American individuals as 'consulting parties' under both state and federal law. State law also addresses the freedom of Native American Religious Expression in Public Resources Code §5097.9.

The California Environmental Quality Act (CEQA – CA Public Resources Code 21000-21177, amendment s effective 3/18/2010) requires that any project that causes a substantial adverse change in the significance of an historical resource, that includes archaeological resources, is a 'significant effect' requiring the preparation of an Environmental Impact Report (EIR) per the CEQA Guidelines defines a significant impact on the environment as 'a substantial, or potentially substantial, adverse change in any of physical conditions within an area affected by the proposed project, including ...objects of historic or aesthetic significance." In order to comply with this provision, the lead agency is required to assess whether the project will have an adverse impact on these resources within the 'area of potential effect (APE), and if so, to mitigate that effect. The NAHC advises the Lead Agency to request a Sacred Lands File search of the NAHC if one has not been done for the 'area of potential effect' or APE previously. This area is known to the NAHC to be very culturally sensitive..

The NAHC "Sacred Sites,' as defined by the Native American Heritage Commission and the California Legislature in California Public Resources Code §§5097.94(a) and 5097.96. Items in the NAHC Sacred Lands Inventory are confidential and exempt from the Public Records Act pursuant to California Government Code §6254 (r).

Early consultation with Native American tribes in your area is the best way to avoid unanticipated discoveries of cultural resources or burial sites once a project is underway. Culturally affiliated tribes and individuals may have knowledge of the religious and cultural

significance of the historic properties in the project area (e.g. APE). We strongly urge that you make contact with the list of Native American Contacts on the attached list of Native American contacts, to see if your proposed project might impact Native American cultural resources and to obtain their recommendations concerning the proposed project. Pursuant to CA Public Resources Code § 5097.95, the NAHC requests cooperation from other public agencies in order that the Native American consulting parties be provided pertinent project information. Consultation with Native American communities is also a matter of environmental justice as defined by California Government Code §65040.12(e). Pursuant to CA Public Resources Code §5097.95, the NAHC requests that pertinent project information be provided consulting tribal parties, including archaeological studies. The NAHC recommends *avoidance* as defined by CEQA Guidelines §15370(a) to pursuing a project that would damage or destroy Native American cultural resources and California Public Resources Code Section 21083.2 (Archaeological Resources) that requires documentation, data recovery of cultural resources, construction to avoid sites and the possible use of covenant easements to protect sites.

Furthermore, the NAHC if the proposed project is under the jurisdiction of the statutes and regulations of the National Environmental Policy Act (e.g. NEPA; 42 U.S.C. 4321-43351). Consultation with tribes and interested Native American consulting parties, on the NAHC list, should be conducted in compliance with the requirements of federal NEPA and Section 106 and 4(f) of federal NHPA (16 U.S.C. 470 *et seq*), 36 CFR Part 800.3 (f) (2) & .5, the President's Council on Environmental Quality (CSQ, 42 U.S.C 4371 *et seq.* and NAGPRA (25 U.S.C. 3001-3013) as appropriate. The 1992 *Secretary of the Interiors Standards for the Treatment of Historic Properties* were revised so that they could be applied to all historic resource types included in the National Register of Historic Places and including cultural landscapes. Also, federal Executive Orders Nos. 11593 (preservation of cultural environment), 13175 (coordination & consultation) and 13007 (Sacred Sites) are helpful, supportive guides for Section 106 consultation. The aforementioned Secretary of the Interior's *Standards* include recommendations for all 'lead agencies' to consider the historic context of proposed projects and to "research" the cultural landscape that might include the 'area of potential effect.'

Confidentiality of "historic properties of religious and cultural significance" should also be considered as protected by California Government Code §6254(r) and may also be protected under Section 304 of he NHPA or at the Secretary of the Interior discretion if not eligible for listing on the National Register of Historic Places. The Secretary may also be advised by the federal Indian Religious Freedom Act (cf. 42 U.S.C., 1996) in issuing a decision on whether or not to disclose items of religious and/or cultural significance identified in or near the APEs and possibility threatened by proposed project activity.

Furthermore, Public Resources Code Section 5097.98, California Government Code §27491 and Health & Safety Code Section 7050.5 provide for provisions for inadvertent discovery of human remains mandate the processes to be followed in the event of a discovery of human remains in a project location other than a 'dedicated cemetery'.

To be effective, consultation on specific projects must be the result of an ongoing relationship between Native American tribes and lead agencies, project proponents and their contractors, in the opinion of the NAHC. Regarding tribal consultation, a relationship built around regular meetings and informal involvement with local tribes will lead to more qualitative consultation tribal input on specific projects.

Finally, when Native American cultural sites and/or Native American burial sites are prevalent within the project site, the NAHC recommends 'avoidance' of the site as referenced by CEQA Guidelines Section 15370(a).

If you have any questions about this response to your request, please do not hesitate to contact me at (916) 653-6251.

Sincerely,

Dave Singleton
Program Analyst

Cc: State Clearinghouse

Attachment: Native American Contact List

Native American Contacts
San Bernardino County
November 9, 2012

Ramona Band of Cahuilla Mission Indians
Joseph Hamilton, Chairman
P.O. Box 391670 Cahuilla
Anza , CA 92539
admin@ramonatribe.com
(951) 763-4105
(951) 763-4325 Fax

Chemehuevi Reservation
Edward Smith, Chairperson
P.O. Box 1976 Chemehuevi
Chemehuevi Valley CA 92363
chair1cit@yahoo.com
(760) 858-4301
(760) 858-5400 Fax

San Manuel Band of Mission Indians
Carla Rodriguez, Chairwoman
26569 Community Center Drive Serrano
Highland , CA 92346
(909) 864-8933
(909) 864-3724 - FAX
(909) 864-3370 Fax

Fort Mojave Indian Tribe
Timothy Williams, Chairperson
500 Merriman Ave Mojave
Needles , CA 92363
(760) 629-4591
(760) 629-5767 Fax

Twenty-Nine Palms Band of Mission Indians
Darrell Mike, Chairperson
46-200 Harrison Place Chemehuevi
Coachella , CA 92236
tribal-epa@worldnet.att.net
(760) 775-5566
(760) 808-0409 - cell - EPA
(760) 775-4639 Fax

Colorado River Indian Tribe
Eldred Enas ,Chairman; Ginger Scott, Museum
26600 Mojave Road Mojave
Parker , AZ 85344 Chemehuevi
crit.museum@yahoo.com
(928) 669-9211-Tribal Office
(928) 669-8970 ext 21
(928) 669-1925 Fax

Joseph R. Benitez (Mike)
P.O. Box 1829 Chemehuevi
Indio , CA 92201
(760) 347-0488
(760) 408-4089 - cell

AhaMaKav Cultural Society, Fort Mojave Indian
Linda Otero, Director
P.O. Box 5990 Mojave
Mohave Valley AZ 86440
(928) 768-4475
LindaOtero@fortmojave.com
(928) 768-7996 Fax

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is applicable for contacting local Native Americans with regard to cultural resources for the proposed SSCH#2012111021 CEQA Notice of Preparation (NOP); draft Envirnmnetal Impact Report (DEIR) for the City of Yucca Valley General Plan Update; located in the City of Yucca Valley; San Bernardino County, California.

Native American Contacts
San Bernardino County
November 9, 2012

Morongo Band of Mission Indians
Michael Contreras, Cultural Heritage Prog.
12700 Pumarra Road Cahuilla
Banning , CA 92220 Serrano
(951) 201-1866 - cell
mcontreras@morongo-nsn.gov
(951) 922-0105 Fax

San Manuel Band of Mission Indians
Ann Brierty, Policy/Cultural Resources Departmen
26569 Community Center. Drive Serrano
Highland , CA 92346
(909) 864-8933, Ext 3250
abrierty@sanmanuel-nsn.gov
(909) 862-5152 Fax

Serrano Nation of Mission Indians
Goldie Walker, Chairwoman
P.O. Box 343 Serrano
Patton , CA 92369

(909) 528-9027 or
(909) 528-9032

Ernest H. Siva
Morongo Band of Mission Indians Tribal Elder
9570 Mias Canyon Road Serrano
Banning , CA 92220 Cahuilla
siva@dishmail.net
(951) 849-4676

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is applicable for contacting local Native Americans with regard to cultural resources for the proposed SSCH#2012111021 CEQA Notice of Preparation (NOP); draft Envirnmnetal Impact Report (DEIR) for the City of Yucca Valley General Plan Update; located in the City of Yucca Valley; San Bernardino County, California.

SOUTHERN CALIFORNIA
EDISON®
An *EDISON INTERNATIONAL*® Company

Jennifer Cusack
Region Manager
Local Public Affairs

January 4, 2013

Mr. Shane Stueckle
Town of Yucca Valley
Planning Division
58928 Monterey Business Center Drive
Yucca Valley, CA 92284

Re: Notice of Preparation of an Environmental Impact Report and Public Scoping Meeting for the Town of Yucca Valley General Plan Update

Dear Mr. Stueckle:

Southern California Edison (SCE) appreciates the opportunity to provide comment on the above referenced project. We apologize for missing the comment deadline for the NOP. Would you please keep us updated on the project.

Southern California Edison Company's rights-of-ways and fee-owned properties are purchased for the exclusive use of SCE to operate and maintain its present and future facilities. Any proposed use will be reviewed on a case-by-case basis by SCE's Operating Department. Approvals or denials will be in writing based upon review of the maps provided by the developer and compatibility with SCE right-of- way constraints and rights. In the event the project proposes to impact SCE facilities or its land related rights, please forward five (5) sets of project plans, and a PDF copy of the same, depicting SCE's facilities and its associated land rights to the following location for review as noted above:

Real Properties Department
Southern California Edison Company
2131 Walnut Grove Avenue
G.O.3 – Second Floor
Rosemead, CA 91770

Please be advised if development plans result in the need to build new or relocate existing SCE electrical facilities that operate at or above 50 kV, the SCE construction may have environmental consequences subject to CEQA review as required by the California Public Utilities Commission (CPUC). If those environmental consequences are identified and addressed by the local agency in the CEQA process for the larger project, SCE may not be required to pursue a later, separate, mandatory CEQA review through the CPUC's General Order 131-D (GO 131-D) process. If the SCE facilities are not adequately addressed in the CEQA review for the larger project, and the new facilities could result in significant environmental impacts, the required additional CEQA review at the CPUC could delay approval of the SCE power line portion of the project for two years or longer.

Once again, we appreciate the opportunity to comment on the project. If you have any questions regarding this letter, do not hesitate to contact me at (760) 202-4211

Sincerely,

Jennifer Cusack

Jennifer Cusack
Local Public Affairs Region Manager
Southern California Edison Company

36100 Cathedral Canyon Dr.
Cathedral City, CA 92234
(760) 202-4211
Fax: (760) 202-4294

DEPARTMENT OF PUBLIC HEALTH

COUNTY OF SAN BERNARDINO

Division of Environmental Health Services: (800) 442-2283
- 385 North Arrowhead Avenue – San Bernardino, CA 92415-0160
- 8575 Haven Avenue, Suite 130 – Rancho Cucamonga, CA 91730-9105
- 15900 Smoke Tree, Suite 131 – Hesperia, CA 92345
- San Bernardino County Vector Control Program
  2355 East 5th Street – San Bernardino, CA 92410-5201

TRUDY RAYMUNDO
Public Health Director

MAXWELL OHIKHUARE, M.D.
Health Officer

CORWIN PORTER, MPH, R.E.H.S
Division Chief, Environmental Health Services

December 7, 2012

Shane Stueckle
Town of Yucca Valley, Planning Division
58928 Monterey Business Drive Center
Yucca Valley, CA 92284

Subject: Notice of Preparation of Environmental Impact Report and Public Scoping Meeting for the Town of Yucca Valley General Plan Update

Mr. Stueckle,

Environmental Health Services has reviewed the Notice of Preparation of Environmental Impact Report and Public Scoping Meeting for the Town of Yucca Valley General Plan Update. The impact of the Yucca Valley General Plan Update in regards to solid waste is addressed on Page 56, Section 3.17 (f) & (g). The initial study states the EIR will evaluate long-term regional landfill capacity as the General Plan Update may increase the amount of solid waste generated in Yucca Valley and may require expansion of landfills or the adoption of alternative methods for waste disposal. San Bernardino County Solid Waste Management is the owner and operator of the majority of landfills in San Bernardino County and they should be contacted in regards to expanding the landfill capacity.

If you have any questions, please contact me at 1(800)442-2283 or by email at Jessica.Ballesteros@dph.sbcounty.gov.

Jessica Ballesteros, REHS
Land Use Protection Program
.

GREGORY C. DEVEREAUX
Chief Executive Officer

Board of Supervisors
ROBERT A. LOVINGOOD……..First District JAMES RAMOS……..…Third District
JANICE RUTHERFORD……Second District GARY C. OVITT….....…Fourth District
JOSIE GONZALES, CHAIR……Fifth District

Appendix C

Air Quality and Greenhouse Gas Emissions Modeling

Appendices

This page intentionally left blank.

TOWN OF YUCCA VALLEY - GHG EMISSIONS INVENTORY

Forecasting SCAQMD's GHG Target	6.6	1.3	4.0
	2020	2050	2035
	AB 32	S-03-05	Interpolated *
		80% Below 1990	40% Below 1990
	1990 Levels	Levels	Levels

	$MTCO_2e$ Business as Usual Forecasts								$MTCO_2e$ Adjusted BAU					
SECTORS	**2012**	**Percent of Total**	**2020**	**Percent of Total**	**2035**	**Percent of Total**	**P-2035**	**Percent of Total**	**2020**	**Percent of Total**	**2035**	**Percent of Total**	**P-2035**	**Percent of Total**
Transportation	157,248	67%	157,562	65%	172,355	65%	488,557	64%	124,041	63%	125,660	61%	356,195	61%
Residential (Natural Gas and Electricity)	44,538	19%	47,114	20%	51,945	20%	128,008	17%	40,598	21%	44,760	22%	110,303	19%
Nonresidential* (Natural Gas and Electricity)	24,874	11%	26,493	11%	29,529	11%	116,126	15%	22,014	11%	24,537	12%	96,494	16%
Town (Natural Gas and Electricity)	540	0.2%	572	0.2%	632	0%	1,794	0.2%	486	0.2%	538	0%	1,525	0.3%
Total Nonresidential	*25,414*	*10.8%*	*27,065*	*11.2%*	*30,161*	*11.4%*	*117,919*	*15.5%*	*22,500*	*11.5%*	*25,074*	*12.3%*	*98,019*	*16.7%*
Waste	3,120	1%	3,306	1%	3,656	1%	10,367	1%	3,306	2%	3,656	2%	10,367	2%
Water/Wastewater	4,593	2%	4,749	2%	5,112	2%	14,972	2%	3,802	2%	4,104	2%	12,035	2%
Other - Offroad Equipment	1,472	1%	1,482	1%	1,500	1%	1,926	0%	1,334	1%	1,350	1%	1,733	0%
Total Community Emissions	236,385	100%	241,279	100%	264,729	100%	761,750	100%	195,582	100%	204,604	100%	588,653	100%
Service Population	29,945		31,731		35,081		99,491		31,731		35,081		99,491	
$MTCO_2e$/SP	7.9		7.6		7.5		7.7		6.2		5.8		5.9	
SCAQMD GHG GP Threshold (PROGRAM LEVEL)	NA		6.6		4.0		4.0		6.6		4.0		4.0	

Notes:

Emissions forecast based on changes in population (residential energy), employment (nonresidential energy), or service population (Town energy, waste, water/wastewater, transportation).

Transportation. EMFAC2011 and data provided by Fehr and Peers and modeled using SBTAM. Transportation sector does not proportion 50 percent of the trip length for trips that occur outside of the Town boundaries. Per the Regional Targets Advisory Committee (RTAC) under Senate Bill 375 (SB 375), 50 percent of the trip length for intrajurisdictional trips are the responsibility of the adjacent/corresponding jurisdiction while the other 50 percent. External-Internal and Internal-External trips do not include 50 percent of the trip length. Therefore, results are conservative.

Energy. Energy use based on a two year (2010-2011) average provided by SCE and a three year (2009-2011) average provided by SoCal Gas. Nonresidential* includes direct access customers, county facilities, and other district facilities within the Town boundaries. SCE energy based on the 2008 eGrid carbon intensity.

Water/Wastewater. Includes fugitive emissions from wastewater processing and energy associated with water/wastewater treatment and conveyance. Water use is estimated based on generation rates identified in the Hi Desert Water District's 2010 Urban Water Management Plan.

Waste. WARM2012 and CalRecycle. Waste generation based on two year average (2010-2011) waste commitment for the Town of Yucca Valley obtained from CalRecycle. Assumes 75 percent of fugitive GHG emissions are captured within the landfill's Landfill Gas Capture System with a landfill gas capture efficiency of 75%. The Landfill gas capture efficiency is based on the California Air Resources Board's (CARB) Local Government Operations Protocol (LGOP), Version 1.1.

Other Sources. OFFROAD2007. Estimated based on population (Landscaping) and employment (Light Commercial Equipment) for Yucca Valley as a percentage of San Bernardino County. Excludes MDAQMD permitted sources (see note below). Construction is estimated based on housing permit data for Yucca Valley from the U.S. Census. Daily construction emissions multiplied by 347 days/year to account for reduced/limited construction activity on weekends and holidays.

Adjusted BAU includes reductions identified in the Scoping Plan associated with Transportation (Pavely+LCFS), Energy & Water/Wastewater (improvements in the carbon intensity of electricity identified by SCE), and Other (LCFS). The current inventory does not account for reductions in building energy use from Title 24 cycle updates.

TOWN OF YUCCA VALLEY - GHG EMISSIONS INVENTORY COMPARISON

	Change of ABAU from 2012 $MTCO_2e$						Change from BAU to ABAU					
SECTORS	**Delta 2020**	**Percent of Total**	**Delta 2035**		**Delta P-2035**	**Percent of Total**	**Delta 2020**		**Delta 2035**		**Delta P-2035**	**Percent of Total**
Transportation	(33,207)		(31,588)		198,947		(33,521)		(46,695)		(132,362)	
Residential (Natural Gas and Electricity)	(3,940)		222		65,765		(6,516)		(7,185)		(17,705)	
Nonresidential* (Natural Gas and Electricity)	(2,860)		(337)		71,620		(4,479)		(4,992)		(19,632)	
Town (Natural Gas and Electricity)	(54)		(2)		985		(86)		(95)		(269)	
Total Nonresidential	*(2,913)*	*0.0%*	*(339)*	*0.0%*	*72,606*	*0.0%*	*(4,564)*	*0.0%*	*(5,087)*	*0.0%*	*(19,900)*	*0.0%*
Waste	186		535		7,247		0		0		0	
Water/Wastewater	(791)		(489)		7,442		(947)		(1,009)		(2,937)	
Other - Offroad Equipment	(138)		(122)		261		(148)		(150)		(193)	
Total Community Emissions	(40,803)		(31,781)		352,267		(45,697)		(60,125)		(173,097)	
	-17%		-13%		149%		-19%		-23%		-23%	

TOWN OF YUCCA VALLEY - CRITERIA AIR POLLUTANT INVENTORY

EXISTING BASELINE	2012 - lbs/day					
SECTORS	**ROG**	**NO_x**	**CO**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Transportation	561	2,427	8,211	10	193	108
Energy - Residential (Natural Gas)	8	68	29	0	5	5
Energy - Nonresidential* (Natural Gas)	2	21	18	0	2	2
Energy - Town (Natural Gas)	0	1	1	0	0	0
subtotal energy	*10*	*90*	*47*	*1*	*7*	*7*
Area Sources (Landscaping, Light Commercial Equipment)	11	7	163	0	1	1
Other (Construction Equipment)	10	77	54	0	4	4
Total	592	2,600	8,475	10	205	120
	2012 - tons/year					
SECTORS	**ROG**	**NO_x**	**CO**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Transportation	97	421	1,425	2	34	19
Energy - Residential (Natural Gas)	1	12	5	0	1	1
Energy - Nonresidential* (Natural Gas)	0	4	3	0	0	0
Energy - Town (Natural Gas)	0	0	0	0	0	0
subtotal energy	*2*	*16*	*9*	*0*	*1*	*1*
Area Sources (Landscaping, Light Commercial Equipment)	2	1	30	0	0	0
Other (Construction Equipment)**	2	13	9	0	1	1
Total	103	452	1,472	2	36	21

EXISTING w/2035 EMISSION RATES	2035 Existing Land Uses - lbs/day					
SECTORS	**ROG**	**NO_x**	**CO**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Transportation	184	665	2,519	10	139	57
Energy - Residential (Natural Gas)	8	68	29	0	5	5
Energy - Nonresidential* (Natural Gas)	2	21	18	0	2	2
Energy - Town (Natural Gas)	0	1	1	0	0	0
subtotal energy	*10*	*90*	*47*	*1*	*7*	*7*
Area Sources (Landscaping, Light Commercial Equipment)	11	7	163	0	1	1
Other (Construction Equipment)	10	77	54	0	4	4
Total	215	838	2,783	10	151	69
Net Change from Baseline	-377	-1,762	-5,692	0	-54	-50
	2035 Existing Land Uses - tons/year					
SECTORS	**ROG**	**NO_x**	**CO**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Transportation	32	115	437	2	24	10
Energy - Residential (Natural Gas)	1	12	5	0	1	1
Energy - Nonresidential* (Natural Gas)	0	4	3	0	0	0
Energy - Town (Natural Gas)	0	0	0	0	0	0
subtotal energy	*2*	*16*	*9*	*0*	*1*	*1*
Area Sources (Landscaping, Light Commercial Equipment)	2	1	30	0	0	0
Other (Construction Equipment)**	2	13	9	0	1	1
Total	37	146	485	2	26	12
Net Change from Baseline	-65	-306	-987	0	-9	-9

TOWN OF YUCCA VALLEY - CRITERIA AIR POLLUTANT INVENTORY

FORECAST YEAR 2035 (SCAG Projections)	2035 Land Uses - lbs/day					
SECTORS	**ROG**	**NO_x**	**CO**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Transportation	201	729	2,761	11	152	63
Energy - Residential (Natural Gas)	9	79	34	1	6	6
Energy - Nonresidential* (Natural Gas)	3	25	21	0	2	2
Energy - Town (Natural Gas)	0	1	1	0	0	0
subtotal energy	*12*	*105*	*55*	*1*	*8*	*8*
Area Sources (Landscaping, Light Commercial Equipment)	13	8	191	0	1	1
Other (Construction Equipment)	10	77	54	0	4	4
Total	236	919	3,061	12	166	76
Net Change from Baseline in 2035	21	80	278	1	15	7
	2035 Land Uses - tons/year					
SECTORS	**ROG**	**NO_x**	**CO**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Transportation	35	126	479	2	26	11
Energy - Residential (Natural Gas)	2	14	6	0	1	1
Energy - Nonresidential* (Natural Gas)	1	5	4	0	0	0
Energy - Town (Natural Gas)	0	0	0	0	0	0
subtotal energy	*2*	*19*	*10*	*0*	*2*	*2*
Area Sources (Landscaping, Light Commercial Equipment)	2	1	35	0	0	0
Other (Construction Equipment)**	2	13	9	0	1	1
Total	41	160	533	2	29	13
Net Change from Baseline in 2035	4	14	49	0	3	1

FORECAST YEAR P-2035 (GP Buildout)	P-2035 Land Uses - lbs/day					
SECTORS	**ROG**	**NO_x**	**CO**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Transportation	570	2,065	7,825	31	540	187
Energy - Residential (Natural Gas)	23	195	83	1	16	16
Energy - Nonresidential* (Natural Gas)	11	99	83	1	8	8
Energy - Town (Natural Gas)	0	2	2	0	0	0
subtotal energy	*34*	*296*	*168*	*2*	*23*	*23*
Area Sources (Landscaping, Light Commercial Equipment)	35	28	570	0	3	3
Other (Construction Equipment)	10	77	54	0	4	4
Total	650	2,466	8,618	33	570	218
Net Change from Baseline in 2035	435	1,628	5,835	22	419	148
	P-2035 Land Uses - tons/year					
SECTORS	**ROG**	**NO_x**	**CO**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**
Transportation	99	358	1,358	5	94	32
Energy - Residential (Natural Gas)	4	36	15	0	3	3
Energy - Nonresidential* (Natural Gas)	2	18	15	0	1	1
Energy - Town (Natural Gas)	0	0	0	0	0	0
subtotal energy	*6*	*54*	*31*	*0*	*4*	*4*
Area Sources (Landscaping, Light Commercial Equipment)	6	5	104	0	1	1
Other (Construction Equipment)**	2	13	9	0	1	1
Total	113	431	1,502	6	99	38
Net Change from Baseline in 2035	76	285	1,017	4	73	26

TOWN OF YUCCA VALLEY - CRITERIA AIR POLLUTANT INVENTORY

Notes: Emissions forecasts estimated based on changes in population (residential energy), employment (nonresidential energy), or service population (transportation)

EMFAC2011 based on daily VMT provided by Fehr and Peers using the SBTAM model. Transportation sector includes the full trip length for external-internal trips. VMT per year based on a conversion of VMT x 347 days per year to account for less travel on weekend, consistent with CARB statewide GHG emissions inventory methodology (CARB 2008). Includes fugitive dust from travel on updated roads using EPA's AP 42.

Emissions forecasts estimated based on changes in population (residential energy), employment (nonresidential energy), or service population (transportation)

Energy. Based on a two-year average (2010-2011) of energy use provided by SCE and a three year average (2009-2011) provided by SoCal Gas. Nonresidential* includes direct access customers, county facilities, and other district facilities within the Town boundaries.

Area Sources. OFFROAD2007. Estimated based on population (Landscaping) and employment (Light Commercial Equipment) for Yucca Valley as a percentage of San Bernardino County. Excludes MDAQMD permitted sources. Does not include emissions from wood-burning fireplaces and consumer products. Various industrial and commercial processes (e.g., manufacturing, dry cleaning) allowed under the proposed Land Use Plan of the General Plan Update would require permitting and would be subject to further study pursuant to MDAQMD Regulation XIII, New Source Review. Because the nature of those emissions cannot be determined at this time and they are subject to further regulation and permitting, they will not be included in the table because they would be speculative.

Other Sources. OFFROAD2007. Estimated based on housing permit data for San Bernardino and Yucca Valley from the US Census. ** Daily offroad construction emissions multiplied by 347 days/year to account for reduced/limited construction activity on weekends and holidays. Excludes fugitive emissions from construction sites.

Model Inputs

	From Buildout Memo			
	2012	2020 estimate	SCAG 2035	Post 2035
Housing Units	9,458	10,067	11,210	27,229
Population	22,464	23,763	26,200	64,565
Non Residential SQFT	3,560,317	3,792,067	4,226,597	20,963,702
Employment	7,481	7,968	8,881	34,926
Service Population	**29,945**	**31,731**	**35,081**	**99,491**

Notes:

2035 SCAG Forecast. A vacancy rate of 5% was assumed for households, adjusted down from the 13% vacancy rate identified by the California Department of Finance (2012) to account for housing market improvements. Employment adjusted from the SCAG forecast based on the relative increase from 2008 to 2035. SQFT is an estimate based on SQFT/employee.

Model Inputs

Note: highlighted areas are the model inputs. The remaining areas are automatically updated based on the change in Population and Employment

	Sector Inputs			
	2012	2020	SCAG 2035	P-2035
Residential Electricity (Kwh)	69,771,454	73,807,533	81,375,182	200,533,916
Commercial + Industrial Electricity + Ag (Kwh)	47,627,242	50,727,415	56,540,240	222,353,837
Town (Kwh)	916,230	970,889	1,073,376	3,044,134
Total Electricity (Kwh)	118,314,925	125,505,837	138,988,798	425,931,887
Residential Natural Gas (Therms)	2,681,638	2,836,763	3,127,623	7,707,441
Commercial+Industrial Natural Gas (Therms)	790,473	841,927	938,403	3,690,425
Town (Therms)	26,755	28,351	31,344	88,892
Total Natural Gas (Therms)	3,498,866	3,707,041	4,097,370	11,486,759
VMT/year	843,906	836,356	99,491	2,622,318
Water (AF/year)	2,923	2,754	3,040	7,989
Water (gallons/year)	952,486,913	897,434,939	990,643,537	2,603,138,088
Wastewater (gallons/year)	859,358,534	792,347,621	874,463,218	2,273,646,453
Indoor Water as a Percent of Total Water Use	90%	88%	88%	87%
Waste Generation (tons/year)	17,151	18,174	20,092	56,983
Waste Generation ADC (tons/year)	1,121	1,187	1,313	3,723
Total Waste Disposal (tons/year)	18,271	19,361	21,405	60,706
Sources				

Natural gas and electricity use for residential land uses in the Town were modeled using data provided by SoCalGas and SCE, respectively. Natural gas use is based on a three-year average (2011, 2010, and 2009) and electricity use is based on a two-year average (2011 and 2010) to account for fluctuation in annual natural use as a result of natural variations in climate. Forecasts in energy are based on the change in population and employment.

EMFAC2011 based on daily VMT provided by Fehr and Peers using the SBTAM model. Transportation sector includes the full trip length for external-internal trips. VMT per year based on a conversion of VMT x 347 days per year to account for less travel on weekend, consistent with CARB statewide GHG emissions inventory methodology (CARB 2008).

Total water generation for Yucca Valley is based on the Hi-Desert Water District's 2010 Urban Water Management Plan SBX7-7 gallons per capita per day (gpcd). Forecasts (2020 and 2035) are adjusted for increases in population and employment and are based on the Target per capita SBx7-7 for the High Desert Water District.

GHG emissions from waste generation is based on waste commitment method. Waste Generation for the Town of Yucca Valley is obtained from CalRecycle. Forecasts are based on an average 2011-2009 disposal rate and adjusted for increases in population and employment.

County Name	City Name	2008 Population	2020 Population	2035 Population	2008 Households	2020 Households	2035 Households	2008 Employment	2020 Employment	2035 Employment
SAN BERNARDINO COUNTY	Yucca Valley town	20,700	23,000	26,200	8,300	9,900	11,800	4,600	5,100	6,000
		2,016,000	2,268,000	2,750,000	606,000	698,000	847,000	701,000	810,000	1,059,000
SCAG REGION		**17,895,000**	**19,663,000**	**22,091,000**	**5,814,000**	**6,458,000**	**7,325,000**	**7,738,000**	**8,414,000**	**9,441,000**
Note: *The city numbers many not sum to the County total due to rounding. City numbers were rounded to the nearest 10 for jurisdictions with small numbers										
or to the nearest 100 for all others, while county numbers were rounded to the nearest 1,000. ** The proposed growth forecast for Eastvale and Jurupa Valley										
are subject to further revisions due to their recent incorporation, pending final approval from cities/county.										
Source: SCAG										

JOSHUA TREE, CALIFORNIA (044405)

Period of Record Monthly Climate Summary

Period of Record : 6/ 1/1959 to 3/31/2013

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	62.2	61.5	69.8	76.4	86.0	93.9	101.1	100.4	95.8	81.2	69.1	58.2	79.6
Average Min. Temperature (F)	37.9	37.5	41.0	46.0	53.4	60.0	70.8	70.1	65.8	53.4	43.0	35.8	51.2
Average Total Precipitation (in.)	0.62	0.48	0.39	0.13	0.17	0.01	0.33	0.50	0.33	0.33	0.61	0.79	4.69
Average Total SnowFall (in.)	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	2.0
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 0% Min. Temp.: 0% Precipitation: 96.6% Snowfall: 96.5% Snow Depth: 96%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

JOSHUA TREE, CALIFORNIA

Period of Record General Climate Summary - Temperature

Station:(044405) JOSHUA TREE													
From Year=1959 To Year=2012													
	Monthly Averages			Daily Extremes				Monthly Extremes				Max. Temp.	
	Max.	Min.	Mean	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year	>= 90 F	< 32
	F	F	F	F	dd/yyyy or yyyymmdd	F	dd/yyyy or yyyymmdd	F	-	F	-	# Days	# Da
January	62.2	37.9	50.1	79	18/2011	22	01/2011	52.2	2012	48.5	2011	0.0	
February	61.5	37.5	49.5	78	11/2012	18	02/2011	51.4	2012	46.9	2011	0.0	
March	69.8	41.0	55.4	87	31/2011	29	06/2009	56.8	2012	54.1	2010	0.0	
April	76.4	46.0	61.2	99	23/2012	32	06/2010	64.5	2012	58.7	2010	2.5	
May	86.0	53.4	69.7	102	22/2012	36	16/2011	76.0	2009	64.5	2010	12.2	
June	93.9	60.0	76.9	106	02/2012	40	02/2011	80.4	2012	74.1	2009	21.5	
July	101.1	70.8	86.0	112	11/2012	57	14/2011	87.4	2009	84.7	2011	31.0	
August	100.4	70.1	85.3	110	25/2011	52	30/2010	88.1	2012	82.9	2010	29.5	
September	95.8	65.8	80.8	105	04/2011	49	30/2009	82.2	2012	79.0	2010	27.5	
October	81.2	53.4	67.3	102	03/2012	37	06/2009	69.8	2011	63.6	2009	5.0	
November	69.1	43.0	56.1	86	02/2011	26	26/2010	60.0	2008	53.3	2011	0.0	
December	58.2	35.8	47.0	78	01/2011	17	19/2008	51.2	2010	45.1	2009	0.0	
Annual	79.6	51.2	65.4	112	20120711	17	20081219	65.3	2009	64.5	2010	129.2	
Winter	60.6	37.1	48.9	79	20110118	17	20081219	49.9	2012	48.2	2010	0.0	
Spring	77.4	46.8	62.1	102	20120522	29	20090306	65.0	2012	59.1	2010	14.8	
Summer	98.5	67.0	82.7	112	20120711	40	20110602	84.7	2012	81.7	2009	82.0	
Fall	82.1	54.0	68.0	105	20110904	26	20101126	68.0	2011	66.4	2010	32.5	

Table updated on Oct 31, 2012
For monthly and annual means, thresholds, and sums:
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered
Seasons are climatological not calendar seasons
Winter = Dec., Jan., and Feb. Spring = Mar., Apr., and May
Summer = Jun., Jul., and Aug. Fall = Sep., Oct., and Nov.

Water and Wastewater

Water Demand Calculations Derived from the Urban Water Management Plan

Source: Hi-Desert Water District. 2011, June 27. Final 2010 Urban Water Management Plan. Prepared by Kennedy/Jenks Consultants.
http://www.hdwd.com/LinkClick.aspx?fileticket=dUTe%2BDg6kBQ%3D&tabid=180

	Table 2-7, Current and Projected Water Delivered by Customer Type (AF)			
	2010	%	2035 w/ SBX7-7	%
Residential (single + multi-family) - Indoor	2,558	81%	2,872	71%
Commercial + Industrial - Indoor	371	12%	863	21%
Irrigation + Other + System Loss - Outdoor	218	7%	314	8%
Total	3,147		4,049	

	Per Capita Water Use (gpdc)			
	Total	Residential	Non-Residential	Outdoor
Base	123	100.0	14.5	8.5
2020 Target	117	83.0	24.9	9.1

The SBX7-7 rate is allocated to residential, non-residential, and outdoor water use based on the Customer type % identified in Table 2-7 for 2010 and for 2035 (which includes reductions from conservation measures)

	Water Use gallons/year			
	Total	Residential	Non-Residential	Outdoor
2012	952,486,913	819,764,040	39,594,494	93,128,379
2020	897,434,939	719,822,460	72,525,161	105,087,318
SCAG 2035	990,643,537	793,627,442	80,835,777	116,180,318
P-2035	2,603,138,088	1,955,746,404	317,900,049	329,491,635

Wastewater Modeling assumes 100% septic treatment for 2012, 50% septic treatment for 2020; 25% septic treatment in 2035, and 0% septic treatment at P-2035.

Water and Wastewater

Fugitive Emissions - Process Emissions from WWTP with Nitrification/Denitrification

CH_4 - Microorganisms can biodegrade soluble organic material in wastewater under aerobic (presence of oxygen) or anaerobic (absence of oxygen) conditions. Anaerobic conditions result in the production of CH_4.

N_2O - Treatment of domestic wastewater during both nitrification and denitrification of the nitrogen present leads to the formation of N_2O, usually in the form of urea, ammonia, and proteins. These compounds are converted to nitrate through the aerobic process of nitrification. Denitrification occurs under anoxic conditions (without free oxygen), and involves the biological conversion of nitrate into dinitrogen. N_2O can be an intermediate product of both processes, but more often is associated with denitrification.

Notes: Waste discharge facilities in compliance with the United States Environmental Protection Agency's Clean Water Standards do not typically result in CH_4 emissions. However, poorly-operated aerobic wastewater treatment systems can result in the generation of CH_4. Because wastewater treatment systems are assumed to operate in compliance with state and federal laws pertaining to water quality, CH_4 emissions from centralized aerobic treatments are not included in the inventory.

2012. Fugitive Emissions: Septic Systems

LGOP Version 1.1. Equation 10.5. Uses default of 200 mg/L of BOD5load to convert wastewater to BOD5

CH4 = Wastewater x BOD5load x 10^-6 x Bo x MCFseptic x 10^-3

	2012	2020	2035	P-2035
wastewater (Liters)=	3,252,672,052	1,499,517,873	827,460,820	0

BOD5load =	200.00	mg/L of Wastewater
10^-6 =	1.00E-06	conversion factor; kg/mg
Bo =	0.60	kg//CH_4/kg BOD5 removed
MCFseptic	0.50	CH_4 correction factor for septic systems
10^-3 =	1.00E-03	conversion factor: MTons/kg

	2012	2020	2035	P-2035
	MTons			
CH_4 =	195.160	89.971	49.648	0.000
CO_2e =	4,098	1,889	1,043	0

Source: California Air Resources Board (CARB). 2010, May. Local Government Operations Protocol (LGOP), Version 1.1. The LGOP protocol provides default values for all the terms with exception to factors outlined in the CalEEMod program manual. South Coast Air Quality Management District (SCAQMD). 2011. California Emissions Estimator Model (CalEEMod), Version 2011.1.1. User's Manual. USEPA. 2008. Page 8-12. USEPA cites Metcalf & Eddy, Inc., 1991, "Wastewater Engineering: Treatment Disposal, and Reuse," 3rd Ed. McGraw Hill Publishing.

Buildout Fugitive Emissions - Process Emissions from WWTP with Nitrification/Denitrification

LGOP Version 1.1. Equation 10.9.

N_2O = Wastewater x 10^-6 x Nload x EF effluent x 10^3

	2012	2020	2035	P-2035
wastewater (Liters)=	0	1,499,517,873	2,482,382,461	8,605,751,824

10^-6 =	1.00E-06	conversion factor; kg/mg	
N Load	40.00	mg/L of wastewater	USEPA 2008
EF effluent	0.01	kg/N_2O/kg N	
10^-3 =	1.00E-03	conversion factor: MTons/kg	

	2012	2020	2035	P-2035
	MTons			
N_2O	0.00	0.30	0.50	1.72
CO_2e =	0	93	154	534

Source: California Air Resources Board (CARB). 2010, May. Local Government Operations Protocol (LGOP), Version 1.1. The LGOP protocol provides default values for all the terms except the Nitrogen Load, which is assumed to be 40 mg of N per Liter of wastewater effluent based on USEPA methodology outlined in the CalEEMod program manual. South Coast Air Quality Management District (SCAQMD). 2011. California Emissions Estimator Model (CalEEMod), Version 2011.1.1. User's Manual. USEPA. 2008. Page 8-12. USEPA cites Metcalf & Eddy, Inc., 1991, "Wastewater Engineering: Treatment Disposal, and Reuse," 3rd Ed. McGraw Hill Publishing.

Total Fugitive Emissions - Process Emissions from WWTP with Nitrification/Denitrification + Septic Tanks

	2012	2020	2035	P-2035
CO_2e =	4,098	1,982	1,197	534

Wastewater Modeling assumes 100% septic treatment for 2012, 50% septic treatment for 2020; 25% septic treatment in 2035, and 0% septic treatment at P-2035.

Water and Wastewater

Energy for Water Conveyance, Treatment, Distribution, and Wastewater Treatment (Southern California)

Water Supply and Conveyance	Water Treatment	Water Distribution	Total Water	Wastewater Treatment (Tertiary)
	kWhr/million gallons			
9,727	111	1,272	11,110	1,911

Source: California Energy Commission (CEC). 2006, December. Refining Estimates of Water-Related Energy Use in California. CEC-500-2006-118. Prepared by Navigant Consulting, Inc. Based on the electricity use for Southern California.

SCE Electricity Carbon Intensity

	Intensity factor				CO_2e
	CO2 MTons/MWH[1]	CH_4 MTons/MWH[2]	N_2O MTons/MWH[2]		MTons/MWh
2008	0.432	0.000013	0.000005		0.434

Source 1: California Public Utilities Commission. 2010, September 13. WCI Final Default Emission Factor Calculator 2008 Data, Version 2. WECC Region.

Source 2: CH_4 and N_2O intensity based on California E-Grid data (CH_4 = 0.029 lbs/MWH; N_2O = 0.011 lbs/MWH)

ABAU Carbon Intensity

	2008	2020	CO_2e
Assumed Percent Renewable	15.8%	33%	MTons/MWh
CO_2e MTons/Mwh	0.432	0.344	0.346

Based on the SCE RPS in 2008 to match the 2008 WECC Carbon Intensity.

Source: California Public Utilities Commission (CPUC). California RPS Procurement Summary 2003-2010. http://www.cpuc.ca.gov/PUC/energy/Renewables/index.htm

GHG Emissions from Energy Associated with Water/Wastewater

	2012	2020	2035	P-2035
Energy Associated with Water Use	**MwH/Year**			
Water	10,582	9,971	11,006	28,921
Wastewater	0	757	418	4,345
Total Water/Wastewater	10,582	10,728	11,424	33,266

Wastewater Modeling assumes 100% septic treatment for 2012, 50% septic treatment for 2020; 25% septic treatment in 2035, and 0% septic treatment at P-2035.

GHG Emissions from Energy Associated with Water Use/Wastewater Generation	2012	2020	2035	P-2035
	$MTCO_2e$/Year			
Water	4,593	4,328	4,777	12,553
Wastewater	0	329	181	1,886
Total Water/Wastewater	4,593	4,656	4,958	14,438

Total GHGs

	2012	2020	2035	P-2035
GHG Emissions from Water/Wastewater Use	**$MTCO_2e$/Year**			
Water	4,593	4,328	4,777	12,553
Wastewater	0	422	335	2,419
Total Water/Wastewater	4,593	4,749	5,112	14,972

GHG Emissions from Energy Use - Adjusted for Lower Carbon Intensity in 2020

		2020	2035	P-2035
GHG Emissions from Water/Wastewater Use		**$MTCO_2e$/Year**		
Water		3,447	3,805	9,999
Wastewater		355	298	2,036
Total Water/Wastewater		3,802	4,104	12,035

Water and Wastewater

General Conversion Factors

	Global Warming Potentials (GWP)
CO_2	1
CH_4	21
N_2O	310

Source: Intergovernmental Panel on Climate Change (IPCC). 2001. Third Assessment Report: Climate Change 2011.

gallons to Liters	3.785
killowatt hrs to megawatt hrs	0.001
gallons to AF	325851.4290

Community Wide GHG Inventory Report for Yucca Valley

Southern California Edison (SCE), 2013, April 3. Electricity Use Report for Town of Yucca Valley, Calendar Year 2011. Version 2.0.
Southern California Edison (SCE), 2013, April 2. Electricity Use Report for Town of Yucca Valley, Calendar Year 2010. Version 2.0.
Southern California Gas Company (SoCal Gas), 2013, April 4. 2011, 2010, and 2009 Annual Natural Gas Use

California Energy Commission Sector Group: Bundled and Direct Access Customers

	2010 Annual KWH	2011 Annual KWH	Average 2010-2011 Annual KWH
Residential	69,441,414	70,101,493	69,771,454
Agricultural	4,038,903	4,000,455	4,019,679
Commercial + Industrial	43,736,818	43,478,308	43,607,563
City	912,559	919,900	916,230
	118,129,694	118,500,156	118,314,925

SoCal Gas Natural Gas Use

	2009 Annual Therms	2010 Annual Therms	2011 Annual Therms	Average 2009-2011 Annual Therms
Residential	2,599,899	2,796,923	2,648,092	2,681,638
Commercial + Industrial	806,264	788,958	776,198	790,473
City	25,115	31,855	23,295	26,755
	3,431,278	3,617,736	3,447,585	3,498,866

Energy

Natural Gas Emission Factors

Natural Gas	Intensity factor				CO_2e
	lbs CO_2/Therm	MTons CO_2/Therm	CH_4 MTons/Therm	N_2O MTons/Therm	MTons/Therm
All Years	11.7	0.00530	5.E-07	1.E-08	**0.00532**

Source: CO_2, CH_4 and N_2O intensity based on Table G.3 of the LGOP for residential and non-residential (CO_2, 53.02 kg/Mmbtu; CH_4: 0.005 kg/MMBtu; N_2O: 0.0001 kg/MMBtu)

SCE Electricity Carbon Intensity

	Intensity factor				CO_2e
	CO_2 MTons/MWH[1]	CH_4 MTons/MWH[2]	N_2O MTons/MWH[2]		MTons/MWh
2008	0.432	0.000013	0.000005		0.434

Source 1: California Public Utilities Commission. 2010, September 13. WCI Final Default Emission Factor Calculator 2008 Data, Version 2. WECC Region.

Source 2: CH_4 and N_2O intensity based on California E-Grid data (CH_4 = 0.029 lbs/MWH; N_2O = 0.011 lbs/MWH) identified in the LGOP

ABAU Carbon Intensity

	2008	2020	CO_2e
Assumed Percent Renewable	15.8%	33%	MTons/MWh
CO_2e MTons/Mwh	0.432	0.344	0.346

Based on the SCE RPS in 2008 to match the 2008 WECC Carbon Intensity.

Source: California Public Utilities Commission (CPUC). California RPS Procurement Summary 2003-2010. http://www.cpuc.ca.gov/PUC/energy/Renewables/index.htm

GHG Emissions from Energy Use

	2012	2020	2035	P-2035
Electricity				
Residential Electricity	30,283	32,035	35,320	87,038
Commercial + Industrial	20,672	22,017	24,540	96,509
City	398	421	466	1,321
Total	51,353	54,474	60,326	184,868

	2012	2020	2035	P-2035
Natural Gas				
Residential Electricity	14,255	15,079	16,625	40,970
Commercial + Industrial	4,202	4,475	4,988	19,617
City	142	151	167	473
Total	18,599	19,705	21,780	61,059

	2012	2020	2035	P-2035
Summary				
Residential Total	44,538	47,114	51,945	128,008
Commercial + Industrial Total	24,874	26,493	29,529	116,126
City Total	540	572	632	1,794
Total	69,951	74,179	82,106	245,928

GHG Emissions from Energy Use - Adjusted for Lower Carbon Intensity in 2020

		2020	2035	P-2035
Electricity		**$MTCO_2e$/Year**		
Residential Electricity		25,518	28,135	69,333
Commercial + Industrial		17,539	19,548	76,877
City		336	371	1,052
Total		43,393	48,054	147,263

		2020	2035	P-2035
Natural Gas		**$MTCO_2e$/Year**		
Residential Electricity		15,079	16,625	40,970
Commercial + Industrial		4,475	4,988	19,617
City		151	167	473
Total		19,705	21,780	61,059

		2020	2035	P-2035
Summary		**$MTCO_2e$/Year**		
Residential Total		40,598	44,760	110,303
Commercial + Industrial Total		22,014	24,537	96,494
City Total		486	538	1,525
Total		63,098	69,834	208,322

General Conversion Factors

lbs to kg	0.4536
kg to MTons	0.001
Mmbtu to Therm	0.1
kilowatt hrs to megawatt hrs	0.001
lbs to Tons	2000
Tons to MTon	0.9071847

Source: California Air Resources Board (CARB). 2010. Local Government Operations Protocol. Version 1.1. Appendix F, Standard Conversion Factors

	Global Warming Potentials (GWP)
CO_2	1
CH_4	21
N_2O	310

Source: Intergovernmental Panel on Climate Change (IPCC). 2001. Third Assessment Report: Climate Change 2011.

Therms to kwh	29.30711111

Criteria Air Pollutants from Natural Gas

Rate	lbs/MBTU					
Natural Gas	ROG	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$
Residential	0.01078431	0.09215686	0.03921569	0.00058824	0.00745098	0.00745098
Non-Residential	0.01078431	0.09803922	0.08235294	0.00058824	0.00745098	0.00745098

Source: CalEEMod Version 2011.1.1.

Natural Gas	2012 lbs/day					
	ROG	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$
Residential	8	68	29	0	5	5
Commercial + Industrial	2	21	18	0	2	2
City	0	1	1	0	0	0
Total	10	90	47	1	7	7

Natural Gas	2020 lbs/day					
	ROG	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$
Residential	8	72	30	0	6	6
Commercial + Industrial	2	23	19	0	2	2
City	0	1	1	0	0	0
Total	11	95	50	1	8	8
Increase from Baseline	1	5	3	0	0	0

Natural Gas	2035 lbs/day					
	ROG	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$
Residential	9	79	34	1	6	6
Commercial + Industrial	3	25	21	0	2	2
City	0	1	1	0	0	0
Total	12	105	55	1	8	8
Increase from Baseline	2	15	8	0	1	1

Natural Gas	P-2035 lbs/day					
	ROG	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$
Residential	23	195	83	1	16	16
Commercial + Industrial	11	99	83	1	8	8
City	0	2	2	0	0	0
Total	34	296	168	2	23	23
Increase from Baseline	24	206	121	1	16	16

General Conversion Factors	
Mmbtu to Therm	0.1
lbs to Tons	2000
Tons to MTon	0.9071847

Source: California Air Resources Board (CARB). 2010. Local Government Operations Protocol. Version 1.1. Appendix F, Standard Conversion Factors

Electricity Use Report
For Town of Yucca Valley
Calendar Year 2010

Prepared by

Southern California Edison

Version 2.0

April 2, 2013

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL® Company

I. Introduction

The purpose of this report is to fulfill your request for overall energy consumption data for the Town of Yucca Valley. SCE has made every effort to fulfill this request. However, our legal responsibility of maintaining confidentiality of individual customer data limits us to providing only the following information:

- Customer Classifications grouped by California Energy Commission (CEC) sectors: Residential, Commercial, Industrial, and Agriculture,
- kWh consumption,
- kW demand for Commercial, Industrial, and Agriculture Sectors with demand meters; no kW demand data is available for Residential Sector, and
- Number of Accounts

II. Data Description

The summaries provided in the Table below in page 3, are based on 12 months usage data for Calendar Year 2010 for SCE installed service accounts within the city's boundaries. The accounts included in the dataset were extracted from SCE's Customer Service System based on the Public Authority Code for the Town of Yucca Valley. This code is used to identify accounts by municipality for the purpose of calculating state and local taxes. Public Authority Code is permanently retained as a part of each premise's identification regardless of occupancy. The only time a Public Authority Code changes is when a city or county annexes a given piece of property into its territory or a particular piece of property is transferred from one public authority to another through other means.

III. Summary of Results (January 1, 2010 – December 31, 2010)

Table – Total of Account Summary Data for Bundled and Direct Access Customers

CALIFORNIA ENERGY COMMISSION (CEC) SECTOR GROUP	ANNUAL KWH	% of TOTAL	KW DEMAND	NUMBER OF ACCOUNTS	% of TOTAL
RESIDENTIAL	69,441,414	59.2%	-	9,240	88.6%
AGRICULTURAL	4,038,903	3.4%	1,604	49	0.5%
COMMERCIAL	43,736,818	37.3%	13,628	1,144	11.0%

Grand Total	117,217,135		10,433

DA % of kWh	8.1%

Application of 15/15 Rule (Section V. Release of Aggregated Customer Information, p. 4)

The Industrial Sector was combined into the Commercial Sector

CITY FACILITIES	NUMBER OF ACCOUNTS	ANNUAL KWH
YUCCA VALLEY, CITY OF	57	912,559

IV. Release of Aggregated Customer Information

The 15/15 Rule is intended to protect customer confidentiality by reducing the possibility of identifying customers through the release of usage information. SCE will apply the 15/15 Rule in releasing aggregated customer information. The rule was initially implemented by the California Public Utilities Commission during Direct Access proceedings in 1997 and was adopted through D. 97-10-031.

The 15/15 rule requires that any aggregated information provided by the Utilities must be made up of at least 15 customers, and a customer's load must be less than 15% of an assigned category. If the number of customers in the compiled data is below 15, or if a single customer's load is more than 15% of the total data, categories (e.g., rate classes) must be combined before the information is released. The rule further requires that if the 15/15 rule is triggered for a second tie after the data has been screened once already using the 15/15 rule, then the customer is dropped from the information provided.

V. Disclaimer

Southern California Edison Company has provided the above information at your request. The data presented here represents 12 months Calendar Year 2010. These estimates are provided for informational purposes only, and are not intended to, nor do they, predict what energy usage and loads within your city boundaries will be in the future. The actual future loads and energy consumption will vary from these estimates for a variety of reasons, including changes in energy usage, demand levels, and weather patterns. Southern California Edison Company assumes no liability for the use of the information provided above. If you have any questions regarding this information, please contact your Southern California Edison Company Account Representative.

Electricity Use Report
For Town of Yucca Valley
Calendar Year 2011

Prepared by

Southern California Edison

Version 2.0

April 3, 2013

I. Introduction

The purpose of this report is to fulfill your request for overall energy consumption data for the Town of Yucca Valley. SCE has made every effort to fulfill this request. However, our legal responsibility of maintaining confidentiality of individual customer data limits us to providing only the following information:

- Customer Classifications grouped by California Energy Commission (CEC) sectors: Residential, Commercial, Industrial, and Agriculture,
- kWh consumption,
- kW demand for Commercial, Industrial, and Agriculture Sectors with demand meters; no kW demand data is available for Residential Sector, and
- Number of Accounts

II. Data Description

The summaries provided in the Table below in page 3, are based on 12 months usage data for Calendar Year 2011 for SCE installed service accounts within the city's boundaries. The accounts included in the dataset were extracted from SCE's Customer Service System based on the Public Authority Code for the Town of Yucca Valley. This code is used to identify accounts by municipality for the purpose of calculating state and local taxes. Public Authority Code is permanently retained as a part of each premise's identification regardless of occupancy. The only time a Public Authority Code changes is when a city or county annexes a given piece of property into its territory or a particular piece of property is transferred from one public authority to another through other means.

III. Summary of Results (January 1, 2011 – December 31, 2011)

Table – Total of Account Summary Data for Bundled and Direct Access Customers

CALIFORNIA ENERGY COMMISSION (CEC) SECTOR GROUP	ANNUAL KWH	% of TOTAL	KW DEMAND	NUMBER OF ACCOUNTS	% of TOTAL
Residential	70,101,493	59.6%	-	9,239	88.5%
Agricultural	4,000,455	3.4%	1,729	50	0.5%
Commercial	43,478,306	37.0%	13,587	1,147	11.0%

Grand Total	117,580,254		10,436

DA % of kWh	8.1%

Application of 15/15 Rule (Section V. Release of Aggregated Customer Information, p. 4)
The Industrial Sector was combined into the Commercial Sector

CITY FACILITIES	NUMBER OF ACCOUNTS	ANNUAL KWH
YUCCA VALLEY, CITY OF	41	919,900

IV. Release of Aggregated Customer Information

The 15/15 Rule is intended to protect customer confidentiality by reducing the possibility of identifying customers through the release of usage information. SCE will apply the 15/15 Rule in releasing aggregated customer information. The rule was initially implemented by the California Public Utilities Commission during Direct Access proceedings in 1997 and was adopted through D. 97-10-031.

The 15/15 rule requires that any aggregated information provided by the Utilities must be made up of at least 15 customers, and a customer's load must be less than 15% of an assigned category. If the number of customers in the compiled data is below 15, or if a single customer's load is more than 15% of the total data, categories (e.g., rate classes) must be combined before the information is released. The rule further requires that if the 15/15 rule is triggered for a second tie after the data has been screened once already using the 15/15 rule, then the customer is dropped from the information provided.

V. Disclaimer

Southern California Edison Company has provided the above information at your request. The data presented here represents 12 months Calendar Year 2011. These estimates are provided for informational purposes only, and are not intended to, nor do they, predict what energy usage and loads within your city boundaries will be in the future. The actual future loads and energy consumption will vary from these estimates for a variety of reasons, including changes in energy usage, demand levels, and weather patterns. Southern California Edison Company assumes no liability for the use of the information provided above. If you have any questions regarding this information, please contact your Southern California Edison Company Account Representative.

		2003	2004	2005	2006	2007	2008	2009	2010
PG&E	Target (GWh)	7,022	7,733	8,454	9,178	9,941	10,732	11,547	15,554
	RPS-Eligible Procurement (GWh)	8,686	8,660	8,707	9,118	9,044	9,817	11,493	13,760
	RPS GWh as % of Bundled Sales	11.5%	12.2%	12.1%	12.6%	11.8%	12.4%	14.1%	17.7%
	Cumulative Deficit/Surplus (GWh)	1,664	2,592	2,844	2,785	1,888	973	919	-876
		2003	2004	2005	2006	2007	2008	2009	2010
SCE	Target (GWh)	11,254	11,960	12,690	13,440	14,228	15,023	15,833	15,028
	RPS-Eligible Procurement (GWh)	12,421	13,182	12,822	12,486	12,261	12,574	13,622	14,548
	RPS GWh as % of Bundled Sales	16.6%	18.7%	17.6%	16.6%	15.5%	15.8%	16.8%	19.4%
	Cumulative Deficit/Surplus (GWh)	1,167	2,390	2,522	1,569	-399	-2,848	-5,058	-5,538
		2003	2004	2005	2006	2007	2008	2009	2010
SDG&E	Target (GWh)	296	447	605	765	933	1,104	1,278	3,257
	RPS-Eligible Procurement (GWh)	550	678	825	900	881	1,047	1,784	1,940
	RPS GWh as % of Bundled Sales	3.7%	4.5%	5.2%	5.6%	5.2%	6.1%	10.2%	11.9%
	Cumulative Deficit/Surplus (GWh)	254	485	706	841	788	732	1,239	-78
		2003	2004	2005	2006	2007	2008	2009	2010
TOTAL	Target (GWh)	18,572	20,139	21,748	23,382	25,102	26,859	28,658	33,839
	RPS-Eligible Procurement (GWh)	21,657	22,520	22,354	22,504	22,185	23,438	26,900	30,249
	RPS GWh as % of Bundled Sales	13.8%	14.0%	13.7%	13.1%	12.6%	13.0%	15.4%	17.9%
	Cumulative Deficit/Surplus (GWh)	3,085	5,466	6,072	5,194	2,277	-1,143	-2,901	-6,492

15.4%

From: Matthew.Evans@sce.com [mailto:Matthew.Evans@sce.com]
Sent: Tuesday, March 19, 2013 2:04 PM
To: Akshay Newgi
Cc: Nicole Vermilion; Jennifer.Cusack@sce.com
Subject: Re: Data request for Town of Yucca Valley

Hi Akshay,

In response to your questions, SCE's most recently reported **renewable portfolio percentage is 20.6% for 2012**. For future reference, the most current information can also be found at the CPUC's Renewables Portfolio Standard (RPS) webpage.

Also, SCE will not quote a specific GHG emissions value based upon SCE's generation mix due to its wide variability in time (i.e. month-to-month or even hour-to-hour variability). Therefore, please use the WECC regional value of **1.01 lbs of CO2/kWh.** This is based upon the publically available information found in the Western Climate Initiative's 2008 Final Default Emissions Factor Calculator but with a transmission loss factor of 8% applied.

Please contact me if you have any further questions. Thank you.

Matt Evans, PhD | Manager, Special Projects & Integration
Strategic Planning & Technical Services | CEES
Southern California Edison
p: 626.302.0772 [pax 20772]
c: 626.800.8984

1515 Walnut Grove Avenue, 3C11-04
Rosemead, CA 91770

2008 Default Emission Factor Pivot Table

Default Factor (metric tons CO2/MWh)	0.46039
Transmission Loss Factor	8%
Capacity Factor Threshold for Marginal Plants	60%

NERC Region	WECC
Marginal	Y
Capped Jurisdiction	N

		Primary Fuel			
State or Province	Data	DFO	NG	SUB	Grand Total
AB	Sum of Metric Tons CO2		1,184,359	1,039,187	2,223,546
	Sum of Net Generation, MWh		3,543,530	719,541	4,263,070
	Sum of Emission Factor		0.334	1.444	0.522
AZ	Sum of Metric Tons CO2	1,129	12,250,641		12,251,770
	Sum of Net Generation, MWh	966	30,285,859		30,286,825
	Sum of Emission Factor	1.168	0.405		0.405
CO	Sum of Metric Tons CO2	6,771	5,090,012		5,096,783
	Sum of Net Generation, MWh	7,507	11,961,465		11,968,972
	Sum of Emission Factor	0.902	0.426		0.426
ID	Sum of Metric Tons CO2	110	639,648		639,758
	Sum of Net Generation, MWh	120	1,599,718		1,599,838
	Sum of Emission Factor	0.916	0.400		0.400
MT	Sum of Metric Tons CO2		23,881		23,881
	Sum of Net Generation, MWh		49,108		49,108
	Sum of Emission Factor		0.486		0.486
NV	Sum of Metric Tons CO2		7,810,593		7,810,593
	Sum of Net Generation, MWh		18,529,250		18,529,250
	Sum of Emission Factor		0.422		0.422
OR	Sum of Metric Tons CO2		92,327		92,327
	Sum of Net Generation, MWh		157,303		157,303
	Sum of Emission Factor		0.587		0.587
SD	Sum of Metric Tons CO2		17,514	171,626	189,140
	Sum of Net Generation, MWh		27,283	120,570	147,853
	Sum of Emission Factor		0.642	1.423	1.279
TX	Sum of Metric Tons CO2	57	1,105,192		1,105,249
	Sum of Net Generation, MWh	92	1,942,152		1,942,244
	Sum of Emission Factor	0.623	0.569		0.569
UT	Sum of Metric Tons CO2	18,193	2,965,018		2,983,211
	Sum of Net Generation, MWh	25,764	7,093,902		7,119,666
	Sum of Emission Factor	0.706	0.418		0.419
WA	Sum of Metric Tons CO2	283	2,641,860		2,642,143
	Sum of Net Generation, MWh	361	6,736,012		6,736,373
	Sum of Emission Factor	0.784	0.392		0.392
WY	Sum of Metric Tons CO2	352	42,840		43,191
	Sum of Net Generation, MWh	468	71,299		71,767
	Sum of Emission Factor	0.751	0.601		0.602
Total Sum of Metric Tons CO2		26,895	33,863,884	1,210,813	35,101,591
Total Sum of Net Generation, MWh		35,278	81,996,881	840,111	82,872,270
Total Sum of Emission Factor		0.762	0.413	1.441	0.424

Version 12

Waste Reduction Model (WARM) -- Inputs

Use this worksheet to describe the baseline and alternative MSW management scenarios that you want to compare. The blue shaded areas indicate where you need to enter information.

1. Describe the baseline generation and management for the MSW materials listed below. If the material is not generated in your community or you do not want to analyze it, leave it blank or enter 0. Make sure that the total quantity generated equals the total quantity managed.

2. Describe the alternative management scenario for the MSW materials generated in the baseline. Any decrease in generation should be entered in the Source Reduction column. Any increase in generation should be entered in the Source Reduction column as a negative value. (Make sure that the total quantity generated equals the total quantity managed.)

Material	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Generated	Tons Source Reduced	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted
Aluminum Cans		21		NA	20.7			21		NA
Aluminum Ingot		36		NA	36.4			36		NA
Steel Cans		111		NA	111.0			111		NA
Copper Wire		346		NA	346.1			346		NA
Glass		244		NA	244.3			244		NA
HDPE		68		NA	68.1			68		NA
LDPE	NA	733		NA	732.9		NA	733		NA
PET		86		NA	86.2			86		NA
LLDPE	NA	210		NA	209.6		NA	210		NA
PP	NA	-		NA	0.0		NA	-		NA
PS	NA	-		NA	0.0		NA	-		NA
PVC	NA	-		NA	0.0		NA	-		NA
PLA	NA	-			0.0		NA	-		
Corrugated Containers		70		NA	70.4			70		NA
Magazines/Third-class Mail		122		NA	122.2			122		NA
Newspaper		216		NA	215.9			216		NA
Office Paper		316		NA	315.7			316		NA
Phonebooks		10		NA	10.4			10		NA
Textbooks		-		NA	0.0			-		NA
Dimensional Lumber		2,489		NA	2489.3			2,489		NA
Medium-density Fiberboard		-		NA	0.0			-		NA
Food Scraps	NA	2,659			2658.8		NA	2,659		
Yard Trimmings	NA	1,108			1108.1		NA	1,108		
Grass	NA	653			653.2		NA	653		
Leaves	NA	-			0.0		NA	-		
Branches	NA	106			106.1		NA	106		
Mixed Paper (general)		2,297		NA	2297.3	NA		2,297		NA
Mixed Paper (primarily residential)		-		NA	0.0	NA		-		NA
Mixed Paper (primarily from offices)		-		NA	0.0	NA		-		NA
Mixed Metals		443		NA	443.3	NA		443		NA
Mixed Plastics		477		NA	477.0	NA		477		NA
Mixed Recyclables		-		NA	0.0	NA		-		NA
Mixed Organics	NA	890			889.8	NA	NA	890		
Mixed MSW	NA	824		NA	824.4	NA	NA	824		NA
Carpet		555		NA	555.0			555		NA
Personal Computers		93		NA	93.4			93		NA
Clay Bricks	NA	544	NA	NA	543.7		NA	544	NA	NA
Concrete [1]		209	NA	NA	208.7	NA		209	NA	NA
Fly Ash [2]		18	NA	NA	18.4	NA		18	NA	NA
Tires [3]		40		NA	40.3			40		NA
Asphalt Concrete		191	NA	NA	190.7			191	NA	NA
Asphalt Shingles		484		NA	484.4			484		NA
Drywall		1,217	NA	NA	1216.6			1,217	NA	NA
Fiberglass Insulation	NA	383	NA	NA	382.9		NA	383	NA	NA
Vinyl Flooring	NA	-		NA	0.0		NA	-		NA
Wood Flooring	NA	-		NA	0.0		NA	-		NA

Please enter data in short tons (1 short ton = 2,000 lbs.)

Please refer to the User's Guide if you need assistance completing this table.

[1] Recycled concrete used as aggregate in the production of new concrete

[2] Recycled fly ash is utilized to displace portland cement in concrete production.

[3] Recycling tires is defined in this analysis as using tires for crumb rubber applications and tire-derived aggregate uses in civil engineering applications

GHG Emissions Analysis -- Summary Report

Version 12

GHG Emissions Waste Management Analysis for TPC/DC&E
Prepared by: Yucca Valley
Project Period for this Analysis: 01/00/00 to 01/00/00

Note: If you wish to save these results, rename this file (e.g., WARM-MN1) and save it. Then the "Analysis Inputs" sheet of the "WARM" file will be blank when you are ready to make another model run.

GHG Emissions from Baseline Waste Management ($MTCO_2E$): 12,481

Commodity	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Total $MTCO_2E$
Aluminum Cans	-	20.7	-	NA	1
Aluminum Ingot	-	36.4	-	NA	1
Steel Cans	-	111.0	-	NA	4
Copper Wire	-	346.1	-	NA	13
Glass	-	244.3	-	NA	9
HDPE	-	68.1	-	NA	3
LDPE	NA	732.9	-	NA	28
PET	-	86.2	-	NA	3
LLDPE	NA	209.6	-	NA	8
Corrugated Containers	-	70.4	-	NA	105
Magazines/third-class mail	-	122.2	-	NA	17
Newspaper	-	215.9	-	NA	(104)
Office Paper	-	315.7	-	NA	1,172
Phonebooks	-	10.4	-	NA	(5)
Dimensional Lumber	-	2,489.3	-	NA	184
Food Scraps	NA	2,658.8	-	-	3,793
Yard Trimmings	NA	1,108.1	-	-	223
Grass	NA	653.2	-	-	336
Branches	NA	106.1	-	-	8
Mixed Paper (general)	-	2,297.3	-	NA	3,105
Mixed Metals	-	443.3	-	NA	17
Mixed Plastics	-	477.0	-	NA	19
Mixed Organics	NA	889.8	-	-	735
Mixed MSW	NA	824.4	-	NA	2,552
Carpet	-	555.0	-	NA	22
Personal Computers	-	93.4	-	NA	4
Clay Bricks	NA	543.7	NA	NA	21
Concrete	-	208.7	NA	NA	8
Fly Ash	-	18.4	NA	NA	1
Tires	-	40.3	-	NA	2
Asphalt Concrete	-	190.7	NA	NA	7
Asphalt Shingles	-	484.4	-	NA	19
Drywall	-	1,216.6	NA	NA	154
Fiberglass Insulation	NA	382.9	NA	NA	15
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0

GHG Emissions from Alternative Waste Management Scenario ($MTCO_2E$): 12,481

Commodity	Tons Source Reduced	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Total $MTCO_2E$	Change (Alt - Base) $MTCO_2E$
Aluminum Cans	-	-	20.7	-	NA	1	0
Aluminum Ingot	-	-	36.4	-	NA	1	0
Steel Cans	-	-	111.0	-	NA	4	0
Copper Wire	-	-	346.1	-	NA	13	0
Glass	-	-	244.3	-	NA	9	0
HDPE	-	-	68.1	-	NA	3	0
LDPE	-	NA	732.9	-	NA	28	0
PET	-	-	86.2	-	NA	3	0
LLDPE	-	NA	209.6	-	NA	8	0
Corrugated Containers	-	-	70.4	-	NA	105	0
Magazines/third-class mail	-	-	122.2	-	NA	17	0
Newspaper	-	-	215.9	-	NA	(104)	0
Office Paper	-	-	315.7	-	NA	1,172	0
Phonebooks	-	-	10.4	-	NA	(5)	0
Dimensional Lumber	-	-	2,489.3	-	NA	184	0
Food Scraps	-	NA	2,658.8	-	-	3,793	0
Yard Trimmings	-	NA	1,108.1	-	-	223	0
Grass	-	NA	653.2	-	-	336	0
Branches	-	NA	106.1	-	-	8	0
Mixed Paper (general)	NA	-	2,297.3	-	NA	3,105	0
Mixed Metals	NA	-	443.3	-	NA	17	0
Mixed Plastics	NA	-	477.0	-	NA	19	0
Mixed Organics	NA	NA	889.8	-	-	735	0
Mixed MSW	NA	NA	824.4	-	NA	2,552	0
Carpet	-	-	555.0	-	NA	22	0
Personal Computers	-	-	93.4	-	NA	4	0
Clay Bricks	-	NA	543.7	NA	NA	21	0
Concrete	NA	-	208.7	NA	NA	8	0
Fly Ash	NA	-	18.4	NA	NA	1	0
Tires	-	-	40.3	-	NA	2	0
Asphalt Concrete	-	-	190.7	NA	NA	7	0
Asphalt Shingles	-	-	484.4	-	NA	19	0
Drywall	-	-	1,216.6	NA	NA	154	0
Fiberglass Insulation	-	NA	382.9	NA	NA	15	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0

Total Change in GHG Emissions ($MTCO_2E$): -

Note: a negative value (i.e., a value in parentheses) indicates an emission reduction; a positive value indicates an emission increase.

This is equivalent to…		
Removing annual emissions from	-	Passenger Vehicles
Conserving	-	Gallons of Gasoline
Conserving	-	Cylinders of Propane Used for Home Barbeques
Conserving	-	Railway Cars of Coal
	0.00000%	Annual CO_2 emissions from the U.S. transportation sector
	0.00000%	Annual CO_2 emissions from the U.S. electricity sector

a) For explanation of methodology, see the EPA report:
Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks (EPA530-R-06-004)
-- available on the Internet at http://epa.gov/climatechange/wycd/waste/downloads/fullreport.pdf (5.6 Mb PDF file).

b) Emissions estimates provided by this model are intended to support voluntary GHG measurement and reporting initiatives.

c) The GHG emissions results estimated in WARM indicate the full life-cycle benefits waste management alternatives. Due to the timing of the GHG emissions from the waste management pathways, (e.g., avoided landfilling and increased recycling), the actual GHG implications may accrue over the long-term. Therefore, one should not interpret the GHG emissions implications as occurring all in one year, but rather through time.

Waste Reduction Model (WARM) -- Results

Total GHG Emissions from Baseline MSW Generation and Management ($MTCO_2E$):	12,481
Total GHG Emissions from Alternative MSW Generation and Management ($MTCO_2E$):	12,481
Incremental GHG Emissions ($MTCO_2E$):	-

$MTCO_2E$ = metric tons of carbon dioxide equivalent

Per Ton Estimates of GHG Emissions for Alternative Management Scenarios

Material	GHG Emissions per Ton of Material Source Reduced ($MTCO_2E$)	GHG Emissions per Ton of Material Recycled ($MTCO_2E$)	GHG Emissions per Ton of Material Landfilled ($MTCO_2E$)	GHG Emissions per Ton of Material Combusted ($MTCO_2E$)	GHG Emissions per Ton of Material Composted ($MTCO_2E$)
Aluminum Cans	(4.94)	(8.89)	0.04	0.05	NA
Aluminum Ingot	(7.27)	(6.97)	0.04	0.05	NA
Steel Cans	(3.18)	(1.80)	0.04	(1.55)	NA
Copper Wire	(7.26)	(4.89)	0.04	0.04	NA
Glass	(0.53)	(0.28)	0.04	0.04	NA
HDPE	(1.47)	(0.86)	0.04	1.69	NA
LDPE	(1.79)	NA	0.04	1.70	NA
PET	(2.22)	(1.11)	0.04	1.47	NA
LLDPE	(1.57)	NA	0.04	1.70	NA
PP	(1.55)	NA	0.04	1.70	NA
PS	(2.50)	NA	0.04	2.02	NA
PVC	(1.98)	NA	0.04	0.84	NA
PLA	(2.18)	NA	(1.62)	(0.44)	(0.20)
Corrugated Containers	(5.59)	(3.11)	1.49	(0.33)	NA
Magazines/third-class mail	(8.64)	(3.07)	0.14	(0.23)	NA
Newspaper	(4.85)	(2.78)	(0.48)	(0.38)	NA
Office Paper	(7.99)	(2.85)	3.71	(0.32)	NA
Phonebooks	(6.27)	(2.65)	(0.48)	(0.38)	NA
Textbooks	(9.11)	(3.11)	3.71	(0.32)	NA
Dimensional Lumber	(2.02)	(2.46)	0.07	(0.40)	NA
Medium-density Fiberboard	(2.22)	(2.47)	0.07	(0.40)	NA
Food Scraps	0.00	NA	1.43	(0.07)	(0.20)
Yard Trimmings	0.00	NA	0.20	(0.09)	(0.20)
Grass	0.00	NA	0.51	(0.09)	(0.20)
Leaves	0.00	NA	(0.30)	(0.09)	(0.20)
Branches	0.00	NA	0.07	(0.09)	(0.20)
Mixed Paper (general)	NA	(3.52)	1.35	(0.34)	NA
Mixed Paper (primarily residential)	NA	(3.52)	1.21	(0.33)	NA
Mixed Paper (primarily from offices)	NA	(3.59)	1.43	(0.30)	NA
Mixed Metals	NA	(3.97)	0.04	(1.06)	NA
Mixed Plastics	NA	(0.98)	0.04	1.58	NA
Mixed Recyclables	NA	(2.80)	1.02	(0.29)	NA
Mixed Organics	NA	NA	0.83	(0.08)	(0.20)
Mixed MSW	NA	NA	3.10	0.07	NA
Carpet	(3.96)	(2.37)	0.04	1.26	NA
Personal Computers	(54.15)	(2.35)	0.04	(0.13)	NA
Clay Bricks	(0.28)	NA	0.04	NA	NA
Concrete	NA	(0.01)	0.04	NA	NA
Fly Ash	NA	(0.87)	0.04	NA	NA
Tires	(4.32)	(0.39)	0.04	0.51	NA
Asphalt Concrete	(0.11)	(0.08)	0.04	NA	NA
Asphalt Shingles	(0.20)	(0.09)	0.04	(0.34)	NA
Drywall	(0.22)	0.03	0.13	NA	NA
Fiberglass Insulation	(0.39)	NA	0.04	NA	NA
Vinyl Flooring	(0.62)	NA	0.04	(0.14)	NA
Wood Flooring	(4.06)	NA	0.07	(0.53)	NA

GHG Emissions from Baseline Management of Municipal Solid Wastes

Material	Baseline Generation of Material (Tons)	Estimated Recycling (Tons)	Annual GHG Emissions from Recycling ($MTCO_2E$)	Estimated Landfilling (Tons)	Annual GHG Emissions from Landfilling ($MTCO_2E$)	Estimated Combustion (Tons)	Annual GHG Emissions from Combustion ($MTCO_2E$)	Estimated Composting (Tons)	Annual GHG Emissions from Composting ($MTCO_2E$)	Total Annual GHG Emissions ($MTCO_2E$)
Aluminum Cans	20.7	0.0	0.0	20.7	0.8	0.0	0.0	NA	NA	0.8
Aluminum Ingot	36.4	0.0	0.0	36.4	1.4	0.0	0.0	NA	NA	1.4
Steel Cans	111.0	0.0	0.0	111.0	4.3	0.0	0.0	NA	NA	4.3
Copper Wire	346.1	0.0	0.0	346.1	13.4	0.0	0.0	NA	NA	13.4
Glass	244.3	0.0	0.0	244.3	9.5	0.0	0.0	NA	NA	9.5
HDPE	68.1	0.0	0.0	68.1	2.6	0.0	0.0	NA	NA	2.6
LDPE	732.9	NA	NA	732.9	28.4	0.0	0.0	NA	NA	28.4
PET	86.2	0.0	0.0	86.2	3.3	0.0	0.0	NA	NA	3.3
LLDPE	209.6	NA	NA	209.6	8.1	0.0	0.0	NA	NA	8.1
PP	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
PS	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
PVC	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
PLA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corrugated Containers	70.4	0.0	0.0	70.4	104.6	0.0	0.0	NA	NA	104.6
Magazines/third-class mail	122.2	0.0	0.0	122.2	16.9	0.0	0.0	NA	NA	16.9
Newspaper	215.9	0.0	0.0	215.9	(103.9)	0.0	0.0	NA	NA	(103.9)
Office Paper	315.7	0.0	0.0	315.7	1,172.5	0.0	0.0	NA	NA	1,172.5
Phonebooks	10.4	0.0	0.0	10.4	(5.0)	0.0	0.0	NA	NA	(5.0)
Textbooks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Dimensional Lumber	2,489.3	0.0	0.0	2,489.3	184.2	0.0	0.0	NA	NA	184.2
Medium-density Fiberboard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Food Scraps	2,658.8	NA	NA	2,658.8	3,792.6	0.0	0.0	0.0	0.0	3,792.6
Yard Trimmings	1,108.1	NA	NA	1,108.1	223.4	0.0	0.0	0.0	0.0	223.4
Grass	653.2	NA	NA	653.2	336.3	0.0	0.0	0.0	0.0	336.3
Leaves	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Branches	106.1	NA	NA	106.1	7.9	0.0	0.0	0.0	0.0	7.9
Mixed Paper (general)	2,297.3	0.0	0.0	2,297.3	3,105.2	0.0	0.0	NA	NA	3,105.2
Mixed Paper (primarily residential)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Mixed Paper (primarily from offices)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Mixed Metals	443.3	0.0	0.0	443.3	17.2	0.0	0.0	NA	NA	17.2
Mixed Plastics	477.0	0.0	0.0	477.0	18.5	0.0	0.0	NA	NA	18.5
Mixed Recyclables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Mixed Organics	889.8	NA	NA	889.8	735.2	0.0	0.0	0.0	0.0	735.2
Mixed MSW	824.4	NA	NA	824.4	2,552.1	0.0	0.0	NA	NA	2,552.1
Carpet	555.0	0.0	0.0	555.0	21.5	0.0	0.0	NA	NA	21.5
Personal Computers	93.4	0.0	0.0	93.4	3.6	0.0	0.0	NA	NA	3.6
Clay Bricks	543.7	NA	NA	543.7	21.1	NA	NA	NA	NA	21.1
Concrete	208.7	0.0	0.0	208.7	8.1	NA	NA	NA	NA	8.1
Fly Ash	18.4	0.0	0.0	18.4	0.7	NA	NA	NA	NA	0.7
Tires	40.3	0.0	0.0	40.3	1.6	0.0	0.0	NA	NA	1.6
Asphalt Concrete	190.7	0.0	0.0	190.7	7.4	NA	NA	NA	NA	7.4
Asphalt Shingles	484.4	0.0	0.0	484.4	18.8	0.0	0.0	NA	NA	18.8
Drywall	1,216.6	0.0	0.0	1,216.6	154.0	NA	NA	NA	NA	154.0
Fiberglass Insulation	382.9	NA	NA	382.9	14.9	NA	NA	NA	NA	14.9
Vinyl Flooring	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
Wood Flooring	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
Total	18,271.4	0.0	0.0	18,271.4	12,481.3	0.0	0.0	0.0	0.0	12,481.3

GHG Emissions from Projected Alternative Management of Municipal Solid Wastes

Material	Baseline Generation of Material (Tons)	Projected Source Reduction (Tons)	Annual GHG Emissions from Source Reduction ($MTCO_2E$)	Projected Recycling (Tons)	Annual GHG Emissions from Recycling ($MTCO_2E$)	Projected Landfilling (Tons)	Annual GHG Emissions from Landfilling ($MTCO_2E$)	Projected Combustion (Tons)	Annual GHG Emissions from Combustion ($MTCO_2E$)	Projected Composting (Tons)	Annual GHG Emissions from Composting ($MTCO_2E$)	Total Annual GHG Emissions ($MTCO_2E$)
Aluminum Cans	20.7	0.0	0.0	0.0	0.0	20.7	0.8	0.0	0.0	NA	NA	0.8
Aluminum Ingot	36.4	0.0	0.0	0.0	0.0	36.4	1.4	0.0	0.0	NA	NA	1.4
Steel Cans	111.0	0.0	0.0	0.0	0.0	111.0	4.3	0.0	0.0	NA	NA	4.3
Copper Wire	346.1	0.0	0.0	0.0	0.0	346.1	13.4	0.0	0.0	NA	NA	13.4
Glass	244.3	0.0	0.0	0.0	0.0	244.3	9.5	0.0	0.0	NA	NA	9.5
HDPE	68.1	0.0	0.0	0.0	0.0	68.1	2.6	0.0	0.0	NA	NA	2.6
LDPE	732.9	0.0	0.0	NA	NA	732.9	28.4	0.0	0.0	NA	NA	28.4
PET	86.2	0.0	0.0	0.0	0.0	86.2	3.3	0.0	0.0	NA	NA	3.3
LLDPE	209.6	0.0	0.0	NA	NA	209.6	8.1	0.0	0.0	NA	NA	8.1
PP	0.0	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
PS	0.0	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
PVC	0.0	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
PLA	0.0	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corrugated Containers	70.4	0.0	0.0	0.0	0.0	70.4	104.6	0.0	0.0	NA	NA	104.6
Magazines/third-class mail	122.2	0.0	0.0	0.0	0.0	122.2	16.9	0.0	0.0	NA	NA	16.9
Newspaper	215.9	0.0	0.0	0.0	0.0	215.9	(103.9)	0.0	0.0	NA	NA	(103.9)
Office Paper	315.7	0.0	0.0	0.0	0.0	315.7	1,172.5	0.0	0.0	NA	NA	1,172.5
Phonebooks	10.4	0.0	0.0	0.0	0.0	10.4	(5.0)	0.0	0.0	NA	NA	(5.0)
Textbooks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Dimensional Lumber	2,489.3	0.0	0.0	0.0	0.0	2,489.3	184.2	0.0	0.0	NA	NA	184.2
Medium-density Fiberboard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Food Scraps	2,658.8	0.0	0.0	NA	NA	2,658.8	3,792.6	0.0	0.0	0.0	0.0	3,792.6
Yard Trimmings	1,108.1	0.0	0.0	NA	NA	1,108.1	223.4	0.0	0.0	0.0	0.0	223.4
Grass	653.2	0.0	0.0	NA	NA	653.2	336.3	0.0	0.0	0.0	0.0	336.3
Leaves	0.0	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Branches	106.1	0.0	0.0	NA	NA	106.1	7.9	0.0	0.0	0.0	0.0	7.9
Mixed Paper (general)	2,297.3	NA	NA	0.0	0.0	2,297.3	3,105.2	0.0	0.0	NA	NA	3,105.2
Mixed Paper (primarily residential)	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Mixed Paper (primarily from offices)	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Mixed Metals	443.3	NA	NA	0.0	0.0	443.3	17.2	0.0	0.0	NA	NA	17.2
Mixed Plastics	477.0	NA	NA	0.0	0.0	477.0	18.5	0.0	0.0	NA	NA	18.5
Mixed Recyclables	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Mixed Organics	889.8	NA	NA	NA	NA	889.8	735.2	0.0	0.0	0.0	0.0	735.2
Mixed MSW	824.4	NA	NA	NA	NA	824.4	2,552.1	0.0	0.0	NA	NA	2,552.1
Carpet	555.0	0.0	0.0	0.0	0.0	555.0	21.5	0.0	0.0	NA	NA	21.5
Personal Computers	93.4	0.0	0.0	0.0	0.0	93.4	3.6	0.0	0.0	NA	NA	3.6
Clay Bricks	543.7	0.0	0.0	NA	NA	543.7	21.1	NA	NA	NA	NA	21.1
Concrete	208.7	NA	NA	0.0	0.0	208.7	8.1	NA	NA	NA	NA	8.1
Fly Ash	18.4	NA	NA	0.0	0.0	18.4	0.7	NA	NA	NA	NA	0.7
Tires	40.3	0.0	0.0	0.0	0.0	40.3	1.6	0.0	0.0	NA	NA	1.6
Asphalt Concrete	190.7	0.0	0.0	0.0	0.0	190.7	7.4	NA	NA	NA	NA	7.4
Asphalt Shingles	484.4	0.0	0.0	0.0	0.0	484.4	18.8	0.0	0.0	NA	NA	18.8
Drywall	1,216.6	0.0	0.0	0.0	0.0	1,216.6	154.0	NA	NA	NA	NA	154.0
Fiberglass Insulation	382.9	0.0	0.0	NA	NA	382.9	14.9	NA	NA	NA	NA	14.9
Vinyl Flooring	0.0	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
Wood Flooring	0.0	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
Total	18,271.4	0.0	0.0	0.0	0.0	18,271.4	12,481.3	0.0	0.0	0.0	0.0	12,481.3

Incremental GHG Emissions from Projected Alternative Management of Municipal Solid Wastes

Material	Source Reduction (Tons)	Incremental GHG Emissions from Source Reduction ($MTCO_2E$)	Incremental Recycling (Tons)	Incremental GHG Emissions from Recycling ($MTCO_2E$)	Incremental Landfilling (Tons)	Incremental GHG Emissions from Landfilling ($MTCO_2E$)	Incremental Combustion (Tons)	Incremental GHG Emissions from Combustion ($MTCO_2E$)	Incremental Composting (Tons)	Incremental GHG Emissions from Composting ($MTCO_2E$)	Total Incremental GHG Emissions ($MTCO_2E$)
Aluminum Cans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Aluminum Ingot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Steel Cans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Copper Wire	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Glass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
HDPE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
LDPE	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
PET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
LLDPE	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
PP	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
PS	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
PVC	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
PLA	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corrugated Containers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Magazines/third-class mail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Newspaper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Office Paper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Phonebooks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Textbooks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Dimensional Lumber	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Medium-density Fiberboard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Food Scraps	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yard Trimmings	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grass	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leaves	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Branches	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mixed Paper (general)	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Mixed Paper (primarily residential)	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Mixed Paper (primarily from offices)	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Mixed Metals	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Mixed Plastics	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Mixed Recyclables	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Mixed Organics	NA	NA	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mixed MSW	NA	NA	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
Carpet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Personal Computers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Clay Bricks	0.0	0.0	NA	NA	0.0	0.0	NA	NA	NA	NA	0.0
Concrete	NA	NA	0.0	0.0	0.0	0.0	NA	NA	NA	NA	0.0
Fly Ash	NA	NA	0.0	0.0	0.0	0.0	NA	NA	NA	NA	0.0
Tires	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Asphalt Concrete	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA	0.0
Asphalt Shingles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0
Drywall	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA	0.0
Fiberglass Insulation	0.0	0.0	NA	NA	0.0	0.0	NA	NA	NA	NA	0.0
Vinyl Flooring	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
Wood Flooring	0.0	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

a) For explanation of methodology, see the EPA report:
Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks (EPA530-R-06-004)
-- available on the Internet at http://epa.gov/climatechange/wycd/waste/downloads/fullreport.pdf (5.6 Mb PDF file).

b) Emissions estimates provided by this model are intended to support voluntary GHG measurement and reporting initiatives.

CalRecycle. 2008 Waste Characterization Study

Material Classes in California's Overall Disposed Waste Stream (Detailed)

	Categories in WARM	Tons	Percent	Percent by Category
Paper				17.3%
Uncoated Corrugated Cardboard	Mixed Paper (general)	1,905,897	4.8%	
Paper Bags	Mixed Paper (general)	155,848	0.4%	
Newspaper	Newspaper	499,960	1.3%	
White Ledger Paper	Office Paper	259,151	0.7%	
Other Office Paper	Office Paper	472,147	1.2%	
Maganizes and Catalogs	Magazines/Third-class Mail	283,069	0.7%	
Phone Books and Directories	Phonebooks	24,149	0.1%	
Other Miscellaneous Paper	Mixed Paper (general)	1,202,354	3.0%	
Remainder/Composite Paper	Mixed Paper (general)	2,056,546	5.2%	
Glass				1.4%
Clear Glass Bottles and Containers	Glass	196,093	0.5%	
Green Glass Bottles and Containers	Glass	79,491	0.2%	
Brown Glass Bottles and Containers	Glass	108,953	0.3%	
Other Colored Glass Bottles and Containers	Glass	40,570	0.1%	
Flat Glas	Glass	33,899	0.1%	
Remainder/Composite Glass	Glass	106,838	0.3%	
Metal				4.6%
Tin/Steel Cans	Steel Cans	236,405	0.6%	
Major Appliances	Steel Cans	17,120	0.0%	
Used Oil Filters	Steel Cans	3,610	0.0%	
Other Ferrous	Copper Wire	801,704	2.0%	
Aluminum Cans	Aluminum Cans	47,829	0.1%	
Other Non-Ferrous	Aluminum Ingot	84,268	0.2%	
Remainder/Composite Metal	Mixed Metals	618,747	1.6%	
Electronics				0.5%
Brown Goods	Personal Computers	76,725	0.2%	
Computer-Related Electronnics	Personal Computers	32,932	0.1%	
Other Small Consumer Electronics	Personal Computers	34,588	0.1%	
Video Display Devices	Personal Computers	72,053	0.2%	
Plastic				9.6%
PETE Containers	PET	199,644	0.5%	
HDPE Containers	HDPE	157,779	0.4%	
Miscellaneous Plastic Containers	Corrugated Containers	163,008	0.4%	
Plastic Trash Bags	LLDPE	361,997	0.9%	
Plastic Grocery and Other Merchandise Bags	LLDPE	123,405	0.3%	
Non-Bag Commercial and Industrial Packaging Film	LDPE	194,863	0.5%	
Film Products	LDPE	113,566	0.3%	
Other Film	LDPE	554,002	1.4%	
Durable Plastic Items	LDPE	834,970	2.1%	
Remainder/Composite Plastic	Mixed Plastics	1,104,719	2.8%	
Other Organic				32.4%
Food	Food Scraps	6,158,120	15.5%	
Leaves and Grass	Grass (assume leaves too)	1,512,832	3.8%	
Prunings and Trimmings	Yard Trimmings	1,058,854	2.7%	
Branches and Stumps	Branches	245,830	0.6%	
Manures	Mixed Organics	20,373	0.1%	
Textiles	Fiberglass Insulation	886,814	2.2%	
Carpet	Carpet	1,285,473	3.2%	
Remainder/Composite Organic	Mixed Organics	1,719,743	4.3%	

Inerts and Other				29.1%
Concrete	Concrete	483,367	1.2%	
Asphalt Paving	Asphalt Concrete	129,834	0.3%	
Asphalt Roofing	Asphalt Shingles	1,121,945	2.8%	
Lumber	Dimensional Lumber	5,765,482	14.5%	
Gypsum Board	Drywall	642,511	1.6%	
Rock, Soil and Fines	Clay Bricks	1,259,308	3.2%	
Remainder/Composite Inerts and Other	Drywall	2,175,322	5.5%	
Household Hazardous Wastes				0.3%
Paint	Mixed MSW	48,025	0.1%	
Vehicle and Equipment Fuels	Mixed MSW	6,424	0.0%	
Used Oil	Mixed MSW	3,348	0.0%	
Batteries	Mixed MSW	19,082	0.0%	
Remainder/Composite Household Hazardous Wast	Mixed MSW	43,873	0.1%	
Special Waste				3.9%
Ash	Fly Ash	40,736	0.1%	
Treated Medical Waste	Mixed MSW	0	0.0%	
Bulky Itmes	Mixed MSW	1,393,091	3.5%	
Tires	Tires	60,180	0.2%	
Remainder/Composite Special Waste	Mixed MSW	52,463	0.1%	
Mixed Residue				0.8%
Mixed Residue	Mixed MSW	330,891	0.8%	
TOTAL		**39,722,820**	**100.0%**	

CalRecycle. Statewide Alternative Daily Cover (ADC) by Material Type

http://www.calrecycle.ca.gov/LGCentral/Reports/ReportViewer.aspx?ReportName=ReportEdrsAnnualQuarterADC

Total of ADC by Material Type

Year	Ash	Auto Shred	C&D	Compost	Contaminated Sediment	Green Material	Mixed	Other	Sludge	Tires	Total
2006	2,255	683,064	383,619	0	77	2,656,850	28,145	126,052	298,998	40,931	4,219,992
2007	1,566	632,495	358,784	3,379	40,960	2,307,255	12,588	172,311	326,680	66,042	3,922,060
2008	5,282	622,055	746,300	679	63,232	2,195,876	17,894	256,033	235,743	49,638	4,192,731

Percent of ADC by Material Type

	Ash	Auto Shred	C&D	Compost	Contaminated Sediment	Green Material	Mixed	Other	Sludge	Tires	Total
2006	0.05%	16.19%	9.09%	0.00%	0.00%	62.96%	0.67%	2.99%	7.09%	0.97%	100.00%
2007	0.04%	16.13%	9.15%	0.09%	1.04%	58.83%	0.32%	4.39%	8.33%	1.68%	100.00%
2008	0.13%	14.84%	17.80%	0.02%	1.51%	52.37%	0.43%	6.11%	5.62%	1.18%	100.00%
Average	0.07%	15.72%	12.01%	0.03%	0.85%	58.05%	0.47%	4.50%	7.01%	1.28%	100.00%

WARM OUTPUTs

CalRecycle Disposal By Facility - Town of Yucca Valley (Disposal Reporting System)

	Interstate Tons + Transform Tons	ADC+AIC	**TOTAL**
2011	17,513	1,012	18,525
2010	16,471	852	17,323
2009	17,469	1,497	18,966
Average 2011-2009	17,151	1,121	18,271

http://www.calrecycle.ca.gov/LGCentral/Reports/Viewer.aspx?P=OriginJurisdictionIDs%3d595%26ReportYear%3d2009%26ReportName%3dReportEDRSJurisDisposalByFacility

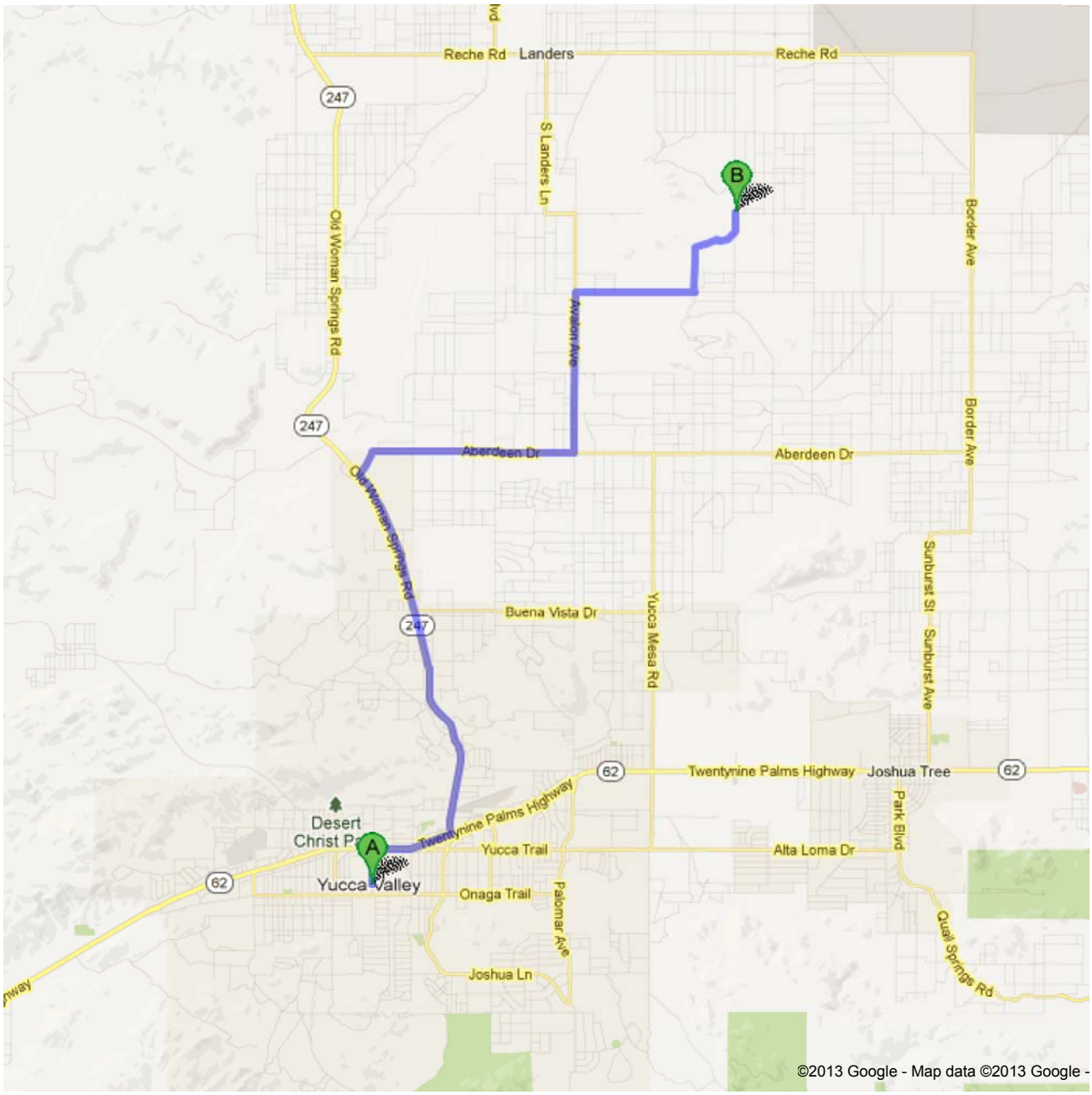
Average Baseline 2012	**TONS MSW**	**TONS ADC**	**TOTAL**	**MTons CO2e**
	17,151	1,121	18,271	12,481

Inputs For WARM	**MSW** %	**TONS MSW** 17,151	**ADC** %	**TONS ADC** 1,121	18,271	**TOTAL** %	**MTons CO2e With 75% Landfill Recovery** 3,120
Aluminum Cans	0.1%	21		0	21	0.1%	
Aluminum Ingot	0.2%	36		0	36	0.2%	
Steel Cans	0.6%	111		0	111	0.6%	
Copper Wire	2.0%	346		0	346	1.9%	
Glass	1.4%	244		0	244	1.3%	
HDPE	0.4%	68		0	68	0.4%	
LDPE	4.3%	733		0	733	4.0%	
PET	0.5%	86		0	86	0.5%	
LLDPE	1.2%	210		0	210	1.1%	
PP	0.0%	0		0	0	0.0%	
PS	0.0%	0		0	0	0.0%	
PVC	0.0%	0		0	0	0.0%	
PLA	0.0%	0		0	0	0.0%	
Corrugated Containers	0.4%	70		0	70	0.4%	
Magazines/Third-class Mail	0.7%	122		0	122	0.7%	
Newspaper	1.3%	216		0	216	1.2%	
Office Paper	1.8%	316		0	316	1.7%	
Phonebooks	0.1%	10		0	10	0.1%	
Textbooks	0.0%	0		0	0	0.0%	
Dimensional Lumber	14.5%	2,489		0	2,489	13.6%	
Medium-density Fiberboard	0.0%	0		0	0	0.0%	
Food Scraps	15.5%	2,659		0	2,659	14.6%	
Yard Trimmings	2.7%	457	58.1%	651	1,108	6.1%	
Grass	3.8%	653		0	653	3.6%	
Leaves	0.0%	0		0	0	0.0%	
Branches	0.6%	106		0	106	0.6%	
Mixed Paper (general)	13.4%	2,297		0	2,297	12.6%	
Mixed Paper (primarily residential)	0.0%	0		0	0	0.0%	
Mixed Paper (primarily from offices)	0.0%	0		0	0	0.0%	
Mixed Metals	1.6%	267	15.7%	176	443	2.4%	
Mixed Plastics	2.8%	477		0	477	2.6%	
Mixed Recyclables	0.0%	0		0	0	0.0%	
Mixed Organics	4.4%	751	12.4%	139	890	4.9%	
Mixed MSW	4.8%	819	0.5%	5	824	4.5%	
Carpet	3.2%	555		0	555	3.0%	
Personal Computers	0.5%	93		0	93	0.5%	
Clay Bricks	3.2%	544		0	544	3.0%	
Concrete	1.2%	209		0	209	1.1%	
Fly Ash	0.1%	18	0.1%	1	18	0.1%	
Tires	0.2%	26	1.3%	14	40	0.2%	
Asphalt Concrete	0.3%	56	12.0%	135	191	1.0%	
Asphalt Shingles	2.8%	484		0	484	2.7%	
Drywall	7.1%	1,217		0	1,217	6.7%	
Fiberglass Insulation	2.2%	383		0	383	2.1%	
Vinyl Flooring	0.0%	0		0	0	0.0%	
Wood Flooring	0.0%	0		0	0	0.0%	
	100%	17,151	100.0%	1,121	18,271	100.0%	

Dry landfill conditions

Assumes 75 percent of fugitive GHG emissions are captured within the landfill's Landfill Gas Capture System with a landfill gas capture efficiency of 75%. The Landfill gas capture efficiency is based on the California Air Resources Board's (CARB) Local Government Operations Protocol (LGOP), Version 1.1. Because the landfill gas captured is not under the jurisdiction of Town of Yucca Valley, the landfill gas emissions from the capture system are not included in Yucca Valley's inventory. Only fugitive sources of GHG emissions from landfill are included.

Directions to 59200 Winter Rd, Landers, CA 92285
14.2 mi – about **29 mins**



Yucca Valley, CA

1.	Head **north** on **Palm Ave** toward **Stardust Trail** About 1 min	go 0.4 mi total 0.4 mi
2.	Turn right onto **CA-62 E** About 2 mins	go 1.0 mi total 1.5 mi
3.	Turn left onto **Old Woman Springs Rd** About 7 mins	go 4.9 mi total 6.3 mi
4.	Turn right onto **Aberdeen Dr** About 4 mins	go 2.9 mi total 9.2 mi
5.	Turn left onto **Avalon Ave** About 3 mins	go 2.0 mi total 11.3 mi
6.	Turn right onto **Gatos Trail/Luna Vista Ln** About 6 mins	go 1.5 mi total 12.8 mi
7.	Turn left onto **Alta Ave** About 5 mins	go 1.1 mi total 13.9 mi
8.	Slight left onto **Mason Dixon Rd** About 1 min	go 0.3 mi total 14.1 mi
9.	Take the 1st right onto **Winter Rd** Destination will be on the left	go 33 ft total 14.2 mi

59200 Winter Rd, Landers, CA 92285

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Map data ©2013 Google

Directions weren't right? Please find your route on maps.google.com and click "Report a problem" at the bottom left.

Jurisdiction Disposal By Facility

With Reported Alternative Daily Cover (ADC) and Alternative Intermediate Cover (AIC)

Disposal during 2009 for Yucca Valley

Destination Facility	SWISNo	Qtr	Instate Ton	Transform Ton	Export Ton	Total ADC	Total AIC
Azusa Land Reclamation Co. Landfill	19-AA-0013		39				
		1	19				
		2	12				
		4	8				
Bakersfield Metropolitan (Bena) SLF	15-AA-0273		1				
		1					
		2					
		3					
		4					
Barstow Sanitary Landfill	36-AA-0046					1	
		1				1	
Lamb Canyon Sanitary Landfill	33-AA-0007		14				
		1	1				
		2	13				
Landers Sanitary Landfill	36-AA-0057		17,101			1,493	
		1	4,241			739	
		2	4,763			370	
		3	4,037			146	
		4	4,059			238	
Mid-Valley Sanitary Landfill	36-AA-0055						
		4					
Otay Landfill	37-AA-0010						
		1					
		2					
		3					
San Timoteo Sanitary Landfill	36-AA-0087		1				
		3	1				
Simi Valley Landfill & Recycling Center	56-AA-0007		31				
		1	4				
		2	14				
		3	6				
		4	6				
Sycamore Sanitary Landfill	37-AA-0023		278				
		1	58				
		2	92				
		3	80				
		4	48				
Victorville Sanitary Landfill	36-AA-0045		4			3	
		1					
		2	2			1	
		4	3			2	
Yearly Totals:			17,469.16.	..	..	1,497.11.	..

Jurisdiction Disposal By Facility

With Reported Alternative Daily Cover (ADC) and Alternative Intermediate Cover (AIC)

Disposal during 2010 for Yucca Valley

Destination Facility	SWISNo	Qtr	Instate Ton	Transform Ton	Export Ton	Total ADC	Total AIC
Azusa Land Reclamation Co. Landfill	19-AA-0013		19				
		1	9				
		2	5				
		3	3				
		4	2				
Bakersfield Metropolitan (Bena) SLF	15-AA-0273						
		1					
		2					
		3					
		4					
Landers Sanitary Landfill	36-AA-0057		16,026			852	
		1	3,575			399	
		2	4,541			215	
		3	3,985			140	
		4	3,926			98	
Mid-Valley Sanitary Landfill	36-AA-0055		2				
		1	2				
San Timoteo Sanitary Landfill	36-AA-0087						
		2					
		3					
Simi Valley Landfill & Recycling Center	56-AA-0007		61				
		1	7				
		2	22				
		3	13				
		4	18				
Sycamore Sanitary Landfill	37-AA-0023		361				
		1	85				
		2	94				
		3	79				
		4	103				
Victorville Sanitary Landfill	36-AA-0045		1				
		1					
		3	1				
Yearly Totals:			16,470.7.		..	852.32.	..

Jurisdiction Disposal By Facility

With Reported Alternative Daily Cover (ADC) and Alternative Intermediate Cover (AIC)

Disposal during 2011 for Yucca Valley

Destination Facility	SWISNo	Qtr	Instate Ton	Transform Ton	Export Ton	Total ADC	Total AIC
Azusa Land Reclamation Co. Landfill	19-AA-0013		14				
		1	5				
		2	1				
		3	3				
		4	6				
Barstow Sanitary Landfill	36-AA-0046		3				
		2	3				
Colton Sanitary Landfill	36-AA-0051						
		2					
Commerce Refuse-To-Energy Facility	19-AA-0506						
		4					
El Sobrante Landfill	33-AA-0217		8				
		2	6				
		4	2				
Lamb Canyon Sanitary Landfill	33-AA-0007		1				
		1	1				
Landers Sanitary Landfill	36-AA-0057		17,016			1,009	
		1	3,955			271	
		2	4,724			164	
		3	4,451			72	
		4	3,886			502	
Mid-Valley Sanitary Landfill	36-AA-0055		1			1	
		1					
		2	1			1	
Otay Landfill	37-AA-0010						
		1					
Puente Hills Landfill	19-AA-0053		3				
		4	3				
San Timoteo Sanitary Landfill	36-AA-0087		2			1	
		1					
		2	2				
Simi Valley Landfill & Recycling Center	56-AA-0007		52				
		1	12				
		2	7				
		3	22				
		4	11				
Sycamore Sanitary Landfill	37-AA-0023		410				
		1	105				
		2	93				
		3	88				
		4	125				
Victorville Sanitary Landfill	36-AA-0045		3			2	
		3	2				
		4	1			2	
Yearly Totals:			17,512.38.	.18.	..	1,012.41.	..

TOWN OF YUCCA VALLEY — TRANSPORTATION SECTOR

VMT	Town of Yucca Valley						
	Population	Employment	Service Population (SP)	Daily VMT*	Rate (VMT/ SP)	Adjusted Daily VMT	Annual VMT
2012	22,464	7,481	29,945	843,906	28.18	844,000	292,868,000
2020	23,763	7,968	31,731	836,356	26.36	836,000	290,092,000
2035	26,200	8,881	35,081	924,642	26.36	925,000	320,975,000
P-2035	64,565	34,926	99,491	2,622,318	26.36	2,622,000	909,834,000
Baseline in 2035	22,464	7,481	29,945	843,906	28.18	844,000	292,868,000
F&P 2008 Baseline	21,871	4,699	26,570	748,793	28.18		
F&P P-2035	64,543	34,927	99,470	2,621,765	26.36		

Source: 2012 and 2035 VMT is based on data provided by Fehr & Peers using the SBTAM model.

VMT is adjusted based on per capita VMT in the Traffic Study provided by Fehr and Peers (i.e., VMT/population and employment (service population)) using the SBTAM model.

Adjusted Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the Climate Change Scoping Plan Measure Documentation Supplement.

CRITERIA AIR POLLUTANTS

	lbs/day					
	ROG	NOx	CO	SOx	PM10	PM2.5
2012	561	2,427	8,211	10	193	108
2020	271	1,095	3,863	10	140	59
2035	201	729	2,761	11	152	63
P-2035	570	2,065	7,825	31	540	187
Baseline in 2035	184	665	2,519	10	139	57
	Tons/year					
	ROG	NOx	CO	SOx	PM10	PM2.5
2012	97	421	1,425	2	34	19
2020	47	190	670	2	24	10
2035	35	126	479	2	26	11
P-2035	99	358	1,358	5	94	32
Baseline in 2035	32	115	437	2	24	10

Daily emissions multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the Climate Change Scoping Plan Measure Documentation Supplement.

Source: EMFAC2011-SG + AP42 (Fugitive Dust)

GHG EMISSIONS

	MTons/year - Business as Usual (BAU)			MTons/year - Adjusted			Percent Reduction from BAU	Percent Reduction from 2012
	N_2O	CO_2	CO_2e	N_2O	CO_2	CO_2e		
2012	12	153,483	157,248	12	148,381	152,147	-3%	NA
2020	5	155,863	157,562	5	122,342	124,041	-21%	-18%
2035	4	171,224	172,355	4	124,529	125,660	-27%	-17%
P-2035	10	485,352	488,557	10	352,990	356,195	-27%	134%
Baseline in 2035	3	156,231	157,262	3	113,625	114,656	-27%	-25%

Source: EMFAC2011-SG

Note: MTons = metric tons; CO_2e = carbon dioxide-equivalent. Adjusted BAU Includes Pavley and the Low Carbon Fuel Standard (LCFS).

State and Federal Fuel Efficiency Improvements + Low Carbon Fuel Standard (LCFS)

1493 (AB 1493) Pavley I Fuel Efficiency Standards. In addition, the State of California has adopted the Low Carbon Fuel Standard (LCFS). In January 2012, the California Air Resources Board (CARB) adopted the Advanced Clean Car Program which implements the Pavley II Fuel Efficiency Standards and projects that by 2025, one in every seven new cars sold will be electric vehicles (PHEV or PEV). However, the Pavley II Advanced Clean Car Program is not included in the transportation emissions reductions and therefore reductions are conservative.

On December 29, 2011, the U.S. District Court for the Eastern District of California issued several rulings in the federal lawsuits challenging the LCFS. One of the court's rulings preliminarily enjoins the CARB from enforcing the regulation during the pendency of the litigation. In January 2012, CARB appealed the decision and on April 23, 2012, the Night Circuit Court granted CARB's motion for a stay of the injunction while it continues to consider CARB's appeal of the lower court's decision.

Fugitive Dust Worksheet

2008 Daily VMT Forecast & Estimates by Speed Bin Unpaved Roads			
	2008		
Speed Bin	Internal	Ext-Int	Total
0-5	0	0	0
5-10	0	0	0
10-15	2,949	0	2,949
15-20	0	0	0
20-25	0	0	0
25-30	0	0	0
30-35	0	0	0
35-40	0	0	0
40-45	0	0	0
45-50	0	0	0
50-55	0	0	0
55-60	0	0	0
60-65	0	0	0
Total VMT	**2,949**	**0**	**2,949**
	Road Dust lbs/day		
PM10	**24**	**0**	**24**
PM2.5	**2**	**0**	**2**

Daily VMT and Demographic Data Summary 2008	
	2008
Internal-Internal VMT	209,481
Internal-External VMT	539,311
Total VMT	748,793
Population	21,871
Households	8,952
Employment (total)	4,699

2035 Daily VMT Forecast & Estimates by Speed Bin Unpaved Roads			
	2035		
Speed Bin	Internal	Ext-Int	Total
0-5	0	0	0
5-10	439	0	439
10-15	8,850	0	8,850
15-20	7,684	0	7,684
20-25	0	0	0
25-30	0	0	0
30-35	0	0	0
35-40	0	0	0
40-45	0	0	0
45-50	0	0	0
50-55	0	0	0
55-60	0	0	0
60-65	0	0	0
Total VMT	**16,973**	**0**	**16,973**
	Road Dust lbs/day		
PM10	**182**	**0**	**182**
PM2.5	**13**	**0**	**13**

SOURCE: Fehr and Peers, February 2013.

Daily VMT and Demographic Data Summary 2035	
	2035
Internal-Internal VMT	817,603
Internal-External VMT	1,804,162
Total VMT	2,621,765
Population	64,543
Households	25,817
Employment (total)	34,927

17.1

Road Dust Equation. US EPA. AP 42, Fifth Edition, Volume I, Chapter 13: Miscellaneous Sources.

$Emissions_{dust} = \Sigma(Ef_{dust} \times VMT)$

Unpaved Roads:		lbs/mile Existing	lbs/mile Forecast		lbs/mile Existing	lbs/mile Forecast
	EF PM_{10}	0.0081	0.0107	EF $PM_{2.5}$	0.0005	0.0008

Chapter 13.2.2, November 2006

$Ef_{dust} = [[(k \times (s/12)^{\wedge 1} \times (S/30)^{\wedge 0.5}/(M/0.5)^{\wedge 0.2}] - C] \times [1-(P/365)]$

k	Particle size multiplier for particle size range and units of interest
s	Surface material silt content (%)
M	Surface material moisture content (%)
S	Mean vehicle speed (mph)
C	Emission factor for 1980's vehicle fleet exhaust, brake wear, and tire wear.
P	Number of days with at least 0.254 mm (0.1 inch) of precipitation during the averaging period,.

k for PM_{10}	1.8	lbs/VMT Public Roads from AP 42 (2006)		
k for $PM_{2.5}$	0.18	lbs/VMT Public Roads from AP 42 (2006)		
s	4.3%	San Bernardino County (MDAB), in CalEEMod		
M	0.5%	San Bernardino County (MDAB), in CalEEMod		
S unpaved	17	mph from Fehr & Peers 2035	10	mph from Fehr & Peers 2008
C PM_{10}	0.00047	lb/VMT from AP 42 (2006)		
C $PM_{2.5}$	0.00036	lb/VMT from AP 42 (2006)		
P	32	San Bernardino County (MDAB), in CalEEMod		
N	365			

grams to lbs	0.0022046
MT to lbs	2204.623

Baseline in 2035

Based on EMFAC2011

	Emission year	Daily						
	Baseline in 2035	**844,000**			**lbs/day**			
	Percent of VMT	**Adjust % VMT**	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
All Other Buses	0.01%	0.01%	0	0	0	0	0	0
LDA	41.46%	41.46%	27	74	725	3	36	15
LDT1	7.20%	7.20%	7	15	142	1	6	3
LDT2	19.61%	19.61%	20	42	390	2	17	7
LHD1	3.98%	3.98%	10	74	74	0	5	2
LHD2	0.68%	0.68%	1	16	10	0	1	1
MCY	0.81%	0.81%	51	20	434	0	1	0
MDV	17.29%	17.29%	27	46	416	2	15	6
MH	0.56%	0.56%	0	7	3	0	1	0
Motor Coach	0.01%	0.01%	0	1	0	0	0	0
OBUS	0.03%	0.03%	0	1	3	0	0	0
PTO	0.02%	0.02%	0	1	0	0	0	0
SBUS	0.04%	0.04%	0	3	1	0	1	0
T6 Ag	0.00%	0.00%	0	0	0	0	0	0
T6 CAIRP heavy	0.00%	0.00%	0	0	0	0	0	0
T6 CAIRP small	0.02%	0.02%	0	0	0	0	0	0
T6 instate construction heavy	0.03%	0.03%	0	1	0	0	0	0
T6 instate construction small	0.09%	0.09%	0	2	1	0	0	0
T6 instate heavy	0.08%	0.08%	0	2	1	0	0	0
T6 instate small	0.21%	0.21%	0	4	2	0	1	0
T6 OOS heavy	0.00%	0.00%	0	0	0	0	0	0
T6 OOS small	0.01%	0.01%	0	0	0	0	0	0
T6 public	0.01%	0.01%	0	0	0	0	0	0
T6 utility	0.00%	0.00%	0	0	0	0	0	0
T6TS	0.14%	0.14%	1	1	6	0	0	0
T7 Ag	0.01%	0.01%	0	0	0	0	0	0
T7 CAIRP	2.49%	2.49%	13	119	86	1	10	7
T7 CAIRP construction	0.03%	0.03%	0	1	1	0	0	0
T7 NNOOS	2.81%	2.81%	14	118	93	1	10	6
T7 NOOS	0.91%	0.91%	5	46	35	0	4	2
T7 other port	0.00%	0.00%	0	0	0	0	0	0
T7 POAK	0.00%	0.00%	0	0	0	0	0	0
T7 POLA	0.39%	0.39%	2	21	13	0	2	1
T7 public	0.01%	0.01%	0	0	0	0	0	0
T7 Single	0.07%	0.07%	0	2	2	0	0	0
T7 single construction	0.07%	0.07%	0	2	2	0	0	0
T7 SWCV	0.02%	0.02%	0	1	1	0	0	0
T7 tractor	0.68%	0.68%	2	26	16	0	3	2
T7 tractor construction	0.05%	0.05%	0	2	1	0	0	0
T7 utility	0.00%	0.00%	0	0	0	0	0	0
T7IS	0.05%	0.05%	0	7	46	0	0	0
UBUS	0.12%	0.12%	1	10	13	0	1	1
TOTAL	100%	100%	**184**	**665**	**2,519**	**10**	**115**	**56**

Based on the emission factors for San Bernardino County - Mojave Desert Air Basin

2035

Based on EMFAC2011

	Emission year	Daily						
	2035	**925,000**			**lbs/day**			
	Percent of VMT	**Adjust % VMT**	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
All Other Buses	0.01%	0.01%	0	0	0	0	0	0
LDA	41.46%	41.46%	30	81	795	3	40	17
LDT1	7.20%	7.20%	8	16	156	1	7	3
LDT2	19.61%	19.61%	22	46	428	2	19	8
LHD1	3.98%	3.98%	11	81	81	0	6	3
LHD2	0.68%	0.68%	1	18	11	0	1	1
MCY	0.81%	0.81%	56	22	476	0	1	0
MDV	17.29%	17.29%	30	51	456	2	17	7
MH	0.56%	0.56%	0	7	3	0	1	0
Motor Coach	0.01%	0.01%	0	1	0	0	0	0
OBUS	0.03%	0.03%	0	1	3	0	0	0
PTO	0.02%	0.02%	0	1	0	0	0	0
SBUS	0.04%	0.04%	0	4	2	0	1	0
T6 Ag	0.00%	0.00%	0	0	0	0	0	0
T6 CAIRP heavy	0.00%	0.00%	0	0	0	0	0	0
T6 CAIRP small	0.02%	0.02%	0	0	0	0	0	0
T6 instate construction heavy	0.03%	0.03%	0	1	0	0	0	0
T6 instate construction small	0.09%	0.09%	0	2	1	0	0	0
T6 instate heavy	0.08%	0.08%	0	2	1	0	0	0
T6 instate small	0.21%	0.21%	0	4	2	0	1	0
T6 OOS heavy	0.00%	0.00%	0	0	0	0	0	0
T6 OOS small	0.01%	0.01%	0	0	0	0	0	0
T6 public	0.01%	0.01%	0	0	0	0	0	0
T6 utility	0.00%	0.00%	0	0	0	0	0	0
T6TS	0.14%	0.14%	1	1	7	0	0	0
T7 Ag	0.01%	0.01%	0	0	0	0	0	0
T7 CAIRP	2.49%	2.49%	14	130	95	1	11	7
T7 CAIRP construction	0.03%	0.03%	0	1	1	0	0	0
T7 NNOOS	2.81%	2.81%	15	129	102	1	11	7
T7 NOOS	0.91%	0.91%	6	51	38	0	4	3
T7 other port	0.00%	0.00%	0	0	0	0	0	0
T7 POAK	0.00%	0.00%	0	0	0	0	0	0
T7 POLA	0.39%	0.39%	2	23	14	0	2	1
T7 public	0.01%	0.01%	0	1	0	0	0	0
T7 Single	0.07%	0.07%	0	3	2	0	0	0
T7 single construction	0.07%	0.07%	0	2	2	0	0	0
T7 SWCV	0.02%	0.02%	0	1	1	0	0	0
T7 tractor	0.68%	0.68%	2	28	18	0	3	2
T7 tractor construction	0.05%	0.05%	0	2	2	0	0	0
T7 utility	0.00%	0.00%	0	0	0	0	0	0
T7IS	0.05%	0.05%	1	8	50	0	0	0
UBUS	0.12%	0.12%	1	10	14	0	1	1
TOTAL	100%	100%	**201**	**729**	**2,761**	**11**	**126**	**61**

Based on the emission factors for San Bernardino County - Mojave Desert Air Basin

P-2035

Based on EMFAC2011

	Emission year	Daily						
	P-2035	**2,622,000**			**lbs/day**			
	Percent of VMT	**Adjust % VMT**	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
All Other Buses	0.01%	0.01%	0	1	0	0	0	0
LDA	41.46%	41.46%	85	230	2,254	8	113	47
LDT1	7.20%	7.20%	22	45	442	2	20	8
LDT2	19.61%	19.61%	62	131	1,212	5	53	22
LHD1	3.98%	3.98%	32	231	230	1	16	7
LHD2	0.68%	0.68%	3	50	31	0	4	2
MCY	0.81%	0.81%	158	62	1,349	0	2	1
MDV	17.29%	17.29%	84	143	1,293	6	47	20
MH	0.56%	0.56%	1	21	8	0	2	1
Motor Coach	0.01%	0.01%	0	2	1	0	0	0
OBUS	0.03%	0.03%	1	2	10	0	0	0
PTO	0.02%	0.02%	0	2	1	0	0	0
SBUS	0.04%	0.04%	1	11	5	0	2	1
T6 Ag	0.00%	0.00%	0	0	0	0	0	0
T6 CAIRP heavy	0.00%	0.00%	0	0	0	0	0	0
T6 CAIRP small	0.02%	0.02%	0	1	0	0	0	0
T6 instate construction heavy	0.03%	0.03%	0	2	1	0	0	0
T6 instate construction small	0.09%	0.09%	0	5	2	0	1	1
T6 instate heavy	0.08%	0.08%	0	5	2	0	1	1
T6 instate small	0.21%	0.21%	1	11	5	0	2	1
T6 OOS heavy	0.00%	0.00%	0	0	0	0	0	0
T6 OOS small	0.01%	0.01%	0	0	0	0	0	0
T6 public	0.01%	0.01%	0	1	0	0	0	0
T6 utility	0.00%	0.00%	0	0	0	0	0	0
T6TS	0.14%	0.14%	2	4	19	0	0	0
T7 Ag	0.01%	0.01%	0	1	1	0	0	0
T7 CAIRP	2.49%	2.49%	39	370	268	2	31	20
T7 CAIRP construction	0.03%	0.03%	0	4	3	0	0	0
T7 NNOOS	2.81%	2.81%	43	366	289	3	31	20
T7 NOOS	0.91%	0.91%	16	144	107	1	11	7
T7 other port	0.00%	0.00%	0	0	0	0	0	0
T7 POAK	0.00%	0.00%	0	0	0	0	0	0
T7 POLA	0.39%	0.39%	5	64	40	0	5	4
T7 public	0.01%	0.01%	0	2	1	0	0	0
T7 Single	0.07%	0.07%	1	7	6	0	1	0
T7 single construction	0.07%	0.07%	1	7	5	0	1	0
T7 SWCV	0.02%	0.02%	0	2	2	0	0	0
T7 tractor	0.68%	0.68%	7	81	51	1	8	6
T7 tractor construction	0.05%	0.05%	1	6	4	0	1	0
T7 utility	0.00%	0.00%	0	0	0	0	0	0
T7IS	0.05%	0.05%	1	23	142	0	0	0
UBUS	0.12%	0.12%	4	30	40	0	3	2
TOTAL	100%	100.0%	**570**	**2,065**	**7,825**	**31**	**358**	**174**

Based on the emission factors for San Bernardino County - Mojave Desert Air Basin

Year 2020

Based on EMFAC2011

	Emission year	Daily						
	2020	**836,000**			**lbs/day**			
	Percent of VMT	**Adjust % VMT**	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
All Other Buses	0.01%	0.01%	0	1	0	0	0	0
LDA	43.11%	43.11%	45	101	991	3	37	15
LDT1	6.82%	6.82%	19	41	344	1	6	3
LDT2	18.41%	18.41%	28	71	561	2	16	7
LHD1	4.65%	4.65%	20	192	176	1	6	3
LHD2	0.78%	0.78%	2	46	15	0	1	1
MCY	1.03%	1.03%	69	26	633	0	1	0
MDV	16.11%	16.11%	44	108	762	2	14	6
MH	0.37%	0.37%	0	9	13	0	1	0
Motor Coach	0.02%	0.02%	0	1	0	0	0	0
OBUS	0.05%	0.05%	1	3	11	0	0	0
PTO	0.02%	0.02%	0	2	0	0	0	0
SBUS	0.06%	0.06%	1	9	4	0	1	0
T6 Ag	0.00%	0.00%	0	0	0	0	0	0
T6 CAIRP heavy	0.00%	0.00%	0	0	0	0	0	0
T6 CAIRP small	0.02%	0.02%	0	0	0	0	0	0
T6 instate construction heavy	0.04%	0.04%	0	3	0	0	0	0
T6 instate construction small	0.10%	0.10%	0	3	1	0	0	0
T6 instate heavy	0.09%	0.09%	0	5	1	0	0	0
T6 instate small	0.23%	0.23%	0	6	2	0	1	1
T6 OOS heavy	0.00%	0.00%	0	0	0	0	0	0
T6 OOS small	0.01%	0.01%	0	0	0	0	0	0
T6 public	0.01%	0.01%	0	1	0	0	0	0
T6 utility	0.00%	0.00%	0	0	0	0	0	0
T6TS	0.17%	0.17%	1	4	20	0	0	0
T7 Ag	0.01%	0.01%	0	1	0	0	0	0
T7 CAIRP	2.61%	2.61%	13	144	89	1	11	7
T7 CAIRP construction	0.03%	0.03%	0	2	1	0	0	0
T7 NNOOS	2.93%	2.93%	14	125	97	1	11	7
T7 NOOS	0.95%	0.95%	5	55	35	0	4	3
T7 other port	0.00%	0.00%	0	0	0	0	0	0
T7 POAK	0.00%	0.00%	0	0	0	0	0	0
T7 POLA	0.26%	0.26%	2	35	14	0	1	1
T7 public	0.01%	0.01%	0	2	0	0	0	0
T7 Single	0.07%	0.07%	0	8	1	0	0	0
T7 single construction	0.07%	0.07%	0	8	1	0	0	0
T7 SWCV	0.02%	0.02%	0	3	0	0	0	0
T7 tractor	0.71%	0.71%	2	54	17	0	3	2
T7 tractor construction	0.05%	0.05%	0	5	1	0	0	0
T7 utility	0.00%	0.00%	0	0	0	0	0	0
T7IS	0.04%	0.04%	1	6	43	0	0	0
UBUS	0.11%	0.11%	3	15	25	0	1	1
TOTAL	100%	100%	**271**	**1,095**	**3,863**	**10**	**117**	**57**

Based on the emission factors for San Bernardino County - Mojave Desert Air Basin

Year 2012

Based on EMFAC2011

	Emission year	Daily						
	2012	**844,000**			**lbs/day**			
	Percent of VMT	**Adjust % VMT**	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
All Other Buses	0.01%	0.01%	0	2	0	0	0	0
LDA	44.99%	44.99%	158	242	2,533	3	40	17
LDT1	7.04%	7.04%	61	98	947	1	7	3
LDT2	17.87%	17.87%	77	190	1,384	2	16	7
LHD1	4.49%	4.49%	30	343	330	1	6	3
LHD2	0.78%	0.78%	3	86	31	0	2	1
MCY	0.98%	0.98%	81	26	939	0	1	0
MDV	15.99%	15.99%	76	218	1,443	2	14	6
MH	0.35%	0.35%	2	18	72	0	1	0
Motor Coach	0.01%	0.01%	0	3	1	0	0	0
OBUS	0.06%	0.06%	1	6	23	0	0	0
PTO	0.02%	0.02%	0	4	1	0	0	0
SBUS	0.06%	0.06%	2	12	14	0	1	1
T6 Ag	0.00%	0.00%	0	1	0	0	0	0
T6 CAIRP heavy	0.00%	0.00%	0	1	0	0	0	0
T6 CAIRP small	0.02%	0.02%	0	1	0	0	0	0
T6 instate construction heavy	0.03%	0.03%	0	4	1	0	0	0
T6 instate construction small	0.07%	0.07%	0	8	1	0	1	0
T6 instate heavy	0.08%	0.08%	1	13	2	0	1	1
T6 instate small	0.20%	0.20%	1	24	4	0	2	1
T6 OOS heavy	0.00%	0.00%	0	0	0	0	0	0
T6 OOS small	0.01%	0.01%	0	1	0	0	0	0
T6 public	0.01%	0.01%	0	1	0	0	0	0
T6 utility	0.00%	0.00%	0	0	0	0	0	0
T6TS	0.16%	0.16%	4	11	58	0	0	0
T7 Ag	0.01%	0.01%	0	3	1	0	0	0
T7 CAIRP	2.26%	2.26%	21	413	125	1	31	26
T7 CAIRP construction	0.02%	0.02%	0	3	1	0	0	0
T7 NNOOS	2.54%	2.54%	18	294	115	1	22	18
T7 NOOS	0.82%	0.82%	8	152	46	0	11	9
T7 other port	0.00%	0.00%	0	0	0	0	0	0
T7 POAK	0.00%	0.00%	0	0	0	0	0	0
T7 POLA	0.18%	0.18%	1	29	8	0	1	1
T7 public	0.01%	0.01%	0	2	0	0	0	0
T7 Single	0.06%	0.06%	1	17	3	0	1	1
T7 single construction	0.05%	0.05%	1	13	2	0	1	0
T7 SWCV	0.02%	0.02%	0	5	0	0	0	0
T7 tractor	0.61%	0.61%	8	147	35	0	9	8
T7 tractor construction	0.03%	0.03%	0	9	2	0	1	0
T7 utility	0.00%	0.00%	0	0	0	0	0	0
T7IS	0.03%	0.03%	2	8	57	0	0	0
UBUS	0.11%	0.11%	4	19	30	0	1	1
TOTAL	100%	100%	**561**	**2,427**	**8,211**	**10**	**169**	**106**

Based on the emission factors for San Bernardino County - Mojave Desert Air Basin

Baseline in 2035 (MTons/Year)

Based on EMFAC2011

	Emission year		GWP	GWP			
	Baseline in 2035	**292,868,000**	**310**	**1**	**MTons**		**MTons**
	Percent of VMT	**NOx**	**N2O**	**CO2**	**CO2e**	**CO2w/Pavley + LCF**	**CO2e w/ Pavley + LCFS**
All Other Buses	0.01%	0	0	44	44	40	40
LDA	41.46%	12	0	41,131	41,246	24,478	24,593
LDT1	7.20%	2	0	8,299	8,321	5,060	5,082
LDT2	19.61%	7	0	26,400	26,465	17,928	17,993
LHD1	3.98%	12	0	6,970	7,085	6,273	6,388
LHD2	0.68%	3	0	1,108	1,133	997	1,022
MCY	0.81%	3	0	421	452	379	410
MDV	17.29%	7	0	29,883	29,955	20,693	20,765
MH	0.56%	1	0	1,149	1,159	1,034	1,044
Motor Coach	0.01%	0	0	72	73	65	66
OBUS	0.03%	0	0	65	66	59	60
PTO	0.02%	0	0	106	107	96	97
SBUS	0.04%	1	0	164	169	148	153
T6 Ag	0.00%	0	0	8	8	8	8
T6 CAIRP heavy	0.00%	0	0	13	14	12	12
T6 CAIRP small	0.02%	0	0	47	47	42	42
T6 instate construction heavy	0.03%	0	0	104	105	94	95
T6 instate construction small	0.09%	0	0	290	292	261	263
T6 instate heavy	0.08%	0	0	232	234	208	211
T6 instate small	0.21%	1	0	640	646	576	582
T6 OOS heavy	0.00%	0	0	8	8	7	7
T6 OOS small	0.01%	0	0	27	27	24	24
T6 public	0.01%	0	0	25	26	23	23
T6 utility	0.00%	0	0	9	9	8	8
T6TS	0.14%	0	0	257	258	231	233
T7 Ag	0.01%	0	0	35	35	31	32
T7 CAIRP	2.49%	19	1	12,683	12,868	11,415	11,599
T7 CAIRP construction	0.03%	0	0	130	132	117	119
T7 NNOOS	2.81%	19	1	14,362	14,545	12,926	13,109
T7 NOOS	0.91%	7	0	4,701	4,772	4,231	4,302
T7 other port	0.00%	0	0	0	0	0	0
T7 POAK	0.00%	0	0	0	0	0	0
T7 POLA	0.39%	3	0	1,923	1,956	1,731	1,763
T7 public	0.01%	0	0	31	32	28	29
T7 Single	0.07%	0	0	351	355	316	320
T7 single construction	0.07%	0	0	325	329	293	296
T7 SWCV	0.02%	0	0	88	89	79	80
T7 tractor	0.68%	4	0	3,261	3,301	2,935	2,975
T7 tractor construction	0.05%	0	0	242	245	218	221
T7 utility	0.00%	0	0	10	10	9	9
T7IS	0.05%	1	0	96	107	86	98
UBUS	0.12%	1	0	520	535	468	483
TOTAL	100%	**105**	**3**	**156,231**	**157,262**	**113,625**	**114,656**

N2O emissions were calculated using an off-model adjustment provided by CARB in AB 32 Technical Appendices. The off-model adjustment uses a linear regression correlating N2O with NOx. (N2O = 0.0167 + 0.0318 x NOx)

Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the Climate Change Scoping Plan Measure Documentation Supplement.

Based on the emission factors for San Bernardino County - Mojave Desert Air Basin

2035 (MTons/Year)

Based on EMFAC2011

	Emission year		GWP	GWP			
	2035	**320,975,000**	**310**	**1**	**MTons**		**MTons**
	Percent of VMT	**NOx**	**N2O**	**CO2**	**CO2e**	**CO2w/Pavley + LCF**	**CO2e w/ Pavley + LCFS**
All Other Buses	0.01%	0	0	48	49	43	44
LDA	41.46%	13	0	45,078	45,204	26,827	26,953
LDT1	7.20%	3	0	9,095	9,120	5,545	5,570
LDT2	19.61%	7	0	28,934	29,005	19,648	19,720
LHD1	3.98%	13	0	7,639	7,765	6,875	7,001
LHD2	0.68%	3	0	1,214	1,242	1,093	1,120
MCY	0.81%	3	0	462	496	415	449
MDV	17.29%	8	0	32,751	32,830	22,679	22,757
MH	0.56%	1	0	1,259	1,270	1,133	1,145
Motor Coach	0.01%	0	0	79	80	71	72
OBUS	0.03%	0	0	71	72	64	65
PTO	0.02%	0	0	117	118	105	106
SBUS	0.04%	1	0	180	186	162	168
T6 Ag	0.00%	0	0	9	9	8	8
T6 CAIRP heavy	0.00%	0	0	15	15	13	13
T6 CAIRP small	0.02%	0	0	51	51	46	46
T6 instate construction heavy	0.03%	0	0	114	116	103	104
T6 instate construction small	0.09%	0	0	317	320	286	288
T6 instate heavy	0.08%	0	0	254	256	228	231
T6 instate small	0.21%	1	0	702	708	632	638
T6 OOS heavy	0.00%	0	0	8	9	8	8
T6 OOS small	0.01%	0	0	29	30	26	27
T6 public	0.01%	0	0	28	28	25	25
T6 utility	0.00%	0	0	10	10	9	9
T6TS	0.14%	0	0	281	283	253	255
T7 Ag	0.01%	0	0	38	39	35	35
T7 CAIRP	2.49%	21	1	13,900	14,103	12,510	12,713
T7 CAIRP construction	0.03%	0	0	142	144	128	130
T7 NNOOS	2.81%	20	1	15,740	15,941	14,166	14,367
T7 NOOS	0.91%	8	0	5,152	5,230	4,637	4,715
T7 other port	0.00%	0	0	0	0	0	0
T7 POAK	0.00%	0	0	0	0	0	0
T7 POLA	0.39%	4	0	2,108	2,143	1,897	1,932
T7 public	0.01%	0	0	34	35	31	31
T7 Single	0.07%	0	0	385	389	347	351
T7 single construction	0.07%	0	0	357	360	321	325
T7 SWCV	0.02%	0	0	96	97	87	88
T7 tractor	0.68%	4	0	3,574	3,618	3,216	3,261
T7 tractor construction	0.05%	0	0	265	269	239	242
T7 utility	0.00%	0	0	11	11	10	10
T7IS	0.05%	1	0	105	118	95	107
UBUS	0.12%	2	0	570	586	513	529
TOTAL	100%	**115**	**4**	**171,224**	**172,355**	**124,529**	**125,660**

N2O emissions were calculated using an off-model adjustment provided by CARB in AB 32 Technical Appendices. The off-model adjustment uses a linear regression correlating N2O with NOx. (N2O = 0.0167 + 0.0318 x NOx)

Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the Climate Change Scoping Plan Measure Documentation Supplement.

Based on the emission factors for San Bernardino County - Mojave Desert Air Basin

P-2035 (MTons/Year)

Based on EMFAC2011

	Emission year		GWP	GWP			
	P-2035	**909,834,000**	**310**	**1**	**MTons**		**MTons**
	Percent of VMT	**NOx**	**N2O**	**CO2**	**CO2e**	**CO2w/Pavley + LCF**	**CO2e w/ Pavley + LCFS**
All Other Buses	0.01%	0	0	137	138	123	124
LDA	41.46%	36	1	127,779	128,136	76,045	76,402
LDT1	7.20%	7	0	25,780	25,850	15,718	15,788
LDT2	19.61%	21	1	82,015	82,219	55,695	55,898
LHD1	3.98%	36	1	21,653	22,011	19,487	19,845
LHD2	0.68%	8	0	3,441	3,519	3,097	3,175
MCY	0.81%	10	0	1,308	1,405	1,177	1,274
MDV	17.29%	23	1	92,837	93,059	64,286	64,508
MH	0.56%	3	0	3,569	3,601	3,212	3,244
Motor Coach	0.01%	0	0	224	227	202	205
OBUS	0.03%	0	0	202	205	182	185
PTO	0.02%	0	0	330	334	297	301
SBUS	0.04%	2	0	510	526	459	475
Source: 2010 and 2035 VMT is ba	0.00%	0	0	26	26	23	24
VMT (forecasted) is approximated	0.00%	0	0	42	42	38	38
Adjusted Daily vehicles miles trav	0.02%	0	0	145	146	130	131
T6 instate construction heavy	0.03%	0	0	324	327	292	295
T6 instate construction small	0.09%	1	0	900	907	810	817
T6 instate heavy	0.08%	1	0	720	727	648	655
T6 instate small	0.21%	2	0	1,990	2,007	1,791	1,808
T6 OOS heavy	0.00%	0	0	24	24	22	22
T6 OOS small	0.01%	0	0	83	84	75	75
T6 public	0.01%	0	0	79	80	71	72
T6 utility	0.00%	0	0	27	27	24	25
T6TS	0.14%	1	0	797	803	717	723
T7 Ag	0.01%	0	0	109	110	98	99
T7 CAIRP	2.49%	58	2	39,401	39,975	35,461	36,035
T7 CAIRP construction	0.03%	1	0	403	409	363	369
T7 NNOOS	2.81%	58	2	44,617	45,186	40,156	40,724
T7 NOOS	0.91%	23	1	14,604	14,826	13,143	13,366
T7 other port	0.00%	0	0	0	0	0	0
T7 POAK	0.00%	0	0	0	0	0	0
T7 POLA	0.39%	10	0	5,976	6,075	5,378	5,478
T7 public	0.01%	0	0	97	99	87	89
T7 Single	0.07%	1	0	1,092	1,103	983	994
T7 single construction	0.07%	1	0	1,011	1,021	910	920
T7 SWCV	0.02%	0	0	273	276	246	249
T7 tractor	0.68%	13	0	10,130	10,256	9,117	9,243
T7 tractor construction	0.05%	1	0	752	762	677	687
T7 utility	0.00%	0	0	30	31	27	28
T7IS	0.05%	4	0	298	334	269	304
UBUS	0.12%	5	0	1,617	1,662	1,455	1,501
TOTAL	100%	**325**	**10**	**485,352**	**488,557**	**352,990**	**356,195**

N2O emissions were calculated using an off-model adjustment provided by CARB in AB 32 Technical Appendices. The off-model adjustment uses a linear regression correlating N2O with NOx. (N2O = 0.0167 + 0.0318 x NOx)

Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the Climate Change Scoping Plan Measure Documentation Supplement.

Based on the emission factors for San Bernardino County - Mojave Desert Air Basin

Year 2020 (MTons/Year)

Based on EMFAC2011

	Emission year		GWP	GWP			
	2020	**290,092,000**	**310**	**1**	**MTons**		**MTons**
	Percent of VMT	**NOx**	**N2O**	**CO2**	**CO2e**	**CO2w/Pavley + LCF**	**CO2e w/ Pavley + LCFS**
All Other Buses	0.01%	0	0	46	48	42	43
LDA	43.11%	16	1	42,700	42,857	29,272	29,429
LDT1	6.82%	6	0	7,803	7,867	5,575	5,639
LDT2	18.41%	11	0	24,766	24,876	18,435	18,545
LHD1	4.65%	30	1	8,380	8,678	7,542	7,840
LHD2	0.78%	7	0	1,288	1,359	1,159	1,230
MCY	1.03%	4	0	536	576	482	522
MDV	16.11%	17	1	27,683	27,851	21,441	21,609
MH	0.37%	1	0	790	805	711	726
Motor Coach	0.02%	0	0	76	78	68	70
OBUS	0.05%	0	0	101	105	91	95
PTO	0.02%	0	0	111	115	100	104
SBUS	0.06%	1	0	213	227	192	206
T6 Ag	0.00%	0	0	12	12	11	11
T6 CAIRP heavy	0.00%	0	0	15	15	13	14
T6 CAIRP small	0.02%	0	0	51	51	46	46
T6 instate construction heavy	0.04%	0	0	127	131	114	118
T6 instate construction small	0.10%	0	0	311	315	280	284
T6 instate heavy	0.09%	1	0	270	279	243	252
T6 instate small	0.23%	1	0	700	709	630	639
T6 OOS heavy	0.00%	0	0	9	9	8	8
T6 OOS small	0.01%	0	0	29	29	26	26
T6 public	0.01%	0	0	26	27	23	24
T6 utility	0.00%	0	0	9	9	8	8
T6TS	0.17%	1	0	345	351	310	317
T7 Ag	0.01%	0	0	50	51	45	46
T7 CAIRP	2.61%	23	1	13,122	13,346	11,810	12,034
T7 CAIRP construction	0.03%	0	0	143	145	129	131
T7 NNOOS	2.93%	20	1	14,881	15,075	13,393	13,587
T7 NOOS	0.95%	9	0	4,858	4,944	4,372	4,458
T7 other port	0.00%	0	0	0	0	0	0
T7 POAK	0.00%	0	0	0	0	0	0
T7 POLA	0.26%	5	0	1,290	1,344	1,161	1,215
T7 public	0.01%	0	0	32	34	29	31
T7 Single	0.07%	1	0	365	377	329	341
T7 single construction	0.07%	1	0	360	372	324	336
T7 SWCV	0.02%	0	0	89	94	81	85
T7 tractor	0.71%	8	0	3,399	3,483	3,059	3,143
T7 tractor construction	0.05%	1	0	268	275	241	248
T7 utility	0.00%	0	0	10	10	9	9
T7IS	0.04%	1	0	81	91	73	83
UBUS	0.11%	2	0	519	543	467	491
TOTAL		**172**	**5**	**155,863**	**157,562**	**122,342**	**124,041**

N2O emissions were calculated using an off-model adjustment provided by CARB in AB 32 Technical Appendices. The off-model adjustment uses a linear regression correlating N2O with NOx. (N2O = 0.0167 + 0.0318 x NOx)

Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the Climate Change Scoping Plan Measure Documentation Supplement.

Based on the emission factors for San Bernardino County - Mojave Desert Air Basin

Year 2012 MTons/Year)

Based on EMFAC2011

	Emission year		GWP	GWP			
	2012	**292,868,000**	**310**	**1**	**MTons**		**MTons**
	Percent of VMT	**NOx**	**N2O**	**CO2**	**CO2e**	**CO2w/Pavley + LCF**	**CO2e w/ Pavley + LCFS**
All Other Buses	0.01%	0	0	46	49	45	49
LDA	44.99%	38	1	45,608	45,983	43,142	43,517
LDT1	7.04%	15	0	8,216	8,367	7,752	7,903
LDT2	17.87%	30	1	24,697	24,991	23,629	23,923
LHD1	4.49%	54	2	8,303	8,835	8,261	8,793
LHD2	0.78%	13	0	1,308	1,441	1,301	1,434
MCY	0.98%	4	0	450	491	448	489
MDV	15.99%	34	1	27,957	28,295	27,088	27,426
MH	0.35%	3	0	763	791	759	787
Motor Coach	0.01%	1	0	73	78	73	78
OBUS	0.06%	1	0	134	143	133	142
PTO	0.02%	1	0	97	104	97	103
SBUS	0.06%	2	0	224	243	223	242
T6 Ag	0.00%	0	0	14	15	14	15
T6 CAIRP heavy	0.00%	0	0	15	16	15	16
T6 CAIRP small	0.02%	0	0	50	52	50	52
T6 instate construction heavy	0.03%	1	0	80	86	79	86
T6 instate construction small	0.07%	1	0	205	218	204	217
T6 instate heavy	0.08%	2	0	246	266	244	265
T6 instate small	0.20%	4	0	643	681	640	678
T6 OOS heavy	0.00%	0	0	9	9	9	9
T6 OOS small	0.01%	0	0	29	30	29	30
T6 public	0.01%	0	0	25	27	25	27
T6 utility	0.00%	0	0	8	8	8	8
T6TS	0.16%	2	0	324	340	322	339
T7 Ag	0.01%	1	0	57	62	56	62
T7 CAIRP	2.26%	65	2	11,329	11,971	11,273	11,914
T7 CAIRP construction	0.02%	1	0	90	96	90	95
T7 NNOOS	2.54%	46	1	12,959	13,415	12,895	13,350
T7 NOOS	0.82%	24	1	4,166	4,402	4,145	4,381
T7 other port	0.00%	0	0	0	0	0	0
T7 POAK	0.00%	0	0	0	0	0	0
T7 POLA	0.18%	4	0	941	985	936	980
T7 public	0.01%	0	0	30	33	30	33
T7 Single	0.06%	3	0	316	343	314	341
T7 single construction	0.05%	2	0	228	248	227	247
T7 SWCV	0.02%	1	0	87	94	86	93
T7 tractor	0.61%	23	1	2,986	3,214	2,971	3,199
T7 tractor construction	0.03%	1	0	171	184	170	184
T7 utility	0.00%	0	0	9	10	9	10
T7IS	0.03%	1	0	69	81	69	81
UBUS	0.11%	3	0	523	552	521	550
TOTAL	100%	**382**	**12**	**153,483**	**157,248**	**148,381**	**152,147**

N2O emissions were calculated using an off-model adjustment provided by CARB in AB 32 Technical Appendices. The off-model adjustment uses a linear regression correlating N2O with NOx. (N2O = 0.0167 + 0.0318 x NOx)

Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the Climate Change Scoping Plan Measure Documentation Supplement.

Based on the emission factors for San Bernardino County - Mojave Desert Air Basin

San Bernardino MD 2035 Annual					Tons/Day							
Veh & Tech	MdlYr	Pop	VMT	Percent of VMT	ROG_TOTAL	NOx_TOTEX	CO_TOTEX	SOx_TOTEX	PM10_TOTAL	PM2_5_TOTAL	CO2_TOTEX	CO2_TOTEX (Pavley I + LCFS)
All Other Buses - TOT	AllMYr	104	6,107	0%	4.652E-04	7.774E-03	3.395E-03	6.755E-05	1.417E-03	8.184E-04	7.081E+00	6.372E+00
LDA - TOT	AllMYr	214,133	17,746,367	41%	6.909E-01	1.878E+00	1.840E+01	6.644E-02	9.186E-01	3.873E-01	6.626E+03	3.943E+03
LDT1 - TOT	AllMYr	37,633	3,083,683	7%	1.793E-01	3.677E-01	3.607E+00	1.340E-02	1.595E-01	6.716E-02	1.337E+03	8.151E+02
LDT2 - TOT	AllMYr	97,556	8,393,074	20%	5.087E-01	1.069E+00	9.893E+00	4.262E-02	4.340E-01	1.828E-01	4.253E+03	2.888E+03
LHD1 - TOT	AllMYr	29,610	1,703,032	4%	2.580E-01	1.883E+00	1.879E+00	1.105E-02	1.317E-01	5.992E-02	1.123E+03	1.011E+03
LHD2 - TOT	AllMYr	5,144	291,738	1%	2.617E-02	4.100E-01	2.530E-01	1.728E-03	3.185E-02	1.495E-02	1.785E+02	1.606E+02
MCY - TOT	AllMYr	15,505	345,349	1%	1.289E+00	5.073E-01	1.101E+01	8.881E-04	1.716E-02	6.866E-03	6.784E+01	6.106E+01
MDV - TOT	AllMYr	98,392	7,401,161	17%	6.850E-01	1.169E+00	1.055E+01	4.823E-02	3.825E-01	1.610E-01	4.814E+03	3.334E+03
MH - TOT	AllMYr	12,934	240,823	1%	5.432E-03	1.684E-01	6.692E-02	1.830E-03	1.830E-02	8.688E-03	1.851E+02	1.666E+02
Motor Coach - TOT	AllMYr	42	6,251	0%	1.435E-03	1.424E-02	1.020E-02	1.110E-04	1.686E-03	1.054E-03	1.163E+01	1.047E+01
OBUS - TOT	AllMYr	182	14,501	0%	8.215E-03	1.535E-02	7.875E-02	1.061E-04	7.198E-04	2.879E-04	1.049E+01	9.442E+00
PTO - TOT	AllMYr	0	7,341	0%	2.165E-03	1.722E-02	6.661E-03	1.634E-04	3.631E-04	3.340E-04	1.713E+01	1.542E+01
SBUS - TOT	AllMYr	486	19,123	0%	6.927E-03	8.751E-02	3.680E-02	2.541E-04	1.319E-02	6.028E-03	2.642E+01	2.378E+01
T6 Ag - TOT	AllMYr	32	1,154	0%	8.878E-05	1.456E-03	6.617E-04	1.287E-05	2.650E-04	1.521E-04	1.349E+00	1.214E+00
T6 CAIRP heavy - TOT	AllMYr	29	1,875	0%	1.219E-04	1.879E-03	8.909E-04	2.071E-05	4.086E-04	2.269E-04	2.170E+00	1.953E+00
T6 CAIRP small - TOT	AllMYr	90	6,490	0%	4.002E-04	5.977E-03	2.920E-03	7.162E-05	1.388E-03	7.614E-04	7.507E+00	6.756E+00
T6 instate construction heavy - TOT	AllMYr	262	14,489	0%	1.057E-03	1.726E-02	7.738E-03	1.604E-04	3.296E-03	1.881E-03	1.681E+01	1.513E+01
T6 instate construction small - TOT	AllMYr	602	40,298	0%	2.646E-03	4.101E-02	1.932E-02	4.450E-04	8.818E-03	4.910E-03	4.665E+01	4.198E+01
T6 instate heavy - TOT	AllMYr	583	32,164	0%	2.349E-03	3.840E-02	1.721E-02	3.560E-04	7.321E-03	4.179E-03	3.732E+01	3.359E+01
T6 instate small - TOT	AllMYr	1,333	89,132	0%	5.855E-03	9.080E-02	4.275E-02	9.844E-04	1.951E-02	1.087E-02	1.032E+02	9.286E+01
T6 OOS heavy - TOT	AllMYr	16	1,075	0%	6.989E-05	1.077E-03	5.108E-04	1.187E-05	2.342E-04	1.301E-04	1.244E+00	1.120E+00
T6 OOS small - TOT	AllMYr	52	3,721	0%	2.294E-04	3.427E-03	1.674E-03	4.106E-05	7.959E-04	4.365E-04	4.304E+00	3.873E+00
T6 public - TOT	AllMYr	190	3,427	0%	2.216E-04	4.711E-03	1.743E-03	3.902E-05	7.094E-04	3.802E-04	4.090E+00	3.681E+00
T6 utility - TOT	AllMYr	59	1,187	0%	7.215E-05	9.984E-04	5.741E-04	1.343E-05	2.399E-04	1.263E-04	1.408E+00	1.267E+00
T6TS - TOT	AllMYr	659	58,082	0%	1.514E-02	3.001E-02	1.526E-01	4.153E-04	2.877E-03	1.148E-03	4.134E+01	3.720E+01
T7 Ag - TOT	AllMYr	42	3,032	0%	7.138E-04	7.318E-03	5.105E-03	5.377E-05	6.925E-04	4.551E-04	5.636E+00	5.072E+00
T7 CAIRP - TOT	AllMYr	4,400	1,067,274	2%	3.184E-01	3.019E+00	2.188E+00	1.949E-02	2.506E-01	1.665E-01	2.043E+03	1.839E+03
T7 CAIRP construction - TOT	AllMYr	45	10,928	0%	3.261E-03	3.091E-02	2.241E-02	1.996E-04	2.566E-03	1.705E-03	2.092E+01	1.883E+01
T7 NNOOS - TOT	AllMYr	4,345	1,200,644	3%	3.503E-01	2.989E+00	2.358E+00	2.207E-02	2.566E-01	1.640E-01	2.314E+03	2.082E+03
T7 NOOS - TOT	AllMYr	1,602	388,674	1%	1.298E-01	1.171E+00	8.753E-01	7.225E-03	9.147E-02	6.082E-02	7.573E+02	6.816E+02
T7 other port - TOT	AllMYr	0	0	0%	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
T7 POAK - TOT	AllMYr	0	0	0%	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
T7 POLA - TOT	AllMYr	844	166,965	0%	4.464E-02	5.239E-01	3.260E-01	2.956E-03	4.455E-02	3.096E-02	3.099E+02	2.789E+02
T7 public - TOT	AllMYr	93	2,324	0%	1.092E-03	1.237E-02	6.646E-03	4.775E-05	4.462E-04	2.710E-04	5.005E+00	4.505E+00
T7 Single - TOT	AllMYr	400	30,537	0%	6.343E-03	5.913E-02	4.492E-02	5.402E-04	6.242E-03	3.909E-03	5.662E+01	5.096E+01
T7 single construction - TOT	AllMYr	371	28,271	0%	5.876E-03	5.477E-02	4.160E-02	5.001E-04	5.780E-03	3.620E-03	5.242E+01	4.718E+01
T7 SWCV - TOT	AllMYr	144	7,219	0%	2.196E-03	1.782E-02	1.429E-02	1.350E-04	1.390E-03	8.453E-04	1.415E+01	1.274E+01
T7 tractor - TOT	AllMYr	1,744	290,132	1%	5.507E-02	6.593E-01	4.178E-01	5.012E-03	6.784E-02	4.500E-02	5.253E+02	4.728E+02
T7 tractor construction - TOT	AllMYr	262	21,078	0%	4.882E-03	5.258E-02	3.534E-02	3.720E-04	4.948E-03	3.287E-03	3.900E+01	3.510E+01
T7 utility - TOT	AllMYr	29	735	0%	3.612E-04	2.235E-03	2.213E-03	1.505E-05	1.345E-04	7.962E-05	1.578E+00	1.420E+00
T7IS - TOT	AllMYr	84	22,131	0%	1.205E-02	1.851E-01	1.161E+00	1.731E-04	1.095E-03	4.358E-04	1.548E+01	1.393E+01
UBUS - TOT	AllMYr	209	50,239	0%	2.896E-02	2.411E-01	3.287E-01	8.146E-04	2.734E-02	1.299E-02	8.383E+01	7.545E+01
			42,801,823	100%								

San Bernardino MD 2035 Annual

Veh & Tech	MdlYr	Pop	VMT	Percent of VMT
All Other Buses - TOT	AllMYr	104	6,107	0%
LDA - TOT	AllMYr	214,133	17,746,367	41%
LDT1 - TOT	AllMYr	37,633	3,083,683	7%
LDT2 - TOT	AllMYr	97,556	8,393,074	20%
LHD1 - TOT	AllMYr	29,610	1,703,032	4%
LHD2 - TOT	AllMYr	5,144	291,738	1%
MCY - TOT	AllMYr	15,505	345,349	1%
MDV - TOT	AllMYr	98,392	7,401,161	17%
MH - TOT	AllMYr	12,934	240,823	1%
Motor Coach - TOT	AllMYr	42	6,251	0%
OBUS - TOT	AllMYr	182	14,501	0%
PTO - TOT	AllMYr	0	7,341	0%
SBUS - TOT	AllMYr	486	19,123	0%
T6 Ag - TOT	AllMYr	32	1,154	0%
T6 CAIRP heavy - TOT	AllMYr	29	1,875	0%
T6 CAIRP small - TOT	AllMYr	90	6,490	0%
T6 instate construction heavy - TOT	AllMYr	262	14,489	0%
T6 instate construction small - TOT	AllMYr	602	40,298	0%
T6 instate heavy - TOT	AllMYr	583	32,164	0%
T6 instate small - TOT	AllMYr	1,333	89,132	0%
T6 OOS heavy - TOT	AllMYr	16	1,075	0%
T6 OOS small - TOT	AllMYr	52	3,721	0%
T6 public - TOT	AllMYr	190	3,427	0%
T6 utility - TOT	AllMYr	59	1,187	0%
T6TS - TOT	AllMYr	659	58,082	0%
T7 Ag - TOT	AllMYr	42	3,032	0%
T7 CAIRP - TOT	AllMYr	4,400	1,067,274	2%
T7 CAIRP construction - TOT	AllMYr	45	10,928	0%
T7 NNOOS - TOT	AllMYr	4,345	1,200,644	3%
T7 NOOS - TOT	AllMYr	1,602	388,674	1%
T7 other port - TOT	AllMYr	0	0	0%
T7 POAK - TOT	AllMYr	0	0	0%
T7 POLA - TOT	AllMYr	844	166,965	0%
T7 public - TOT	AllMYr	93	2,324	0%
T7 Single - TOT	AllMYr	400	30,537	0%
T7 single construction - TOT	AllMYr	371	28,271	0%
T7 SWCV - TOT	AllMYr	144	7,219	0%
T7 tractor - TOT	AllMYr	1,744	290,132	1%
T7 tractor construction - TOT	AllMYr	262	21,078	0%
T7 utility - TOT	AllMYr	29	735	0%
T7IS - TOT	AllMYr	84	22,131	0%
UBUS - TOT	AllMYr	209	50,239	0%
			42,801,823	100%

San Bernardino MD 2035 Annual				###	MTons/Mile							
Veh & Tech	MdlYr	Pop	VMT	Percent of VMT	ROG_TOTAL	NOx_TOTEX	CO_TOTEX	SOx_TOTEX	PM10_TOTAL	PM2_5_TOTAL	CO2_TOTEX	CO2_TOTEX (Pavley I + LCFS)
All Other Buses - TOT	AllMYr	104	6,107	0%	6.910E-08	1.155E-06	5.043E-07	1.003E-08	2.105E-07	1.216E-07	1.052E-03	9.466E-04
LDA - TOT	AllMYr	214,133	17,746,367	41%	3.532E-08	9.601E-08	9.403E-07	3.396E-09	4.696E-08	1.980E-08	3.387E-04	2.016E-04
LDT1 - TOT	AllMYr	37,633	3,083,683	7%	5.276E-08	1.082E-07	1.061E-06	3.943E-09	4.691E-08	1.976E-08	3.933E-04	2.398E-04
LDT2 - TOT	AllMYr	97,556	8,393,074	20%	5.499E-08	1.156E-07	1.069E-06	4.606E-09	4.691E-08	1.975E-08	4.597E-04	3.122E-04
LHD1 - TOT	AllMYr	29,610	1,703,032	4%	1.374E-07	1.003E-06	1.001E-06	5.889E-09	7.015E-08	3.192E-08	5.981E-04	5.383E-04
LHD2 - TOT	AllMYr	5,144	291,738	1%	8.136E-08	1.275E-06	7.867E-07	5.375E-09	9.903E-08	4.648E-08	5.549E-04	4.994E-04
MCY - TOT	AllMYr	15,505	345,349	1%	3.385E-06	1.333E-06	2.892E-05	2.333E-09	4.508E-08	1.804E-08	1.782E-04	1.604E-04
MDV - TOT	AllMYr	98,392	7,401,161	17%	8.397E-08	1.433E-07	1.294E-06	5.912E-09	4.689E-08	1.974E-08	5.901E-04	4.086E-04
MH - TOT	AllMYr	12,934	240,823	1%	2.046E-08	6.345E-07	2.521E-07	6.893E-09	6.895E-08	3.273E-08	6.972E-04	6.275E-04
Motor Coach - TOT	AllMYr	42	6,251	0%	2.082E-07	2.067E-06	1.480E-06	1.611E-08	2.446E-07	1.530E-07	1.688E-03	1.519E-03
OBUS - TOT	AllMYr	182	14,501	0%	5.139E-07	9.601E-07	4.927E-06	6.639E-09	4.503E-08	1.801E-08	6.563E-04	5.907E-04
PTO - TOT	AllMYr	0	7,341	0%	2.675E-07	2.128E-06	8.231E-07	2.020E-08	4.487E-08	4.128E-08	2.117E-03	1.905E-03
SBUS - TOT	AllMYr	486	19,123	0%	3.286E-07	4.152E-06	1.746E-06	1.206E-08	6.257E-07	2.860E-07	1.253E-03	1.128E-03
T6 Ag - TOT	AllMYr	32	1,154	0%	6.980E-08	1.144E-06	5.202E-07	1.011E-08	2.083E-07	1.195E-07	1.060E-03	9.541E-04
T6 CAIRP heavy - TOT	AllMYr	29	1,875	0%	5.900E-08	9.092E-07	4.311E-07	1.002E-08	1.977E-07	1.098E-07	1.050E-03	9.453E-04
T6 CAIRP small - TOT	AllMYr	90	6,490	0%	5.594E-08	8.356E-07	4.082E-07	1.001E-08	1.940E-07	1.064E-07	1.049E-03	9.444E-04
T6 instate construction heavy - TOT	AllMYr	262	14,489	0%	6.615E-08	1.081E-06	4.845E-07	1.004E-08	2.064E-07	1.178E-07	1.053E-03	9.473E-04
T6 instate construction small - TOT	AllMYr	602	40,298	0%	5.956E-08	9.232E-07	4.348E-07	1.002E-08	1.985E-07	1.105E-07	1.050E-03	9.451E-04
T6 instate heavy - TOT	AllMYr	583	32,164	0%	6.626E-08	1.083E-06	4.853E-07	1.004E-08	2.065E-07	1.179E-07	1.053E-03	9.473E-04
T6 instate small - TOT	AllMYr	1,333	89,132	0%	5.960E-08	9.242E-07	4.351E-07	1.002E-08	1.986E-07	1.106E-07	1.050E-03	9.451E-04
T6 OOS heavy - TOT	AllMYr	16	1,075	0%	5.900E-08	9.092E-07	4.311E-07	1.002E-08	1.977E-07	1.098E-07	1.050E-03	9.453E-04
T6 OOS small - TOT	AllMYr	52	3,721	0%	5.594E-08	8.356E-07	4.082E-07	1.001E-08	1.940E-07	1.064E-07	1.049E-03	9.444E-04
T6 public - TOT	AllMYr	190	3,427	0%	5.866E-08	1.247E-06	4.613E-07	1.033E-08	1.878E-07	1.006E-07	1.082E-03	9.742E-04
T6 utility - TOT	AllMYr	59	1,187	0%	5.514E-08	7.631E-07	4.388E-07	1.027E-08	1.833E-07	9.656E-08	1.076E-03	9.686E-04
T6TS - TOT	AllMYr	659	58,082	0%	2.364E-07	4.688E-07	2.384E-06	6.487E-09	4.494E-08	1.793E-08	6.456E-04	5.811E-04
T7 Ag - TOT	AllMYr	42	3,032	0%	2.136E-07	2.190E-06	1.528E-06	1.609E-08	2.072E-07	1.362E-07	1.687E-03	1.518E-03
T7 CAIRP - TOT	AllMYr	4,400	1,067,274	2%	2.706E-07	2.566E-06	1.860E-06	1.657E-08	2.130E-07	1.415E-07	1.737E-03	1.563E-03
T7 CAIRP construction - TOT	AllMYr	45	10,928	0%	2.707E-07	2.566E-06	1.861E-06	1.657E-08	2.130E-07	1.415E-07	1.737E-03	1.563E-03
T7 NNOOS - TOT	AllMYr	4,345	1,200,644	3%	2.647E-07	2.259E-06	1.782E-06	1.668E-08	1.939E-07	1.239E-07	1.748E-03	1.573E-03
T7 NOOS - TOT	AllMYr	1,602	388,674	1%	3.030E-07	2.734E-06	2.043E-06	1.686E-08	2.135E-07	1.420E-07	1.768E-03	1.591E-03
T7 other port - TOT	AllMYr	0	0	0%								
T7 POAK - TOT	AllMYr	0	0	0%								
T7 POLA - TOT	AllMYr	844	166,965	0%	2.425E-07	2.846E-06	1.771E-06	1.606E-08	2.420E-07	1.682E-07	1.684E-03	1.515E-03
T7 public - TOT	AllMYr	93	2,324	0%	4.264E-07	4.830E-06	2.595E-06	1.864E-08	1.742E-07	1.058E-07	1.954E-03	1.759E-03
T7 Single - TOT	AllMYr	400	30,537	0%	1.884E-07	1.757E-06	1.334E-06	1.605E-08	1.854E-07	1.161E-07	1.682E-03	1.514E-03
T7 single construction - TOT	AllMYr	371	28,271	0%	1.885E-07	1.758E-06	1.335E-06	1.605E-08	1.855E-07	1.162E-07	1.682E-03	1.514E-03
T7 SWCV - TOT	AllMYr	144	7,219	0%	2.759E-07	2.240E-06	1.796E-06	1.697E-08	1.747E-07	1.062E-07	1.779E-03	1.601E-03
T7 tractor - TOT	AllMYr	1,744	290,132	1%	1.722E-07	2.062E-06	1.306E-06	1.567E-08	2.121E-07	1.407E-07	1.643E-03	1.478E-03
T7 tractor construction - TOT	AllMYr	262	21,078	0%	2.101E-07	2.263E-06	1.521E-06	1.601E-08	2.130E-07	1.415E-07	1.678E-03	1.511E-03
T7 utility - TOT	AllMYr	29	735	0%	4.459E-07	2.759E-06	2.732E-06	1.858E-08	1.660E-07	9.829E-08	1.948E-03	1.753E-03
T7IS - TOT	AllMYr	84	22,131	0%	4.939E-07	7.587E-06	4.759E-05	7.097E-09	4.487E-08	1.787E-08	6.345E-04	5.710E-04
UBUS - TOT	AllMYr	209	50,239	0%	5.230E-07	4.354E-06	5.935E-06	1.471E-08	4.937E-07	2.346E-07	1.514E-03	1.362E-03
			42,801,823	100%								

San Bernardino MD 2035 Annual				###	lbs/Mile							
Veh & Tech	MdlYr	Pop	VMT	Percent of VMT	ROG_TOTAL	NOx_TOTEX	CO_TOTEX	SOx_TOTEX	PM10_TOTAL	PM2_5_TOTAL	CO2_TOTEX	CO2_TOTEX (Pavley I + LCFS)
All Other Buses - TOT	AllMYr	104	6,107	0%	1.524E-04	2.546E-03	1.112E-03	2.212E-05	4.641E-04	2.680E-04	2.319E+00	2.087E+00
LDA - TOT	AllMYr	214,133	17,746,367	41%	7.786E-05	2.117E-04	2.073E-03	7.487E-06	1.035E-04	4.365E-05	7.468E-01	4.444E-01
LDT1 - TOT	AllMYr	37,633	3,083,683	7%	1.163E-04	2.385E-04	2.340E-03	8.693E-06	1.034E-04	4.356E-05	8.671E-01	5.286E-01
LDT2 - TOT	AllMYr	97,556	8,393,074	20%	1.212E-04	2.548E-04	2.357E-03	1.016E-05	1.034E-04	4.355E-05	1.013E+00	6.882E-01
LHD1 - TOT	AllMYr	29,610	1,703,032	4%	3.030E-04	2.212E-03	2.206E-03	1.298E-05	1.547E-04	7.037E-05	1.319E+00	1.187E+00
LHD2 - TOT	AllMYr	5,144	291,738	1%	1.794E-04	2.811E-03	1.734E-03	1.185E-05	2.183E-04	1.025E-04	1.223E+00	1.101E+00
MCY - TOT	AllMYr	15,505	345,349	1%	7.463E-03	2.938E-03	6.377E-02	5.143E-06	9.938E-05	3.976E-05	3.929E-01	3.536E-01
MDV - TOT	AllMYr	98,392	7,401,161	17%	1.851E-04	3.160E-04	2.852E-03	1.303E-05	1.034E-04	4.351E-05	1.301E+00	9.008E-01
MH - TOT	AllMYr	12,934	240,823	1%	4.511E-05	1.399E-03	5.558E-04	1.520E-05	1.520E-04	7.215E-05	1.537E+00	1.383E+00
Motor Coach - TOT	AllMYr	42	6,251	0%	4.590E-04	4.556E-03	3.262E-03	3.551E-05	5.394E-04	3.373E-04	3.722E+00	3.350E+00
OBUS - TOT	AllMYr	182	14,501	0%	1.133E-03	2.117E-03	1.086E-02	1.464E-05	9.928E-05	3.971E-05	1.447E+00	1.302E+00
PTO - TOT	AllMYr	0	7,341	0%	5.897E-04	4.691E-03	1.815E-03	4.453E-05	9.891E-05	9.100E-05	4.667E+00	4.201E+00
SBUS - TOT	AllMYr	486	19,123	0%	7.245E-04	9.153E-03	3.849E-03	2.658E-05	1.379E-03	6.304E-04	2.763E+00	2.487E+00
T6 Ag - TOT	AllMYr	32	1,154	0%	1.539E-04	2.523E-03	1.147E-03	2.230E-05	4.592E-04	2.635E-04	2.337E+00	2.104E+00
T6 CAIRP heavy - TOT	AllMYr	29	1,875	0%	1.301E-04	2.005E-03	9.505E-04	2.209E-05	4.359E-04	2.421E-04	2.316E+00	2.084E+00
T6 CAIRP small - TOT	AllMYr	90	6,490	0%	1.233E-04	1.842E-03	9.000E-04	2.207E-05	4.278E-04	2.346E-04	2.313E+00	2.082E+00
T6 instate construction heavy - TOT	AllMYr	262	14,489	0%	1.458E-04	2.382E-03	1.068E-03	2.214E-05	4.549E-04	2.596E-04	2.320E+00	2.088E+00
T6 instate construction small - TOT	AllMYr	602	40,298	0%	1.313E-04	2.035E-03	9.587E-04	2.209E-05	4.377E-04	2.437E-04	2.315E+00	2.084E+00
T6 instate heavy - TOT	AllMYr	583	32,164	0%	1.461E-04	2.388E-03	1.070E-03	2.214E-05	4.552E-04	2.599E-04	2.320E+00	2.088E+00
T6 instate small - TOT	AllMYr	1,333	89,132	0%	1.314E-04	2.037E-03	9.593E-04	2.209E-05	4.378E-04	2.438E-04	2.315E+00	2.084E+00
T6 OOS heavy - TOT	AllMYr	16	1,075	0%	1.301E-04	2.005E-03	9.505E-04	2.209E-05	4.359E-04	2.421E-04	2.316E+00	2.084E+00
T6 OOS small - TOT	AllMYr	52	3,721	0%	1.233E-04	1.842E-03	9.000E-04	2.207E-05	4.278E-04	2.346E-04	2.313E+00	2.082E+00
T6 public - TOT	AllMYr	190	3,427	0%	1.293E-04	2.749E-03	1.017E-03	2.277E-05	4.139E-04	2.219E-04	2.386E+00	2.148E+00
T6 utility - TOT	AllMYr	59	1,187	0%	1.216E-04	1.682E-03	9.673E-04	2.264E-05	4.041E-04	2.129E-04	2.373E+00	2.135E+00
T6TS - TOT	AllMYr	659	58,082	0%	5.213E-04	1.033E-03	5.256E-03	1.430E-05	9.907E-05	3.952E-05	1.423E+00	1.281E+00
T7 Ag - TOT	AllMYr	42	3,032	0%	4.709E-04	4.828E-03	3.368E-03	3.547E-05	4.569E-04	3.003E-04	3.718E+00	3.346E+00
T7 CAIRP - TOT	AllMYr	4,400	1,067,274	2%	5.966E-04	5.657E-03	4.101E-03	3.653E-05	4.696E-04	3.120E-04	3.829E+00	3.446E+00
T7 CAIRP construction - TOT	AllMYr	45	10,928	0%	5.968E-04	5.658E-03	4.102E-03	3.653E-05	4.696E-04	3.120E-04	3.829E+00	3.446E+00
T7 NNOOS - TOT	AllMYr	4,345	1,200,644	3%	5.836E-04	4.979E-03	3.928E-03	3.677E-05	4.274E-04	2.731E-04	3.854E+00	3.469E+00
T7 NOOS - TOT	AllMYr	1,602	388,674	1%	6.680E-04	6.028E-03	4.504E-03	3.718E-05	4.707E-04	3.129E-04	3.897E+00	3.507E+00
T7 other port - TOT	AllMYr	0	0	0%								
T7 POAK - TOT	AllMYr	0	0	0%								
T7 POLA - TOT	AllMYr	844	166,965	0%	5.347E-04	6.275E-03	3.904E-03	3.541E-05	5.336E-04	3.708E-04	3.712E+00	3.341E+00
T7 public - TOT	AllMYr	93	2,324	0%	9.400E-04	1.065E-02	5.720E-03	4.110E-05	3.840E-04	2.333E-04	4.308E+00	3.877E+00
T7 Single - TOT	AllMYr	400	30,537	0%	4.155E-04	3.872E-03	2.942E-03	3.538E-05	4.088E-04	2.560E-04	3.709E+00	3.338E+00
T7 single construction - TOT	AllMYr	371	28,271	0%	4.157E-04	3.875E-03	2.943E-03	3.538E-05	4.089E-04	2.561E-04	3.709E+00	3.338E+00
T7 SWCV - TOT	AllMYr	144	7,219	0%	6.083E-04	4.938E-03	3.959E-03	3.741E-05	3.851E-04	2.342E-04	3.921E+00	3.529E+00
T7 tractor - TOT	AllMYr	1,744	290,132	1%	3.796E-04	4.545E-03	2.880E-03	3.455E-05	4.677E-04	3.102E-04	3.621E+00	3.259E+00
T7 tractor construction - TOT	AllMYr	262	21,078	0%	4.632E-04	4.989E-03	3.353E-03	3.530E-05	4.695E-04	3.119E-04	3.700E+00	3.330E+00
T7 utility - TOT	AllMYr	29	735	0%	9.831E-04	6.083E-03	6.024E-03	4.097E-05	3.660E-04	2.167E-04	4.294E+00	3.865E+00
T7IS - TOT	AllMYr	84	22,131	0%	1.089E-03	1.673E-02	1.049E-01	1.565E-05	9.893E-05	3.939E-05	1.399E+00	1.259E+00
UBUS - TOT	AllMYr	209	50,239	0%	1.153E-03	9.599E-03	1.309E-02	3.243E-05	1.088E-03	5.171E-04	3.337E+00	3.004E+00
			42,801,823	100%								

San Bernardino MD 2020 Annual					Tons/Day							
Veh & Tech	MdlYr	Pop	VMT	Percent of VMT	ROG_TOTAL	NOx_TOTEX	CO_TOTEX	SOx_TOTEX	PM10_TOTAL	PM2_5_TOTAL	CO2_TOTEX	CO2_TOTEX (Pavley I + LCFS)
All Other Buses - TOT	AllMYr	85	4,708	0%	3.645E-04	1.504E-02	2.532E-03	5.271E-05	1.127E-03	6.628E-04	5.525E+00	4.973E+00
LDA - TOT	AllMYr	163,185	13,536,007	43%	8.536E-01	1.895E+00	1.861E+01	5.115E-02	6.944E-01	2.896E-01	5.094E+03	3.492E+03
LDT1 - TOT	AllMYr	26,778	2,141,909	7%	3.489E-01	7.694E-01	6.468E+00	9.402E-03	1.126E-01	4.837E-02	9.310E+02	6.651E+02
LDT2 - TOT	AllMYr	67,051	5,780,135	18%	5.238E-01	1.328E+00	1.054E+01	2.967E-02	2.969E-01	1.240E-01	2.955E+03	2.199E+03
LHD1 - TOT	AllMYr	24,363	1,460,006	5%	3.664E-01	3.602E+00	3.299E+00	9.877E-03	1.171E-01	5.524E-02	9.998E+02	8.998E+02
LHD2 - TOT	AllMYr	4,176	246,380	1%	3.657E-02	8.631E-01	2.873E-01	1.490E-03	2.803E-02	1.367E-02	1.536E+02	1.383E+02
MCY - TOT	AllMYr	14,011	324,876	1%	1.288E+00	4.848E-01	1.189E+01	8.633E-04	1.619E-02	6.497E-03	6.395E+01	5.756E+01
MDV - TOT	AllMYr	66,963	5,056,934	16%	8.342E-01	2.026E+00	1.431E+01	3.321E-02	2.610E-01	1.096E-01	3.303E+03	2.558E+03
MH - TOT	AllMYr	6,496	117,308	0%	8.985E-03	1.778E-01	2.437E-01	9.356E-04	1.146E-02	6.581E-03	9.424E+01	8.481E+01
Motor Coach - TOT	AllMYr	34	4,819	0%	1.063E-03	2.055E-02	7.728E-03	8.649E-05	1.361E-03	8.693E-04	9.066E+00	8.159E+00
OBUS - TOT	AllMYr	184	15,718	0%	1.323E-02	4.787E-02	2.065E-01	1.235E-04	7.856E-04	3.170E-04	1.201E+01	1.081E+01
PTO - TOT	AllMYr	0	5,607	0%	1.477E-03	4.530E-02	4.666E-03	1.266E-04	3.252E-04	2.991E-04	1.327E+01	1.194E+01
SBUS - TOT	AllMYr	445	17,957	0%	1.099E-02	1.751E-01	8.218E-02	2.449E-04	1.337E-02	6.192E-03	2.539E+01	2.285E+01
T6 Ag - TOT	AllMYr	36	1,210	0%	2.192E-04	4.357E-03	1.077E-03	1.365E-05	3.986E-04	2.706E-04	1.431E+00	1.288E+00
T6 CAIRP heavy - TOT	AllMYr	23	1,522	0%	9.924E-05	3.131E-03	7.231E-04	1.695E-05	3.412E-04	1.930E-04	1.777E+00	1.599E+00
T6 CAIRP small - TOT	AllMYr	72	5,204	0%	3.430E-04	5.849E-03	2.588E-03	5.768E-05	1.188E-03	6.793E-04	6.046E+00	5.442E+00
T6 instate construction heavy - TOT	AllMYr	250	12,804	0%	9.363E-04	5.256E-02	6.338E-03	1.442E-04	3.060E-03	1.798E-03	1.511E+01	1.360E+01
T6 instate construction small - TOT	AllMYr	490	31,836	0%	2.571E-03	5.223E-02	1.935E-02	3.542E-04	8.334E-03	5.137E-03	3.712E+01	3.341E+01
T6 instate heavy - TOT	AllMYr	516	27,360	0%	1.975E-03	1.014E-01	1.362E-02	3.075E-04	6.490E-03	3.796E-03	3.223E+01	2.901E+01
T6 instate small - TOT	AllMYr	1,081	71,686	0%	5.595E-03	1.104E-01	4.212E-02	7.969E-04	1.831E-02	1.115E-02	8.352E+01	7.517E+01
T6 OOS heavy - TOT	AllMYr	13	872	0%	5.690E-05	1.795E-03	4.146E-04	9.718E-06	1.956E-04	1.107E-04	1.019E+00	9.168E-01
T6 OOS small - TOT	AllMYr	41	2,984	0%	1.966E-04	3.353E-03	1.484E-03	3.307E-05	6.810E-04	3.895E-04	3.466E+00	3.120E+00
T6 public - TOT	AllMYr	143	2,547	0%	1.572E-04	1.333E-02	1.035E-03	2.952E-05	5.446E-04	2.987E-04	3.094E+00	2.785E+00
T6 utility - TOT	AllMYr	45	896	0%	5.155E-05	1.853E-03	4.126E-04	1.024E-05	1.855E-04	9.947E-05	1.074E+00	9.664E-01
T6TS - TOT	AllMYr	570	54,632	0%	2.462E-02	7.769E-02	3.819E-01	4.174E-04	2.730E-03	1.101E-03	4.115E+01	3.703E+01
T7 Ag - TOT	AllMYr	47	3,178	0%	1.078E-03	2.080E-02	6.306E-03	5.637E-05	1.133E-03	8.512E-04	5.908E+00	5.317E+00
T7 CAIRP - TOT	AllMYr	3,320	818,094	3%	2.371E-01	2.707E+00	1.666E+00	1.494E-02	1.991E-01	1.341E-01	1.566E+03	1.409E+03
T7 CAIRP construction - TOT	AllMYr	36	8,905	0%	2.578E-03	2.987E-02	1.811E-02	1.626E-04	2.168E-03	1.460E-03	1.704E+01	1.534E+01
T7 NNOOS - TOT	AllMYr	3,271	920,325	3%	2.645E-01	2.351E+00	1.815E+00	1.694E-02	2.006E-01	1.293E-01	1.775E+03	1.598E+03
T7 NOOS - TOT	AllMYr	1,209	297,929	1%	9.608E-02	1.038E+00	6.610E-01	5.529E-03	7.268E-02	4.898E-02	5.795E+02	5.216E+02
T7 other port - TOT	AllMYr	0	0	0%	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
T7 POAK - TOT	AllMYr	0	0	0%	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
T7 POLA - TOT	AllMYr	458	80,313	0%	3.427E-02	6.522E-01	2.666E-01	1.469E-03	2.532E-02	1.847E-02	1.539E+02	1.385E+02
T7 public - TOT	AllMYr	69	1,727	0%	4.937E-04	2.901E-02	2.654E-03	3.623E-05	3.602E-04	2.277E-04	3.797E+00	3.418E+00
T7 Single - TOT	AllMYr	311	23,407	0%	3.813E-03	1.459E-01	2.703E-02	4.157E-04	5.043E-03	3.234E-03	4.358E+01	3.922E+01
T7 single construction - TOT	AllMYr	309	23,035	0%	3.737E-03	1.483E-01	2.645E-02	4.093E-04	4.983E-03	3.201E-03	4.290E+01	3.861E+01
T7 SWCV - TOT	AllMYr	107	5,364	0%	1.330E-03	4.975E-02	8.110E-03	1.019E-04	1.068E-03	6.608E-04	1.068E+01	9.608E+00
T7 tractor - TOT	AllMYr	1,364	222,394	1%	4.138E-02	1.013E+00	3.168E-01	3.869E-03	5.486E-02	3.712E-02	4.055E+02	3.650E+02
T7 tractor construction - TOT	AllMYr	218	17,174	0%	3.737E-03	8.951E-02	2.730E-02	3.045E-04	4.265E-03	2.893E-03	3.192E+01	2.872E+01
T7 utility - TOT	AllMYr	22	555	0%	2.213E-04	4.076E-03	1.360E-03	1.150E-05	1.058E-04	6.404E-05	1.205E+00	1.085E+00
T7IS - TOT	AllMYr	51	12,974	0%	1.378E-02	1.188E-01	8.077E-01	1.093E-04	6.465E-04	2.596E-04	9.636E+00	8.673E+00
UBUS - TOT	AllMYr	150	35,937	0%	5.804E-02	2.875E-01	4.635E-01	6.058E-04	2.040E-02	1.007E-02	6.191E+01	5.572E+01
			31,397,224	100%								

San Bernardino MD 2020 Annual					9.072E-01	MTons/Mile						
Veh & Tech	MdlYr	Pop	VMT	Percent of VMT	ROG_TOTAL	NOx_TOTEX	CO_TOTEX	SOx_TOTEX	PM10_TOTAL	PM2_5_TOTAL	CO2_TOTEX	CO2_TOTEX (Pavley I + LCFS)
All Other Buses - TOT	AllMYr	85	4,708	0%	7.024E-08	2.897E-06	4.880E-07	1.016E-08	2.172E-07	1.277E-07	1.065E-03	9.582E-04
LDA - TOT	AllMYr	163,185	13,536,007	43%	5.721E-08	1.270E-07	1.247E-06	3.428E-09	4.654E-08	1.941E-08	3.414E-04	2.341E-04
LDT1 - TOT	AllMYr	26,778	2,141,909	7%	1.478E-07	3.259E-07	2.739E-06	3.982E-09	4.770E-08	2.049E-08	3.943E-04	2.817E-04
LDT2 - TOT	AllMYr	67,051	5,780,135	18%	8.221E-08	2.085E-07	1.654E-06	4.657E-09	4.660E-08	1.947E-08	4.637E-04	3.452E-04
LHD1 - TOT	AllMYr	24,363	1,460,006	5%	2.277E-07	2.238E-06	2.050E-06	6.137E-09	7.278E-08	3.433E-08	6.212E-04	5.591E-04
LHD2 - TOT	AllMYr	4,176	246,380	1%	1.347E-07	3.178E-06	1.058E-06	5.485E-09	1.032E-07	5.035E-08	5.656E-04	5.091E-04
MCY - TOT	AllMYr	14,011	324,876	1%	3.597E-06	1.354E-06	3.320E-05	2.411E-09	4.522E-08	1.814E-08	1.786E-04	1.607E-04
MDV - TOT	AllMYr	66,963	5,056,934	16%	1.497E-07	3.634E-07	2.567E-06	5.957E-09	4.682E-08	1.966E-08	5.925E-04	4.589E-04
MH - TOT	AllMYr	6,496	117,308	0%	6.949E-08	1.375E-06	1.885E-06	7.235E-09	8.860E-08	5.090E-08	7.288E-04	6.559E-04
Motor Coach - TOT	AllMYr	34	4,819	0%	2.000E-07	3.868E-06	1.455E-06	1.628E-08	2.563E-07	1.637E-07	1.707E-03	1.536E-03
OBUS - TOT	AllMYr	184	15,718	0%	7.637E-07	2.763E-06	1.192E-05	7.128E-09	4.534E-08	1.830E-08	6.934E-04	6.241E-04
PTO - TOT	AllMYr	0	5,607	0%	2.391E-07	7.330E-06	7.550E-07	2.048E-08	5.261E-08	4.840E-08	2.147E-03	1.932E-03
SBUS - TOT	AllMYr	445	17,957	0%	5.550E-07	8.845E-06	4.151E-06	1.237E-08	6.756E-07	3.128E-07	1.283E-03	1.155E-03
T6 Ag - TOT	AllMYr	36	1,210	0%	1.644E-07	3.267E-06	8.075E-07	1.024E-08	2.989E-07	2.029E-07	1.073E-03	9.657E-04
T6 CAIRP heavy - TOT	AllMYr	23	1,522	0%	5.917E-08	1.867E-06	4.312E-07	1.011E-08	2.035E-07	1.151E-07	1.059E-03	9.534E-04
T6 CAIRP small - TOT	AllMYr	72	5,204	0%	5.979E-08	1.020E-06	4.512E-07	1.006E-08	2.071E-07	1.184E-07	1.054E-03	9.486E-04
T6 instate construction heavy - TOT	AllMYr	250	12,804	0%	6.633E-08	3.724E-06	4.490E-07	1.021E-08	2.168E-07	1.274E-07	1.071E-03	9.636E-04
T6 instate construction small - TOT	AllMYr	490	31,836	0%	7.327E-08	1.488E-06	5.514E-07	1.009E-08	2.375E-07	1.464E-07	1.058E-03	9.520E-04
T6 instate heavy - TOT	AllMYr	516	27,360	0%	6.547E-08	3.364E-06	4.515E-07	1.020E-08	2.152E-07	1.259E-07	1.069E-03	9.618E-04
T6 instate small - TOT	AllMYr	1,081	71,686	0%	7.080E-08	1.397E-06	5.331E-07	1.008E-08	2.317E-07	1.411E-07	1.057E-03	9.513E-04
T6 OOS heavy - TOT	AllMYr	13	872	0%	5.917E-08	1.867E-06	4.312E-07	1.011E-08	2.035E-07	1.151E-07	1.059E-03	9.534E-04
T6 OOS small - TOT	AllMYr	41	2,984	0%	5.979E-08	1.020E-06	4.512E-07	1.006E-08	2.071E-07	1.184E-07	1.054E-03	9.486E-04
T6 public - TOT	AllMYr	143	2,547	0%	5.599E-08	4.748E-06	3.687E-07	1.052E-08	1.940E-07	1.064E-07	1.102E-03	9.920E-04
T6 utility - TOT	AllMYr	45	896	0%	5.221E-08	1.876E-06	4.180E-07	1.038E-08	1.879E-07	1.008E-07	1.088E-03	9.788E-04
T6TS - TOT	AllMYr	570	54,632	0%	4.089E-07	1.290E-06	6.341E-06	6.930E-09	4.533E-08	1.829E-08	6.833E-04	6.150E-04
T7 Ag - TOT	AllMYr	47	3,178	0%	3.078E-07	5.939E-06	1.800E-06	1.609E-08	3.233E-07	2.430E-07	1.687E-03	1.518E-03
T7 CAIRP - TOT	AllMYr	3,320	818,094	3%	2.629E-07	3.001E-06	1.848E-06	1.656E-08	2.208E-07	1.487E-07	1.736E-03	1.562E-03
T7 CAIRP construction - TOT	AllMYr	36	8,905	0%	2.627E-07	3.043E-06	1.845E-06	1.656E-08	2.208E-07	1.487E-07	1.736E-03	1.563E-03
T7 NNOOS - TOT	AllMYr	3,271	920,325	3%	2.607E-07	2.318E-06	1.789E-06	1.670E-08	1.978E-07	1.275E-07	1.750E-03	1.575E-03
T7 NOOS - TOT	AllMYr	1,209	297,929	1%	2.926E-07	3.162E-06	2.013E-06	1.684E-08	2.213E-07	1.491E-07	1.765E-03	1.588E-03
T7 other port - TOT	AllMYr	0	0	0%								
T7 POAK - TOT	AllMYr	0	0	0%								
T7 POLA - TOT	AllMYr	458	80,313	0%	3.871E-07	7.367E-06	3.011E-06	1.659E-08	2.860E-07	2.086E-07	1.739E-03	1.565E-03
T7 public - TOT	AllMYr	69	1,727	0%	2.594E-07	1.524E-05	1.395E-06	1.903E-08	1.892E-07	1.196E-07	1.995E-03	1.796E-03
T7 Single - TOT	AllMYr	311	23,407	0%	1.478E-07	5.655E-06	1.048E-06	1.611E-08	1.954E-07	1.253E-07	1.689E-03	1.520E-03
T7 single construction - TOT	AllMYr	309	23,035	0%	1.472E-07	5.839E-06	1.042E-06	1.612E-08	1.962E-07	1.261E-07	1.690E-03	1.521E-03
T7 SWCV - TOT	AllMYr	107	5,364	0%	2.250E-07	8.414E-06	1.372E-06	1.723E-08	1.807E-07	1.118E-07	1.806E-03	1.625E-03
T7 tractor - TOT	AllMYr	1,364	222,394	1%	1.688E-07	4.133E-06	1.292E-06	1.578E-08	2.238E-07	1.514E-07	1.654E-03	1.489E-03
T7 tractor construction - TOT	AllMYr	218	17,174	0%	1.974E-07	4.728E-06	1.442E-06	1.608E-08	2.253E-07	1.528E-07	1.686E-03	1.517E-03
T7 utility - TOT	AllMYr	22	555	0%	3.621E-07	6.668E-06	2.225E-06	1.881E-08	1.731E-07	1.048E-07	1.972E-03	1.774E-03
T7IS - TOT	AllMYr	51	12,974	0%	9.633E-07	8.305E-06	5.648E-05	7.642E-09	4.520E-08	1.815E-08	6.738E-04	6.064E-04
UBUS - TOT	AllMYr	150	35,937	0%	1.465E-06	7.259E-06	1.170E-05	1.529E-08	5.149E-07	2.541E-07	1.563E-03	1.407E-03
			31,397,224	100%								

San Bernardino MD 2020 Annual					2.000E+03	lbs/Mile						
Veh & Tech	MdlYr	Pop	VMT	Percent of VMT	ROG_TOTAL	NOx_TOTEX	CO_TOTEX	SOx_TOTEX	PM10_TOTAL	PM2_5_TOTAL	CO2_TOTEX	CO2_TOTEX (Pavley I + LCFS)
All Other Buses - TOT	AllMYr	85	4,708	0%	1.548E-04	6.388E-03	1.076E-03	2.239E-05	4.788E-04	2.816E-04	2.347E+00	2.112E+00
LDA - TOT	AllMYr	163,185	13,536,007	43%	1.261E-04	2.800E-04	2.750E-03	7.558E-06	1.026E-04	4.278E-05	7.527E-01	5.160E-01
LDT1 - TOT	AllMYr	26,778	2,141,909	7%	3.258E-04	7.184E-04	6.039E-03	8.779E-06	1.052E-04	4.516E-05	8.693E-01	6.211E-01
LDT2 - TOT	AllMYr	67,051	5,780,135	18%	1.812E-04	4.596E-04	3.647E-03	1.027E-05	1.027E-04	4.291E-05	1.022E+00	7.610E-01
LHD1 - TOT	AllMYr	24,363	1,460,006	5%	5.019E-04	4.935E-03	4.519E-03	1.353E-05	1.604E-04	7.567E-05	1.370E+00	1.233E+00
LHD2 - TOT	AllMYr	4,176	246,380	1%	2.969E-04	7.006E-03	2.332E-03	1.209E-05	2.275E-04	1.110E-04	1.247E+00	1.122E+00
MCY - TOT	AllMYr	14,011	324,876	1%	7.930E-03	2.985E-03	7.320E-02	5.315E-06	9.969E-05	4.000E-05	3.937E-01	3.543E-01
MDV - TOT	AllMYr	66,963	5,056,934	16%	3.299E-04	8.012E-04	5.659E-03	1.313E-05	1.032E-04	4.335E-05	1.306E+00	1.012E+00
MH - TOT	AllMYr	6,496	117,308	0%	1.532E-04	3.031E-03	4.156E-03	1.595E-05	1.953E-04	1.122E-04	1.607E+00	1.446E+00
Motor Coach - TOT	AllMYr	34	4,819	0%	4.410E-04	8.528E-03	3.207E-03	3.590E-05	5.649E-04	3.608E-04	3.763E+00	3.387E+00
OBUS - TOT	AllMYr	184	15,718	0%	1.684E-03	6.091E-03	2.627E-02	1.572E-05	9.995E-05	4.034E-05	1.529E+00	1.376E+00
PTO - TOT	AllMYr	0	5,607	0%	5.270E-04	1.616E-02	1.665E-03	4.516E-05	1.160E-04	1.067E-04	4.733E+00	4.260E+00
SBUS - TOT	AllMYr	445	17,957	0%	1.224E-03	1.950E-02	9.152E-03	2.728E-05	1.489E-03	6.896E-04	2.828E+00	2.545E+00
T6 Ag - TOT	AllMYr	36	1,210	0%	3.625E-04	7.204E-03	1.780E-03	2.257E-05	6.590E-04	4.474E-04	2.366E+00	2.129E+00
T6 CAIRP heavy - TOT	AllMYr	23	1,522	0%	1.305E-04	4.115E-03	9.505E-04	2.228E-05	4.486E-04	2.537E-04	2.335E+00	2.102E+00
T6 CAIRP small - TOT	AllMYr	72	5,204	0%	1.318E-04	2.248E-03	9.946E-04	2.217E-05	4.565E-04	2.611E-04	2.324E+00	2.091E+00
T6 instate construction heavy - TOT	AllMYr	250	12,804	0%	1.462E-04	8.210E-03	9.900E-04	2.252E-05	4.780E-04	2.808E-04	2.360E+00	2.124E+00
T6 instate construction small - TOT	AllMYr	490	31,836	0%	1.615E-04	3.281E-03	1.216E-03	2.225E-05	5.235E-04	3.227E-04	2.332E+00	2.099E+00
T6 instate heavy - TOT	AllMYr	516	27,360	0%	1.443E-04	7.416E-03	9.954E-04	2.248E-05	4.744E-04	2.775E-04	2.356E+00	2.120E+00
T6 instate small - TOT	AllMYr	1,081	71,686	0%	1.561E-04	3.080E-03	1.175E-03	2.223E-05	5.108E-04	3.110E-04	2.330E+00	2.097E+00
T6 OOS heavy - TOT	AllMYr	13	872	0%	1.305E-04	4.115E-03	9.505E-04	2.228E-05	4.486E-04	2.537E-04	2.335E+00	2.102E+00
T6 OOS small - TOT	AllMYr	41	2,984	0%	1.318E-04	2.248E-03	9.946E-04	2.217E-05	4.565E-04	2.611E-04	2.324E+00	2.091E+00
T6 public - TOT	AllMYr	143	2,547	0%	1.234E-04	1.047E-02	8.129E-04	2.318E-05	4.277E-04	2.345E-04	2.430E+00	2.187E+00
T6 utility - TOT	AllMYr	45	896	0%	1.151E-04	4.137E-03	9.214E-04	2.288E-05	4.142E-04	2.221E-04	2.398E+00	2.158E+00
T6TS - TOT	AllMYr	570	54,632	0%	9.015E-04	2.844E-03	1.398E-02	1.528E-05	9.994E-05	4.031E-05	1.506E+00	1.356E+00
T7 Ag - TOT	AllMYr	47	3,178	0%	6.787E-04	1.309E-02	3.969E-03	3.547E-05	7.128E-04	5.357E-04	3.718E+00	3.346E+00
T7 CAIRP - TOT	AllMYr	3,320	818,094	3%	5.796E-04	6.617E-03	4.074E-03	3.651E-05	4.868E-04	3.278E-04	3.827E+00	3.445E+00
T7 CAIRP construction - TOT	AllMYr	36	8,905	0%	5.791E-04	6.708E-03	4.068E-03	3.652E-05	4.869E-04	3.279E-04	3.827E+00	3.445E+00
T7 NNOOS - TOT	AllMYr	3,271	920,325	3%	5.747E-04	5.109E-03	3.945E-03	3.681E-05	4.360E-04	2.811E-04	3.858E+00	3.472E+00
T7 NOOS - TOT	AllMYr	1,209	297,929	1%	6.450E-04	6.971E-03	4.438E-03	3.712E-05	4.879E-04	3.288E-04	3.891E+00	3.501E+00
T7 other port - TOT	AllMYr	0	0	0%								
T7 POAK - TOT	AllMYr	0	0	0%								
T7 POLA - TOT	AllMYr	458	80,313	0%	8.534E-04	1.624E-02	6.639E-03	3.657E-05	6.305E-04	4.600E-04	3.833E+00	3.450E+00
T7 public - TOT	AllMYr	69	1,727	0%	5.719E-04	3.360E-02	3.074E-03	4.196E-05	4.172E-04	2.638E-04	4.398E+00	3.959E+00
T7 Single - TOT	AllMYr	311	23,407	0%	3.258E-04	1.247E-02	2.310E-03	3.552E-05	4.309E-04	2.763E-04	3.723E+00	3.351E+00
T7 single construction - TOT	AllMYr	309	23,035	0%	3.244E-04	1.287E-02	2.297E-03	3.554E-05	4.326E-04	2.779E-04	3.725E+00	3.352E+00
T7 SWCV - TOT	AllMYr	107	5,364	0%	4.961E-04	1.855E-02	3.024E-03	3.798E-05	3.983E-04	2.464E-04	3.981E+00	3.583E+00
T7 tractor - TOT	AllMYr	1,364	222,394	1%	3.721E-04	9.112E-03	2.849E-03	3.479E-05	4.934E-04	3.338E-04	3.647E+00	3.282E+00
T7 tractor construction - TOT	AllMYr	218	17,174	0%	4.352E-04	1.042E-02	3.179E-03	3.546E-05	4.967E-04	3.369E-04	3.717E+00	3.345E+00
T7 utility - TOT	AllMYr	22	555	0%	7.983E-04	1.470E-02	4.906E-03	4.147E-05	3.816E-04	2.310E-04	4.346E+00	3.912E+00
T7IS - TOT	AllMYr	51	12,974	0%	2.124E-03	1.831E-02	1.245E-01	1.685E-05	9.965E-05	4.001E-05	1.485E+00	1.337E+00
UBUS - TOT	AllMYr	150	35,937	0%	3.230E-03	1.600E-02	2.580E-02	3.372E-05	1.135E-03	5.602E-04	3.446E+00	3.101E+00
			31,397,224	100%								

San Bernardino MD 2012 Annual

Veh & Tech	MdlYr	Pop	VMT	Percent of VMT	Tons/Day ROG_TOTAL	NOx_TOTEX	CO_TOTEX	SOx_TOTEX	PM10_TOTAL	PM2_5_TOTAL	CO2_TOTEX	CO2_TOTEX (Pavley I + LCFS)
All Other Buses - TOT	AllMYr	68	3,851	0%	1.574E-03	3.722E-02	5.521E-03	4.384E-05	2.470E-03	1.966E-03	4.595E+00	4.572E+00
LDA - TOT	AllMYr	147,282	12,029,185	45%	2.506E+00	3.827E+00	4.013E+01	4.650E-02	6.276E-01	2.661E-01	4.590E+03	4.342E+03
LDT1 - TOT	AllMYr	23,861	1,881,893	7%	9.613E-01	1.546E+00	1.500E+01	8.512E-03	1.050E-01	4.761E-02	8.268E+02	7.801E+02
LDT2 - TOT	AllMYr	56,910	4,778,507	18%	1.221E+00	3.006E+00	2.192E+01	2.518E-02	2.506E-01	1.069E-01	2.485E+03	2.378E+03
LHD1 - TOT	AllMYr	19,804	1,200,102	4%	4.701E-01	5.427E+00	5.221E+00	8.296E-03	1.027E-01	5.119E-02	8.356E+02	8.314E+02
LHD2 - TOT	AllMYr	3,461	209,337	1%	5.269E-02	1.359E+00	4.941E-01	1.280E-03	2.546E-02	1.307E-02	1.316E+02	1.309E+02
MCY - TOT	AllMYr	11,630	262,666	1%	1.279E+00	4.192E-01	1.488E+01	7.227E-04	1.342E-02	5.506E-03	4.527E+01	4.504E+01
MDV - TOT	AllMYr	55,793	4,274,751	16%	1.208E+00	3.445E+00	2.286E+01	2.847E-02	2.234E-01	9.504E-02	2.813E+03	2.726E+03
MH - TOT	AllMYr	5,335	92,983	0%	2.575E-02	2.794E-01	1.144E+00	7.777E-04	1.108E-02	7.013E-03	7.680E+01	7.641E+01
Motor Coach - TOT	AllMYr	27	3,879	0%	2.277E-03	5.350E-02	1.132E-02	7.025E-05	3.084E-03	2.529E-03	7.364E+00	7.327E+00
OBUS - TOT	AllMYr	175	17,118	0%	1.812E-02	9.251E-02	3.564E-01	1.403E-04	8.684E-04	3.565E-04	1.344E+01	1.338E+01
PTO - TOT	AllMYr	0	4,152	0%	3.937E-03	6.702E-02	1.887E-02	9.342E-05	2.259E-03	2.079E-03	9.792E+00	9.743E+00
SBUS - TOT	AllMYr	382	15,994	0%	2.416E-02	1.921E-01	2.230E-01	2.196E-04	1.659E-02	9.745E-03	2.255E+01	2.243E+01
T6 Ag - TOT	AllMYr	34	1,158	0%	6.432E-04	1.184E-02	1.970E-03	1.333E-05	7.954E-04	6.397E-04	1.397E+00	1.390E+00
T6 CAIRP heavy - TOT	AllMYr	20	1,275	0%	2.983E-04	8.586E-03	1.260E-03	1.442E-05	5.783E-04	4.307E-04	1.512E+00	1.504E+00
T6 CAIRP small - TOT	AllMYr	61	4,267	0%	7.652E-04	2.172E-02	3.942E-03	4.819E-05	1.821E-03	1.337E-03	5.051E+00	5.026E+00
T6 instate construction heavy - TOT	AllMYr	129	6,741	0%	3.047E-03	6.923E-02	9.426E-03	7.647E-05	4.086E-03	3.224E-03	8.015E+00	7.975E+00
T6 instate construction small - TOT	AllMYr	275	17,420	0%	5.222E-03	1.283E-01	2.049E-02	1.968E-04	9.376E-03	7.242E-03	2.063E+01	2.053E+01
T6 instate heavy - TOT	AllMYr	394	20,804	0%	9.155E-03	2.076E-01	2.847E-02	2.359E-04	1.236E-02	9.717E-03	2.472E+01	2.460E+01
T6 instate small - TOT	AllMYr	853	54,677	0%	1.576E-02	3.861E-01	6.237E-02	6.174E-04	2.858E-02	2.195E-02	6.471E+01	6.439E+01
T6 OOS heavy - TOT	AllMYr	12	731	0%	1.710E-04	4.922E-03	7.222E-04	8.268E-06	3.315E-04	2.469E-04	8.666E-01	8.623E-01
T6 OOS small - TOT	AllMYr	35	2,446	0%	4.387E-04	1.246E-02	2.260E-03	2.763E-05	1.044E-03	7.662E-04	2.896E+00	2.881E+00
T6 public - TOT	AllMYr	114	2,030	0%	6.588E-04	2.049E-02	2.200E-03	2.369E-05	1.030E-03	7.861E-04	2.483E+00	2.471E+00
T6 utility - TOT	AllMYr	33	660	0%	1.008E-04	4.920E-03	4.694E-04	7.637E-06	2.563E-04	1.833E-04	8.005E-01	7.965E-01
T6TS - TOT	AllMYr	482	41,607	0%	5.971E-02	1.711E-01	9.252E-01	3.411E-04	2.194E-03	9.339E-04	3.257E+01	3.240E+01
T7 Ag - TOT	AllMYr	44	3,062	0%	2.719E-03	5.337E-02	1.080E-02	5.437E-05	2.816E-03	2.407E-03	5.699E+00	5.670E+00
T7 CAIRP - TOT	AllMYr	2,610	603,933	2%	3.390E-01	6.549E+00	1.984E+00	1.088E-02	4.886E-01	4.132E-01	1.140E+03	1.134E+03
T7 CAIRP construction - TOT	AllMYr	21	4,819	0%	2.732E-03	5.301E-02	1.597E-02	8.679E-05	3.952E-03	3.346E-03	9.097E+00	9.052E+00
T7 NNOOS - TOT	AllMYr	2,559	679,402	3%	2.901E-01	4.649E+00	1.819E+00	1.244E-02	3.527E-01	2.837E-01	1.304E+03	1.298E+03
T7 NOOS - TOT	AllMYr	951	219,937	1%	1.266E-01	2.406E+00	7.335E-01	4.000E-03	1.775E-01	1.501E-01	4.193E+02	4.172E+02
T7 other port - TOT	AllMYr	0	0	0%	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
T7 POAK - TOT	AllMYr	0	0	0%	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
T7 POLA - TOT	AllMYr	335	49,319	0%	1.662E-02	4.518E-01	1.256E-01	9.033E-04	1.833E-02	1.391E-02	9.468E+01	9.421E+01
T7 public - TOT	AllMYr	56	1,385	0%	1.802E-03	3.290E-02	6.761E-03	2.900E-05	1.197E-03	1.019E-03	3.040E+00	3.024E+00
T7 Single - TOT	AllMYr	238	17,280	0%	1.125E-02	2.755E-01	4.050E-02	3.034E-04	1.090E-02	8.993E-03	3.180E+01	3.164E+01
T7 single construction - TOT	AllMYr	173	12,467	0%	8.233E-03	2.022E-01	2.949E-02	2.189E-04	7.972E-03	6.585E-03	2.295E+01	2.283E+01
T7 SWCV - TOT	AllMYr	86	4,302	0%	8.177E-04	7.360E-02	4.150E-03	8.317E-05	9.031E-04	5.726E-04	8.718E+00	8.674E+00
T7 tractor - TOT	AllMYr	1,026	164,175	1%	1.224E-01	2.330E+00	5.493E-01	2.867E-03	1.435E-01	1.221E-01	3.005E+02	2.990E+02
T7 tractor construction - TOT	AllMYr	121	9,295	0%	7.657E-03	1.389E-01	3.301E-02	1.639E-04	8.285E-03	7.064E-03	1.718E+01	1.710E+01
T7 utility - TOT	AllMYr	17	411	0%	2.861E-04	7.387E-03	1.372E-03	8.549E-06	2.168E-04	1.747E-04	8.961E-01	8.916E-01
T7IS - TOT	AllMYr	45	9,010	0%	2.815E-02	1.265E-01	9.009E-01	8.427E-05	4.676E-04	1.954E-04	6.945E+00	6.910E+00
UBUS - TOT	AllMYr	125	29,964	0%	5.762E-02	2.967E-01	4.829E-01	5.167E-04	1.750E-02	8.843E-03	5.265E+01	5.239E+01
			26,736,996									

San Bernardino MD 2012 Annual

Veh & Tech	MdlYr	Pop	VMT	Percent of VMT
All Other Buses - TOT	AllMYr	68	3,851	0%
LDA - TOT	AllMYr	147,282	12,029,185	45%
LDT1 - TOT	AllMYr	23,861	1,881,893	7%
LDT2 - TOT	AllMYr	56,910	4,778,507	18%
LHD1 - TOT	AllMYr	19,804	1,200,102	4%
LHD2 - TOT	AllMYr	3,461	209,337	1%
MCY - TOT	AllMYr	11,630	262,666	1%
MDV - TOT	AllMYr	55,793	4,274,751	16%
MH - TOT	AllMYr	5,335	92,983	0%
Motor Coach - TOT	AllMYr	27	3,879	0%
OBUS - TOT	AllMYr	175	17,118	0%
PTO - TOT	AllMYr	0	4,152	0%
SBUS - TOT	AllMYr	382	15,994	0%
T6 Ag - TOT	AllMYr	34	1,158	0%
T6 CAIRP heavy - TOT	AllMYr	20	1,275	0%
T6 CAIRP small - TOT	AllMYr	61	4,267	0%
T6 instate construction heavy - TOT	AllMYr	129	6,741	0%
T6 instate construction small - TOT	AllMYr	275	17,420	0%
T6 instate heavy - TOT	AllMYr	394	20,804	0%
T6 instate small - TOT	AllMYr	853	54,677	0%
T6 OOS heavy - TOT	AllMYr	12	731	0%
T6 OOS small - TOT	AllMYr	35	2,446	0%
T6 public - TOT	AllMYr	114	2,030	0%
T6 utility - TOT	AllMYr	33	660	0%
T6TS - TOT	AllMYr	482	41,607	0%
T7 Ag - TOT	AllMYr	44	3,062	0%
T7 CAIRP - TOT	AllMYr	2,610	603,933	2%
T7 CAIRP construction - TOT	AllMYr	21	4,819	0%
T7 NNOOS - TOT	AllMYr	2,559	679,402	3%
T7 NOOS - TOT	AllMYr	951	219,937	1%
T7 other port - TOT	AllMYr	0	0	0%
T7 POAK - TOT	AllMYr	0	0	0%
T7 POLA - TOT	AllMYr	335	49,319	0%
T7 public - TOT	AllMYr	56	1,385	0%
T7 Single - TOT	AllMYr	238	17,280	0%
T7 single construction - TOT	AllMYr	173	12,467	0%
T7 SWCV - TOT	AllMYr	86	4,302	0%
T7 tractor - TOT	AllMYr	1,026	164,175	1%
T7 tractor construction - TOT	AllMYr	121	9,295	0%
T7 utility - TOT	AllMYr	17	411	0%
T7IS - TOT	AllMYr	45	9,010	0%
UBUS - TOT	AllMYr	125	29,964	0%
			26,736,996	

San Bernardino MD 2012 Annual				#####	MTons/Mile							
Veh & Tech	MdlYr	Pop	VMT	Percent of VMT	ROG_TOTAL	NOx_TOTEX	CO_TOTEX	SOx_TOTEX	PM10_TOTAL	PM2_5_TOTAL	CO2_TOTEX	CO2_TOTEX (Pavley I + LCFS)
All Other Buses - TOT	AllMYr	68	3,851	0%	3.709E-07	8.769E-06	1.301E-06	1.033E-08	5.818E-07	4.632E-07	1.083E-03	1.077E-03
LDA - TOT	AllMYr	147,282	12,029,185	45%	1.890E-07	2.886E-07	3.026E-06	3.507E-09	4.733E-08	2.007E-08	3.461E-04	3.274E-04
LDT1 - TOT	AllMYr	23,861	1,881,893	7%	4.634E-07	7.451E-07	7.231E-06	4.103E-09	5.059E-08	2.295E-08	3.986E-04	3.761E-04
LDT2 - TOT	AllMYr	56,910	4,778,507	18%	2.317E-07	5.706E-07	4.161E-06	4.781E-09	4.758E-08	2.030E-08	4.718E-04	4.514E-04
LHD1 - TOT	AllMYr	19,804	1,200,102	4%	3.554E-07	4.102E-06	3.947E-06	6.271E-09	7.766E-08	3.870E-08	6.316E-04	6.285E-04
LHD2 - TOT	AllMYr	3,461	209,337	1%	2.283E-07	5.887E-06	2.141E-06	5.546E-09	1.103E-07	5.664E-08	5.702E-04	5.674E-04
MCY - TOT	AllMYr	11,630	262,666	1%	4.418E-06	1.448E-06	5.138E-05	2.496E-09	4.635E-08	1.902E-08	1.563E-04	1.556E-04
MDV - TOT	AllMYr	55,793	4,274,751	16%	2.564E-07	7.312E-07	4.852E-06	6.043E-09	4.740E-08	2.017E-08	5.971E-04	5.785E-04
MH - TOT	AllMYr	5,335	92,983	0%	2.512E-07	2.726E-06	1.116E-05	7.588E-09	1.081E-07	6.842E-08	7.493E-04	7.455E-04
Motor Coach - TOT	AllMYr	27	3,879	0%	5.324E-07	1.251E-05	2.648E-06	1.643E-08	7.212E-07	5.914E-07	1.722E-03	1.713E-03
OBUS - TOT	AllMYr	175	17,118	0%	9.601E-07	4.903E-06	1.889E-05	7.437E-09	4.602E-08	1.889E-08	7.125E-04	7.090E-04
PTO - TOT	AllMYr	0	4,152	0%	8.604E-07	1.464E-05	4.122E-06	2.041E-08	4.937E-07	4.542E-07	2.140E-03	2.129E-03
SBUS - TOT	AllMYr	382	15,994	0%	1.370E-06	1.089E-05	1.265E-05	1.246E-08	9.411E-07	5.527E-07	1.279E-03	1.272E-03
T6 Ag - TOT	AllMYr	34	1,158	0%	5.038E-07	9.276E-06	1.543E-06	1.044E-08	6.229E-07	5.010E-07	1.094E-03	1.088E-03
T6 CAIRP heavy - TOT	AllMYr	20	1,275	0%	2.123E-07	6.109E-06	8.963E-07	1.026E-08	4.115E-07	3.065E-07	1.076E-03	1.070E-03
T6 CAIRP small - TOT	AllMYr	61	4,267	0%	1.627E-07	4.619E-06	8.382E-07	1.024E-08	3.872E-07	2.841E-07	1.074E-03	1.068E-03
T6 instate construction heavy - TOT	AllMYr	129	6,741	0%	4.101E-07	9.318E-06	1.269E-06	1.029E-08	5.499E-07	4.338E-07	1.079E-03	1.073E-03
T6 instate construction small - TOT	AllMYr	275	17,420	0%	2.720E-07	6.684E-06	1.067E-06	1.025E-08	4.883E-07	3.771E-07	1.074E-03	1.069E-03
T6 instate heavy - TOT	AllMYr	394	20,804	0%	3.992E-07	9.053E-06	1.242E-06	1.029E-08	5.390E-07	4.237E-07	1.078E-03	1.073E-03
T6 instate small - TOT	AllMYr	853	54,677	0%	2.615E-07	6.405E-06	1.035E-06	1.024E-08	4.742E-07	3.642E-07	1.074E-03	1.068E-03
T6 OOS heavy - TOT	AllMYr	12	731	0%	2.123E-07	6.109E-06	8.963E-07	1.026E-08	4.115E-07	3.065E-07	1.076E-03	1.070E-03
T6 OOS small - TOT	AllMYr	35	2,446	0%	1.627E-07	4.619E-06	8.382E-07	1.024E-08	3.872E-07	2.841E-07	1.074E-03	1.068E-03
T6 public - TOT	AllMYr	114	2,030	0%	2.945E-07	9.158E-06	9.831E-07	1.059E-08	4.603E-07	3.514E-07	1.110E-03	1.104E-03
T6 utility - TOT	AllMYr	33	660	0%	1.385E-07	6.761E-06	6.450E-07	1.049E-08	3.522E-07	2.519E-07	1.100E-03	1.095E-03
T6TS - TOT	AllMYr	482	41,607	0%	1.302E-06	3.730E-06	2.017E-05	7.436E-09	4.784E-08	2.036E-08	7.101E-04	7.065E-04
T7 Ag - TOT	AllMYr	44	3,062	0%	8.055E-07	1.581E-05	3.200E-06	1.611E-08	8.344E-07	7.132E-07	1.688E-03	1.680E-03
T7 CAIRP - TOT	AllMYr	2,610	603,933	2%	5.092E-07	9.837E-06	2.981E-06	1.634E-08	7.339E-07	6.207E-07	1.713E-03	1.704E-03
T7 CAIRP construction - TOT	AllMYr	21	4,819	0%	5.143E-07	9.979E-06	3.007E-06	1.634E-08	7.438E-07	6.299E-07	1.712E-03	1.704E-03
T7 NNOOS - TOT	AllMYr	2,559	679,402	3%	3.874E-07	6.208E-06	2.428E-06	1.661E-08	4.710E-07	3.788E-07	1.741E-03	1.733E-03
T7 NOOS - TOT	AllMYr	951	219,937	1%	5.223E-07	9.924E-06	3.025E-06	1.650E-08	7.322E-07	6.192E-07	1.729E-03	1.721E-03
T7 other port - TOT	AllMYr	0	0	0%								
T7 POAK - TOT	AllMYr	0	0	0%								
T7 POLA - TOT	AllMYr	335	49,319	0%	3.056E-07	8.310E-06	2.311E-06	1.662E-08	3.372E-07	2.558E-07	1.742E-03	1.733E-03
T7 public - TOT	AllMYr	56	1,385	0%	1.180E-06	2.156E-05	4.429E-06	1.900E-08	7.845E-07	6.672E-07	1.991E-03	1.981E-03
T7 Single - TOT	AllMYr	238	17,280	0%	5.907E-07	1.446E-05	2.126E-06	1.593E-08	5.724E-07	4.721E-07	1.670E-03	1.661E-03
T7 single construction - TOT	AllMYr	173	12,467	0%	5.991E-07	1.471E-05	2.146E-06	1.593E-08	5.801E-07	4.792E-07	1.670E-03	1.661E-03
T7 SWCV - TOT	AllMYr	86	4,302	0%	1.724E-07	1.552E-05	8.752E-07	1.754E-08	1.905E-07	1.208E-07	1.838E-03	1.829E-03
T7 tractor - TOT	AllMYr	1,026	164,175	1%	6.765E-07	1.287E-05	3.035E-06	1.584E-08	7.928E-07	6.749E-07	1.660E-03	1.652E-03
T7 tractor construction - TOT	AllMYr	121	9,295	0%	7.473E-07	1.356E-05	3.222E-06	1.600E-08	8.086E-07	6.894E-07	1.677E-03	1.669E-03
T7 utility - TOT	AllMYr	17	411	0%	6.310E-07	1.629E-05	3.027E-06	1.886E-08	4.781E-07	3.854E-07	1.976E-03	1.967E-03
T7IS - TOT	AllMYr	45	9,010	0%	2.834E-06	1.273E-05	9.071E-05	8.485E-09	4.708E-08	1.968E-08	6.993E-04	6.958E-04
UBUS - TOT	AllMYr	125	29,964	0%	1.744E-06	8.984E-06	1.462E-05	1.564E-08	5.297E-07	2.677E-07	1.594E-03	1.586E-03
			26,736,996									

San Bernardino MD 2012 Annual				#######	lbs/Mile							
Veh & Tech	MdlYr	Pop	VMT	Percent of VMT	ROG_TOTAL	NOx_TOTEX	CO_TOTEX	SOx_TOTEX	PM10_TOTAL	PM2_5_TOTAL	CO2_TOTEX	CO2_TOTEX (Pavley I + LCFS)
All Other Buses - TOT	AllMYr	68	3,851	0%	8.176E-04	1.933E-02	2.867E-03	2.277E-05	1.283E-03	1.021E-03	2.387E+00	2.375E+00
LDA - TOT	AllMYr	147,282	12,029,185	45%	4.166E-04	6.363E-04	6.671E-03	7.731E-06	1.044E-04	4.424E-05	7.631E-01	7.218E-01
LDT1 - TOT	AllMYr	23,861	1,881,893	7%	1.022E-03	1.643E-03	1.594E-02	9.046E-06	1.115E-04	5.060E-05	8.787E-01	8.291E-01
LDT2 - TOT	AllMYr	56,910	4,778,507	18%	5.108E-04	1.258E-03	9.174E-03	1.054E-05	1.049E-04	4.475E-05	1.040E+00	9.952E-01
LHD1 - TOT	AllMYr	19,804	1,200,102	4%	7.834E-04	9.044E-03	8.701E-03	1.383E-05	1.712E-04	8.532E-05	1.392E+00	1.386E+00
LHD2 - TOT	AllMYr	3,461	209,337	1%	5.034E-04	1.298E-02	4.721E-03	1.223E-05	2.432E-04	1.249E-04	1.257E+00	1.251E+00
MCY - TOT	AllMYr	11,630	262,666	1%	9.741E-03	3.192E-03	1.133E-01	5.503E-06	1.022E-04	4.192E-05	3.447E-01	3.430E-01
MDV - TOT	AllMYr	55,793	4,274,751	16%	5.653E-04	1.612E-03	1.070E-02	1.332E-05	1.045E-04	4.447E-05	1.316E+00	1.275E+00
MH - TOT	AllMYr	5,335	92,983	0%	5.538E-04	6.010E-03	2.461E-02	1.673E-05	2.382E-04	1.508E-04	1.652E+00	1.644E+00
Motor Coach - TOT	AllMYr	27	3,879	0%	1.174E-03	2.758E-02	5.838E-03	3.622E-05	1.590E-03	1.304E-03	3.796E+00	3.777E+00
OBUS - TOT	AllMYr	175	17,118	0%	2.117E-03	1.081E-02	4.165E-02	1.639E-05	1.015E-04	4.165E-05	1.571E+00	1.563E+00
PTO - TOT	AllMYr	0	4,152	0%	1.897E-03	3.228E-02	9.088E-03	4.500E-05	1.088E-03	1.001E-03	4.717E+00	4.694E+00
SBUS - TOT	AllMYr	382	15,994	0%	3.021E-03	2.402E-02	2.789E-02	2.746E-05	2.075E-03	1.219E-03	2.819E+00	2.805E+00
T6 Ag - TOT	AllMYr	34	1,158	0%	1.111E-03	2.045E-02	3.401E-03	2.301E-05	1.373E-03	1.104E-03	2.412E+00	2.400E+00
T6 CAIRP heavy - TOT	AllMYr	20	1,275	0%	4.680E-04	1.347E-02	1.976E-03	2.262E-05	9.071E-04	6.756E-04	2.371E+00	2.359E+00
T6 CAIRP small - TOT	AllMYr	61	4,267	0%	3.587E-04	1.018E-02	1.848E-03	2.259E-05	8.537E-04	6.264E-04	2.367E+00	2.356E+00
T6 instate construction heavy - TOT	AllMYr	129	6,741	0%	9.042E-04	2.054E-02	2.797E-03	2.269E-05	1.212E-03	9.564E-04	2.378E+00	2.366E+00
T6 instate construction small - TOT	AllMYr	275	17,420	0%	5.996E-04	1.474E-02	2.353E-03	2.260E-05	1.076E-03	8.314E-04	2.369E+00	2.357E+00
T6 instate heavy - TOT	AllMYr	394	20,804	0%	8.801E-04	1.996E-02	2.737E-03	2.267E-05	1.188E-03	9.342E-04	2.377E+00	2.365E+00
T6 instate small - TOT	AllMYr	853	54,677	0%	5.764E-04	1.412E-02	2.281E-03	2.258E-05	1.045E-03	8.028E-04	2.367E+00	2.355E+00
T6 OOS heavy - TOT	AllMYr	12	731	0%	4.680E-04	1.347E-02	1.976E-03	2.262E-05	9.071E-04	6.756E-04	2.371E+00	2.359E+00
T6 OOS small - TOT	AllMYr	35	2,446	0%	3.587E-04	1.018E-02	1.848E-03	2.259E-05	8.537E-04	6.264E-04	2.367E+00	2.356E+00
T6 public - TOT	AllMYr	114	2,030	0%	6.492E-04	2.019E-02	2.167E-03	2.334E-05	1.015E-03	7.746E-04	2.447E+00	2.435E+00
T6 utility - TOT	AllMYr	33	660	0%	3.053E-04	1.491E-02	1.422E-03	2.314E-05	7.765E-04	5.554E-04	2.425E+00	2.413E+00
T6TS - TOT	AllMYr	482	41,607	0%	2.870E-03	8.224E-03	4.447E-02	1.639E-05	1.055E-04	4.489E-05	1.565E+00	1.558E+00
T7 Ag - TOT	AllMYr	44	3,062	0%	1.776E-03	3.486E-02	7.055E-03	3.551E-05	1.839E-03	1.572E-03	3.722E+00	3.703E+00
T7 CAIRP - TOT	AllMYr	2,610	603,933	2%	1.123E-03	2.169E-02	6.572E-03	3.602E-05	1.618E-03	1.368E-03	3.776E+00	3.757E+00
T7 CAIRP construction - TOT	AllMYr	21	4,819	0%	1.134E-03	2.200E-02	6.628E-03	3.602E-05	1.640E-03	1.389E-03	3.775E+00	3.756E+00
T7 NNOOS - TOT	AllMYr	2,559	679,402	3%	8.540E-04	1.369E-02	5.353E-03	3.663E-05	1.038E-03	8.352E-04	3.839E+00	3.820E+00
T7 NOOS - TOT	AllMYr	951	219,937	1%	1.152E-03	2.188E-02	6.670E-03	3.637E-05	1.614E-03	1.365E-03	3.813E+00	3.794E+00
T7 other port - TOT	AllMYr	0	0	0%								
T7 POAK - TOT	AllMYr	0	0	0%								
T7 POLA - TOT	AllMYr	335	49,319	0%	6.738E-04	1.832E-02	5.095E-03	3.663E-05	7.435E-04	5.639E-04	3.839E+00	3.820E+00
T7 public - TOT	AllMYr	56	1,385	0%	2.602E-03	4.752E-02	9.764E-03	4.188E-05	1.729E-03	1.471E-03	4.390E+00	4.368E+00
T7 Single - TOT	AllMYr	238	17,280	0%	1.302E-03	3.188E-02	4.688E-03	3.512E-05	1.262E-03	1.041E-03	3.681E+00	3.663E+00
T7 single construction - TOT	AllMYr	173	12,467	0%	1.321E-03	3.244E-02	4.731E-03	3.512E-05	1.279E-03	1.056E-03	3.681E+00	3.663E+00
T7 SWCV - TOT	AllMYr	86	4,302	0%	3.802E-04	3.422E-02	1.930E-03	3.867E-05	4.199E-04	2.662E-04	4.053E+00	4.033E+00
T7 tractor - TOT	AllMYr	1,026	164,175	1%	1.491E-03	2.838E-02	6.691E-03	3.492E-05	1.748E-03	1.488E-03	3.661E+00	3.642E+00
T7 tractor construction - TOT	AllMYr	121	9,295	0%	1.647E-03	2.989E-02	7.103E-03	3.527E-05	1.783E-03	1.520E-03	3.697E+00	3.679E+00
T7 utility - TOT	AllMYr	17	411	0%	1.391E-03	3.592E-02	6.673E-03	4.157E-05	1.054E-03	8.497E-04	4.357E+00	4.336E+00
T7IS - TOT	AllMYr	45	9,010	0%	6.248E-03	2.807E-02	2.000E-01	1.871E-05	1.038E-04	4.338E-05	1.542E+00	1.534E+00
UBUS - TOT	AllMYr	125	29,964	0%	3.846E-03	1.981E-02	3.223E-02	3.449E-05	1.168E-03	5.903E-04	3.514E+00	3.497E+00
			26,736,996									

Area Sources - Criteria Air Pollutants

2012	ROG Exhaust	NO_x Exhaust	CO Exhaust	SO_2 Exhaust	PM_{10} Exhaust	$PM_{2.5}$ Exhaust*
			lbs/day			
Construction Equipment	10	77	54	0	4	4
Lawn & Garden Equipment	9	2	105	0	0	0
Light Commercial Equipment	2	5	57	0	0	0
TOTAL	21	84	217	0	5	5

2020	ROG Exhaust	NO_x Exhaust	CO Exhaust	SO2 Exhaust	PM10 Exhaust	PM2.5 Exhaust*
			lbs/day			
Construction Equipment	10	77	54	0	4	4
Lawn & Garden Equipment	9	2	111	0	0	0
Light Commercial Equipment	2	5	61	0	1	1
TOTAL	22	84	227	0	5	5

2035	ROG Exhaust	NO_x Exhaust	CO Exhaust	SO2 Exhaust	PM10 Exhaust	PM2.5 Exhaust*
			lbs/day			
Construction Equipment	10	77	54	0	4	4
Lawn & Garden Equipment	10	3	123	0	0	0
Light Commercial Equipment	3	5	68	0	1	1
TOTAL	23	85	245	0	5	5

P-2035	ROG Exhaust	NO_x Exhaust	CO Exhaust	SO2 Exhaust	PM10 Exhaust	PM2.5 Exhaust*
			lbs/day			
Construction Equipment	10	77	54	0	4	4
Lawn & Garden Equipment	25	7	303	0	1	1
Light Commercial Equipment	11	22	267	0	2	2
TOTAL	45	105	624	0	7	7

* assumes PM2.5 is 99 percent of PM10

Sources

Building Permits

Source: U.S. Census Bureau

http://censtats.census.gov/cgi-bin/bldgprmt/bldgdisp.pl

Employment

Source. U.S. Census Bureau. 2010. Longitudinal Employer-Household Dynamics.

Population

Source. U.S. Census Bureau, 2010.

Other Emissions Sources - Off-road Equipment

Source: OFFROAD2007. Based on equipment use in San Bernardino County.

Year 2012 BAU	2012 MTons of CO_2e	Notes
Light Commercial Equipment	88	Based on the percentage of residential building permits issued in Yucca Valley compared to San Bernardino County.
Lawn & Garden Equipment	70	Based on the percentage of residential units in Yucca Valley compared to San Bernardino County.
Construction Equipment	1,315	Based on the percentage of employment in Yucca Valley compared to San Bernardino County.
TOTAL	1,472	

Year 2020 BAU	2020 MTons of CO_2e	Notes
Light Commercial Equipment	94	proportional to employment growth
Lawn & Garden Equipment	74	proportional to population growth
Construction Equipment	1,315	similar to historic
TOTAL	1,482	

Year 2035 BAU	2035 MTons of CO_2e	Notes
Light Commercial Equipment	105	proportional to employment growth
Lawn & Garden Equipment	81	proportional to population growth
Construction Equipment	1,315	similar to historic
TOTAL	1,500	

Year P-2035 BAU	P-2035 MTons of CO_2e	Notes
Light Commercial Equipment	411	proportional to employment growth
Lawn & Garden Equipment	200	proportional to population growth
Construction Equipment	1,315	similar to historic
TOTAL	1,926	

Other Emissions Sources - Off-road Equipment

Source: OFFROAD2007. Based on equipment use in San Bernardino County.

Adjusted Business as Usual - Low Carbon Fuel Standard

On December 29, 2011, the U.S. District Court for the Eastern District of California issued several rulings in the federal lawsuits challenging the LCFS. One of the court's rulings preliminarily enjoins the CARB from enforcing the regulation during the pendency of the litigation. In January 2012, CARB appealed the decision and on April 23, 2012, the Night Circuit Court granted CARB's motion for a stay of the injunction while it continues to consider CARB's appeal of the lower court's decision.

Year 2020 Adjusted	2020 MTons of CO_2e	Notes
Light Commercial Equipment	84	With LCFS (10% reduction)
Lawn & Garden Equipment	66	With LCFS (10% reduction)
Construction Equipment	1,183	With LCFS (10% reduction)
TOTAL	1,334	
reduction	148	

Year 2035 Adjusted	2035 MTons of CO_2e	Notes
Light Commercial Equipment	94	With LCFS (10% reduction)
Lawn & Garden Equipment	73	With LCFS (10% reduction)
Construction Equipment	1,183	With LCFS (10% reduction)
TOTAL	1,350	
reduction	150	

Year P-2035 Adjusted	P-2035 MTons of CO_2e	Notes
Light Commercial Equipment	370	With LCFS (10% reduction)
Lawn & Garden Equipment	180	With LCFS (10% reduction)
Construction Equipment	1,183	With LCFS (10% reduction)
TOTAL	1,733	
reduction	193	

Sources

Building Permits

Source: U.S. Census Bureau

http://censtats.census.gov/cgi-bin/bldgprmt/bldgdisp.pl

Employment

Source. U.S. Census Bureau. 2010. Longitudinal Employer-Household Dynamics. http://lehd.ces.census.gov/

Population

Source. U.S. Census Bureau, 2010.

People QuickFacts	San Bernardino County	California
Population, 2012 estimate	2,081,313	38,041,430
Population, 2010 (April 1) estimates base	2,035,210	37,253,956
Population, percent change, April 1, 2010 to July 1, 2012	2.3%	2.1%
Population, 2010	2,035,210	37,253,956
Persons under 5 years, percent, 2011	7.7%	6.7%
Persons under 18 years, percent, 2011	28.7%	24.6%
Persons 65 years and over, percent, 2011	9.1%	11.7%
Female persons, percent, 2011	50.3%	50.3%
White persons, percent, 2011 (a)	77.7%	74.0%
Black persons, percent, 2011 (a)	9.6%	6.6%
American Indian and Alaska Native persons, percent, 2011 (a)	2.0%	1.7%
Asian persons, percent, 2011 (a)	6.9%	13.6%
Native Hawaiian and Other Pacific Islander persons, percent, 2011 (a)	0.5%	0.5%
Persons reporting two or more races, percent, 2011	3.3%	3.6%
Persons of Hispanic or Latino Origin, percent, 2011 (b)	49.9%	38.1%
White persons not Hispanic, percent, 2011	32.7%	39.7%
Living in same house 1 year & over, percent, 2007-2011	82.6%	84.2%
Foreign born persons, percent, 2007-2011	21.4%	27.2%
Language other than English spoken at home, percent age 5+, 2007-2011	40.9%	43.2%
High school graduate or higher, percent of persons age 25+, 2007-2011	77.8%	80.8%
Bachelor's degree or higher, percent of persons age 25+, 2007-2011	18.6%	30.2%
Veterans, 2007-2011	112,983	1,997,566
Mean travel time to work (minutes), workers age 16+, 2007-2011	29.5	27
Housing units, 2011	702,060	13,720,462
Homeownership rate, 2007-2011	64.2%	56.7%
Housing units in multi-unit structures, percent, 2007-2011	19.2%	30.8%
Median value of owner-occupied housing units, 2007-2011	$278,400	$421,600
Households, 2007-2011	598,822	12,433,172
Persons per household, 2007-2011	3.3	2.91
Per capita money income in the past 12 months (2011 dollars), 2007-2011	$21,932	$29,634
Median household income, 2007-2011	$55,853	$61,632
Persons below poverty level, percent, 2007-2011	16.0%	14.4%
Business QuickFacts	San Bernardino County	California
Private nonfarm establishments, 2010	31,478	849,875
Private nonfarm employment, 2010	501,018	12,536,402
Private nonfarm employment, percent change, 2000-2010	7.6	-2.7
Nonemployer establishments, 2010	130,532	2,814,409
Total number of firms, 2007	151,888	3,425,510
Black-owned firms, percent, 2007	7.9%	4.0%
American Indian- and Alaska Native-owned firms, percent, 2007	S	1.3%
Asian-owned firms, percent, 2007	11.5%	14.9%
Native Hawaiian and Other Pacific Islander-owned firms, percent, 2007	0.3%	0.3%
Hispanic-owned firms, percent, 2007	27.7%	16.5%
Women-owned firms, percent, 2007	30.6%	30.3%
Manufacturers shipments, 2007 ($1000)	18,907,342	491,372,092
Merchant wholesaler sales, 2007 ($1000)	27,579,924	598,456,486
Retail sales, 2007 ($1000)	21,717,402	455,032,270
Retail sales per capita, 2007	$10,897	$12,561
Accommodation and food services sales, 2007 ($1000)	2,754,662	80,852,787
Building permits, 2011	1,472	45,471
Geography QuickFacts	San Bernardino County	California
Land area in square miles, 2010	20,056.94	155,779.22
Persons per square mile, 2010	101.5	239.1
FIPS Code	71	6
Metropolitan or Micropolitan Statistical Area	Riverside-San Bernardino-Ontario, CA Metro Are	
	(a) Includes persons reporting only one race.	
	(b) Hispanics may be of any race, so also are included in applicable race categories.	
	FN: Footnote on this item for this area in place of data	
	NA: Not available	
	D: Suppressed to avoid disclosure of confidential information	
	X: Not applicable	
	S: Suppressed; does not meet publication standards	
	Z: Value greater than zero but less than half unit of measure shown	
	F: Fewer than 100 firms	
	Source: US Census Bureau State & County QuickFacts	

QWI Quick Facts	San Bernardino (Q1)	San Bernardino (Avg:Selected + 3 Prior qtrs)	California (Q1)	California (Avg:Selected + 3 Prior qtrs)
Total_Employment	612,543	600,939	14,228,431	14,291,645
Net_Job_Flows	-1,273	8,421	120,216	155,781
Job_Creation	25,759	31,899	672,248	754,897
New_Hires	76,693	87,331	1,795,434	2,066,051
Separations	89,377	94,723	2,049,129	2,391,186
Turnover	8.40%	8.50%	7.70%	8.10%
Avg_Monthly_Earnings	$3,569.00	$3,568.25	$4,839.00	$4,636.00
Avg_New_Hire_Earnings	$2,008.00	$2,179.00	$2,667.00	$2,825.00

Building Permits
2007 Building Permits
Monthly New Privately-Owned Residential Building Permits
San Bernardino County California (071)

	Estimates with Imputation			Reported Only		
Item	Buildings	Units	Construction cost	Buildings	Units	Construction cost
Single Family	6,302	6,302	$1,211,200,704	6,113	6,113	$1,175,655,678
Two Family	32	64	$4,602,012	30	60	$4,358,888
Three and Four Family	91	329	$34,434,932	91	329	$34,434,932
Five or More Family	79	1,057	$72,961,988	79	1,057	$72,961,988
Total	6,504	7,752	$1,323,199,636	6,313	7,559	$1,287,411,486

Source: U.S. Census Bureau

Building Permits
2008 Building Permits
Monthly New Privately-Owned Residential Building Permits
San Bernardino County California (071)

	Estimates with Imputation			Reported Only		
Item	Buildings	Units	Construction cost	Buildings	Units	Construction cost
Single Family	1,976	1,976	$355,425,538	1,953	1,953	$352,669,939
Two Family	12	24	$2,963,864	11	22	$2,831,691
Three and Four Family	26	99	$11,347,785	26	99	$11,347,785
Five or More Family	89	1,084	$94,956,296	89	1,084	$94,956,296
Total	2,103	3,183	$464,693,483	2,079	3,158	$461,805,711

Source: U.S. Census Bureau

Building Permits
2009 Building Permits
Monthly New Privately-Owned Residential Building Permits
San Bernardino County California (071)

	Estimates with Imputation			Reported Only		
Item	Buildings	Units	Construction cost	Buildings	Units	Construction cost
Single Family	1,481	1,481	$294,026,651	1,438	1,438	$287,904,952
Two Family	4	8	$1,141,741	4	8	$1,141,741
Three and Four Family	2	7	$981,201	2	7	$981,201
Five or More Family	56	767	$77,553,099	53	742	$75,744,774
Total	1,543	2,263	$373,702,692	1,497	2,195	$365,772,668

Source: U.S. Census Bureau

Building Permits
2010 Building Permits
Monthly New Privately-Owned Residential Building Permits
San Bernardino C California (071)

	Estimates with Imputation			Reported Only		
Item	Buildings	Units	Construction cost	Buildings	Units	Construction cost
Single Family	1,260	1,260	$231,453,388	1,216	1,216	225,073,494.00
Two Family	11	22	$2,575,944	11	22	2,575,944.00
Three and Four F	29	96	$9,553,723	29	96	9,553,723.00
Five or More Fam	30	411	$39,259,361	30	411	39,259,361.00
Total	1,330	1,789	$282,842,416	1,286	1,745	276,462,522.00

Source: U.S. Census Bureau

Building Permits
2011 Building Permits
Monthly New Privately-Owned Residential Building Permits
San Bernardino County California (071)

	Estimates with Imputation			Reported Only		
Item	Buildings	Units	Construction cost	Buildings	Units	Construction cost
Single Family	1,103	1,103	$223,217,374	1,060	1,060	$216,757,647
Two Family	10	20	$2,871,004	10	20	$2,871,004
Three and Four Family	9	27	$5,594,946	9	27	$5,594,946
Five or More Family	28	322	$32,450,079	27	317	$32,088,414
Total	1,150	1,472	$264,133,403	1,106	1,424	$257,312,011

Source: U.S. Census Bureau

People QuickFacts	Yucca Valley	California
Population, 2011 estimate	21,009	37,683,933
Population, 2010 (April 1) estimates base	20,700	37,253,956
Population, percent change, April 1, 2010 to July 1, 2011	1.5%	1.2%
Population, 2010	20,700	37,253,956
Persons under 5 years, percent, 2010	6.4%	6.8%
Persons under 18 years, percent, 2010	23.9%	25.0%
Persons 65 years and over, percent, 2010	18.5%	11.4%
Female persons, percent, 2010	51.4%	50.3%
White persons, percent, 2010 (a)	83.5%	57.6%
Black persons, percent, 2010 (a)	3.2%	6.2%
American Indian and Alaska Native persons, percent, 2010 (a)	1.1%	1.0%
Asian persons, percent, 2010 (a)	2.3%	13.0%
Native Hawaiian and Other Pacific Islander, percent, 2010 (a)	0.2%	0.4%
Persons reporting two or more races, percent, 2010	4.0%	4.9%
Persons of Hispanic or Latino origin, percent, 2010 (b)	17.8%	37.6%
White persons not Hispanic, percent, 2010	73.7%	40.1%
Living in same house 1 year & over, percent, 2007-2011	79.6%	84.2%
Foreign born persons, percent, 2007-2011	6.8%	27.2%
Language other than English spoken at home, percent age 5+, 2007-2011	10.7%	43.2%
High school graduate or higher, percent of persons age 25+, 2007-2011	86.0%	80.8%
Bachelor's degree or higher, percent of persons age 25+, 2007-2011	16.7%	30.2%
Veterans, 2007-2011	2,378	1,997,566
Mean travel time to work (minutes), workers age 16+, 2007-2011	26.3	27
Housing units, 2010	9,558	13,680,081
Homeownership rate, 2007-2011	63.1%	56.7%
Housing units in multi-unit structures, percent, 2007-2011	11.9%	30.8%
Median value of owner-occupied housing units, 2007-2011	$183,300	$421,600
Households, 2007-2011	7,957	12,433,172
Persons per household, 2007-2011	2.54	2.91
Per capita money income in the past 12 months (2011 dollars), 2007-2011	$21,990	$29,634
Median household income, 2007-2011	$45,502	$61,632
Persons below poverty level, percent, 2007-2011	15.5%	14.4%
Business QuickFacts	Yucca Valley	California
Total number of firms, 2007	2,356	3,425,510
Black-owned firms, percent, 2007	S	4.0%
American Indian- and Alaska Native-owned firms, percent, 2007	S	1.3%
Asian-owned firms, percent, 2007	S	14.9%
Native Hawaiian and Other Pacific Islander-owned firms, percent, 2007	F	0.3%
Hispanic-owned firms, percent, 2007	S	16.5%
Women-owned firms, percent, 2007	F	30.3%
Manufacturers shipments, 2007 ($1000)	NA	491,372,092
Merchant wholesaler sales, 2007 ($1000)	D	598,456,486
Retail sales, 2007 ($1000)	319,230	455,032,270
Retail sales per capita, 2007	$15,818	$12,561
Accommodation and food services sales, 2007 ($1000)	29,671	80,852,787
Geography QuickFacts	Yucca Valley	California
Land area in square miles, 2010	40.02	155,779.22
Persons per square mile, 2010	517.3	239.1
FIPS Code	87056	6
Counties	San Bernardino County	
	(a) Includes persons reporting only one race.	
	(b) Hispanics may be of any race, so also are included in applicable race categories.	
	FN: Footnote on this item for this area in place of data	
	NA: Not available	
	D: Suppressed to avoid disclosure of confidential information	
	X: Not applicable	
	S: Suppressed; does not meet publication standards	
	Z: Value greater than zero but less than half unit of measure shown	
	F: Fewer than 100 firms	
	Source: US Census Bureau State & County QuickFacts	

Building Permits
2007 Building Permits
Monthly New Privately-Owned Residential Building Permits
Yucca Valley California (San Bernardino County - 516000)

	Estimates with Imputation			Reported Only		
Item	Buildings	Units	Construction cost	Buildings	Units	Construction cost
Single Family	87	87	$10,639,841	67	67	$8,215,212
Two Family	6	12	$793,036	4	8	$549,912
Three and Four Family	0	0	$0	0	0	$0
Five or More Family	0	0	$0	0	0	$0
Total	93	99	$11,432,877	71	75	$8,765,124

Source: U.S. Census Bureau

Building Permits
2008 Building Permits
Monthly New Privately-Owned Residential Building Permits
Yucca Valley California (San Bernardino County - 516000)

	Estimates with Imputation			Reported Only		
Item	Buildings	Units	Construction cost	Buildings	Units	Construction cost
Single Family	23	23	$2,945,469	18	18	$2,333,984
Two Family	1	2	$132,173	0	0	$0
Three and Four Family	0	0	$0	0	0	$0
Five or More Family	0	0	$0	0	0	$0
Total	24	25	$3,077,642	18	18	$2,333,984

Source: U.S. Census Bureau

Building Permits
2009 Building Permits
Monthly New Privately-Owned Residential Building Permits
Yucca Valley California (San Bernardino County - 516000)

	Estimates with Imputation			Reported Only		
Item	Buildings	Units	Construction cost	Buildings	Units	Construction cost
Single Family	7	7	$892,084	4	4	$507,892
Two Family	0	0	$0	0	0	$0
Three and Four Family	0	0	$0	0	0	$0
Five or More Family	0	0	$0	0	0	$0
Total	7	7	$892,084	4	4	$507,892

Source: U.S. Census Bureau

Building Permits
2010 Building Permits
Monthly New Privately-Owned Residential Building Permits
Yucca Valley California (San Bernardino County - 516000)

	Estimates with Imputation			Reported Only		
Item	Buildings	Units	Construction cost	Buildings	Units	Construction cost
Single Family	7	7	966,985	7	7	966,985
Two Family	0	0	0	0	0	0
Three and Four Family	0	0	0	0	0	0
Five or More Family	0	0	0	0	0	0
Total	7	7	966,985	7	7	966,985

Source: U.S. Census Bureau

Building Permits
2011 Building Permits
Monthly New Privately-Owned Residential Building Permits
Yucca Valley town California (San Bernardino County - 516000)

	Estimates with Imputation			Reported Only		
Item	Buildings	Units	Construction cost	Buildings	Units	Construction cost
Single Family	15	15	$1,862,175	15	15	$1,862,175
Two Family	0	0	$0	0	0	$0
Three and Four Family	0	0	$0	0	0	$0
Five or More Family	0	0	$0	0	0	$0
Total	15	15	$1,862,175	15	15	$1,862,175

Source: U.S. Census Bureau

Construction

					Tons/Day										MTons/Year
Equipment	**Fuel**	**MaxHP**	**Population**	**Activity**	**Consumption**	**ROG Exhaust**	**NOX Exhaust**	**CO Exhaust**	**SO2 Exhaust**	**PM Exhaust**	**CO2 Exhaust**	**N2O Exhaust**	**CH4 Exhaust**	**CO2e**	**CO2e**
Tampers/Rammers	G2	15	34.30538	1.71E+01	3.45E+00	2.17E-04	1.70E-04	9.33E-03	7.34E-07	1.49E-04	1.78E-02	2.66E-05	1.35E-05	2.64E-02	8
Plate Compactors	G2	15	2.942725	1.66E+00	3.35E-01	2.11E-05	1.65E-05	9.06E-04	7.13E-08	1.45E-05	1.73E-03	2.58E-06	1.31E-06	2.56E-03	1
Asphalt Pavers	G4	15	0.7481282	8.12E-01	4.65E-01	3.48E-05	2.63E-05	1.31E-03	6.51E-08	1.91E-05	2.28E-03	2.32E-06	2.01E-06	3.05E-03	1
Asphalt Pavers	G4	25	1.279408	1.39E+00	2.00E+00	1.54E-04	1.02E-04	5.83E-03	2.42E-07	8.00E-05	9.55E-03	6.14E-06	8.88E-06	1.16E-02	4
Asphalt Pavers	G4	50	0.7119879	7.65E-01	1.77E+00	6.47E-05	9.68E-05	1.86E-03	1.70E-07	1.07E-06	1.40E-02	4.24E-06	3.74E-06	1.53E-02	5
Asphalt Pavers	G4	120	0.3910919	4.20E-01	1.64E+00	4.41E-05	1.35E-04	7.83E-04	1.40E-07	1.12E-06	1.44E-02	3.63E-06	2.55E-06	1.56E-02	5
Tampers/Rammers	G4	15	1.582996	7.90E-01	3.79E-01	2.92E-05	2.08E-05	1.08E-03	5.28E-08	1.55E-05	1.85E-03	2.02E-06	1.69E-06	2.51E-03	1
Plate Compactors	G4	5	58.11547	2.87E+01	5.15E+00	7.19E-04	3.29E-04	1.09E-02	1.03E-06	9.74E-06	2.99E-02	4.72E-05	4.16E-05	4.54E-02	14
Plate Compactors	G4	15	61.63926	3.48E+01	1.48E+01	1.11E-03	8.23E-04	4.18E-02	2.07E-06	6.08E-04	7.25E-02	8.42E-05	6.41E-05	1.00E-01	31
Rollers	G4	5	6.472935	1.47E+00	3.94E-01	4.68E-05	2.15E-05	9.28E-04	7.47E-08	7.05E-07	2.16E-03	2.75E-06	2.71E-06	3.07E-03	1
Rollers	G4	15	10.47379	8.90E+00	4.78E+00	3.55E-04	2.68E-04	1.35E-02	6.71E-07	1.97E-04	2.35E-02	2.45E-05	2.05E-05	3.15E-02	10
Rollers	G4	25	7.069269	6.01E+00	7.01E+00	5.34E-04	3.53E-04	2.04E-02	8.49E-07	2.81E-04	3.35E-02	2.36E-05	3.09E-05	4.15E-02	13
Rollers	G4	50	0.5014	8.54E-01	2.26E+00	1.03E-04	1.32E-04	2.86E-03	2.06E-07	1.30E-06	1.69E-02	5.36E-06	5.96E-06	1.87E-02	6
Rollers	G4	120	0.942632	1.61E+00	7.43E+00	2.59E-04	6.63E-04	4.44E-03	6.16E-07	4.94E-06	6.37E-02	1.63E-05	1.50E-05	6.91E-02	22
Paving Equipment	G4	5	81.32912	3.79E+01	7.33E+00	1.01E-03	4.64E-04	1.56E-02	1.46E-06	1.38E-05	4.24E-02	6.45E-05	5.85E-05	6.36E-02	20
Paving Equipment	G4	15	137.5797	7.55E+01	4.29E+01	3.21E-03	2.39E-03	1.22E-01	6.01E-06	1.77E-03	2.11E-01	2.13E-04	1.86E-04	2.81E-01	88
Paving Equipment	G4	25	3.057568	1.68E+00	2.16E+00	1.65E-04	1.08E-04	6.30E-03	2.61E-07	8.64E-05	1.03E-02	6.91E-06	9.55E-06	1.26E-02	4
Paving Equipment	G4	50	1.945432	9.34E-01	2.10E+00	4.47E-05	7.88E-05	1.62E-03	2.14E-07	1.35E-06	1.76E-02	4.06E-06	2.59E-06	1.89E-02	6
Paving Equipment	G4	120	0.5014001	2.41E-01	8.76E-01	1.22E-05	4.46E-05	2.58E-04	7.73E-08	6.20E-07	8.00E-03	1.45E-06	7.04E-07	8.46E-03	3
Surfacing Equipment	G4	5	14.93004	8.19E+00	1.62E+00	2.32E-04	1.06E-04	3.37E-03	3.28E-07	3.10E-06	9.50E-03	1.44E-05	1.34E-05	1.42E-02	4
Surfacing Equipment	G4	15	44.36726	6.12E+01	2.31E+01	1.80E-03	1.36E-03	6.54E-02	3.24E-06	9.52E-04	1.14E-01	1.43E-04	1.04E-04	1.60E-01	50
Surfacing Equipment	G4	25	0.6071765	8.37E-01	7.74E-01	6.18E-05	4.08E-05	2.26E-03	9.35E-08	3.09E-05	3.69E-03	2.98E-06	3.57E-06	4.69E-03	1
Signal Boards	G4	5	0.1843214	6.57E-02	2.11E-02	2.67E-06	1.22E-06	4.77E-05	4.08E-09	3.85E-08	1.18E-04	1.40E-07	1.54E-07	1.65E-04	0
Signal Boards	G4	15	1.311935	1.02E+00	5.97E-01	4.41E-05	3.33E-05	1.69E-03	8.38E-08	2.47E-05	2.94E-03	2.93E-06	2.55E-06	3.90E-03	1
Trenchers	G4	15	12.13269	1.44E+01	9.18E+00	6.98E-04	5.27E-04	2.60E-02	1.29E-06	3.78E-04	4.51E-02	4.40E-05	4.03E-05	5.96E-02	19
Trenchers	G4	25	9.400393	1.12E+01	1.54E+01	1.20E-03	7.93E-04	4.49E-02	1.86E-06	6.15E-04	7.34E-02	4.86E-05	6.92E-05	8.99E-02	28
Trenchers	G4	50	4.56274	5.03E+00	1.11E+01	4.35E-04	6.37E-04	1.21E-02	1.05E-06	6.59E-06	8.60E-02	2.82E-05	2.51E-05	9.53E-02	30
Trenchers	G4	120	1.514228	1.67E+00	7.10E+00	2.09E-04	6.27E-04	3.62E-03	6.00E-07	4.81E-06	6.21E-02	1.60E-05	1.21E-05	6.73E-02	21
Bore/Drill Rigs	G4	15	0.346958	1.18E-01	9.02E-02	6.73E-06	4.79E-06	2.57E-04	1.26E-08	3.70E-06	4.41E-04	3.80E-07	3.89E-07	5.67E-04	0
Bore/Drill Rigs	G4	25	1.723948	5.86E-01	8.29E-01	6.26E-05	3.95E-05	2.43E-03	1.00E-07	3.31E-05	3.95E-03	2.47E-06	3.62E-06	4.79E-03	2
Bore/Drill Rigs	G4	50	0.220616	6.47E-02	1.72E-01	5.17E-06	9.72E-06	1.46E-04	1.72E-08	1.08E-07	1.41E-03	3.91E-07	2.99E-07	1.54E-03	0
Bore/Drill Rigs	G4	120	1.012828	2.97E-01	1.97E+00	4.26E-05	1.71E-04	7.59E-04	1.70E-07	1.37E-06	1.76E-02	3.52E-06	2.46E-06	1.88E-02	6
Bore/Drill Rigs	G4	175	0.2507	7.36E-02	6.64E-01	8.46E-06	6.67E-05	1.89E-04	6.04E-08	4.84E-07	6.08E-03	1.11E-06	4.89E-07	6.43E-03	2
Concrete/Industrial Saws	G4	5	6.364511	2.27E+00	5.97E-01	7.57E-05	3.47E-05	1.35E-03	1.16E-07	1.09E-06	3.35E-03	4.35E-06	4.38E-06	4.79E-03	2
Concrete/Industrial Saws	G4	15	28.62403	2.43E+01	1.64E+01	1.22E-03	9.23E-04	4.65E-02	2.31E-06	6.78E-04	8.09E-02	7.57E-05	7.06E-05	1.06E-01	33
Concrete/Industrial Saws	G4	25	8.955853	7.61E+00	1.00E+01	7.62E-04	5.04E-04	2.92E-02	1.21E-06	4.01E-04	4.78E-02	3.19E-05	4.40E-05	5.86E-02	18
Concrete/Industrial Saws	G4	50	0.822296	1.38E+00	3.80E+00	3.91E-05	5.85E-05	2.62E-03	3.94E-07	2.48E-06	3.24E-02	4.55E-06	2.25E-06	3.39E-02	11
Concrete/Industrial Saws	G4	120	0.471316	7.88E-01	3.71E+00	1.61E-05	3.74E-05	7.14E-04	3.35E-07	2.68E-06	3.46E-02	2.76E-06	9.26E-07	3.55E-02	11
Cement and Mortar Mixers	G4	5	115.5695	2.92E+01	7.32E+00	9.04E-04	4.15E-04	1.69E-02	1.41E-06	1.33E-05	4.07E-02	5.37E-05	5.23E-05	5.85E-02	18
Cement and Mortar Mixers	G4	15	195.8144	4.94E+01	2.43E+01	2.47E-03	1.07E-03	7.27E-02	3.15E-06	8.98E-04	1.10E-01	1.13E-04	1.43E-04	1.49E-01	47
Cement and Mortar Mixers	G4	25	0.8240252	2.08E-01	3.20E-01	3.05E-05	1.26E-05	9.69E-04	3.68E-08	1.18E-05	1.45E-03	8.26E-07	1.76E-06	1.74E-03	1
Cranes	G4	50	0.2507	2.85E-01	5.52E-01	2.20E-05	3.18E-05	6.11E-04	5.21E-08	3.28E-07	4.28E-03	1.50E-06	1.27E-06	4.77E-03	2
Cranes	G4	120	0.5014	5.71E-01	1.94E+00	5.77E-05	1.71E-04	9.98E-04	1.64E-07	1.31E-06	1.69E-02	4.85E-06	3.33E-06	1.85E-02	6
Cranes	G4	175	0.020056	2.28E-02	1.22E-01	1.83E-06	1.30E-05	3.86E-05	1.11E-08	8.87E-08	1.11E-03	2.73E-07	1.06E-07	1.20E-03	0
Crushing/Proc. Equipment	G4	15	0.3144307	2.49E-01	1.83E-01	1.35E-05	1.02E-05	5.19E-04	2.57E-08	7.56E-06	9.02E-04	8.09E-07	7.83E-07	1.17E-03	0
Crushing/Proc. Equipment	G4	25	0.2060063	1.63E-01	2.20E-01	1.67E-05	1.10E-05	6.41E-04	2.66E-08	8.81E-06	1.05E-03	6.91E-07	9.63E-07	1.29E-03	0
Crushing/Proc. Equipment	G4	120	0.290812	1.92E-01	1.51E+00	3.81E-05	1.32E-04	6.68E-04	1.29E-07	1.04E-06	1.34E-02	2.52E-06	2.20E-06	1.42E-02	4
Rough Terrain Forklifts	G4	50	0.10028	1.14E-01	3.74E-01	1.49E-05	2.16E-05	4.13E-04	3.53E-08	2.22E-07	2.90E-03	7.90E-07	8.58E-07	3.17E-03	1
Rough Terrain Forklifts	G4	120	1.423976	1.61E+00	8.44E+00	2.50E-04	7.46E-04	4.34E-03	7.12E-07	5.71E-06	7.37E-02	1.72E-05	1.45E-05	7.94E-02	25
Rough Terrain Forklifts	G4	175	0.05014	5.68E-02	4.64E-01	6.93E-06	4.93E-05	1.46E-04	4.19E-08	3.36E-07	4.22E-03	8.49E-07	4.00E-07	4.49E-03	1
Rubber Tired Loaders	G4	50	0.2507	3.52E-01	8.58E-01	3.59E-05	4.92E-05	1.00E-03	7.98E-08	5.03E-07	6.56E-03	2.08E-06	2.07E-06	7.25E-03	2
Rubber Tired Loaders	G4	120	1.664648	2.34E+00	8.94E+00	2.82E-04	7.83E-04	4.87E-03	7.49E-07	6.01E-06	7.76E-02	2.10E-05	1.62E-05	8.44E-02	27
Tractors/Loaders/Backhoes	G4	120	0.882464	2.11E+00	6.18E+00	1.20E-04	2.94E-04	3.10E-03	5.25E-07	4.21E-06	5.44E-02	1.14E-05	6.91E-06	5.80E-02	18

Construction

					Tons/Day										MTons/Year
Equipment	**Fuel**	**MaxHP**	**Population**	**Activity**	**Consumption**	**ROG Exhaust**	**NOX Exhaust**	**CO Exhaust**	**SO2 Exhaust**	**PM Exhaust**	**CO2 Exhaust**	**N2O Exhaust**	**CH4 Exhaust**	**CO2e**	**CO2e**
Skid Steer Loaders	G4	15	0.6180189	5.41E-01	4.22E-01	3.18E-05	2.40E-05	1.19E-03	5.92E-08	1.74E-05	2.08E-03	1.83E-06	1.84E-06	2.68E-03	1
Skid Steer Loaders	G4	25	41.32052	3.61E+01	3.95E+01	3.05E-03	2.01E-03	1.15E-01	4.78E-06	1.58E-03	1.89E-01	1.38E-04	1.76E-04	2.35E-01	74
Skid Steer Loaders	G4	50	6.839096	5.81E+00	1.11E+01	1.48E-04	2.43E-04	8.51E-03	1.13E-06	7.14E-06	9.32E-02	1.82E-05	8.54E-06	9.90E-02	31
Skid Steer Loaders	G4	120	4.091424	3.48E+00	1.49E+01	1.02E-04	3.20E-04	3.53E-03	1.33E-06	1.07E-05	1.38E-01	1.53E-05	5.90E-06	1.43E-01	45
Dumpers/Tenders	G4	5	5.898286	2.41E+00	3.20E-01	4.55E-05	2.09E-05	6.67E-04	6.46E-08	6.10E-07	1.87E-03	3.41E-06	2.63E-06	2.98E-03	1
Dumpers/Tenders	G4	15	12.57723	5.14E+00	1.95E+00	1.93E-04	9.13E-05	5.79E-03	2.56E-07	7.37E-05	8.98E-03	1.06E-05	1.11E-05	1.25E-02	4
Dumpers/Tenders	G4	25	2.331124	9.52E-01	7.69E-01	7.20E-05	3.23E-05	2.31E-03	8.90E-08	2.88E-05	3.51E-03	2.77E-06	4.16E-06	4.46E-03	1
Dumpers/Tenders	G4	120	0.180504	6.29E-02	1.62E-01	3.60E-06	1.41E-05	6.39E-05	1.40E-08	1.13E-07	1.45E-03	4.52E-07	2.08E-07	1.60E-03	1
Other Construction Equipment	G4	175	0.70196	7.14E-01	3.91E+00	1.67E-05	6.94E-05	1.15E-03	3.56E-07	2.86E-06	3.59E-02	3.36E-06	9.63E-07	3.69E-02	12
Pavers	D	25	0.1855536	4.18E-01	3.55E-01	5.32E-06	3.20E-05	1.69E-05	4.94E-08	1.68E-06	3.89E-03	0.00E+00	4.80E-07	3.90E-03	1
Pavers	D	50	10.78685	2.47E+01	3.24E+01	1.79E-03	3.74E-03	4.53E-03	4.46E-06	4.03E-04	3.45E-01	0.00E+00	1.61E-04	3.48E-01	110
Pavers	D	120	12.7166	2.91E+01	9.24E+01	2.13E-03	1.28E-02	7.42E-03	1.18E-05	1.13E-03	1.01E+00	0.00E+00	1.92E-04	1.01E+00	318
Pavers	D	175	7.904582	1.81E+01	1.06E+02	1.68E-03	1.31E-02	7.07E-03	1.30E-05	7.39E-04	1.16E+00	0.00E+00	1.52E-04	1.16E+00	366
Pavers	D	250	0.9525084	2.18E+00	1.92E+01	2.37E-04	2.25E-03	6.93E-04	2.38E-06	8.91E-05	2.12E-01	0.00E+00	2.14E-05	2.12E-01	67
Pavers	D	500	0.977249	2.24E+00	2.37E+01	2.66E-04	2.50E-03	1.11E-03	2.56E-06	9.86E-05	2.60E-01	0.00E+00	2.40E-05	2.61E-01	82
Plate Compactors	D	15	3.983217	6.55E+00	1.29E+00	1.64E-05	1.03E-04	8.62E-05	2.20E-07	4.11E-06	1.41E-02	0.00E+00	1.48E-06	1.42E-02	4
Rollers	D	15	7.483995	1.43E+01	4.11E+00	5.24E-05	3.28E-04	2.75E-04	7.01E-07	1.26E-05	4.50E-02	0.00E+00	4.73E-06	4.51E-02	14
Rollers	D	25	3.129671	5.96E+00	3.62E+00	4.82E-05	3.07E-04	1.64E-04	5.04E-07	1.33E-05	3.98E-02	0.00E+00	4.35E-06	3.98E-02	13
Rollers	D	50	9.735379	1.87E+01	2.27E+01	1.03E-03	2.51E-03	2.80E-03	3.14E-06	2.46E-04	2.43E-01	0.00E+00	9.32E-05	2.45E-01	77
Rollers	D	120	52.26426	1.01E+02	2.72E+02	5.30E-03	3.33E-02	2.06E-02	3.48E-05	2.88E-03	2.96E+00	0.00E+00	4.78E-04	2.97E+00	936
Rollers	D	175	21.01704	4.04E+01	2.00E+02	2.67E-03	2.17E-02	1.26E-02	2.46E-05	1.19E-03	2.18E+00	0.00E+00	2.41E-04	2.19E+00	689
Rollers	D	250	2.981227	5.74E+00	3.98E+01	3.86E-04	4.04E-03	1.17E-03	4.94E-06	1.43E-04	4.39E-01	0.00E+00	3.48E-05	4.39E-01	138
Rollers	D	500	2.09057	4.02E+00	4.00E+01	3.53E-04	3.64E-03	1.36E-03	4.32E-06	1.31E-04	4.40E-01	0.00E+00	3.18E-05	4.41E-01	139
Scrapers	D	120	0.4824394	1.47E+00	6.35E+00	1.46E-04	8.64E-04	5.16E-04	8.10E-07	7.75E-05	6.91E-02	0.00E+00	1.32E-05	6.94E-02	22
Scrapers	D	175	4.416176	1.35E+01	9.12E+01	1.46E-03	1.11E-02	6.17E-03	1.12E-05	6.36E-04	9.97E-01	0.00E+00	1.32E-04	1.00E+00	315
Scrapers	D	250	4.304843	1.31E+01	1.25E+02	1.55E-03	1.43E-02	4.40E-03	1.55E-05	5.64E-04	1.38E+00	0.00E+00	1.40E-04	1.38E+00	434
Scrapers	D	500	11.85069	3.62E+01	5.29E+02	6.02E-03	5.45E-02	2.35E-02	5.70E-05	2.15E-03	5.81E+00	0.00E+00	5.44E-04	5.82E+00	1,832
Scrapers	D	750	5.915858	1.81E+01	4.56E+02	5.22E-03	4.79E-02	2.03E-02	5.04E-05	1.87E-03	5.01E+00	0.00E+00	4.71E-04	5.02E+00	1,580
Paving Equipment	D	25	0.3216262	7.31E-01	4.20E-01	5.59E-06	3.56E-05	1.90E-05	5.85E-08	1.55E-06	4.61E-03	0.00E+00	5.05E-07	4.62E-03	1
Paving Equipment	D	50	0.2721452	6.24E-01	7.00E-01	3.86E-05	8.08E-05	9.74E-05	9.64E-08	8.69E-06	7.46E-03	0.00E+00	3.48E-06	7.53E-03	2
Paving Equipment	D	120	3.921367	8.99E+00	2.25E+01	5.16E-04	3.10E-03	1.80E-03	2.87E-06	2.74E-04	2.45E-01	0.00E+00	4.66E-05	2.46E-01	77
Paving Equipment	D	175	1.843166	4.23E+00	1.95E+01	3.07E-04	2.40E-03	1.29E-03	2.40E-06	1.35E-04	2.13E-01	0.00E+00	2.77E-05	2.14E-01	67
Paving Equipment	D	250	0.51955	1.19E+00	6.62E+00	8.03E-05	7.72E-04	2.35E-04	8.19E-07	3.02E-05	7.28E-02	0.00E+00	7.24E-06	7.29E-02	23
Surfacing Equipment	D	50	0.2474048	3.07E-01	2.01E-01	7.87E-06	2.16E-05	2.21E-05	2.80E-08	1.96E-06	2.16E-03	0.00E+00	7.10E-07	2.18E-03	1
Surfacing Equipment	D	120	0.04948096	6.14E-02	1.79E-01	3.19E-06	2.12E-05	1.30E-05	2.30E-08	1.71E-06	1.96E-03	0.00E+00	2.88E-07	1.96E-03	1
Surfacing Equipment	D	175	0.03711072	4.61E-02	1.80E-01	2.18E-06	1.89E-05	1.09E-05	2.22E-08	9.71E-07	1.97E-03	0.00E+00	1.97E-07	1.98E-03	1
Surfacing Equipment	D	250	0.07422145	9.21E-02	5.63E-01	5.04E-06	5.52E-05	1.62E-05	6.98E-08	1.90E-06	6.21E-03	0.00E+00	4.55E-07	6.22E-03	2
Surfacing Equipment	D	500	0.6185122	7.68E-01	7.70E+00	6.26E-05	6.83E-04	2.61E-04	8.33E-07	2.38E-05	8.48E-02	0.00E+00	5.64E-06	8.50E-02	27
Surfacing Equipment	D	750	1.130419	1.40E+00	2.21E+01	1.82E-04	2.00E-03	7.50E-04	2.45E-06	6.91E-05	2.43E-01	0.00E+00	1.65E-05	2.44E-01	77
Signal Boards	D	15	34.82222	7.16E+01	2.02E+01	2.57E-04	1.61E-03	1.35E-03	3.43E-06	6.24E-05	2.21E-01	0.00E+00	2.32E-05	2.21E-01	70
Signal Boards	D	50	0.1731834	2.54E-01	4.26E-01	1.61E-05	4.52E-05	4.55E-05	5.94E-08	4.11E-06	4.59E-03	0.00E+00	1.45E-06	4.62E-03	1
Signal Boards	D	120	2.832785	4.16E+00	1.52E+01	2.66E-04	1.74E-03	1.09E-03	1.95E-06	1.46E-04	1.67E-01	0.00E+00	2.40E-05	1.67E-01	53
Signal Boards	D	175	1.756574	2.58E+00	1.81E+01	2.14E-04	1.84E-03	1.08E-03	2.24E-06	9.65E-05	1.99E-01	0.00E+00	1.93E-05	1.99E-01	63
Signal Boards	D	250	0.3711072	5.44E-01	6.29E+00	4.75E-05	5.87E-04	1.50E-04	7.81E-07	1.74E-05	6.94E-02	0.00E+00	4.28E-06	6.95E-02	22
Trenchers	D	15	0.9277679	1.57E+00	6.07E-01	7.74E-06	4.85E-05	4.06E-05	1.03E-07	1.88E-06	6.65E-03	0.00E+00	6.98E-07	6.66E-03	2
Trenchers	D	25	0.9772489	1.66E+00	2.48E+00	3.29E-05	2.08E-04	1.12E-04	3.46E-07	8.32E-06	2.72E-02	0.00E+00	2.97E-06	2.73E-02	9
Trenchers	D	50	37.1973	6.44E+01	9.93E+01	5.33E-03	1.14E-02	1.34E-02	1.37E-05	1.20E-03	1.06E+00	0.00E+00	4.81E-04	1.07E+00	337
Trenchers	D	120	50.40872	8.73E+01	2.60E+02	5.90E-03	3.60E-02	2.06E-02	3.32E-05	3.09E-03	2.83E+00	0.00E+00	5.32E-04	2.84E+00	894
Trenchers	D	175	5.517127	9.55E+00	6.28E+01	9.78E-04	7.78E-03	4.15E-03	7.73E-06	4.30E-04	6.87E-01	0.00E+00	8.82E-05	6.89E-01	217
Trenchers	D	250	0.4948095	8.57E-01	8.68E+00	1.06E-04	1.02E-03	3.18E-04	1.07E-06	4.07E-05	9.54E-02	0.00E+00	9.59E-06	9.56E-02	30
Trenchers	D	500	0.6308823	1.09E+00	1.55E+01	1.71E-04	1.65E-03	7.65E-04	1.67E-06	6.50E-05	1.70E-01	0.00E+00	1.54E-05	1.70E-01	54
Trenchers	D	750	0.2260838	3.92E-01	1.05E+01	1.17E-04	1.13E-03	5.17E-04	1.15E-06	4.43E-05	1.15E-01	0.00E+00	1.05E-05	1.15E-01	36
Bore/Drill Rigs	D	15	0.1237024	2.75E-01	1.30E-01	1.65E-06	1.04E-05	8.68E-06	2.21E-08	3.99E-07	1.42E-03	0.00E+00	1.49E-07	1.42E-03	0

Construction

					Tons/Day										MTons/Year
Equipment	**Fuel**	**MaxHP**	**Population**	**Activity**	**Consumption**	**ROG Exhaust**	**NOX Exhaust**	**CO Exhaust**	**SO2 Exhaust**	**PM Exhaust**	**CO2 Exhaust**	**N2O Exhaust**	**CH4 Exhaust**	**CO2e**	**CO2e**
Bore/Drill Rigs	D	25	0.3711072	8.25E-01	6.00E-01	7.99E-06	5.08E-05	2.71E-05	8.36E-08	2.21E-06	6.59E-03	0.00E+00	7.21E-07	6.61E-03	2
Bore/Drill Rigs	D	50	1.620501	3.74E+00	5.31E+00	6.56E-05	5.18E-04	4.37E-04	7.50E-07	2.80E-05	5.80E-02	0.00E+00	5.92E-06	5.82E-02	18

Construction

					Tons/Day										MTons/Year
Equipment	**Fuel**	**MaxHP**	**Population**	**Activity**	**Consumption**	**ROG Exhaust**	**NOX Exhaust**	**CO Exhaust**	**SO2 Exhaust**	**PM Exhaust**	**CO2 Exhaust**	**N2O Exhaust**	**CH4 Exhaust**	**CO2e**	**CO2e**
Bore/Drill Rigs	D	120	4.972836	1.15E+01	4.03E+01	2.95E-04	2.88E-03	2.71E-03	5.19E-06	1.88E-04	4.43E-01	0.00E+00	2.66E-05	4.43E-01	139
Bore/Drill Rigs	D	175	1.150432	2.66E+00	1.70E+01	9.96E-05	9.93E-04	1.00E-03	2.11E-06	4.86E-05	1.87E-01	0.00E+00	8.99E-06	1.87E-01	59
Bore/Drill Rigs	D	250	0.9896192	2.29E+00	1.94E+01	9.57E-05	9.96E-04	3.92E-04	2.42E-06	3.06E-05	2.15E-01	0.00E+00	8.64E-06	2.15E-01	68
Bore/Drill Rigs	D	500	2.201902	5.09E+00	7.16E+01	3.44E-04	3.34E-03	1.40E-03	7.76E-06	1.11E-04	7.91E-01	0.00E+00	3.10E-05	7.92E-01	249
Bore/Drill Rigs	D	750	3.504298	8.09E+00	2.25E+02	1.09E-03	1.07E-02	4.42E-03	2.50E-05	3.51E-04	2.49E+00	0.00E+00	9.81E-05	2.49E+00	784
Bore/Drill Rigs	D	1000	5.878178	1.36E+01	5.69E+02	3.05E-03	4.49E-02	1.14E-02	6.32E-05	1.15E-03	6.29E+00	0.00E+00	2.75E-04	6.30E+00	1,982
Excavators	D	25	0.4576989	1.75E+00	1.31E+00	1.74E-05	1.10E-04	5.92E-05	1.83E-07	4.19E-06	1.44E-02	0.00E+00	1.57E-06	1.44E-02	5
Excavators	D	50	17.23174	6.73E+01	7.83E+01	3.06E-03	8.63E-03	9.86E-03	1.09E-05	7.95E-04	8.41E-01	0.00E+00	2.77E-04	8.47E-01	267
Excavators	D	120	46.79662	1.83E+02	6.16E+02	1.08E-02	6.66E-02	4.76E-02	7.88E-05	6.00E-03	6.72E+00	0.00E+00	9.74E-04	6.74E+00	2,122
Excavators	D	175	90.27803	3.53E+02	1.80E+03	2.27E-02	1.69E-01	1.18E-01	2.22E-04	1.00E-02	1.98E+01	0.00E+00	2.05E-03	1.98E+01	6,234
Excavators	D	250	36.71487	1.43E+02	1.03E+03	9.32E-03	8.90E-02	2.60E-02	1.28E-04	2.97E-03	1.14E+01	0.00E+00	8.41E-04	1.14E+01	3,583
Excavators	D	500	26.48469	1.03E+02	1.09E+03	9.32E-03	8.32E-02	2.84E-02	1.19E-04	2.97E-03	1.21E+01	0.00E+00	8.41E-04	1.21E+01	3,807
Excavators	D	750	1.770989	6.92E+00	1.21E+02	1.04E-03	9.50E-03	3.15E-03	1.35E-05	3.34E-04	1.34E+00	0.00E+00	9.38E-05	1.34E+00	422
Concrete/Industrial Saws	D	25	0.04948096	8.03E-02	6.02E-02	7.99E-07	5.06E-06	2.72E-06	8.39E-09	2.02E-07	6.61E-04	0.00E+00	7.21E-08	6.63E-04	0
Concrete/Industrial Saws	D	50	0.4329583	6.89E-01	9.64E-01	3.60E-05	1.02E-04	1.04E-04	1.34E-07	9.21E-06	1.04E-02	0.00E+00	3.25E-06	1.05E-02	3
Concrete/Industrial Saws	D	120	0.7545847	1.20E+00	4.07E+00	6.92E-05	4.57E-04	2.93E-04	5.21E-07	3.83E-05	4.45E-02	0.00E+00	6.24E-06	4.46E-02	14
Concrete/Industrial Saws	D	175	0.02474048	3.93E-02	2.87E-01	3.31E-06	2.85E-05	1.71E-05	3.54E-08	1.51E-06	3.15E-03	0.00E+00	2.99E-07	3.16E-03	1
Cement and Mortar Mixers	D	15	6.321193	5.20E+00	1.50E+00	1.95E-05	1.23E-04	1.00E-04	2.55E-07	6.06E-06	1.64E-02	0.00E+00	1.76E-06	1.65E-02	5
Cement and Mortar Mixers	D	25	0.5690311	4.68E-01	3.75E-01	6.86E-06	3.62E-05	1.99E-05	5.21E-08	2.12E-06	4.11E-03	0.00E+00	6.19E-07	4.12E-03	1
Cranes	D	50	0.4205882	1.48E+00	1.60E+00	8.13E-05	1.83E-04	2.20E-04	2.21E-07	1.90E-05	1.71E-02	0.00E+00	7.33E-06	1.73E-02	5
Cranes	D	120	4.6141	1.62E+01	3.73E+01	7.95E-04	4.73E-03	2.96E-03	4.76E-06	4.32E-04	4.06E-01	0.00E+00	7.17E-05	4.08E-01	128
Cranes	D	175	4.6141	1.62E+01	5.95E+01	8.81E-04	6.69E-03	3.92E-03	7.32E-06	3.88E-04	6.51E-01	0.00E+00	7.95E-05	6.52E-01	205
Cranes	D	250	8.943684	3.14E+01	1.60E+02	1.73E-03	1.68E-02	4.87E-03	1.98E-05	6.09E-04	1.76E+00	0.00E+00	1.56E-04	1.76E+00	555
Cranes	D	500	3.278113	1.15E+01	9.41E+01	9.41E-04	8.82E-03	3.27E-03	1.02E-05	3.28E-04	1.04E+00	0.00E+00	8.49E-05	1.04E+00	327
Cranes	D	750	7.347722	2.58E+01	3.55E+02	3.57E-03	3.41E-02	1.24E-02	3.93E-05	1.26E-03	3.91E+00	0.00E+00	3.22E-04	3.91E+00	1,232
Cranes	D	9999	9.231754	3.24E+01	1.43E+03	1.60E-02	1.77E-01	5.80E-02	1.58E-04	5.48E-03	1.57E+01	0.00E+00	1.45E-03	1.57E+01	4,954
Graders	D	50	0.1731834	4.52E-01	5.80E-01	2.67E-05	6.50E-05	7.59E-05	8.03E-08	6.44E-06	6.21E-03	0.00E+00	2.41E-06	6.26E-03	2
Graders	D	120	11.5538	3.01E+01	1.04E+02	2.03E-03	1.24E-02	8.06E-03	1.32E-05	1.11E-03	1.13E+00	0.00E+00	1.83E-04	1.13E+00	356
Graders	D	175	39.47343	1.03E+02	5.82E+02	7.99E-03	6.13E-02	3.79E-02	7.17E-05	3.53E-03	6.37E+00	0.00E+00	7.21E-04	6.39E+00	2,011
Graders	D	250	24.49308	6.39E+01	4.98E+02	5.02E-03	4.89E-02	1.44E-02	6.18E-05	1.74E-03	5.49E+00	0.00E+00	4.53E-04	5.50E+00	1,732
Graders	D	500	0.6927334	1.81E+00	1.88E+01	1.76E-04	1.64E-03	5.99E-04	2.03E-06	6.05E-05	2.07E-01	0.00E+00	1.59E-05	2.07E-01	65
Graders	D	750	0.1130419	2.95E-01	6.49E+00	6.10E-05	5.81E-04	2.07E-04	7.19E-07	2.12E-05	7.15E-02	0.00E+00	5.51E-06	7.17E-02	23
Off-Highway Trucks	D	175	0.8040655	4.39E+00	2.51E+01	3.36E-04	2.43E-03	1.67E-03	3.09E-06	1.46E-04	2.74E-01	0.00E+00	3.03E-05	2.75E-01	87
Off-Highway Trucks	D	250	5.937716	3.24E+01	2.45E+02	2.38E-03	2.19E-02	6.39E-03	3.03E-05	7.46E-04	2.70E+00	0.00E+00	2.15E-04	2.70E+00	850
Off-Highway Trucks	D	500	8.362282	4.57E+01	5.63E+02	5.16E-03	4.44E-02	1.52E-02	6.10E-05	1.61E-03	6.21E+00	0.00E+00	4.66E-04	6.22E+00	1,958
Off-Highway Trucks	D	750	23.70112	1.29E+02	2.59E+03	2.39E-02	2.10E-01	6.98E-02	2.87E-04	7.51E-03	2.86E+01	0.00E+00	2.15E-03	2.86E+01	9,002
Off-Highway Trucks	D	1000	11.11578	6.06E+01	1.72E+03	1.75E-02	1.94E-01	5.42E-02	1.90E-04	5.85E-03	1.89E+01	0.00E+00	1.58E-03	1.90E+01	5,966
Crushing/Proc. Equipment	D	50	1.979238	5.18E+00	1.06E+01	4.99E-04	1.18E-03	1.35E-03	1.47E-06	1.20E-04	1.14E-01	0.00E+00	4.50E-05	1.15E-01	36
Crushing/Proc. Equipment	D	120	5.578977	1.46E+01	5.57E+01	1.11E-03	6.69E-03	4.25E-03	7.12E-06	6.21E-04	6.07E-01	0.00E+00	1.00E-04	6.09E-01	192
Crushing/Proc. Equipment	D	175	2.362715	6.19E+00	4.72E+01	6.45E-04	5.05E-03	2.98E-03	5.82E-06	2.92E-04	5.17E-01	0.00E+00	5.82E-05	5.18E-01	163
Crushing/Proc. Equipment	D	250	0.2350345	6.15E-01	6.82E+00	6.00E-05	6.73E-04	1.72E-04	8.46E-07	2.10E-05	7.52E-02	0.00E+00	5.42E-06	7.53E-02	24
Crushing/Proc. Equipment	D	500	1.323616	3.47E+00	5.87E+01	4.73E-04	5.10E-03	1.55E-03	6.35E-06	1.68E-04	6.47E-01	0.00E+00	4.27E-05	6.48E-01	204
Crushing/Proc. Equipment	D	750	0.1884031	4.93E-01	1.32E+01	1.07E-04	1.19E-03	3.43E-04	1.46E-06	3.84E-05	1.45E-01	0.00E+00	9.69E-06	1.45E-01	46
Crushing/Proc. Equipment	D	9999	0.1884031	4.93E-01	2.93E+01	2.99E-04	3.51E-03	9.97E-04	3.24E-06	1.04E-04	3.22E-01	0.00E+00	2.69E-05	3.23E-01	102
Rough Terrain Forklifts	D	50	1.373096	4.27E+00	6.72E+00	2.80E-04	7.36E-04	8.33E-04	9.33E-07	7.04E-05	7.22E-02	0.00E+00	2.53E-05	7.27E-02	23
Rough Terrain Forklifts	D	120	65.7602	2.04E+02	5.84E+02	1.06E-02	6.56E-02	4.46E-02	7.48E-05	5.97E-03	6.38E+00	0.00E+00	9.55E-04	6.40E+00	2,013
Rough Terrain Forklifts	D	175	8.424135	2.62E+01	1.49E+02	1.89E-03	1.46E-02	9.50E-03	1.84E-05	8.52E-04	1.63E+00	0.00E+00	1.70E-04	1.64E+00	515
Rough Terrain Forklifts	D	250	0.4700692	1.46E+00	1.13E+01	9.88E-05	1.03E-03	2.84E-04	1.40E-06	3.34E-05	1.25E-01	0.00E+00	8.91E-06	1.25E-01	39
Rough Terrain Forklifts	D	500	0.3092559	9.61E-01	1.12E+01	9.09E-05	8.92E-04	2.87E-04	1.21E-06	3.08E-05	1.23E-01	0.00E+00	8.20E-06	1.23E-01	39
Rubber Tired Loaders	D	25	0.1731834	4.54E-01	3.50E-01	4.64E-06	2.94E-05	1.58E-05	4.88E-08	1.17E-06	3.84E-03	0.00E+00	4.19E-07	3.85E-03	1
Rubber Tired Loaders	D	50	3.364705	9.00E+00	1.31E+01	5.91E-04	1.46E-03	1.69E-03	1.81E-06	1.43E-04	1.40E-01	0.00E+00	5.33E-05	1.41E-01	44
Rubber Tired Loaders	D	120	91.47794	2.45E+02	6.60E+02	1.28E-02	7.82E-02	5.12E-02	8.44E-05	7.03E-03	7.20E+00	0.00E+00	1.15E-03	7.22E+00	2,274
Rubber Tired Loaders	D	175	51.55916	1.38E+02	6.69E+02	9.03E-03	6.98E-02	4.33E-02	8.24E-05	4.01E-03	7.32E+00	0.00E+00	8.15E-04	7.34E+00	2,310

Construction

Equipment	Fuel	MaxHP	Population	Activity	Consumption (Tons/Day)	ROG Exhaust	NOX Exhaust	CO Exhaust	SO2 Exhaust	PM Exhaust	CO2 Exhaust	N2O Exhaust	CH4 Exhaust	CO2e	CO2e (MTons/Year)
Rubber Tired Loaders	D	250	51.27465	1.37E+02	9.26E+02	9.11E-03	8.99E-02	2.63E-02	1.15E-04	3.17E-03	1.02E+01	0.00E+00	8.22E-04	1.02E+01	3,218
Rubber Tired Loaders	D	500	21.33867	5.71E+01	6.13E+02	5.59E-03	5.29E-02	1.93E-02	6.63E-05	1.93E-03	6.76E+00	0.00E+00	5.04E-04	6.77E+00	2,130
Rubber Tired Loaders	D	750	4.559355	1.22E+01	2.68E+02	2.46E-03	2.38E-02	8.43E-03	2.97E-05	8.57E-04	2.96E+00	0.00E+00	2.22E-04	2.96E+00	932
Rubber Tired Loaders	D	1000	0.4898482	1.31E+00	3.53E+01	3.58E-04	4.14E-03	1.28E-03	3.90E-06	1.25E-04	3.88E-01	0.00E+00	3.23E-05	3.89E-01	122
Rubber Tired Dozers	D	175	0.1237024	5.53E-01	3.28E+00	6.10E-05	4.50E-04	2.35E-04	4.02E-07	2.61E-05	3.58E-02	0.00E+00	5.50E-06	3.59E-02	11
Rubber Tired Dozers	D	250	3.030709	1.35E+01	1.13E+02	1.72E-03	1.49E-02	4.82E-03	1.40E-05	6.38E-04	1.24E+00	0.00E+00	1.55E-04	1.24E+00	392
Rubber Tired Dozers	D	500	4.663579	2.08E+01	2.52E+02	3.48E-03	3.00E-02	1.59E-02	2.71E-05	1.26E-03	2.76E+00	0.00E+00	3.14E-04	2.76E+00	870
Rubber Tired Dozers	D	750	5.011524	2.24E+01	4.07E+02	5.65E-03	4.93E-02	2.57E-02	4.49E-05	2.05E-03	4.46E+00	0.00E+00	5.10E-04	4.47E+00	1,408
Rubber Tired Dozers	D	1000	0.3391256	1.51E+00	4.09E+01	5.92E-04	5.89E-03	2.79E-03	4.50E-06	2.07E-04	4.48E-01	0.00E+00	5.34E-05	4.49E-01	141
Tractors/Loaders/Backhoes	D	25	3.488408	9.01E+00	6.51E+00	8.95E-05	5.63E-04	2.98E-04	9.06E-07	2.75E-05	7.14E-02	0.00E+00	8.07E-06	7.16E-02	23
Tractors/Loaders/Backhoes	D	50	20.84386	5.53E+01	7.78E+01	2.78E-03	8.37E-03	9.13E-03	1.08E-05	7.37E-04	8.39E-01	0.00E+00	2.51E-04	8.44E-01	266
Tractors/Loaders/Backhoes	D	120	278.8004	7.40E+02	1.75E+03	2.81E-02	1.81E-01	1.31E-01	2.24E-04	1.60E-02	1.91E+01	0.00E+00	2.53E-03	1.92E+01	6,035
Tractors/Loaders/Backhoes	D	175	20.80674	5.52E+01	2.55E+02	2.92E-03	2.29E-02	1.62E-02	3.15E-05	1.32E-03	2.80E+00	0.00E+00	2.63E-04	2.80E+00	882
Tractors/Loaders/Backhoes	D	250	6.729409	1.79E+01	1.39E+02	1.13E-03	1.14E-02	3.35E-03	1.72E-05	3.71E-04	1.53E+00	0.00E+00	1.02E-04	1.53E+00	483
Tractors/Loaders/Backhoes	D	500	10.86107	2.88E+01	4.50E+02	3.44E-03	3.26E-02	1.11E-02	5.59E-05	1.13E-03	4.97E+00	0.00E+00	3.10E-04	4.97E+00	1,565
Tractors/Loaders/Backhoes	D	750	22.79678	6.05E+01	1.42E+03	1.09E-02	1.06E-01	3.50E-02	1.76E-04	3.62E-03	1.56E+01	0.00E+00	9.83E-04	1.57E+01	4,928
Crawler Tractors	D	50	0.1731834	4.98E-01	5.81E-01	3.14E-05	6.75E-05	8.29E-05	8.00E-08	7.19E-06	6.19E-03	0.00E+00	2.83E-06	6.25E-03	2
Crawler Tractors	D	120	98.25681	2.82E+02	8.53E+02	1.94E-02	1.15E-01	6.92E-02	1.09E-04	1.03E-02	9.29E+00	0.00E+00	1.75E-03	9.32E+00	2,935
Crawler Tractors	D	175	33.25121	9.56E+01	5.29E+02	8.39E-03	6.32E-02	3.58E-02	6.51E-05	3.65E-03	5.79E+00	0.00E+00	7.57E-04	5.80E+00	1,827
Crawler Tractors	D	250	28.57526	8.21E+01	6.20E+02	7.61E-03	6.99E-02	2.14E-02	7.67E-05	2.74E-03	6.82E+00	0.00E+00	6.86E-04	6.83E+00	2,150
Crawler Tractors	D	500	19.58209	5.63E+01	6.63E+02	7.48E-03	6.72E-02	2.87E-02	7.15E-05	2.65E-03	7.29E+00	0.00E+00	6.75E-04	7.30E+00	2,299
Crawler Tractors	D	750	3.01445	8.66E+00	1.83E+02	2.07E-03	1.89E-02	7.93E-03	2.02E-05	7.39E-04	2.01E+00	0.00E+00	1.87E-04	2.02E+00	634
Crawler Tractors	D	1000	3.01445	8.66E+00	2.59E+02	3.13E-03	3.36E-02	1.26E-02	2.86E-05	1.08E-03	2.85E+00	0.00E+00	2.82E-04	2.85E+00	898
Skid Steer Loaders	D	25	23.75086	5.43E+01	3.42E+01	5.73E-04	3.23E-03	1.72E-03	4.75E-06	1.81E-04	3.74E-01	0.00E+00	5.17E-05	3.75E-01	118
Skid Steer Loaders	D	50	215.4277	5.03E+02	5.91E+02	1.50E-02	6.03E-02	5.85E-02	8.28E-05	4.53E-03	6.41E+00	0.00E+00	1.35E-03	6.44E+00	2,026
Skid Steer Loaders	D	120	112.8784	2.63E+02	5.14E+02	6.34E-03	4.65E-02	3.64E-02	6.60E-05	3.76E-03	5.63E+00	0.00E+00	5.72E-04	5.64E+00	1,775
Off-Highway Tractors	D	120	0.01237024	3.79E-02	1.63E-01	4.21E-06	2.45E-05	1.38E-05	2.08E-08	2.16E-06	1.77E-03	0.00E+00	3.80E-07	1.78E-03	1
Off-Highway Tractors	D	175	15.1288	4.64E+01	2.77E+02	4.94E-03	3.72E-02	1.95E-02	3.40E-05	2.14E-03	3.02E+00	0.00E+00	4.46E-04	3.03E+00	954
Off-Highway Tractors	D	250	14.3	4.38E+01	2.60E+02	3.76E-03	3.34E-02	1.07E-02	3.21E-05	1.41E-03	2.85E+00	0.00E+00	3.39E-04	2.86E+00	901
Off-Highway Tractors	D	750	18.91568	5.80E+01	1.50E+03	1.98E-02	1.78E-01	8.99E-02	1.65E-04	7.30E-03	1.64E+01	0.00E+00	1.78E-03	1.65E+01	5,190
Off-Highway Tractors	D	1000	1.997073	6.11E+00	2.27E+02	3.14E-03	3.21E-02	1.48E-02	2.50E-05	1.11E-03	2.49E+00	0.00E+00	2.83E-04	2.49E+00	785
Dumpers/Tenders	D	25	0.2968858	5.39E-01	1.87E-01	2.68E-06	1.65E-05	8.73E-06	2.60E-08	8.42E-07	2.05E-03	0.00E+00	2.42E-07	2.06E-03	1
Other Construction Equipment	D	15	4.09455	7.75E+00	3.57E+00	4.55E-05	2.85E-04	2.39E-04	6.09E-07	1.10E-05	3.91E-02	0.00E+00	4.11E-06	3.92E-02	12
Other Construction Equipment	D	25	0.6927334	1.31E+00	7.88E-01	1.05E-05	6.67E-05	3.56E-05	1.10E-07	2.90E-06	8.65E-03	0.00E+00	9.47E-07	8.67E-03	3
Other Construction Equipment	D	50	1.063841	2.05E+00	2.65E+00	8.62E-05	2.77E-04	2.81E-04	3.71E-07	2.33E-05	2.87E-02	0.00E+00	7.78E-06	2.88E-02	9
Other Construction Equipment	D	120	1.756574	3.39E+00	1.25E+01	1.87E-04	1.28E-03	9.00E-04	1.60E-06	1.07E-04	1.37E-01	0.00E+00	1.68E-05	1.37E-01	43
Other Construction Equipment	D	175	2.424567	4.67E+00	2.27E+01	2.35E-04	2.01E-03	1.37E-03	2.80E-06	1.09E-04	2.49E-01	0.00E+00	2.12E-05	2.49E-01	78
Other Construction Equipment	D	500	5.628458	1.09E+01	1.25E+02	8.22E-04	8.98E-03	2.94E-03	1.35E-05	2.95E-04	1.38E+00	0.00E+00	7.42E-05	1.38E+00	434
			2,958	6,078	32,965	0.438	3.320	2.350	0.004	0.178	360.061	0.001	0.039	361	113,737
			Population	Activity	Consumption	lbs/day					Tons/Day				MTons/Year
			34	70	381	10	77	54	0	4	4	0	0	4	**1,315**

As a percent of Total Building Permits issued. San Bernardino County 2,526 Yucca Valley 29 Percent 1.16%

SOURCE: U.S. Census Bureau. http://censtats.census.gov/cgi-bin/bldgprmt/bldgdisp.pl

Annual GHG emissions (MTons/Year) multiplied by 347 days/year to account for reduced/limited construction activity on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology for transportation within the Climate Change Scoping Plan Measure Documentation Supplement.

Buildings Estimates with Imputation

	SB	YV
2011	1,150	15
2010	1,330	7
2009	1,543	7
2008	2,103	24
2007	6,504	93
avg	2,526	29

Lawn & Garden					Tons/Day										MTons/Year
Equipment	Fuel	MaxHP	Population	Activity	Consumption	ROG Exhaust	NOX Exhaust	CO Exhaust	SO2 Exhaust	PM Exhaust	CO2 Exhaust	N2O Exhaust	CH4 Exhaust	CO2e	CO2e
Lawn Mowers	G2	15	4.38E+02	2.75E+02	3.11E+01	3.51E-03	9.45E-04	6.31E-02	7.71E-06	5.90E-04	1.87E-01	2.43E-04	2.18E-04	2.67E-01	88
Lawn Mowers	G2	15	3.29E+03	1.40E+02	2.00E+01	4.59E-03	5.32E-04	5.13E-02	3.92E-06	3.35E-04	9.53E-02	1.24E-04	2.85E-04	1.40E-01	46
Chainsaws	G2	2	7.85E+02	6.22E+02	3.71E+01	3.10E-02	4.94E-04	5.61E-02	6.25E-06	8.83E-05	1.52E-01	2.52E-04	1.93E-03	2.70E-01	89
Chainsaws	G2	2	8.83E+03	1.19E+02	6.70E+00	3.60E-03	9.81E-05	1.40E-02	1.19E-06	6.64E-05	2.89E-02	4.86E-05	2.24E-04	4.87E-02	16
Chainsaws	G2	15	5.53E+02	4.38E+02	6.32E+01	5.28E-02	8.41E-04	9.56E-02	1.06E-05	1.50E-04	2.58E-01	2.84E-04	3.28E-03	4.15E-01	137
Chainsaws	G2	15	6.22E+03	8.35E+01	1.09E+01	5.53E-03	1.64E-04	2.23E-02	2.03E-06	1.25E-04	4.92E-02	5.41E-05	3.44E-04	7.32E-02	24
Chainsaws Preempt	G2	15	6.88E+02	5.46E+02	7.87E+01	6.58E-02	1.05E-03	1.19E-01	1.32E-05	1.87E-04	3.22E-01	3.53E-04	4.09E-03	5.17E-01	171
Chainsaws Preempt	G2	15	7.75E+03	1.04E+02	1.53E+01	9.12E-03	1.69E-04	3.31E-02	2.52E-06	8.48E-05	6.13E-02	6.11E-05	5.67E-04	9.21E-02	31
Trimmers/Edgers/Brush Cutters	G2	2	2.56E+03	8.51E+02	3.78E+01	2.04E-02	5.90E-04	6.71E-02	7.47E-06	1.06E-04	1.81E-01	3.20E-04	1.27E-03	3.07E-01	102
Trimmers/Edgers/Brush Cutters	G2	2	2.85E+04	1.68E+03	7.14E+01	3.22E-02	1.20E-03	1.33E-01	1.47E-05	2.12E-04	3.58E-01	6.42E-04	2.00E-03	5.99E-01	198
Leaf Blowers/Vacuums	G2	2	3.82E+03	2.06E+03	1.10E+02	7.57E-02	1.58E-03	1.80E-01	2.01E-05	2.83E-04	4.87E-01	8.18E-04	4.71E-03	8.39E-01	278
Leaf Blowers/Vacuums	G2	2	9.86E+03	1.30E+02	7.11E+00	3.81E-03	1.04E-04	1.49E-02	1.26E-06	7.05E-05	3.07E-02	5.23E-05	2.37E-04	5.19E-02	17
Shredders	G2	15	1.93E+01	7.18E+00	3.15E+00	1.77E-04	1.39E-04	8.54E-03	6.72E-07	1.37E-04	1.63E-02	1.59E-05	1.10E-05	2.15E-02	7
Shredders	G2	15	6.88E+02	1.70E+00	8.53E-01	2.04E-04	2.51E-05	2.29E-03	1.59E-07	3.23E-05	3.85E-03	3.19E-06	1.27E-05	5.11E-03	2
Commercial Turf Equipment	G2	15	1.02E+01	2.25E+01	9.20E+00	4.25E-04	3.24E-04	2.50E-02	1.97E-06	2.23E-05	4.78E-02	4.25E-05	2.64E-05	6.16E-02	20
Commercial Turf Equipment	G2	25	5.06E+00	1.11E+01	9.84E+00	4.41E-04	3.39E-04	2.77E-02	2.05E-06	2.32E-05	4.98E-02	3.14E-05	2.74E-05	6.01E-02	20
Other Lawn & Garden Equipment	G2	2	4.33E+00	8.14E-01	4.54E-02	2.23E-05	7.27E-07	8.26E-05	9.20E-09	1.30E-07	2.23E-04	3.50E-07	1.38E-06	3.61E-04	0
Other Lawn & Garden Equipment	G2	2	1.33E+02	1.56E+00	9.92E-02	5.27E-05	1.46E-06	2.08E-04	1.77E-08	9.86E-07	4.29E-04	6.82E-07	3.28E-06	7.09E-04	0
Other Lawn & Garden Equipment	G2	15	1.88E+00	3.54E-01	9.88E-02	4.85E-05	1.58E-06	1.80E-04	2.00E-08	2.83E-07	4.86E-04	3.60E-07	3.01E-06	6.61E-04	0
Other Lawn & Garden Equipment	G2	15	5.78E+01	6.80E-01	2.06E-01	1.03E-04	3.11E-06	4.22E-04	3.85E-08	2.38E-06	9.34E-04	6.92E-07	6.42E-06	1.28E-03	0
Lawn Mowers	G4	5	2.60E+03	1.63E+03	1.91E+02	2.24E-02	5.82E-03	4.13E-01	3.83E-05	3.49E-03	1.11E+00	1.44E-03	1.29E-03	1.58E+00	523
Lawn Mowers	G4	5	4.12E+04	1.75E+03	2.40E+02	2.46E-02	6.96E-03	6.58E-01	4.11E-05	2.83E-03	1.19E+00	1.57E-03	1.41E-03	1.71E+00	566
Tillers	G4	5	2.69E+02	4.13E+01	5.75E+00	5.08E-04	1.33E-04	1.42E-02	1.08E-06	8.23E-05	3.12E-02	3.42E-05	2.94E-05	4.25E-02	14
Tillers	G4	5	1.05E+03	5.16E+01	7.94E+00	8.93E-04	2.31E-04	2.17E-02	1.35E-06	9.67E-05	3.91E-02	4.96E-05	5.16E-05	5.55E-02	18
Trimmers/Edgers/Brush Cutters	G4	5	4.74E+02	1.76E+02	5.32E+00	6.85E-04	3.14E-04	1.19E-02	1.04E-06	9.79E-06	3.00E-02	1.07E-04	3.96E-05	6.41E-02	21
Trimmers/Edgers/Brush Cutters	G4	5	2.21E+03	1.30E+02	4.64E+00	6.83E-04	1.92E-04	1.27E-02	7.65E-07	3.85E-05	2.22E-02	7.15E-05	3.95E-05	4.51E-02	15
Leaf Blowers/Vacuums	G4	5	1.21E+02	2.05E+01	1.34E+00	9.80E-05	2.47E-05	3.52E-03	2.42E-07	1.64E-05	7.00E-03	1.01E-05	5.67E-06	1.03E-02	3
Leaf Blowers/Vacuums	G4	5	1.04E+02	1.36E+00	1.03E-01	9.74E-06	2.34E-06	3.10E-04	1.61E-08	9.21E-07	4.65E-04	7.92E-07	5.63E-07	7.22E-04	0
Rear Engine Riding Mowers	G4	15	1.42E+03	1.06E+03	3.44E+02	1.59E-02	1.17E-02	9.84E-01	4.88E-05	7.94E-04	1.71E+00	1.70E-03	9.17E-04	2.26E+00	748
Rear Engine Riding Mowers	G4	15	1.25E+03	9.63E+01	3.17E+01	1.65E-03	1.10E-03	9.14E-02	4.45E-06	6.19E-05	1.56E-01	1.57E-04	9.57E-05	2.07E-01	68
Rear Engine Riding Mowers	G4	25	6.50E+00	4.83E+00	3.05E+00	1.36E-04	1.02E-04	9.02E-03	3.75E-07	6.86E-06	1.48E-02	1.10E-05	7.87E-06	1.83E-02	6
Rear Engine Riding Mowers	G4	25	5.61E+00	4.33E-01	2.76E-01	1.43E-05	8.73E-06	8.19E-04	3.36E-08	5.26E-07	1.32E-03	9.54E-07	8.25E-07	1.64E-03	1
Front Mowers	G4	15	6.52E+01	4.84E+01	2.52E+01	1.16E-03	8.53E-04	7.20E-02	3.57E-06	5.81E-05	1.25E-01	1.00E-04	6.71E-05	1.58E-01	52
Front Mowers	G4	15	2.11E+03	1.63E+02	8.55E+01	4.46E-03	2.98E-03	2.47E-01	1.20E-05	1.67E-04	4.21E-01	3.41E-04	2.58E-04	5.32E-01	176
Front Mowers	G4	25	5.10E+01	3.79E+01	2.65E+01	1.18E-03	8.83E-04	7.83E-02	3.25E-06	5.95E-05	1.28E-01	9.10E-05	6.83E-05	1.58E-01	52
Front Mowers	G4	25	1.65E+03	1.27E+02	8.98E+01	4.64E-03	2.84E-03	2.66E-01	1.09E-05	1.71E-04	4.31E-01	2.96E-04	2.68E-04	5.28E-01	175
Shredders	G4	5	5.12E+01	1.90E+01	5.11E+00	6.58E-04	3.02E-04	1.14E-02	9.95E-07	9.39E-06	2.88E-02	3.71E-05	3.80E-05	4.11E-02	14
Shredders	G4	5	1.90E+03	4.69E+00	1.59E+00	1.51E-04	4.72E-05	4.91E-03	2.45E-07	1.55E-05	7.11E-03	7.19E-06	8.74E-06	9.52E-03	3
Lawn & Garden Tractors	G4	15	2.61E+02	9.18E+01	5.75E+01	2.23E-03	1.66E-03	1.65E-01	8.18E-06	1.13E-04	2.87E-01	1.92E-04	1.29E-04	3.49E-01	116
Lawn & Garden Tractors	G4	15	1.69E+03	6.77E+01	4.28E+01	1.98E-03	1.39E-03	1.24E-01	6.03E-06	7.68E-05	2.12E-01	1.51E-04	1.15E-04	2.61E-01	86
Lawn & Garden Tractors	G4	25	1.03E+02	3.62E+01	3.60E+01	1.38E-03	9.79E-04	1.07E-01	4.43E-06	6.86E-05	1.75E-01	9.41E-05	7.99E-05	2.06E-01	68
Lawn & Garden Tractors	G4	25	6.68E+02	2.67E+01	2.68E+01	1.24E-03	7.81E-04	7.96E-02	3.27E-06	4.68E-05	1.29E-01	7.19E-05	7.19E-05	1.53E-01	51
Lawn & Garden Tractors	G4	50	1.49E+00	4.24E-01	6.54E-01	1.32E-05	2.65E-05	4.93E-04	6.67E-08	4.20E-07	5.49E-03	1.60E-06	7.65E-07	6.00E-03	2
Wood Splitters	G4	5	8.75E+01	3.08E+01	8.92E+00	9.31E-04	2.41E-04	2.05E-02	1.74E-06	1.48E-04	5.03E-02	4.11E-05	5.38E-05	6.42E-02	21
Wood Splitters	G4	5	2.19E+03	6.59E+00	2.38E+00	1.87E-04	5.07E-05	7.29E-03	3.72E-07	1.92E-05	1.08E-02	8.52E-06	1.08E-05	1.36E-02	5
Chippers/Stump Grinders	G4	15	1.23E+00	4.27E+00	3.57E+00	2.79E-04	2.10E-04	1.02E-02	4.94E-07	1.45E-04	1.73E-02	1.52E-05	1.58E-05	2.24E-02	7
Chippers/Stump Grinders	G4	15	2.20E+00	9.96E-02	8.71E-02	6.49E-06	3.28E-06	2.62E-04	1.15E-08	3.06E-06	4.04E-04	2.87E-07	3.75E-07	5.01E-04	0
Chippers/Stump Grinders	G4	25	7.01E+00	2.42E+01	3.41E+01	2.74E-03	1.80E-03	1.01E-01	4.08E-06	1.35E-03	1.61E-01	1.07E-04	1.56E-04	1.98E-01	65
Chippers/Stump Grinders	G4	25	1.25E+01	5.64E-01	8.18E-01	5.79E-05	2.75E-05	2.50E-03	9.49E-08	2.83E-05	3.75E-03	2.00E-06	3.35E-06	4.44E-03	1
Commercial Turf Equipment	G4	15	9.23E+01	2.02E+02	1.07E+02	6.12E-03	4.45E-03	3.06E-01	1.50E-05	2.94E-04	5.26E-01	4.69E-04	3.51E-04	6.79E-01	225
Commercial Turf Equipment	G4	25	4.54E+01	9.96E+01	9.34E+01	5.09E-03	3.93E-03	2.76E-01	1.14E-05	2.50E-04	4.48E-01	3.16E-04	2.92E-04	5.52E-01	183
Commercial Turf Equipment	G4	50	1.83E+01	3.68E+01	6.02E+01	1.78E-03	2.74E-03	8.22E-02	5.41E-06	3.41E-05	4.45E-01	1.57E-04	1.03E-04	4.96E-01	164
Commercial Turf Equipment	G4	120	1.21E-01	2.43E-01	5.94E-01	2.61E-06	1.59E-05	1.40E-04	5.32E-08	4.26E-07	5.51E-03	1.01E-06	1.51E-07	5.82E-03	2

Lawn & Garden					Tons/Day										MTons/Year
Equipment	**Fuel**	**MaxHP**	**Population**	**Activity**	**Consumption**	**ROG Exhaust**	**NOX Exhaust**	**CO Exhaust**	**SO2 Exhaust**	**PM Exhaust**	**CO2 Exhaust**	**N2O Exhaust**	**CH4 Exhaust**	**CO2e**	**CO2e**
Other Lawn & Garden Equipment	G4	5	8.10E+01	1.52E+01	3.08E+00	2.70E-04	6.90E-05	7.63E-03	5.77E-07	4.39E-05	1.67E-02	1.52E-05	1.56E-05	2.18E-02	7
Other Lawn & Garden Equipment	G4	5	2.48E+03	2.92E+01	7.08E+00	6.58E-04	1.60E-04	2.15E-02	1.11E-06	6.28E-05	3.21E-02	3.15E-05	3.80E-05	4.27E-02	14
Other Lawn & Garden Equipment	G4	15	3.60E+01	6.76E+00	2.98E+00	1.17E-04	8.71E-05	8.54E-03	4.23E-07	5.89E-06	1.49E-02	1.18E-05	6.77E-06	1.87E-02	6
Other Lawn & Garden Equipment	G4	15	1.10E+03	1.30E+01	5.96E+00	3.05E-04	1.91E-04	1.77E-02	8.14E-07	9.81E-06	2.85E-02	2.43E-05	1.76E-05	3.64E-02	12
Other Lawn & Garden Equipment	G4	25	7.60E-01	1.43E-01	1.37E-01	5.35E-06	3.80E-06	4.07E-04	1.69E-08	2.64E-07	6.67E-04	3.68E-07	3.10E-07	7.87E-04	0
Other Lawn & Garden Equipment	G4	25	2.34E+01	2.76E-01	2.75E-01	1.38E-05	7.77E-06	8.38E-04	3.27E-08	4.43E-07	1.29E-03	7.29E-07	7.97E-07	1.53E-03	1
Other Lawn & Garden Equipment	G4	50	5.51E-02	9.20E-03	1.97E-02	4.24E-07	8.74E-07	1.44E-05	2.02E-09	1.27E-08	1.66E-04	4.35E-08	2.45E-08	1.80E-04	0
Other Lawn & Garden Equipment	G4	120	1.32E-01	2.21E-02	1.22E-01	1.77E-06	8.23E-06	3.73E-05	1.08E-08	8.64E-08	1.12E-03	2.14E-07	1.02E-07	1.18E-03	0
Leaf Blowers/Vacuums	D	15	8.81E-02	2.90E-02	3.98E-03	4.59E-08	3.23E-07	2.66E-07	6.78E-10	1.48E-08	4.36E-05	0.00E+00	4.14E-09	4.36E-05	0
Leaf Blowers/Vacuums	D	120	7.71E-02	2.53E-02	5.63E-02	7.27E-07	5.66E-06	3.65E-06	7.23E-09	3.89E-07	6.16E-04	0.00E+00	6.56E-08	6.18E-04	0
Leaf Blowers/Vacuums	D	250	2.20E-02	7.24E-03	3.29E-02	1.84E-07	2.70E-06	7.16E-07	4.08E-09	7.14E-08	3.63E-04	0.00E+00	1.66E-08	3.63E-04	0
Lawn & Garden Tractors	D	15	2.13E+02	3.17E+02	1.34E+02	1.57E-03	1.10E-02	8.99E-03	2.29E-05	5.42E-04	1.47E+00	0.00E+00	1.42E-04	1.47E+00	488
Lawn & Garden Tractors	D	25	1.66E+02	2.48E+02	1.61E+02	2.16E-03	1.38E-02	7.30E-03	2.25E-05	6.36E-04	1.77E+00	0.00E+00	1.95E-04	1.78E+00	588
Chippers/Stump Grinders	D	25	9.92E-02	1.26E-01	1.16E-01	1.54E-06	9.72E-06	5.23E-06	1.61E-08	3.88E-07	1.27E-03	0.00E+00	1.39E-07	1.27E-03	0
Chippers/Stump Grinders	D	120	2.73E+00	3.48E+00	1.21E+01	1.91E-04	1.31E-03	8.46E-04	1.55E-06	1.05E-04	1.32E-01	0.00E+00	1.72E-05	1.32E-01	44
Chippers/Stump Grinders	D	175	1.87E-01	2.39E-01	1.43E+00	1.53E-05	1.37E-04	8.34E-05	1.77E-07	6.97E-06	1.57E-02	0.00E+00	1.38E-06	1.57E-02	5
Chippers/Stump Grinders	D	250	4.41E-02	5.61E-02	5.65E-01	4.03E-06	5.02E-05	1.35E-05	7.02E-08	1.51E-06	6.24E-03	0.00E+00	3.64E-07	6.25E-03	2
Chippers/Stump Grinders	D	500	4.08E-01	5.19E-01	5.81E+00	3.74E-05	4.62E-04	1.46E-04	6.29E-07	1.45E-05	6.41E-02	0.00E+00	3.38E-06	6.42E-02	21
Chippers/Stump Grinders	D	750	4.63E-01	5.89E-01	1.59E+01	1.05E-04	1.30E-03	3.99E-04	1.76E-06	4.04E-05	1.75E-01	0.00E+00	9.47E-06	1.75E-01	58
Chippers/Stump Grinders	D	1000	8.81E-01	1.12E+00	4.30E+01	3.72E-04	4.80E-03	1.34E-03	4.77E-06	1.35E-04	4.74E-01	0.00E+00	3.35E-05	4.75E-01	157
Commercial Turf Equipment	D	15	5.35E+00	1.57E+01	6.90E+00	7.84E-05	5.51E-04	4.61E-04	1.18E-06	2.20E-05	7.56E-02	0.00E+00	7.07E-06	7.57E-02	25
Commercial Turf Equipment	D	25	1.01E+02	2.94E+02	1.94E+02	2.57E-03	1.62E-02	8.77E-03	2.70E-05	6.20E-04	2.13E+00	0.00E+00	2.32E-04	2.14E+00	707
Other Lawn & Garden Equipment	D	15	7.71E-02	9.15E-02	5.10E-02	5.82E-07	4.09E-06	3.41E-06	8.69E-09	1.72E-07	5.59E-04	0.00E+00	5.26E-08	5.60E-04	0
Other Lawn & Garden Equipment	D	25	1.10E-02	1.31E-02	9.69E-03	1.29E-07	8.14E-07	4.38E-07	1.35E-09	3.25E-08	1.06E-04	0.00E+00	1.16E-08	1.07E-04	0
			140,141	14,018	2,651	0.422	0.112	5.179	0.000	0.015	16.673	0.011	0.026	20.655	6,839
			Population	**Activity**	**Consumption**	**lbs/day**					Tons/Day				MTons/Year
			1,425	143	27	9	2	105	0	0	0	0	0	0	**70**

As a percent of 2010 Total Population San Bernardino County 2,035,210 Yucca Valley 20,700 Percent 1%

SOURCE: U.S. Census Bureau, 2010.

Light Commercial					Tons/Day										MTons/Year
Equipment	**Fuel**	**MaxHP**	**Population**	**Activity**	**Consumption**	**ROG Exhaust**	**NOX Exhaust**	**CO Exhaust**	**SO2 Exhaust**	**PM Exhaust**	**CO2 Exhaust**	**N2O Exhaust**	**CH4 Exhaust**	**CO2e**	**CO2e**
Generator Sets	G2	2	1.55E+01	5.69E+00	3.61E-01	9.61E-05	1.42E-05	8.17E-04	7.55E-08	7.36E-06	1.83E-03	4.17E-06	5.97E-06	3.25E-03	1
Generator Sets	G2	2	1.22E+01	3.01E+00	2.07E-01	6.58E-05	7.43E-06	4.93E-04	3.99E-08	4.19E-06	9.69E-04	2.18E-06	4.09E-06	1.73E-03	1
Generator Sets	G2	15	1.56E-01	5.74E-02	3.27E-02	2.13E-06	1.31E-06	8.98E-05	6.85E-09	8.41E-08	1.66E-04	1.38E-07	1.33E-07	2.12E-04	0
Generator Sets	G2	15	1.19E-01	2.94E-02	1.82E-02	3.05E-06	6.26E-07	5.04E-05	3.51E-09	1.16E-07	8.53E-05	6.74E-08	1.90E-07	1.10E-04	0
Pumps	G2	2	6.15E+01	4.35E+01	2.33E+00	3.48E-04	1.10E-04	4.41E-03	5.85E-07	4.99E-05	1.42E-02	3.22E-05	2.17E-05	2.46E-02	8
Pumps	G2	2	4.83E+01	2.30E+01	1.41E+00	3.36E-04	5.87E-05	3.08E-03	3.09E-07	2.91E-05	7.50E-03	1.70E-05	2.09E-05	1.32E-02	4
Pumps	G2	15	1.66E+01	1.17E+01	5.97E+00	3.94E-04	2.96E-04	1.62E-02	1.26E-06	2.57E-04	3.06E-02	3.00E-05	2.45E-05	4.04E-02	13
Pumps	G2	15	1.30E+01	6.19E+00	3.25E+00	3.29E-04	1.50E-04	8.88E-03	6.66E-07	1.36E-04	1.62E-02	1.54E-05	2.04E-05	2.14E-02	7
Pumps	G2	25	2.01E-01	1.42E-01	1.57E-01	1.03E-05	7.08E-06	4.37E-04	3.24E-08	6.60E-06	7.88E-04	5.22E-07	6.42E-07	9.63E-04	0
Pumps	G2	25	1.56E-01	7.42E-02	8.26E-02	5.59E-06	3.59E-06	2.32E-04	1.70E-08	3.45E-06	4.12E-04	2.68E-07	3.47E-07	5.02E-04	0
Generator Sets	G4	5	2.03E+02	7.47E+01	1.89E+01	3.55E-03	7.87E-04	4.60E-02	3.32E-06	3.32E-04	9.62E-02	1.16E-04	2.05E-04	1.36E-01	45
Generator Sets	G4	5	1.60E+02	3.95E+01	1.06E+01	2.10E-03	4.14E-04	2.74E-02	1.76E-06	1.73E-04	5.09E-02	6.10E-05	1.21E-04	7.23E-02	24
Generator Sets	G4	15	5.58E+02	2.05E+02	1.23E+02	8.98E-03	5.52E-03	3.55E-01	1.70E-05	3.14E-04	5.95E-01	5.28E-04	5.19E-04	7.69E-01	255
Generator Sets	G4	15	4.39E+02	1.09E+02	6.87E+01	6.60E-03	2.76E-03	2.06E-01	8.96E-06	1.64E-04	3.14E-01	2.70E-04	3.82E-04	4.06E-01	134
Generator Sets	G4	25	3.00E+02	1.10E+02	1.42E+02	1.00E-02	5.97E-03	4.21E-01	1.71E-05	3.56E-04	6.75E-01	4.12E-04	5.80E-04	8.15E-01	270
Generator Sets	G4	25	2.36E+02	5.83E+01	7.83E+01	6.95E-03	2.87E-03	2.37E-01	9.04E-06	1.87E-04	3.57E-01	2.07E-04	4.02E-04	4.29E-01	142
Generator Sets	G4	50	9.98E+01	3.14E+01	7.16E+01	1.85E-03	3.62E-03	5.94E-02	7.18E-06	4.52E-05	5.90E-01	1.66E-04	1.07E-04	6.44E-01	213
Generator Sets	G4	120	1.93E+01	6.07E+00	3.25E+01	5.89E-04	2.50E-03	1.18E-02	2.82E-06	2.27E-05	2.92E-01	6.25E-05	3.40E-05	3.12E-01	103
Generator Sets	G4	175	1.82E+00	5.73E-01	5.15E+00	5.51E-05	4.50E-04	1.45E-03	4.69E-07	3.76E-06	4.73E-02	8.31E-06	3.19E-06	4.99E-02	17
Pumps	G4	5	7.21E+01	5.09E+01	8.54E+00	1.43E-03	5.82E-04	1.72E-02	1.72E-06	4.17E-05	4.99E-02	8.36E-05	8.26E-05	7.76E-02	26
Pumps	G4	5	5.66E+01	2.69E+01	5.13E+00	1.00E-03	2.83E-04	1.23E-02	9.10E-07	5.48E-05	2.64E-02	4.21E-05	5.79E-05	4.06E-02	13
Pumps	G4	15	7.81E+01	5.52E+01	2.95E+01	2.32E-03	1.66E-03	8.40E-02	4.11E-06	1.21E-03	1.44E-01	1.52E-04	1.34E-04	1.94E-01	64
Pumps	G4	15	6.14E+01	2.92E+01	1.59E+01	1.37E-03	8.39E-04	4.61E-02	2.17E-06	6.30E-04	7.62E-02	7.82E-05	7.94E-05	1.02E-01	34
Pumps	G4	25	2.00E+01	1.41E+01	1.64E+01	1.27E-03	8.37E-04	4.79E-02	1.99E-06	6.58E-04	7.85E-02	5.58E-05	7.31E-05	9.73E-02	32
Pumps	G4	25	1.57E+01	7.47E+00	8.76E+00	7.00E-04	4.25E-04	2.57E-02	1.05E-06	3.48E-04	4.15E-02	2.88E-05	4.05E-05	5.12E-02	17
Pumps	G4	50	7.98E+00	4.83E+00	1.09E+01	2.90E-04	4.93E-04	9.28E-03	1.08E-06	6.83E-06	8.91E-02	2.34E-05	1.68E-05	9.67E-02	32
Pumps	G4	120	1.01E+01	6.12E+00	3.72E+01	6.91E-04	2.44E-03	1.33E-02	3.24E-06	2.60E-05	3.35E-01	5.70E-05	3.99E-05	3.54E-01	117
Pumps	G4	175	3.05E-01	1.84E-01	1.66E+00	1.73E-05	1.26E-04	4.85E-04	1.51E-07	1.21E-06	1.52E-02	2.29E-06	1.00E-06	1.59E-02	5
Air Compressors	G4	5	2.60E+01	4.03E+01	8.77E+00	1.40E-03	6.42E-04	1.65E-02	1.84E-06	1.74E-05	5.34E-02	7.89E-05	8.08E-05	7.96E-02	26
Air Compressors	G4	5	2.05E+01	2.13E+01	4.63E+00	7.39E-04	3.39E-04	8.70E-03	9.75E-07	9.20E-06	2.82E-02	4.17E-05	4.27E-05	4.21E-02	14
Air Compressors	G4	15	1.32E+01	2.04E+01	7.72E+00	6.01E-04	4.54E-04	2.18E-02	1.08E-06	3.17E-04	3.79E-02	4.77E-05	3.46E-05	5.34E-02	18
Air Compressors	G4	15	1.04E+01	1.08E+01	4.07E+00	3.10E-04	2.34E-04	1.15E-02	5.70E-07	1.68E-04	2.00E-02	2.49E-05	1.79E-05	2.81E-02	9
Air Compressors	G4	25	1.78E+00	2.75E+00	2.60E+00	2.08E-04	1.37E-04	7.59E-03	3.14E-07	1.04E-04	1.24E-02	9.91E-06	1.20E-05	1.57E-02	5
Air Compressors	G4	25	1.40E+00	1.45E+00	1.37E+00	1.08E-04	7.12E-05	4.01E-03	1.66E-07	5.50E-05	6.56E-03	5.19E-06	6.22E-06	8.30E-03	3
Air Compressors	G4	50	3.03E+00	4.02E+00	8.77E+00	3.52E-04	4.82E-04	9.74E-03	8.27E-07	5.21E-06	6.80E-02	2.17E-05	2.03E-05	7.52E-02	25
Air Compressors	G4	120	9.84E+00	1.30E+01	4.99E+01	1.50E-03	4.16E-03	2.56E-02	4.21E-06	3.38E-05	4.36E-01	1.13E-04	8.63E-05	4.73E-01	157
Air Compressors	G4	175	6.62E-01	8.77E-01	6.00E+00	8.72E-05	6.04E-04	1.90E-03	5.43E-07	4.35E-06	5.46E-02	1.14E-05	5.03E-06	5.83E-02	19
Welders	G4	15	5.09E+01	2.90E+01	1.64E+01	1.50E-03	8.36E-04	4.78E-02	2.20E-06	6.28E-04	7.70E-02	7.77E-05	8.69E-05	1.03E-01	34
Welders	G4	25	1.84E+02	1.05E+02	9.13E+01	7.56E-03	4.42E-03	2.69E-01	1.09E-05	3.59E-03	4.30E-01	3.44E-04	4.37E-04	5.46E-01	181
Welders	G4	50	1.59E+01	9.02E+00	2.20E+01	7.02E-04	1.19E-03	1.97E-02	2.17E-06	1.37E-05	1.79E-01	5.09E-05	4.06E-05	1.95E-01	65
Welders	G4	120	1.62E+01	9.21E+00	3.14E+01	7.25E-04	2.58E-03	1.27E-02	2.71E-06	2.17E-05	2.81E-01	7.36E-05	4.19E-05	3.04E-01	101
Welders	G4	175	1.12E+00	6.35E-01	3.82E+00	4.84E-05	3.66E-04	1.11E-03	3.47E-07	2.78E-06	3.50E-02	7.45E-06	2.80E-06	3.73E-02	12
Pressure Washers	G4	5	5.46E+01	2.01E+01	7.06E+00	1.09E-03	3.25E-04	1.50E-02	1.39E-06	1.38E-04	4.04E-02	3.90E-05	6.33E-05	5.38E-02	18
Pressure Washers	G4	5	4.29E+01	1.06E+01	4.33E+00	8.29E-04	1.73E-04	1.10E-02	7.37E-07	7.23E-05	2.13E-02	2.07E-05	4.79E-05	2.88E-02	10
Pressure Washers	G4	15	4.87E+01	1.79E+01	1.04E+01	7.62E-04	4.68E-04	3.01E-02	1.44E-06	2.66E-05	5.04E-02	4.53E-05	4.40E-05	6.54E-02	22
Pressure Washers	G4	15	3.83E+01	9.47E+00	5.83E+00	5.60E-04	2.34E-04	1.75E-02	7.60E-07	1.40E-05	2.67E-02	2.32E-05	3.24E-05	3.45E-02	11
Pressure Washers	G4	25	9.15E+00	3.36E+00	5.12E+00	3.44E-04	2.15E-04	1.51E-02	6.17E-07	1.28E-05	2.44E-02	1.37E-05	1.99E-05	2.90E-02	10
Pressure Washers	G4	25	7.18E+00	1.78E+00	2.80E+00	2.38E-04	1.04E-04	8.45E-03	3.26E-07	6.69E-06	1.29E-02	6.91E-06	1.38E-05	1.53E-02	5
Pressure Washers	G4	50	8.92E-01	2.81E-01	7.16E-01	1.73E-05	3.22E-05	5.50E-04	7.27E-08	4.58E-07	5.98E-03	1.44E-06	1.00E-06	6.44E-03	2
Generator Sets	C4	120	1.44E+00	4.52E-01	2.83E+00	2.38E-06	1.56E-04	5.97E-04	0.00E+00	1.69E-06	1.90E-02	0.00E+00	2.00E-05	1.94E-02	6

Light Commercial					Tons/Day										MTons/Year
Equipment	**Fuel**	**MaxHP**	**Population**	**Activity**	**Consumption**	**ROG Exhaust**	**NOX Exhaust**	**CO Exhaust**	**SO2 Exhaust**	**PM Exhaust**	**CO2 Exhaust**	**N2O Exhaust**	**CH4 Exhaust**	**CO2e**	**CO2e**
Generator Sets	C4	175	1.19E+00	3.74E-01	4.10E+00	2.74E-06	2.26E-04	7.15E-04	0.00E+00	2.46E-06	2.76E-02	0.00E+00	2.29E-05	2.81E-02	9
Gas Compressors	C4	50	2.23E-01	5.19E+00	1.78E+01	1.01E-05	3.67E-04	1.79E-03	0.00E+00	9.34E-06	1.22E-01	0.00E+00	8.48E-05	1.24E-01	41
Gas Compressors	C4	120	4.61E-01	1.07E+01	1.04E+02	5.51E-05	2.17E-03	2.86E-02	0.00E+00	5.31E-05	6.86E-01	0.00E+00	4.62E-04	6.95E-01	230
Gas Compressors	C4	175	7.44E-02	1.73E+00	2.67E+01	1.54E-05	5.81E-04	5.83E-03	0.00E+00	1.42E-05	1.78E-01	0.00E+00	1.29E-04	1.81E-01	60
Gas Compressors	C4	250	5.95E-02	1.39E+00	2.76E+01	1.18E-05	5.63E-04	6.71E-03	0.00E+00	1.64E-05	1.84E-01	0.00E+00	9.92E-05	1.86E-01	62
Gas Compressors	C4	500	5.21E-02	1.21E+00	3.89E+01	1.67E-05	7.92E-04	9.44E-03	0.00E+00	2.30E-05	2.59E-01	0.00E+00	1.40E-04	2.62E-01	87
Generator Sets	D	15	3.75E+01	3.47E+01	1.62E+01	2.72E-04	1.85E-03	1.21E-03	2.75E-06	1.07E-04	1.77E-01	0.00E+00	2.46E-05	1.77E-01	59
Generator Sets	D	25	2.74E+01	2.54E+01	2.04E+01	3.51E-04	2.07E-03	1.21E-03	2.83E-06	1.22E-04	2.23E-01	0.00E+00	3.16E-05	2.24E-01	74
Generator Sets	D	50	3.35E+01	3.10E+01	4.38E+01	1.50E-03	4.60E-03	4.25E-03	6.12E-06	3.97E-04	4.74E-01	0.00E+00	1.35E-04	4.77E-01	158
Generator Sets	D	120	5.09E+01	4.71E+01	1.68E+02	2.87E-03	1.91E-02	1.17E-02	2.15E-05	1.52E-03	1.83E+00	0.00E+00	2.59E-04	1.84E+00	608
Generator Sets	D	175	3.01E+00	2.78E+00	1.80E+01	2.05E-04	1.84E-03	1.03E-03	2.22E-06	9.01E-05	1.97E-01	0.00E+00	1.85E-05	1.98E-01	65
Generator Sets	D	250	1.68E+00	1.55E+00	1.49E+01	1.07E-04	1.41E-03	3.50E-04	1.86E-06	3.95E-05	1.65E-01	0.00E+00	9.68E-06	1.65E-01	55
Generator Sets	D	500	3.74E+00	3.46E+00	5.27E+01	3.39E-04	4.50E-03	1.32E-03	5.71E-06	1.31E-04	5.82E-01	0.00E+00	3.06E-05	5.82E-01	193
Generator Sets	D	750	2.32E+00	2.15E+00	5.28E+01	3.51E-04	4.65E-03	1.32E-03	5.86E-06	1.33E-04	5.83E-01	0.00E+00	3.17E-05	5.84E-01	193
Generator Sets	D	9999	6.04E-01	5.59E-01	2.66E+01	2.44E-04	3.05E-03	8.58E-04	2.94E-06	8.71E-05	2.93E-01	0.00E+00	2.20E-05	2.93E-01	97
Pumps	D	15	2.82E+01	3.10E+01	1.06E+01	2.07E-04	1.23E-03	7.88E-04	1.79E-06	8.42E-05	1.15E-01	0.00E+00	1.87E-05	1.16E-01	38
Pumps	D	25	8.41E+00	9.27E+00	8.27E+00	1.79E-04	8.37E-04	4.88E-04	1.15E-06	5.45E-05	9.03E-02	0.00E+00	1.62E-05	9.06E-02	30
Pumps	D	50	1.47E+01	1.62E+01	2.57E+01	9.44E-04	2.72E-03	2.62E-03	3.58E-06	2.43E-04	2.77E-01	0.00E+00	8.51E-05	2.79E-01	92
Pumps	D	120	2.87E+01	3.17E+01	1.13E+02	2.00E-03	1.31E-02	7.99E-03	1.45E-05	1.07E-03	1.23E+00	0.00E+00	1.81E-04	1.24E+00	410
Pumps	D	175	3.11E+00	3.43E+00	2.19E+01	2.59E-04	2.27E-03	1.27E-03	2.70E-06	1.15E-04	2.40E-01	0.00E+00	2.34E-05	2.41E-01	80
Pumps	D	250	2.24E+00	2.47E+00	2.25E+01	1.69E-04	2.16E-03	5.37E-04	2.80E-06	6.20E-05	2.49E-01	0.00E+00	1.52E-05	2.49E-01	82
Pumps	D	500	4.42E-02	4.88E-02	7.62E-01	5.11E-06	6.58E-05	1.96E-05	8.25E-08	1.96E-06	8.41E-03	0.00E+00	4.61E-07	8.42E-03	3
Pumps	D	750	7.37E-03	8.13E-03	2.10E-01	1.45E-06	1.87E-05	5.40E-06	2.33E-08	5.49E-07	2.32E-03	0.00E+00	1.31E-07	2.32E-03	1
Pumps	D	9999	1.62E-01	1.79E-01	1.10E+01	1.03E-04	1.28E-03	3.64E-04	1.22E-06	3.66E-05	1.21E-01	0.00E+00	9.30E-06	1.21E-01	40
Air Compressors	D	15	3.83E-01	8.55E-01	2.83E-01	5.54E-06	3.29E-05	2.11E-05	4.80E-08	2.25E-06	3.08E-03	0.00E+00	5.00E-07	3.09E-03	1
Air Compressors	D	25	7.59E-01	1.69E+00	1.12E+00	2.43E-05	1.13E-04	6.60E-05	1.55E-07	7.37E-06	1.22E-02	0.00E+00	2.19E-06	1.23E-02	4
Air Compressors	D	50	6.90E+00	1.54E+01	1.60E+01	7.85E-04	1.78E-03	2.05E-03	2.21E-06	1.85E-04	1.71E-01	0.00E+00	7.08E-05	1.73E-01	57
Air Compressors	D	120	4.59E+01	1.02E+02	2.21E+02	4.61E-03	2.75E-02	1.69E-02	2.82E-05	2.55E-03	2.40E+00	0.00E+00	4.16E-04	2.41E+00	799
Air Compressors	D	175	1.74E+00	3.88E+00	1.57E+01	2.22E-04	1.75E-03	9.84E-04	1.93E-06	1.00E-04	1.71E-01	0.00E+00	2.00E-05	1.72E-01	57
Air Compressors	D	250	2.45E+00	5.46E+00	3.24E+01	2.92E-04	3.35E-03	8.34E-04	4.02E-06	1.04E-04	3.58E-01	0.00E+00	2.64E-05	3.58E-01	119
Air Compressors	D	500	3.19E+00	7.12E+00	7.47E+01	6.11E-04	6.83E-03	2.04E-03	8.09E-06	2.22E-04	8.24E-01	0.00E+00	5.51E-05	8.25E-01	273
Air Compressors	D	750	1.19E+00	2.66E+00	4.32E+01	3.59E-04	4.07E-03	1.18E-03	4.79E-06	1.31E-04	4.76E-01	0.00E+00	3.23E-05	4.77E-01	158
Air Compressors	D	1000	2.95E-02	6.57E-02	1.45E+00	1.50E-05	1.78E-04	5.15E-05	1.61E-07	5.25E-06	1.60E-02	0.00E+00	1.35E-06	1.60E-02	5
Welders	D	15	1.27E+01	2.24E+01	6.37E+00	1.25E-04	7.41E-04	4.75E-04	1.08E-06	5.08E-05	6.94E-02	0.00E+00	1.13E-05	6.97E-02	23
Welders	D	25	1.12E+01	1.97E+01	1.02E+01	2.21E-04	1.03E-03	6.00E-04	1.41E-06	6.71E-05	1.11E-01	0.00E+00	1.99E-05	1.12E-01	37
Welders	D	50	3.45E+01	6.07E+01	7.33E+01	3.28E-03	8.01E-03	8.70E-03	1.02E-05	7.93E-04	7.87E-01	0.00E+00	2.96E-04	7.93E-01	263
Welders	D	120	2.68E+01	4.71E+01	8.52E+01	1.68E-03	1.04E-02	6.34E-03	1.09E-05	9.20E-04	9.30E-01	0.00E+00	1.52E-04	9.33E-01	309
Welders	D	175	1.33E-01	2.33E-01	1.05E+00	1.39E-05	1.14E-04	6.39E-05	1.29E-07	6.24E-06	1.14E-02	0.00E+00	1.26E-06	1.15E-02	4
Welders	D	250	2.95E-02	5.19E-02	2.80E-01	2.37E-06	2.81E-05	7.02E-06	3.47E-08	8.56E-07	3.09E-03	0.00E+00	2.14E-07	3.09E-03	1
Welders	D	500	7.37E-02	1.30E-01	9.84E-01	7.52E-06	8.82E-05	2.64E-05	1.07E-07	2.80E-06	1.09E-02	0.00E+00	6.78E-07	1.09E-02	4
Pressure Washers	D	15	1.74E+00	6.90E-01	1.54E-01	2.60E-06	1.76E-05	1.15E-05	2.62E-08	1.02E-06	1.69E-03	0.00E+00	2.34E-07	1.69E-03	1
Pressure Washers	D	25	4.05E-01	1.61E-01	5.25E-02	9.02E-07	5.33E-06	3.10E-06	7.29E-09	3.14E-07	5.74E-04	0.00E+00	8.14E-08	5.76E-04	0
Pressure Washers	D	50	8.03E-01	3.19E-01	2.10E-01	5.63E-06	2.14E-05	1.72E-05	2.94E-08	1.64E-06	2.28E-03	0.00E+00	5.08E-07	2.29E-03	1
Pressure Washers	D	120	3.32E-01	1.32E-01	1.45E-01	2.21E-06	1.58E-05	9.59E-06	1.86E-08	1.14E-06	1.58E-03	0.00E+00	1.99E-07	1.59E-03	1
			3,464	1,809	2,426	0.094	0.189	2.343	0.000	0.020	20.548	0.004	0.007	21.786	7,214
			Population	**Activity**	**Consumption**	**lbs/day**					Tons/Day				MTons/Year
			42	22	30	2	5	57	0	0	0	0	0	0	**88**

As a percent of 2010 Total Employment San Bernardino County 612,543 Yucca Valley 7,481 Percent 1.2%

SOURCE: U.S. Census Bureau. 2010. Longitudinal Employer-Household Dynamics. http://lehd.ces.census.gov/

Appendix D

Biological Resources Technical Report

Appendices

This page intentionally left blank.

Biological Technical Report for the Town of Yucca Valley General Plan Update

January 22, 2013

Prepared For:

Town of Yucca Valley
Shane Stueckle, Deputy Town Manager
57090 Twentynine Palms Hwy
Yucca Valley, CA 92284

Prepared By:

Alden Environmental, Inc.
3245 University Ave., #1188
San Diego, CA 92104

Town of Yucca Valley General Plan Update
Biological Technical Report

TABLE OF CONTENTS

Section	Title	Page
1.0	INTRODUCTION	1
2.0	METHODS	1
3.0	EXISTING BIOLOGICAL RESOURCES SETTING	2
	3.1 Regulatory Context	2
	3.1.1 Federal Regulations	2
	3.1.2 State Regulations	5
	3.1.3 Regional Conservation Framework	9
	3.1.4 Local Conservation Framework	12
	3.2 Existing Biological Conditions	13
	3.2.1 Environmental Setting	13
	3.2.2 Topography and Soils	13
	3.2.3 Climate	14
	3.2.4 Vegetation Communities and Land Cover Types	14
	3.2.5 Flora	18
	3.2.6 Fauna	18
	3.3 Sensitive Biological Resources	19
	3.3.1 Sensitive Vegetation Communities	19
	3.3.2 Special Status Plant Species	20
	3.3.3 Special Status Wildlife Species	26
	3.3.4 Wildlife Movement Corridors	39
	3.3.5 Open Space Resource Areas	43
	3.3.6 Wetland and Riparian Resources	44
4.0	FUTURE ENVIRONMENTAL OPPORTUNITIES, CONSTRAINTS, AND MITIGATION MEASURES	47
	4.1 Opportunities	47
	4.2 Constraints and Compensatory Mitigation Measures	48
	4.2.1 General Measures for Impact Assessments	48
	4.2.2 Measures for Impacts to Jurisdictional Areas	50
	4.2.3 Measures for Impacts to WCEAs and OSRAs	51
5.0	REFERENCES	52

TABLE OF CONTENTS (cont.)

LIST OF FIGURES

Number	Title	Follows Page
1	Regional Map	2
2	Vicinity Map	2
3	Conservation Areas	10
4	Biological Resources	14
5	Potential Wetland and Riparian Resources	20

LIST OF TABLES

Number	Title	Page
1	Sensitive Plant Species within the Vicinity of the Town of Yucca Valley	25
2	Sensitive Wildlife Species within the Vicinity of the Town of Yucca Valley	37

1.0 INTRODUCTION

This Biological Technical Report describes the existing biological conditions within and adjacent to the Town of Yucca Valley (Town) General Plan Update Area (Figures 1 and 2). The information contained in this report will be used to inform the General Plan Update and Environmental Impact Report (EIR) for the Town. Detailed information provided in this report includes regulatory context, existing biological conditions, sensitive biological resources, and future opportunities to protect the natural environment and constraints for development.

2.0 METHODS

A review of existing literature and databases were conducted to determine the existing biological conditions and general occurrence of sensitive biological resources within the Town General Plan Update area.

Background research to determine the existing biological conditions included a review of current federal, state, and local regulations, historical and current aerial photographs, U.S. Geological Survey (USGS) topographic maps, U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey maps, historical weather information for the Town, literature from peer review journals, and reputable online resources that provide data for the region.

A review of the California Natural Diversity Data Base (CNDDB) was performed to identify known sensitive biological resources in the vicinity of the Town General Plan Update area. The CNDDB, which is administered by the California Department of Fish and Wildlife (CDFW), provides an inventory of vegetation communities, plant species, and wildlife species that are considered sensitive by state and federal resource agencies, academic institutions, and other conservation groups. Historical occurrences of sensitive species from the Yucca Valley North and Yucca Valley South USGS quadrangles were used to determine species with a potential to occur within and adjacent to the Town General Plan Update area.

The information provided in this report is based solely on an analysis of existing literature and data for the region. No new surveys were conducted to prepare this report.

The presence of regional conservation plans that govern the management of lands for the protection of biological resources were also identified in the Town General Plan Update area to provide the regional regulatory framework for the Town General Plan Update and EIR.

3.0 EXISTING BIOLOGICAL RESOURCES SETTING

This section describes the regulatory context, existing biological conditions, and sensitive biological resources found within and adjacent to the Town.

3.1 REGULATORY CONTEXT

To establish the regulatory context for the Town General Plan Update, a variety of federal, state, and local regulations were evaluated to determine if they may be applicable to future proposed projects within the Town General Plan Update area. In addition, regional land use and management, including established and proposed parks and preserves, and multiple regional conservation plans were evaluated to provide the regional regulatory framework for the Town General Plan Update. This section describes the federal and state regulations that may apply to future projects as well as the regional and local regulatory framework for the Town.

3.1.1 Federal Regulations

Several federal regulations may apply to future projects that are proposed within the Town General Plan area. These include, but are not limited to:

- National Environmental Policy Act
- Federal Endangered Species Act of 1973 (16 United States Code [USC] 1531 *et seq.*)
- Clean Water Act of 1972 (33 USC 1251 *et seq.*)
- Migratory Bird Treaty Act of 1918 (16 USC 703 through 711)
- Bald and Golden Eagle Protection Act (16 USC 668)

These federal regulations are described in detail in this section.

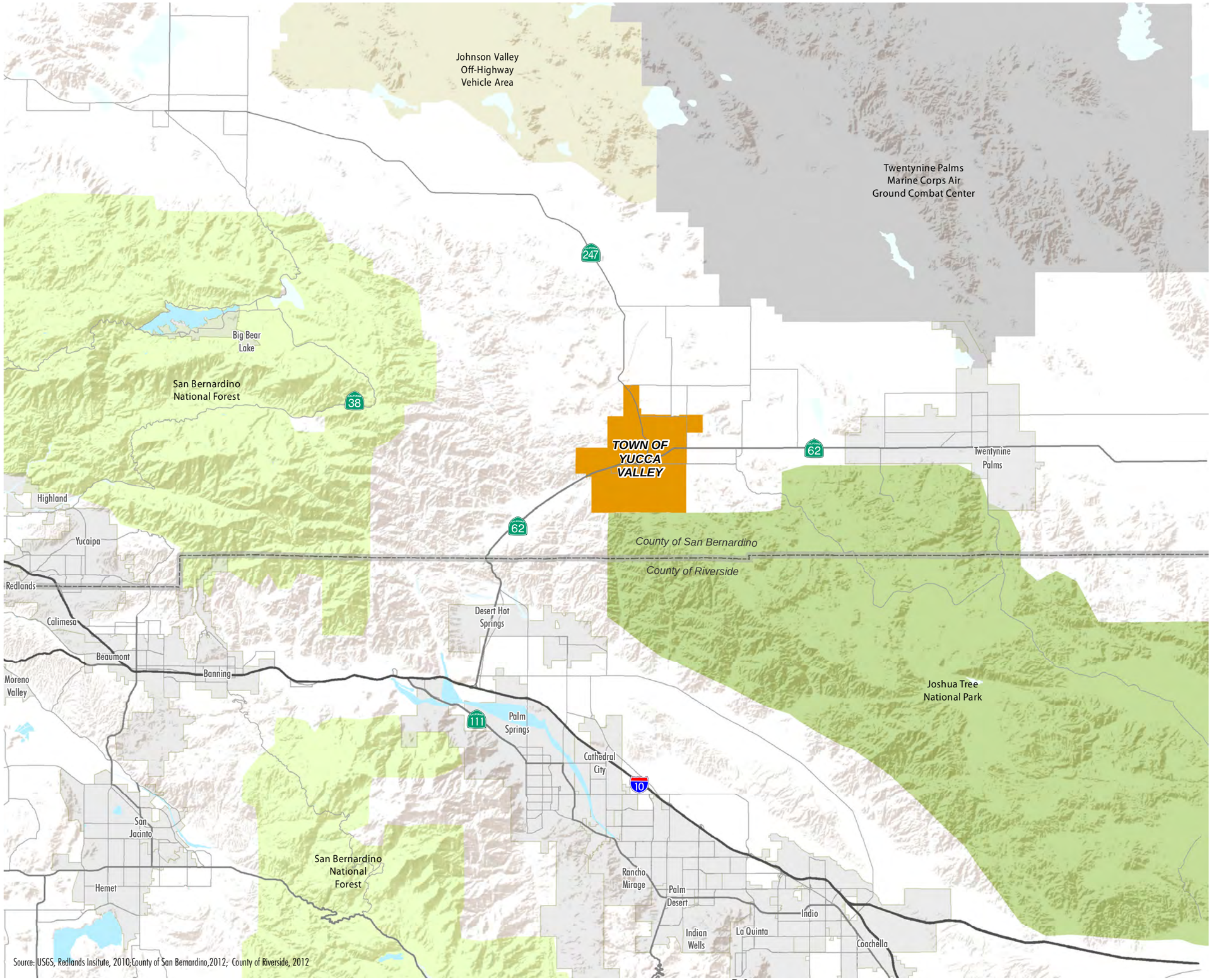
<u>National Environmental Policy Act</u>

The National Environmental Policy Act (NEPA) was passed in 1969 and established a broad national framework for protecting the environment by assuring that all branches of government give proper consideration to the environment prior to undertaking any major federal action that has the potential to significantly affect the environment. NEPA applies to projects undertaken, funded, or requiring the issuance of a permit by a federal agency, including projects associated with airports, buildings, military complexes, highways, parkland purchases, and other federal activities are proposed.

NEPA is administered by the President's Council on Environmental Quality (CEQ), which is supported by a staff of environmental professionals. CEQ's main responsibilities in the NEPA process are to gather information on the conditions and trends in environmental quality, to evaluate federal programs in light of the goals established by NEPA, to develop and promote

Figure 1

REGIONAL MAP



Source: USGS, Redlands Insitute, 2010;County of San Bernardino,2012; County of Riverside, 2012

- Johnson Valley Off Highway Vehicle Area
- Joshua Tree National Park
- San Bernardino National Forest
- Twenty Nine Palms Marine Corps Air Ground Combat Center
- Town of Yucca Valley Limits
- City Boundary
- County Boundary

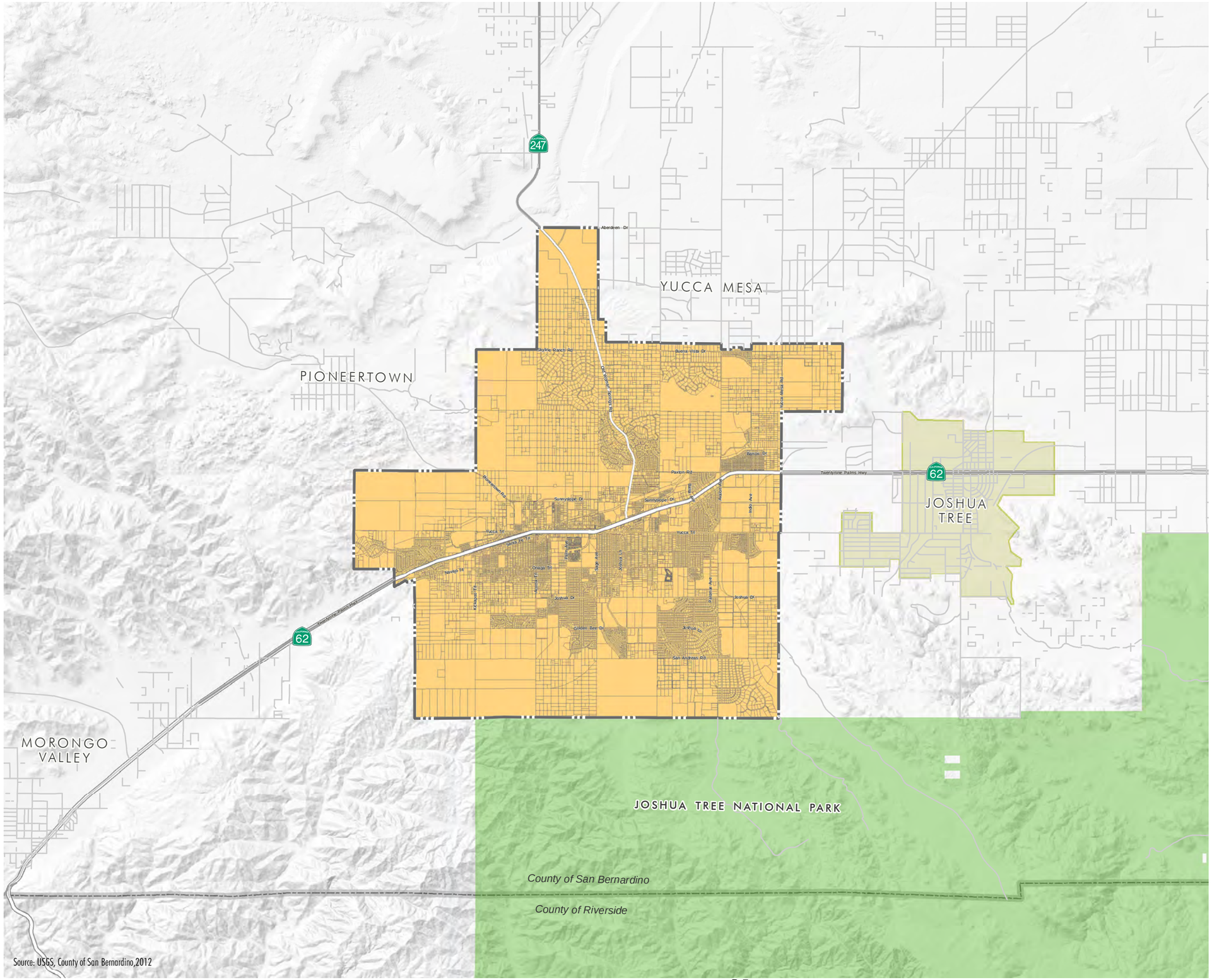
ALDEN ENVIRONMENTAL, INC

TYV-01 01.21.13

0 10,500 21,000 42,000 Feet

Figure 2

VICINITY MAP



- Town of Yucca Valley
- Joshua Tree
- Joshua Tree National Park
- County Boundary

ALDEN ENVIRONMENTAL, INC

TYV-01 01.21.13

0 2,800 5,600 11,200 Feet

national policies to improve environmental quality, and to conduct studies, surveys, research, and analyses relating to ecosystems and environmental quality. In addition, federal agencies may involve CEQ in the NEPA process when there are disagreements concerning the environmental effects of a proposed action.

The federal agency responsible for complying with NEPA is the agency that is proposing to implement the federal action; however, several federal agencies may be involved with the NEPA process based on an agency's expertise and relationship to the proposed action. A federal agency may be a Lead Agency or a Cooperating Agency in the NEPA process.

A Lead Agency is designated when more than one federal agency is involved in a proposed action. The Lead Agency is responsible for supervising the environmental analysis and the preparation of the appropriate environmental document, such as a Categorical Exclusion (CE), Finding of No Significant Impact (FONSI), Environmental Assessment (EA), or Environmental Impact Statement (EIS).

A Cooperating Agency is a federal, state, local, or tribal agency that has jurisdiction over a proposed action or that has special expertise with an environmental issue associated with the proposed action. The Cooperating Agency assists the Lead Agency by participating in the entire NEPA process, including the scoping, environmental analysis, and document preparation.

Any federal lead agency may be a Lead Agency or a Cooperating Agency, depending upon the specifics of the proposed action. However, the Environmental Protection Agency (EPA) has a unique role in the NEPA review process because it is required to review and publicly comment on the environmental impacts of major proposed federal actions, specifically those for which an EIS is required. If the EPA determines that the environmental analysis is unsatisfactory or that the proposed action would have adverse environmental effects, it is required to involve CEQ in the NEPA process.

Federal Endangered Species Act of 1973 (16 United States Code [USC] 1531 *et seq.*)

The Federal Endangered Species Act of 1973 (FESA) was designed to protect critically imperiled plant and wildlife species from extinction by eliminating or reducing the threats to these species and by aiding in the recovery and/or maintenance of the species populations. FESA designates species that are endangered or threatened, as well as species that are candidates for listing and protects these species from unauthorized "take", which is defined as to "harass, harm, pursue, hunt, shoot, wound, kill trap, capture, or collect, or to attempt to engage in any such conduct." FESA also designates critical habitat for federally listed species and protects these species from interference with vital breeding and behavioral activities and from critical habitat degradation.

FESA is administered by the U.S. Fish and Wildlife Service (USFWS) for freshwater fish and terrestrial wildlife and the National Oceanic and Atmospheric Administration (NOAA) for

marine and anadromous species. A person, defined as an "individual, corporation, partnership, trust, association, or any other private entity; or any officer, employee, agent, department, or instrumentality of the Federal Government, of any State, municipality, or political subdivision of a State, or of any foreign government; any State, municipality, or political subdivision of a State; or any other entity subject to the jurisdiction of the United States", is prohibited from taking a listed species until an appropriate permit pursuant to Section 7, 9, and/or 10 of the ESA has been obtained from USFWS and/or NOAA.

Clean Water Act of 1972 (33 USC 1251 *et seq.*)

Sections 404 and 401 of the Clean Water Act of 1972 (CWA) apply to potential impacts to wetlands, Waters of the U.S., and Waters of the State. The U.S. Environmental Protection Agency (ESA) administers the CWA; however, some sections of the CWA are administered by other agencies.

Section 404 of the CWA regulates the discharge of dredged or fill material into navigable waters, including both wetlands and other Waters of the U.S. The discharge of dredged or fill material is typically associated with a variety of development projects, agricultural activities, and water resource projects. The U.S. Army Corps of Engineers (Corps) administers Section 404 of the CWA and is responsible for issuing general and individual permits and for making jurisdictional determinations.

Section 401 of the CWA requires a State Water Quality Certification or waiver for any activity requiring a Section 404 permit. The State Water Quality Certification ensures the activity will not violate any established State water quality standards. The State Water Resources Control Board (SWRCB), in conjunction with the nine California Regional Water Quality Control Boards (RWQCBs), administers Section 401 of the CWA and is responsible for issuing permits pursuant to the Section 401 Water Quality Certification Program.

Migratory Bird Treaty Act of 1918 (16 USC 703 through 711)

The Migratory Bird Treaty Act of 1918 (MBTA) implements various conventions and treaties between the United States and Canada, Mexico, Japan, and Russia for the protection of over 800 migratory bird species. Under the MBTA, it is unlawful to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird…or any part, nest, or egg of any such bird" (16 USC 703).

The MBTA is administered by USFWS. Take permits for MBTA species are rarely issued, except for specific actions to aid recovery of a species; however, USFWS establishes hunting seasons for species for which there is a long tradition of hunting, as long as hunting will not

adversely impact their population status or long-term conservation. While the MBTA includes approximately 170 species of game birds, hunting is typically authorized for fewer than 60 of these species each year.

Bald and Golden Eagle Protection Act (16 USC 668)

The Bald and Golden Eagle Protection Act (BGEPA) provides protection for both the bald eagle (*Haliaeetus leucocephalus*) and the golden eagle (*Aquila chrysaetos*) by prohibiting the "take" of either of these species, including their parts, nests, or eggs. The MBTA defines "take" as to "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb" any bald or golden eagle. The BGEPA is administered by the USFWS, and limited take authorizations are granted for qualifying activities. Persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle [or any golden eagle], alive or dead, or any part, nest, or egg thereof" without prior approval are subject to criminal penalties.

3.1.2 State Regulations

Several state regulations may apply to future projects that are proposed within the Town General Plan area. These include, but are not limited to the:

- California Environmental Quality Act
- California Endangered Species Act (Fish and Game Code 2050 *et seq.*)
- California Fish and Game Code
- California Porter-Cologne Water Quality Control Act
- California Native Desert Plants Act
- California Natural Community Conservation Planning Program

These state regulations are described in detail in this section.

California Environmental Quality Act

The California Environmental Quality Act (CEQA) was passed in 1970 as the state counterpart to NEPA to institute a statewide policy of environmental protection. CEQA applies to projects undertaken, funded, or requiring the issuance of a permit by a state or local public agency and requires the project proponent to identify significant environmental impacts as well as avoidance, minimization, and/or mitigation measures to reduce these impacts to below a level of significance.

The CDFW has jurisdiction over the conservation, protection, and management of native habitats, plant species, and wildlife species found within California and is responsible for maintaining sustainable populations of these habitats and species. The CDFW provides

biological expertise to review and comment on CEQA documents, including the impacts resulting from proposed project activities and the proposed avoidance, minimization, and mitigation measures associated with these impacts. The CDFW may play various roles in the CEQA process; the CDFW is always a Trustee Agency and may also be a Lead Agency or a Responsible Agency.

The CDFW is one of four trustee agencies, which also include the State Lands Commission, the Department of Parks and Recreation, and the University of California. As a Trustee Agency, the CDFW has jurisdiction over certain resources held in trust for the people of California and is typically required to be notified of CEQA documents that are relevant to its jurisdiction, such as documents for projects involving fish and wildlife resources. As a Trustee Agency, the CDFW cannot approve or disapprove a project; however, the lead and responsible agencies must consult with the CDFW, and the CDFW reviews the CEQA document(s) and provides recommendations regarding the resources under their jurisdiction (Fish and Game Code Section 1802).

When the CDFW proposes to implement its own project, it is designated as the Lead Agency in the CEQA process and serves as the California government agency with principle responsibility for implementing or approving the proposed project. Such projects typically include projects in state wildlife areas and state fish hatcheries as well as habitat or stream restoration projects. Additionally, the CDFW is the Lead Agency when it is the only agency issuing a permit, as is sometimes the case with Streambed Alteration Agreements. As the Lead Agency for such projects, the CDFW is responsible for preparing the CEQA document and determines whether a Negative Declaration or an EIR is required by CEQA (CEQA Statutes, Sections 21080.3 and 21104.2; Guidelines, Sections 15050 and 15367).

The CDFW is also sometimes designated as a Responsible Agency, which is an agency, other than the Lead Agency, that has the legal responsibility for implementing and approving a proposed project. The CDFW is designated as the Responsible Agency when the Lead Agency requires a 1600 Streambed Alteration Agreement or a 2081(b) California Endangered Species Act Incidental Take Permit for a project. As a Responsible Agency, CDFW actively participates in the CEQA process by reviewing the Lead Agency's CEQA document and using that document to make decisions about the proposed project, to prepare and issue its own findings regarding the project (CEQA Guidelines, Sections 15096 and 15381), and to determine whether or not to issue an incidental take permit.

California Endangered Species Act (CESA; Fish and Game Code 2050 *et seq.*)

The CESA parallels FESA and protects and/or preserves native plant and wildlife species and their habitats, especially those that are threatened with extinction and those that are experiencing significant decline that may lead to a threatened or endangered designation, within the state of California. CESA designates special status species that are protected from unauthorized "take", which is defined as to "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill."

CESA is administered by the CDFW. A state lead agency is required to consult with the CDFW to ensure that a proposed project is not likely to jeopardize the continued existence of a special status species or result in the destruction or adverse modification of essential habitat for a species. CESA allows for the issuance of incidental take permits for lawful development projects and emphasizes the benefits of early consultation between the lead agency and CDFW to avoid potential impacts to special status species and to develop appropriate mitigation measures to reduce impacts to and avoid loss of a special status species.

California Fish and Game Code

Several sections of the California Fish and Game Code, which is administered by the CDFW, also may apply to future projects proposed in the Town. These include Section 2081; Sections 1600 through 1616; Sections 1900, et seq.; Sections 2511, 4700, 5050, and 5515; Sections 3503, 3503.5, and 3513; and Title 14, California Code of Regulations, Section 670.2 and 670.6. Each of these sections is discussed in detail below.

Section 2081

Section 2081 of the California Fish and Game Code allows for the issuance of an incidental take permit from CDFW for projects that have the potential to take a special status species, including a state-listed species, as long as the impacts are minimized and fully mitigated and will not jeopardize the continued existence of a state-listed species. The measures required to minimize and fully mitigate impacts must be roughly proportional to the extent of the proposed impact to the species and must be capable of successful implementation while maintaining the applicant's objectives to the greatest extent feasible. The applicant must show that adequate funding is available to implement the required avoidance and mitigation measures and monitor the effectiveness of the mitigation measures.

Sections 1600 through 1616

Sections 1600 through 1616 of the California Fish and Game Code apply to all projects that would (1) substantially divert or obstruct the natural flow of, (2) substantially change or use any material from, or (3) deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement into the bed, channel, or bank of any river, stream, or lake. Sections 1600 through 1616 require any person, business, public utility, or state or local government agency that proposes any activity within or adjacent to a lake, river, or stream that flows at least intermittently through a bank or channel, including watercourses with a subsurface flow (e.g., ephemeral streams, desert washes) and some flood plains, to notify the regional CDFW office of the proposed activity. CDFW will determine if the proposed activity may substantially adversely affect fish and wildlife resources and if a Streambed Alteration Agreement is necessary.

Other Sections

Additional sections of the California Fish and Game Code may apply to future projects proposed in the Town, including, but not limited to, Sections 1900 through 1913; Sections 2511, 4700, 5050, and 5515; Sections 3503, 3503.5, and 3513; and Title 14, California Code of Regulations, Section 670.2 and 670.6. Sections 1900 through 1913 provide guidelines to preserve, protect, and enhance endangered or rare native plants within California. Sections 2511, 4700, 5050, and 5515 provide guidelines to protect wildlife species that are designated as "fully protected" by the CDFW and as therefore cannot be harmed, taken, or possessed. Sections 3503, 3503.5, and 3513 state that it is unlawful to take, possess, or destroy the nest or eggs of any bird species except otherwise allowed by the or any regulation made pursuant to the California Fish and Game Code. Section 3503.5 provides protection specifically in the orders Falconiformes (hawks, eagles, and flacons) and Strigiformes (owls), and Section 3513 provides protection specifically for migratory, non-game birds designated by the MBTA. Title 14, California Code of Regulations, Section 670.2 and 670.6 list wildlife species that are designated as California Species of Concern or are state-listed as threatened or endangered species.

California Porter-Cologne Water Quality Control Act

The California Porter-Cologne Water Quality Control Act was enacted in 1969 and is administered by either the SWRCB and/or the RWQCB. This Act provides protection for Waters of the State, which are defined as "any surface water or groundwater, including saline waters, within the boundaries of the state." If a proposed project involves alteration to any Waters of the State, the project proponent must file a Report of Waste Discharge with the appropriate RWQCB to obtain "Waste Discharge Requirements" (WDRs), which serve as the project discharge permit.

California Desert Native Plants Act

The California Desert Native Plants Act was passed in 1981 and is administered by the CDFW. This Act provides protection for non-listed California desert native plants from unlawful harvesting on both public and private lands within Imperial Inyo, Kern, Los Angeles, Mono, Riverside, San Bernardino, and San Diego counties. The California Desert Native Plants Act prohibits a person from harvesting, transporting, selling, or possessing specific native desert plants unless that person has a valid permit or wood receipt, and the required tags and seals.

This Act does not apply to the clearing or removal of native plants from a canal, lateral ditch, survey line, building site, or road or other right-of-way by the landowner or his or her agent, if the native plants are not to be transported from the land or offered for sale. Additionally, this Act does not apply to a public agency or to a publicly or privately owned public utility when acting in the performance of its obligation to provide service to the public.

California Natural Community Conservation Planning Program

The California Natural Community Conservation Planning (NCCP) program was initiated in 1991 and is administered by CDFW. It is a cooperative effort by the CDFW and numerous public and private partners that takes a broad scale, ecosystem approach to planning for the protection and perpetuation of biological diversity throughout California by protecting both habitats and the species within these habitats while also accommodating compatible land use.

An NCCP plan identifies and provides for the regional protection of plants, wildlife, and their habitats, while allowing compatible and appropriate economic activity in the region. By including key interests in the process and by working with landowners, environmental organizations, and other interested parties, an NCCP plan provides the framework for a local agency to oversee the numerous activities that compose the development of a conservation plan. The CDFW and USFWS provide the necessary support, direction, and guidance to NCCP participants during the NCCP plan development and implementation. Within California, there are currently 23 active NCCP plans covering more than 11 million acres, and several draft NCCP plans--including the draft West Mojave Plan, which is discussed in detail in Section 3.1.3.1--are pending approval.

3.1.3 Regional Conservation Framework

Several management plans and preserves provide a regional conservation framework for the General Plan Update area (Figure 3). These include existing conservation plans and management areas as well as proposed conservation plans and management areas. Adopted conservation plans and management areas include, but are not limited to:

- Joshua Tree National Park
- Big Morongo Canyon Preserve
- Burns Piñon Ridge Reserve
- San Gorgonio Wilderness
- Pioneertown Mountains Preserve
- Bighorn Mountain Wilderness

Draft conservation plans and management areas include, but are not limited to:

- Draft West Mojave Plan
- Draft Desert Renewable Energy Conservation Plan
- Proposed Sand to Snow National Monument

Each of these is discussed in detail, below.

Joshua Tree National Park

Joshua Tree National Park, which abuts the southern Town boundary, is located in San Bernardino and Riverside counties and covers approximately 791,000 acres south and southeast of the Town. Joshua Tree National Park protects portions of three ecosystems: the Colorado Desert, the Mojave Desert, and the pinyon and juniper woodlands in the Little San Bernardino Mountains A large part of Joshua Tree National Park (approximately 430,000 acres) has been designated as a wilderness area and is managed by the National Park Service in accordance with the Wilderness Act.

Big Morongo Canyon Preserve

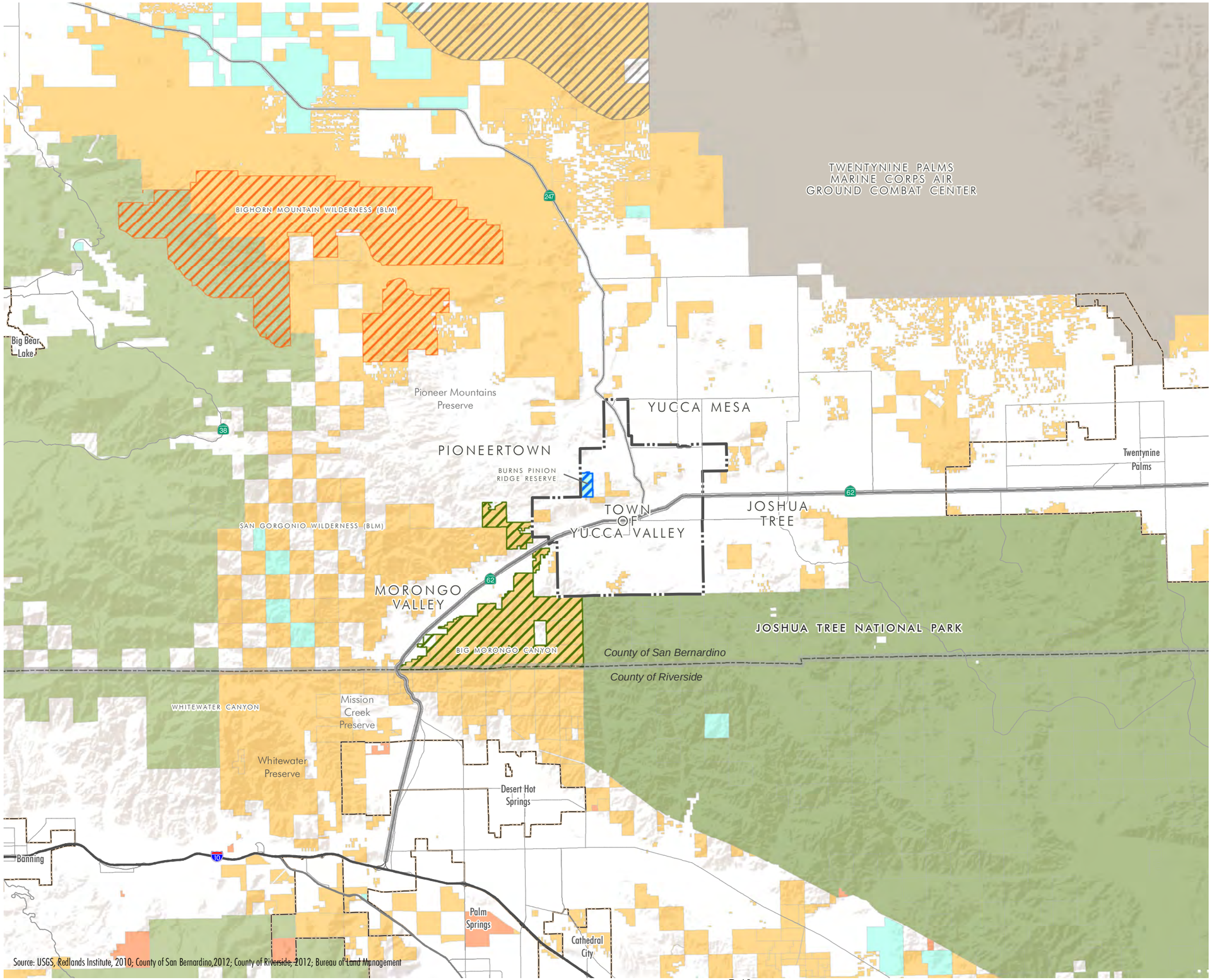
Big Morongo Canyon Preserve, which occurs approximately 3 miles southwest of the Town, is located in the Little San Bernardino Mountains and covers approximately 31,000 acres, with elevations ranging from approximately 600 feet above mean sea level on the canyon bottoms to approximately 3,000 feet above mean sea level on the ridgelines. Because of its ecological importance to the region, the Big Morongo Canyon Preserve was designated as an Area of Critical Environment Concern by BLM in 1982. This Preserve protects one of the 10 largest cottonwood and willow riparian habitats in California as well as a variety of other ecosystems. Big Morongo Canyon Preserve is managed by BLM, and a small portion – approximately 147 acres – is managed under a cooperative agreement with San Bernardino County to protect rare and endangered wildlife, enhance sensitive riparian zones, promote the growth and restoration of a wide variety of plants, and offer educational opportunities.

Burns Piñon Ridge Reserve

The approximately 300-acre Burns Piñon Ridge Reserve is located just north of the Town. It is situated in the Big Morongo Basin and is characterized by a rugged, boulder-strewn landscape composed of a series of shallow canyons along with steep, rocky ridges of sculptured granite. The Reserve, which shows little evidence of disturbance from human activities or grazing, has a diverse mixture of flora and fauna that is characteristic of its unique location as a transition between the lower desert, the upper desert, and the mountains as well as an ecotone between three floristic regions – the Transverse Range, Sonoran Desert, and Mojave Desert. Habitats protected on the Reserve include pinyon and juniper woodland with elements of Joshua tree woodland and montane chaparral, desert wash, and freshwater seep. This Burns Piñon Ridge Reserve is a part of the University of California Natural Land and Water Reserves System.

San Gorgonio Wilderness

The San Gorgonio Wilderness is located west of the Town boundary and covers approximately 95,000 acres in Riverside and San Bernardino counties. The topography within the San Gorgonio Wilderness changes rapidly from canyons and low, rolling foothills to steep rugged mountain. Elevations range from approximately 2,300 feet above mean sea level to



Source: USGS, Redlands Institute, 2010; County of San Bernardino,2012; County of Riverside, 2012; Bureau of Land Management

Figure 3
CONSERVATION AREAS

Land Ownership
- Bureau of Land Management
- Local Government
- State
- US Forest Service
- National Park Service
- Military

Conservation Areas
- Big Morongo Canyon
- Burns Pinion Ridge Reserve
- Bighorn Mountain Wilderness
- Johnson Valley Off Highway

- Town Yucca Valley Limits
- City Boundary
- County Boundary

ALDEN
ENVIRONMENTAL, INC

TYV-01 01.21.12

0 7,000 14,000 28,000 Feet

approximately 11,500 feet above mean sea level. With its diverse landscape and large elevation range, the San Gorgonio Wilderness is a unique transition zone between the desert, mountain, and coastal ecosystems. The San Gorgonio Wilderness is managed jointly by the BLM and the United States Forest Service (USFS).

Pioneertown Mountains Preserve

The Pioneertown Mountains Preserve is located northwest of the Town and covers approximately 25,500 acres from the San Bernardino Mountains down into the Pioneertown Valley in the Mojave Desert. Elevations within the Pioneertown Mountains Preserve range from approximately 4,000 feet in the Pioneertown Valley to approximately 7,800 feet in the San Bernardino Mountains. The Pioneertown Mountains Preserve supports year-round riparian corridors through Pipes Canyon and Little Morongo Canyon, and provides important wildlife corridors between Joshua Tree National Park to the south and the Bighorn Mountains Wilderness to the north. The Pioneertown Mountain Preserve is owned and operated by the Wildlands Conservancy.

Bighorn Mountain Wilderness

The Bighorn Mountain Wilderness is located northwest of the Town and protects 38,500 acres along the eastern slopes of the San Bernardino Mountains down into the Mojave Desert. The rugged Bighorn Mountains, which are foothills of the San Bernardino Mountains, occupy the north central portion of this wilderness. Elevations change dramatically, with distinct changes in vegetation from Joshua tree woodland on the desert floor to stands of Jeffrey Pine at higher elevations up to 7,500 feet above mean sea level. The Bighorn Mountain Wilderness is managed jointly by the BLM and the USFS.

Draft West Mojave Plan

The draft West Mojave Plan (WMP) covers approximately 9.3 million acres of the western portion of the Mojave Desert that is located in California, including parts of Inyo, Los Angeles, Kern, and San Bernardino counties. The draft WMP is an interagency Habitat Conservation Plan (HCP) that is being prepared by the Bureau of Land Management (BLM) in collaboration with federal and state agencies.. The Town is located in the draft WMP area but is not currently a participating agency.

The purpose of the draft WMP is to conserve and protect the desert tortoise (*Gopherus agassizii*) and nearly 100 other sensitive plant and wildlife species as well as the habitats on which these species depend while also providing developers of public and private projects with a streamlined program for compliance with FESA and CESA by reducing delays and expenses, eliminating uncertainty, and applying the costs of compensation and mitigation equitably to all agencies and parties. Once adopted, the WMP would allow incidental take of covered species and would be consistent with the resource management plans adopted by each of the region's five military

bases as well as with the Desert Tortoise Recovery Plan. The term of the WMP would be 30 years.

Draft Desert Renewable Energy Conservation Plan

The draft Desert Renewable Energy Conservation Plan (DRECP) covers approximately 22.5 million acres of federal and non-federal lands located in the California deserts and adjacent lands located in Imperial, Inyo, Kern, Los Angeles, Riverside, San Bernardino, and San Diego counties. It is a collaboration between state (e.g., California Energy Commission, CDFW) and federal (e.g., BLM, USFWS) agencies, with input from local governments, environmental organizations, industry, and other interested parties to provide effective protection, conservation, and management of desert ecosystems while allowing for the appropriate development and timely permitting of renewable energy projects (CEC 2012).

Once approved, the DRECP would result in an efficient and effective biological mitigation and conservation program providing renewable energy project developers with binding, long-term endangered species permit assurances while facilitating the review and approval of solar thermal, utility-scale solar photovoltaic (PV), wind, and other forms of renewable energy and associated infrastructure such as electric transmission lines necessary for renewable energy development within the Mojave and Colorado desert regions of California (CEC 2012).

Proposed Sand to Snow National Monument

The proposed Sand to Snow National Monument would be located west of the Town and would include approximately 134,000 acres of federal land between Joshua Tree National Park and the San Bernardino National Forest, including the San Gorgonio Wilderness and the Big Morongo Canyon Preserve, which were discussed earlier in this section. The proposed Sand to Snow National Monument would rise from approximately 1,400 feet above mean sea level at the Mojave Desert floor up to approximately 11,503 feet above mean sea level at San Gorgonio Mountain. The proposed Sand to Snow National Monument would include one of California's most diverse landscapes and would also protect wildlife corridors between the San Bernardino Mountains, San Jacinto Mountains and Joshua Tree National Park. The proposed Sand to Snow National Monument would be managed jointly by the BLM and the USFS.

3.1.4 Local Conservation Framework

The Town General Plan (Town 1995) identifies the importance of the biological resources that occur within and adjacent to the Town and outlines goals, policies, and programs to utilize and conserve these resources by guiding decision makers in regulating land use and development while protecting the biological resources. In addition to goals, policies, and programs established in the existing Town General Plan, the local conservation framework also includes the Plant Protection and Management Ordinance as well as existing natural open space in Yucca Valley, both of which are discussed, below.

Plant Protection and Management Ordinance

The Town established the Plant Protection and Management Ordinance (Ordinance No. 140; DCA-06-01) to protect its abundant and diverse plant resources. This Ordinance, which is still under review, provides regulations and guidelines for the management of the plant resources in the Town with the intent to preserve native plants that are unique to the Town. The Plant Protection and Management Ordinance regulates the removal and/or relocation of several native plant species, including Joshua trees (*Yucca brevefolia*), California juniper (*Juniperus californica*), desert willow (*Chilopsis linearis*), single-leaf pinyon pine (*Pinus monophylla*), all species of palo verde (*Cercidium* spp.), all species of manzanita (*Arctostaphylos* spp.), all species of mesquite (*Prosopis* spp.) with stems 2 inches or greater in diameter or 6 feet or greater in height, all species of yucca (e.g., Mohave yucca [*Yucca schidigera*] and our Lord's candle [*Yucca whipplei*]), all creosote (*Larrea tridentata*) rings measuring 10 feet or greater in diameter, and all plants protected or regulated by the California Desert Native Plants Act.

Existing Natural Open Space in Yucca Valley

Two parks – North Park and South Park – totaling approximately 120 acres, are preserved as natural open space on BLM land. North Park is located in the foothills of the San Bernardino Mountains near the west end of the Town, and South Park is located in the Little San Bernardino Mountains near the south Town boundary.

3.2 EXISTING BIOLOGICAL CONDITIONS

The Town is located in a biologically rich environment. This section describes the environmental setting, climate, vegetation communities and land cover types, and general flora and fauna within and adjacent to the Town General Plan Update area.

3.2.1 Environmental Setting

The Town of Yucca Valley is located in San Bernardino County in southern California (Figure 1). It is bordered to the south by Joshua Tree National Park, to the west by the San Bernardino Mountains, and to the north and east by relatively open desert habitats (Figure 2). Because the Town is located along the southern edge of the Mojave Desert and just north of the Sonoran Desert, it is a transition area between the two deserts and shows characteristics of both.

3.2.2 Topography and Soils

The topography within the approximately 40-square-mile Town varies greatly. While the northeastern portion of the Town is situated in the Morongo Basin, an east-west desert valley, the west end of the Town is in the southeastern foothills of the San Bernardino Mountains and the south end of the Town is in the Little San Bernardino Mountains. Because of this varied

topography, the elevations in the Town range from approximately 3,090 feet above mean seal level on the floor or the Morongo Basin in the eastern portion of the Town to approximately 4,603 feet above mean sea level in the Little San Bernardino Mountains in the southern portion of the Town.

Six soil types are mapped within the General Plan Update area, including Ramona-Hanford-Greenfield, Sheephead-Rock Outcrop-Bancas, Upspring-Sparkhule-Rock Outcrop, Cajon-Arizo, and Wasco-Helendale-Bryman (USDA 1973).

3.2.3 Climate

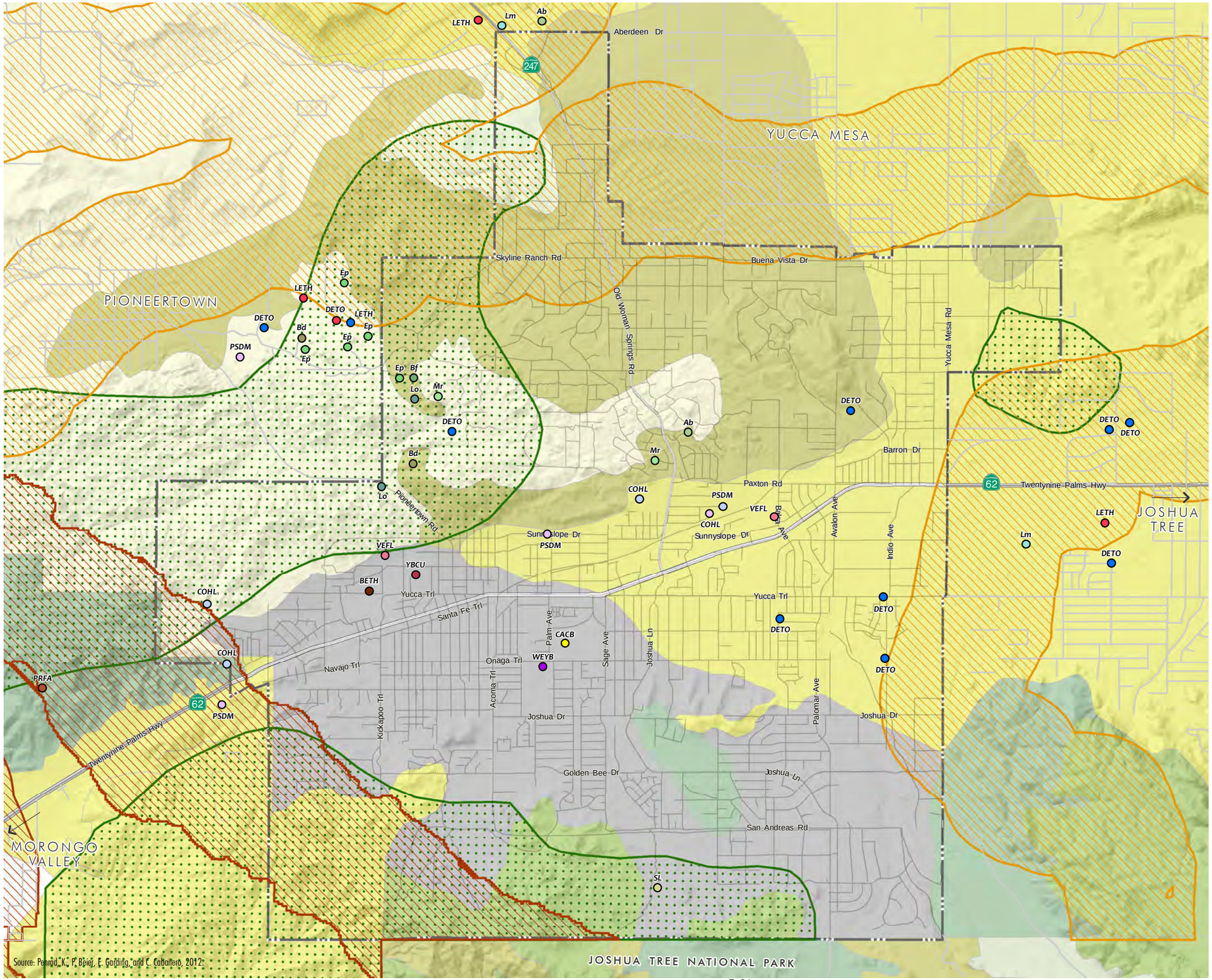
The Town is located in an arid, desert region in southern California. In general, these deserts experience hot summers, with temperatures over 100 degrees Fahrenheit, and low annual precipitation, typically getting fewer than 5 inches of precipitation each year. The Town, however, experiences a milder climate. Temperatures in the Town during the summer (June to August) average highs between 94 and 98 degrees Fahrenheit and lows between 61 and 75 degrees Fahrenheit, while temperatures during the winter (December to February) average highs between 57 and 62 degrees Fahrenheit and lows between 36 and 40 degrees Fahrenheit. The spring (March to May) and fall (September to November) typically have warm days and cool nights (Town 2012).

Total rainfall for the year averages just over 5 inches, with the majority of the rainfall occurring in September, November, and December. The Town also averages approximately 3 inches of snowfall each year, with all the snowfall occurring in January. In addition, the Town typically experiences windy conditions throughout each month of the year, with wind speeds ranging from 8 to 39 miles per hour (mph) and a monthly average of 20 mph (Town 2012).

3.2.4 Vegetation Communities and Land Cover Types

Land cover mapping for the provided by CNDDB provides generalized vegetation community mapping for the General Plan update area (Figure 4). The land cover categories include non-native grassland, blackbush scrub, Mojave creosote bush scrub, Mojave mixed woody scrub, Mojavean pinyon and juniper woodlands, semi-desert chaparral, and urban land. While these cover categories are useful in identifying overall vegetation, they are not specific enough to identify sensitive vegetation communities at a project level. Two additional vegetation communities, desert wash scrub and Joshua tree woodland, are known from the area but not shown on the CNDDB land cover map.

In total, 10 vegetation communities and land cover types have been identified as potentially present within the General Plan Update area (Tierra 2004). Each of the vegetation community is described in detail below, based on information provided in the *Preliminary Descriptions of the Terrestrial Natural Communities of California* (Holland 1986). A detailed description of disturbed lands and urban/developed lands are also provided.



Source: Penrod, K., P. Beier, E. Gerding, and C. Cabanero, 2012.

Figure 4

BIOLOGICAL RESOURCES

Historic Sensitive Species Locations

Plants

- Bf Fremont's barberry (Berberis fremontii)
- SL Latimer's woodland-gilia (Saltugilia latimeri)
- Lm Little San Bernardino Mountains linanthus(Linanthus maculatus)
- Lo Orcutt's linanthus (Linanthus orcuttii)
- Ep Parish's daisy (Erigeron parishii)
- Bd Pinyon rock-cress (Boechera dispar)
- Mr Robison's monardella (Monardella robisonii)
- Ab San Bernardino milk-vetch (Astragalus bernardinus)

Birds

- BETH Bendire's thrasher (Toxostoma bendirei)
- LETH LeConte's thrasher (Toxostoma lecontei)
- PRFA Prairie falcon (Falco mexicanus)
- VEFL Vermilion flycatcher (Pyrocephalus rubinus)
- YBCU Western yellow-billed cuckoo (Coccyzus americanus occidentalis)

Mammals

- PSDM Pallid San Diego pocket mouse (Chaetodipus fallax pallidus)
- WEYB Western yellow bat (Lasiurus xanthinus)

Reptiles

- COHL Coast horned lizard (Phrynosoma blainvillii)
- DETO Desert tortoise (Gopherus agassizii)

Insects

- CACB California cuckoo bee (Paranomada californica)

CNDDB Land Cover

- Blackbush Scrub
- Mojave Creosote Bush Scrub
- Mojave Mixed Steppe
- Mojave Mixed Woody Scrub
- Mojavean Pinyon and Juniper Woodlands
- Non-Native Grassland
- Semi-Desert Chaparral
- Urban or Built-up Land

Other

- San Bernardino-Little San Bernardino Linkage Design
- Joshua Tree 29 Palms Linkage Design
- Open Space Resource Area
- Town Limits

ALDEN ENVIRONMENTAL, INC

TYV-01 01.21.13

0 1,500 3,000 6,000 Feet

In addition to these vegetation communities and land cover types, there are several wetland and riparian habitats that have been identified within the Town General Plan Update area in the USFWS National Wetlands Inventory (USFWS 2012). However, because a current wetland evaluation and/or wetland delineation of these areas is not available, these areas are discussed in general in Section 3.3.5 (Wetlands and Riparian Resources) later in this document.

Blackbush Scrub

Blackbush scrub is characterized by low growing, often intricately branched shrubs that measure approximately 1.5 to 3.5 feet tall. Within this vegetation community, the crowns of the shrubs typically do not touch, and there is often bare ground between plants. Dominant plants species typically include blackbrush (*Coleogyne ramosissima*) along with Joshua tree, singleleaf pinyon (*Pinus monophylla*), and Utah juniper (*Juniperus osteosperma*). Most of the growth and flowering occurs in late spring, and most of the species found within blackbush scrub are dormant in the winter from the cold temperatures and in the summer and fall from lack of rainfall.

Blackbush scrub is found on dry, well-drained slopes and flats with shallow, often calcareous soils, with low water holding capacity. This vegetation community is found at elevations between 4,000 and 7,000 feet above mean sea level from the Owens Valley region in Inyo and southern Mono counties to the Mojave Desert in Kern and San Bernardino counties.

Creosote Bush Scrub

Creosote bush scrub is characterized by shrubs that measure approximately 1.5 to 10 feet tall. Within this vegetation community, the shrubs are often widely spaced, and there is often bare ground between the plants. Dominant plant species typically include creosote bush (*Larrea tridentata*) and burrobush (*Ambrosia dumosa*). Most of the growth within this vegetation community occurs during spring if rainfall is sufficient, and many species of annuals may flower in late March and April or occasionally after thunderstorms in late summer or fall after sufficient rainfall. However, most of the species found within creosote bush scrub are dormant in the winter from the cold temperatures and in the summer and fall from lack of rainfall.

Creosote bush scrub is found on well-drained secondary soils with very low available water holding capacity on slopes and fans and within valleys. This vegetation community is found at elevations below 4,000 feet above mean sea level and is found extensively from the Death Valley region south into Baja California, Mexico.

Desert Wash Scrub

Desert wash scrub is a low growing, scrubby vegetation community with a diversity of species often including catclaw (*Acacia greggii*), desert willow, ephedra (*Ephedra californica*), desert

olive (*Forestiera neomexicana*), red-fruited mahonia (*Berberis haematocarpa*), and smoke tree (*Psorothamnus spinosus*). Desert wash scrub is found in sandy arroyos, washes, springs, and alluvial slopes throughout the Mojave Desert, usually below about 5,000 feet.

Joshua Tree Woodland

Joshua tree woodland is an open woodland community. The dominant species exhibit a diversity of life forms; the Joshua tree is usually the only arborescent species, growing up to approximately 40 feet high, while the numerous shrub species – sclerophyllous evergreen trees and shrubs (e.g., *Yucca* spp.), microphyllous evergreen shrubs (*Juniperus* spp.), semideciduous shrubs (*Eriogonum*, *Tetradymia*), semisucculents (*Lycium* spp.), and succulents (*Opuntia* spp.) – found in this community usually grow to between approximately 3 and 13 feet high. While there is typically little to no herbaceous understory, ephemeral herbs may germinate following sufficient late fall or winter rains and flower in mid-spring. Most of the growth within this vegetation community occurs during the spring; however, growth is limited in the winter from the cold temperatures and in the summer and fall from lack of rainfall.

Joshua tree woodland is found on sandy, loamy, or gravelly, well-drained gentle alluvial slopes at elevations between 2,500 and 5,000 feet above mean sea level. It is found on the desert slopes of the southern Sierra Nevada, Tehachapi, and Traverse ranges in Inyo, Kern, Los Angeles, Riverside, and San Bernardino counties and eastward, mainly on slopes and mesas, across the Mojave Desert to southwestern Utah.

Mojave Mixed Woody Scrub

Mojave mixed woody scrub is a complex scrub community that is open enough to be passable. Dominant plant species typically include by Joshua tree, Eastern Mojave buckwheat (*Eriogonum fasciculatum* var. *polifolium*), and bladderpod (*Isomeris arborea*).

Mojave mixed woody scrub is found on rolling to steeply sloping terrain with very shallow, overly-drained soils often formed from granitic parent material. These soils typically have extremely low water holding capacity and mild alkalinity and are not very saline. Mojave mixed woody scrub is found at elevations between 2,000 and 5,000 feet above mean sea level and is widely but erratically scattered from the Owens Valley south along the Tehachapi, San Gabriel, San Bernardino, San Jacinto, and Peninsular mountain ranges into northern Baja California, Mexico.

Mojavean Pinyon and Juniper Woodland

Mojavean pinyon and juniper woodland is an open woodland that either is dominated by singleleaf pinyon with an open shrubby understory of species commonly found in adjacent non-forested stands or is dominated by California juniper with understory of typical Mojave mixed scrub and steppe species. The understory is more diverse than in most pinyon-juniper vegetation communities, and many of the understory species exceed the tree cover. Additional dominant shrubs found within Mojavean pinyon and juniper woodland include big-basin sagebrush (*Artemisia tridentata*) and desert mountain mahogany (*Cercocarpus ledifolius*). This vegetation community often intergrades with Joshua tree woodland and/or creosote bush scrub.

Pinyon-dominated Mojavean pinyon and juniper woodland typically is found on steeper, very dry slopes, while the juniper-dominated Mojavean pinyon and juniper woodland typically is found on gentle slopes or alluvium and usually at slightly lower elevations than the pinyon-dominated Mojavean pinyon and juniper woodland. This vegetation community typically is found between 4,000 and 8,000 feet above mean sea level in the desert mountain ranges from the southern Sierra Nevada and Tehachapi mountains, along the desert regions of the Transverse and Peninsular ranges, and in most mountain ranges in the Mojave Desert.

Non-native Grassland

Non-native grassland is characterized by a dense to sparse cover of annual grasses that range from 8 to 20 inches high. While non-native grassland is usually dominated by non-native grass species, numerous native annual forbs may be associated with this vegetation community in years with sufficient rainfall. Germination within non-native grassland typically is associated with late fall rains, and most of the growth, flowering, and seed-set occur from winter through spring; most of the plant species within this vegetation community are dead through the summer and fall dry season, persisting only as seeds until the next germination cycle begins.

Non-native grassland is found on fine textured, often clay soils, that are moist or saturated during the rainy season but very dry during the summer and fall. This vegetation community typically is found below 3,000 feet above mean sea level, but occasionally reaches up to 4,000 feet in some southern California mountains.

Semi-desert Chaparral

Semi-desert chaparral is more open than other chaparral communities and is characterized by shrubs that typically are less than 10 feet tall with litter or no understory. Dominant species include a variety of broad-leaved sclerophyllous along with juniper (*Juniperus* spp.), buckwheat (*Eriogonum* spp.), and cactus (*Opuntia* spp.). Most of the growth and flowering occurs in late spring, and most of the species found within semi-desert chaparral are dormant in the winter from the cold temperatures and in the summer and fall from lack of rainfall.

Semi-desert chaparral typically is found on north-facing, dry, rocky slopes. In southern California, this vegetation community usually is found between 2,000 and 5,000 feet above mean sea level from Ventura and Santa Barbara counties south into the interior slopes of the Transverse and Peninsular ranges that border the Mojave and Colorado Deserts.

Disturbed Lands

Disturbed lands are those lands that have been modified from their natural conditions so that they provide little or no habitat value to wildlife. Disturbed lands typically consist of vegetation that has been graded or otherwise disturbed so that there is less than 50 percent cover, often dominated by weedy, non-native species.

Urban/Developed Lands

Urban/developed lands are lands include building, paved roads, parking lots, parks, and residential areas that are either unvegetated or are dominated by exotic, ornamental plant species.

3.2.5 Flora

In addition to the vegetation described above, the Town is located in the Mojave Desert, which has a diversity of desert plant species that have adapted to survive the extreme seasonal temperatures and to endure extreme drought condition. Annual desert plant species survive as seeds that lie dormant in the soil, sometimes for many years, until a sufficient amount of rain and favorable temperatures trigger germination.

The plant species found in the vicinity of the Town General Plan Update area include species that are widespread throughout the Mojave Desert as well as endemic species known only from a few occurrences in a few locations. Some of the most common plant species include creosote bush, teddy bear cholla (*Cylindropuntia bigelovii*), palo verde, Joshua tree, brittlebush (*Encelia farinosa*), alkali saltbush (*Atriplex polycarpa*), Mojave aster (*Xylorhiza tortifolia*), desert fan palm (*Washingtonia filifera*), and triangle-leaf bursage (*Ambrosia deltoidea*).

3.2.6 Fauna

A variety of resident and migratory wildlife species occupy the Town and the adjacent open space, parks, and preserves in the Mojave Desert and nearby mountain ranges. Many of the resident desert species have special adaptations that allow them to tolerate the high desert temperatures and limited availability of water. Many desert animals are physiologically adapted to require little or no water in addition to the water they get from the foods that they eat. However, the springs and seeps in the desert and nearby mountains are necessary for the survival of many of the wildlife species found in the area, such as Nelson's bighorn sheep (*Ovis canadensis nelsoni*), mule deer (*Odocoileus hemionus*), and coyote (*Canis latrans*).

While some desert species – such as birds, lizards, and ground squirrels – are diurnal, many other species – such as insects, frogs, toads, snakes, bats, bighorn sheep, kangaroo rats, coyotes, and black-tailed jackrabbits – are crepuscular or nocturnal to avoid the excessive daytime temperatures. Reptiles and small mammals tend to take refuge from the heat by retreating into underground burrows during extreme temperatures, and these species often hibernate during the winter. The winter, however, has the greatest concentrations of bird species, because many of the bird species that are found in the vicinity are migratory species. Species found within the vicinity of the Town General Plan area include a variety of common insects, amphibians, reptiles, birds, and mammals such as the yucca moth (*Tegeticula paradoxa*), which is responsible for pollinating the Joshua tree; the tarantula (*Aphonopelma chalcodes*); green darner (*Anax junius*); giant desert scorpion (*Hadrurus arizonensis*), which can grow to be more than 4 inches long; California tree frog (*Hyla cadaverina*); spotted toad (*Bufo punctatus*); golden eagle (*Aquila chrysaetos*), greater roadrunner (*Geococcyx californianus*), Gambel's quail (*Callipepla gambelii*), and a variety of bat species.

3.3 SENSITIVE BIOLOGICAL RESOURCES

Sensitive biological resources include sensitive vegetation communities, special status plant species, special status wildlife species, wildlife movement corridors and nursery sites, and wetland resources. In general, the principal reason that a species, subspecies, or variety is considered sensitive is the documented or perceived decline or limitation of its population size or geographical extent and/or distribution resulting in most cases from habitat loss. Wildlife movement corridors or linkages also are considered sensitive by local, state, and federal resource and conservation agencies because these corridors allow wildlife to move between adjoining open space areas that are becoming increasingly isolated as open space becomes increasingly fragmented from urbanization, rugged terrain, or changes in vegetation (Beier and Loe 1992). In addition, wetland resources are considered sensitive because of their limited distribution and high wildlife value.

Many sensitive biological resources are known to occur or have the potential to occur within or adjacent to the Town General Plan Update area based on historical data for the region identified through a query of the CNDDB (Figure 4), the presence of suitable habitat within the Town General Plan Update area, and/or presence of other requisite environmental components within the Town General Plan Update area. The following section describes the sensitive biological resources within and adjacent to the Town General Plan Update area and provides definitions for each of these sensitive biological resources.

3.3.1 Sensitive Vegetation Communities

Sensitive vegetation communities are vegetation assemblages, associations, or subassociations that have cumulative losses throughout the region, have relatively limited distribution, support or potentially support sensitive plant or wildlife species, or have particular value to other wildlife. Typically, sensitive vegetation communities are considered sensitive whether or not they have

been disturbed. Sensitive vegetation communities are regulated by various local, state, and federal resource agencies. The CNDDB provides an inventory of vegetation communities that are considered sensitive by state and federal resource agencies, academic institutions, and conservation groups such as the CNPS. Determination of the level of sensitivity is based on the Nature Conservancy Heritage Program Status Ranks that rank both species and plant communities on a global and statewide basis according to the number and size of remaining occurrences as well as recognized threats such as proposed development, habitat degradation, and invasion by non-native species.

Based on a CNDDB search, no sensitive vegetation communities were identified within the Town General Plan Update area; however, vegetation communities that provide habitat for special status plant and/or wildlife species would be considered sensitive. In addition, unavoidable impacts to vegetation communities that are important to the region – such as Joshua tree woodland– would require mitigation, as is discussed in Section 4 of this document.

Potential jurisdictional wetland and riparian resources may occur within the Town General Plan Update area based on the information provided in the USGS National Hydrography Dataset (NHD; USGS 2012). The USGS NHD provides data on surface water systems, such as lakes, ponds, streams, rivers, canals, dams, and stream gages. Several of these features have been identified within the Town General Plan Update area (Figure 5); however, a wetland evaluation or formal wetland delineation was not conducted to provide jurisdictional data for this document. Given the limited water availability within the region, all wetland and riparian habitats would be protected according to federal, state, and local regulations, as discussed in Section 3.3.5 of this document.

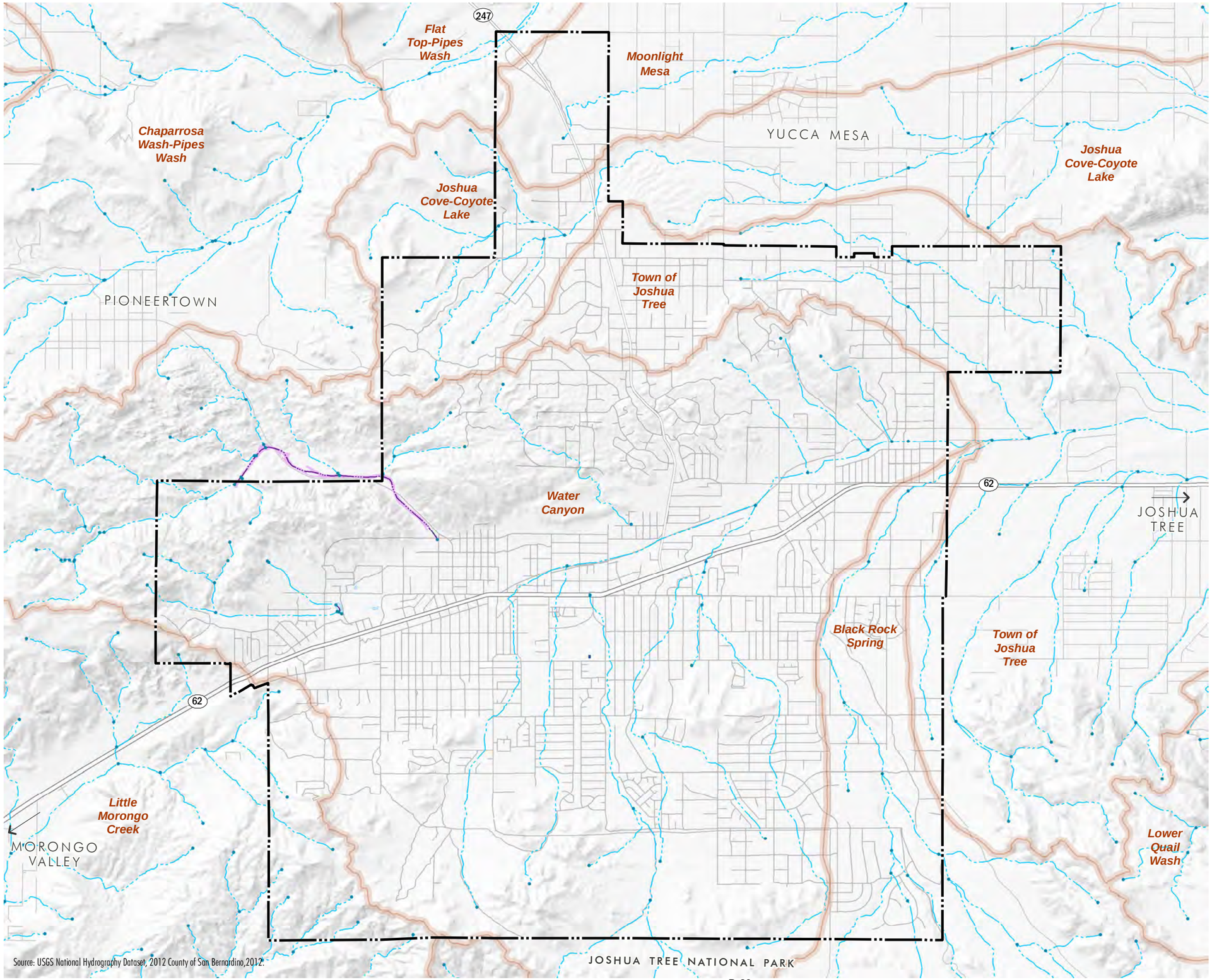
3.3.2 Special Status Plant Species

For purposes of this report, special status plant species include those that are (1) listed or proposed for listing by federal or state agencies as threatened or endangered; (2) on List 1B (considered endangered throughout its range) or List 2 (considered endangered in California but more common elsewhere) of the CNPS's *Inventory of Rare and Endangered Vascular Plants of California* (CNPS 2012); or (3) considered rare, endangered, or threatened by the CDFW (CDFW 2011a) or other local conservation organizations or specialists. Noteworthy plant species are considered to be those on List 3 (more information about the plant distribution and rarity needed) and List 4 (plants of limited distribution) of the CNPS *Inventory*. The CNPS is a statewide resource conservation organization that has developed an inventory of California's sensitive plant species. The CNPS listing is sanctioned by the CDFW and essentially serves as an early warning list of potential candidate species for threatened or endangered status.

According to USFWS, a federally endangered species is defined as a species facing extinction throughout all or a significant portion of its geographic range, and a federally threatened species is defined as a species that is likely to become endangered within the foreseeable future throughout all or a significant part of its range. CDFW defines an endangered species as one

Figure 5

POTENTIAL WETLAND AND RIPARIAN RESOURCES



Source: USGS National Hydrography Dataset, 2012 County of San Bernardino,2012.

- Hydrographic Junction
- Stream / River
- Artificial Path
- Wash
- Lake / Pond
- Reservoir
- Watershed Boundary
- Town Limits

ALDEN ENVIRONMENTAL, INC

TYV-01 01.21.13

0 1,500 3,000 6,000 Feet

whose prospects of survival and reproduction are in immediate jeopardy, a threatened species as one present in such small numbers throughout its range that it is likely to become an endangered species in the near future in the absence of special protection or management, and a rare species as one present in such small numbers throughout its range that it may become endangered if its present environment worsens.

Species that are federally or state-listed threatened or endangered species and/or are designated as CNPS List 1B or 2 species are afforded a degree of protection that entails a permitting process, including specific mitigation measures to compensate for impacts to the species. Species that are proposed to be listed by the USFWS are treated similarly to listed species by that agency. Recommendations of the USFWS, however, are advisory rather than mandatory in the case of proposed species. Although plant species that are classified as List 3 or 4 species by CNPS are not provided legal protection, this designation is used to identify declining plant species that are considered sensitive by the CNPS but not considered threatened or endangered.

Eleven special status plant species are known to occur within the vicinity of the Town (CDFW 2012a, Town 1995). These species are discussed in detail in this section and are summarized in Table 1, below. No critical habitat for any of these or other special status plant species has been designated within or adjacent to the Town.

San Bernardino Milk-vetch

San Bernardino milk-vetch (*Astragalus bernardinus*) is a CNPS List 1B.2 species, which means it is rare, threatened, or endangered in California and elsewhere. It is a perennial herb in the Fabaceae family that typically blooms from April to June. This species often is found on granitic or carbonate soils and is associated with Joshua tree woodland and pinyon-juniper woodland. San Bernardino milk-vetch is endemic to California and is known from Riverside and San Bernardino counties at elevations between 2,950 and 6,565 feet above mean sea level. The San Bernardino milk-vetch is threatened by mining, development, grazing, and recreational activities (CNPS 2012).

The San Bernardino milk-vetch is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Triple-ribbed Milk-vetch

The triple-ribbed milk-vetch (*Astragalus tricarinatus*) is a federally endangered species and a CNPS List 1B.2 species, which means it is rare, threatened, or endangered in California and elsewhere. It is a perennial herb in the Fabaceae family that typically blooms from February to May. This species is found on sandy or gravelly soils and is associated with Joshua tree woodland, creosote bush scrub, and Sonoran Desert scrub. Triple-ribbed milk-vetch is endemic to California and is known from fewer than 20 occurrences Riverside and San Bernardino

counties at elevations between 1,475 and 3,905 feet above mean sea level. This species is potentially threatened by pipeline maintenance and vehicles (CNPS 2012).

The triple-ribbed milk-vetch is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Fremont Barberry

The Fremont barberry (*Berberis fremontii*) is a CNPS List 3 species, which means it is on the review list. It is an evergreen shrub in the Berberidaceae family that typically blooms from April to June. This species is found on rocky soils and is associated with Joshua tree woodland, pinyon-juniper woodland, and chaparral. The Fremont barberry is known from California, Arizona, Colorado, New Mexico, and Utah as well as from Baja California and Sonora, Mexico. In southern California, it is known from San Bernardino and San Diego counties at elevations between 2,755 and 6,070 feet above mean sea level. The primary threats to this species are not known but probably include loss of habitat resulting from development.

The Fremont barberry is known to occur within and adjacent to the Town General Plan Update area (CDFW 2012a, Town 1995).

Pinyon Rockcress

The pinyon rockcress (*Boechera dispar*) is a CNPS List 2.3 species, which means it is rare, threatened, or endangered in California but common elsewhere. It is a perennial herb in the Brassicaceae family that typically blooms from March to June. This species is found in granitic or gravelly soils and is associated with Joshua tree woodland, Mojavean desert scrub, and pinyon-juniper woodland. Pinyon rockcress is known from Nevada as well as Inyo, Kern, Los Angeles, Mono, San Bernardino, and Tulare counties in California at elevations between 3,935 and 8,335 feet above mean sea level. Threats to this species include mining, non-native plants, recreational activities, road construction, and vehicles (CNPS 2012).

The pinyon rockcress is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Parish's Daisy

Parish's daisy (*Erigeron parishii*) is a federally threatened and CNPS List 1B.1 species, which means it is rare, threatened, or endangered in California and elsewhere. It is a perennial herb in the Asteraceae family that typically blooms from May to August. This species usually is found on carbonate soils and sometimes on granitic soils and is associated with pinyon-juniper woodland, creosote bush scrub, and Mojavean desert scrub. Parish's daisy is known from Riverside and San Bernardino counties at elevations between 2,625 and 6,565 feet above mean

sea level. Threats to this species include carbonate mining, vehicles, road construction, and residential development (CNPS 2012).

Parish's daisy is known to occur within and adjacent to the Town General Plan Update area (CDFW 2012a, Town 1995).

Parish's Club-cholla

Parish's club-cholla (*Grusonia parishii*) is a CNPS List 2.2 species, which means it is rare, threatened, or endangered in California but common elsewhere. It is a succulent shrub in the Cactaceae family that typically blooms from May to June and sometimes into July. This species is found in sandy and/or rocky soils and is associated with Joshua tree woodland, creosote bush scrub, Mojavean desert scrub, and Sonoran desert scrub. Parish's club-cholla is known to occur in Imperial, Riverside, and San Bernardino counties at elevations between 980 and 5,000 feet above mean sea level. The main threat to this species is solar energy development (CNPS 2012).

Parish's club-cholla is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Baldwin Lake Linanthus

The Baldwin Lake linanthus (*Linanthus killipii*) is a CNPS List 1B.2 species, which means it is rare, threatened, or endangered in California and elsewhere. It is an annual herb in the Plemoniaceae family that typically blooms from May to July. This species is found in meadows, seeps, and pebble-plain associated with Joshua tree woodland and pinyon-juniper woodland. The Baldwin Lake linanthus is known only from San Bernardino County at elevations between 5,575 and 7,875 feet above mean sea level. Threats to this species include urbanization, vegetation/fuel management, recreational activities, and vehicles (CNPS 2012).

The Baldwin Lake linanthus is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Little San Bernardino Mountains Linanthus

The Little San Bernardino Mountains linanthus (*Linanthus maculatus*) is a CNPS List 1B.2 species, which means it is rare, threatened, or endangered in California and elsewhere. It is an annual herb in the Polemoniaceae family that typically blooms from March to May. This species is found in sandy soils and is associated with desert dunes, Joshua tree woodland, Mojavean desert scrub, and Sonoran desert scrub. The Little San Bernardino Mountains linanthus is known to occur in Imperial, Riverside, San Bernardino, and San Diego counties at elevations between 640 and 6,810 feet above mean sea level. Threats to this species include development, vehicles, and dumping (CNPS 2012).

The Little San Bernardino Mountains linanthus is known to occur within and adjacent to the Town General Plan Update area (CDFW 2012a; Town 1995).

Orcutt's Linanthus

Orcutt's linanthus (*Linanthus orcuttii*) is a CNPS List 1B.3 species, which means it is rare, threatened, or endangered in California and elsewhere. It is an annual herb in the Plemoniaceae family that typically blooms from May to June. This species is found in openings in chaparral, lower montane coniferous forest, and pinyon-juniper woodland. Orcutt's linanthus is known to occur in Riverside, San Bernardino, and San Diego counties as well as in Baja California, Mexico, at elevations between 3,000 and 7,040 feet above mean sea level. Threats to this species include foot traffic and recreational activities (CNPS 2012).

Orcutt's linanthus is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Robison's Monardella

Robison's monardella (*Monardella robisonii*) is a CNPS List 1B.3 species, which means it is rare, threatened, or endangered in California and elsewhere. It is a rhizomatous, perennial herb in the Lamiaceae family that typically blooms from April to September but can bloom as early as February and as late as October depending on environmental conditions. This species is found in pinyon-juniper woodland. Robison's monardella is known to occur in Riverside and San Bernardino counties at elevations between 2,000 and 4,925 feet above mean sea level. The primary threats to this species include rock climbing and other recreational activities; invasive, non-native species; burning; and habitat loss resulting from development (NatureServe 2012).

Robison's monardella is known to occur within and adjacent to the Town General Plan Update area (CDFW 2012a, Town 1995).

Latimer's Woodland-gilia

Latimer's woodland-gilia (*Saltugilia latimeri*) is a CNPS List 1B.2 species, which means it is rare, threatened, or endangered in California and elsewhere. It is an annual herb in the Polemoniaceae family and typically blooms from March to June. This species is found on rocky or sandy, often granitic, soils and sometimes in washes. It is associated with chaparral, Mojavean desert scrub, and pinyon-juniper woodland. Latimer's woodland-gilia is known from fewer than 20 occurrence in Inyo, Kern, Riverside, and San Bernardino counties at elevations between 1,310 and 6,235 feet above mean sea level. The primary threats to this species are not known but probably include habitat loss from development (NatureServe 2012).

Latimer's woodland-gilia is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Table 1. Sensitive Plant Species within the Vicinity of the Town of Yucca Valley

Scientific Name	Common Name	Status	Habitat Description
Astragalus bernardinus	San Bernardino milk-vetch	List 1B.2	Blooms April to June. Granitic or carbonate soils. Joshua tree woodland and pinyon-juniper woodland. Elevations from 2,950 to 6,565 feet.
Astragalus tricarinatus	triple-ribbed milk-vetch	FE List 1B.2	Blooms February to May. Sandy or gravelly soils. Joshua tree woodland, creosote bush scrub, and Sonoran Desert scrub. Elevations from 1,475 to 3,905 feet.
Berberis fremontii	Fremont barberry	List 3	Blooms April to June. Rocky soils. Joshua tree woodland, pinyon-juniper woodland, and chaparral. Elevations from 2,755 to 6,070 feet.
Boechera dispar	pinyon rockcress	List 2.3	Blooms March to June. Granitic or gravelly soils. Joshua tree woodland, Mojavean desert scrub, and pinyon-juniper woodland. Elevations from 3,935 to 8,335 feet.
Erigeron parishii	Parish's daisy	FT List 1B.1	Blooms May to August. Carbonate soils and sometimes on granitic soils. Pinyon-juniper woodland, creosote bush scrub, and Mojavean desert scrub. Elevations from 2,625 to 6,565 feet.
Grusonia parishii	Parish's club-cholla	List 2.2	Blooms May to June and sometimes into July. Sandy and/or rocky soils. Joshua tree woodland, creosote bush scrub, Mojavean desert scrub, and Sonoran desert scrub. Elevations from 980 to 5,000 feet.
Linanthus killipii	Baldwin Lake linanthus	List 1B.2	Blooms May to July. Meadows, seeps, and pebble-plain. Joshua tree woodland and pinyon-juniper woodland. Elevations from 5,575to 7,875 feet.
Linanthus maculatus	Little San Bernardino Mountains linanthus	List 1B.2	Blooms March to May. Sandy soils. Desert dunes, Joshua tree woodland, Mojavean desert scrub, and Sonoran desert scrub. Elevations from 640 to 6,810 feet.
Linanthus orcuttii	Orcutt's linanthus	List1B.3	Blooms May to June. Openings in chaparral, lower montane coniferous forest, and pinyon-juniper woodland. Elevations from 3,000 to 7,040 feet.
Monardella robisonii	Robison's monardella	List 1B.3	Blooms April to September but can bloom as early as February and as late as October. Pinyon-juniper woodland. Elevations from 2,000 to 4,925 feet.
Saltugilia latimeri	Latimer's woodland-gilia	List 1B.2	Blooms March to June. Rocky or sandy, often granitic, soils and sometimes in washes. Chaparral, Mojavean desert scrub, and pinyon-juniper woodland. Elevations from 1,310 to 6,235 feet.

3.3.3 Special Status Wildlife Species

For purposes of this report, special status wildlife species include those that are (1) listed or proposed for listing as threatened or endangered by the USFWS or the CDFW (CDFW 2011b); and/or (2) designated as California Fully Protected by the CDFW. In addition, raptors (birds of prey) and active raptor nests are protected by the California Fish and Game Code 3503.5, which states that it is "unlawful to take, possess, or destroy any birds of prey or to take, possess, or destroy the nest or eggs of any such bird" unless authorized (CDFW 1991). The federal MBTA, which restricts the killing, taking, collecting, selling, or purchasing of native bird species or their parts, nests, or eggs, also provides legal protection for almost all breeding bird species occurring in the U.S. Noteworthy wildlife species are those given the informal designation of California Species of Concern by the CDFW. This designation applies to animals not listed under FESA or CESA but which nonetheless (1) are declining at a rate that could result in listing, or (2) historically occurred in low numbers and known threats to their persistence currently exist.

According to the USFWS, a federally endangered species is defined as a species facing extinction throughout all or a significant portion of its geographic range, and a federally threatened species is defined as a species that is likely to become endangered within the foreseeable future throughout all or a significant part of its range. The CDFW defines an endangered species as one whose prospects of survival and reproduction are in immediate jeopardy, a threatened species as one present in such small numbers throughout its range that it is likely to become an endangered species in the near future in the absence of special protection or management, a fully protected species as one that is rare or faces possible extinction, and a California Species of Concern as one that is declining in numbers.

Species that are federally or state-listed threatened or endangered are afforded a degree of protection that entails a permitting process, including specific mitigation measures to compensate for impacts to the species. Species that are proposed to be listed by the USFWS are treated similarly to listed species by that agency. Recommendations of the USFWS, however, are advisory rather than mandatory in the case of proposed species. As regulated by the CDFW, fully protected species may not be taken or possessed at any time and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research and relocation of the bird species for the protection of livestock. Wildlife species classified as California Species of Concern by the CDFW are not typically provided legal protection; however, there are exceptions for some species such as the burrowing owl.

Twenty-one special status wildlife species are known to occur within the vicinity of the Town based on historical data for the region (CDFW 2012a, Town 1995). In addition, 2 other species, the California cuckoo bee and Nelson's bighorn sheep, do not have a special status ranking but are of special interest were identified within the region. All of these species are discussed in detail in this section and summarized in Table 2, below. No critical habitat for any of these or other special status wildlife species has been designated within or adjacent to the Town.

California Cuckoo Bee

The California cuckoo bee (*Paranomada californica*) currently has no special status ranking. This species is a cleptoparasitic bee that is a nest parasite of other solitary ground-nesting bees. While no cleptoparasitic behavior by this species has been observed directly, the females lack pollen-collecting structures, which is typical of other cleptoparasitic species (Linsley 1945). Other species within the same subfamily Nomadinae do not excavate their own nests or collect pollen for their larvae. Instead, the females enter the nests of pollen-collecting species and lay their eggs in the open, unfinished cells while the host females are absent (CDFW 2012). Based on the few observations of the California cuckoo bee, it is likely that *Exomalopsis verbesinae* (no common name), a pollen-collecting bee species, is a host, since the California cuckoo bee was observed flying in the same immediate vicinity of this species (Linsley 1945). However, not much is known about the habitat preferences, life history, or behavior of the California cuckoo bee, and it has only been documented in two locations, both in San Bernardino County--one near the Town and one approximately 9.5 miles northwest of Pioneertown.

The California cuckoo bee is known to occur adjacent to the Town General Plan Update area only based on historical data (CDFW 2012a).

Desert Tortoise

The desert tortoise is a federally and state-listed threatened species. It is found typically in desert scrub, washes, dunes, and rocky slopes with firm but not hard pan soils where it feeds on annual grasses, herbs, desert flowers, and cacti (Stebbins 2003). This species is active primarily in spring and fall but will remain inactive in its burrow during the warmest times of the year and will also hibernate in its burrow during the cooler fall and winter months. The desert tortoise is found in the Mojave Desert and the Colorado/Sonoran deserts of California, Arizona, southern Nevada, and southwestern Utah, as well as northern Mexico (NatureServe 2012) from sea level to approximately 5,200 feet above mean sea level (Stebbins 2003). The most significant threats to the desert tortoise include urbanization, disease, habitat destruction and fragmentation, illegal collection and vandalism by humans, and habitat conversion from native to invasive plant species.

The desert tortoise is known to occur within and adjacent to the Town General Plan Update area (CDFW 2012a, Town 1995).

Coast Horned Lizard

The coast horned lizard (*Phrynosoma blainvillii*) is a state species of special concern. This species is found in a variety of habitats, including scrubland, grassland, coniferous woods, and broadleaf woodlands, especially in areas with sandy soils, scattered shrubs, and ant colonies, such as along the edges of arroyo bottoms or dirt roads (Stebbins 2003). It retreats underground and is inactive during extreme heat and during cold weather. The coast horned lizard is found in

the Sierra Nevada foothills from Butte County south to Kern County as well as throughout the central and southern California coast, at elevations ranging from sea level to approximately 4,000 feet above mean sea level in the Sierra Nevada foothills and up to approximately 6000 feet above mean sea level in the mountains of southern California (CDFW 2012b). This species is absent from much of its former southern California range as a result of urbanization, agricultural development, over-collecting, and displacement of native ant species by non-native Argentine ants (Jennings 1987, Jennings 1988, and Stebbins 2003).

The coast horned lizard is known to occur within and adjacent to the Town General Plan Update area (CDFW 2012a, Town 1995).

Mojave Fringe-toed Lizard

The Mojave fringe-toed lizard (*Uma scoparia*) is a state species of special concern. This species is found in habitats with sparse vegetation and windblown sands, such as dune systems and washes where it feeds on insects, spiders, seeds, and flowers (Stebbins 2003). This species is active during the day but will burrow in the sand during extreme temperatures. In fall, it also will burrow in the sand and emerge in late winter (California Herps 2012). The Mojave fringe-toed lizard ranges from the Mojave Desert to the southern end of Death Valley National Park, and east to south of Parker in Yuma County, Arizona from elevations from below sea level to approximately 3,280 feet above mean sea level (Jennings and Hayes 1994, Stebbins 2003). Threats to this species are associated with off-road vehicle activity and the creation of windbreaks, which alter how the windblown sand is deposited (CA Herps 2012).

The Mojave fringe-toed lizard is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Red-diamond Rattlesnake

The red-diamond rattlesnake (*Crotalus ruber*) is a state species of special concern. This species is found in a variety of habitats including coastal sage scrub, desert scrub, thornscrub, open chaparral, woodland, grassland, and cultivated areas. Its diet mainly consists of ground squirrels, rabbits, lizards, and carrion. The red-diamond rattlesnake is known from southwestern California, from near Pioneertown and Morongo Valley in San Bernardino County and southeastern Los Angeles County south through Baja California, Mexico, including several islands in the Gulf of California and several islands off the Pacific coast of Baja California (Murphy et al. 1995, Grismer 2002, Campbell and Lamar 2004). It is known from elevations ranging from sea level to approximately 4,900 feet above mean sea level, but typically below 3,200 feet above mean sea level (Campbell and Lamar 2004, Stebbins 2003). Threats to this species are associated with habitat loss, particularly within the coastal regions of its range (CA Herps 2012).

The red-diamond rattlesnake is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Prairie Falcon

The prairie falcon (*Falco mexicanus*) currently has no special status ranking. This species is associated primarily with perennial grasslands, savannahs, rangeland, agricultural fields, and desert scrub areas but has also been observed using annual grasslands and alpine meadows. It nests on cliff ledges and occasionally in rock crevices (Patten et. al. 2003; Rosenberg et. al. 1991, Steenhof 1998).

Endemic to North America, the prairie falcon ranges across the western United States, parts of Canada, and into northern Mexico. In California, it is a rare breeding resident throughout many arid regions of the state (Small 1994). The relatively small breeding population in California makes the prairie falcon vulnerable to impact. Shooting is the most common cause of death for this species; however, intermittent human disturbance near nest sites, especially rock climbing, is probably the greatest threat to this species (Steenhof 1998; Unitt 2004).

The prairie falcon is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Western Yellow-billed Cuckoo

The western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) is a state-listed endangered species and a candidate for federal listing. This species is found in valley foothill and desert riparian habitats, usually with dense, mature riparian woodlands with large stands of cottonwood-willow riparian forest. It forages on large insects, caterpillars, and some fruit.

Endemic to the Americas, the western yellow-billed cuckoo is found throughout the western United States, south into Baja California and mainland Mexico, south through Central America, and likely into South America. In California, this species is an uncommon to rare summer resident that is found in scattered locations throughout the state.

Although the western yellow-billed cuckoo was once a common breeder throughout much of lowland California, this species has declined drastically as a result of habitat loss (Grinnell and Miller 1944, Gaines 1974b, Garrett and Dunn 1981).

The western yellow-billed cuckoo is known to occur within the Town General Plan Update area (Town 1995).

Burrowing Owl

The burrowing owl (*Athene cunicularia*) is a state species of special concern and a federal bird of conservation concern. Habitat for the western burrowing owl includes dry, open areas with low-growing vegetation in grasslands, deserts, prairies, and agricultural lands; it is often associated with burrowing mammals (Haug et al. 1993).

Endemic to the Americas, the bulk of the population resides in western North America, but this species can be found in suitable habitat north into southern Canada, south through Central and South America to Tierra del Fuego, and in disjunct populations on coastal islands off of Florida and in the Caribbean (Haug et. al. 1993; NatureServe 2012). In California, although this species is declining in much of the state, it remains fairly common in Imperial Valley, which is home to nearly 70 percent of the entire California population (Unitt 2004). The northernmost populations of this species are almost completely migratory; however, the individuals found in southern California are only partially migratory as evidenced by reduced population sizes in winter, with some birds remaining in their territories throughout the year.

Population declines have been attributed to loss of suitable habitat though urban expansion, pesticide use, vehicle collisions, and reduction of the mammals that supply the owl with burrows (Haug et. al. 1993; Remsen 1978; Unitt 2004). Further, its propensity for nesting and foraging near roadsides and agricultural drains make it particularly vulnerable to roadside shooting, collisions with vehicles, road maintenance, and general harassment (Patten et. al. 2003; Remsen 1978; Unitt 2004).

The burrowing owl is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Vermilion Flycatcher

The vermilion flycatcher (*Pyrocephalus rubinus*) is a state species of special concern. This species inhabits cottonwood, willow, mesquite, and other vegetation in desert riparian and desert wash habitats as well as savannas and arid scrub, often associated with surface water (Shuford and Gardali 2008). It feeds on flying insects, especially bees, as well as insects from ground (Bent 1942).

The vermilion flycatcher ranges from the southwestern United States through Mexico, Central America, and well south into Argentina including the Galapagos (Wolf and Jones 2000). In California, this species is a rare, localized, yearlong resident along Colorado River, but small local populations exist in scattered areas across southern California.

Formerly a more common and widespread breeder in California, this species suffered greatly from riparian habitat loss in the last century, especially in the Colorado River, Imperial, and Coachella valleys where it was historically reported as a fairly common breeder (Grinnell and

Miller 1944). However, despite these declines, over the past 60 years, the vermilion flycatcher has expanded its range westward from its stronghold along the Colorado River through the Mojave Desert and along southern coast, where rare and localized populations are now known to occur (Small 1994, Shuford and Gardali 2008).

The vermilion flycatcher is known to occur within the Town General Plan Update area (Town 1995).

Loggerhead Shrike

The loggerhead shrike (*Lanius ludovicianus*) is a state species of special concern. This species is found in open-canopied valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, pinyon-juniper, juniper, desert riparian, and Joshua tree woodland habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches. It feeds primarily on large insects, other invertebrates, small birds, lizards, frogs, and rodents and sometimes scavenges (Fraser and Luukkonen 1986).

The loggerhead shrike ranges from central and southern Canada, throughout the United States, throughout Baja and mainland Mexico, and into northern Central America (NatureServe 2012). In California, it is a common resident and winter visitor in lowlands and foothills throughout the state (CDFW 2012a).

Though widely distributed, the loggerhead shrike is one of the few North American passerines whose populations have declined nearly continent-wide in recent decades. This species retreats from urbanization, and major factors contributing to its decline include changes in human land-use practices, pesticide use, and competition with species that are more tolerant of anthropogenic habitats (Yosef 1996; Unitt 2004).

The loggerhead shrike is known to occur adjacent to the Town General Plan Update area (Town 1995).

Least Bell's Vireo

The least Bell's vireo (*Vireo bellii pusillus*) is a federally and state-listed endangered species and a federal bird of conservation concern. This species prefers willow-dominated woodland or scrub, *Baccharis* scrub, mixed oak/willow woodland, mesquite woodland, and elderberry scrub in riparian habitat. This species typically nests and forages in vegetation along streams and rivers that measures approximately 3 to 6 feet in height and has a dense, stratified canopy providing both foraging habitat and song perches for territorial advertisement.

Endemic to California and Baja California, Mexico, this highly migratory species arrives in California in mid-March and departs by late September when it flies south to wintering grounds near the tip of Baja California, Mexico. This species formally bred in lowland riparian habitat

ranging from coastal southern California through the Sacramento and San Joaquin Valleys as far north as Red Bluff, and other scattered locations east of the Sierra Nevada (USFWS 1998; Grinnell and Miller 1944); however, by the time the species was listed in by CDFW in 1984, it had been extirpated from much of its former range and was restricted to 8 central and southern California counties, with just 300 pairs statewide (Unitt 2004).

Population declines were caused by widespread clearing of riparian habitat combined with brood parasitism by the brown-headed cowbird (*Molothrus ater*), whose increase in California was as dramatic as the least Bell's vireo's decline. Currently, with restriction of habitat destruction, extensive cowbird trapping, and protection from both FESA and CESA, populations of the least Bell's vireo have recovered in some areas of cismontane southern California, and populations are expanding into former ranges (Brown 1993, Kus 2002).

The least Bell's vireo is known to occur adjacent to the Town General Plan Update area (CDFW 2012a, Town 1995).

Bendire's Thrasher

Bendire's thrasher (*Toxostoma bendirei*) is a state species of special concern. This species is found in a variety of desert habitats with Joshua tree, Mojave yucca, cactus, and open ground and feeds on insects and arthropods, such as caterpillars, beetles, grasshoppers, ants, and termites. It is found only in the southwestern United States and the northwestern coast of mainland Mexico (NatureServe 2012). In California, it is a very local spring and summer resident and breeder that occurs primarily in San Bernardino County and western Kern County (Grinnell and Miller 1944, Remsen 1978, Garrett and Dunn 1981).

The main threats to Bendire's thrasher are the loss of habitat, such as the clearing of desert scrub habitats and habitats supporting large desert cacti and yucca (NatureServe 2012).

Bendire's thrasher is known to occur adjacent to the Town General Plan Update area (Town 1995).

LeConte's Thrasher

The LeConte's thrasher (*Toxostoma lecontei*) is a state species of special concern in its San Joaquin population, and other populations are on the state watch list. This species is found typically in sparsely vegetated desert flats, dunes, alluvial fans, or gently rolling hills that usually have multiple species of saltbush and/or cholla cactus and undisturbed substrates with accumulated leaf litter beneath desert shrubs for foraging (Sheppard 1996). The LeConte's thrasher is rare throughout its restricted range, which extends from the southwestern United States, portions of Baja California, Mexico, and extreme the northwestern portion of mainland Mexico. In California, this species occurs locally in the Antelope and Owens valleys south to the

southwestern corner of the San Joaquin Valley (including the Carrizo Plains) and southeast into isolated pockets throughout the Mojave and Colorado Deserts.

The LeConte's thrasher's limited breeding distribution, specialized habitat use, and small population size make it susceptible to changing land use practices. Habitat loss and degradation have been and continue to be the major population-level threats to this species. Though agriculture and urban development have eliminated considerable former habitat, any destruction of substrate, litter, or shrubs affects habitat suitability for the LeConte's thrasher. (Sheppard 1996; Unitt 2004). One factor contributing to habitat loss has been extensive off-road vehicle activity, which eliminates or seriously degrades habitat by crushing vegetation, destroying underlying litter and soil surface, and precluding heavily used sites from further use by this species.

The LeConte's thrasher is known to occur within and adjacent to the Town General Plan Update area (CDFW 2012a, Town 1995).

Yellow Warbler

The yellow warbler (*Dendroica petechia*) is a state species of special. This species inhabits a variety of riparian habitats varying by biogeographic region but usually in close proximity to water along streams and in wet meadows (Grinnell and Miller 1944, Lowther et. al. 1999), and feeds on a variety of small arthropods. The yellow warbler has a broad distribution in the Americas, where it breeds from Alaska, throughout the Canada and the northern United States, and into both mainland and Baja California, Mexico (Lowther et. al. 1999). In California, this species breeds throughout much of the state, including coastal areas along the length of the state, inland in extreme northern California, throughout the Central Valley, and along the east and west slopes of the Sierra Nevada Mountains, and it winters in southeastern California in the Imperial Valley and along the Colorado River.

Like many other riparian songbirds, the yellow warbler population collapsed in the late 1900s as a result of habitat destruction and cowbird parasitism (Remsen 1978; Rosenberg et. al. 1991; Unitt 2004). The yellow warbler is known throughout its range as the most frequent host of the brown-headed cowbird (Lowther et. al. 1999). Following widespread trapping of cowbirds after the least Bell's vireo was federally listed as endangered in 1986, the yellow warbler was among the species whose populations surged and has now reoccupied much of its former breeding range, except in the Central Valley, where it is close to extirpation (Shufford and Gardali 2008).

The yellow warbler is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Summer Tanager

The summer tanager (*Piranga rubra*) is a state species of special concern. This species is found in desert riparian habitats, usually in older, dense stands along rivers and streams with cottonwoods and willows. It eats insects, spiders, and small fruits. The summer tanager is known from the southern United States, south through Mexico and Central America, and into northern South America. In California, the summer tanager is an uncommon summer resident and breeder in the desert riparian habitat along the lower Colorado River and also occurs very locally in other portions of the southern California deserts (Grinnell and Miller 1944, McCaskie et al. 1979, 1988, Garrett and Dunn 1981). This species has declined primarily from loss of native habitat.

The summer tanager is known to occur within the Town General Plan Update area (Town 1995).

Pallid Bat

The pallid bat (*Antrozous pallidus*) is a state species of special concern. This species is found in a variety of habitats, including open desert scrub, grasslands, shrub lands, woodlands, and forests, and prefers open, dry environments and rocky areas for roosting (Zeiner et al. 1990). The pallid bat roosts in a variety of areas, including rock crevices, caves, mines, tree hollows, and abandoned and occupied buildings (BCI 2012) and forage low over open ground, and consume large, hard-shelled prey items such as beetles, grasshoppers, cicadas, spiders, scorpions, and Jerusalem crickets. This species ranges from central Mexico, throughout the western United States, and north to western Canada (BCI 2012) with an isolated population also occurs in Cuba (BCI 2012). In California, the pallid bat is a common year-round resident throughout most of California below 6,000 feet above mean sea level but has been documented as high as 10,000 feet above mean sea level (BCI 2012). Pallid bats are very sensitive to roost disturbance, as these roosts are crucial for metabolic economy and juvenile development. Threats to pallid bat are generally attributable to loss of roost sites resulting from human intrusion and physical alteration (Zeiner et al. 1990).

The pallid bat is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Spotted Bat

The spotted bat (*Euderma maculatum*) is a state species of special concern. This species is found in arid desert, scrub, and open forest habitats, particularly in areas with vertical cliffs or canyons near water (Blood 1993). Though specific roosting characteristics are poorly understood, the spotted bat is known to roost on rock-faced cliffs. Its diet consists almost exclusively of moths, captured using echolocation loud enough to be audible to the human ear (Blood 1993). The spotted bat ranges from southwestern British Columbia, south through the western United States, and into northern Mexico (BCI 2012). Though it has a large range, the spotted bat distribution is patchy because of its specific roosting requirements. Because the spotted bat roosts in high cliffs

and rock faces, threats to this species are believed to be minimal. However, the increase in recreational rock climbing may represent a threat to this poorly understood bat species (BCI 2012).

The spotted bat is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Western Yellow Bat

The western yellow bat (*Lasiurus xanthinus*) is a state species of special concern. This species is found in valley foothill riparian, desert riparian, desert wash, and palm oasis habitats. It roosts in palm trees and forages for flying insects over water and among trees in palm oases and riparian habitat. The western yellow bat is known from the southwestern United States south into mainland and Baja California, Mexico. In California, this species is an uncommon, year-round resident that has been documented below approximately 2,000 feet above mean sea level only in Los Angeles and San Bernardino counties. Threats to the western yellow bat are generally associated with the loss of roost sites resulting from human intrusion and physical alteration.

The western yellow bat is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Pocketed Free-tailed Bat

The pocketed free-tailed bat (*Nyctinomops femorosaccus*) is a state species of special concern. This species is found in pinyon-juniper woodlands, desert scrub, desert succulent scrub, desert riparian, Joshua tree, and palm oasis (Zeiner et al. 1990). It roosts in areas with rugged cliffs, high rocky outcrops, and steep slopes and may also roost in old buildings, mines and caves, and under roof tiles (BCI 2012). The pocketed free-tailed bat forages for flying insects mainly over ponds, streams, and arid desert habitats (Easterla and Whitaker 1972). This species is found in the arid lowlands of southern California, southern Arizona, the extreme southwest of New Mexico and Texas, into Baja California, Mexico, as well as into central and western mainland Mexico at elevations from sea level to approximately 7,300 feet above mean sea level (BCI 2012). In California, this species is a rare, year-round resident that has been reported from Riverside, San Diego, and Imperial counties but may occur in other areas.

The pocketed free-tailed bat is known to occur within and adjacent to the Town General Plan Update area (CDFW 2012a).

Big Free-tailed Bat

The big free-tailed bat (*Nyctinomops macrotis*) is a state species of special concern. This species is found in desert scrub, woodlands and evergreen forests where roost sites (rock outcrops, steep canyon walls, cliffs, buildings, caves, and tree cavities) are available. It feeds primarily on large

moths but also eats crickets, grasshoppers, flying ants, stinkbugs, froghoppers, leafhoppers, and other insects (Schmidly 1977, Milner et al. 1990, Zeiner et al. 1990). The big free-tailed bat ranges from the southwestern United States, including southern California, Arizona, New Mexico, and Texas, south through Central America, the Caribbean Islands, and throughout northern South America; individuals have also been observed as far north as British Columbia, Iowa, Kansas, and South Carolina (BCI 2012). The big free-tailed bat is found at elevations up to 8,000 feet above mean sea level. In California, this species is a rare, year-round resident that is known from urban areas of San Diego County and more rugged, rocky terrain in other parts of its range. Threats to the big free-tailed bat are generally associated with the loss of roost sites resulting from human intrusion and physical alteration.

The big free-tailed bat is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Pallid San Diego Pocket Mouse

The pallid San Diego pocket mouse (*Chaetodipus fallax pallidus*) is a state species of special concern. While data is limited on this subspecies, it is likely similar to the San Diego pocket mouse, which is a common resident in coastal scrub, chamise-redshank chaparral, mixed chaparral, sagebrush, desert wash, desert scrub, desert succulent shrub, pinyon-juniper woodland, and annual grassland with sandy, rocky, or gravelly soils (Grinnell 1933, Miller and Stebbins 1964) where it forages on seeds of forbs, grasses, and shrubs. The pallid San Diego pocket mouse is known only from southwestern California and northwestern Baja California, Mexico. It has been documented in Los Angeles, Imperial, Riverside, San Bernardino, and San Diego counties at elevations from sea level up to 4,500 feet above mean sea level in the Santa Rosa Mountains in Riverside County and up to 6,000 feet above mean sea level on the northern slope of the San Bernardino Mountains.

The pallid San Diego pocket mouse is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Nelson's Bighorn Sheep

The Nelson's bighorn sheep currently has no special status ranking. This species occurs in a variety of habitats, including alpine dwarf-shrub, low sage, sagebrush, bitterbrush, pinyon-juniper woodland, palm oasis, desert riparian, desert succulent shrub, desert scrub, subalpine conifer, perennial grassland, montane chaparral, and montane riparian (DeForge 1980, Monson and Sumner 1980, Wehausen 1980) that have suitable escape terrain, such as cliffs or talus slopes. Nelson's bighorn sheep mainly feeds on grasses and forbs but also grazes on shrubs (Miller and Gaud 1989, Krausman et al. 1999, Shackleton et al. 1999). The bighorn sheep is found from southwestern Canada south through the western portion of the United States and into portions of Baja California and mainland Mexico. In California, the Nelson's bighorn sheep is one of three subspecies and occurs in the desert mountain ranges, from the White Mountains in

Mono and Inyo counties south into the San Bernardino Mountains and south to the United States/Mexico border. An isolated population also occurs in the San Gabriel Mountains. Threats to this species include habitat changes resulting from fire suppression, interactions with feral and domestic livestock, and human encroachment.

The Nelson's bighorn sheep is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

American Badger

The American badger (*Taxidea taxus*) is a state species of special concern. This species is found in drier, open stages of shrub steppes, agricultural fields, open woodland forests, and large grass and sagebrush meadows and valleys with friable soils. It eats of a variety of rodents, scorpions, insects, snakes, lizards, birds, and carrion. The American badger is found throughout southern Canada south through the central and western United States and south into Baja California and mainland Mexico. In California, it is an uncommon, permanent resident that is found throughout the state, except in the extreme north coast area (Grinnell et al. 1937). Threats to this species are associated mainly with human activities, such as habitat destruction, trapping, hunting, vehicular deaths, and poisoning.

The American badger is known to occur adjacent to the Town General Plan Update area (CDFW 2012a).

Table 2. Sensitive Wildlife Species within the Vicinity of the Town of Yucca Valley

Scientific Name	Common Name	Status	Habitat Description
Insects			
Paranomada californica	California cuckoo bee	--	No habitat data available.
Reptiles			
Gopherus agassizii	desert tortoise	FT ST	Desert scrub, washes, dunes, and rocky slopes with firm but not hard pan soils. Elevations from sea level to approximately 5,200 feet.
Phrynosoma blainvillii	coast horned lizard	CSC	Scrubland, grassland, coniferous woods, and broadleaf woodlands, especially in areas with sandy soils, scattered shrubs, and ant colonies, such as along the edges of arroyo bottoms or dirt roads. Elevations from sea level to approximately 6,000 feet.
Uma scoparia	Mojave fringe-toed lizard	CSC	Habitats with sparse vegetation and windblown sands, such as dune systems and washes. Elevations from below sea level to approximately 3,280 feet.

Table 2. Sensitive Wildlife Species within the Vicinity of the Town of Yucca Valley (cont.)

Scientific Name	Common Name	Status	Habitat Description
Birds			
Crotalus ruber	red-diamond rattlesnake	CSC	Coastal sage scrub, desert scrub, thornscrub, open chaparral, woodland, grassland, and cultivated areas. Elevations from sea level to approximately 4,900 feet but typically below 3,200 feet.
Falco mexicanus	prairie falcon	--	Perennial grasslands, savannahs, rangeland, agricultural fields, desert scrub, annual grasslands, and alpine meadows. Nests on cliff ledges and occasionally in rock crevices.
Coccyzus americanus occidentalis	western yellow-billed cuckoo	FC SE	Valley foothill and desert riparian habitats, usually with dense, mature riparian woodlands with large stands of cottonwood-willow riparian forest.
Athene cunicularia	burrowing owl	CSC	Dry, open areas with low-growing vegetation in grasslands, deserts, prairies, and agricultural lands often associated with burrowing mammals.
Pyrocephalus rubinus	vermilion flycatcher	CSC	Cottonwood, willow, mesquite, and other vegetation in desert riparian and desert wash habitats as well as savannas and arid scrub, often associated with surface water.
Lanius ludovicianus	loggerhead shrike	CSC	Open-canopied valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, pinyon-juniper, juniper, desert riparian, and Joshua tree woodland habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches.
Vireo bellii pusillus	least Bell's vireo	FE SE	Willow-dominated woodland or scrub, *Baccharis* scrub, mixed oak/willow woodland, mesquite woodland, and elderberry scrub in riparian habitat. Nests and forages in vegetation along streams and rivers that measures approximately 3 to 6 feet in height and has a dense, stratified canopy providing both foraging habitat and song perches for territorial advertisement.
Toxostoma bendirei	Bendire's thrasher	CSC	Variety of desert habitats with Joshua tree, Mojave yucca, cactus, and open ground.
Toxostoma lecontei	Le Conte's thrasher	CSC	Sparsely vegetated desert flats, dunes, alluvial fans, or gently rolling hills that usually have multiple species of saltbush and/or cholla cactus and undisturbed substrates with accumulated leaf litter beneath desert shrubs for foraging.
Dendroica petechia brewsteri	yellow warbler	CSC	Variety of riparian habitats varying by biogeographic region but usually in close proximity to water along streams and meadows.
Piranga rubra	summer tanager	CSC	Desert riparian habitats, usually in older, dense stands along rivers and streams with cottonwoods and willows.

Table 2. Sensitive Wildlife Species within the Vicinity of the Town of Yucca Valley (cont.)

Scientific Name	Common Name	Status	Habitat Description
Mammals			
Antrozous pallidus	pallid bat	CSC	Open desert scrub, grasslands, shrub lands, woodlands, and forests. Roosts in a variety of areas, including rock crevices, caves, mines, tree hollows, and abandoned and occupied buildings.
Euderma maculatum	spotted bat	CSC	Arid desert, scrub, and open forest habitats, particularly in areas with vertical cliffs or canyons near water. Specific roosting characteristics are poorly understood but known to roost on rock-faced cliffs.
Lasiurus xanthinus	western yellow bat	CSC	Valley foothill riparian, desert riparian, desert wash, and palm oasis habitats. Roosts in palm trees and forages for flying insects over water and among trees in palm oases and riparian habitat.
Nyctinomops femorosaccus	pocketed free-tailed bat	CSC	Pinyon-juniper woodlands, desert scrub, desert succulent scrub, desert riparian, Joshua tree woodland, and palm oasis. Roosts in areas with rugged cliffs, high rocky outcrops, and steep slopes as well as old buildings, mines and caves, and under roof tiles.
Nyctinomops macrotis	big free-tailed bat	CSC	Desert scrub, woodlands and evergreen forests with roost sites, such as rock outcrops, steep canyon walls, cliffs, buildings, caves, and tree cavities.
Chaetodipus fallax pallidus	pallid San Diego pocket mouse	CSC	Coastal scrub, chamise-redshank chaparral, mixed chaparral, sagebrush, desert wash, desert scrub, desert succulent shrub, pinyon-juniper woodland, and annual grassland with sandy, rocky, or gravelly soils.
Ovis canadensis nelsoni	Nelson's bighorn sheep	--	Alpine dwarf-shrub, low sage, sagebrush, bitterbrush, pinyon-juniper woodland, palm oasis, desert riparian, desert succulent shrub, desert scrub, subalpine conifer, perennial grassland, montane chaparral, and montane riparian.
Taxidea taxus	American badger	CSC	Drier, open stages of shrub steppes, agricultural fields, open woodland forests, and large grass and sagebrush meadows and valleys with friable soils.

3.3.4 Wildlife Movement Corridors

Wildlife corridors are essential to maintain populations of healthy and genetically diverse plant and wildlife species. At a minimum, wildlife corridors promote colonization of habitat and genetic variability for both plant and wildlife species by connecting fragments of habitat that are separated by otherwise foreign or inhospitable habitats. Because the isolation of plant and wildlife populations can have many harmful effects on local and regional species' populations and may contribute significantly to local species extinctions, wildlife corridors are important to

sustain individual species distributions within these habitat fragments. Studies have concluded that many wildlife species would not likely persist in these habitat fragments over time because isolation through fragmentation would prohibit the infusion of new individuals and genetic information into the population (MacArthur and Wilson 1967; Soule 1987; Harris and Gallagher 1989; Bennett 1990). While the debate over the value of corridors has been extensive (Simberloff and Cox 1987, Noss 1987, Beier and Loe 1992, Beier and Noss 1998, Haddad et al. 2000, Beier and Noss 2000), most leading wildlife corridor biologists agree that, if corridors are used in appropriate situations and designed properly, they can be useful tools in conservation.

Wildlife corridors are considered sensitive by local, state, and federal resource and conservation agencies because these corridors allow wildlife to move between adjoining open space areas that are becoming increasingly isolated as open space becomes fragmented from urbanization, rugged terrain, and/or changes in vegetation (Beier and Loe 1992). In southern California, habitat fragmentation is one of the main concerns for the maintenance of healthy wildlife populations because natural areas are often scarce and maintaining connectivity between these habitats is perhaps one of the best feasible options for preventing localized extinctions and enhancing biodiversity (Penrod et al. 2001). In addition, roadway mortality must be considered when evaluating the importance of maintaining habitat connectivity and providing well-designed wildlife crossings (e.g., over/underpasses). If animals are inclined to move between habitat patches, a narrow road or even a wider highway isn't an absolute barrier. However, if these animals choose to cross these roadways, the likelihood of mortality increases and potentially could depress regional species' populations if these failed crossing attempts become a common occurrence.

Wildlife corridors can be classified as either regional corridors or local corridors. Regional corridors are defined as those linking two or more large areas of natural open space and local corridors are defined as those allowing resident animals to access critical resources (e.g., food, cover, water) in a smaller area that might otherwise be isolated by some form of urban development (e.g., roads, housing tracts). Both regional and local wildlife corridors reduce the effects of habitat fragmentation by (1) allowing wildlife to move between remaining habitat fragments, thereby permitting depleted populations to be replenished and promoting genetic exchange; (2) providing escape routes from fire, predators, and human disturbances, thus reducing the risk of catastrophic events (such as fire or disease) on a population that may cause local species extinction; and (3) serving as travel routes for individual animals as they move within their home ranges in search of food, water, mates, and other life cycle requirements (Noss 1983; Farhig and Merriam 1985; Simberloff and Cox 1987; Harris and Gallagher 1989).

Within these wildlife corridors, wildlife movement activities typically fall into one of three movement categories: (1) dispersal (i.e., juvenile animals from natal areas or individuals extending range distributions), (2) seasonal migration, and (3) movement related to home range activities (e.g., foraging for food or water, defending territories, searching for mates). A number of terms have been used in various wildlife movement studies, such as "travel route", "wildlife corridor", and "wildlife crossing" to refer to areas in which wildlife move from one area to

another. To clarify the meaning of these terms and facilitate this discussion on wildlife movement in this evaluation, these terms are defined as follows:

Travel Route. A travel route is a landscape feature - such as a ridgeline, drainage, canyon, or riparian strip - within a larger natural habitat area that is used frequently by animals to facilitate movement and provide access to necessary resources (e.g., water, food, cover, den sites). The travel route is generally preferred because it provides the least amount of topographic resistance in moving from one area to another. It contains adequate food, water, and/or cover for wildlife moving between habitat areas and provides a relatively direct link between suitable habitat areas.

Wildlife Corridor. A wildlife corridor is an area of habitat, usually linear in nature, which connects two or more habitat patches that, otherwise, would be fragmented or isolated from one another. Wildlife corridors are often bounded by urban land uses or other areas that are unsuitable for wildlife. A corridor generally contains suitable cover, food, and/or water to support species and facilitate movement while in the corridor. Larger, landscape-level corridors (often referred to as habitat or landscape linkages) can provide both transitory and resident habitat for a variety of species.

Wildlife Crossing. A wildlife crossing is a small, narrow area, relatively short in length and generally constricted in nature that allows wildlife to pass under, over, or through an obstacle or barrier that otherwise hinders or prevents movement. Crossings typically are manmade and include culverts, underpasses, overpasses, drainage pipes, and tunnels that provide access across or under roads, highways, pipelines, or other physical obstacles.

As discussed above, wildlife corridors provide routes for migration and dispersal. In addition, several studies have demonstrated the importance of corridors in preventing extinctions and increasing species diversity (Fahrig and Merriam 1985, Crooks 2002, Crooks and Soulé 1999, Soulé et al. 1988). Wildlife corridors also play a very important role in linking reserves and reducing the negative effects of fragmentation. While corridors are not reserves themselves, they can be viewed as a means to effectively increase reserve size. To some wide-ranging animals such as bobcat (*Felis rufus*), coyote, and mountain lion (*Felis* concolor), even a relatively large isolated reserve may not be capable of sustaining populations. However, by allowing these and other species to disperse to and move between reserves via wildlife corridors, these animals have more space to utilize and are more likely to maintain stable populations.

Within the vicinity of the Town, vast natural landscapes have been set aside as public and private conservation lands to protect their ecological values and the species that rely on them. These conserved lands have become important refuges for many native plant and wildlife species; however, the long-term conservation of the desert ecosystems will require maintaining connectivity across and between the diversity of desert habitats. Several comprehensive wildlife corridor analyses have been conducted within the vicinity of the Town, including A Linkage Design for the San Bernardino-Little San Bernardino Connection (Penrod et al. 2005), A Linkage Design for the Joshua Tree-Twentynine Palms Connection (Penrod et al. 2008), the

California Essential Habitat Connectivity Project (Spencer 2010), and the California Desert Connectivity Project (Penrod et al. 2012). The Morongo Basin Open Space Group also has adopted these corridor designs in their overall open space strategy for the Morongo Basin area.

Two of these wildlife connectivity studies, A Linkage Design for the San Bernardino-Little San Bernardino Connection and A Linkage Design for the Joshua Tree-Twentynine Palms Connection, were focused on areas that are within and immediately adjacent to the Town. These studies resulted in the identification of the Joshua Tree-29 Palms linkage design and the San Bernardino-Little San Bernardino linkage design, both of which pass through the Town (Figure 4). The California Essential Habitat Connectivity Project and the California Desert Connectivity Project are more recent studies conducted at a regional level. These studies, described below, incorporated the linkage designs of the previous studies.

The California Essential Habitat Connectivity Project was initiated by the CDFW and the California Department of Transportation (Caltrans) and implemented by South Coast Wildlands. Over sixty federal, state, local, tribal, and non-governmental organizations collaborated to produce a statewide assessment of essential habitat connectivity within California using the best available science, data sets, spatial analyses, and modeling techniques. The primary goal of the California Essential Habitat Connectivity Project was to identify large blocks of intact habitat or natural landscape within California and immediately adjacent areas in neighboring states and to model linkages between these natural landscape blocks that need to be maintained, particularly as linkages/corridors for wildlife movement, to provide guidance to help infrastructure, land use, and conservation planners maintain and restore a connected California, while simultaneously making infrastructure planning projects more cost efficient. The California Essential Habitat Connectivity Project provided a statewide wildlife habitat connectivity map using a Geographic Information System (GIS) based modeling approach, an assessment of the biological value of identified connectivity areas, and a strategic plan that facilitates the interpretation and use of the statewide map and outlines a methodology necessary for completing connectivity analyses at finer spatial scales for future proposed projects. The California Essential Habitat Connectivity Project includes an analysis of the Mojave Desert Ecoregion and identifies areas surrounding the Town as Natural Landscape Blocks.

The California Desert Connectivity Project is a comprehensive connectivity assessment that will develop 23 Linkage Designs that will inform land management and conservation decisions by identifying areas where maintaining or restoring ecological connectivity is essential to conserving the biological diversity of the California deserts. This assessment used several science-based models (e.g., landscape permeability, habitat suitability, patch size, configuration analyses) and field studies to evaluate habitat suitability and movement needs for selected focal species. The California Desert Connectivity Project identifies several Wildland Blocks and open space associated with military bases. Within the vicinity of the project, these Wildland Block and military lands include the San Bernardino Mountains, Joshua Tree National Park, and the Twentynine Palms Newberry-Rodman Area of Critical Environmental Concern (ACEC), which is a combination of an open space preserve and military lands. The California Desert

Connectivity Project includes numerous Linkage Planning Areas and Linkage Designs between these Wildland Blocks.

Through the California Essential Habitat Connectivity Project, the California Desert Connectivity Project, and the earlier linkage studies, two linkages (Joshua Tree-29 Palms and San Bernardino-Little San Bernardino) have been identified within the Town (Figure 4). Collectively, these linkages are referred to as Wildlife Corridor Evaluation Areas (WCEA) by the Town. The WCEAs provide dispersal, seasonal migration, and movement opportunities for more wide-ranging species – such as mule deer, coyote, and bighorn sheep – to have access to the resources available in the desert, riparian, and mountain habitats in the region. In addition, these corridors provide dispersal, seasonal migration, and movement opportunities for more localized, resident species – such as the desert tortoise, coast horned lizard, and pallid San Diego pocket mouse – to access resources required for survival.

The Joshua Tree-29 Palms linkage crosses the northern "pan handle" portion of the Town as well as a portion of the Town on its eastern border (Figure 4). This linkage is somewhat constrained in the north part of the Town as it passes through a developed industrial area. While constrained, it still provides east-west connectivity between larger open space areas. The area within this linkage on the eastern border of the Town is on a hilly area and supports mostly undisturbed native habitat.

The San Bernardino-Little San Bernardino linkage passes through mostly undeveloped, hilly terrain in the southwestern corner of the Town. This area supports high quality native habitat and provides connectivity between Joshua Tree National Park, Big Morongo Canyon, and Open Space areas to the west. Within the Town, the goals of the WECAs are to:

- conserve habitat for rare and endangered species found in the region;
- maintain these areas for aesthetic and low-impact recreational uses;
- utilize major recreation and open-space reservations including trails and scenic highway corridors;
- preserve the scenic character of the Town;
- maintain areas for wildlife movement corridors between regional open space areas.

3.3.5 Open Space Resource Areas

The Town has identified three Open Space Resource Areas (Figure 4) with the intent of providing open space for the protection of sensitive biological resources located within and adjacent to the Town. These areas were identified based on several parameters including presence of sensitive vegetation communities, presence of sensitive plant and animal species, limited development, low density zoning, presence of wildlife linkages, scenic value, and adjacency to existing open space areas. The areas also generally correspond with other limitations to development including federal land, steep hillside zones, and established parks and preserve areas. The overall goals of the Open Space Resource Areas are the same as those

identified for the WECAs above plus an additional goal of providing an additional buffer between development and the WCEAs.

The OSRA located on the western portion of the Town, north of Highway 62 would provide added connectivity between the Sawtooth Mountains to the west and BLM and open space areas within the Town limits (e.g. North Park). This OSRA also enhances north-south connectivity between the San Bernardino-Little San Bernardino and Joshua Tree-29 Palms linkages. Most of this OSRA is undeveloped with proposed low density land uses.

The OSRA south of Highway 62 would enhance the San Bernardino-Little San Bernardino linkage and provide a buffer between the Town and Joshua Tree National Park. This OSRA also would provide additional connectivity between open space areas within the Town limits (e.g. BLM land and South Park), Joshua Tree National Park, and the Big Morongo Canyon preserve.

The third OSRA is located on a hill top at the eastern boundary of the Town. This OSRA provides added connectivity with the Joshua Tree-29 Palms linkage and BLM land located east of the Town. The proposed land uses at this location are low density lots in a hillside area.

3.3.6 Wetland and Riparian Resources

Wetland and riparian resources within the vicinity of the Town General Plan Update area are considered sensitive biological resources and are regulated by the USACE, CDFW, and/or RWQCB pursuant to several federal and state regulations. A description of each agencies jurisdiction is provided in this section, and the potential wetland resources within and adjacent to the Town are discussed as well.

United States Army Corps of Engineers Jurisdiction

In accordance with Section 404 of the CWA, the USACE has regulatory authority over the discharge of dredged or fill material into waters of the U.S. (including non-wetland waters of the U.S. and wetlands). Federal jurisdiction is dependent on a demonstrated nexus between the subject water feature and navigable waters or interstate commerce.

The USACE and EPA define wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions" (USACE 1987). To be considered a USACE jurisdictional wetland under Section 404 of the CWA, an area must possess three wetland characteristics: (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology. The definition of a wetland includes the phrase “under normal circumstances” because there are situations in which the vegetation of a wetland has been removed or altered as a result of recent natural event or human activities (USACE 1987). The terms “atypical situation” and “problem area” are used to describe wetlands that exhibit these conditions. An atypical situation refers to a wetland area in which one or more

wetland parameters (vegetation, soil, and/or hydrology) have been sufficiently altered by recent human activities or natural events to preclude the presence of wetland indicators of the parameter (USACE 1987). A problem area refers to a wetland area in which wetland indicators of one or more wetland parameters may be periodically lacking due to normal seasonal or annual variations in environmental conditions that result from causes other than human activities or catastrophic natural events (e.g., seasonal wetlands, wetlands on drumlins, prairie potholes, and vegetated flats) (USACE 1987). Although atypical situations and problem areas may lack one or more wetland parameters, these areas may still be considered wetlands if background information on the previous condition of the area and field observations indicate that the missing wetland criteria were present before the disturbance and would occur at the site under normal circumstances.

The USACE defines non-wetland waters of the U.S. as drainages, or portions thereof, which have strong hydrology indicators such as the presence of seasonal flows and an ordinary high watermark (OHWM). An OHWM is defined as "that line on the shore established by the fluctuations of water and indicated by physical characteristics such as [a] clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas" (USACE 1987). Areas delineated as non-wetland waters of the U.S. may lack hydrophytic vegetation or hydric soil characteristics. Hydrophytic vegetation may be absent for various reasons such as the lack of sufficient water flow to support hydrophytic vegetation or the influence of frequent scouring due to rapid water flow. Hydric soil indicators may be missing for various reasons such as the lack of sufficient water or the presence of steep topography that precludes ponding and prohibits the development of hydric soils. Non-wetland waters of the U.S. are delineated by the lateral and upstream/downstream extent of the OHWM of the particular drainage or depression.

California Department of Fish and Wildlife Jurisdiction

In accordance with Sections 1600 to 1616 of the Fish and Game Code, the CDFW regulates activities that would divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake that supports fish or wildlife. These sections discuss the process by which an individual, government agency, or public utility must notify the CDFW prior to any activity that would substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake. The CDFW regulates wetland areas only to the extent that those wetlands are part of a river, stream, or lake as defined by the CDFW. Following such notification, the CDFW must inform the individual, agency, or utility of the existence of any fish and wildlife resources that may be substantially adversely affected by the activity. The CDFW must also include a proposal called the Streambed Alteration Agreement for measures to protect fish and wildlife resources.

The CDFW exerts jurisdiction over all waters of the State, such as streams and rivers (measured from bank to bank) and any "riparian" vegetation associated with the waters. Streams and rivers

are defined by the presence of a channel bed and banks, and at least an intermittent flow of water. The term "riparian" vegetation refers to vegetation that occurs in and/or adjacent to a watercourse. Typical "riparian" vegetation includes willows, mulefat, western sycamores (*Platanus racemosa*), Fremont cottonwoods, cattails (*Typha* spp.), and other vegetation found in moist areas and typically associated with the banks of a stream or lake shoreline. CDFW jurisdictional areas are delineated by the outer edge of riparian vegetation or from the top of one channel bank to the top of the opposite channel bank, whichever is wider. Thus, defining the limits of the CDFW jurisdiction based on riparian habitat will automatically include any wetland areas and may include additional areas that do not meet the USACE criteria for soils and/or hydrology (e.g., where riparian woodland canopy extends beyond the channel area of a stream away from frequently saturated soils). In addition, the CDFW may take jurisdiction over isolated wetlands and streambeds in cases where the USACE may not. Therefore, the CDFW jurisdiction is typically equal to or greater than the USACE jurisdiction.

Regional Water Quality Control Board

The RWQCB is the primary agency responsible for protecting water quality in California. The RWQCB regulates discharges to surface waters under Section 401 of the CWA and the California Porter-Cologne Water Quality Control Act. The RWQCB's jurisdiction extends to all waters of the State and to all waters of the U.S. as considered jurisdictional by the USACE and CDFW. The RWQCB also regulates isolated wetlands, such as vernal pools, that are not regulated by the USACE. Section 401 of the CWA and the state Porter-Cologne Water Quality Control Act give the RWQCB the authority to regulate any proposed activity that may affect water quality. Water quality certification and/or a Report of Waste Discharge must be based upon a finding that the proposed discharge will comply with water quality standards.

Wetland and Riparian Resources in the Town

The majority of the Town is located within the Morongo Basin watershed, which generally drains from west to east primarily through Yucca Creek; however, the northern end of the Town drains northeastward into the Homestead Valley. No major water bodies are located within the Town. Many of the Town's existing drainage courses have insufficient hydraulic capacity and, therefore, intense storms often result in significant quantities of water and sediment being conveyed from the mountains through the developed areas in the Town, thus resulting in flooding and sediment disposition within properties and in the streets.

Wetland and riparian resources within the Town would include creeks, washes, underground water (aquifers), and other water courses as well as various riparian vegetation communities that are associated with these water courses. While no wetland habitats are identified within the CNDDB, the USFWS National Wetlands Inventory identifies several wetlands and riparian resources within and adjacent to the Town General Plan Update area. These habitats include mesquite bosque, riverine, riparian forest, riparian scrub, fresh emergent wetland, freshwater

pond, and other wetlands that are associated with Pinyon Creek, Yucca Creek, and numerous other washes.

4.0 EVALUATION OF FUTURE ENVIRONMENTAL OPPORTUNITIES, CONSTRAINTS, AND MITIGATION MEASURES

The Town's opportunities to protect the natural environment within the Town General Plan area as well as the potential development constraints for future projects associated with the natural resources are discussed in this section.

4.1 Opportunities

The Town lies within a portion of the Mojave Desert that has an abundance of open space, including both public and private lands as well as designated wilderness areas, national parks, and military bases. Because it is situated in such an area, the Town, through implementation of the General Plan, has the opportunity to preserve and enhance its valuable natural resources by managing growth to avoid or minimize impacts to sensitive biological resources. The Town manages biological resources through implementation of the General Plan as well as other codes, ordinances, and guidelines to assure that the Town utilizes all opportunities to integrate biological resources, open space, and conservation principles with future development.

The Town General Plan provides a variety of goals, policies, and programs that aim to protect and preserve the Town's biological resources (i.e., vegetation communities, plant species, wildlife species, wildlife corridors, jurisdictional areas), open space, and conservation principles by creating a balance between the natural environment and human development while also maintaining its rural atmosphere and the scenic qualities of the Town. By implementing these goals, policies, and programs as well as the measures discussed in Section 4.2, below, the Town will protect special status species, the broad variety of habitats needed to support these species, local and regional wildlife movement corridors, and other natural resources in the vicinity by requiring future proposed projects to comply with federal, state, regional, and local regulations established to protect these sensitive biological resources.

4.2 Constraints and Compensatory Mitigation Measures

Local, state, and federal agencies regulate sensitive biological resources and require an assessment of their presence or potential presence to be conducted for each proposed development project site for all sensitive vegetation communities and special status species that have the potential to occur within or adjacent to a proposed development project site prior to the approval and implementation of a proposed development project. Because the information provided in this report is based solely on an analysis of existing literature and data for the region and because no new surveys were conducted to prepare this report, future development projects will require a more refined evaluation of biological resources.

Sensitive biological resources in the Town General Plan area include but are not limited to those discussed in this document. The Town's environment is not static and may change over time as a result of fire, climate change, and other environmental factors. In addition, vegetation communities may become sensitive and/or species may become listed in the future. For future proposed development projects, it is the responsibility of each Project Proponent to evaluate the known and potential sensitive biological resources within the proposed development project area. This section provides the Town and future Project Proponents with guidelines to evaluate potential project-related impacts and design appropriate avoidance, minimization, and/or mitigation measures to assure impacts are below a level of significance, as defined by CEQA. Both general and resource-specific mitigation measures – designated as Bio-1, Bio-2, and so forth – are presented, below.

4.2.1 General Measures for Impact Assessments

As part of the project approval process, each future proposed development project must conduct an analysis to determine if sensitive biological resources would be impacted. The following general biological mitigation measures would apply to future proposed development projects.

Bio-1: The proposed development project shall include a biological resources survey. The biological resources survey shall be conducted by a qualified biologist. The biological resources survey shall include, but not be limited to, an:

- An analysis of available literature and biological databases, such as CNDDB, to determine sensitive biological resources that have been reported historically from the proposed development project vicinity
- A review of current land use and land ownership within the proposed development project vicinity
- An assessment and mapping of vegetation communities present within the proposed development project vicinity
- An evaluation of potential local and regional wildlife movement corridors
- A general assessment of potential jurisdictional areas, including wetlands and riparian habitats

Bio-2: If the proposed development project site supports vegetation communities that may provide habitat for plant or wildlife species, a focused habitat assessment shall be conducted by a qualified biologist to determine the potential for special status plant and/or animal species to occur within or adjacent to the proposed development project area.

Bio-3: If one or more special status species has the potential to occur within the proposed development project area, focused species surveys shall be conducted to determine the presence/absence of these species to adequately evaluate potential direct and/or indirect impacts to these species.

Bio-4: If construction activities are not initiated immediately after focused surveys have been completed, additional pre-construction special status species surveys may be required to assure impacts are avoided or minimized to the extent feasible. If pre-construction activities are required, a qualified biologist would perform these surveys as required for each special status species that is known to occur or has a potential to occur within or adjacent to the proposed development project area.

Bio-5: The results of the biological survey shall be presented in a biological survey letter report for proposed development projects with no significant impacts or in a biological technical report for proposed development projects with significant impacts that require mitigation to reduce the impacts to below a level of significance.

Bio-6: If sensitive biological resources are identified within or adjacent to the proposed development project area, the construction limits shall be clearly flagged to assure impacts to sensitive biological resources are avoided or minimized to the extent feasible. Prior to implementing construction activities, a qualified biologist shall verify that the flagging clearly delineates the construction limits and sensitive resources to be avoided.

Bio-7: If sensitive biological resources are known to occur within or adjacent to the proposed development project area, a project-specific contractor training program shall be developed and implemented to educate project contractors on the sensitive biological resources within and adjacent to the proposed development project area and measures being implemented to avoid and/or minimize impacts to these species. A qualified biologist shall develop and implement the contractor training program.

Bio-8: If sensitive biological resources are present within or adjacent to the proposed development project area and impacts may occur from implementation of construction activities, a qualified biological monitor may be required during a portion or all of the construction activities to assure impacts to the sensitive biological resources are avoided or minimized to the extent feasible. The specific biological monitoring requirements shall be evaluated on a project by project basis. The qualified biological monitor shall be approved by the Town on a project by

project basis based on applicable experience with the sensitive biological resources that may be impacted by the proposed development project activities.

Bio-9: If birds that are covered under the MBTA are identified within or adjacent to the proposed development project area, the proposed development project may result in direct or indirect impacts to these species, especially during breeding season. If impacts cannot be avoided, potential impacts during the breeding season may be considered significant depending on the species and the extent of the impact. To ensure that active nests are not impacted, pre-construction general nesting bird surveys shall be conducted within all suitable nesting habitat that may be impacted by active construction during the general avian breeding season (February 1 through August 31). The pre-construction surveys shall be conducted no more than 7 days prior to initiation of construction. If no active avian nests are identified within the proposed development project area or within a 300-foot buffer of the proposed development project area, no further mitigation is necessary. If active nests of avian species covered by the MBTA are detected within the proposed development project area or within a 300-foot buffer of the proposed development project area, construction shall be halted until the young have fledged, until a qualified biologist has determined the nest is inactive, or until appropriate mitigation measures that respond to the specific situation have been developed and implemented in consultation with the regulatory agencies.

4.2.2 Measures for Impacts to Jurisdictional Areas

Impacts to jurisdictional areas would be considered significant under CEQA depending on the extent of the proposed impact. Survey requirements and mitigation measures for unavoidable impacts associated with future proposed development projects are discussed below.

Bio-10: If the proposed development project has the potential to affect jurisdictional resources, a qualified biologist shall conduct a jurisdictional delineation following the methods outlined in the 1987 USACE Wetland Delineation Manual (USACE 1987) and the Regional Supplement to the USACE Wetland Delineation Manual: Arid West Region (USACE 2008) to map the extent of wetlands and non-wetland waters, determine jurisdiction, and assess potential impacts. The results of the delineation shall be presented in a wetland delineation letter report and shall be incorporated into the CEQA document(s) required for approval and permitting of the proposed development project.

Bio-11: If a proposed project would impact jurisdictional features, permits and authorizations shall be obtained from the USACE, CDFW, and/or RWQCB. The agency authorization would include impact avoidance and minimization measures as well as mitigation measures for unavoidable impacts. Specific avoidance, minimization, and mitigation measures for impacts to jurisdictional resources shall be determined through discussions with the regulatory agencies during the proposed development project permitting process and may include monetary contributions to a mitigation bank or habitat creation, restoration, or enhancement.

4.2.3 Measures for Impacts to WCEAs and OSRAs

While development is not prohibited in these areas, it should be conducted in such a way as to support the goals and objectives of the linkages and OSRAs.

Bio-12: If a proposed project would occur within a WCEA and/or an OSRA then, in addition to the mitigation measures identified above, a habitat connectivity evaluation shall be conducted. The results of the evaluation will be incorporated into the project's biological report required under Bio-5 above. The WCEAs and OSRAs are intended to protect sensitive biological resources, provide habitat connectivity for wildlife movement, support low-impact outdoor recreational activities, provide a buffer between development and existing open space areas (e.g. Joshua Tree National Park), and protect the scenic nature of the town. The habitat connectivity evaluation will assess the potential for the project to adversely affect the intended functions of the WCEA and/or OSRA. The evaluation also will identify project design features that would reduce potential impacts and maintain functionality. To this end, the Town will incorporate the following measures, to the extent practicable, into projects that would propose development within a WCEA and/or an OSRA shall:

- Adhere to low density zoning standards
- Encourage clustering of development
- Avoid known sensitive biological resources
- Provide shielded lighting adjacent to sensitive habitat areas
- Encourage development plans that maximize wildlife movement
- Provide buffers between development and wetland/riparian areas
- Protect wetland/riparian areas through regulatory agency permitting process
- Encourage wildlife passable fence designs (e.g. 3 strand barbless wire fence) on property boundaries
- Encourage preservation of native habitat on the undeveloped remainder of developed parcels
- Minimize road/driveway development to help prevent loss of habitat due to roadkill and habitat loss
- Use native, drought resistant plant species in landscape design
- Encourage project applicants to fulfill required mitigation measures within an OSRA
- Encourage participation in local/regional recreational trail design efforts

5.0 REFERENCES

Bat Conservation International (BCI)

2012 Bat species profiles from Bat Conservation International Website at http://www.batcon.org/index.php/all-about-bats/species-profiles.html. Accessed October and November 2012.

Beier, P., and S. Loe

1992 A checklist for evaluating impacts to wildlife movement corridors. Wildl. soc. bull. 20: 434-440.

Beier, P., and R.F. Noss

1998 Do Habitat Corridors Provide Connectivity? Conservation Biology, Vol. 12, No. 6, pp. 1241-1252.

Beier, P., and R.F. Noss

2000 Arguing over Little Things. Conservation Biology, Vol. 14, No. 5, pp. 1546-1548.

Bent, A.C.

1942 Life histories of North American flycatchers, larks, swallows, and their allies. U.S. Natl. Mus. Bull. 179:159-163, 306307.

Bennett, A.F.

1990 Habitat Corridors and the Conservation of Small Mammals in the Fragmented Forest Environment. Landscape Ecology. 4: 109-122.

Blood, D.A.

1993 Spotted Bat; Wildlife at Risk in British Columbia. Brochure. Ministry of Water, Land and Air Protection, Victoria, British Columbia.

Brown, B.T.

1993 Bell's Vireo (*Vireo bellii*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/035

California Department of Fish and Game (CDFW)

1991 California Fish and Game Code from www.dfg.ca.gov. Accessed October and November 2012.

2011a CDFW Biogeographic Data Branch, California Natural Diversity Database. Special Vascular Plants, Bryophytes, and Lichens List from http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/SPPlants.pdf. October 2012.

2011b CDFW Biogeographic Data Branch, California Natural Diversity Database. Special Animals List from http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/spanimals.pdf. January 2011.

2012a Natural Diversity Data Base. Nongame-Heritage Program, California Department of Fish and Wildlife, Sacramento.

2012b California Wildlife Habitat Relationships: CWHR Life History Accounts and Range Maps at http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.aspx. Accessed October and November 2012.

California Energy Commission (CEC)

2012 Information on Desert Renewable Energy Conservation Plan (DRECP) from http://www.drecp.org/. Accessed October and November 2012.

California Native Plant Society (CNPS)

2012 Information on special status plant species from *Inventory of Rare and Endangered Vascular Plants of California* from http://www.rareplants.cnps.org/. Accessed October and November 2012.

California Herps

2012 Information of herpetofauna from http://www.californiaherps.com/. Accessed October and November 2012.

Campbell, J. A., and W. W. Lamar

2004 The Venomous Reptiles of the Western Hemisphere, 2 vols. Cornell University Press, Ithaca, New York. xvii pp. + 870 pp. + 56 pp., 282 figs., 8 color maps, 113 distribution maps, 1500 plates, 63 tables (ISBN 0-8014-4141-2).

Crooks, K. R.

2002 Relative sensitivities of mammalian carnivores to habitat fragmentation. Conservation Biology Vol. 16, No. 2, pp. 488–502.

Crooks, K. R., and M. E. Soulé

1999 Mesopredator release and avifaunal extinctions in a fragmented system. Nature 400:563-566.

DeForge, J. R.

1980 Population biology of desert bighorn sheep in the San Gabriel Mountains of California. Desert Bighorn Council Transactions 24:29-32.

Easterla, D.A., and J.O. Whitaker, Jr.

1972 Food habits of some bats from Big Bend National Park. Texas. J. Mammal. 53:997-890.

Farhig, L., and G. Merriam
1985 Habitat Patch Connectivity and Population Survival. Ecology 66:1,762-1,768.

Fraser, J. D., and D. R. Luukkonen
1986 The loggerhead shrike. Pages 933-941 in R. L. DiSilvestro, editor. Audubon Wildlife Report 1986. Academic Press, New York.

Gaines, D.
1974 Review of the status of the Yellow-billed Cuckoo in California: Sacramento Valley populations. Condor 76:204-209.

Garrett, K. and J. Dunn
1981 Birds of southern California: status and distribution. Los Angeles Audubon Soc., Los Angeles.

Grinnell, J.
1933 Review of the recent mammal fauna of California. Univ. Calif. Publ. Zool. 40:71-234.

Grinnell, J., and A. H. Miller
1944 The distribution of the birds of California. Pac. Coast Avifauna No. 27. 608pp.

Grinnell, J., J. Dixon, and J.M. Linsdale
1937 Fur-bearing mammals of California. 2 vol., University of California Press, Berkeley, 777 pp.

Haddad, N.M., D.K. Rosenberg, and B.R. Noon
2002 On Experimentation and the Study of Corridors: Response to Beier and Noss ... Volume 14, No. 5, pp. 1543-1545.

Harris, L.D. and P.B. Gallagher
1989 New Initiatives For Wildlife Conservation: The Need For Movement Corridors. Pages 11-34 in, Defenders of Wildlife. In Defense of Wildlife: Preserving Communities and Corridors. Defenders of Wildlife, Washington, D.C.

Haug, E.A., B.A. Millsap, and M.S. Martell
1993 Burrowing Owl (*Speotyto cunicularia*). In: A. Poole and F. Gill (eds.), The Birds of North America, No. 61. Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Holland, R.F.
1986 Preliminary descriptions of the terrestrial natural communities of California. State of California, The Resources Agency, Nongame Heritage Program, Dept. Fish & Game, Sacramento, Calif. 156 pp.

Jennings, M.R.
1987 Impact of the curio trade for San Diego Horned Lizards (*Phrynosoma coronatum blainvillii*) in the Los Angeles Basin, California: 1885-1930. J. Herpetol. 21(4):356-358.
1988 *Phrynosoma coronatum*.. Cat. Amer. Amph. Rept. 428.1-5.

Jennings, M.R., and M.P. Hayes
1994 Amphibian and reptile species of special concern in California. Final Report, Contract 8023. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

Krausman, P. R., A. Sandoval, and R. C. Etchberger
1999 Desert bighorn sheep: natural history. Pages 139 -191 In R. Valdez and P. R. Krausman, eds. Mountain sheep of North America. Univ. Arizona Press, Tucson.

Kus, B.
2002 Least Bell's vireo (*Vireo bellii pusillus*). In California Partners in Flight. The riparian bird conservation plan: a strategy for reversing the decline of riparian-associated birds in California. Available at: http://www.prbo.org/calpif/htmldocs/riparian_v-2.html.

Linsley, E.G.
1945 A new species of *Paranomada* with notes on *Melecta thoracica* Cresson. Entomological News 56(6):149.

Lowther, P. E., C. Celada, N. K. Klein, C. C. Rimmer, and D. A. Spector
1999 Yellow Warbler (Dendroica petechia). Species Account Number 454. The Birds of North America Online (A. Poole, Ed.). Ithaca, NY: Cornell Laboratory of Ornithology; Retrieved 3/25/2008 from The Birds of North America Online database: http://bna.birds.cornell.edu/bna/

MacArthur, R. H., and E. O. Wilson
1967 The Theory of Island Biogeography. Princeton, N.J.: Princeton University Press.

McCaskie, G., P. De Benedictis, R. Erickson, and J. Morlan
1979 Birds of northern California, an annotated field list. 2nd ed. Golden Gate Audubon Soc., Berkeley. 84pp.

McCaskie, G., P. De Benedictis, R. Erickson, and J. Morlan
1988 Birds of northern California, an annotated field list. 2nd ed. Golden Gate Audubon Soc., Berkeley. Reprinted with suppl. 108pp.

Miller, G. D., and W. S. Gaud
1989 Composition and variability of desert bighorn sheep diets. Journal of Wildlife Management 53:597-606.

Miller, A. H., and R. C. Stebbins
1964 The lives of desert animals in Joshua Tree National. Monument. Univ. California Press, Berkeley. 452pp. Norris, K. S. 1958.

Milner, J., C. Jones, and J. K. Jones, Jr.
1990 *Nyctinomops macrotis*. Am. Soc. Mamm., Mammalian Species No. 351:1-4.

Monson, G., and L. Sumner
1980 The Desert Bighorn: Its Life History, Ecology, and Management. Tucson: The University of Arizona Press. 370 pp.

Murphy R., V. Kovac, O. Haddrath, G. Allen, A. Fishbein, N. Mandrak
1995 mtDNA gene sequence, allozyme, and morphological uniformity among red diamond rattlesnakes, *Crotalus ruber* and *Crotalus exsul*. Canadian Journal of Zoology-Revue Canadienne De Zoologie 73:270-281.

NatureServe
2012 NatureServe Explorer: an online encyclopedia of life. Available at http://www.natureserve.org/explorer/. Accessed October and November 2012.

Noss, R. F.
1983 A regional landscape approach to maintain diversity. BioScience 33:700-706.
1987 Corridors in real landscapes: a reply to Simberloff and Cox. Conserv. Biol. 1:159-164.

Patten, M. A., McCaskie, G., Unitt, P.A.
2003 Birds of the Salton Sea. Univ. of California Press, Los Angeles.

Penrod, K., R. Hunter, and M. Merrifield.
2001 Missing Linkages: Restoring Connectivity to the California Landscape, Conference Proceedings. Co-sponsored by California Wilderness Coalition, The Nature Conservancy, U.S. Geological Survey, Center for Reproduction of Endangered Species, and California State Parks.

Penrod, K., C. Cabañero, P. Beier, C. Luke, W. Spencer, E. Rubin, and C. Paulman.
2008 A Linkage Design for the Joshua Tree-Twentynine Palms Connection. South Coast Wildlands, Fair Oaks, CA. www.scwildlands.org.

Penrod, K., P. Beier, E. Garding, and C. Cabañero.
2012 A Linkage Network for the California Deserts. Produced for the Bureau of Land Management and The Wildlands Conservancy. Produced by Science and Collaboration for Connected Wildlands, Fair Oaks, CA www.scwildlands.org and Northern Arizona University, Flagstaff, Arizona http://oak.ucc.nau.edu/pb1/

Remsen, J. V., Jr.
1978 Bird species of special concern in California. Calif. Dept. Fish & Game, Wildlife Mgt. Branch Admin. Rpt. 78-1.

Rosenberg, K. V., R. D. Ohmart, W. C. Hunter and B. W. Anderson.
1991 Birds of the lower Colorado River valley. Univ. of Arizona Press, Tucson.

Schmidly, D. J.
1977 The mammals of Trans-Pecos Texas. Texas A & M University Press, College Station.

Shackleton, D. M., C. C. Shank, and B. M. Wikeem
1999 Natural history of rocky mountain and California Bighorn sheep. In Mountain Sheep of North America, 1st Edition, R. Valdez and R. P. Krausman (eds.). The University of Arizona Press, Tucson, Arizona, pp. 78–138.

Sheppard, J.M.
1996 Le Conte's Thrasher (*Toxostoma lecontei*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/230

Shuford, D. and T. Gardali
2008 Yellow Warbler (*Dendroica petechia*), California Bird Species of Special Concern. Western Field Ornithologists and California Department of Fish and Game.

Simberloff, D. S., and J. Cox.
1987 Consequences and Costs of Conservation Corridors. Conservation Biology 1:63-71.

Small, A.
1994 California birds: their status and distribution. Ibis Publ. Co., Vista, CA.

Soulé, M.E.
1987 Viable populations for conservation. Cambridge Univ. Press, Cambridge.

Soulé, M.E., D.T. Bolger, A.C. Roberts, J. Wright, M. Sorice, and S. Hill
1988 Reconstructed dynamics of rapid extinctions of chaparral-requiring birds in urban habitat islands. Conserv. Biol. 2:75- 92.

Spencer, W.D., P. Beier, K. Penrod, K. Winters, C. Paulman, H. Rustigian-Romsos, J. Strittholt, M. Parisi, and A. Pettler.
2010 California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California. Prepared for California Department of Transportation, California Department of Fish and Game, and Federal Highways Administration.

Stebbins, R.C.
2003 Western Reptiles and Amphibians. Third Edition. Houghton Mifflin Company, Boston.

Steenhof, K.
1998 Prairie Falcon (*Falco mexicanus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/346

Tierra Madre Consultants, Inc.
2004 Technical Biological Assessment for the Town of Yucca Valley General Plan. March 24.

Town of Yucca Valley (Town)
1995 Town of Yucca Valley's General Plan available at http://www.yucca-valley.org/departments/gen_plan.html
2012 Information about the Town's resources available on the Chamber of Commerce website at http://www.yuccavalley.org/52.html

United States Army Corps of Engineers (USACE)
1987 U.S. Army Corps of Engineers Wetlands Delineation Manual. Wetlands Research Program, Technical Report Y-87-1. Department of the Army, Washington, D.C.
2008 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0). ERDC/EL TR-08-28. Vicksburg, MS: U.S. Army Engineer Research and Development Center. September.

United States Bureau of Land Management (BLM)
2007 Draft West Mojave Plan available at: http://www.blm.gov/ca/st/en/fo/cdd/wemo.html. Accessed October and November 2012.

United States Department of Agriculture (USDA)
1973 Soil Survey, Yucca Valley, California. Soil Conservation Service and Forest Service. Roy H. Bowman, ed. San Diego. December.

United States Fish and Wildlife Service (USFWS)
1998 Draft recovery plan for the Least Bell's Vireo. U.S. Fish and Wildlife Service, Portland, OR. 139pp.
2012 Information on the USFWS National Wetlands Inventory website at: http://www.fws.gov/wetlands/.

Unitt, P.A.
2004 San Diego County Bird Atlas. San Diego Natural History Museum. San Diego, CA.

Wehausen, J. D.
1980 Sierra Nevada bighorn sheep: history and population ecology. Ph.D. Diss. Univ. Michigan, Ann Arbor. 240pp.

Wolf, B., and S. Jones
2000 Vermillion Flycatcher. Pp. No. 213, pp. 1-19 in A Poole, F Gill, eds. *The Birds of North America: life histories for the 21st century*. Washington, D.C..: The American Ornithologists' Union.

Yosef, R.
1996 Loggerhead shrike (*Lanius ludovicianus*). In: Poole A. and F. Gill, eds. 1996. The Birds of North America, No.231. The Academy of Natural Sciences, Philadelphia, and The American Ornithologists. Union, Washington, D.C.

Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White
1990 California's Wildlife. Volume III. Mammals. State of California, The Resources Agency, Department of Fish and Game, Sacramento, CA. 407 pp.

Appendix E

Paleontological and Cultural Resources Assessment

Appendices

This page intentionally left blank.

cogstone
PALEONTOLOGY - ARCHAEOLOGY - HISTORY

PALEONTOLOGICAL AND CULTURAL RESOURCES ASSESSMENT FOR THE TOWN OF YUCCA VALLEY GENERAL PLAN UPDATE, SAN BERNARDINO COUNTY, CALIFORNIA

Public Version

Prepared for:
The Planning Center – DC&E
3 MacArthur Place, Suite 1100
Santa Ana, CA 92707

Authors:
Melinda Horne, Sherri Gust, and Amy Glover

Principal Investigator:
Sherri Gust
Registered Professional Archaeologist and Qualified Principal Paleontologist

November 2012

Project Number: 2179
Type of Study: Paleontological and Cultural Resources Inventory
USGS 7.5' Quadrangles: Yucca Valley North 1972; Yucca Valley South 1972; Joshua Tree North 1972; Joshua Tree South 1972
Area: 25,470
Key Words: Old Woman Sandstone, Quaternary older alluvium, Quaternary older gravel, Quaternary older fanglomerate, Serrano, ranching, gold mining, Warren's Well, Warren's Tank, Desert Christ Park, CA State Route 63

1518 West Taft Avenue
Orange, CA 92865
Office (714) 974-8300
Toll free (888) 497-0700

Branch Offices
West Sacramento - Morro Bay - Inland Empire - San Diego

cogstone.com

TABLE OF CONTENTS

MANAGEMENT SUMMARY ..... **IV**

INTRODUCTION **1**

PROJECT DESCRIPTION 2
PROJECT PERSONNEL 6

REGULATORY FRAMEWORK **7**

FEDERAL LAWS AND REGULATIONS 7
National Historic Preservation Act of 1966, as amended *7*
National Register of Historic Places *8*
Paleontological Resources Preservation Act *9*
STATE LAWS AND REGULATIONS 10
California Environmental Quality Act of 1970, as amended *10*
California Register of Historical Resources *10*
California Historical Landmarks *11*
California Points of Historical Interest *12*
ADDITIONAL RELEVANT GUIDANCE 13
Potential Fossil Yield Classification System *13*
Definition of Significance for Paleontological Resources *13*

BACKGROUND **14**

ENVIRONMENTAL SETTING 14
GEOLOGIC SETTING 15
Mesozoic and Pre-Mesozoic Formations *15*
Old Woman Sandstone *16*
Basalt *16*
Older Fanglomerate *16*
Quaternary Older Gravel *16*
Quaternary Older Alluvium *16*
Quaternary Alluvium *16*
PREHISTORIC CULTURAL SETTING 18
Paleoindian/San Dieguito Period (ca. 12,000 B.P. to 7000 B.P.) *18*
Pinto Period (ca. 7000 B.P. to 4000 B.P.) *19*
Gypsum Period (ca. 4000 B.P. to 1500 B.P.) *19*
Saratoga Springs Period (ca. 1500 B.P. to 750 B.P.) *20*
Late Prehistoric Period (ca. 750–200 B.P.) *21*
ETHNOGRAPHIC SETTING 22
HISTORIC SETTING 25
Spanish & Mexican Periods (ca. 1769-1848) *25*
Early American Period (1850-1900) *25*
Early 20th Century (1900-1949) *26*
Late 20th Century Era (Post-1950) *29*

RECORDS SEARCH AND LITERATURE REVIEW **31**

PALEONTOLOGICAL RESOURCES 31
CULTURAL RESOURCES 31
California Historic Resources Inventory System *31*
Other Sources Consulted *34*
NATIVE AMERICAN CONSULTATION 36

IMPACT ANALYSIS AND MITIGATION **36**

PAL-1. POTENTIAL IMPACTS TO PALEONTOLOGICAL RESOURCES 36

POTENTIAL IMPACTS TO CULTURAL RESOURCES 37
CUL-1. Adverse Changes to Historical Built Environment Resources 37
CUL-2. Adverse Changes to Archaeological Resources 38
CUL-3. Potential to Disturb Native American Human Remains 39
MITIGATION MEASURES 39
MM PAL-1 39
MM CUL-1 39
MM CUL-2 39
MM CUL-3 40

REFERENCES CITED 41

APPENDIX A: QUALIFICATIONS 45

APPENDIX B: PFYC 50

APPENDIX C: PALEONTOLOGICAL RECORDS SEARCH 55

APPENDIX D: GLO LAND PATENTS 61

APPENDIX E: PREVIOUS CULTURAL RESOURCES STUDIES 69

APPENDIX F: NATIVE AMERICAN HERITAGE COMMISSION 77

APPENDIX G: NATIVE AMERICAN OUTREACH 83

APPENDIX H: NATIVE AMERICAN CONTACT LOG 87

LIST OF FIGURES

FIGURE 1. TOWN OF YUCCA VALLEY STUDY VICINITY 1
FIGURE 2A. TOWN OF YUCCA VALLEY STUDY OVERVIEW 1
FIGURE 2B. TOWN OF YUCCA VALLEY STUDY AREA MAP 1 1
FIGURE 2C. TOWN OF YUCCA VALLEY STUDY AREA MAP 2 1
FIGURE 2D. TOWN OF YUCCA VALLEY STUDY AREA MAP 3 2
FIGURE 2E. TOWN OF YUCCA VALLEY STUDY AREA MAP 4 3
FIGURE 2F. TOWN OF YUCCA VALLEY STUDY AREA MAP 5 4
FIGURE 3. YUCCA VALLEY GEOLOGY MAP 17
FIGURE 4. SOUTHERN CALIFORNIA TRIBAL TERRITORIES 23
FIGURE 5. 1947 AERIAL OF YUCCA VALLEY, VIEW TO NORTHWEST (EVANS 1965) 30
FIGURE 7. PEARCE REST HOME IN THE 1920S (EVANS 1965) 27
FIGURE 8. THE LONE STAR RANCH IN THE 1920S (EVANS 1965) 28
FIGURE 9. CIRCA 1947 AAA MAP OF YUCCA VALLEY AREA (WILSON AND GRUBB 1988) 28
FIGURE 10. 1965 AERIAL OF YUCCA VALLEY, VIEW TO NORTHWEST (EVANS 1965) 30

LIST OF TABLES

TABLE 1. YUCCA VALLEY STUDY AREA LOCATIONS 2
TABLE 2. REGIONAL FOSSILS FROM QUATERNARY OLDER ALLUVIUM 32
TABLE 3. FOSSILS FROM OLD WOMAN SANDSTONE IN REGION 33
TABLE 4. PREVIOUSLY RECORDED CULTURAL RESOURCES SITES WITHIN YUCCA VALLEY STUDY AREA 33
TABLE 5. ADDITIONAL SOURCES CONSULTED 34
TABLE 6. HISTORICAL RESOURCES WITHIN THE TOWN OF YUCCA VALLEY 34
TABLE 7. PFYC RESULTS 37

MANAGEMENT SUMMARY

The Town of Yucca Valley is located along the southwestern margin of the Mojave Desert in the southwestern portion San Bernardino County, California. The objective of this Paleontological and Cultural Resources Assessment is to review available information on known resources within the Town in support of the General Plan Update Environmental Documents.

The Town is mapped as geologic sediments of Quaternary alluvium, Quaternary older alluvium, Quaternary Older fan, Quaternary older gravel, Quaternary older fanglomerate, basalt, Old Woman Sandstone, quartz monzonite, monzonite porphyry, and gneissic rocks. The developed townsite is mostly on Quaternary alluvium and Quaternary older alluvium. Two vertebrate fossils of extinct horse and desert tortoise are known within the Town limits.

Fossils of extinct horse and desert tortoise are known within the city limits (west-central portion) in Quaternary older alluvium. Additional fossils are known regionally in the same sediments (near Twentynine Palms) and include extinct animals such as mammoth, ground sloths, camel, horse, llama, dwarf pronghorn and saber-toothed cat. Fossils are also known from the Old Woman Sandstone in the local region. These include extinct animals such as a zebra-like horse and Furlong's rabbit in addition to cotton rat, wood rat and brown bat.

The local vicinity has prehistoric resources ranged from about 10,000 years ago to 200 years ago. At the time of historic contact, the Project study region was within the ethnographic territory of the Serrano. During the 1870s leading up to the turn of the century, the region was used largely by ranchers and gold mining prospectors, especially after the discovery of gold east of what is now Twentynine Palms. Many individuals and families did not stay long, due to harsh living conditions such as lack of water and the general difficulty in raising crops in a desert environment. The first school in Yucca Valley was established in 1915. A telephone was not available in Yucca Valley until 1935 and population did not dramatically increase until after World War II, when hundreds of land patents were filed. The highway from Morongo Valley through Yucca Valley was constructed in 1937 but not paved until 1951. Electricity did not appear until 1946, three years after the Town streets were laid out.

The records search determined that there are nine prehistoric resources, three historical archaeological resources and five historic resources within the Town. The prehistoric archaeological sites recorded previously include five lithic artifact scatters, a camp site, a quarry sites, a bedrock milling site, and one isolated pottery sherd. The historical archaeological sites include two historic refuse scatters and a dove blind associated with a refuse scatter. The historic resources include a historical school house, Warren's Well, Warren's Ranch/Tanks, Desert Christ Park (a local folk art site), and State Route 62 (Twentynine Palms Highway). 82 cultural resources studies have been completed previously within the Town covering only 11 percent of the Town's acreage.

A Sacred Lands File search was requested from the Native American Heritage Commission on December 2, 2011. On December 5, the Commission replied that there were no known Native American cultural resources within the study area, and provided a list of 12 Native American

tribes or individuals to contact for further information. Letters requesting information on any cultural heritage sites and containing maps and study information were sent by U.S. Mail on December 7, 2011, to the 12 Native American contacts. After no responses were received, follow-up e-mails were sent and phone calls were placed to the Native America contacts on December 28, 2011, and again on January 5, 2012. No responses were received from the 12 Native American individuals or organizations.

A general analysis of impacts of future projects in the Town that may adversely affect paleontological, archaeological or historic resources is provided along with recommendations.

INTRODUCTION

The Town of Yucca Valley is located along the southwestern margin of the Mojave Desert in the southwestern portion San Bernardino County, California (Figure 1). The objective of this Paleontological and Cultural Resources Assessment is to review available information on known resources within the Town in support of the General Plan Update Environmental Documents. The Town of Yucca Valley's (Town's) General Plan is a policy document for the long-range comprehensive development of the Town. As a policy document, the General Plan provides the legal basis for all subdivision, zoning and related ordinances, and also the legal basis for the initiation and authorization for all public improvements and projects that may be proposed in the Town's General Plan Updates and various Specific Plans.

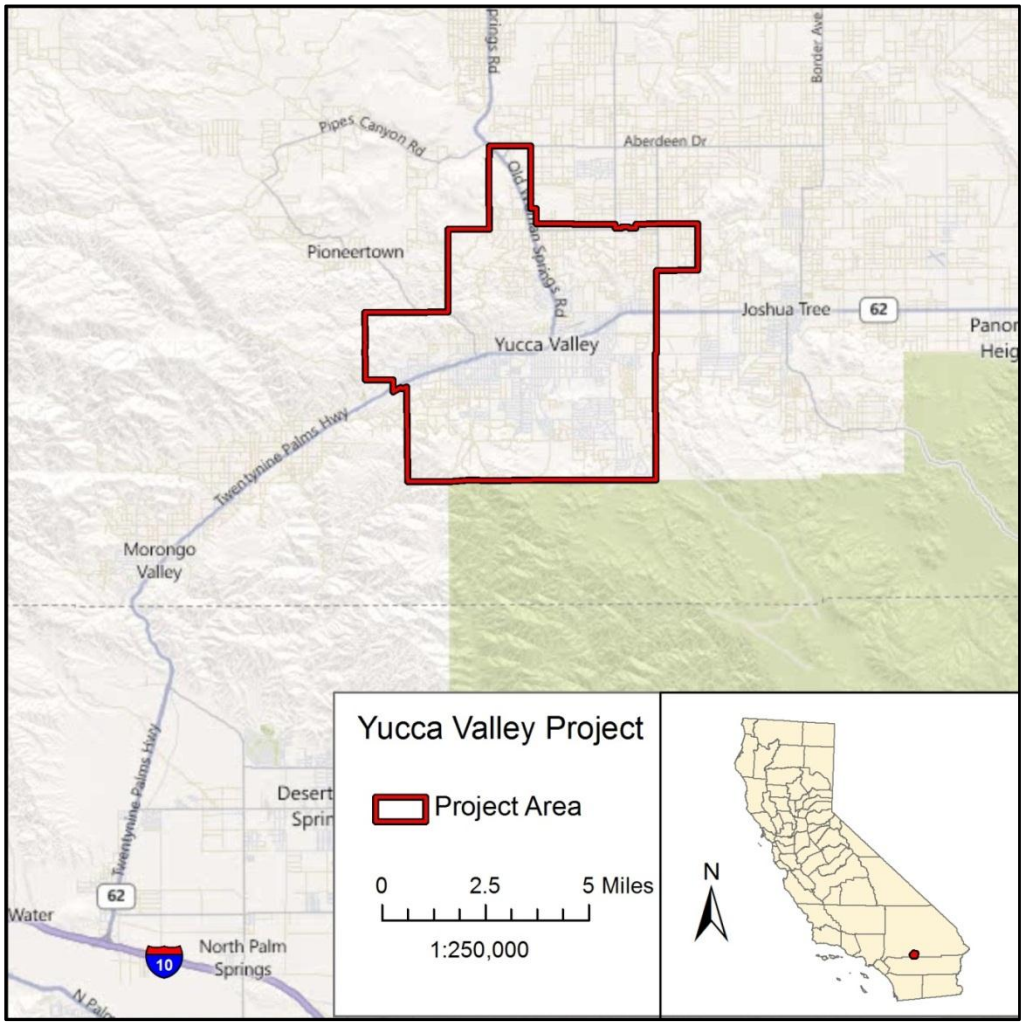


Figure 1. Town of Yucca Valley Vicinity

PROJECT DESCRIPTION

The Town of Yucca Valley is depicted on multiple U.S.G.S 7.5-minute series topographic quadrangles (Table 1), and is bordered to the north by the Sawtooth Mountains, to the west by Morongo Valley, to the south by Joshua Tree National Park, and to the east by the community of Joshua Tree (Figures 2a-2f). Of the 25,470 acre Town area, 1,038 acres are public lands administered by the Bureau of Land Management (BLM), comprising approximately 4 percent of the total study area. There are no lands within the Project study area administered by the Bureau of Indian Affairs (BIA).

Elevations within the Town's general study region ranges from approximately 4,400 feet (ft) above mean sea level (amsl) in the northern portion of the study area (Figure 2b) and gradually declines to approximately 3,260-3,200 ft amsl at the community of Yucca Valley and the Yucca Valley Airport, respectively (Figure 2d). Desert Christ Park, a local historical landmark composed of folk art located at the northwestern corner of the Town proper, is at an approximate elevation of 3,400 ft amsl. At the south-central edge of the Project study area, elevations again gradually rise to 3,795 ft amsl and 4,395 ft amsl at Burnt Mountain and South Park Peak, respectively (Figure 2f). State Route 62 (Twentynine Palms Highway) is generally at an elevation of 3,300 ft amsl and transects the Project study area from northeast to southwest. (Figure 2d and 2e).

Table 1. Yucca Valley Study Area Locations

7.5' Quad	Section	Township & Range
Yucca Valley North	11, 14, 22-27, 32-36	T 1N R 5E
	19, 20, 29-32	T 1N R 6E
Yucca Valley South	32-36	T 1N R 5E
	1-5, 9-16	T 1S R 5E
	31, 32	T 1N R 6E
	5-8, 17, 18	T 1S R 6E
Joshua Tree North	20, 21, 29, 32	T 1N R 6E
Joshua Tree South	32	T 1N R 6E
	5, 8, 17	T 1S R 6E

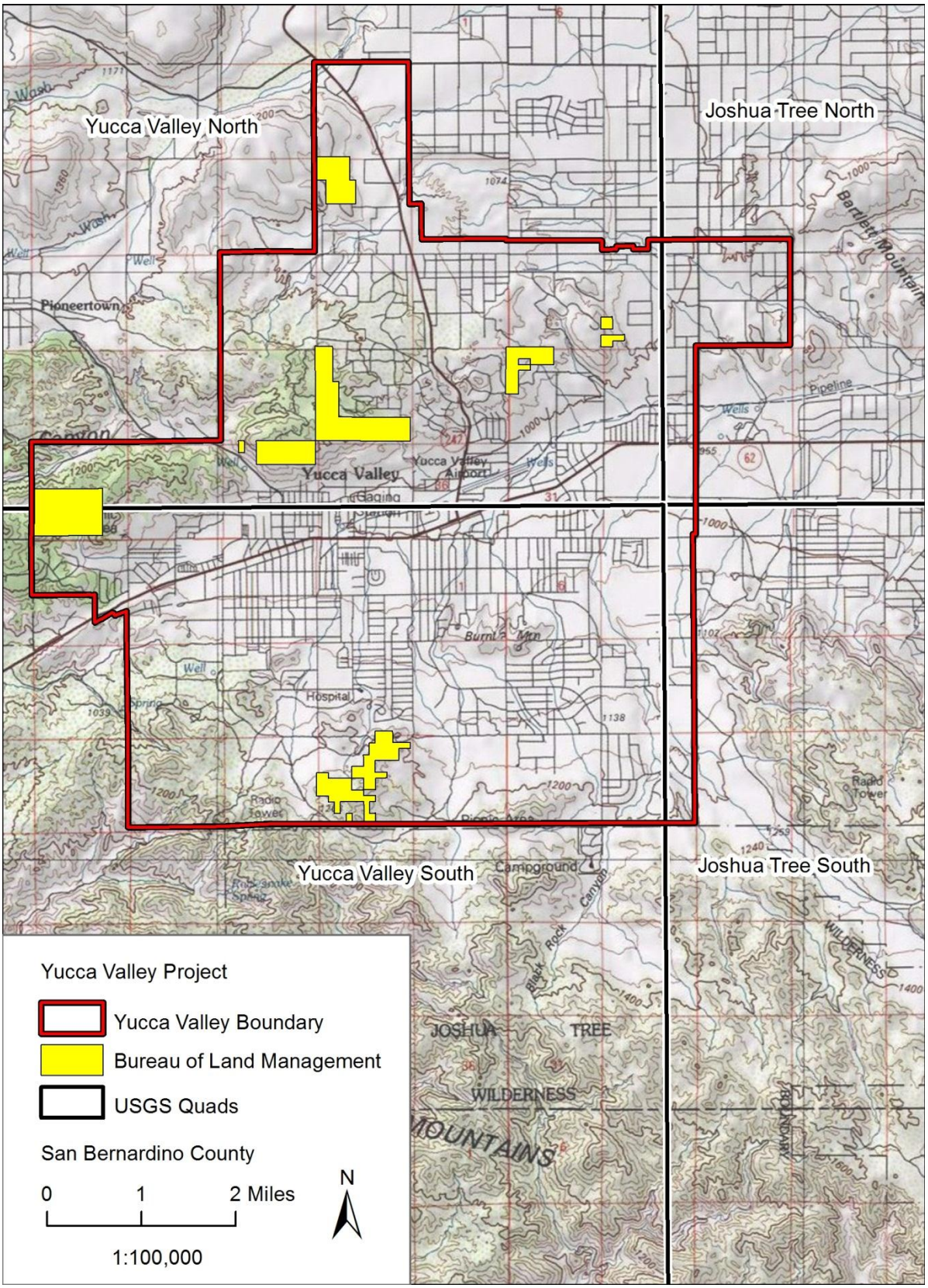


Figure 2a. Town of Yucca Valley Study Overview

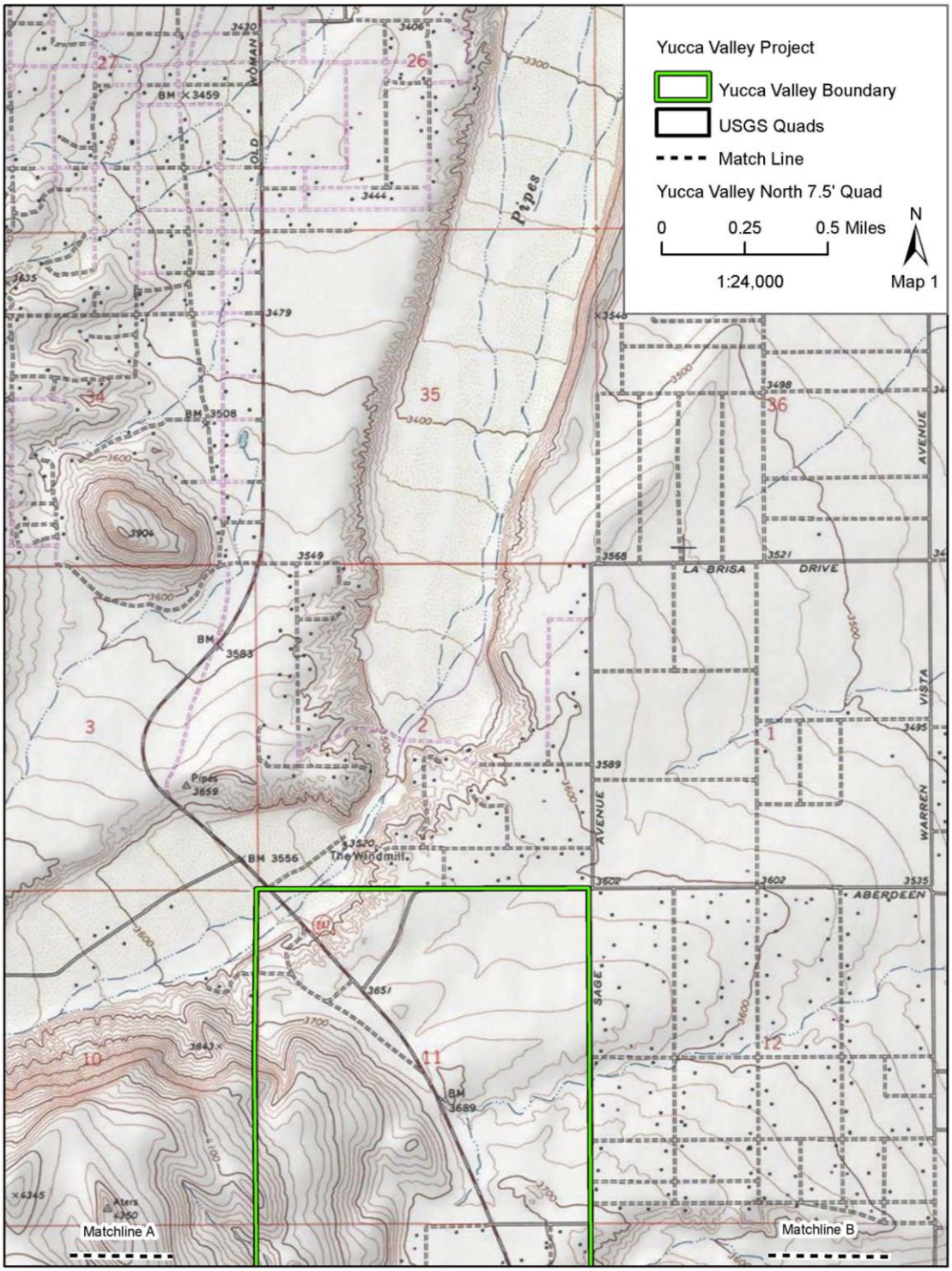


Figure 2b. Town of Yucca Valley Study Area Map 1

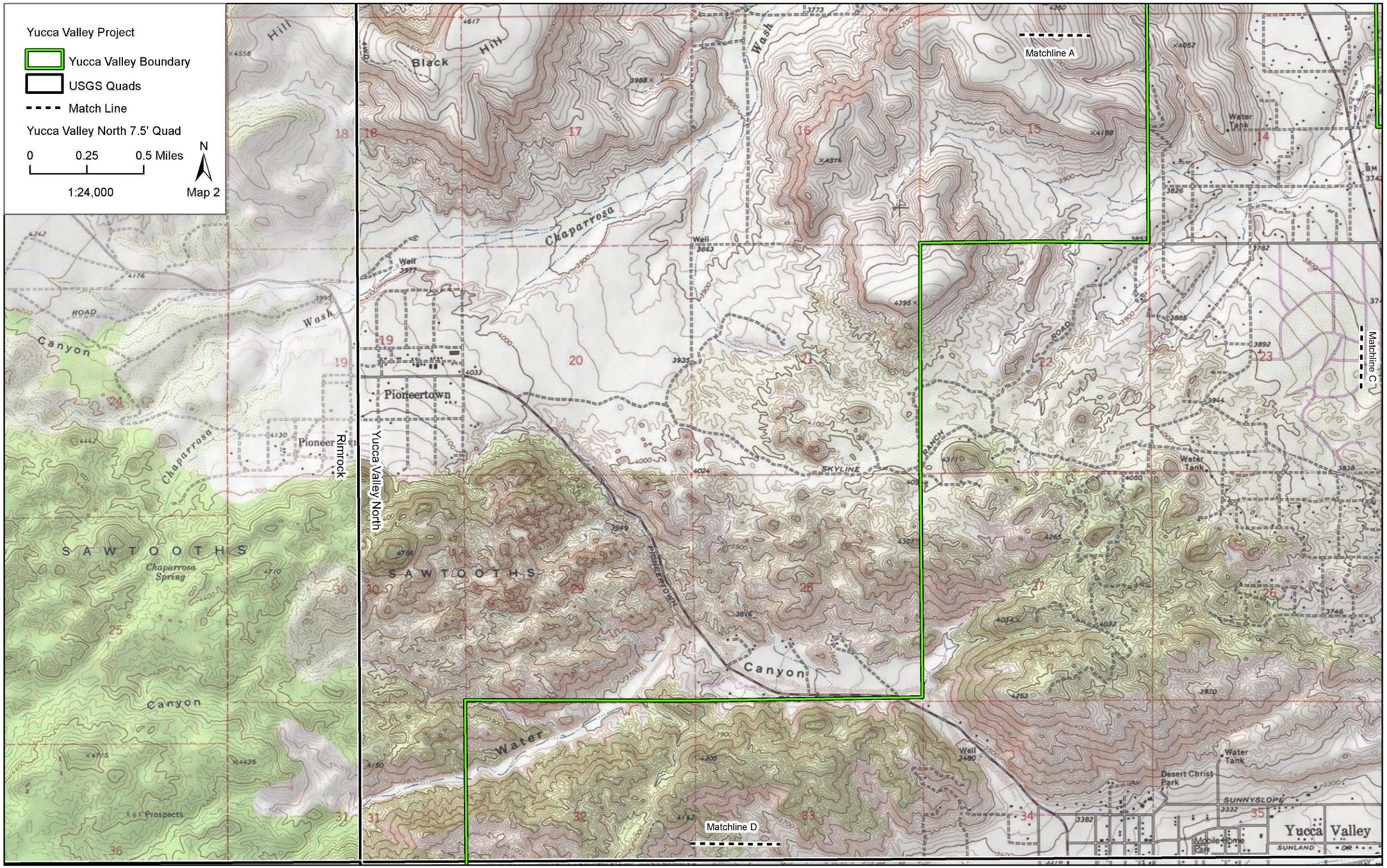


Figure 2c. Town of Yucca Valley Study Area Map 2

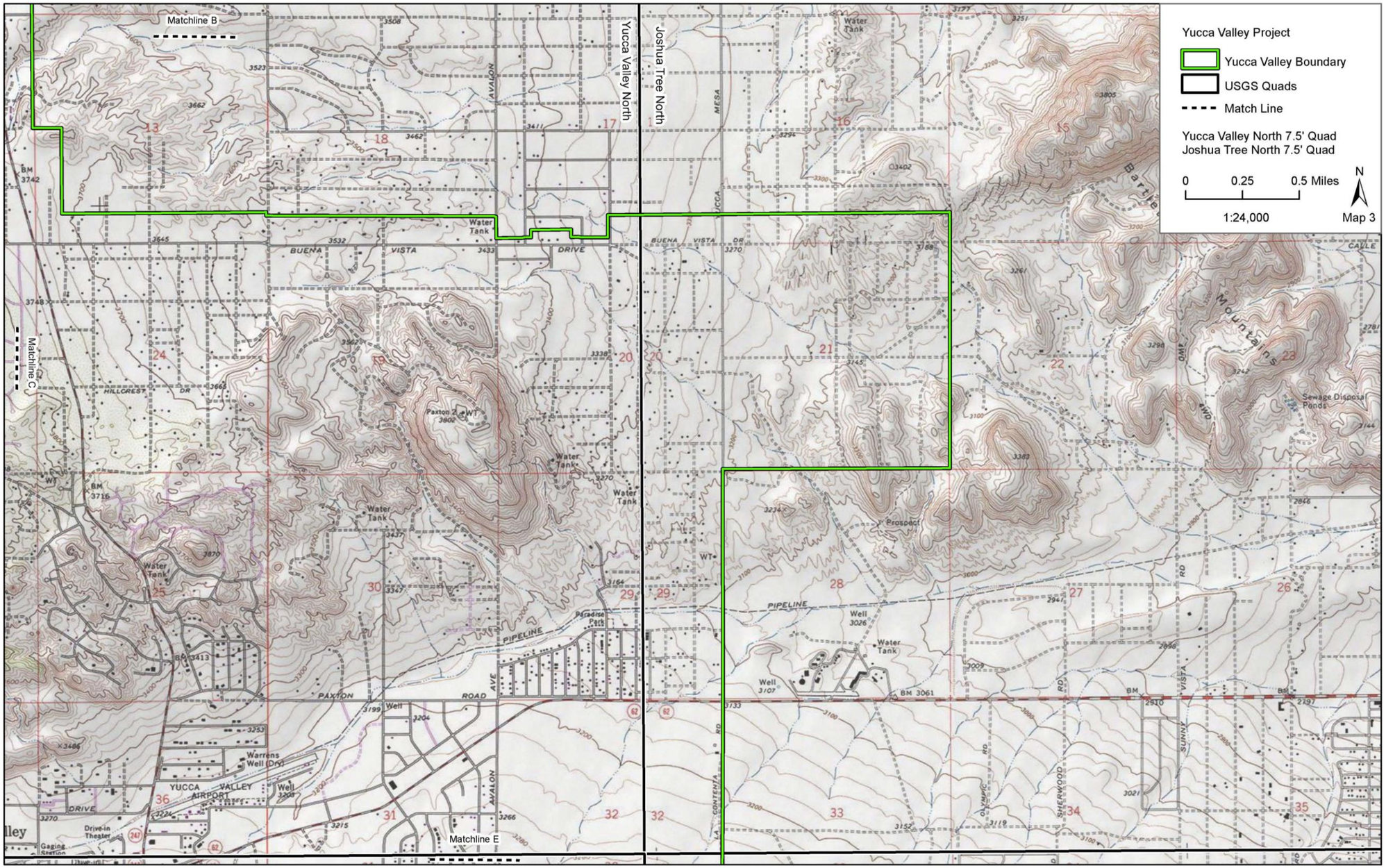


Figure 2d. Town of Yucca Valley Study Area Map 3

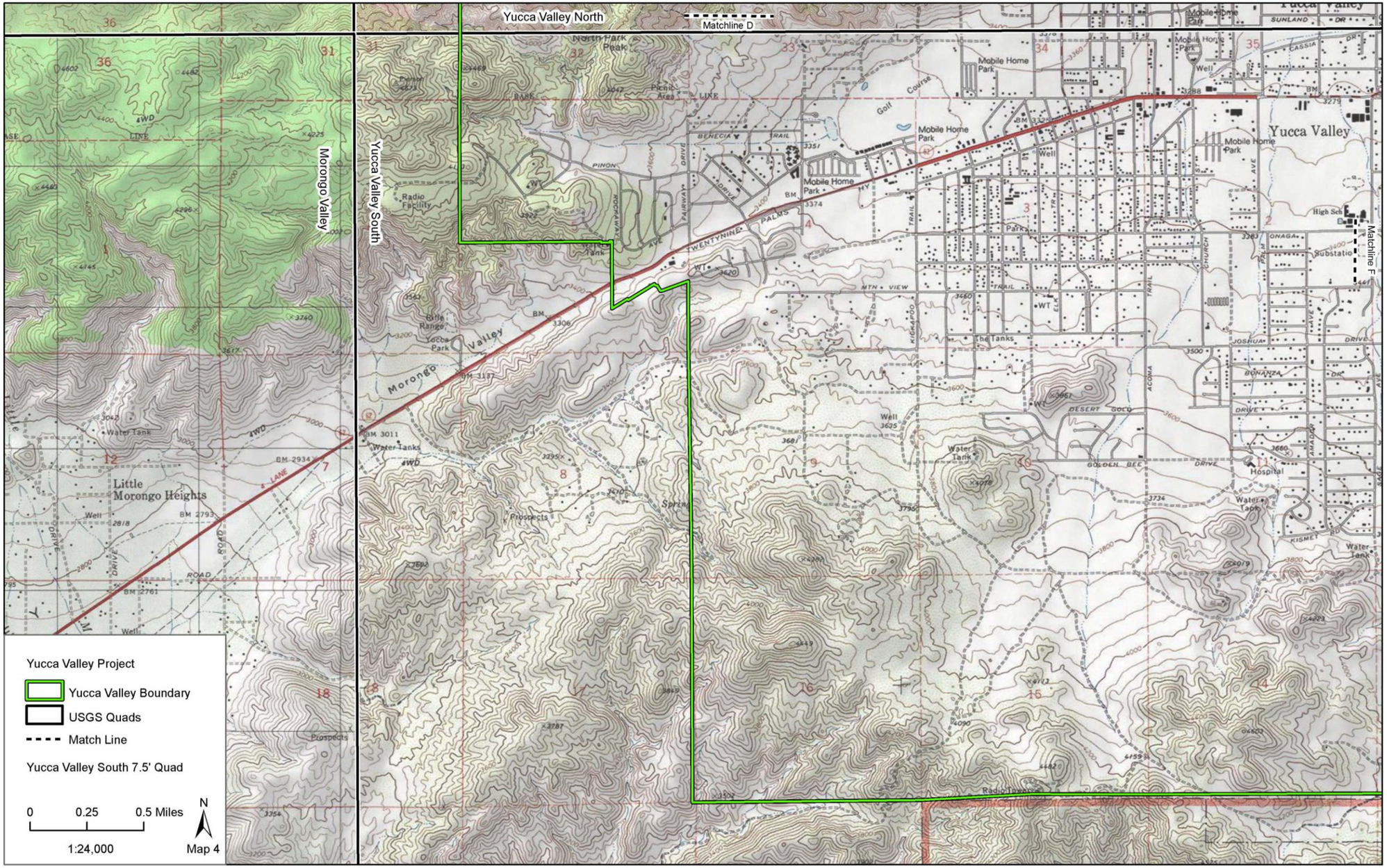


Figure 2e. Town of Yucca Valley Study Area Map 4

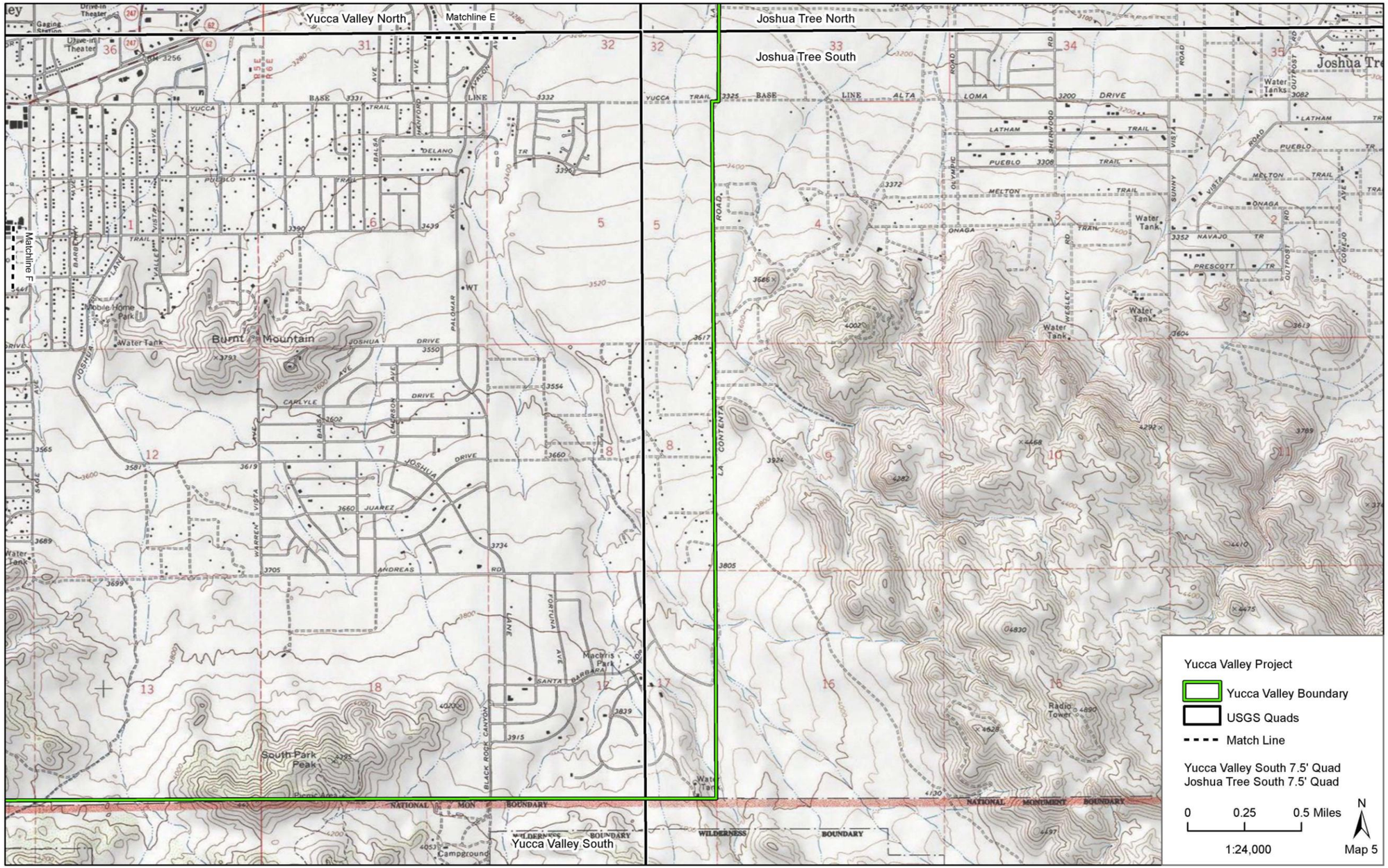


Figure 2f. Town of Yucca Valley Study Area Map 5

The Town of Yucca Valley has a number of land uses, but the vast majority of Town's land is either single-family land uses (24.0%) or vacant (73.4%). This is due to the Town's desert residential character and isolated high desert location. With a few exceptions, existing commercial and industrial uses are generally located within ½ mile of the SR-62 corridor and concentrated in the Old Town and Mid-Town areas. Yucca Valley does not contain any major water bodies or improved open space areas. Therefore, the Town's abundant vacant land generally consists of undeveloped desert saltbrush scrub, Joshua tree woodland, and pinyon-juniper woodland. The majority of roadways in the less developed portions of the Town are unimproved (e.g., dirt roads).

The proposed project is an update to the Town of Yucca Valley General Plan. The Yucca Valley General Plan Update is intended to shape development with in the Town for the next twenty years and beyond. The Update is guided by a set of community values that were developed by the Yucca Valley Town Council with input from the community and adopted by the Town Council on March 20, 2012. The community values are: Small town atmosphere, balanced growth, safe and established neighborhoods, fiscal sustainability, diverse range of community services, efficient infrastructure, strong economy, desert environment and natural resources, arts and culture and community pride and participation.

The update shifts the Town's goals slightly to reduce residential use and the Old Town Specific Plan areas, increase commercial and miscellaneous uses and adds a Westside Special Policy Area (Table 2). More detail can be found in the Initial Study for this general plan update (Planning Center 2012).

Table 2. Current and Proposed Land Use Percentages

Land Use Descriptions	Previous General Plan	Proposed General Plan
Residential	88.6%	82.4%
Commercial, Mixed & Industrial	3.7%	5.8%
Miscellaneous	3.6%	7.3%
Old Town Specific Plan	0.8%	0.7%
Westside Special Policy Area	0%	3.8%

PROJECT PERSONNEL

Cogstone Resource Management, Inc., performed the studies reported herein. Melinda Horne served as Principal Archaeologist for the study and wrote portions of this report pertaining to the cultural history and recommendations and edited this report. Horne is a Registered Professional Archaeologist and received her B.A. and M.A. in Anthropology/Geography from the University of Utah. She has more than 30 years of archaeological experience in California, Oregon, Nevada, and Utah. Sherri Gust served as Principal Paleontologist for the study, wrote the paleontological sections and recommendations, and edited this report. Gust is a Qualified Principal Paleontologist and Registered Professional Archaeologist with a M.S. in Anatomy (Evolutionary Morphology) from the University of Southern California, a B.S. in Anthropology from the University of California at Davis, and more than 30 years of experience in California.

Amy Glover performed the archaeological records search, documented the results of this search, and assisted Horne with preparing the cultural context sections of the report. Ms. Glover has a B.S. in Anthropology from the University of California, Riverside and more than six years of experience in California archaeology. Todd Wirths wrote the geologic setting. He has a B.A. in geology from the University of California, Santa Cruz, and an M.S. in geology from San Diego State University. In addition, Mr. Wirths is a California Certified Professional Geologist (No. 7588).

Molly Valasik and Shanna Wexelblatt prepared the GIS maps presented in this document. Ms. Valasik has a M.A. in Anthropology and experience in California archaeology. Ms. Wexelblatt holds a Bachelor's degree in Philosophy, minoring in anthropology, and is currently working towards her Master's degree in anthropology. Further qualifications of Cogstone staff are provided (Appendix A).

REGULATORY FRAMEWORK

The General Plan Update is subject to state regulations. Future projects within the Town may be subject to federal, state or local regulations depending on land ownership. Information on federal laws provided here can also assist with evaluating National Register properties.

FEDERAL LAWS AND REGULATIONS

NATIONAL HISTORIC PRESERVATION ACT OF 1966, AS AMENDED

The National Historic Preservation Act (NHPA) is the primary federal law governing the preservation of cultural and historic resources in the United States. The law establishes a national preservation program and a system of procedural protections which encourage the identification and protection of cultural and historic resources of national, state, tribal and local significance. Primary components of the act include:

a) Articulation of a national policy governing the protection of historic and cultural resources.
b) Establishment of a comprehensive program for identifying historic and cultural resources for listing in the National Register of Historic Places.
c) Creation of a federal-state/tribal-local partnership for implementing programs established by the act.
d) Requirement that federal agencies take into consideration actions that could adversely affect historic properties listed or eligible for listing on the National Register of Historic Places, known as the Section 106 Review Process.
e) Establishment of the Advisory Council on Historic Preservation, which oversees federal agency responsibilities governing the Section 106 Review Process.
f) Placement of specific stewardship responsibilities on federal agencies for historic properties owned or within their control (Section 110 of the NHPA).

Section 106, as noted above (item d), requires the head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation a reasonable opportunity to comment with regard to such undertaking.

NATIONAL REGISTER OF HISTORIC PLACES

The National Register of Historic Places is the nation's official list of buildings, structures, objects, sites, and districts worthy of preservation because of their significance in American history, architecture, archeology, engineering, and culture. The National Register recognizes resources of local, state and national significance which have been documented and evaluated according to uniform standards and criteria.

Authorized under the National Historic Preservation Act of 1966, the National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. The National Register is administered by the National Park Service, which is part of the U. S. Department of the Interior.

To be eligible for listing in the National Register, a resource must meet at least one of the following criteria:

A. Is associated with events that have made a significant contribution to the broad patterns of our history
B. Is associated with the lives of persons significant in our past
C. Embodies the distinctive characteristics of a type, period or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction
D. Has yielded, or may be likely to yield, information important in history or prehistory

Effects of National Register Designation include:

a) Tax incentives, in some cases, for rehabilitation of depreciable structures.
b) Tax deduction available for donation of preservation easement.
c) Local building inspector must grant code alternatives provided under State Historical Building Code.
d) Local assessor may enter into contract with property owner for property tax reduction (Mills Act).
e) Consideration in federally funded or licensed undertakings (Section 106, National Historic Preservation Act).
f) Limited Protection: Environmental review may be required under the California Environmental Quality Act (CEQA) if property is threatened by a project. Contact the local government planning agency for more information.
g) Automatic listing in California Register of Historical Resources. Owner may place his or her own plaque or marker at the resource site.
h) Listing in the National Register may result in restrictions, such as design review, imposed locally pursuant to the California Environmental Quality Act (CEQA) or through local zoning and land use planning regulations.

PALEONTOLOGICAL RESOURCES PRESERVATION ACT

The Paleontological Resources Preservation Act (Public Law 111-011, Title VI, Subtitle D on Paleontological Resources Preservation) requires the Secretaries of the Interior and Agriculture to manage and protect paleontological resources on Federal land using scientific principles and expertise. The law affirms the authority for many of the policies the Federal land managing agencies already have in place for the management of paleontological resources such as issuing permits for collecting paleontological resources, curation of paleontological resources, and confidentiality of locality data. It only applies to Federal lands. It provides authority for the protection of significant paleontological resources on Federal lands including criminal and civil penalties for fossil theft and vandalism. The act states (in part):

a) The term ‘‘paleontological resource’’ means any fossilized remains, traces, or imprints of organisms, preserved in or on the earth’s crust, that are of paleontological interest and that provide information about the history of life on earth.
b) The Secretary shall manage and protect paleontological resources on Federal land using scientific principles and expertise.
c) The Secretary shall develop appropriate plans for inventory, monitoring, and the scientific and educational use of paleontological resources, in accordance with applicable agency laws, regulations, and policies. These plans shall emphasize interagency coordination and collaborative efforts where possible with non-Federal partners, the scientific community, and the general public.
d) A paleontological resource may not be collected from Federal land without a permit issued under this subtitle by the Secretary.
e) The Secretary may issue a permit for the collection of a paleontological resource pursuant to an application if the Secretary determines that:

    1) the applicant is qualified to carry out the permitted activity;
    2) the permitted activity is undertaken for the purpose of furthering paleontological knowledge or for public education;
    3) the permitted activity is consistent with any management plan applicable to the Federal land concerned; and
    4) the proposed methods of collecting will not threaten significant natural or cultural resources.

f) A permit for the collection of a paleontological resource issued under this section shall contain such terms and conditions as the Secretary deems necessary to carry out the purposes of this subtitle. Every permit shall include requirements that:

    1) the paleontological resource that is collected from Federal land under the permit will remain the property of the United States;
    2) the paleontological resource and copies of associated records will be preserved for the public in an approved repository, to be made available for scientific research and public education; and
    3) specific locality data will not be released by the permittee or repository without the written permission of the Secretary.

g) Any paleontological resource, and any data and records associated with the resource, collected under a permit, shall be deposited in an approved repository. The Secretary may

enter into agreements with non-Federal repositories regarding the curation of these resources, data, and records.

h) Information concerning the nature and specific location of a paleontological resource shall be exempt from disclosure under section 552 of title 5, United States Code, and any other law unless the Secretary determines that disclosure would further the purposes of this subtitle, not create risk of harm to or theft or destruction of the resource or the site containing the resource and be in accordance with other applicable laws. [BLM 2009]

STATE LAWS AND REGULATIONS

CALIFORNIA ENVIRONMENTAL QUALITY ACT OF 1970, AS AMENDED

CEQA declares that it is state policy to "take all action necessary to provide the people of this state with...historic environmental qualities." It further states that public or private projects financed or approved by the state are subject to environmental review by the state. All such projects, unless entitled to an exemption, may proceed only after this requirement has been satisfied. CEQA requires detailed studies that analyze the environmental effects of a proposed project. In the event that a project is determined to have a potential significant environmental effect, the act requires that alternative plans and mitigation measures be considered.

CEQA includes historic and archaeological resources as integral features of the environment. If paleontological resources are identified as being within the proposed project area, the sponsoring agency must take those resources into consideration when evaluating project effects. The level of consideration may vary with the importance of the resource.

CALIFORNIA REGISTER OF HISTORICAL RESOURCES

The State Historical Resources Commission has designed this program for use by state and local agencies, private groups and citizens to identify, evaluate, register and protect California's historical resources. The Register is the authoritative guide to the state's significant historical and archeological resources.

The California Register program encourages public recognition and protection of resources of architectural, historical, archeological and cultural significance, identifies historical resources for state and local planning purposes, determines eligibility for state historic preservation grant funding and affords certain protections under the California Environmental Quality Act.

To be eligible for listing in the California Register, a resource must meet at least one of the following criteria:

1) Associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States
2) Associated with the lives of persons important to local, California or national history
3) Embodies the distinctive characteristics of a type, period, region or method of construction or represents the work of a master or possesses high artistic values

4) Has yielded, or has the potential to yield, information important to the prehistory or history of the local area, California or the nation

In addition to having significance, resources must have integrity for the period of significance. The period of significance is the date or span of time within which significant events transpired, or significant individuals made their important contributions. Integrity is the authenticity of a historical resource's physical identity as evidenced by the survival of characteristics or historic fabric that existed during the resource's period of significance. Alterations to a resource or changes in its use over time may have historical, cultural, or architectural significance. Simply, resources must retain enough of their historic character or appearance to be recognizable as historical resources and to convey the reasons for their significance. A resource that has lost its historic character or appearance may still have sufficient integrity for the California Register, if, under Criterion 4, it maintains the potential to yield significant scientific or historical information or specific data.

Effects of Designation include:

1) Limited protection: Environmental review may be required under CEQA if property is threatened by a project. Contact your local planning agency for more information.
2) Local building inspector must grant code alternatives provided under State Historical Building Code.

CALIFORNIA HISTORICAL LANDMARKS

California Historical Landmarks are buildings, structures, sites, or places that have been determined to have statewide historical significance by meeting at least one of the criteria listed below. The resource also must be approved for designation by the County Board of Supervisors or the City/Town Council in whose jurisdiction it is located; be recommended by the State Historical Resources Commission; and be officially designated by the Director of California State Parks.

To be eligible for designation as a Landmark, a resource must meet at least one of the following criteria:

1) Be the first, last, only, or most significant of its type in the state or within a large geographic region (Northern, Central, or Southern California).
2) Be associated with an individual or group having a profound influence on the history of California.
3) Be a prototype of, or an outstanding example of, a period, style, architectural movement or construction or is one of the more notable works or the best surviving work in a region of a pioneer architect, designer or master builder.

Effects of Designation include:

1) Registration will be recorded on the property deed.
2) Limited protection: Environmental review may be required under the California Environmental Quality Act (CEQA) if property is threatened by a project. Contact your local planning agency for more information.
3) Local assessor may enter into contract with property owner for property tax reduction using the Mills Act.
4) Local building inspector must grant code alternative provided under State Historic Building Code.
5) Automatic listing in California Register of Historical Resources.
6) Bronze plaque at site (underwritten by local sponsor) may be ordered through OHP; highway directional sign available through local Department of Transportation (Caltrans) district office.

CALIFORNIA POINTS OF HISTORICAL INTEREST

California Points of Historical Interest are sites, buildings, features, or events that are of local (city or county) significance and have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other value.

Points of Historical Interest designated after December 1997 and recommended by the State Historical Resources Commission are also listed in the California Register. No historical resource may be designated as both a Landmark and a Point. If a Point is subsequently granted status as a Landmark, the Point designation will be retired.

To be eligible for designation as a Point of Historical Interest, a resource must meet at least one of the following criteria:

1) The first, last, only, or most significant of its type within the local geographic region (City or County).
2) Associated with an individual or group having a profound influence on the history of the local area.
3) A prototype of, or an outstanding example of, a period, style, architectural movement or construction or is one of the more notable works or the best surviving work in the local region of a pioneer architect, designer or master builder.

Effects of Designation include:

1) Limited protection: Environmental review may be required under CEQA if property is threatened by a project. Contact your local planning agency for more information.
2) Local assessor may enter into contract with property owner for property tax reduction (Mills Act).
3) Local building inspector must grant code alternative provided under State Historic Building Code.

4) Registration is recorded on property deed.
5) A small enamel directional sign (no text) available through local Caltrans district office. Owner may place his or her own marker at the site.

ADDITIONAL RELEVANT GUIDANCE

POTENTIAL FOSSIL YIELD CLASSIFICATION SYSTEM

The Potential Fossil Yield Classification (PFYC) System was developed by the USDA Forest Service and further refined by the BLM. Occurrences of paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Therefore, geologic mapping can be used for assessing the potential for the occurrence of paleontological resources.

Using the PFYC system, geologic units are classified based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts, with a higher class number indicating a higher potential. This classification is applied to the geologic formation, member, or other distinguishable unit, preferably at the most detailed mapable level. It is not intended to be applied to specific paleontological localities or small areas within units. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher class; instead, the relative abundance of significant localities is intended to be the major determinant for the class assignment.

The PFYC system is meant to provide baseline guidance for predicting, assessing, and mitigating paleontological resources in a given region. The classification should be considered at an intermediate point in the analysis, and should be used to assist in determining the need for further mitigation assessment or actions (Appendix B).

DEFINITION OF SIGNIFICANCE FOR PALEONTOLOGICAL RESOURCES

Only qualified, trained paleontologists with specific expertise in the type of fossils being evaluated can determine the scientific significance of paleontological resources. Fossils are considered to be significant if one or more of the following criteria apply:

1. The fossils provide information on the evolutionary relationships and developmental trends among organisms, living or extinct;

2. The fossils provide data useful in determining the age(s) of the rock unit or sedimentary stratum, including data important in determining the depositional history of the region and the timing of geologic events therein;

3. The fossils provide data regarding the development of biological communities or

interaction between paleobotanical and paleozoological biotas;

4. The fossils demonstrate unusual or spectacular circumstances in the history of life;

5. The fossils are in short supply and/or in danger of being depleted or destroyed by the elements, vandalism, or commercial exploitation, and are not found in other geographic locations.

As so defined, significant paleontological resources are determined to be fossils or assemblages of fossils that are unique, unusual, rare, uncommon, or diagnostically important. Significant fossils can include remains of large to very small aquatic and terrestrial vertebrates or remains of plants and animals previously not represented in certain portions of the stratigraphy. Assemblages of fossils that might aid stratigraphic correlation, particularly those offering data for the interpretation of tectonic events, geomorphologic evolution, and paleoclimatology are also critically important (Scott and Springer 2003).

BACKGROUND

ENVIRONMENTAL SETTING

The Town of Yucca Valley area is located near the Morongo Basin area along the southwestern margin of the Mojave Desert in the southwestern portion San Bernardino County, California. Elevations within the Town range from approximately 4,400 feet (ft) above mean sea level (amsl) in the northern portion of the study area (see Figure 2b) and gradually declines to approximately 3,260-3,200 ft amsl at the community of Yucca Valley and the Yucca Valley Airport, respectively (see Figure 2d). State Route 62 (Twentynines Plams Highway) is generally at an elevation of 3,300 ft amsl and transects the Project study area from northeast to southwest. (see Figure 2d and 2e). The climate of the Project region is generally hot and dry, with most precipitation occurring during the winter, although summer thunderstorms and resultant flash flooding do occur. Winter snowfall is common at the higher elevations (Schoenherr 1992:411). Although the Project study region is transected by numerous washes and arroyos generally draining from the northeast to the southwest, the primary drainage system is Pipes Wash that enters the Project study area from the north (see Figure 2b), and is a 0.5 mile-wide braided drainage with channel-and-bar topography incised to a depth of approximately 100 ft into the surrounding valley floor. Pipes Wash becomes known as Chaparrosa Wash near Pioneertown along the northwestern boundary of the Town's study area (see Figure 2c)

Native vegetation in the general Project study region is dominated by species of the Creosote Bush Scrub and Joshua Tree Woodland plant communities (Schoenherr 1992:435–442, 454–456). Typical member species of the Creosote Bush Scrub plant community include creosote

bush (*Larrea tridentata*), burr weed (*Ambrosia dumosa*), catclaw (*Acacia greggii*), cheesebush (*Hymenoclea salsola*), and various cacti (*Echinocactus spp., Opuntia spp.*). The suite of species commonly found in the Joshua Tree Woodland community includes Joshua tree (*Yucca brevifolia*), Mohave yucca (*Y. schidigera*), and *Salazaria*, *Lycium*, *Salvia*, and *Eriogonum* species (Munz 1974:4).

Fauna in the Project area include antelope ground squirrel (*Ammospermophilus leucurus*), kangaroo rat (*Dipodomys spp.*), desert wood rat (*Neotoma lepida*), jackrabbit (*Lepus californicus*), Audubon cottontail (*Sylvilagus audubonii*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), and desert tortoise (*Xerobates agassizii*). Cactus wrens (*Campylorbynchus brunneicapill*us)and Ladder-back Woodpeckers (*Picoides scalaris*) are commonly found in the Joshua Tree Woodland, and there are at least 12 common bat sprecies. Small burrowing mammals are also common, as are a numours species of reptiles, lizards, and venomous and non-poisonous snakes. A wide variety of raptors, ravens, and other birds also occur within the Yucaa Valley stduy region. It should be noted that the nationally protected Desert Tortoise (*Gopherus agassizii*) is common within the Project study region.

Probably the most important environmental change in the southwestern Mojave Desert and the northwestern Colorado Desert in the past 2,000 years was the formation of Lake Cahuilla, also known geologically as Lake Le Conte and historically as Blake's Lake. Lake Cahuilla formed numerous times throughout the Pleistocene and Holocene in response to the western diversion of the Colorado River into the Salton Trough. It should be noted that while the shoreline of ancient Lake Cahuilla falls outside the Project study area to the south, periodic high stands of the Lake were undoubtedly relevant to the prehistoric cultural use and occupation of the overall Project study region.

GEOLOGIC SETTING

The project area is mapped as Quaternary alluvium, Quaternary older alluvium, Quaternary Older fan, Quaternary older gravel, Quaternary older fanglomerate, basalt, Old Woman Sandstone, quartz monzonite, monzonite porphyry, and gneissic rocks (Figure 3; Dibblee 2008). The developed townsite is mostly on Quaternary alluvium and Quaternary older alluvium.

MESOZOIC AND PRE-MESOZOIC FORMATIONS

Pre-Mesozoic gneissic rocks are exposed in the northeastern and southern portions of the project area (refer to Figure 3). These rocks are likely metamorphosed Precambrian (>542 million years old) sediments, ranging from quartz diorite to quartz monzonite in composition. Minor outcrops of Mesozoic (between 65 and 251 million years ago) monzonite porphyry (mp), located at the extreme northeast corner of the project area, are characterized by large phenocrysts of potassic

feldspar, and intrude the older gneissic rocks. Intruding both the older gneissic rocks and monzonite porphyry is a homogeneous Mesozoic quartz monzonite (qm) (Dibblee 2008). Outcrops of the quartz monzonite are found throughout much of the north-central and northwestern portions of the project area.

OLD WOMAN SANDSTONE

Two small outcrops of the late Tertiary Old Woman Sandstone (To) are mapped within the northern portion of the project area (refer to Figure 3; Dibblee 2008). The Old Woman sandstone is characterized by interbedded units of arkosic sandstone, conglomerate, silt, and clay, with scattered clasts of limestone and basalt.

BASALT

Flows of late Tertiary to early Quaternary (from approximately 3 to 1.5 million years ago) basalt (QTb) overlie, and rest conformably on, the Old Woman Sandstone, in the extreme north of the project area (refer to Figure 3; Dibblee 2008).

OLDER FANGLOMERATE

Deposits of late Quaternary older fanglomerate (Qof) are located along the western edge of the project area and compose most of Burnt Mountain near the center of the project area. These outcrops represent erosional remnants of light gray, massive deposits of unsorted boulders and cobbles in a weekly cemented arkose matrix (Dibblee 2008).

QUATERNARY OLDER GRAVEL

These deposits represent probable early Pleistocene valley fill sediments consisting mostly of quartz monzonite detritus of poorly bedded cobbles, pebbles and coarse sand (Qog), and are located along the northern portion of the project area (refer to Figure 3; Dibblee 2008).

QUATERNARY OLDER ALLUVIUM

The older alluvial deposits (Qoa) are characterized by poorly bedded to nonbedded cobbles, gravels and sand. There are some surface exposures but these sediments often underlie the other types of Quaternary sediments.

QUATERNARY ALLUVIUM

Deposits of Quaternary alluvium (Qa) represent very young Pleistocene to Recent surficial deposits of loose sand and gravel in washes, with fine sand, silt and clay in valley areas (Dibblee 2008).

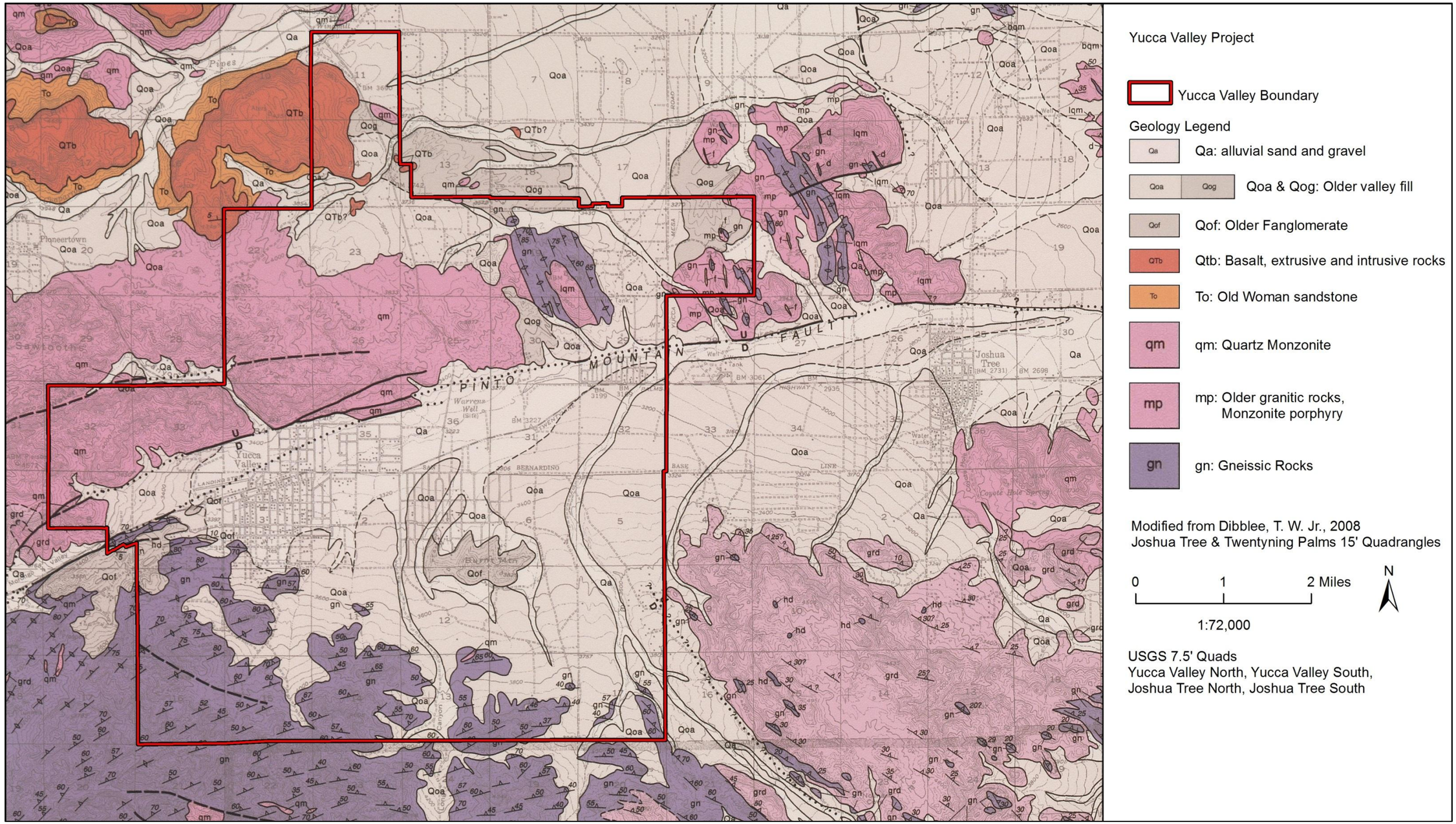


Figure 3. Yucca Valley Geology Map

PREHISTORIC CULTURAL SETTING

Excluding the controversial "Early Man" pre-projectile point materials from the Calico Ghost Town area, Native American occupation of the Yucca Valley and neighboring regions can be divided into five cultural periods: Paleoindian/San Dieguito (ca. 12,000–7000 years before present1 (B.P.); Pinto (ca. 7000–4000 B.P.); Gypsum Period (ca. 4000–1500 B.P.); Saratoga Springs Period (ca. 1500–750 B.P.); and the Late Prehistoric Period (ca. 750–200 B.P.) which ended in the ethnographic period (see Warren 1984). Salient data regarding these temporal periods are briefly reviewed below.

PALEOINDIAN/SAN DIEGUITO PERIOD (CA. 12,000 B.P. TO 7000 B.P.)

The Paleoindian Period is marked by deglacial climatic changes that began by about 13,000 B.P. In the desert interior, the change from glacial to postglacial ecosystems began by at least 11,700 B.P. (Spaulding 1995), but took millennia to complete. Paleoclimatic and paleoecological data suggest that until about 7500 B.P. the prevailing westerly air flow pattern weakened, while the desert interior received moist monsoonal flow from the southeast. This resulted in the interior deserts having considerably higher levels of effective moisture than present. Thus, the desert interior was apparently less arid than cismontane southern California during this period, and possessed an abundance of water sources and relatively productive ecosystems.
Both coastal and desert region designations for the early Holocene refer to a long period of human adaptation to environmental changes brought about by the transition from the late Pleistocene to the early Holocene geologic periods. As climatic conditions became warmer and more arid, Pleistocene megafauna perished abruptly between 13,000 and 10,000 B.P. Human populations responded to these changing environmental conditions by focusing their subsistence efforts on the procurement of a wider variety of faunal and floral resources. These early occupants of southern California are believed to have been nomadic large-game hunters whose tool assemblage included percussion-flaked scrapers and knives; large, well-made fluted, leaf-shaped, or stemmed projectile points (e.g., Lake Mojave, Silver Lake); crescentics; heavy core/cobble tools; hammerstones; bifacial cores; and choppers and scraper planes.

Many Lake Mojave deposits investigated in the southwestern Great Basin have also yielded some amount of milling equipment, usually large slabs with ephemeral wear and handstones, implying regular, albeit limited, use of vegetal resources (Basgall and Hall 1993:19). Although intact stratified sites dating to this period are very scarce, the limited data do suggest that the prehistoric populations of this period moved about the region in small, highly mobile groups, with a wetland-focused subsistence strategy based on hunting and foraging. Sites dating from

1 Before present is defined as 1950 – the year in which nuclear weapons testing artificially altered carbon isotopes present

this interval have generally been found around early Holocene marshes, lakes and streams which dominated much of the landscape.

PINTO PERIOD (CA. 7000 B.P. TO 4000 B.P.)

The Pinto Period is marked by the gradual transition from pluvial to arid conditions during the terminal Pleistocene-Early Holocene. Sites attributed to the Pinto Period are few in number in southern California, with those in the Pinto Basin, Salt Springs, and Death Valley, as well as the Stahl site being best known. These sites are associated with ephemeral lakes and now-dry streams and springs, suggesting wetter conditions than now prevail in the deserts.

The distinctive characteristics of the Pinto Basin Complex as defined are projectile points of the Pinto series, generally coarse in manufacture as well as form, in association with heavy-keeled scrapers, flat milling stones, and manos. Throughout most of the California desert region, sites containing elements of the Pinto Basin Complex are small and are usually limited to surface deposits, suggestive of temporary and perhaps seasonal occupation by small groups of people.

Warren postulates that the "Pinto Basin Complex evolved from the earlier hunting complexes of the Lake Mojave Period and that it represents a small population dependent on hunting and gathering, but lacking a well-developed milling technology" (Moratto 1984:414). As the Pleistocene lakes and rivers dried up, early hunting populations of the Lake Mojave Period likely withdrew to the margins of the deserts or concentrated around the few oases in the desert. According to Warren (Moratto 1984:414), with the return of moister conditions at approximately 4500 B.C., the Pinto Basin peoples appear to have reoccupied much of the lower Mojave Desert where shallow lakes had formed and along stream courses and major springs. With the return of more arid conditions at about 3500 B.C., these people again may have withdrawn to the desert margins and oases, leaving much of the desert region uninhabited until the end of the Pinto Period (ca. 4000 B.P.).

GYPSUM PERIOD (CA. 4000 B.P. TO 1500 B.P.)

The Gypsum Period is marked by Humboldt Concave Base, Gypsum Cave, and Elko series projectile points and is dated between ca. 4000 B.P. to 1500 B.P. A few Gypsum Period sites from the deserts of California, Nevada, and Arizona have been excavated, including Gypsum Cave, Newberry Cave, Willow Beach, Rose Spring, Indian Hill Rockshelter and Ray, Baird and Chapman caves. In addition to diagnostic projectile points, Gypsum Period sites include leaf-shaped points (e.g., Elko and Humbolt series), rectangular-based knives, flake scrapers, T-shaped drills and occasionally, large scraper planes, choppers and hammerstones (Moratto 1984:416). Manos and milling stones are common; the mortar and pestle also were introduced during this period. Other artifacts include shaft smoothers, incised slate and sandstone tablets and pendants, bone awls, *Olivella* shell beads and *Haliotis* beads and ornaments. A wide range of perishable

items dating to this period was recovered from Newberry Cave, including atlatl hooks, dartshafts and foreshafts, sandals and S-twist cordage, tortoise-shell bowls and split-twig animal figurines. The presence of both *Haliotis* and *Olivella* shell beads and ornaments and split-twig animal figurines indicates that the California desert occupants were in contact with populations from the southern California coast and southern Great Basin (e.g., Arizona, Utah, and Nevada).

The beginning of the Gypsum period coincides with the beginning of the Little Pluvial (ca. 2000 B.C.), which apparently allowed for more intensive occupation of the California deserts. During the succeeding arid periods, it appears that these populations gradually adapted in a variety of technological and socioeconomic ways to the more arid desert environment. Technologically, the artifact assemblage of this period is similar to that of the preceding Pinto Basin Period; new tools also were added either as innovations or as "borrowed" cultural items. Included are the mortar and pestle, used for processing hard seeds (e.g., mesquite pods) and the bow and arrow, as evidenced by the presence of Rose Spring projectile points late in this period. Increased contact with neighboring groups likely provided the desert occupants important storable foodstuffs during less productive seasons or years, in exchange for valuable lithic materials such as obsidian and cryptocrystalline silicates for flaked stone tool manufacture.

SARATOGA SPRINGS PERIOD (CA. 1500 B.P. TO 750 B.P.)

The Saratoga Springs Period saw essentially a continuation of the Gypsum Period subsistence adaptation throughout much of the California desert. Unlike the preceding period, however, the Saratoga Springs Period is marked by strong regional cultural developments, especially in the southern California desert regions, which were heavily influenced by the Hakataya culture of the lower Colorado River area.

Generally, the Saratoga Springs Period is marked by the dominance of Rose Spring and Eastgate arrow points replacing the earlier Elko and Humboldt series dart points. In the southern desert region, the impetus for change appears to have derived from the lower Colorado River as evidenced by the introduction of Buff and Brown Ware pottery and Cottonwood and Desert Side-notched arrow points. The initial date for the first Hakataya influence on the southern California desert region remains unknown; however, it does appear that by A.D. 800 to 900 the Mojave Sink to the north of the Yucca Valley study region was heavily influenced, if not occupied by, lower Colorado River peoples. In this area, large village sites developed and contain deep midden deposits and cemeteries which often contain large quantities of shell beads and steatite items that originated from the southern California coastal regions.

LATE PREHISTORIC PERIOD (CA. 750–200 B.P.)

The Late Prehistoric Period in the general study region is marked by the introduction of new artifact types and technological innovations to the previous transitional Late Archaic Saratoga Springs Period and has been defined as the Payatan Pattern (Cleland 1998; CSRI 1986; Schaefer 1994, 1995). New projectile point types, including Desert Side-notched and Cottonwood Triangular points, signify the introduction of the bow and arrow hunting technology, marking a pre-ceramic Payatan phase of the expansion of the earlier assemblages perhaps as early as 1500 B.P. Techniques of flood plain horticultural were also introduced to the inhabitants along the Colorado River at the same time as ceramics. This period is also characterized by the introduction of ceramics, including brown ware from the Peninsular Range, buff wares from the Colorado River region and Lake Cahuilla shoreline (Schaefer 1995; Waters 1982). As well, burial practices changed from extended inhumations to cremated remains, sometimes buried in ceramic vessels. Typical of the Hohokam culture from southern Arizona, these traits were introduced to the Colorado River inhabitants and gradually spread west to the Peninsular Range and Coastal Plains of southern California. Only agriculture remains a problematic trait in regard to its spread beyond the Colorado River and Imperial Valley in late prehistoric times (CSRI 1986:35).

Three phases of Payatan are generally recognized, in addition to the pre-ceramic Payatan Phase (Schaefer 1995). These phases are defined by changes in pottery frequencies and by the cultural and demographic effects of the infilling and subsequent desiccation of ancient Lake Cahuilla in the Saltoin Sea Basin, south of the Project study area. The Payatan I phase appears to have been confined to the Colorado River region and began approximately 1,200 years ago with the introduction of pottery; the artifact assemblage of this phase bears the closest similarity to that of the Hohokam (Schaefer 1995; Waters 1982). The Payatan II phase, beginning about 950 years ago, is contemporary with Lacustrine Interval 2 of Lake Cahuilla. Attracted to highly productive microenvironments along the Lake Cahuilla shoreline, people on both its eastern and western shores were producing pottery by the time the lake was fully formed. New ceramic types indicate that sedimentary, nonmarine clays from the Peninsular Range were being utilized. The final Payatan III phase began approximately 500 years ago, coinciding with Lake Cahuilla Lacustrine Interval 4. This phase is characterized by new pottery types that reflect changes in settlement patterns, as well as with intensified communication between the Colorado River and Peninsular Range tribes as people living around the former Lake Cahuilla shoreline dispersed to their base territories, and the Imperial and Coachella valleys dried up, facilitating long distance travel (Schaefer 1995). Wilke (1976) has postulated that by approximately 250 years ago, with the final desiccation of Lake Cahuilla prior to the twentieth century, the native habitants occupying the lake shores began moving westward into areas such as Anza-Borrego, Coyote Canyon, the Upper Coachella Valley, the Little San Bernardino Mountains, the San Jacinto Valley, and Perris Plain.

The Payatan III phase continued into the ethnographic period, ending in the late nineteenth century when Euro-American incursions disrupted the traditional culture. Although the Payatan III peoples include the Takic-speaking Cahuilla who occupied the western Colorado Desert region, as well as the Quechan, Mojave, and Cocopa of the Colorado River region, the following discussion of the ethnographic setting will focus on the Serrano.

ETHNOGRAPHIC SETTING

At the time of historic contact, the Project study region was within the ethnographic territory of the Serrano (Figure 4). The name Serrano comes from a Spanish word meaning "mountaineer" or "highlander." The Serrano were nomadic and migratory, and according to lore passed down, they migrated to the cool, pine forests of the San Bernardino Mountains to the west during the summer and returned to the desert regions during the winter. The Serrano language is considered part of the Takic subfamily of the larger Uto-Aztecan language family that includes a number of language groups. Other Takic speakers include the Gabrielino, Luiseño, and Cahuilla, whose territories share borders with the Serrano. The Serrano culture area extends from the San Bernardino Mountains south to Yucaipa Valley, east to the Mojave River watershed, and north to the Twentynine Palms region (Bean and Smith 1978:570). Most Serrano village sites were located in the foothills of the upper Sonoran zone with a few outliers located near permanent water sources on the desert floor, or in the forest transition zone.

Traditional Serrano territory includes areas occupied by three clan groups: the Kitanemuk, Allikik and the Vanyume. The Kitanemuk were located on the upper Tejon and Paso Creeks near the Tehachapis and extended into the western portion of the Mojave Desert. The Allikik were located on the upper Santa Clara River, and the Vanyume were located along the Mojave River. These politically independent clan groups also belonged to one of two basic subdivisions or exogamous moieties, the Coyotes and Wildcats. The clans were divided into land holding lineages. Each of these lineages had a chief determined by heredity called the *kika*. The chief's assistant was the *paha*, who assisted him in ceremonial, political and economic affairs (Bean and Smith 1978:572).

The Serrano traded with the Mojave to the east and the Gabrielino to the west. They also traded with their close neighbors, the Cahuilla in the San Jacinto and Santa Rosa Mountains, the Banning Pass area, and the greater Coachella Valley. In addition, the Serrano traded with the Chemehuevi who occupied the lower Colorado River region, some of whom migrated westward towards the Project study area.

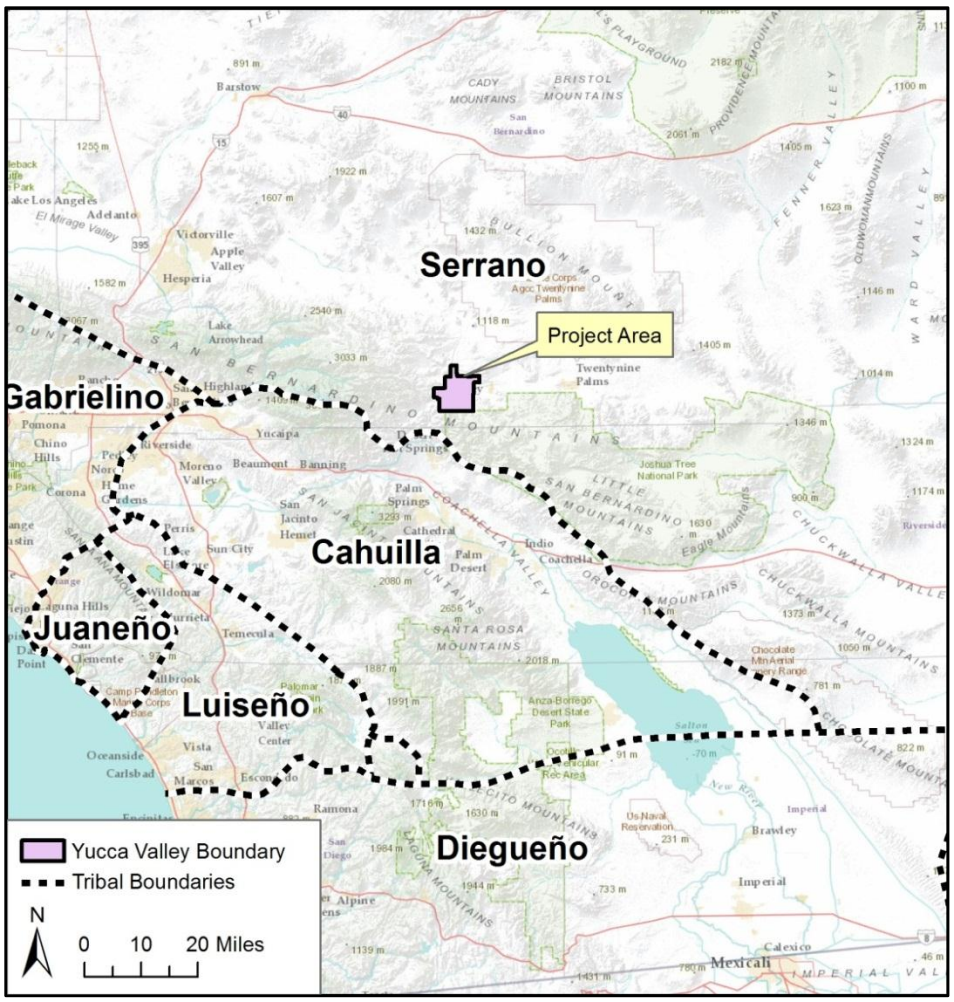


Figure 4. Southern California tribal territories

Prior to European contact, the Serrano were primarily hunters and gatherers. Women were responsible for most of the gathering and acorns, piñon nuts, and mesquite beans were collected as staple foods. Spring cactus fruits and berries were consumed fresh for both food and water. Flower blossoms were roasted and eaten. Yucca blossoms and stalks were blanched before being eaten. Roots were used for food and medicine, and leaves and stems were used for making tea. Digging sticks were frequently used to dig for plants and roots for subsistence and medicinal purposes (Johnston 1965:8). One main seed resource was chia, and stands of chia were periodically burned in order to increase yield. Other major plant foods included mesquite beans and the nuts from piñon pine and acorn. Acorns were leached by placing baskets of pounded and shelled acorn meal into a sandy hole with just enough water to allow the dissolved tannic acid to seep out. Other plant seeds were parched and made into a mush by boiling or cooking and dropping a heated stone into a water-tight basket filled with seeds and water. Some seeds were dried and stored in baskets. Baskets were made from willow and mesquite branches and woven with bone awls.

Important game animals included coyotes, bobcats, gray foxes, ground squirrels, desert chipmunks, field mice, packrats, kangaroo rats, bighorn sheep, antelope, bear, deer, insects, and a variety of reptiles, including the Desert Tortoise. Meat was either boiled in cooking ollas or broiled over hot coals; it was also roasted and dried in the sun. Hunting was performed with bows and arrows, using quartz, crystalline quartz, quartzite, a variety of cryptocrystalline silicates, and obsidian for flaked stone projectile points. Arrow shafts were constructed from cane shoots and arrow weed, while bows were constructed from manzanita and desert willow. Horns obtained from big horn sheep and deer were made into flaking tools to create chipped tools such as projectile points, knives, and a variety of scrapers. Hunters also utilized a long stick with a crook at the end to pull small animals from burrows, and smaller game like rabbits, rodents, and various birds were hunted with throwing sticks, nets, and snares.

Men typically wore no clothing, while women wore an apron or sack-style dress furnished from animal skins. Moccasins and sandals were also worn, made from juniper bark and yucca leaves. Hides used for clothing and footwear were scraped with a stone tool and cured and softened. Dried animal sinew was used as thread and bone awls were used to lace skins as well as to weave baskets.

Because of their migratory nature, the Serrano and neighboring tribes “cached” many of their possessions and provisions instead of transporting theses often heavy items long distances. These “caches” were guarded by “spirit sticks” that were left upright adjacent to the cache.

When the Spanish arrived in 1769, Serrano population levels were fairly high. By 1790, the westernmost Serrano groups began to enter Mission San Gabriel. After an attempted revolt in 1810, most of the San Bernardino Mountains and the western Mojave Desert Native groups were brought into the Mission. The Serrano in the easternmost desert, beyond the San Bernardino Mountains and Little San Bernardino Mountains, were beyond the reach of the Mission, and absorbed Native peoples from a number cultural groups who fled the missions of greater southern California (Bean and Vane 2002:18).

Prehistoric and ethnohistoric archaeological sites likely to be found within the Town of Yucca Valley’s planning area include: villages represented by residential bases with house features (stone and/or adobe), storage features, human burials and cremations, rock art (pictographs and/or petroglyphs); temporary encampments represented by flaked and ground stone scatters with fire hearths and possibly storage features; resource procurement and processing sites represented by bedrock milling stations, tool stone quarries, flaked and ground stone artifact scatters, and/or hunting blinds; trails demarked by cairns and possibly rock art; isolated cultural features such as rock art, intaglios, and/or shrines; isolated flaked or ground stone artifacts; and traditional cultural landscapes/sacred places that may include important gathering or collecting places, springs, mountain tops or rock outcroppings, burial grounds, etc.

HISTORIC SETTING

SPANISH & MEXICAN PERIODS (CA. 1769-1848)

Although the Serrano continued to reside in the greater Yucca Valley study region as Spanish and Mexican prospectors started to make their way into the Valley, they suffered from devastating smallpox epidemics in 1825 and again in 1862 (Clark and Couzens 1966:6). Early colonizers largely ignored the arid, inland regions of southern California, including that of the Yucca Valley area. It is reported that study area was first explored by Spaniards making forays northward from Mexico along the southern California coast and Colorado River area. Although never substantiated, oral tradition suggests that Captain Juan Iturbe sailed a large vessel into the Salton Sea from the Gulf of California and explored westerly as far as Joshua Tree National Park area. As the waters of Lake Cahuilla slowly receded, it has been reported that Iturbe's ship became landlocked in the area of the Salton Sea (Town of Yucca Valley 1995:IV-10). Evidence of other Spanish or Mexican explorers in the Project study area is rare or non-existent.

Under the Treaty of Cordova in 1821, Mexico gained independence from Spain and control of California. By 1834, the Spanish mission lands were being redistributed as private Mexican land grants called "ranchos." There is no historical evidence of any Spanish or Mexican settlements in the Yucca Valley area, although it was essentially under the influence of Mexico until the Treaty of Guadalupe Hidalgo in 1848, when southern California fell under the control of the United States Government. It should be noted that Morongo Basin was noted briefly by Brevet Captain John C. Fremont, who passed north of the Project area in 1844 and remarked that although the area was a desert, the presence of water presented the possibility of an oasis (Clark and Couzens 1966:3).

EARLY AMERICAN PERIOD (1850-1900)

With the region under American control and the discovery of gold in California 1848, the stage was set for admittance of California into the union in 1850, which led to the dramatic influx of non-Native people from throughout the nation, as well as from other countries. Between 1855 and 1856, Colonel Henry Washington conducted the first U.S. Government surveys in the Morongo Basin. He noted signs of Native American occupation but no individuals (Evans 1965:6). In 1867, General William J. Palmer conducted a survey that led to the recommendation of the Morongo Basin route between present day Needles and the coastal and inland valley missions west of the San Gorgonio Pass.

During the 1870s leading up to the turn of the century, the general Project study region area was used largely by cattlemen and gold mining prospectors, especially after the discovery of gold east of what is now Twentynine Palms. Cattle were moved between Arizona and California, taking advantage of the watering holes in the great Morongo Basin year-round and the native

grasses during the winter months. The first settlers in the Project study area were the de Crevecoeur brothers and their families in approximately 1873, running both cattle and sheep.

Both cattle rustlers and legitimate cattlemen continued to use the Project study area throughout the 1870s, and by the early 1880s, both large and small gold mines were in operation in the study area with several continuing in operation until the mid-1910s (Town of Yucca Valley 1995:IV-10). In 1881, Mark "Chuck" Warren expanded his cattle operations west of his Big Morongo Canyon Ranch and dug a well in what was to become Yucca Valley. The well, windmill, and small frame house, located adjacent to the present day Yucca Valley Airport (Town of Yucca Valley 1995:IV-11). Miners, a stage line, horse-drawn freighters, and other travelers made heavy use of Warren's Ranch in Morongo Valley and Warren's Well in Yucca Valley for many years largely due to Mr. Warren's hospitality and his access to a reliable water supply. Warren's Well was severely damaged after a series of earthquakes in 1893 but repaired after 30 days (Clark and Couzens 1966:1-2). According to the BLM GLO records, no sizeable land patents were filed in the area during this era (BLM GLO n.d.; Town of Yucca Valley IV-10).

EARLY 20TH CENTURY (1900-1949)

After the turn of the century, homesteading in the Morongo Basin began. A government land locator named Percy and Joseph and Mary Heard were among the first individuals who filed for land patents between 1910 and 1916, mostly in the western portion of the Project study area near Big Skies County Club (Town of Yucca Valley 1995:IV-11). Many individuals and families did not stay in the Morongo Basin long, due to harsh living conditions such as lack of water and the general difficulty in raising crops in a desert environment. Warren's Well, The Tunnel (a spring south of the Town), and the Oasis of Mara (in the Twentynine Palms area) provided the only water for settlers until they could dig their own wells (Long n.d.).

The first school in Yucca Valley was established in 1915 with 15 students, following the establishment of an earlier school in Morongo Valley. Most of the prospectors and mining activity had left Morongo Basin by the onset of World War I. Following the war, veterans suffering from lung ailments such as tuberculosis and desiring the dry desert air, settled in the area. Many of these veterans had been gassed during the war and some of them recovered, leading to non-veterans moving into the area to treat lung conditions such as tuberculosis. Despite the population increase, a telephone was not available in Yucca Valley until 1935 (Evans 1966:14; Town of Yucca Valley IV-10).

In 1936 the government withdrew over 870 square miles of public lands and formed the Joshua Tree National Monument (Evans 1965:22). Two years later in 1938, The "Baby Homestead Act" was passed, allowing homestead patents to be filed for five acres instead of the standard 160. The highway from Morongo Valley through Yucca Valley was oiled in 1937 but washed out in 1938 during a flash flood (Evans 1965:26). It was re-oiled, but not resurfaced and paved

until 1951. Electricity did not appear in the Project study area until 1946, three years after streets were laid out and the Yucca Water Company, Ltd. was established (Evans 1966:14). Water availability had been less of an issue in the Morongo Valley and Twentynine Palms area, leading to more rapid growth in these areas, most notably the replacement of the Navy Glider Base with the Twenynine Palms Marine Base.

The last cattle drive through Yucca Valley was in 1947, the same year the Yucca Valley Airstrip was constructed to accommodate moviemakers, who were accessing nearby Pioneertown, located west of the Town's study area (see Figure 2c) to film westerns in the late 1940s, 1950s and 1960s (Town of Yucca Valley IV-1).

According to the BLM Government Land Office (GLO) records (n.d.), the State of California and the Southern California Railroad Company acquired the vast majority of land patents within the Project study region between the years 1903 and 1915 (Appendix D). Twenty-six individuals filed for patents of 160 acres or more between 1914 and 1934, and nine individuals filed for patents of five acres or more between 1939 and 1949 following the Baby Homestead Act which allowed for a significantly smaller land patent.

Fred and Barbara Pearce had a land patent in the Project study area dating to 1916 where they built a rest home in the Pipes Canyon area in 1924 (Figure 5; Evans 1965:18). The couple moved to Yucca Valley in 1912 from Corona, making this arduous journey with four children and two milk cows in an eight day period (Pearce 1988:38).

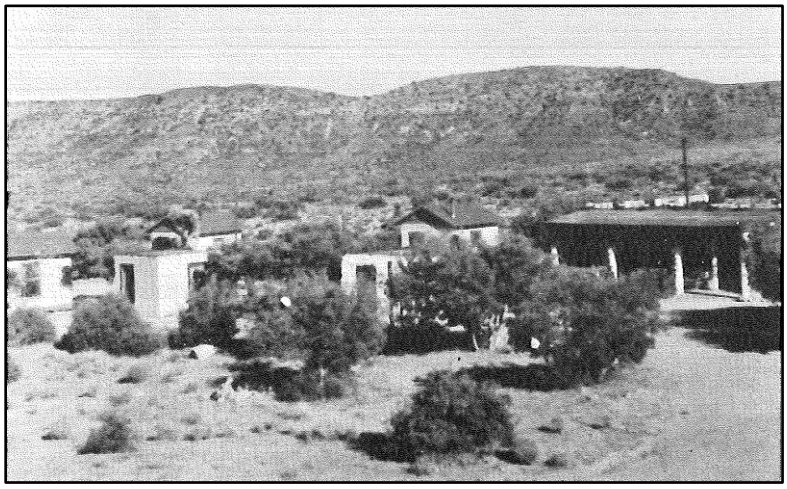


Figure 5. Pearce Rest Home in the 1920s (Evans 1965)

Walter A. Harrell, who filed a patent in 1923, installed the first gas pump in the Town of Yucca Valley (Town of Yucca Valley IV-11; Figure 6). The gas station was also the first between the

communities of Whitewater and Twentynine Palms. Harrell named his station the Lone Star Ranch; Lone Star was what Harrell wanted Yucca Valley named, and the town actually appeared as Lone Star on AAA maps of the Mojave and Colorado deserts between 1937 and 1949, despite the name officially being changed to Yucca Valley in 1945 (Wilson and Grubb 1985:50; Evans 1965:23; Figure 7). Later in the 1940s, John Stephenson built and owned the first Texaco station in the area (Wilson and Grubb 1985:51). Stephenson sold the station to Sam Anderson and Doc Toothacker in 1951 and filed a land patent in the study area in 1960 (Evans 1965:8). Kenneth Witting filed a land patent in 1958. Witting sold real estate and published a newspaper from a location at Twentynine Palms Highway and Victorville Road (Wilson and Grubb 1985:57).

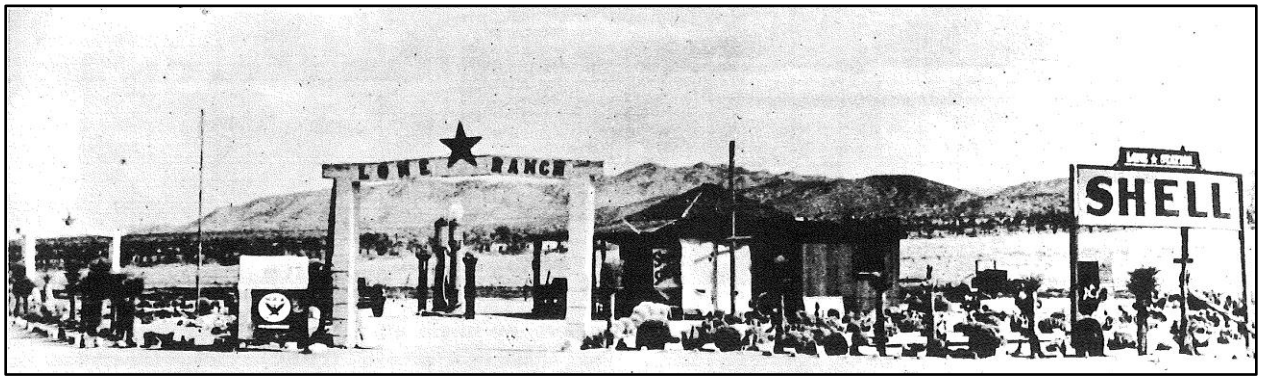


Figure 6. The Lone Star Ranch & Gas Station in the 1920s (Evans 1965)

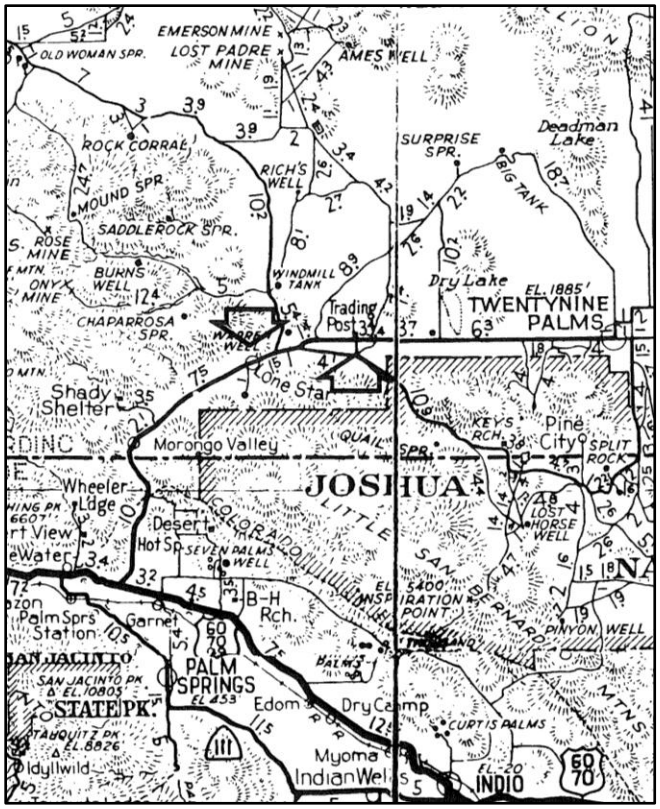


Figure 7. Circa 1947 AAA map of Yucca Valley area (Wilson and Grubb 1988)

LATE 20TH CENTURY ERA (POST-1950)

By 1966, Yucca Valley had a population of 8,197 and encompassed approximately 33 square miles. Only two years earlier, natural gas lines were installed. Primary industries in the Town switched from mining, cattle, and crops to real estate and construction, reflecting the population growth (Clark and Couzens 1966:15). Multiple businesses, shopping facilities and professional services developed within the Project study area during the 1950s and 1960s. The 1950s saw the creation of the Yucca Valley Chamber of Commerce, Morongo Unified School District, the Yucca Valley Sheriff's Reserve Unit, and the Yucca Valley Park District. During the 1960s, due to the increased population growth, chain stores such as Safeway and Bank of America were built in Yucca Valley, as were the Hi-Desert Memorial Hospital facility and the Hi-Desert Nature Center. Also during this time, much of the frontage properties were developed along State Route 62 (Twentynine Plams Highway). In 1964, an attempt to incorporate Yucca Valley into a city was vetoed by voters (Clark and Couzens 1966:22); however, by 1991, Yucca Valley was incorporated as a town and had a population of 20,700 as of the 2010 census.

The significant mid-century population growth of the Town of Yucca Valley is reflected in the number of land patents filed after 1950 (Appendix D; Figure 8; BLM GLO n.d.). The State of California and 140 individuals filed patents for five acres or more between 1950 and 1959. However, the number of patents filed between 1960 and 1966 dropped almost by half to 79 individuals. The Yucca Valley Lions Club Company, the Yucca Valley Parks and Recreation, and the County of San Bernardino filled out the remainder of land patents filed during this era.

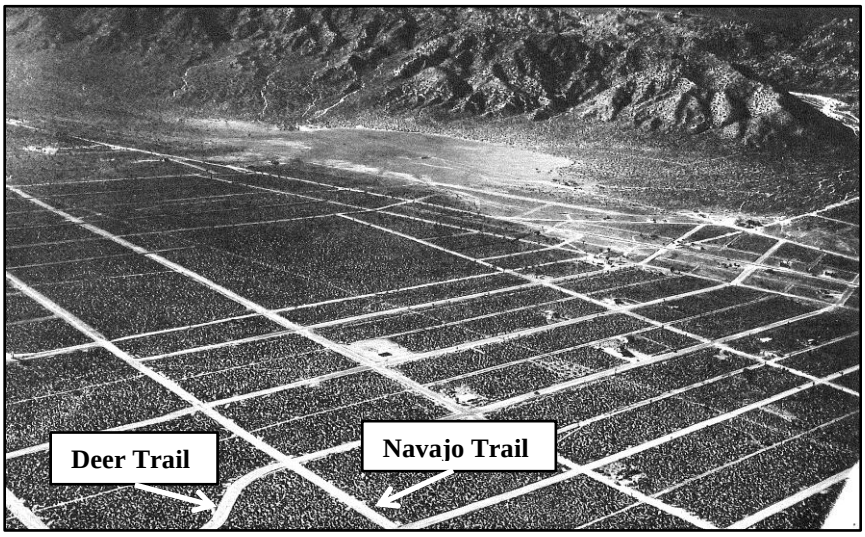


Figure 8a. 1947 aerial of Yucca Valley, view to northwest (Evans 1965)

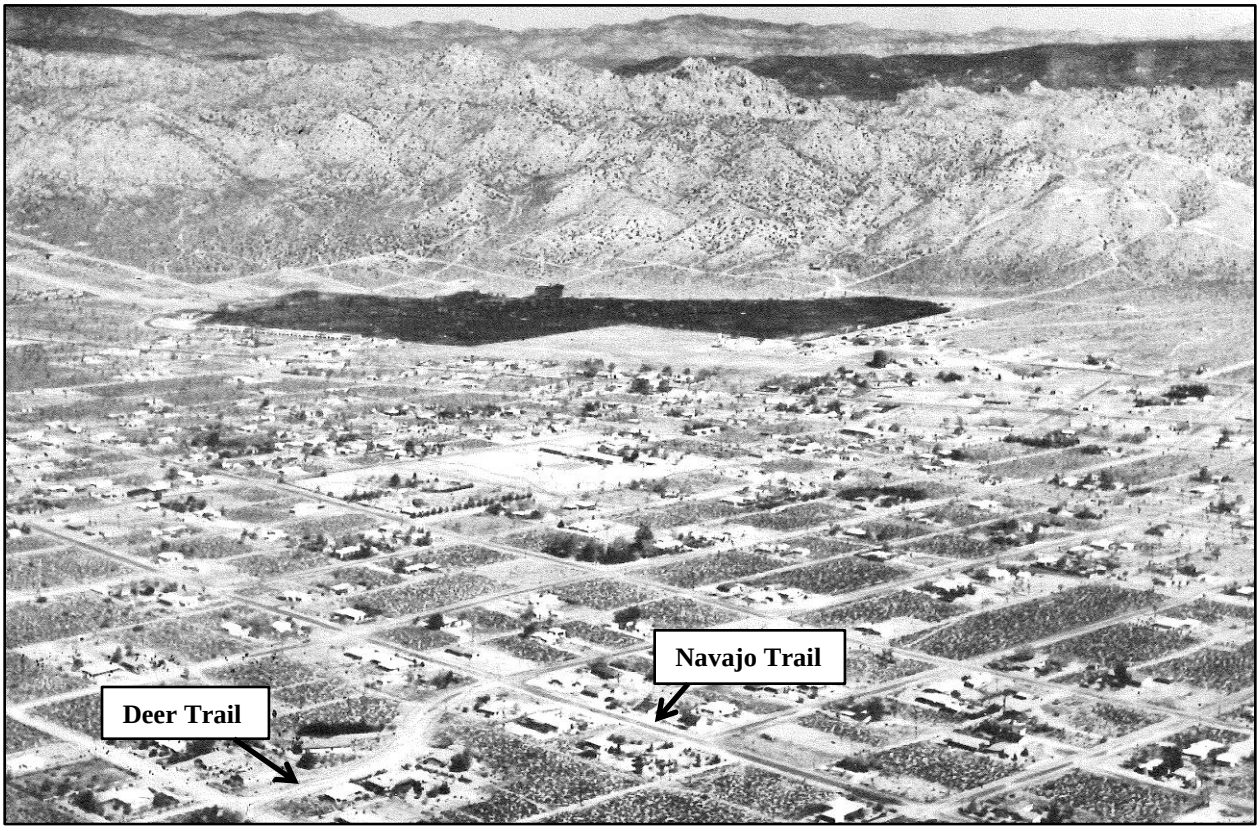


Figure 8b. 1965 aerial of Yucca Valley, view to northwest (Evans 1965)

RECORDS SEARCH AND LITERATURE REVIEW

PALEONTOLOGICAL RESOURCES

A paleontological records search for the project area was conducted in 2012 by the San Bernardino County Museum (Appendix G; Table 2). In addition, online paleontological databases and paleontological literature were searched by Cogstone staff.

Fossils of extinct horse and desert tortoise are known within the city limits (west-central portion) in Quaternary older alluvium (Table 2). Additional fossils are known regionally in the same sediments (near Twentynine Palms) and include extinct animals such as mammoth, ground sloths, camel, horse, llama, dwarf pronghorn and saber-toothed cat (Table 3).

Fossils are also known from the Old Woman Sandstone in the local region. These include extinct animals such as a zebra-like horse and Furlong's rabbit in addition to cotton rat, wood rat and brown bat (Table 4).

CULTURAL RESOURCES

CALIFORNIA HISTORIC RESOURCES INVENTORY SYSTEM

A search for archaeological and historical records was completed at the San Bernardino Information Center (SBIC) of the California Historic Resources Inventory System (CHRIS) on December 6, 2011 by Amy Glover. The records search covered the entire 25,470 acre Project study area.

The records search determined that there are nine prehistoric resources, three historical archaeological resources and five historic resources with the Town (Table 5). The prehistoric archaeological sites recorded previously include five lithic artifact scatters, a camp site, a quarry sites, a bedrock milling station site, and one isolated pottery sherd. The historical archaeological sites include two historic refuse scatters and a dove blind associated with a refuse scatter. The historic resources include a historical school house, Warren's Well, Warren's Ranch/Tanks, Desert Christ Park – a local folk art site, and State Route 62 (Twentynine Palms Highway).

The cultural resources records and literature search completed at the SBCM of the CHRIS indicate that 82 cultural resources studies have been completed previously within the Project study area, composing of approximately 2,860 acres or only 11 percent of the overall study area (Appendix E).

Table 3. Regional Fossils from Quaternary older alluvium

† indicates extinct species

Common name	Taxon	Location	Locality	Source
HERBIVORES				
mammoth	*Mammuthus* sp. †	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
ground sloth, Jefferson's	*Megalonyx* sp. †	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
ground sloth, Shasta	*Nothrotheriops* sp. †	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
camel	*Camelops* sp. †	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
camel	*Camelops* sp. †	Surprise Springs, Twentynine Palms	LACM 3350	Jefferson 2003
bison	*Bison* sp. †	Surprise Springs, Twentynine Palms	LACM 3350	Jefferson 2003
horse	*Equus* sp. †	within city limits of Yucca Valley	SBCM 1.95.1 and 1.95.8	Scott 2012; Jefferson 2003
horse	*Equus* sp. †	Surprise Springs, Twentynine Palms	LACM 3350	Jefferson 2003
horse	*Equus* sp. (large) †	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
horse	*Equus* sp. (small) †	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
llama	*Hemiauchenia* sp. †	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
llama	*Hemiauchenia* sp. †	Surprise Springs, Twentynine Palms	LACM 3350	Jefferson 2003
deer	*Odocoileus* sp.	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
sheep, bighorn	*Ovis* sp. cf. *O. canadensis*	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
pronghorn, dwarf	*Capromeryx* sp. †	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
CARNIVORES				
cat, sabre-toothed	*Smilodon* sp. cf. *S. fatalis* †	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
puma	*Felis concolor*	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
badger	*Taxidea taxus*	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
OTHER				
gopher, pocket	*Thomomys* sp.	Campbell Hill/ Twentynine Palms Gravel Pit	LACM 4281-4283; SBCM 1.86.4, 1.86.9	Scott 2012; Jefferson 2003
tortoise	*Gopherus* sp.	within city limits of Yucca Valley	SBCM 1.95.1 and 1.95.8	Scott 2012; Jefferson 2003

Table 4. Fossils from Old Woman Sandstone in region

Common name	Taxon	Location	Locality	Source
horse, zebra-like	*Equus simplicidens* †	Lucerne Valley	SBCM 01.94.10	Jefferson 2003, Reynolds 1992, Czaplewski 1993
rat, cotton	*Sigmodon medius* or *S. minor*			
rat, wood	*Neotoma* (*Paraneotoma*) sp.			
rabbit, Furlong's	*Hypolagus furlongi* †			
bat, brown	*Eptesicus* sp.			

Table 5. Previously Recorded Cultural Resources

Reference	Site Type	Date	Time Period	USGS Quad
P1033-1H	Historical school house	n.d.	Mid-20th century	Yucca Valley South
P-36-001605	Prehistoric camp site	1975	Prehistoric	Joshua Tree North
P-36-002379	Prehistoric lithic artifact scatter	1973	Prehistoric	Yucca Valley North
P-36-002380	Prehistoric lithic artifact scatter	1973	Prehistoric	Yucca Valley North
P-36-004851	Prehistoric quarry site	1981	Prehistoric	Yucca Valley North
P-36-004852	Prehistoric lithic artifact scatter	1981	Prehistoric	Yucca Valley North
P-36-004853	Prehistoric lithic artifact scatter	1981	Prehistoric	Yucca Valley North
P-36-004854	Prehistoric lithic artifact scatter	1981	Prehistoric	Yucca Valley North
P-36-009610	Historical ranch complex (Warren's Well)	1999	Late 19th Century	Yucca Valley North
P-36-009988	Historical can scatter	2000	Early 20th century	Yucca Valley North
P-36-009994	Historical ranch complex (Warren's Tanks)	1999	Turn of the 20th century	Yucca Valley South
P-36-010525	Historical road (CA State Route 62)	2000	Mid-20th century	Joshua Tree North, Yucca Valley North, Yucca Valley South
P-36-011658	Historical dove blind and associated trash	2004	Early to mid-20th century	Yucca Valley North
P-36-013387	Prehistoric milling slick	2007	Prehistoric	Yucca Valley North
P-36-013394	Historical folk art sculptures (Desert Christ Park)	2007	Mid-20th century	Yucca Valley North

Reference	Site Type	Date	Time Period	USGS Quad
P-36-013413	Prehistoric pottery sherds isolate	2007	Prehistoric	Yuccan Valley South
P-36-014407H	Historical trash	2008	Mid-20th century	Yucca Valley South

OTHER SOURCES CONSULTED

In addition to the records at the SBIC of the CHRIS, a variety of other sources were consulted by Glover in December 2011 to obtain additional cultural resources information regarding the Project study area (Table 6). Sources include the National Register of Historical Places (HRER), California Register of Historic Resources (CRHR), California Historical Resources Inventory (CHRI), California Historical Landmarks (CHL), and California Points of Historical Interest (CPHI). As shown, no previously-recorded resources are listed as eligible for the NRHPO, CRHR, CHL, or CPHI.

Table 6. Additional Sources Consulted

Source	Results
National Register of Historic Places (NRHP; 1979-2002 & supplements)	Negative
Historical United States Geological Survey topographic maps	Show 20th-century development
Historical United States Department of Agriculture aerial photos	Not available
California Register of Historical Resources (CRHR; 1992-2010)	Negative
California Historical Resources Inventory (HRI; 1976-2010)	Positive
California Historical Landmarks (CHL; 1995 & supplements to 2010)	Negative
California Points of Historical Interest (CPHI; 1992 to 2010)	Negative
California Department of Transportation Historic Bridge Inventory (Caltrans 2007)	Negative
Local Historical Register Listings (Morongo Basin Historical Society n.d.)	Positive
Bureau of Land Management General Land Office Records	Show multiple land owners

Local County Registries were also examined and indicate that four historical resources are listed by the HRI and six historical resources are listed on local registers (Table 7).

Table 7. Historical Resources within the Town of Yucca Valley

Resource	HRI	Local
Water Canyon		X
Desert Christ Folk Art Park (P-36-013394)		X
Warren's Well (P-36-00961)		X
The Water Tanks (P-36-009994)		X

Resource	HRI	Local
Historical School House (P1033-1H)		X
Yucca Valley Elks Club		X
7858 Elk Trail	X	
56831 Little League Drive	X	
7593 Lucerne Vista	X	
55486 Onaga Trail	X	

Perhaps one of the more noteworthy historical sites within the Town's study area that deserves recognition as a present and future historical site is the Desert Christ Park (P-36013394) built by members of the Yucca Valley and composed of biblical figures designed and sculpted by Frank Antone Martin. A monumental figure of Christ was the first sculpture placed in the Park in 1951; additional figures were added to the Park until Martin's death in 1961 (Town of Yucca Valley 1995:IV-11). Another historical site is the Talmadge Brothers Tanks in the southwest quadrant of the Project study area that was built at a spring before 1903 to water cattle. The old Yucca Valley Elementary School (P1033-1H), now known as the "Scout House," located north of Yucca Trail, is also a site of special local interest, while Juney Joy Paxton's home on Paxton Road is another example of early historical settlement in the general Yucca Valley region (Town of Yucca Valley 1995:IV-11).

Known historical archaeological site types that may be found in the Yucca Valley Project study are may include: numerous water conveyance features (e.g., canals and canal remnants, standpipes, weirs, pump houses) dating to the late 1800s and early 1900s, historical roads, and historical structural remains associated with former homestead and ranching locations. In addition, other types of historical archaeological resources, such as buried hollow features (e.g., cisterns, privies) containing historical refuse deposits are often associated with former homestead locations.

NATIVE AMERICAN CONSULTATION

CEQA consultation was conducted by Cogstone. The City is required to separately consult with tribes under SB 18 for this update. A Sacred Lands File search was requested from the Native American Heritage Commission (NAHC) on December 2, 2011. On December 5, the NAHC replied that there were no known Native American cultural resources previously documented within the Project study area. However, the NAHC did recommend that 12 Native American tribes or individuals be contacted that may have additional knowledge of the religious and cultural significance of historic properties within or immediately adjacent to the Project study area for further information (Appendix F).

Letters requesting information on any heritage sites and containing maps and study information were sent by post on December 7, 2011 to the 12 Native American contacts (Appendix G). After no responses were received, follow-up e-mails were sent and phone calls were placed with the Native America contacts on December 28, 2011 and again on January 5, 2012 (Appendix H). No responses have been received from the 12 Native American tribes or individuals contacted.

IMPACT ANALYSIS AND MITIGATION

The potential impacts to paleontological and cultural resources within the Town are reviewed. Because the *Town's General Plan Update* does not directly address specific future projects, these impacts are described generically. For most projects within the Town, CEQA will apply. However, for all sections under management of the BLM, federal laws will apply.

PAL-1. POTENTIAL IMPACTS TO PALEONTOLOGICAL RESOURCES

The core of the Town of Yucca Valley is situated on low-sensitivity Quaternary alluvium underlain by moderately sensitive Quaternary older alluvium (Table 8, refer to Figure 3). The Quaternary alluvium is composed of mostly recent sediments that do not usually contain fossils as the sediments are too young. Therefore, it is ranked 2 or low. The Quaternary older alluvium has previously produced two fossils within the Town limits and many others in the region. Throughout southern California, the Quaternary older alluvium has produced scientifically important fossils in unpredictable locations. Based on these criteria it is ranked as 3a or moderate but unevenly distributed. The Old Woman Sandstone, which is found in a tiny portion of the northern extension of the town limits, has produced limited fossils in the region. This formation is ranked 3a or moderate but unevenly distributed.

The Quaternary older gravels and Quaternary older fanglomerate have not produced fossils in the past. Generally, fine-grained sediments produce many more fossils than coarse sediments. These formations are ranked as 3b or unknown based on the fact that they have not been heavily impacted in the past and thus their potential is undemonstrated.

The basalts and the metamorphic rock units consisting of monzonites, granitics and gneissic rocks are ranked as 1 or very low. This is due to their igneous origin as the extreme heat and pressure that has affected these rocks would have destroyed any fossils which might have been present.

Table 8. Potential Fossil Yield Classification Results

PFYC ranking	5a: very high & exposed	4: high	3a: moderate-patchy distribution	3b: moderate-undemonstrated	2: low	1: very low
Rock Units						
Quaternary alluvium					X	
Quaternary older alluvium			X			
Quaternary older gravel/fanglomerate				X		
Old Woman Sandstone			X			
Basalt						X
Monzonite/Granitics						X
Gneissic rocks						X

POTENTIAL IMPACTS TO CULTURAL RESOURCES

Three basic impacts to cultural resources may occur through the implementation of future projects: (1) adverse changes in the elements of historical structures, features, and landscapes that make them significant resources; (2) potential destruction of prehistoric and historical archaeological resources; and (3) potential to disturb Native American human remains. Each of these impacts is described more fully below.

CUL-1. ADVERSE CHANGES TO HISTORICAL BUILT ENVIRONMENT RESOURCES

The Town was visited and permanently settled by Euro-Americans since the later part of the eighteenth century, through the nineteenth century, and into the twentieth century. As a result, potentially significant historical structures and other historical features may be found within the Town's planning area.

The historical neighborhoods in the Town's planning area can provide a context and setting for many types of the Town's historical resources. The setting of many of the late nineteenth and early twentieth-century historical buildings has, in many instances, been compromised by lot splits, zoning changes, variances, or conversion to other housing. Saving a historical building also requires retaining the historical context of the structure and its immediate surroundings. Modern buildings crowded next door to an early historic homestead give a completely different impression than the structure in its original neighborhood with original plantings.

For the most part, the Town's early neighborhoods developed as the unique result of changing technology, ways of life and philosophies, new architectural fashions, and innovations in urban planning. The late nineteenth- and early twentieth-century structures and development patterns are key elements of these neighborhoods. Because these neighborhoods seem so ordinary, many people tend to overlook their unique qualities or consider them undeserving of special attention. Consequently, new construction and development, building alterations, land-use plans and zoning have frequently ignored the heritage of these neighborhoods. Modern factory-produced building materials and lack of information about earlier building techniques have often resulted in inappropriate alterations; insensitive alterations and changes can destroy the important historical characteristics of these early neighborhoods. As a consequence, intact historical neighborhoods are becoming increasingly rare in southern California.

Future Town development may occur in areas that may contain significant historical structures and features. Although the Town of Yucca Valley currently has policies to protect and minimize adverse impacts to historical structures and features (Town of Yucca Valley 1995:IV), the potential exists for significant impacts to these resources to occur as a result of development projects proposed or permitted by the Town, as defined in the CEQA Guidelines, Section 15064.5.

CUL-2. Adverse Changes to Archaeological Resources

Based on what is known of the histories of local Native American groups and prehistoric and historical archaeological sites recorded previously, potentially significant archeological resources are known to exist within the Town's planning area. Future projects may require ground disturbance (e.g., earthmoving activities) which may cause the destruction of significant archaeological resources, or previously unknown buried archaeological resources as defined in the CEQA Guidelines, Section 15064.5(b). As stated, a project with an effect that may cause a substantial adverse change in the significance of an archaeological resource is a project that may have a significant effect on the environment. Effects on an archaeological resource deemed to be significant could be considered adverse if they involve physical demolition, destruction, or alteration of the resource or its immediate surroundings such that the significance of a resource would be materially impaired. Thus, significant prehistoric and historical archaeological

resources must be considered in the Town's project planning and development process, and any proposed Town project that may affect significant archaeological cultural resources must be submitted to the State Historic Preservation Officer (SHPO) for review and comment prior to project approval by the Town and prior to construction.

CUL-3. Potential to Disturb Native American Human Remains

Although Native American human remains are normally associated with former residential village locations, isolated burials and cremations have been found in many other locations. Future projects may disturb or destroy buried Native American human remains, including those interred outside of formal cemeteries. Consistent with state laws protecting these remains (that is, Health and Safety Code Section 7050.5 and Public Resources Code Section 5097.98), sites containing Native American human remains must be treated in a sensitive manner.

MITIGATION MEASURES

MM PAL-1. Town staff shall require applicants for future proposed projects with planned impacts greater than 5 feet below the current surface in undisturbed sediments ranked PFYC 3 or above to provide a technical paleontological assessment consisting of a record search, survey, background context and project specific recommendations performed by a qualified paleontologist. If resources are known or reasonably anticipated the recommendations shall provide a detailed mitigation plan which shall require monitoring during grading and other earthmoving activities in undisturbed sediments, provides a fossil recovery protocol that includes data to be collected, requires professional identification, radiocarbon dates and other special studies as appropriate, requires curation at an accredited museum such as the San Bernardino County Museum for fossils meeting significance criteria, requires a comprehensive final mitigation compliance report including a catalog of fossil specimens with museum numbers and an appendix containing a letter from the museum stating that they are in possession of the fossils.

MM CUL-1. Town staff shall require applicants for future proposed projects with intact extant building(s) more than 45 years old to provide a historic resource technical study evaluating the significance and data potential of the resource. If significance criteria are met, detailed mitigation recommendations are required as part of the technical study. All work will be performed by a qualified architectural historian meeting Secretary of the Interior Standards.

MM CUL-2. Town staff shall require applicants for future proposed projects in areas of known or inferred archaeological resources, prehistoric or historic, to provide a technical cultural resources assessment consisting of a record search, survey, background context and project specific recommendations performed by a qualified archaeologist. If resources are known or reasonably anticipated the recommendations shall provide a detailed mitigation plan which shall

require monitoring during grading and other earthmoving activities in undisturbed sediments, provide a treatment plan for potential resources that includes data to be collected, requires professional identification, other special studies as appropriate, requires curation at an accredited museum such as the San Bernardino County Museum for artifacts meeting significance criteria, requires a comprehensive final mitigation compliance report including a catalog of specimens with museum numbers and an appendix containing a letter from the museum stating that they are in possession of the materials.

MM CUL-3. Unanticipated discoveries of human remains shall require immediate cessation of ground disturbance and notification to Town staff and shall follow state law as stated in Health and Safety Code Section 7050.5 and Public Resources Code Section 5097.98.

REFERENCES CITED

Basgall, M. E., and M. C. Hall
1993 Archaeology of the Awl Site (CA-SBR-4562), Fort Irwin, San Bernardino County, California: An Early Holocene Residential Base in the North-Central Mojave Desert. Far Western Anthropological Research Group, Inc., Davis, California. Submitted to the U.S. Army Corps of Engineers, Los Angeles District.

Bean, L. and C. Smith
1978 Serrano. In *Handbook of North American Indian, Vol. 8, California*, R.F. Heizer (ed), Smithsonian Institute, Washington, D.C.

Bean, L. and S. Vane
2002 The Native American Ehtonography and Ethnohistory of Joshua Tree National Park: an overview. Produced for the National Park Service. On file, San Bernardino Archaeological Information Center.

BLM
2007 Potential Fossil Yield Classification (PFYC) System for Paleontological Resources on Public Lands. Online at: http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning_and_Renewable_Resources/coop_agencies/paleontology_library.Par.76283.File.dat/IM-2008-009-cor.pdf

2009 Paleontological Resources Preservation Act. Online at: http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning_and_Renewable_Resources/coop_agencies/paleontology_library/paleon_legis.Par.45651.File.dat/PL-111-011-prpa.pdf

BLM GLO (Bureau of Land Management Government Land Office)
n.d. Online Patent Search. Available online at http://www.glorecords.com, last accessed December 1, 2011.

Clark, May L. and Twila G. Couzens
1966 *Yucca Valley and its History*. Self-published, Yucca Valley.

Cleland, J. H.
1998 From Paleo-Indian to Protohistoric: The Chronology if Human Occupation of the Salton Sea Test Base. KEA Environmental, Inc. *Proceedings of the Society for California Archaeology* 12:10–14.

Czaplewski, N. J.
1993 Late Tertiary bats (Mammalia, Chiroptera) from the southwestern United States. *Southwestern Naturalist* 38:111-118

CSRI (Cultural Systems Research, Inc.)
1986 *Cultural Resources Testing and Data Recovery, Tahquitz Canyon Project Research Design.* Cultural Systems Research, Inc., Menlo Park, California.

Dibblee, Thomas W., Jr.
2008 Geologic Map of the Joshua Tree & Twentynine Palms 15 Minute Quadrangles, Riverside & San Bernardino Counties, California. Dibblee Geology Center Map #DF-390, Santa Barbara Museum of Natural History, Santa Barbara, California.

Evans, Carolyn
1965 *A Glimpse into the History of Yucca Valley, Morongo Valley, Palm Wells and Yucca Mesa, California*. Artcraft Print Shop, Yucca Valley, California.

1966 *Remembrances of the High Desert and the communities of Morongo Valley, Palm Wells, Yucca Valley, Pioneertown, Landers, Joshua Tree and Twentynine Palms*. Artcraft Print Shop, Yucca Valley, California.

Jefferson, G. T.
2003 A Catalogue of late Quaternary Vertebrates from California: Part two, Mammals. Natural History Museum of Los Angeles, Technical Report #7; 1st ed. 1991, updated.

Long, Ruth
n.d. Morongo Basin History Overview. Available online at http://www.yuccavalley.org/42.html, last accessed January 6, 2012.

Moratto, M. J.
1984 *California Archaeology*. Academic Press, New York.

Morongo Basin Historical Society
n.d. MBHS Historical Sites Guide. Available online at http://www.mbhs.net/MBHS_HistSites.html, last accessed December 8, 2011.

Pearce, Keith
1988 The Pearce Family. In *Hi Desert Dreaming: A History of the Communities of Morongo Valley, Yucca Valley, Joshua Tree, 29 Palms, Whitewater and Landers, Volume 2*. Joan Wilson and Charleen Grubb, eds. Joan Wilson, Yucca Valley.

Reynolds, R.E.
1992 The Tertiary Pioneertown sequence. In Old Routes to the Colorado, edited by R.E. Reynolds, *San Bernardino County Museum Association Special Publication*, Mojave Desert Quaternary Research Conference 1992(2):31-33.

Schaefer, J.
1994 The Challenge of Archaeological Research in the Colorado River: Recent Approaches and Discoveries. Journal of California and Great Basin Anthropology 16 (1):60–80.

1995 Prehistoric Cultural Setting. In *Archaeological, Ethnographic, and Ethnohistoric Investigations at Tahquitz Canyon Palm Springs, California, Volume IA of 4: Management Summary, Forward, Introduction, Environmental Setting, Prehistoric Cultural Setting, Research Orientation, Ethnography*. Cultural Systems Research, Inc., Menlo Park, California. Submitted to the Riverside County Flood Control and Conservation District, Riverside, California.

Schoenherr, A.
1992 *A Natural History of California*. University of California Press, Berkeley.

Scott, E.
2012 Yucca Valley Record Search, San Bernardino County Museum, Division of Earth Sciences.

Scott, E., and K. Springer
2003 CEQA and fossil preservation in southern California. In *The Environmental Monitor*. Fall 2003, p. 4-10, 17.

Spaulding, W. G.
1995 Environmental Change, Ecosystem Responses, and the Late Quaternary Development of the Mojave Desert. In *Late Quaternary Environments and Deep History: A Tribute to Paul S. Martin*, edited by D. Steadman and J. Mead. The Mammoth Site of Hot Springs, South Dakota, Inc. Scientific Papers, Volume 3. Hot Springs, South Dakota

Town of Yucca Valley
1995 Town of Yucca Valley General Plan. Available online at http://www.yucca-valley.org/departments/gen_plan.html, last accessed December 29, 2011.

Warren, C. N.
1984 The Desert Region. In: *California Archaeology* by Michael J. Moratto, pp. 339–430. Orlando: Academic Press.

Waters, M. R.
1982 The Lowland Patayan Ceramic Tradition. In *Hohokan Patayan: Prehistory of Southwestern Arizona*, edited by R. H. McGuire and M. B. Schiffer, pp. 275–298. Academic Press, New York.

Wilke, P. J.
1976 Late Prehistoric Human Ecology at Lake Cahuilla, Coachella Valley, California. Unpublished Ph.D. Dissertation, Department of Anthropology, University of California, Riverside.

Wilson, Joan and Charleen Grubb
1985 *Yucca Valley: Reflections of the Past*. Joan Wilson, Yucca Valley

APPENDIX A: QUALIFICATIONS

cogstone
PALEONTOLOGY - ARCHAEOLOGY - HISTORY

MELINDA C. HORNE
Principal Investigator for Archaeology

EDUCATION

1984	M.A.	Geography, University of Utah, Salt Lake City.
1980	B.A.	Archaeology, University of Utah, Salt Lake City, *cum laude*.

SUMMARY QUALIFICATIONS

Ms. Horne has more than 30 years of experience in prehistoric archaeology and cultural resources management. Her areas of expertise include the prehistory of California and the Great Basin, archaeological method and theory, prehistoric settlement patterns, predictive modeling, land-use planning, facility siting, environmental impact analyses, and synthetic analyses, as well as proposal preparation, contract coordination, and budgeting, planning, and directing field research. With more than 27 years of supervisory experience, Ms. Horne has served variously as project manager, research associate, and field director on more than 150 projects throughout California, Oregon, Nevada, and Utah. Ms. Horne also has specialized training in preparing agreement documents under Section 106 of the NHPA and federal project and historic preservation law.

SELECTED PROJECTS

State Route 58 (SR-58) Realignment Project through Kramer Junction, San Bernardino County. Project Manager Applied EarthWorks, Inc. contract with Caltrans District 8. Supervision of a Phase I archaeological survey and archaeological site documentation; Native American and agency consultation; preparation of a Positive Historic Property Survey Report/Archaeological Survey Report; project budgeting and tracking. 2007–2010

Emergency Data Recovery Excavations at CA-RIV-5211. Project Manager. Supervision of emergency excavation of a large Cahuilla cremation cemetery; coordinating all special analyses studies; extensive Native American and agency consultation; preparation of a Final Synthetic Report of Findings; project budgeting and tracking. 2006–2010

Ivanpah Solar Generating System Project, San Bernardino County. Project Manager. Contract with Aspen Environmental and Applied EarthWorks, Inc. Supervision of a Phase I archaeological survey and archaeological site documentation; agency consultation; preparation of a Phase I Cultural Resources Report; project budgeting and tracking. 2009

Antelope Valley–East Kern Water Agency North Buttes WSSP Water Banking Project. Project Manager. Contract with Boyle Engineering and Applied EarthWorks, Inc. Supervision of a Phase I archaeological survey and archaeological site documentation; Native American and agency consultation; preparation of a Phase I Cultural Resources Report; project budgeting and tracking. 2008–2009

Travertine Point Specific Plan, located northwest of the Salton Sea in eastern Riverside and Imperial counties. Project Manager. Applied EarthWorks, Inc. contract with Federated Insurance. Supervision of a Phase I archaeological survey and archaeological site documentation; Native American and agency consultation; preparation of a Phase I Cultural Resources Survey Report; project budgeting and tracking. 2007–2009

Fort Yuma-Quechan Native American Training Project. Project Manager. Contract with the Fort Yuma-Quechan Tribe and Applied EarthWorks, Inc. Responsible for the design and implementation of presentations to educate interested Native American monitors on cultural resources management, the prehistory of the Palm Springs region, lithic technology, human remains identification, local flora identification, and field training in archaeological survey, site identification, mapping, and site documentation. 2007

The Mojave Water Agency Water Banking Project, San Bernardino County. Project Manager. Contract with J. Monroe Consulting Services and Applied EarthWorks, Inc. on behalf of the Mojave Water Agency. Supervision of a Phase I archaeological survey of approximately 1,500 acres; identification and documentation of three cultural resources; Native American and agency consultation; report preparation; project budgeting and tracking. 2005

cogstone
PALEONTOLOGY - ARCHAEOLOGY - HISTORY

SHERRI GUST

Project Manager & Principal Investigator

EDUCATION

1994 M. S., Anatomy (Evolutionary Morphology), University of Southern California, Los Angeles
1979 B. S., Anthropology (Physical), University of California, Davis

SUMMARY QUALIFICATIONS

Gust has more than 30 years of experience in California, acknowledged credentials for meeting national standards, and is a certified/qualified principal archaeologist and paleontologist in all California cities and counties that maintain lists. Gust is an Associate of the Natural History Museum of Los Angeles County in the Vertebrate Paleontology and Rancho La Brea Sections. She is a Member of the Society of Vertebrate Paleontology, Society for Archaeological Sciences, Society for Historical Archaeology, the Society for California Archaeology and others. She has special expertise in the identification and analysis of human, animal and fossil bone. Gust is a Riverside County Certified Archaeologist (No.116) and is also a Riverside County Certified Paleontologist.

SELECTED PROJECTS

WECC Path 42 Transmission Line Upgrades, Palm Springs area. Supervised cultural and paleontological resources Phase I studies for 14.5 mile segment on BLM and private lands on behalf of SCE. Project Manager and Principal Archaeologist and Paleontologist. 2011-2012

San Juan Capistrano Town Center Master Plan Update, San Juan Capistrano. Supervised archaeological and paleontological record searches, research, and survey plus Native American consultation for 31 acre town center. Also evaluation of resources including updated site records and impact assessment. Principal Archaeologist and Paleontologist and Project Manager. 2011

City of Chino Hills General Plan Update. Cultural and paleontological resources programmatic technical study with recommendations for entire City. Principal Archaeologist and Paleontologist. 2011

Mojave Water Agency Ground Water Replenishment Project. Cultural and Paleontological Resources Management Plan was prepared, including an updated assessment, and submitted to SHPO. Cultural resources sensitivity training provided to all construction personnel and both archaeological and paleontological monitoring performed. Principal Archaeologist and Paleontologist and Project Manager. 2010-2012

Falcon Ridge Substation and Transmission Lines. Archaeological survey, assessment and recording of historical archaeological features on 287 acres in Fontana and Rialto, San Bernardino County, A. Principal Archaeologist and Paleontologist and Project Manager. 2010

El Casco Transmission Project. Conducted preconstruction mitigation measures and prepared Paleontological Resources Treatment Plan for new SCE transmission project in Riverside County. Project Manager and Principal Paleontologist. 2009

Chuckwalla Valley Raceway. Paleontological assessment, Paleontological Mitigation Plan and Paleontological Monitoring Compliance Report for 1100 acres in Riverside County, CA. Project Manager and Principal Paleontologist. 2009-2010

San Bernardino County Road Improvement Projects. (Caltrans District 8 On-Call Contract). Paleontology subconsultant to Applied Earthworks. Prepared portions of Paleontological Identification Reports, Paleontological Evaluation Reports and Paleontological Mitigation Plan for projects including I10, SR58, SR138, SR247. Supervised paleontological monitoring for SR138, recovered significant fossils and prepared Paleontological Mitigation Report. Field and Lab Director. 2005-present

cogstone
PALEONTOLOGY - ARCHAEOLOGY - HISTORY

AMY GLOVER
Archaeologist/ Cross-Trained Paleontologist
& Laboratory Supervisor

EDUCATION

2004 B.S., Anthropology (Biological), University of California, Riverside

2004 Archaeological Collections Management Internship, San Diego Archaeological Center

SUMMARY QUALIFICATIONS

Glover has more than four years of archaeological experience in California, and knowledge in lab procedures, including the preparation of collections for curation. Glover specializes in historic artifacts, and has over 48 hours of paleontology cross-training.

SELECTED PROJECTS AND REPORTS

Eastside Goldline Light Rail/Subway Project & Historic Los Angeles Cemetery. Archaeology/paleontology monitor, lab supervisor. Performed archaeological/paleontological monitoring, data recovery and field lab supervision, cataloguing, identification, and analysis of Euro-American and Chinese artifacts from over 150 human interments. Also co-authored the final report. 1,968 total hours on project. 2005-Present.

Santa Ysabel Ranch. Archaeology/paleontology monitor, lab supervisor. 200-acre land development in San Luis Obispo counting. Performed mitigation monitoring, artifact and fossil recovery, laboratory processing of prehistoric artifacts for curation. 967 hours on project. 2004-2005

Tehachapi Renewable Transmission Project. Installation of new electrical facilities in Los Angeles & Kern County. Archaeology/paleontology Monitor for Segments 1, 2, and 3. Also performed supplemental surveys, site record preparation, and co-authored supplemental survey reports. 470 hours on project. 2008-2009

Rosedale Development /Monrovia Nursery Project. Mixed-use development of roughly 500 acres of land previously used as a plant nursery. Archaeology/paleontology monitor, lab supervisor. Performed cultural resources monitoring, recovery of artifacts, laboratory processing and preparation for curation. 345 hours on project. 2004-2007

Komar Desert Center Project. Development of roughly 18-acres for retail space and associated parking. Archaeology/Paleontology monitor and lab supervisor. Performed mitigation monitoring, fossil and artifact recovery, laboratory processing and preparation of artifacts for curation. Lead author on final report. 266 hours on project. 2007-2008

Pomona Valley Creamery. Redevelopment of the historic creamery into a new educational building on the Western University campus. Archaeology/paleontology monitor, lab supervisor. Performed archaeological pedestrian survey, excavation of three historic trash pits, construction monitoring and the identification, cataloguing and analysis of historic artifacts. Lead author on the final report. 225 hours on project. 2007

Malburg Generating Station. Construction of the Malburg Generating Station, a 134-megawatt power plant adjacent to the City of Vernon's existing Station A, natural gas and water pipelines, and associated lay-down and storage areas. Lab supervisor. Performed artifact recovery and analysis. 193 hours on project.

cogstone
PALEONTOLOGY - ARCHAEOLOGY - HISTORY

TODD WIRTHS
Geologist/ Paleontologist

EDUCATION

1995 M.S., Geology, San Diego State University

1992 B.A., Geology, University of California, Santa Cruz

1988 A.A., Geology, San Diego City College

SUMMARY QUALIFICATIONS

Wirths is a certified California Professional Geologist (#7588) with more than two years' experience in paleontological survey, monitoring, and excavation. At Santa Barbara City College, he gained experience with the excavation, preparation, and curation of vertebrate fossils. He earned his Bachelor's degree in Earth Sciences at University of California, Santa Cruz. As an undergraduate, he studied early Cambrian faunal assemblages and environments as well as invertebrate classification and taxonomy. Wirths subsequently earned his Master's degree in Geological Sciences at San Diego State University. Although he began his career as a paleontological monitor for the San Diego Natural History Museum, Wirths then spent more than fourteen years as a consulting environmental geologist. In early 2011, he returned to paleontology. Wirths is currently the President of the San Diego Association of Geologists.

SELECTED PROJECTS AND REPORTS

High Speed Rail Project, Bakersfield to Palmdale Segment. Paleontologist**:** Participated in five-day paleontological survey of portions of project study area highly sensitive for fossils in Kern County. Authored survey results section of report. 2011.

SDG&E Sunrise Powerlink Project. Paleontologist**:** Electrical transmission project in San Diego and Imperial Counties. Performed paleontological monitoring lasting several months and covering a wide area. 2011.

SDG&E Wood to Steel Projects. Paleontologist: Several electrical transmission projects in San Diego County, performing paleontological monitoring. 2011.

San Diego City College Expansion. Paleontologist**:** Grading for college expansion in downtown San Diego, California. Performed paleontological monitoring. 2011.

Pygmy Mammoth Recovery. Assisted with recovery of Pygmy Mammoth from Santa Rosa Island with personnel from San Diego State University and the Museum of Northern Arizona. 1994.

Fossil Fish Recovery. Assisted with saw-cut extraction of a Miocene halibut in Monterey Fm. at Gaviota State Beach with personnel from Santa Barbara City College. 1988.

Fossil Horse Recovery. Assisted with excavation of a partial skeleton and skull of Merychippus from Cuyama Badlands, Ventura County, with personnel from Santa Barbara City College. 1987.

APPENDIX B: PFYC

FEDERAL POTENTIAL FOSSIL YIELD CLASSIFICATION SYSTEM

The PFYC System was developed by the United States Department of Agriculture (USDA) Forest Service and refined by the BLM (2007). Occurrences of paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Therefore, geologic mapping can be used for assessing the potential for the occurrence of paleontological resources.

Using the PFYC system, geologic units are classified based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts, with a higher class number indicating a higher potential. This classification is applied to the geologic formation, member, or other distinguishable unit, preferably at the most detailed mapable level. It is not intended to be applied to specific paleontological localities or small areas within units. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher class; instead, the relative abundance of significant localities is intended to be the major determinant for the class assignment.

The PFYC system is meant to provide baseline guidance for predicting, assessing, and mitigating paleontological resources. The classification should be considered at an intermediate point in the analysis, and should be used to assist in determining the need for further mitigation assessment or actions.

The descriptions for the classes below are written to serve as guidelines rather than as strict definitions. Knowledge of the geology and the paleontological potential for individual units or preservational conditions should be considered when determining the appropriate class assignment. Assignments are best made by collaboration between land managers and knowledgeable researchers.

CLASS 1 – VERY LOW. Geologic units that are not likely to contain recognizable fossil remains. The probability for impacting any fossils is negligible. Assessment or mitigation of paleontological resources is usually unnecessary. The occurrence of significant fossils is non-existent or extremely rare. This class includes:

- Units that are igneous or metamorphic, excluding reworked volcanic ash units.
- Units that are Precambrian in age or older.

<u>Class 1 Management notes:</u>

1) Management concern for paleontological resources in Class 1 units is usually negligible or not applicable.
2) Assessment or mitigation is usually unnecessary except in very rare or isolated circumstances.

CLASS 2 – LOW. Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils. The probability for impacting vertebrate fossils or scientifically significant invertebrate or plant fossils is low. Assessment or mitigation of paleontological resources is not likely to be necessary. Localities containing important resources may exist, but would be rare and would not influence the classification. These important localities would be managed on a case-by-case basis. This class includes:

• Vertebrate or significant invertebrate or plant fossils not present or very rare.
• Units that are generally younger than 10,000 years before present.
• Recent aeolian deposits.
• Sediments that exhibit significant physical and chemical changes (i.e., diagenetic alteration).

Class 2 Management notes:

(1) Management concern for paleontological resources is generally low.
(2) Assessment or mitigation is usually unnecessary except in rare or isolated circumstances.

CLASS 3 – MODERATE OR UNKNOWN. Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential. This classification includes a broad range of paleontological potential. It includes geologic units of unknown potential, as well as units of moderate or infrequent occurrence of significant fossils. Management considerations cover a broad range of options as well, and could include pre-disturbance surveys, monitoring, or avoidance. Surface-disturbing activities will require sufficient assessment to determine whether significant paleontological resources occur in the area of a proposed action, and whether the action could affect the paleontological resources. These units may contain areas that would be appropriate to designate as hobby collection areas due to the higher occurrence of common fossils and a lower concern about affecting significant paleontological resources. This class includes:
• Formations with sporadic known occurrences of vertebrate fossils - often marine in origin.
• Vertebrate fossils and scientifically significant invertebrate or plant fossils known to occur intermittently; predictability known to be low.
• Poorly studied and/or poorly documented formations. Potential yield cannot be assigned without ground reconnaissance.

Class 3 Management notes:

(1) Management concern for paleontological resources is moderate; or cannot be determined from existing data.
(2) Surface-disturbing activities may require field assessment to determine appropriate course of action.

CLASS 3A – MODERATE POTENTIAL. Units are known to contain vertebrate fossils or scientifically significant nonvertebrate fossils, but these occurrences are widely scattered. Common invertebrate or plant fossils may be found in the area, and opportunities may exist for hobby collecting. The potential for a project to be sited on or impact a significant fossil locality is low, but is somewhat higher for common fossils.

CLASS 3B – UNKNOWN POTENTIAL. Units exhibit geologic features and preservational conditions that suggest significant fossils could be present, but little information about the paleontological resources of the unit or the area is known. This may indicate the unit or area is poorly studied, and field surveys may uncover significant finds. The units in this Class may eventually be placed in another Class when sufficient survey and research is performed. The unknown potential of the units in this Class should be carefully considered when developing any mitigation or management actions.

CLASS 4 – HIGH. Geologic units containing a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability. Surface disturbing activities may adversely

affect paleontological resources in many cases. The probability for impacting significant paleontological resources is moderate to high, and is dependent on the proposed action. Mitigation considerations must include assessment of the disturbance, such as removal or penetration of protective surface alluvium or soils, potential for future accelerated erosion, or increased ease of access resulting in greater looting potential. If impacts to significant fossils can be anticipated, on-the-ground surveys prior to authorizing the surface disturbing action will usually be necessary. On-site monitoring or spot-checking may be necessary during construction activities. This class includes:

• Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
• Areas of exposed outcrop are smaller than two contiguous acres.
• Outcrops from cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.
• Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

Class 4 Management notes:

(1) Management concern for paleontological resources in Class 4 is moderate to high, depending on the proposed action.
(2) A field survey by a qualified paleontologist is often needed to assess local conditions.
(3) Management prescriptions for resource preservation and conservation through controlled access or special management designation should be considered.
(4) Class 4 and Class 5 units may be combined as Class 5 for broad applications, such as planning efforts or preliminary assessments, when geologic mapping at an appropriate scale is not available. Resource assessment, mitigation, and other management considerations are similar at this level of analysis, and impacts and alternatives can be addressed at a level appropriate to the application.

CLASS 4A – HIGH AND EXPOSED. Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than two acres. Paleontological resources may be susceptible to adverse impacts from surface disturbing actions. Illegal collecting activities may impact some areas.

CLASS 4B – HIGH AND UNEXPOSED. These are areas underlain by geologic units with high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

CLASS 5 – VERY HIGH. Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils, and that are at risk of human-caused adverse impacts or natural degradation. The probability for impacting significant fossils is high. Vertebrate fossils or scientifically significant invertebrate fossils are known or can reasonably be expected to occur in the impacted area. On-the-ground surveys prior to authorizing any surface disturbing activities will usually be necessary. On-site monitoring may be necessary during construction activities. This class includes:

• Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
• Areas of exposed outcrop are smaller than two contiguous acres.
• Outcrops from cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.

- Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

Class 5 Management notes:

(1) Management concern for paleontological resources in Class 5 areas is high to very high.
(2) A field survey by a qualified paleontologist is usually necessary prior to surface disturbing activities or land tenure adjustments. Mitigation will often be necessary before and/or during these actions.
(3) Official designation of areas of avoidance, special interest, and concern may be appropriate.

CLASS 5A – VERY HIGH AND EXPOSED. Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than two contiguous acres. Paleontological resources are highly susceptible to adverse impacts from surface disturbing actions. Unit is frequently the focus of illegal collecting activities.

CLASS 5B – VERY HIGH AND UNEXPOSED. These are areas underlain by geologic units with very high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has very high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity. [BLM 2007]

APPENDIX C: PALEONTOLOGICAL RECORDS SEARCH

19 December 2011

Cogstone Resource Management
attn: Sherri Gust
1518 W. Taft Avenue
Orange, CA 92865

re: **PALEONTOLOGY LITERATURE AND RECORDS REVIEW, YUCCA VALLEY GENERAL PLAN UPDATE, SAN BERNARDINO COUNTY, CALIFORNIA**

Dear Sherri,

The Division of Geological Sciences of the San Bernardino County Museum (SBCM) has completed a literature review and records search for the above-referenced study area in the Yucca Valley area of San Bernardino County, California. The proposed study area encompasses portions of the sections 11, 14, 22 - 27, and 32 - 36, Township 1 North, Range 5 East, as well as portions of sections 19 - 21 and 29 - 32, T 1N, R 6E, sections 1 - 5 and 9 - 16, T 1S, R 5E, and sections 5 - 8, 17, and 18, T 1S, R 6E, San Bernardino Base and Meridian, as seen on the Joshua Tree North, California (1972 edition), the Joshua Tree South, California (1972 edition), the Yucca Valley North, California (1972 edition, photorevised 1979), and the Yucca Valley South, California (1972 edition) 7.5' United States Geological Survey topographic quadrangle maps.

Geologic mapping by Bortugno and Spittler (1986) and Dibblee (2008) indicates that the proposed Yucca Valley General Plan boundaries encompass multiple rock units, including (from oldest to youngest): sheared and deformed gneiss of uncertain age (= unit **gn**); granitic rocks, quartz monzonite, and monzonite porphyry of possible Jurassic age (= **qm**, **mp**); sedimentary rocks of the Old Woman Sandstone (= **To**); Neogene and/or Quaternary basalts (= **QTb**); and surface and subsurface Quaternary alluvial valley fill sediments, primarily undifferentiated Pleistocene older alluvium (= unit **Qoa**) but also including well-dissected Pleistocene fans and gravels (= **Qof**, **Qog**), all overlain in many low-lying areas by recent alluvial sand and gravel (= **Qa**). Of these, the Mesozoic rocks, the basalts, and recent alluvium all have low potential to contain fossil resources, and so are assigned low paleontologic sensitivity. In contrast, the sediments of the Old Woman Sandstone and the older Pleistocene alluvial deposits have high potential to contain significant nonrenewable paleontologic resources, and so are assigned high paleontologic sensitivity depending upon their lithology.

Exposures of the Old Woman Sandstone are restricted to the northern part of the study area. These outcrops consist of interbedded units of arkosic sandstone, conglomerate, silt, and clay, with

scattered clasts of limestone and basalt (Sadler, 1982). May and Repenning (1982) reported the presence of late Pliocene and early Pleistocene vertebrate fossils from the resistant sandstone unit of the Old Woman Sandstone, demonstrating the high paleontologic sensitivity of this formation.

Pleistocene older alluvium throughout much of this region of the Mojave Desert has been previously demonstrated to be fossiliferous (Jefferson, 1991; Scott and Cox, 2008). In the Twentynine Palms region, for example, older Pleistocene sediments have yielded fossil remains of the following Pleistocene taxa (Bacheller, 1978; Jefferson, 1991, 1992; Scott and Cox, 2008):

Megalonyx sp. . . . . flat-footed ground sloth
Nothrotheriops sp. . . . . Shasta ground sloth
Thomomys sp. . . . . pocket gopher
Taxidea taxus . . . . . badger
Smilodon sp. cf. *S. fatalis* . . . . . sabre-toothed cat
Felis concolor . . . . . puma
Mammuthus sp. . . . . mammoth
Equus sp. (large) . . . . . large horse
Equus sp. (small) . . . . . small horse
Camelops sp. . . . . large camel
Hemiauchenia sp. . . . . llama
Odocoileus sp. cf. *O. virginianus* . . . . . deer
Capromeryx sp. . . . . dwarf pronghorn
Bison sp. . . . . possible long-horned bison
Ovis sp. cf. *O. canadensis* . . . . . bighorn sheep

Additionally, fossils reported from Pleistocene older alluvium in the Pinto Basin area in eastern Joshua Tree National Park represent extinct mammoth (*Mammuthus*), wolf-sized canid (*Canis*), large and small horses (*Equus* spp.), llamas (*Hemiauchenia*), and large camel (*Camelops*) (Jefferson, 1991; Scott and others, 2006), as well as bison (*Bison*). Although these localities are at some distance from the proposed study area, they nevertheless demonstrate the high paleontologic sensitivity of Pleistocene alluvium in this general region of San Bernardino County, depending upon the depositional context and lithology.

For this report, I conducted a review of the Regional Paleontologic Locality Inventory (RPLI) at the SBCM. The results of this review indicated that two previously recorded fossil localities, SBCM 1.95.1 and 1.95.8, are located within the west-central portion of the study area. These localities yielded fossil remains of extinct horse (*Equus*) and tortoise (?*Gopherus*) from Pleistocene older alluvial sediments.

Recommendations

The results of the literature review and the check of the RPLI at the SBCM suggest that multiple rock units within the Yucca Valley General Plan study area have high potential to contain significant

nonrenewable paleontologic resources. A qualified vertebrate paleontologist must develop a program to mitigate potential adverse impacts to such resources for any excavation in the sensitive rock units. This program must include curation of recovered resources (Scott and others, 2004) and be consistent with the provisions of the California Environmental Quality Act (Scott and Springer, 2003), as well as with regulations currently implemented by the County of San Bernardino and the proposed guidelines of the Society of Vertebrate Paleontology.

The County of San Bernardino (Development Code §82.20.040) defines a qualified vertebrate paleontologist as meeting the following criteria:

Education: An advanced degree (Masters or higher) in geology, paleontology, biology or related disciplines (exclusive of archaeology).

Professional experience: At least five years professional experience with paleontologic (not including cultural) resources, including the collection, identification and curation of the resources.

The County of San Bernardino (Development Code §82.20.030) requires that paleontologic mitigation programs include, but not be limited to:

(a) Field survey before grading. In areas of potential but unknown sensitivity, field surveys before grading shall be required to establish the need for paleontologic monitoring.

(b) Monitoring during grading. A project that requires grading plans and is located in an area of known fossil occurrence, or that has been demonstrated to have fossils present in a field survey, shall have all grading monitored by trained paleontologic crews working under the direction of a qualified professional, so that fossils exposed during grading can be recovered and preserved. Paleontologic monitors shall be equipped to salvage fossils as they are unearthed, to avoid construction delays, and to remove samples of sediments that are likely to contain the remains of small fossil invertebrates and vertebrates. Monitors shall be empowered to temporarily halt or divert equipment to allow removal of abundant or large specimens. Monitoring is not necessary if the potentially-fossiliferous units described for the property in question are not present, or if present are determined upon exposure and examination by qualified paleontologic personnel to have low potential to contain fossil resources.

(c) Recovered specimens. Qualified paleontologic personnel shall prepare recovered specimens to a point of identification and permanent preservation, including washing of sediments to recover small invertebrates and vertebrates. Preparation and stabilization of all recovered fossils is essential in order to fully mitigate adverse impacts to the resources.

(d) Identification and curation of specimens. Qualified paleontologic personnel shall identify and curate specimens into the collections of the Division of Geological Sciences, San Bernardino County Museum, an established, accredited museum repository with permanent retrievable paleontologic storage. These procedures are also essential steps in effective paleontologic mitigation and CEQA

compliance. The paleontologist must have a written repository agreement in hand prior to the initiation of mitigation activities. Mitigation of adverse impacts to significant paleontologic resources is not considered complete until curation into an established museum repository has been fully completed and documented.

(e) Report of findings. Qualified paleontologic personnel shall prepare a report of findings with an appended itemized of specimens. A preliminary report shall be submitted and approved before granting of building permits, and a final report shall be submitted and approved before granting of occupancy permits. The report and inventory, when submitted to the appropriate Lead Agency along with confirmation of the curation of recovered specimens into the collections of the San Bernardino County Museum, will signify completion of the program to mitigate impacts to paleontologic resources.

References

Bacheller, J. III, 1978. Quaternary geology of the Mojave Desert - eastern Transverse Ranges boundary in the vicinity of Twentynine Palms, California. Unpublished MS thesis, Department of Geology, University of California, Los Angeles. Copy on file, Division of Geological Sciences, SBCM.

Bortugno, E.J. and T. E. Spittler, l986. Geologic map of California, San Bernardino sheet, scale 1:250,000. California Division of Mines and Geology Regional Geologic Map Series, Map 3A.

Dibblee, T.W. Jr., 2008. Geologic map of Joshua Tree & Twentynine Palms 15 minute quadrangles : Riverside & San Bernardino Counties, California. Dibblee Map Series, edited by J. Minch.

Jefferson, G.T., 1991. A catalogue of late Quaternary vertebrates from California: Part Two, mammals. Natural History Museum of Los Angeles County Technical Reports, No. 7.

Jefferson, G.T. 1992. Pleistocene vertebrate fossils from Twentynine Palms, California. *In* Old routes to the Colorado, ed. J. Reynolds, 43-45. Redlands: San Bernardino County Museum Association.

May, S.R. and Repenning, C.A., 1982. New evidence for the age of the old Woman sandstone, Mojave Desert, California. *In* Sadler, P.M. and Kooser, M.A. (eds.), Late Cenozoic stratigraphy and structure of the San Bernardino Mountains. Geological Society of America, Cordilleran Section, 78th Annual Meeting Field Trip Guidebook, p. 93-96.

Sadler, P.M., 1982. Provenance and structure of late Cenozoic sediments in the northeast San Bernardino Mountains. *In* Sadler, P.M. and Kooser, M.A. (eds.), Late Cenozoic stratigraphy and structure of the San Bernardino Mountains. Geological Society of America, Cordilleran Section, 78th Annual Meeting Field Trip Guidebook, p. 82-91.

Scott, E. and S.M. Cox, 2008. Late Pleistocene distribution of *Bison* (Mammalia; Artiodactyla) in the Mojave Desert of southern California and Nevada. *In* X. Wang and L.G. Barnes (eds.) Geology and Vertebrate Paleontology of Western and Southern North America, Contributions in Honor of David P. Whistler. Natural History Museum of Los Angeles County Science Series No. 41, p. 359 - 382.

Scott, E. and K. Springer, 2003. CEQA and fossil preservation in southern California. The Environmental Monitor, Fall 2003, p. 4-10, 17.

Scott, E., K. Springer and J.C. Sagebiel, 2004. Vertebrate paleontology in the Mojave Desert: the continuing importance of "follow-through" in preserving paleontologic resources. *In* M.W. Allen and J. Reed (eds.) The human journey and ancient life in California's deserts: Proceedings from the 2001 Millennium Conference. Ridgecrest: Maturango Museum Publication No. 15, p. 65-70.

Scott, E., K. Springer, J.C. Sagebiel, and C.R. Manker, 2006. Planning for the future: preserving and interpreting paleontology and geology in Joshua Tree National Park. In S.G. Lucas, J.A. Spielmann, P.M. Hester, J.P. Kenworthy, and V.L. Santucci (eds.), America's Antiquities: 100 Years of Managing Fossils on Federal Lands. New Mexico Museum of Natural History and Science Bulletin 34, p. 159 – 164.

Please do not hesitate to contact us if you have any further questions.

Sincerely,

Eric Scott, Curator of Paleontology
Division of Geological Sciences
San Bernardino County Museum

APPENDIX D: GLO LAND PATENTS

BLM land patents for study area between 1903 and 1949

Section	Township	Range	Name	Date
36	1N	5E	State of California	1903
16	1S	5E	State of California	1903
11	1N	5E	Southern Pacific Railroad Company	1910
21	1N	6E	Southern Pacific Railroad Company	1910
19	1N	6E	Southern Pacific Railroad Company	1910; 1915
29	1N	6E	Southern Pacific Railroad Company	1910; 1915
35	1N	5E	Southern Pacific Railroad Company	1915; 1921
34	1N	5E	Heard, Joseph H.	1914
23	1N	5E	Southern Pacific Railroad Company	1915
25	1N	5E	Southern Pacific Railroad Company	1915
27	1N	5E	Southern Pacific Railroad Company	1915
33	1N	5E	Southern Pacific Railroad Company	1915
1	1S	5E	Southern Pacific Railroad Company	1915
3	1S	5E	Southern Pacific Railroad Company	1915
5	1S	5E	Southern Pacific Railroad Company	1915
9	1S	5E	Southern Pacific Railroad Company	1915
11	1S	5E	Southern Pacific Railroad Company	1915
13	1S	5E	Southern Pacific Railroad Company	1915
15	1S	5E	Southern Pacific Railroad Company	1915
5	1S	6E	Southern Pacific Railroad Company	1915
7	1S	6E	Southern Pacific Railroad Company	1915
17	1S	6E	Southern Pacific Railroad Company	1915
32	1N	6E	Leslie, Wilford	1916
2	1S	5E	Pearce, Fred A.	1916
4	1S	5E	Quick, Hezekiah	1916
6	1S	6E	Ellis, Albert E.	1917
6	1S	6E	Sargent, Mabel Francis	1917
12	1S	5E	Smalley, William S.	1919
2	1S	5E	Fuller, Martin V.	1920
12	1S	5E	Smalley, Isaac W.	1920
31	1N	6E	Southern Pacific Railroad Company	1921
6	1S	6E	Dutton, William D.	1922
10	1S	5E	State of California	1925
32	1N	6E	Cain, Tatum E.	1926
2	1S	5E	Harrell, Walter A.	1926
4	1S	5E	Redden, John L.	1926
30	1N	6E	Hudson, William J.	1927
10	1S	5E	Peeden, Jether L.	1927

Section	Township	Range	Name	Date
34	1N	5E	State of California	1927
32	1N	6E	Colon, Albert E.	1928
2	1S	5E	Anderson, Claude R.	1929
32	1N	6E	Widdifield, Cecil James	1930
4	1S	5E	Peden, William Leslie R.	1930
8	1S	6E	Young, Arthur Charles	1930
18	1S	6E	Thomerson, Joseph R.	1931
30	1N	6E	Redwine, John Dee	1933
12	1S	5E	Rolston, Howard W.	1933
8	1S	6E	Gould, John D.	1933
20	1N	6E	McConnell, Dee	1934
12	1S	5E	Heffelfinger, Miles Akin	1934
22	1N	5E	Bull, Francis N.	1939
22	1N	5E	State of California	1939
18	1S	6E	Bergstrom, Jesse S.	1939
22	1N	5E	Curtis, Dick	1949
20	1N	6E	Ehlers, Fred	1949
20	1N	6E	Weber, William	1949
8	1S	6E	Gingrich, Raymond F.	1949
8	1S	6E	Martin, Alan Joseph	1949
8	1S	6E	Wiblishouser, Ruth Ann	1949

BLM land patents for study area between 1950 and 1966

Section	Township	Range	Name	Date
8	1S	6E	Jones, Raymond S.	1950
8	1S	6E	Rausch, Earl L.	1950
8	1S	6E	Snyder, Lee Harley	1950
8	1S	6E	Thedieck, Myrtle & Thedieck, Alvin John	1950
14	1N	5E	English, Ruth M.	1951
8	1S	6E	Christopher, Otto & Garver, Clifford	1951
8	1S	6E	Snyder, Loren Russell	1951
8	1S	6E	Williams, John Wilberforce	1951
8	1S	6E	Wrightsman, Otis F.	1951
24	1N	5E	Blauvelt, Everett J.	1952
24	1N	5E	Warren, George Blackstone	1952
26	1N	5E	Cantelo, Franklin James	1952
20	1N	6E	Larson, Hans A.	1952
20	1N	6E	Redmon, Lavella Marguerita	1952
8	1S	6E	Clarke, Agnes F. & Pendley, Floyd J.	1952

Section	Township	Range	Name	Date
8	1S	6E	Hall, Dorothy M.	1952
8	1S	6E	Hume, James N. & Warren, Otis Stephen	1952
8	1S	6E	Gazdik, William	1953
8	1S	6E	Hatheway, Donald	1953
8	1S	6E	Hershberger, Andrew B.	1953
8	1S	6E	Manwell, Ethel May	1953
8	1S	6E	Marble, Fred F. & Gonzalez, Alfonso Humberto	1953
8	1S	6E	Orr, Grier Emerson	1953
8	1S	6E	Peeples, Lewis L.	1953
34	1N	5E	Mortensen, William Peter	1954
34	1N	5E	Rice, Robert James	1954
34	1N	5E	Sentous, Frank Leon	1954
20	1N	6E	Baldwin, Edward A.	1954
8	1S	6E	Clark, Howard L.	1954
8	1S	6E	Dotson, Anna	1954
8	1S	6E	Taylor, Thomas Richard	1954
34	1N	5E	State of California	1954; 1957
34	1N	5E	Courtney, William Roy	1955
8	1S	6E	Manley, Georgina Booth	1955
8	1S	6E	Popjoy, Dannie Mac	1955
8	1S	6E	Woods, Joseph Colley	1955
34	1N	5E	Chiabotti, Peter	1956
34	1N	5E	Garver, Edward Oliver	1956
34	1N	5E	Hull, Lillian Anne	1956
34	1N	5E	Miranaian, Sarkis Katchadur	1956
34	1N	5E	Rice, John W.	1956
8	1S	6E	Beck, Elsie Elizabeth Omer & Omer, Elsie Elizabeth	1956
8	1S	6E	Dixon, Clara Delaney	1956
8	1S	6E	Johnson, Jennie May Hall & Hall, Jennie May	1956
8	1S	6E	Johnson, Paul William	1956
8	1S	6E	Peoples, Joe Ben	1956
8	1S	6E	Schaffer, Florence Ruth	1956
8	1S	6E	Shepherdson, Evelyn Virginia	1956
8	1S	6E	Webb, Edwin Ellis	1956
12	1S	5E	Kelly, Maurine	1957
12	1S	5E	Kingston, Ralph Theodore	1957
14	1S	5E	Blakely, Etta Inez	1957
14	1S	5E	Gigante, Frank Richard	1957
14	1S	5E	Giombini, Gloria Annunziate	1957
14	1S	5E	Hoffman, William Edward	1957

Section	Township	Range	Name	Date
14	1S	5E	Hopson, Dessie	1957
14	1S	5E	Penko, Joseph Peter	1957
14	1S	5E	Snyder, Saul	1957
14	1S	5E	Soble, Naomi F.	1957
14	1S	5E	Stallings, Manford C.	1957
14	1S	5E	Sturtz, William John A.	1957
8	1S	6E	Allen, Lisle Tate	1957
8	1S	6E	Ferris, Frank Earl	1957
8	1S	6E	Mocabee, Clarence Douglas	1957
8	1S	6E	Sullivan, Erin Brown	1957
8	1S	6E	Weeda, Anthony Jerry	1957
8	1S	6E	York, Pauline A. & Bild, John J.	1957
34	1N	5E	Bertrand, Charles Raymond	1958
34	1N	5E	Duell, Elsie Tucker	1958
34	1N	5E	Duval, Ann Catherine & Loveland, Roberta Briggs	1958
34	1N	5E	Stone, Elaine Fredericka	1958
12	1S	5E	Bourke, Donall Garraid	1958
12	1S	5E	Dedominic, John	1958
12	1S	5E	Dickey, Medea Hazel	1958
12	1S	5E	Lamain, John	1958
12	1S	5E	Turner, Harvey Allen	1958
14	1S	5E	Anderson, A. William	1958
14	1S	5E	Bagley, Byron Wilson	1958
14	1S	5E	Bradley, Kenneth James	1958
14	1S	5E	Brown, Katherine Sue	1958
14	1S	5E	Campbell, Ray Grant	1958
14	1S	5E	Chatten, Victor H.	1958
14	1S	5E	Dresser, Donald Luckett	1958
14	1S	5E	Duncan, Richard Graves	1958
14	1S	5E	Heard, Howard	1958
14	1S	5E	Hill, Harold Burler	1958
14	1S	5E	Hill, Lloyd George	1958
14	1S	5E	Hill, Richard Allen	1958
14	1S	5E	Kulik, Elizabeth	1958
14	1S	5E	Lemke, Irene Anne	1958
14	1S	5E	Nelson, Robert Kent	1958
14	1S	5E	Ryman, Sidney Alonzo	1958
14	1S	5E	Stephenson, Jesse Charles	1958
14	1S	5E	Stockdale, George Robert	1958
14	1S	5E	Watkins, Charles Stuart	1958

Section	Township	Range	Name	Date
14	1S	5E	Witting, Kenneth Braun	1958
8	1S	6E	Guggie, Robert Charles & Steele, Grace Schock	1958
8	1S	6E	Mortimer, Roy C. & Burkett, Paul J.	1958
8	1S	6E	Whittle, Louie Carroll	1958
34	1N	5E	Altenburger, Betty Ann	1959
34	1N	5E	Chaiten, Louise & Martin, Antone	1959
34	1N	5E	Laurie, Morris Keith	1959
34	1N	5E	Scott, Mildred N.	1959
34	1N	5E	Wallis, Robert H. & Ham, Elmer R.	1959
34	1N	5E	Williams, Desmond Arthur & Tabor, Henry L.	1959
34	1N	5E	Wood, Edith Roberta	1959
12	1S	5E	Bourke, Richard William	1959
12	1S	5E	Butler, Harrison & Richards, John D.	1959
12	1S	5E	Cooper, Roy C.	1959
12	1S	5E	Ellis, Jane Francis	1959
12	1S	5E	Grauer, Ralph L.	1959
12	1S	5E	Gulebian, Edith M. Forbes	1959
12	1S	5E	Housh, Mabel Jane	1959
14	1S	5E	Brady, Vera A.	1959
14	1S	5E	Cummings, John Robert	1959
14	1S	5E	Fallis, Lotsee Marie	1959
8	1S	6E	Backes, Kathleen Ann	1959
8	1S	6E	Dennhardt, Margaret Ilene	1959
8	1S	6E	Drum. Robert Cornelius	1959
8	1S	6E	Elizey, Madelyne	1959
8	1S	6E	Enger, Leslie E.	1959
8	1S	6E	Jessup, Bertha	1959
8	1S	6E	Lane, Anna V.	1959
8	1S	6E	Puddy, Alpha Gertrude	1959
8	1S	6E	Simpson, Edward B.	1959
8	1S	6E	Slanina, Francis	1959
8	1S	6E	Somers, Michael J.	1959
8	1S	6E	Williams, Everett R.	1959
8	1S	6E	Williams, Luella Smith	1959
34	1N	5E	Bruton, Lawrence Layne	1960
34	1N	5E	Covington, Chester Walter	1960
34	1N	5E	Cumrow, Willard Louis	1960
34	1N	5E	Goraki, Mary Catherine	1960
34	1N	5E	Gray, Dudley Willard	1960
34	1N	5E	Jacoby, Blanche D.	1960

Section	Township	Range	Name	Date
34	1N	5E	Jenkins, Marie Luella	1960
34	1N	5E	Krieger, Lawrence L.	1960
34	1N	5E	Papendick, Gerald W. & Smith, Myra Antoinette	1960
34	1N	5E	Pierce, Roy V.	1960
34	1N	5E	Rice, Margaret T.	1960
12	1S	5E	Eberhard, Dorothy D.	1960
12	1S	5E	Hamilton, Charles K. & Talbot, Robert Herbert	1960
14	1S	5E	Anderson, Clarence Dean	1960
14	1S	5E	Balazs, George	1960
14	1S	5E	Belcher, Kermit Thornton	1960
14	1S	5E	Boldizsar, Julius Ervin	1960
14	1S	5E	Clark, Albert Leon	1960
14	1S	5E	Dysart, Russell Doan	1960
14	1S	5E	Flint, August John	1960
14	1S	5E	Harmon, John Philip	1960
14	1S	5E	Harmon, William Thomas	1960
14	1S	5E	Ingels, Mack	1960
14	1S	5E	Irby, William Wall	1960
14	1S	5E	Kamin, Aviva S.	1960
14	1S	5E	Kruder, Edwin Otto	1960
14	1S	5E	MacDonald, Elspeth Catherine	1960
14	1S	5E	Mamath, Patsy Ann	1960
14	1S	5E	Miller, Glenn	1960
14	1S	5E	Newton, Harold Joseph	1960
14	1S	5E	Pekarovich, Daniel Paul	1960
14	1S	5E	Reyman, Cora Esther	1960
14	1S	5E	Ross, Charles Laycester	1960
14	1S	5E	Royal, William	1960
14	1S	5E	Sakshaug, Ingvald Carl	1960
14	1S	5E	Stephenson, John Martin	1960
14	1S	5E	Williams, John Oliver	1960
8	1S	6E	Burley, Kenneth Monroe	1960
8	1S	6E	Cundiff, Norman Francis	1960
8	1S	6E	Davis, Melvin Glenn	1960
8	1S	6E	Gibson, Gwynn	1960
8	1S	6E	Keyes, Mary Agnes	1960
8	1S	6E	Krug, Albert Louis	1960
8	1S	6E	Kyle, Richard Lawrence	1960
8	1S	6E	Vogel, Julia Catherine	1960
14	1S	5E	Wyne, Dora Ella	1961

Section	Township	Range	Name	Date
14	1S	5E	Conroy, Earnest	1962
14	1S	5E	Crain, Calvin E.	1962
14	1S	5E	Donaher, Philip Andrew	1962
14	1S	5E	Yucca Valley Lions Club Co	1962
32	1N	5E	Yucca Valley Park and Recreation	1963
14	1S	5E	Brock, Eleanor A.	1963
14	1S	5E	Brock, Jack	1963
14	1S	5E	Curtin, Raymond Leo	1963
14	1S	5E	Curtin, Virginia Eileen	1963
14	1S	5E	Gillespie, Agnes R.	1963
14	1S	5E	Gillespie, Joseph D.	1963
14	1S	5E	Hilterbrand, Carl Leon	1963
14	1S	5E	Hopkins, Juanita Jewel	1963
14	1S	5E	Hunt, Emma R.	1963
14	1S	5E	Johnson, Robert Glenn	1963
14	1S	5E	Kyle, Dorothy	1963
14	1S	5E	Largent, Donnie Lee	1963
14	1S	5E	Osgood, Zanna Matilda	1963
14	1S	5E	Peters, Louis Donald	1963
14	1S	5E	Peterson, John Erling	1963
14	1S	5E	Proud, John Cranston	1963
14	1S	5E	Savoie, Angeline Louise Miela	1963
14	1S	5E	Shoner, Doris Jean	1963
14	1S	5E	Shoner Marshall Monce	1963
14	1S	5E	Smallwood, Manza Beavers	1963
14	1S	5E	Swanson, Virginia L.	1963
14	1S	5E	Thompson, Wilbur Wayne	1963
18	1S	6E	Yucca Valley Park and Recreation	1963
14	1S	5E	Perlberg, Bobbe	1964
32	1N	5E	County of San Bernardino	1965
14	1S	5E	Blackwood, Allen Thurman	1965
14	1S	5E	Bodo, Joseph J.	1965
14	1S	5E	Ryan, Kenneth Edward	1965
14	1S	5E	Swint, Virginia Londeree	1965
18	1S	6E	Heirs of Cummings, J. Carl	1966

APPENDIX E: PREVIOUS CULTURAL RESOURCES STUDIES

Author	Doc. No.	Title	Date	USGS Quad
Walker, Edwin F.	1060004	Introduction and General Description.	1931	Overview
Campbell, Elizabeth W. Crozer	1060005	An Archaeological Survey of the Twenty Nine Palms Region	1931	Overview
King, Samuel A.	1060026	A History of Joshua Tree National Monument	1954	Overview
King, Thomas F.	1060108	An Archaeological Survey of the Proposed Right-of-Way of the Morongo-Yucca-Upper Coachella Valley Pipeline	1971	Yucca Valley North, Yucca Valley South
Decker, Dean A.	1060152	The Archaeological Impact of a Residential Development North of Yucca Valley California	1973	Yucca Valley North
Cardiff, Eugene A.	1060174	Environmental Impact Survey – Yucca Valley	1973	Yucca Valley North
Schuiling, Walter C.	1060175	Environmental Impact Report – Zone Change – Yucca Valley – ZC550-71	1973	Yucca Valley South
San Bernardino County Museum Assoc.	1060187	Archaeological, Paleontological, Historical and Natural History Values – Long Canyon Channel, Yucca Valley	1974	Yucca Valley South
King, Thomas	1060282	Fifty Years of Archaeology in the California Desert: An Archaeological Overview of Joshua Tree National Monument.	1975	Overview
Hearn, Joseph E.	1060411	Archaeological – Historical Resources Assessment of Existing Yucca Valley Park and Recreation District Park Site	1976	Yucca Valley South
Hearn, Joseph E.	1060472	Archaeological – Historical Resources Assessment of Tract 6572. Yucca Valley Area	1977	Yucca Valley North
Hearn, Joseph E.	1060499	Archaeological – Historical Resources Assessment at the Southwest Corner of Balsa Avenue and Twentynine Palms Highway, Yucca Valley Area	1977	Yucca Valley North
Hearn, Joseph E.	1060524	Archaeological – Historical Resources Assessment of Hi Desert Memorial Hospital Property, Yucca Valley	1977	Yucca Valley South
Hearn, Joseph E.	1060570	Archaeological – Historical Resources Assessment of Northeast Corner of Kickapoo and Santa Fe in Yucca Valley	1977	Yucca Valley South
Hearn, Joseph E.	1060595	Assessment of Archaeological – Historical Resources, Burnt Mountain Wash, Yucca Valley Area	1978	Yucca Valley North, Yucca Valley South
Hearn, Joseph E.	1060598	Archaeological – Historical Resources Assessment of the Northeast Corner of Barberry Avenue and Twentynine Palms	1978	Yucca Valley South

Author	Doc. No.	Title	Date	USGS Quad
		Highway		
Hearn, Joseph E.	1060618	Archaeological – Historical Resources Assessment, Sec. 10, T1S R5E, Yucca Valley Area	1978	Yucca Valley South
Litel, Gerald F.	1060674	Archaeological – Historical Resources Assessment for Yucca Trail, Indio Avenue to Olympic Road	1978	Yucca Valley South
Joseph Hearn	1060686	Archaeological – Historical Resources Assessment of Sec. 5, T15 R6E, Joshua Tree Quadrangle	1978	Yucca Valley South, Joshua Tree South
San Bernardino County Museum Assoc.	1060687	Archaeological Resources Assessment of Sec. 8, T1S R6E, Yucca Valley Area	1978	Yucca Valley South
Hearn, Joseph E.	1060704	Archaeological – Historical Resources Assessment of Parcel #60141407, Yucca Valley Area	1978	Yucca Valley North
Hearn, Joseph E.	1060705	Archaeological Resources Assessment of Assessors Parcels No. 58709142, 58709143, 58709144, and 58709120 in the Yucca Valley Area	1978	Yucca Valley South
Hearn, Joseph E.	1060708	Cultural Resources Assessment of Assessors Parcels Numbers 58506233 and 58506238, Yucca Valley Area	1978	Yucca Valley South
Coombs, Gary B.; McCarty, Richard; Shepperson, Tara; Dean, Sharon	1060719	The Archaeology of the Western Mojave (Class II Cultural Resources Inventory of the Calico, Kramer, Stoddard, Johnson-Morongo and 29 Palms Planning Units)	1979	Overview
SBCMA	1060748	Cultural Resources Assessment, Assessor's Parcels 588-031-01 and 588-031-02, Yucca Valley Area	1979	Yucca Valley South
SBCMA	1060767	Environmental Impact Analysis, Cultural Resources, AP 586-421-01, Yucca Valley	1979	Yucca Valley South
Hearn, Joseph E.	1060789	Cultural Resources Assessment of AP 595-371-10, Yucca Valley Area for Santa Anita Development Corporation	1979	Yucca Valley South
Simpson, Ruth D.	1060816	Cultural Resources Assessment: Parcel Number 1 of Parcel Map 2757, Yucca Valley Area	1979	Yucca Valley South
SBCMA	1060817	Cultural Resources Assessment: Assessor's Parcel Number 601-331-01, Yucca Valley Area	1979	Yucca Valley South
SBCMA	1060832	Cultural Resources Assessment: Yucca Valley Area	1980	Yucca Valley North
SBCMA	1060840	AP 595012393872, Cultural Resources Assessment, Yucca Valley Area	1979	Yucca Valley North, Yucca Valley South

Author	Doc. No.	Title	Date	USGS Quad
Simpson, Ruth D.	1060859	Cultural Resources Assessment: A Portion of Ex. 18, T1SR6E, Yucca Valley Area	1979	Yucca Valley South
SBCMA	1060862	Cultural Resources Assessment: Yucca Valley, California	1979	Joshua Tree North
Bean, Lowell J.; Brakke-Vane, Sylvia	1060878	Allen-Warner Valley Energy System: Western Transmission System Ethnographic and Historical Resources	1979	Overview
Stickel, E.G.; Weinman-Roberts, Lois J.	1060891	An Overview of the Cultural Resources of the Western Mojave Desert	1980	Overview
Simpson, Ruth D.	1060898	Cultural Resources Assessment, Sec. 12, T1S R5E, Yucca Valley	1980	Yucca Valley South
Simpson, Ruth D.	1060919	Cultural Resources Assessment, Tract no. 11024, Yucca Valley	1980	Yucca Valley North
Smith, Gerald A.	1060974	Cultural Resources Assessment, Sec. 18, T1S R6E, Yucca Valley Area	1980	Yucca Valley South
SBCMA	1060987	Cultural Resources Assessment: Burnt Mountain Club, Yucca Valley, California	1980	Yucca Valley South
SBCMA	1061042	Cultural Resources Assessment: Yucca Valley, Tentative Tract No. 11661	1980	Yucca Valley South
Smith, Gerald A.; Lerch, Michael K.	1061112	Cultural Resources Assessment of Tentative Tract No., 11917, Yucca Valley, California	1981	Yucca Valley South
Lerch, Michael K.	1061215	Cultural Resources Assessment of A.P. #601-071-11, Yucca Valley, San Bernardino County, California	1981	Yucca Valley North
Hammond, Stephen R.	1061241	Archaeological Survey Report: Proposed Drainage Improvement Project Along West Side of Route 247	1982	Yucca Valley North
Lerch, Michael K.	1061257	Cultural Resources Mitigation of CA SBR 4851, A.P. #601-071-11, Yucca Valley, San Bernardino County, California	1982	Yucca Valley North
Sutton, Mark	1061273	Cultural Assessment for High Desert Water District Water Tank, Yucca Valley	1982	Yucca Valley North
Lerch, Michael K.	1061390	Cultural Resources Assessment of Tentative Map 12410, Yucca Valley, San Bernardino County, California	1983	Yucca Valley South
Greene, Linda W.	1061408	Historic Resource Study: A History of Land Use in Joshua Tree National Monument	1983	Overview
Smith, Gerald A.; Simpson, Ruth D.; Lerch, Michael K.	1062002	Cultural Resources Assessment of Tract No. 10343, Rialto, California	1981	Overview
Mortland, Carol A.	1062158	Archaeological Impact Evaluation: Southern California Edison Proposed Generating Station in Upper Johnson Valley and Associated Transmission, Gas and Fuel	1974	Yucca Valley North

Author	Doc. No.	Title	Date	USGS Quad
		Routes		
Brown, Joan C.	1062478	Cultural Resources Reconnaissance of Twenty-Seven Acres Located in Yucca Valley, San Bernardino County, California	1991	Yucca Valley North
Sutton, Paula A.	1062523	Negative Archaeological Survey Report: Highway Project Route 247, Post Mile 5.4 to 6.2	1990	Yucca Valley North
Lerch, Michael K.	1062776	Class III Cultural Resources Inventory of the Hi-Desert Water District Supplemental Water Delivery and Management Plan, Yucca Valley, San Bernardino County, CA	1993	Yucca Valley North, Yucca Valley South
Love, Bruce	1063113	2 Parcels on SR-62	1995	Yucca Valley South
Hammond, Stephen; Love, Bruce	1063442	SR 62 – Park & Ride	1999	Yucca Valley South
Bonner, Wayne	1063908	Phase I Archaeological Field Survey for Cingular Wireless Site CM 457-02 Located at 4451 Old Woman Springs Road, Yucca Valley, San Bernardino County, CA	2002	Yucca Valley North
Love, Bruce Tang, Bai Hogan, Michael	1063909	Avalon Ave at SR-62	2000	Yucca Valley North
Buysse, Johnna L.; Smith, Brian F.	1063910	A Cultural Resources Impact Survey for the high Desert Water Recharge Site 6, Yucca Valley, CA	2001	Yucca Valley North
Mason, Roger D.	1063913	Cultural Resources Record Search & Literature Review for an AT&T Telecommunications Facility C589, Morongo Valley, in the City of Yucca Valley, San Bernardino County, CA	2001	Yucca Valley South
McKenna, Jeanette A.	1063915	Road Improvements to SR-62 Between La Honda and Dumosa Ave – In Two Segments	2003	Yucca Valley South
Tibbett, Casey	1064198	Identification & Evaluation of Historic Properties: Warren Valley Basin Groundwater Recharge Project, Town of Yucca Valley, San Bernardino County, CA	2004	Yucca Valley North, Yucca Valley South
Bean, Lowell; Brakke-Vane, Sylvia	1064477	The Native American Ethnography & Ethnohistory of Joshua Tree National Park: An Overview	2002	Overview
Warren, Claude N.; Schneider, Joan S.	1066289	Phase II: An Archaeological Inventory of Joshua Tree National Park: Description and Analyses of the Results of a Stratified Random Sample Inventory Conducted 1991-1992	2000	Overview

Author	Doc. No.	Title	Date	USGS Quad
Tang, Bai; Hogan, Michael	1066284	Historical/Archaeological Resources Survey Report: Yucca Valley Water System Infrastructure Improvements, Town of Yucca Valley, San Bernardino County, California	2000	Yucca Valley North, Yucca Valley South, Joshua Tree North, Joshua Tree South
Hinton, Sarah	1066252	Archaeological Clearance Survey Form	2003	Yucca Valley South
Tang, Bai Hogan, Michael	1065969	Identification and Evaluation of Historic Properties: Hi-Desert Water District Wastewater Treatment Plant, Town of Yucca Valley, San Bernardino County, California	2008	Yucca Valley North, Joshua Tree North, Joshua Tree South
Tang, Bai Hogan, Michael	1065968	Historical/Archaeological Resources Survey Report: Hi-Desert Water District Wastewater Treatment Plant, Town of Yucca Valley, San Bernardino County, California	2007	Yucca Valley North, Joshua Tree North
McKenna, Jeanette A.	1065965	RE: Record Search for the Proposed Yucca Valley County Day School, San Bernardino County, CA (Yucca Valley South 7.5' USGS Quadrangle; McKenna et al. Job 07.1283	2007	Yucca Valley South
Tsunoda Koji	1065963	Archaeological Survey Report for Southern California Edison Company Deteriorated Pole Replacement Program for Pole #A13721281E on Private land (WO#4750-0081, JO#2144) and Pole #A13721477E on Public Land Managed by San Bernardino County Flood Control (WO#4750-0081, JO#2145), on the Devers-High Desert Terawind-Yucca 115KV Circuit, San Bernardino County, California	2008	Yucca Valley South
Michael Brandman Associates	1065846	Cultural Resource Records Search Results and Site Visit for T-Mobile Telecommunications Facility Candidate IE24110A (Dunn), 7248 Joshua Lane, Yucca Valley, San Bernardino County, California	2007	Yucca Valley South
Brock, James	1065845	Phase I Archaeological and Historical Resources Assessment for TTM17862, Copper Hill Homes, Yucca Valley, San Bernardino County, California (GPA 06-01)	2007	Yucca Valley South
Michael Brandman Associates	1065844	Letter Report: Cultural and Paleontological Resource Monitoring at the Home Depot Project, Town of Yucca Valley, San Bernardino County, California. Mitigation Measure CR-1 and CR-2 Satisfied	2007	Yucca Valley North

Author	Doc. No.	Title	Date	USGS Quad
Tang, Bai; Hogan, Michael Wetherbee, Mathew; Ballester, Daniel	1065407	Historical/Archaeological Resources Survey Report: Mountain Vista at Western Hills Ranch, Town of Yucca Valley, San Bernardino, California	2005	Yucca Valley South
Tejada, Barbara S.	1064654	Archaeological Survey Report for the State Route 247 at Buena Vista Drive, Yucca Valley, San Bernardino County, California	2005	Yucca Valley North
Deur, Douglas	1066332	Joshua Tree National Park Traditional Use Study: The Rock Art of Joshua Tree National Park	2006	Overview
McKenna, Jeanette A.	1066388	A Phase I Cultural Resources Investigation of Two Pipeline Alignments for the San Bernardino County Special Districts Department, CSA 70, Zone W-4, Pioneertown and Landers, San Bernardino Co, California	2008	Yucca Valley North
McKenna, Jeanette A.	106390	A Phase I Cultural Resources Investigation for the Proposed Yucca Valley Community Day School Site in Yucca Valley, San Bernardino County, California	2008	Yucca Valley South
Northwest Economic Associates	1066498	Ethnographic Overview of the Northern San Bernardino Forest – Part A: The North	2004	Overview
Parr, Robert E.	1066823	Cultural Resource Assessment for the Replacement of Deteriorated Power Pole #240717S on the Southern California Edison Company Onaga 12 KV Circuit, Yucca Valley, San Bernardino County, California	2010	Joshua Tree North
Brock, James	1066846	Phase I Cultural Resources Assessment for a Proposed 39.4-Acre School Site, North Side of Buena Vista Avenue Between Indio Avenue and Yucca Mesa Road, Town of Yucca Valley, California (APNs 0598-084-16, -17, -18, -19, & -30)	2011	Yucca Valley North, Joshua Tree North
Bonner, Wayne H.	1066848	Cultural Resource Records Search and Site Visit Results for T-Mobile USA Candidate IE24275A (St. Mary's) 7495 Church Street, Yucca Valley, San Bernardino County, California (EBI Job No. 61104238)	2010	Yucca Valley South
Bonner, Wayne H.	1066849	Cultural Resource Records Search and Site Visit Results for T-Mobile USA Candidate IE242278-A (Joshua Springs), 57352 Joshua Lane, Yucca Valley, San Bernardino County, California	2010	Yucca Valley South

Author	Doc. No.	Title	Date	USGS Quad
CRM Tech	1066927	Identification and Evaluation of Historic Properties, Yucca Valley Wastewater System Infrastructure Improvements, Town of Yucca Valley, San Bernardino County, California	2011	Yucca Valley North, Yucca Valley South, Joshua Tree North, Joshua Tree South

APPENDIX F: NATIVE AMERICAN HERITAGE COMMISSION

STATE OF CALIFORNIA Edmund G. Brown, Jr., Governor

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-6251
Fax (916) 657-5390
Web Site www.nahc.ca.gov
ds_nahc@pacbell.net

December 5, 2011

Ms. Sherri Gust, RPA, Principal
Cogstone Resource Management
1518 W. Taft Avenue
Orange, CA 92865

Sent by FAX to: 714-974-8303
No. of Pages: 5

Re: Sacred Lands File Search and Native American Contacts list for the **"Proposed Yucca Valley General Plan Update Project No. 2179;"** located in the Yucca Valley area of San Bernardino County, California

Dear Mr. Gust:

The Native American Heritage Commission (NAHC) conducted a Sacred Lands File search of the 'area of potential effect,' (APE) based on the USGS coordinates provided and **Native American cultural resources were not identified** in the project area of potential effect (e.g. APE): you specified. Also, please note; the NAHC Sacred Lands Inventory is not exhaustive and does not preclude the discovery of cultural resources during any project groundbreaking activity.

This project is subject to California Government Code §§65352.3, 65352.4 *et seq.*

California Public Resources Code §§5097.94 (a) and 5097.96 authorize the NAHC to establish a Sacred Land Inventory to record Native American sacred sites and burial sites. These records are exempt from the provisions of the California Public Records Act pursuant to. California Government Code §6254 (r). The purpose of this code is to protect such sites from vandalism, theft and destruction.

In the 1985 Appellate Court decision (170 Cal App 3rd 604), the court held that the NAHC has jurisdiction and special expertise, as a state agency, over affected Native American resources, impacted by proposed projects including archaeological, places of religious significance to Native Americans and burial sites

The California Environmental Quality Act (CEQA – CA Public Resources Code §§ 21000-21177, amendments effective 3/18/2010) requires that any project that causes a substantial adverse change in the significance of an historical resource, that includes archaeological resources, is a 'significant effect' requiring the preparation of an Environmental Impact Report (EIR) per the CEQA Guidelines defines a significant impact on the environment as 'a substantial, or potentially substantial, adverse change in any of physical conditions within an area affected by the proposed project, including ...objects of historic or aesthetic significance." In order to comply with this provision, the lead agency is required to assess whether the project will have an adverse impact on these resources within the 'area of potential

effect (APE), and if so, to mitigate that effect. CA Government Code §65040.12(e) defines "environmental justice" provisions and is applicable to the environmental review processes.

Early consultation with Native American tribes in your area is the best way to avoid unanticipated discoveries once a project is underway. Local Native Americans may have knowledge of the religious and cultural significance of the historic properties of the proposed project for the area (e.g. APE). Consultation with Native American communities is also a matter of environmental justice as defined by California Government Code §65040.12(e). We urge consultation with those tribes and interested Native Americans on the list the NAHC has attached in order to see if your proposed project might impact Native American cultural resources. Lead agencies should consider avoidance as defined in §15370 of the CEQA Guidelines when significant cultural resources as defined by the CEQA Guidelines §15064.5 (b)(c)(f) may be affected by a proposed project. If so, Section 15382 of the CEQA Guidelines defines a significant impact on the environment as "substantial," and Section 2183.2 which requires documentation, data recovery of cultural resources.

The 1992 *Secretary of the Interiors Standards for the Treatment of Historic Properties* were revised so that they could be applied to all historic resource types included in the National Register of Historic Places and including cultural landscapes. Also, federal Executive Orders Nos. 11593 (preservation of cultural environment), 13175 (coordination & consultation) and 13007 (Sacred Sites) are helpful, supportive guides for Section 106 consultation. The aforementioned Secretary of the Interior's *Standards* include recommendations for all 'lead agencies' to consider the historic context of proposed projects and to "research" the cultural landscape that might include the 'area of potential effect.'

Partnering with local tribes and interested Native American consulting parties, on the NAHC list, should be conducted in compliance with the requirements of federal NEPA (42 U.S.C 4321-43351) and Section 106 4(f), Section 110 (f)(k) of federal NHPA (16 U.S.C. 470 *et seq*), 36 CFR Part 800.3 (f) (2) & .5, the President's Council on Environmental Quality (CSQ, 42 U.S.C 4371 *et seq*. and NAGPRA (25 U.S.C. 3001-3013) as appropriate. The 1992 *Secretary of the Interiors Standards for the Treatment of Historic Properties* were revised so that they could be applied to all historic resource types included in the National Register of Historic Places and including cultural landscapes. Also, federal Executive Orders Nos. 11593 (preservation of cultural environment), 13175 (coordination & consultation) and 13007 (Sacred Sites) are helpful, supportive guides for Section 106 consultation. The NAHC remains concerned about the limitations and methods employed for NHPA Section 106 Consultation.

Also, California Public Resources Code Section 5097.98, California Government Code §27491 and Health & Safety Code Section 7050.5 provide for provisions for accidentally discovered archeological resources during construction and mandate the processes to be followed in the event of an accidental discovery of any human remains in a project location other than a 'dedicated cemetery', another important reason to have Native American Monitors on board with the project.

To be effective, consultation on specific projects must be the result of an ongoing relationship between Native American tribes and lead agencies, project proponents and their contractors, in the opinion of the NAHC. An excellent way to reinforce the relationship between a project and local tribes is to employ Native American Monitors in all phases of proposed projects including the planning phases.

Confidentiality of "historic properties of religious and cultural significance" may also be protected under Section 304 of he NHPA or at the Secretary of the Interior discretion if not

eligible for listing on the National Register of Historic Places. The Secretary may also be advised by the federal Indian Religious Freedom Act (cf. 42 U.S.C., 1996) in issuing a decision on whether or not to disclose items of religious and/or cultural significance identified in or near the APE and possibility threatened by proposed project activity.

If you have any questions about this response to your request, please do not hesitate to contact me at (916) 653-6251.

Sincerely,

Dave Singleton

Attachment: Native American Contact List

California Native American Contacts
San Bernardino County
December 5, 2011

Ramona Band of Cahuilla Mission Indians
Joseph Hamilton, Chairman
P.O. Box 391670 Cahuilla
Anza , CA 92539
admin@ramonatribe.com
(951) 763-4105
(951) 763-4325 Fax

San Manuel Band of Mission Indians
James Ramos, Chairperson
26569 Community Center Drive Serrano
Highland , CA 92346
(909) 864-8933
(909) 864-3724 - FAX
(909) 864-3370 Fax

Twenty-Nine Palms Band of Mission Indians
Darrell Mike, Chairperson
46-200 Harrison Place Chemehuevi
Coachella , CA 92236
tribal-epa@worldnet.att.net
(760) 775-5566
(760) 808-0409 - cell - EPA
(760) 775-4639 Fax

Joseph R. Benitez (Mike)
P.O. Box 1829 Chemehuevi
Indio , CA 92201
(760) 347-0488
(760) 408-4089 - cell

Chemehuevi Reservation
Charles Wood, Chairperson
P.O. Box 1976 Chemehuevi
Chemehuevi Valley CA 92363
chair1cit@yahoo.com
(760) 858-4301
(760) 858-5400 Fax

Fort Mojave Indian Tribe
Tim Williams, Chairperson
500 Merriman Ave Mojave
Needles , CA 92363
(760) 629-4591
(760) 629-5767 Fax

Colorado River Indian Tribe
Ginger Scott, Museum Curator; George Ray, Coor
26600 Mojave Road Mojave
Parker , AZ 85344 Chemehuevi
crit.museum@yahoo.com
(928) 669-9211-Tribal Office
(928) 669-8970 ext 21
(928) 669-1925 Fax

AhaMaKav Cultural Society, Fort Mojave Indian
Linda Otero, Director
P.O. Box 5990 Mojave
Mohave Valley AZ 86440
(928) 768-4475
LindaOtero@fortmojave.com
(928) 768-7996 Fax

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is applicable for contacting local Native Americans with regard to cultural resources for the proposed Yucca Valley General Plan Update Project No. 2179; located in the Yucca Valley area of San Bernardino County, California for which a Sacred Lands File search and Native American Contacts list were requested.

California Native American Contacts
San Bernardino County
December 5, 2011

Morongo Band of Mission Indians
Michael Contreras, Cultural Heritage Prog.
12700 Pumarra Road Cahuilla
Banning , CA 92220 Serrano
(951) 201-1866 - cell
mcontreras@morongo-nsn.gov
(951) 922-0105 Fax

San Manuel Band of Mission Indians
Ann Brierty, Policy/Cultural Resources Departmen
26569 Community Center. Drive Serrano
Highland , CA 92346
(909) 864-8933, Ext 3250
abrierty@sanmanuel-nsn.gov
(909) 862-5152 Fax

Serrano Nation of Indians
Goldie Walker
P.O. Box 343 Serrano
Patton , CA 92369

(909) 862-9883

Ernest H. Siva
Morongo Band of Mission Indians Tribal Elder
9570 Mias Canyon Road Serrano
Banning , CA 92220 Cahuilla
siva@dishmail.com
(951) 849-4676

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is applicable for contacting local Native Americans with regard to cultural resources for the proposed Yucca Valley General Plan Update Project No. 2179; located in the Yucca Valley area of San Bernardino County, California for which a Sacred Lands File search and Native American Contacts list were requested.

APPENDIX G: NATIVE AMERICAN OUTREACH

cogstone
PALEONTOLOGY - ARCHAEOLOGY - HISTORY

December 7, 2011

Dear Sir or Madam,

A project is proposed for the general plan update of the City of Yucca Valley, San Bernardino County, California. A map of the project location and all other information are provided.

The Native American Heritage Commission was contacted on December 2, 2001 to perform a search of the Sacred Lands file. The NAHC has no record of Native American sacred sites in the immediate vicinity of the project area. The NAHC also provided to us a list of Native American individuals/organizations that may have knowledge of cultural resources within the project area and recommended that we contact you, among others.

In an effort to evaluate cultural resources, I am requesting any information not contained in the present NAHC database. I would appreciate it if you could notify me if you have records of any sacred lands or other heritage sites that might be impacted by the proposed project. All information provided regarding cultural and historic sites or other areas of concern would be treated as confidential material. We need your response within 2 weeks to meet the deadline for our report. You can email or fax your response if you like (amy@cogstone.com or number below). Thank you for your assistance.

Sincerely,

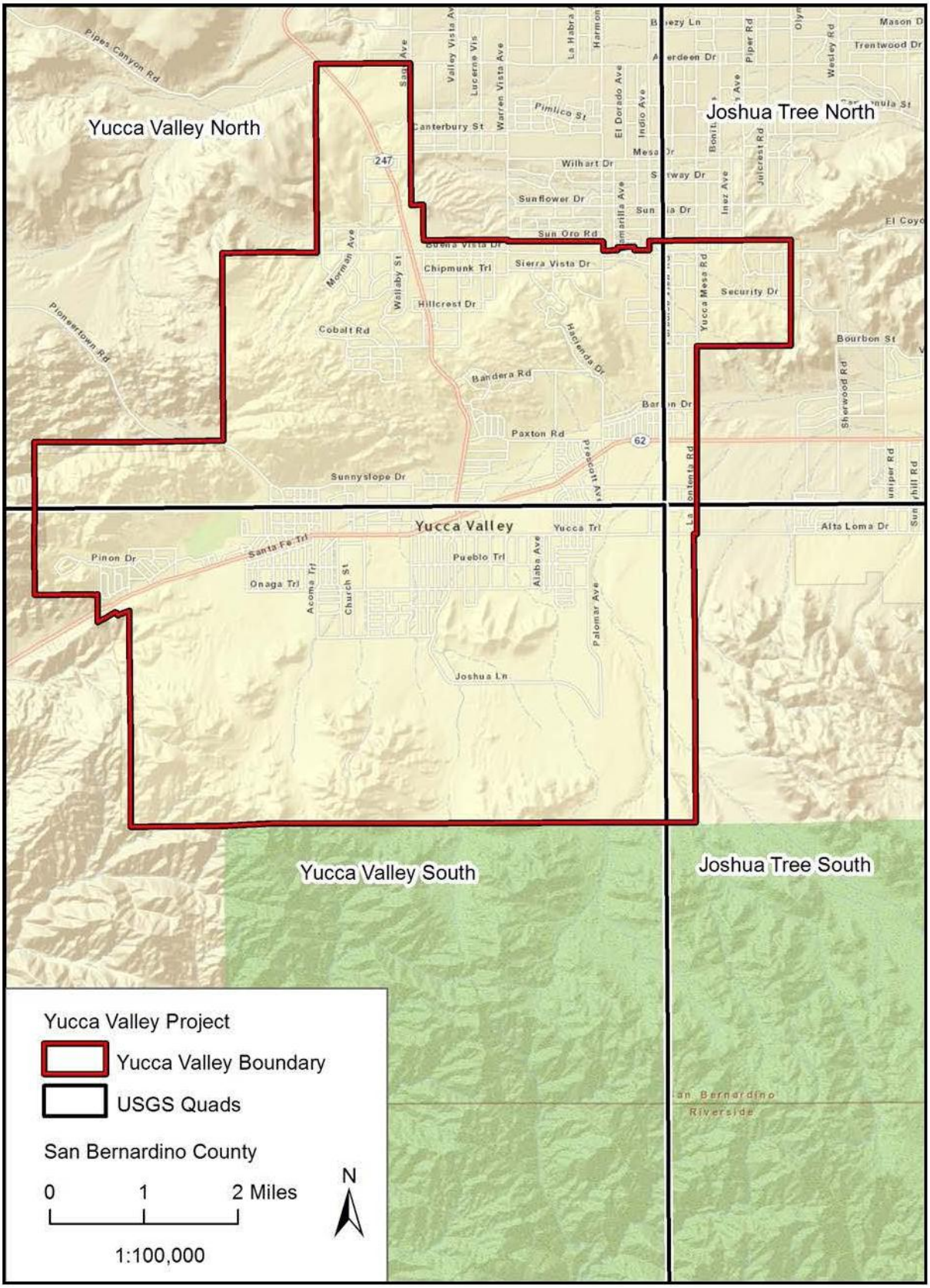
Amy Glover
Lab Supervisor
Cogstone Resource Management Inc.

1518 West Taft Avenue
Orange, CA 92865
Office (714) 974-8300
Toll free (888) 497-0700

Branch Offices
West Sacramento - Morro Bay - Inland Empire

cogstone.com

COGSTONE CULTURAL RESOURCES INFO REQUEST	
DATE	12/02/2011
COGSTONE PROJECT NUMBER:	2179
COGSTONE PROJECT NAME:	Yucca Valley
DESCRIPTION:	Yucca Valley General Plan Update
USGS 7.5' QUAD:	Yucca Valley North 1972 PR 1979 Yucca Valley South 1972 Joshua Tree North 1972 Joshua Tree South 1972
COUNTY:	San Bernardino
TOWNSHIP/SECTION:	T 1N R 5E Sec 11, 14, 22, 23, 24, 25, 26, 27,32, 33, 34, 35, 36, T 1N R 6E Sec 19, 20, 21, 29, 30, 31, 32 T 1S R 5E Sec 1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 14, 15, 16 T 1S R 6E Sec 5, 6, 7, 8, 17, 18
ACRES:	25,470 acres
TYPE OF SEARCH:	Sacred Sites
map attached	√
Thank you.	
Please Mail to:	Sherri Gust 1518 W. Taft Ave. Orange, CA 92865 (714) 974-8303 fax admin@cogstone.com


Yucca Valley North
Joshua Tree North
Yucca Valley
Yucca Valley South
Joshua Tree South
Yucca Valley Project
Yucca Valley Boundary
USGS Quads
San Bernardino County
0
1
2 Miles
1:100,000
N

APPENDIX H: NATIVE AMERICAN CONTACT LOG

Native American Group/Individual	**Date(s) of First Contact Attempt**	**Date(s) of Replies Rec'd**	**Date(s) of 2nd Contact Attempt**	**Date(s) of 3rd Contact Attempt**	**Comments**
Ramona Band of Cahuilla Mission Indians, Joseph Hamilton	12/7/2011	N/A	12/28/2011	1/5/2012	On December 7, 2011 a letter and map detailing the project location were mailed to Mr. Hamilton. When no response was received, two emails were sent and no responses were received.
San Manuel Band of Mission Indians, James Ramos	12/7/2011	N/A	12/28/2011	1/5/2012	On December 7, 2011 a letter and map detailing the project location were mailed to Mr. Ramos. When no response was received, two phone calls were placed and two messages were left. No responses were received.
Twenty-Nine Palms Band of Mission Indians, Darrell Mike	12/7/2011	N/A	12/28/2011	1/5/2012	On December 7, 2011 a letter and map detailing the project location were mailed to Mr. Mike. When no response was received, two emails were sent and no responses were received.
Joseph R. Benitez	12/7/2011	N/A	12/28/2011	1/5/2012	On December 7, 2011 a letter and map detailing the project location were mailed to Mr. Benitez. When no response was received, two phone calls were placed and two messages were left. No responses were received.
Chemehuevi Reservation, Charles Wood	12/7/2011	N/A	12/28/2011	1/5/2012	On December 7, 2011 a letter and map detailing the project location were mailed to Mr. Wood. When no response was received, two emails were sent and no responses were received.
Fort Mojave Indian Tribe, Tim Williams	12/7/2011	N/A	12/28/2011	1/5/2012	On December 7, 2011 a letter and map detailing the project location were mailed to Mr. Williams. When no response was received, two phone calls were placed and two messages were left. No responses were received.
Colorado River Indian Tribe, Ginger Scott	12/7/2011	N/A	12/28/2011	1/5/2012	On December 7, 2011 a letter and map detailing the project location were mailed to Ms. Scott. When no response was received, two emails were sent and no responses were received.

Native American Group/Individual	**Date(s) of First Contact Attempt**	**Date(s) of Replies Rec'd**	**Date(s) of 2nd Contact Attempt**	**Date(s) of 3rd Contact Attempt**	**Comments**
AhaMaKav Cultural Society, Linda Otero	12/7/2011	N/A	12/28/2011	1/5/2012	On December 7, 2011 a letter and map detailing the project location were mailed to Ms. Otero. When no response was received, two emails were sent and no responses were received.
Morongo Band of Mission Indians, Michael Contreras	12/7/2011	N/A	12/28/2011	1/5/2012	On December 7, 2011 a letter and map detailing the project location were mailed to Mr. Contreras. When no response was received, two emails were sent and no responses were received.
San Manuel Band of Mission Indians, Ann Brierty	12/7/2011	N/A	12/28/2011	1/5/2012	On December 7, 2011 a letter and map detailing the project location were mailed to Ms. Brierty. When no response was received, two emails were sent and no responses were received.
Serrano Nation of Indians, Goldie Walker	12/7/2011	N/A	12/28/2011	1/5/2012	On December 7, 2011 a letter and map detailing the project location were mailed to Ms. Walker. When no response was received, two phone calls were placed and two messages were left. No responses were received.
Morongo Band of Mission Indians, Ernest H. Siva	12/7/2011	N/A	12/28/2011	1/5/2012	On December 7, 2011 a letter and map detailing the project location were mailed to Mr. Siva. When no response was received, two emails were sent and no responses were received.

Appendix F

Technical Background Report to the Safety Element

Appendices

This page intentionally left blank.

TECHNICAL BACKGROUND REPORT
to the SAFETY ELEMENT
of the

YUCCA VALLEY
GENERAL PLAN

SEISMIC HAZARDS
GEOLOGIC HAZARDS
FLOOD HAZARDS
FIRE HAZARDS
HAZARDOUS MATERIALS MANAGEMENT
SEVERE WEATHER HAZARDS

Prepared by:

Earth Consultants International

1642 E. Fourth Street, Santa Ana, California 92701
(714) 544-5321 & (714) 412-2654

September 2012

TABLE OF CONTENTS

Section **Page No.**

CHAPTER 1: SEISMIC HAZARDS 1-1
1.1 SEISMIC CONTEXT – EARTHQUAKE BASICS 1-1
1.2 REGULATORY CONTEXT 1-8
1.2.1 Alquist-Priolo Earthquake Fault Zoning Act 1-8
1.2.2 Seismic Hazards Mapping Act 1-9
1.2.3 California Building Code 1-9
1.2.4 Unreinforced Masonry Law 1-10
1.2.5 Real Estate Disclosure Requirements 1-11
1.2.6 California Environmental Quality Act 1-12
1.3 NOTABLE PAST EARTHQUAKES 1-12
1.3.1 Wrightwood Earthquake of December 8, 1812 1-12
1.3.2 San Jacinto Earthquake of 1899 1-14
1.3.3 San Jacinto Earthquake of 1918 1-14
1.3.4 North San Jacinto Fault Earthquake of 1923 1-14
1.3.5 Long Beach Earthquake of 1933 1-15
1.3.6 Desert Hot Springs Earthquake of 1948 1-15
1.3.7 Borrego Mountain Earthquake of 1968 1-15
1.3.8 San Fernando (Sylmar) Earthquake of 1971 1-16
1.3.9 Homestead Valley Earthquake Sequence of 1979 1-16
1.3.10 North Palm Springs Earthquake of 1986 1-17
1.3.11 Joshua Tree Earthquake of 1992 1-17
1.3.12 Landers Earthquake of 1992 1-17
1.3.13 Big Bear Earthquake of 1992 1-18
1.3.14 Northridge Earthquake of 1994 1-18
1.3.15 Hector Mine Earthquake of 1999 1-18
1.3.16 Baja California Earthquake of 2010 1-19
1.4 SEISMIC GROUND SHAKING 1-20
1.4.1 Pinto Mountain Fault Zone 1-26
1.4.2 Burnt Mountain Fault 1-27
1.4.3 Eureka Peak Fault 1-27
1.4.4 Landers (or Kickapoo) Fault 1-28
1.4.5 Emerson South – Copper Mountain Fault Zone 1-28
1.4.6 North Frontal Fault 1-29
1.4.7 Johnson Valley Fault 1-29
1.4.8 San Andreas Fault Zone 1-29
1.4.9 Calico – Hidalgo Fault Zone 1-33
1.4.10 Pisgah – Bullion Mountain – Mesquite Lake Fault Zone 1-34
1.4.11 Lenwood – Lockhart – Old Woman Springs Faults 1-34
1.4.12 Helendale – South Lockhart Fault 1-35
1.5 SURFACE FAULT RUPTURE 1-36
1.5.1 Definitions 1-36
1.5.2 Faults in the Town of Yucca Valley Area 1-37
1.5.2.1 Pinto Mountain Fault Zone 1-39
1.5.2.2 Burnt Mountain Fault 1-40
1.5.2.3 Eureka Peak Fault 1-41
1.5.2.4 Lower Covington Flat Fault 1-41
1.5.2.5 Southern Johnson Valley Fault 1-42
1.5.3 Mitigation of Primary Fault Rupture 1-42

TABLE OF CONTENTS (Continued)

Section Page No.

1.6 GROUND FAILURE DUE TO EARTHQUAKE SHAKING 1-44
1.6.1 Liquefaction 1-44
1.6.2 Earthquake-Induced Slope Failure 1-46
1.6.3 Seismically Induced Settlement 1-52
1.6.4 Deformation of Sidehill Fills 1-52
1.6.5 Ridgetop Fissuring and Shattering 1-53
1.7 OTHER POTENTIAL SEISMIC HAZARDS 1-53
1.7.1 Seiches 1-53
1.7.2 Tsunami 1-54
1.8 VULNERABILITY OF STRUCTURES TO EARTHQUAKE DAMAGE 1-55
1.8.1 Unreinforced Masonry Structures 1-60
1.8.2 Soft-Story Buildings 1-60
1.8.3 Wood-Frame Structures 1-60
1.8.4 Pre-Cast Concrete Structures 1-61
1.8.5 Tilt-up Buildings 1-61
1.8.6 Reinforced Concrete Frame Buildings 1-62
1.8.7 Multi-Story Steel Frame Buildings 1-62
1.8.8 Mobile Homes 1-62
1.8.9 Combination Types 1-62
1.9 SUMMARY AND RECOMMENDATIONS 1-63

CHAPTER 2: GEOLOGIC HAZARDS 2-1
2.1 PHYSIOGRAPHIC SETTING 2-1
2.2 GEOLOGIC SETTING 2-1
2.3 GEOLOGIC UNITS AND THEIR ENGINEERING PROPERTIES 2-2
2.3.1 Sedimentary Deposits 2-3
2.3.1.1 Surficial Sediments 2-3
2.3.1.2 Sedimentary Rock (Map Symbol: Ts) 2-7
2.3.2 Crystalline Rocks 2-7
2.3.2.1 Volcanic Rocks 2-7
2.3.2.2 Metamorphic Rocks 2-10
2.4 GEOLOGIC HAZARDS IN THE YUCCA VALLEY AREA 2-11
2.4.1 Slope Instability 2-11
2.4.1.1 Types of Slope Failures 2-11
2.4.1.2 Susceptibility to Slope Failure 2-15
2.4.1.3 Mitigation of Slope Instability in Future Development 2-15
2.4.1.4 Mitigation of Slope Instability in Existing Development 2-17
2.4.2 Compressible Soils 2-18
2.4.3 Collapsible Soils 2-18
2.4.4 Expansive Soils 2-19
2.4.5 Corrosive Soils 2-19
2.4.6 Land Subsidence due to Groundwater Withdrawal 2-20
2.4.6.1 Subsidence in Yucca Valley 2-21
2.4.6.2 Prevention of Subsidence 2-22
2.4.7 Erosion and Sedimentation 2-23
2.5 SUMMARY OF ISSUES 2-24

CHAPTER 3: FLOOD HAZARDS 3-1
3.1 STORM FLOODING 3-1
3.1.1 Hydrologic and Geomorphic Setting 3-1

TABLE OF CONTENTS (Continued)

Section Page No.

3.1.2 Weather and Climate 3-2
3.1.3 Past Flooding 3-5
3.1.4 National Flood Insurance Program (NFIP) 3-7
3.1.5 FEMA Flood Zone Mapping 3-9
3.1.6 Flood Zone Mapping in the Town of Yucca Valley 3-12
3.1.7 Flood Management Policies 3-15
3.1.8 Existing Flood Control 3-16
3.1.9 Future Flood Control 3-16
3.1.10 Flood Protection Measures for Property Owners 3-18
3.1.11 Bridge Scour and Flood Channel Crossings 3-19
3.2 SEISMICALLY INDUCED INUNDATION 3-20
3.2.1 Dam Failure 3-20
3.2.2 Inundation From Above-Ground Storage Tanks 3-20
3.3 SUMMARY 3-21

CHAPTER 4: FIRE HAZARDS 4-1
4.1 WILDFIRES 4-1
4.1.1 Local Characteristics and History on Local Fires 4-3
4.1.1.1 Fuel Loads and Topography 4-4
4.1.1.2 Weather 4-5
4.1.1.3 Wildfire History 4-6
4.1.2 Regulatory Context and Fire Risk Areas 4-8
4.1.2.1 HUD Study System 4-9
4.1.2.2 California Department of Forestry and Fire Protection – State Responsibility Areas System 4-9
4.1.2.3 Bates Bill Process 4-10
4.1.2.4 California Fire Plan 4-10
4.1.2.5 National Fire Plan 4-12
4.1.2.6 California Fire Alliance (CFA) 4-13
4.1.2.7 Real-Estate Disclosure Requirements 4-13
4.1.3 Fire Prevention and Suppression Programs and Regulations 4-15
4.1.3.1 Vegetation Management 4-15
4.1.3.2 Notification and Abatement 4-17
4.1.3.3 Building to Reduce the Fire Hazard 4-17
4.1.3.4 Restricted Public Access 4-20
4.1.3.5 Fire Safety Education 4-21
4.2 STRUCTURE FIRES 4-22
4.2.1 Target Fire Hazards and Standards of Coverage 4-24
4.2.2 Regulatory Context 4-25
4.3 FIRE SUPPRESSION SERVICES 4-27
4.3.1 Response Objectives and Statistics 4-28
4.3.2 Automatic and Mutual Aid Agreements 4-30
4.3.3 Standardized Emergency Management System (SEMS) and National Incident Management System (NIMS) 4-32
4.4 CHEMICAL FIRES 4-35
4.5 FIRES FOLLOWING EARTHQUAKES 4-36
4.6 SUMMARY AND RECOMMENDED PROGRAMS 4-38

CHAPTER 5: HAZARDOUS MATERIALS MANAGEMENT 5-1
5.1 SETTING AND DEFINITIONS 5-1

TABLE OF CONTENTS (Continued)

Section Page No.

5.2 REGULATORY CONTEXT AND LISTS OF SITES 5-1
5.2.1 Federal Clean Water Act (33 U.S.C §1251 et seq., 1972) and California Water Code. 5-1
5.2.2 Comprehensive Environmental Response, Compensation and Liability Act 5-4
5.2.3 Emergency Planning and Community Right-To-Know Act (EPCRA) 5-6
5.2.4 Resources Conservation and Recovery Act 5-7
5.2.5 Cortese List 5-9
5.2.6 Hazardous Materials Disclosure Program 5-10
5.2.7 Hazardous Materials Incident Response 5-13
5.2.8 Hazardous Material Spill/Release Notification Guidance 5-15
5.3 LEAKING UNDERGROUND STORAGE TANKS (LUSTS) 5-19
5.4 DRINKING WATER QUALITY 5-19
5.4.1 Contaminants of Concern in Groundwater 5-19
5.4.1.1 Coliform 5-19
5.4.1.2 Perchlorate 5-20
5.4.1.3 Arsenic 4-21
5.4.1.4 Nitrate and Nitrite 4-22
5.4.1.5 Hexavalent Chromium 4-22
5.5 HOUSEHOLD HAZARDOUS WASTE AND RECYCLING 5-23
5.6 RELEASES DUE TO TRANSPORTATION ACCIDENTS AND PIPELINE FAILURES 5-25
5.7 EARTHQUAKE-INDUCED RELEASES OF HAZARDOUS MATERIALS 5-27
5.8 OTHER POTENTIAL HAZARDOUS MATERIALS RELEASE INCIDENTS 5-29
5.9 HAZARD ANALYSIS 5-29
5.10 SUMMARY OF FINDINGS 5-30

CHAPTER 6: SEVERE WEATHER HAZARDS 6-1
6.1 HIGH WINDS 6-1
6.1.1 Definitions and Setting. 6-2
6.1.2 Types of High Winds in Southern California 6-2
6.1.2.1 Santa Ana WInds 6-2
6.1.2.2 Thunderstorm-Related Tornadoes 6-3
6.1.2.3 Macrobursts and Microbursts 6-6
6.1.2.4 Dust Storms 6-7
6.1.3 Historic Southern California Windstorms 6-7
6.2 OTHER EXTREME WEATHER EVENTS 6-23
6.2.1 Hail 6-23
6.2.2 Heavy Snow and Ice 6-24
6.2.3 Temperature Extremes. 6-29
6.3 COMMUNITY VULNERABILITY TO SEVERE WEATHER DAMAGE 6-34
6.3.1 Hazards Assessment Summary. 6-34
6.3.1.1 Windstorms 6-34
6.3.1.2 Hail 6-35
6.3.1.3 Heavy Snow and Ice 6-36
6.3.1.4 Temperature Extremes 6-36
6.3.2 Damage Assessment 6-37
6.3.2.1 Structural Damage 6-38
6.3.2.2 Lifelines and Critical Facilities 6-38
6.3.2.3 Infrastructure 6-39

TABLE OF CONTENTS (Continued)

Section Page No.

APPENDICES

APPENDIX A: REFERENCES A-1
APPENDIX B: GLOSSARY B-1

FIGURES, TABLES AND PLATES

Figure 1-1: Regional Fault Map 1-3
Figure 1-2: Local Active and Potentially Active Faults 1-5
Figure 1-3: Notable Regional Earthquakes 1-13
Figure 1-4: ShakeMap for a Magnitude 7.8 Earthquake Scenario on the Southern San Andreas Fault 1-25
Figure 1-5: Modified Mercalli Intensity ShakeMap for the June 28, 1992 Landers Earthquake 1-26
Figure 1-6: View of Steep Slope of the Sawtooth Mountains Showing Abundant Rounded Boulders, Many of Them Perched Atop Other Boulders 1-49

Figure 3-1: Yucca Valley's Dry, Arid Landscape is Deceiving 3-7

Figure 4-1: View of the Cedar Fire of October 2003 Moving Down Oak Canyon, Toward the 52 Freeway, in San Diego County 4-2
Figure 4-2: View of a Backfire to the Station Fire Behind Homes in La Crescenta 4-3
Figure 4-3: Typical Fuel Loads in the Yucca Valley Region 4-4

Figure 6-1: View from Space of Smoke from the October 2003 Fires in Southern California Carried Offshore by Strong Santa Ana Winds 6-4
Figure 6-2: View of a Tornado 6-4

Table 1-1: Abridged Modified Mercalli Intensity Scale 1-6
Table 1-2: Estimated Horizontal Peak Ground Accelerations and Seismic Intensities in the Town of Yucca Valley Area 1-23
Table 1-3: Earthquake-Induced Slope Failures in Arid Environments 1-51
Table 1-4: Seismic Source Type 1-59

Table 2-1: General Slope Instability Potential Within Yucca Valley 2-15

Table 3-1: Average Annual Rainfall by Month for the Twentynine Palms Weather Station 3-3
Table 3-2: Average Annual Rainfall by Month for the Morongo Valley Weather Station 3-3
Table 3-3: Above-ground Water Tanks in the Yucca Valley General Plan Area 3-21

Table 4-1: Response Statistics for the Yucca Valley Fire Stations for Fiscal Years 2009 to 2012 4-23
Table 4-2: Fire Stations In and Near the Town of Yucca Valley 4-28

Table 5-1: EPA-Registered Small- and Large-Quantity Generators of Hazardous Materials in the Town of Yucca Valley 5-8
Table 5-2: Leaking Underground Fuel Tanks Reported in the Town of Yucca Valley 5-18
Table 5-3: Regional Household Hazardous Waste Collection Centers 5-24

TABLE OF CONTENTS (Continued)

Section **Page No.**

Table 5-4: Active Landfills, Transfer Stations, and Land Disposal Sites Near the Town of Yucca Valley 5-24
Table 5-5: Routes Through Yucca Valley and Surrounding Areas Used to Transport Hazardous Materials and Explosives 5-25

Table 6-1: The Beaufort Scale 6-2
Table 6-2: The Fujita-Pearson Tornado Damage Scale 6-5
Table 6-3: Enhanced Fujita Scale 6-6
Table 6-4: Major Southern California Windstorms (1858-2011) and Strong Winds Reported in the Yucca Valley Area (1973-October 2011) 6-8
Table 6-5: Tornadoes and Funnel Clouds Reported In and Near San Bernardino County Between 1914 and 2011 6-18
Table 6-6: Dust Storms Reported in San Bernardino County Between 1989 and 2011 6-21
Table 6-7: Hail Events In the Yucca Valley Area Between 1956 and 2011 6-23
Table 6-8: Significant Heavy Snow and Ice Events in Southern California That Likely Impacted the Yucca Valley Area Between 1948 and 2010 6-25
Table 6-9: Historical High Heat, Excessive Heat and Extreme Cold Events Reported in Southern California that Impacted or Are Inferred to Have Impacted the Yucca Valley Area 6-31

Plate 1-1: Faults and Historical (1800-2011) Seismicity Map 1-21
Plate 1-2: Fault Map 1-38
Plate 1-3: Seismic Hazard Zones 1-47
Plate 1-4a: Engineering Site Classes 1-57
Plate 1-4b: Site Class Definitions (Based on Soil Profile Types) (from CBC, 2010) 1-58

Plate 2-1a: Geologic Map 2-4
Plate 2-1b: Explanation for Geologic Map 2-5
Plate 2-2a: Engineering Materials Map 2-8
Plate 2-2b: Explanation for Engineering Materials Map 2-9
Plate 2-3: Slope Distribution Map 2-14

Plate 3-1a: Flood Hazard Map 3-13
Plate 3-1b: Flood Hazard Map, Yucca Wash Area 3-14

Plate 4-1: Historical Wildland Fires (1910-2008) in and Near Yucca Valley 4-8
Plate 4-2: High Fire Hazard Areas in and Near Yucca Valley 4-11

Plate 5-1: Hazardous Materials Site Map 5-5

CHAPTER 1: SEISMIC HAZARDS

Earthquake-triggered geologic effects include ground shaking, surface fault rupture, landslides, liquefaction, subsidence, tsunamis and seiches. Some of these hazards can occur in the Town of Yucca Valley, as discussed in detail below. Earthquakes can also lead to reservoir failures, urban fires, and toxic chemical releases. Where appropriate, and if applicable to Yucca Valley, these hazards are discussed in Chapters 3, 4 and 5, respectively.

In seismically active southern California, an earthquake has the potential to cause far-reaching loss of life or property, and economic damage. This is so because damaging earthquakes are relatively frequent, affect widespread areas, trigger many secondary effects, and can overwhelm the ability of local jurisdictions to respond. Although it is not possible to prevent earthquakes, their destructive effects can be minimized. Comprehensive hazard mitigation programs that include the identification and mapping of hazards, prudent planning, public education, emergency exercises, enforcement of building codes, and expedient retrofitting and rehabilitation of weak structures can significantly reduce the scope of an earthquake's effects and avoid disaster. The record shows that local government, emergency relief organizations, and residents can and must take action to develop and implement policies and programs to reduce the effects of earthquakes. Thus, this document not only discusses the potential hazards that can impact the Town of Yucca Valley, but also provides action items and programs that can help the Town become more self-sufficient in the event of an earthquake.

1.1 Seismic Context – Earthquake Basics

The outer 10 to 70 kilometers of the Earth consist of enormous blocks of moving rock referred to as ***tectonic plates***. There are about a dozen major plates, which slowly collide, separate, and grind past each other. In the uppermost brittle portion of the plates, friction locks the plate edges together, while plastic movement continues at depth. Consequently, the near-surface rocks bend and deform near plate boundaries, storing strain energy. Eventually, the frictional forces are overcome and the locked portions of the plates move. The stored strain energy is then released in seismic waves that radiate out in all directions from the rupture surface causing the Earth to vibrate and shake as the waves travel through. This shaking is what we feel in an earthquake. Most earthquakes occur on or near plate boundaries. Southern California has many earthquakes because it straddles the boundary between the North American and Pacific plates, and fault rupture accommodates their motion.

By definition, the break or fracture between moving blocks of rock is called a ***fault***, and such differential movement produces a fault rupture. Few faults are simple, planar breaks in the Earth. They more often consist of smaller strands, with a similar orientation and sense of movement. A ***strand*** is mappable as a single, fairly continuous feature. Sometimes geologists group strands into segments, which are believed capable of rupturing together during a single earthquake. The more extensive the fault, the bigger the earthquake it can produce. Therefore, multi-strand fault ruptures produce larger earthquakes.

Total ***displacement*** is the length, measured in kilometers (km), of the total movement that has occurred along a fault over as long a time as the geologic record reveals. It is usually estimated by measuring distances between geologic features that have been split apart and separated (offset) by

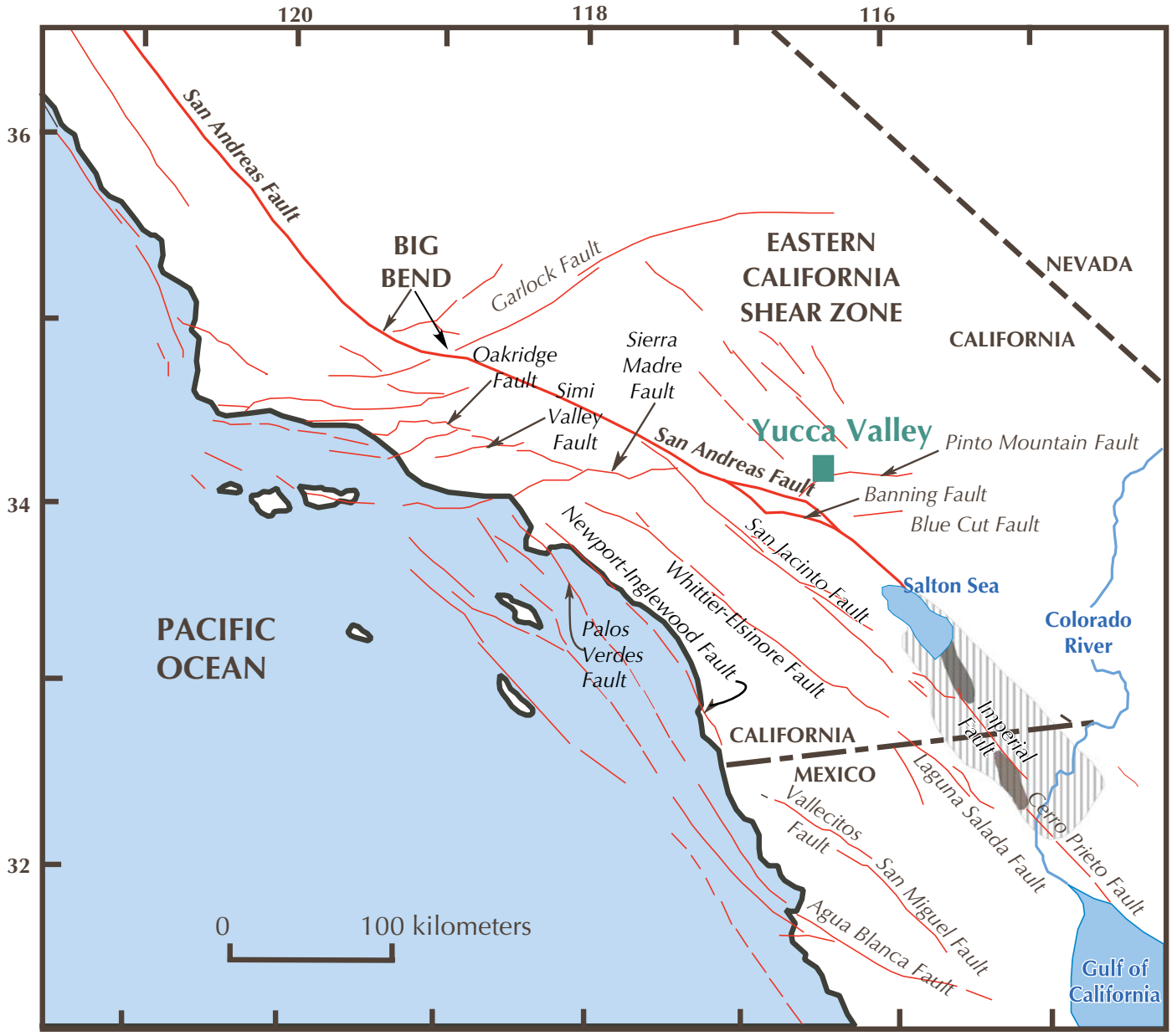
the cumulative movement of the fault over many earthquakes. ***Slip rate*** is a speed, expressed in millimeters per year (mm/yr). Slip rate is estimated by measuring an amount of offset accrued during a known amount of time, obtained by dating the ages of geologic features. Slip rate data also are used to estimate a fault's earthquake recurrence interval. Sometimes referred to as "repeat time" or "return interval," the ***recurrence interval*** represents the average amount of time that elapses between major earthquakes on a fault. The most specific way to derive the recurrence interval for a given fault is to excavate trenches across the fault to obtain ***paleoseismic*** evidence of earthquakes that have occurred during prehistoric time. Paleoseismic studies show that faults with high slip rates generally have shorter recurrence intervals between major earthquakes. This is so because a high slip rate indicates rocks that, at depth, are moving relatively quickly, and the stored energy trapped within the locked, surficial rocks needs to be released in frequent (geologically speaking), large earthquakes.

The Town of Yucca Valley and most of the eastern part of southern California, is riding on the North American Plate, which is moving southeasterly (relative to the Pacific Plate), at about 50 millimeters per year (mm/yr), or about 165 feet in 1,000 years. This is about the rate at which fingernails grow, and seems unimpressive. However, it is enough to accumulate enormous amounts of strain energy over tens to thousands of years. Despite being locked in place most of the time, in another 15 million years (a short time in the context of the Earth's history), due to plate movements, Los Angeles (which is on the Pacific Plate) will be almost next to San Francisco (which, like Yucca Valley is on the North American Plate).

Although the San Andreas fault is the principal separation between the Pacific and North American plates, only about 70% of the plate motion actually occurs on this fault. The rest is distributed along other faults of the San Andreas system, including the San Jacinto, Whittier-Elsinore, Newport-Inglewood, Palos Verdes, and several faults offshore, in the Pacific Ocean. To the east of the San Andreas fault, slip is distributed among faults of the Eastern California Shear Zone, including those responsible for the 1992 M_W 7.3 Landers and 1999 M_W 7.1 Hector Mine earthquakes. (M_W stands for ***moment magnitude***, a measure of earthquake energy release, discussed further below.) Thus, the zone of plate-boundary earthquakes and ground deformation covers an area that stretches from Nevada to the Pacific Ocean (see Figure 1-1).

Because the Pacific and North American plates are sliding past each other, with relative motions to the northwest and southeast, respectively, all of the faults mentioned above trend northwest-southeast, and are strike-slip faults. On average, ***strike-slip faults*** are nearly vertical breaks in the rock, and when a strike-slip fault ruptures, the rocks on either side of the fault slide horizontally past each other. However, there is a kink in the San Andreas fault commonly referred to as the "Big Bend," located about 170 miles (275 km) northwest of Yucca Valley (Figure 1-1). Near the Big Bend, the two plates do not slide past each other. Instead, they collide, causing localized compression, which results in folding and thrust faulting. ***Thrusts*** are a type of dip-slip fault where rocks on opposite sides of the fault move up or down relative to each other. When a thrust fault ruptures, the top block of rock moves up and over the rock on the opposite side of the fault.

In southern California, ruptures along thrust faults have built the Transverse Ranges geologic province, a region with a unique east-west trend to its landforms and underlying geologic structures that is a direct consequence of the plates colliding at the Big Bend. Many of southern



Source: Modified from Fuis and Mooney, 1990.

MAP EXPLANATION

Fault

Onshore Spreading Center

New Crust (late Cenozoic)

Earth Consultants International

Project Number: 3114
Date: 2011

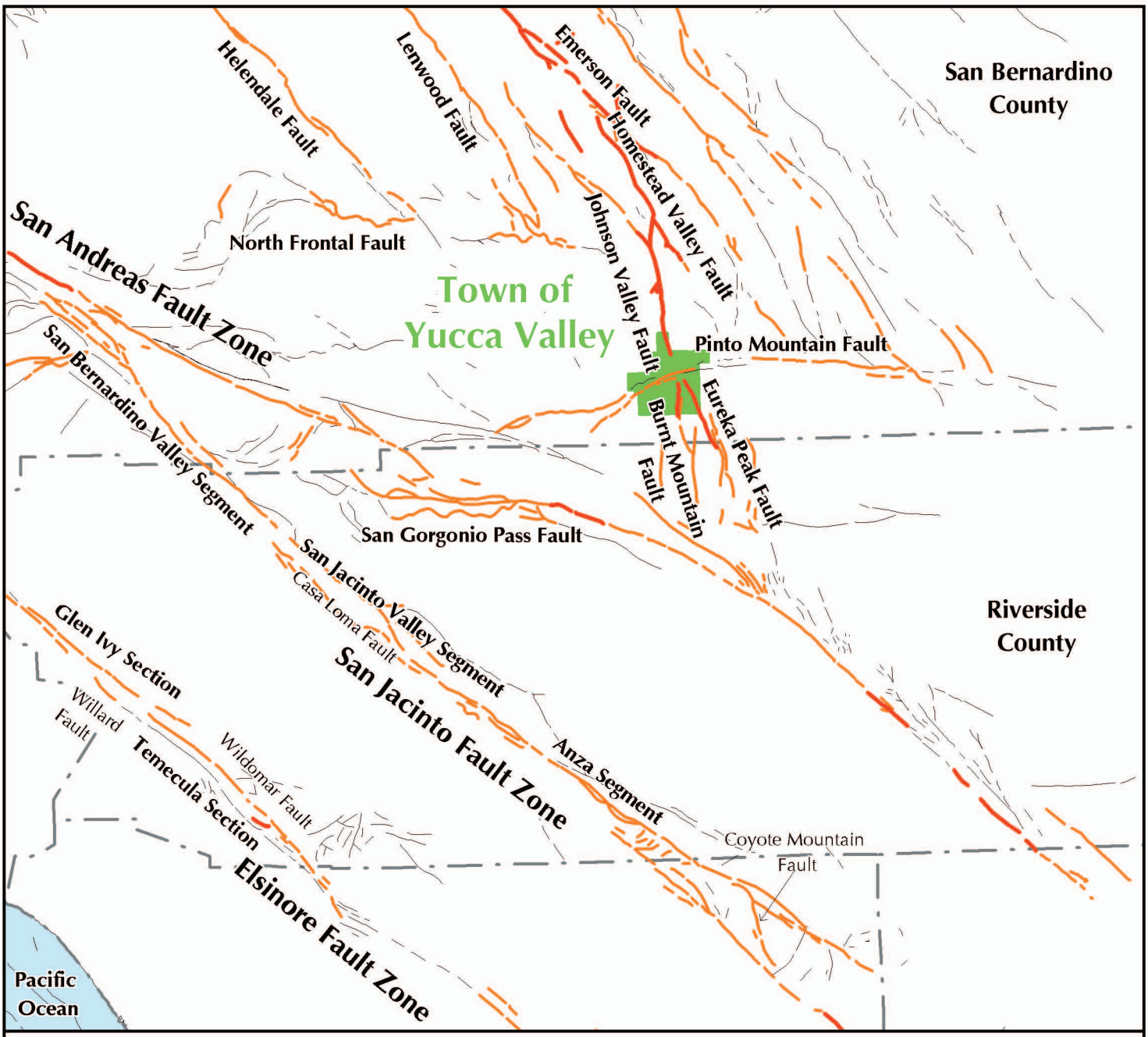
Regional Fault Map

Figure 1-1

California's most recent damaging earthquakes have occurred on thrust faults that are uplifting the Transverse Ranges, including the 1971 M_W 6.7 San Fernando, the 1987 M_W 5.9 Whittier Narrows, the 1991 M_W 5.8 Sierra Madre, and the 1994 M_W 6.7 Northridge earthquakes. Thrust faults in southern California have been particularly hazardous because many are "***blind***;" that is, they do not extend to the surface of the Earth, and have therefore been difficult to detect and study before they rupture. Some of the latest earthquakes in southern California, including the 1987 Whittier Narrows earthquake and the 1994 Northridge earthquake, occurred on previously unknown blind thrust faults. A great amount of research in the last 15 years has gone into learning to recognize subtle features in the landscape that suggest the presence of a buried thrust fault at depth, and developing techniques to confirm and study these structures. Some geologists have started to develop paleoseismic data for these buried thrust faults, including recurrence interval, estimates of the maximum magnitude earthquake these faults are capable of generating, and displacement per event. A smaller kink in the San Andreas fault occurs in the vicinity of San Gorgonio Pass, to the northwest of Palm Springs. This kink (or "knot" as it is often called) is a result of a slight bend and a step in the main fault's surface trace. As with the Big Bend, complex fault patterns, including thrust faulting, have developed in this area to accommodate these changes.

The portion of the Town of Yucca Valley south of the Pinto Mountain fault is located in the Transverse Ranges Province described above. The part of Town north of the Pinto Mountain fault is located in the southwestern portion of the Mojave Desert Province, an arid region of alluvial fans, desert plains, dry lakebeds, and scattered mountain ranges described in more detail in Chapter 2. The east-trending Garlock fault defines the northern boundary of this province, whereas the San Andreas fault defines its western boundary. These faults, and other seismically active faults that are part of the Eastern California Shear Zone (also referred to as the Eastern Mojave Shear Zone), including the Burnt Mountain, Eureka Peak, Landers, Johnson Valley, Mesquite Lake-Pisgah-Bullion Mountains, South Emerson–Copper Mountain, Calico-Hidalgo, and Lenwood-Lockhart-Old Woman faults, have the potential to impact the Yucca Valley region (see Figure 1-2). With the exception of the Pinto Mountain fault, which is a left-lateral strike-slip fault, all other faults mentioned above are right-lateral strike slip. Each of these faults is discussed in more detail in Section 1.4 below, and those that extend across the Town of Yucca Valley are described further in Section 1.5.

Strong ground shaking causes the vast majority of earthquake damage. As mentioned previously, when a fault breaks in the subsurface, the seismic energy released by the earthquake radiates away from the hypocenter in waves that are felt at the surface as shaking. In general, the bigger and closer the earthquake, the more damage it may cause. However, other effects discussed below are also important. Earthquakes are typically classified by the amount of damage reported, or by how strong and how far the shaking was felt. An early measure of earthquake size still used today is the seismic intensity scale, which is a qualitative assessment of an earthquake's effects at a given location. The most commonly used measure of seismic intensity is called the ***Modified Mercalli Intensity*** (MMI) scale, which has 12 damage levels (see Table 1-1). Although it has limited scientific application, intensity is intuitively clear and quick to determine. Limitations of this scale are related to the fact that earthquake damage depends on the characteristics of human-made structures, and the complex interaction between the ground motions and the built environment, rather than the size of the earthquake alone. Governing factors include a building's height, construction, and stiffness, which determine the structure's resonant period; the underlying soil's strength and resonant period; and the periods of the incoming seismic waves. Other factors include architectural design, condition, and age of the structures.



Modified from: Jennings, 1995

Explanation

N
W E
S

0 15
Miles

Fault Showing Evidence of Historic Rupture (Active).

Fault Showing Evidence of Holocene Rupture (Active).

Fault Showing Evidence of Quaternary and Late Quaternary Rupture (Potentially Active).

Earth Consultants International

Project Number: 3114
Date: 2011

Local Active and Potentially Active Faults

Figure 1-2

Table 1-1: Abridged Modified Mercalli Intensity Scale

Intensity Value and Description		Average Peak Velocity (cm/sec)	Average Peak Acceleration (g = gravity)
I.	Not felt except by very few under especially favorable circumstances (I Rossi-Forel scale). Damage potential: None.	<0.1	<0.0017
II.	Felt only by a few persons at rest, especially on upper floors of high-rise buildings. Delicately suspended objects may swing. (I to II Rossi-Forel scale). Damage potential: None.	0.1 – 1.1	0.0017 – 0.014
III.	Felt quite noticeably indoors, especially on upper floors of buildings, but many people did not recognize it as an earthquake. Standing automobiles may have rocked slightly. Vibration like passing of truck. Duration estimated. (III Rossi-Forel scale). Damage potential: None.		
IV.	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls made creaking sound. Sensation like a heavy truck striking building. Standing automobiles rocked noticeably. (IV to V Rossi-Forel scale). Damage potential: None. Perceived shaking: Light.	1.1 – 3.4	0.014 - 0.039
V.	Felt by nearly everyone; many awakened. Some dishes, windows, and so on broken; plaster cracked in a few places; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may have stopped. (V to VI Rossi-Forel scale). Damage potential: Very light. Perceived shaking: Moderate.	3.4 – 8.1	0.039-0.092
VI.	Felt by all; many frightened and ran outdoors. Some heavy furniture moved, few instances of fallen plaster and damaged chimneys. Damage slight. (VI to VII Rossi-Forel scale). Damage potential: Light. Perceived shaking: Strong.	8.1 - 16	0.092 -0.18
VII.	Everybody ran outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving cars. (VIII Rossi-Forel scale). Damage potential: Moderate. Perceived shaking: Very strong.	16 - 31	0.18 - 0.34
VIII.	Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving cars disturbed. (VIII+ to IX Rossi-Forel scale). Damage potential: Moderate to heavy. Perceived shaking: Severe.	31 - 60	0.34 - 0.65
IX.	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken. (IX+ Rossi-Forel scale). Damage potential: Heavy. Perceived shaking: Violent.	60 - 116	0.65 – 1.24
X.	Some well-built wooden structures destroyed; most masonry and frame structures destroyed; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes. Shifted sand and mud. Water splashed, slopped over banks. (X Rossi-Forel scale). Damage potential: Very heavy. Perceived shaking: Extreme.	> 116	> 1.24
XI.	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.		
XII.	Damage total. Waves seen on ground surface. Lines of sight and level distorted. Objects thrown into air.		

Modified from Bolt (1999); Wald and others (1999)

Scientists used to measure the amplitude of ground motion, as recorded by an instrument a given distance from the epicenter, to report the size of an earthquake (such as the Richter magnitude, a traditional measure of earthquake size that is no longer preferred). Seismologists now find that the most meaningful factor in determining the size of an earthquake is the amount of energy released when a fault ruptures. This measure is called the ***seismic moment*** (abbreviated M_w), and most moderate to large earthquakes today are reported using moment magnitude. Both traditional magnitude scales and seismic moment scales are logarithmic. Thus, each one-point increase in magnitude represents a ten-fold increase in amplitude of the waves as measured at a specific location, and a 32-fold increase in energy. That is, in the Richter-magnitude scale, a magnitude 7 earthquake produces 100 times (10 x 10) the ground motion amplitude of a magnitude 5 earthquake. Similarly, a moment magnitude 7 earthquake releases approximately 1,000 times more energy (32 x 32) than a moment magnitude 5 earthquake.

An important point to remember is that any given earthquake will have one moment and, in principle, one magnitude, although there are several methods of calculating magnitude, which give slightly different results. However, one earthquake will produce many levels of intensity because intensity effects vary with the location and the perceptions of the observer.

Fault dimensions and proximity are key parameters in any hazard assessment. In addition, it is important to know a fault's style of movement (i.e., is it dip-slip or strike-slip), the age of its most recent activity, its total displacement, and its slip rate. These values allow an estimation of how often a fault produces damaging earthquakes, and how big an earthquake can be expected the next time the fault ruptures. Horizontal ground acceleration is frequently responsible for widespread damage to structures, so it is commonly estimated as a percentage of ***g***, the ***acceleration of gravity***. Full characterization of shaking potential, however, requires estimates of peak (maximum) ground displacement and velocity, the duration of strong shaking, and the periods (lengths) of waves that will control each of these factors at a given location.

In general, the degree of shaking can depend upon:

- **Source effects.** These include earthquake size, location, and distance. In addition, the exact way that rocks move along the fault can influence shaking. For example, the 1995, M_W 6.9 Kobe, Japan earthquake was not much bigger than the 1994, M_W 6.7 Northridge, California earthquake, but the city of Kobe suffered much worse damage. This is in part because during the Kobe earthquake, the fault's orientation and movement directed seismic waves into the city, whereas during the Northridge earthquake, the fault's motion directed waves away from populous areas. Similarly, the seismic energy released during the Landers earthquake was directed away from the most densely areas of Yucca Valley and the Coachella Valley to the south.

- **Path effects.** Seismic waves change direction as they travel through the Earth's contrasting layers, just as light bounces (reflects) and bends (refracts) as it moves from air to water. Sometimes seismic energy gets focused into one location and causes damage in unexpected areas. Focusing of the seismic waves during the 1989 M_W 7.1 Loma Prieta earthquake caused damage in San Francisco's Marina district, some 62 miles (100 km) distant from the rupturing fault.

- **Site effects.** Seismic waves slow down in the loose sediments and weathered rock at the Earth's surface. As they slow, their energy converts from speed to amplitude, which heightens shaking. This is like the behavior of ocean waves – as the waves slow down near shore, their crests grow higher. The Marina District of San Francisco also serves as an example of site effects. Earthquake motions were greatly amplified in the deep, sediment-filled basin underlying the District compared to the surrounding bedrock areas. Seismic waves can get trapped at the surface and reverberate (resonate). Whether resonance will occur depends on the period (the length) of the incoming waves. Waves, soils and buildings all have resonant periods. When these resonant periods coincide, tremendous damage can occur.

  Waves repeat their motions with varying frequencies. Slow-to-repeat waves are called long-period waves. Quick-to-repeat waves are called short-period waves. Long-period seismic waves, which are created by large earthquakes, are most likely to reverberate and cause damage in long-period structures, like bridges and high-rise buildings that respond to long-period waves. Shorter-period seismic waves, which tend to die out quickly, will most often cause damage fairly near the fault, and they will cause most damage to shorter-period structures such as one- to three-story buildings. Very short-period waves are most likely to cause near-fault, interior damage, such as to equipment.

1.2 Regulatory Context

1.2.1 Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Special Studies Zones Act was signed into law in 1972 (in 1994 it was renamed the Alquist-Priolo Earthquake Fault Zoning Act). The primary purpose of the Act is to mitigate the hazard of fault rupture by prohibiting the location of structures for human occupancy across the trace of an active fault (Hart and Bryant, 1999; 2007). This State law was passed in direct response to the 1971 San Fernando earthquake, which was associated with extensive surface fault ruptures that damaged numerous homes, commercial buildings and other structures.

The Act requires the State Geologist (Chief of the California Geological Survey) to delineate "Earthquake Fault Zones" along faults that are "sufficiently active" and "well defined." These faults show evidence of Holocene surface displacement along one or more or their segments (sufficiently active) and are clearly detectable by a trained geologist as a physical feature at or just below the ground surface (well defined). The boundary of an "Earthquake Fault Zone" is generally about 500 feet from major active faults, and 200 to 300 feet from well-defined minor faults. The Act dictates that cities and counties withhold development permits for sites within an Earthquake Fault Zone until geologic investigations demonstrate that the sites are not threatened by surface displacements from future faulting (Hart and Bryant, 2007).

Alquist-Priolo maps are distributed to all affected cities and counties for their use in planning and controlling new or renewed construction. Local agencies must regulate most development projects within these zones. Projects include all land divisions and most structures for human occupancy. State law exempts single-family wood-frame and steel-frame dwellings that are less than three stories and are not part of a development of four

units or more. However, local agencies can be more restrictive. There are several Alquist-Priolo Earthquake Fault Zones mapped through the Town of Yucca Valley. The faults included in these zones are, from west to east, the Morongo Valley, Pinto Mountain, Johnson Valley, Burnt Mountain fault, and Eureka Peak faults. These faults and boundaries of the State-delineated fault zones are discussed further in Section 1.5.

1.2.2 Seismic Hazards Mapping Act

The Alquist-Priolo Earthquake Fault Zoning Act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards. Recognizing this, in 1990, the State passed the Seismic Hazards Mapping Act (SHMA), which addresses non-surface fault rupture earthquake hazards, including strong ground shaking, liquefaction and seismically induced landslides. The California Geological Survey (CGS) is the principal State agency charged with implementing the Act. Pursuant to the SHMA, the CGS is directed to provide local governments with seismic hazard zone maps that identify areas susceptible to liquefaction, earthquake-induced landslides and other ground failures. The goal is to minimize loss of life and property by identifying and mitigating seismic hazards. The seismic hazard zones delineated by the CGS are referred to as "zones of required investigation." Site-specific geological hazard investigations are required by the SHMA when construction projects fall within these areas.

The CGS, pursuant to the 1990 SHMA, has been releasing seismic hazards maps since 1997, with emphasis on the large metropolitan areas of Los Angeles, Orange and Ventura counties (funding for this program limits the geographic scope of this studies to these three counties in southern California). As a result, at this time, there are no State-issued (and therefore official) seismic hazard zone maps for the Town of Yucca Valley. Nevertheless, the methodology that the CGS uses to prepare these maps is well documented, and can be duplicated in areas that the CGS has yet to map. To that end, and for the purposes of this study, we have followed a simplified version of the CGS methodology to identify areas in Yucca Valley that are susceptible to liquefaction or earthquake-induced slope instability. These hazards are discussed in more detail in Section 1.6.

1.2.3 California Building Code

The International Conference of Building Officials (ICBO) was formed in 1922 to develop a uniform set of building regulations; this led to the publication of the first Uniform Building Code (UBC) in 1927. In keeping with the intent of providing a safe building environment, building codes were updated on a fairly regular basis, but adoption of these updates at the county- and city-level was not mandatory. As a result, the building codes used from one community to the next were often not the same. In 1980, recognizing that many building code provisions are not affected by local conditions, and that industries working in California should have some uniformity in building code provisions throughout the State, the legislature amended the State's Health and Safety Code to require local jurisdictions to adopt, at a minimum, the latest edition of the Uniform Building Code (UBC). The law states that every local agency, such as individual cities and counties, enforcing building regulations must adopt the provisions of the California Building Code (CBC) within 180 days of its publication, although each jurisdiction can require more stringent regulations, issued as amendments to the CBC. The publication date of the CBC is established by the California Building Standards Commission and the code is known as Title 24 of the

California Code of Regulations. Based on the publication cycle of the UBC, the CBC used to be updated and republished every three years.

Then, in 1994, to further the concept of uniformity in building design, the ICBO joined with the two other national building code publishers, the Building Officials and Code Administrators International, Inc. (BOCA) and the Southern Building Code Congress International, Inc. (SBCCI), to form a single organization, the International Code Council, (ICC). In the year 2000, the group published the first International Building Code (IBC) as well as an entire family of codes, (i.e. building, mechanical, plumbing and fire) that were coordinated with each other. As a result, the last (and final) version of the UBC was issued in 1997. However, the California Building Standards Commission, after careful review of the 2000 IBC, chose not to use it, but instead continued to adopt the older 1997 UBC as the basis for the CBC. The 2001 CBC (based on the 1997 UBC) was used throughout the State from 2001 to 2007, often with local, more restrictive amendments based upon local geographic, topographic or climatic conditions.

Since then, the California Building Standards Commission (BSC) issued the 2007 edition of the CBC based on the 2006 IBC, and more recently, the 2010 edition of the CBC based on the 2009 IBC. The 2010 CBC became effective on January 1, 2011. Based on the last two cycles, updates to the building code can again be expected every three years. [For updates and additional information regarding the CBC, refer to the California Building Standards Commission website at www.bsc.ca.gov/.]

The CBC provides requirements for structural design that apply to the construction, alteration, replacement, and demolition of every building or structure and any appurtenances connected or attached to such buildings or structures throughout the state of California. The code is meant to safeguard the public's health, safety and general welfare through structural strength, general stability and means of egress by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all buildings and structures within its jurisdiction. It is important to recognize, however, that building codes provide minimum standards. With respect to seismic shaking, for example, the provisions of the building code are designed to prevent the catastrophic collapse of structures during a strong earthquake; however, structural damage to buildings, and potential loss of functionality, are expected. Specific provisions contained in the California Building Code that pertain to seismic and geologic hazards are discussed further in other sections of this document.

1.2.4 Unreinforced Masonry Law

Enacted in 1986, the Unreinforced Masonry Law (Senate Bill 547, codified in Section 8875 *et seq.* of the California Government Code) required all cities and counties in what the Building Code at the time referred to as Seismic Zone 4 (zones near historically active faults) to identify potentially hazardous unreinforced masonry (URM) buildings in their jurisdictions, establish a URM loss-reduction program, and report their progress to the State by 1990. The owners of such buildings were to be notified of the potential earthquake hazard these buildings pose. Some jurisdictions implemented mandatory retrofit programs, while others established voluntary programs. A few cities only notified the building owners, but did not adopt any type of strengthening program. Prior to 1997, local governments could adopt other building standards that preceded the UCBC, and in fact, in

many jurisdictions, retrofits were conducted in accordance with local ordinances that only partially complied with the latest UCBC. Then, starting in 1997, California required all jurisdictions to enforce the 1997 Uniform Code for Building Conservation (UCBC) Appendix Chapter 1 as the model building code, although local governments could adopt amendments to that code under certain circumstances (ICBO, 2001; CSSC, 2006). The UCBC standards were meant to significantly reduce but not necessarily eliminate the risk to life from collapse of the structure. The 2010 California Building Code (CBC) includes newly approved building standards for historical buildings (2010 California Historical Building Code, Part 8 of Title 24), and building standards for existing buildings (2010 California Existing Building Code, Part 10 of Title 24) based on the 2009 International Existing Building Code.

Although the Town of Yucca Valley is located in the Seismic Zone 4 area identified in the building code in effect when the Unreinforced Masonry Law was enacted, there is no record that the Town has reported to the Seismic Safety Commission whether or not it has unreinforced masonry buildings in its jurisdiction. Essentially, the Town of Yucca Valley is not included in either the 2003 or 2006 reports by the Seismic Safety Commission.

1.2.5 Real Estate Disclosure Requirements

Since June 1, 1998, the Natural Hazards Disclosure Act has required that sellers of real property and their agents provide prospective buyers with a "Natural Hazard Disclosure Statement" when the property being sold is located within one or more State-mapped hazard areas. For example, if a property lies in a Seismic Hazard Zone as shown on a map issued by the State Geologist, the seller or the seller's agent must disclose this fact to potential buyers. The law specifies two ways in which this disclosure can be made: (1) Using the Natural Hazards Disclosure Statement as provided in Section 1102.6c of the California Civil Code, or (2) using the Local Option Real Estate Disclosure Statement as provided in Section 1102.6a of the California Civil Code. The Local Option Real Estate Disclosure Statement (Option 2) can be substituted for the Natural Hazards Disclosure Statement (Option 1) only if the Local Option Statement contains substantially the same information and substantially the same warnings as the Natural Hazards Disclosure Statement.

California State law also states that when houses built before 1960 are sold, the seller must give the buyer a completed earthquake hazards disclosure report and a copy of the booklet entitled “The Homeowner’s Guide to Earthquake Safety.” This publication was written and adopted by the California Seismic Safety Commission. The most recent edition of this booklet is available from the web at www.seismic.ca.gov/. The booklet includes a sample of a residential earthquake hazards report that buyers are required to fill in, and describes structural weaknesses common in homes that if they fail in an earthquake can result in significant damage to the structure. The booklet then provides detailed information on actions that homeowners can take to strengthen their homes.

The Alquist-Priolo Earthquake Fault Zoning Act and the Seismic Hazards Mapping Act also require that real estate agents, or sellers of real estate acting without an agent, disclose to prospective buyers that the property is located in an Earthquake Fault or Seismic Hazard Zone. This mandate, therefore, applies to all properties within the official Alquist-Priolo maps for Yucca Valley, and within any other fault hazard management zones if defined in

the Safety Element. In addition, those regions in the study area that have the potential of being impacted by other natural hazards, such as seismically induced liquefaction or slope instability, as identified in this report, should be disclosed to prospective buyers, following the provisions of the Natural Hazards Disclosure Act.

1.2.6 California Environmental Quality Act

The California Environmental Quality Act (CEQA) was passed in 1970 to insure that local governmental agencies consider and review the environmental impacts of development projects within their jurisdictions. CEQA requires that an Environmental Impact Report (EIR) be prepared for projects that may have significant effects on the environment. EIRs are required to identify geologic and seismic hazards, and to recommend potential mitigation measures, thus giving the local agency the authority to regulate private development projects in the early stages of planning. The law requires that these documents be issued in draft form and made available at local libraries and government offices for individuals and organizations to review and comment on. The comments are addressed in the final report submitted for approval or refusal by the Planning Commission and/or Town Council.

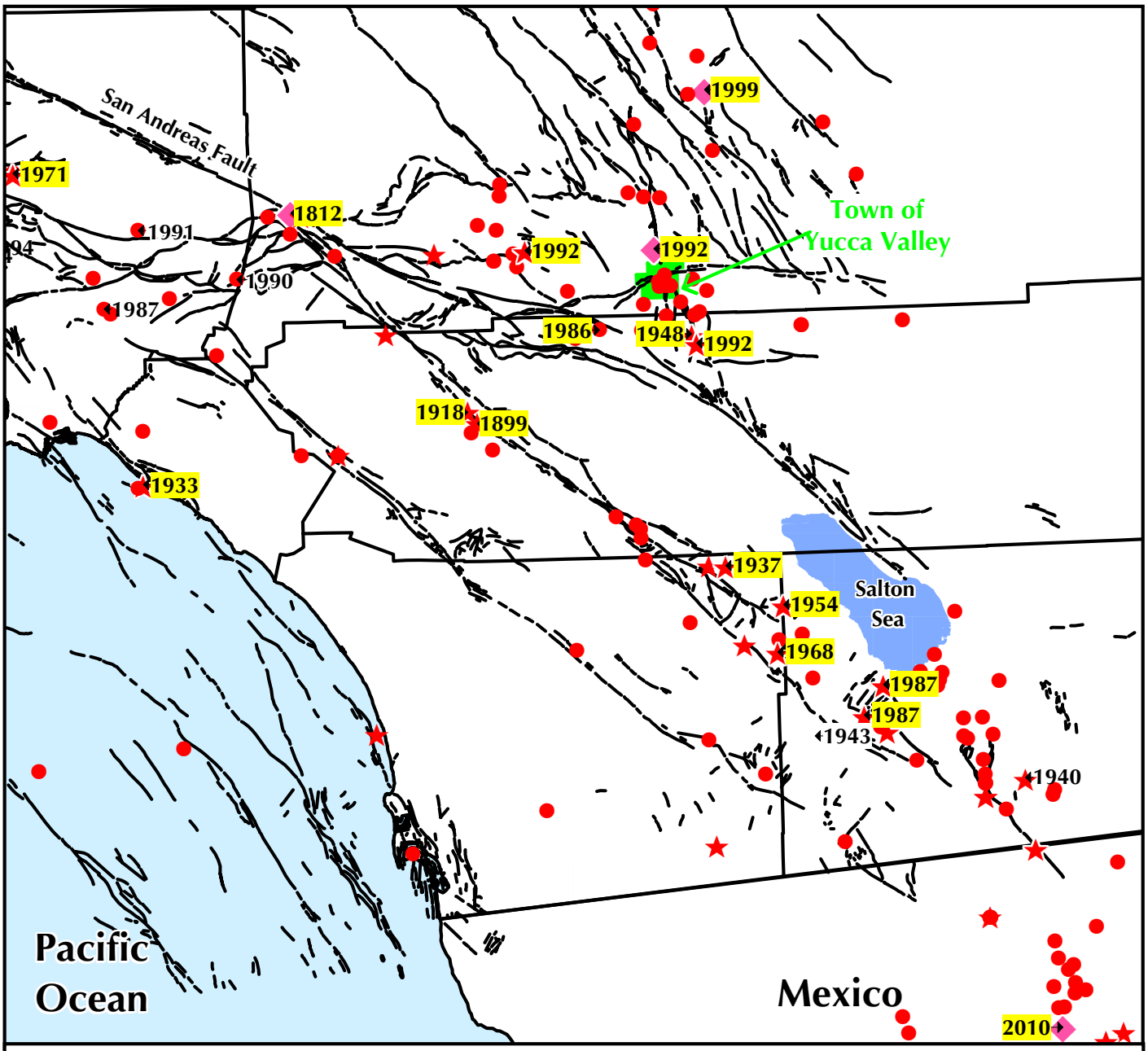
1.3 Notable Past Earthquakes

Figure 1-3 shows the approximate epicenters of some of the historical earthquakes that have resulted in significant ground shaking in the southern California area, including Yucca Valley. The most significant of these events, either because they were felt strongly in the area, or because they led to the passage of important legislation, are described below.

1.3.1 Wrightwood Earthquake of December 12, 1812

This large earthquake occurred on December 8, 1812 and was felt throughout southern California. Based on accounts of damage recorded at missions in the earthquake-affected area, an estimated magnitude of 7.5 has been calculated for the event (Toppozada and others, 1981). Subsurface investigations and tree ring studies show that the earthquake likely ruptured the Mojave section of the San Andreas fault near Wrightwood, and may have been accompanied by a significant surface rupture between Cajon Pass and Tejon Pass (Jacoby, Sheppard and Sieh, 1988).

The worst reported damage caused by the earthquake occurred significantly west of the San Andreas fault at San Juan Capistrano Mission, where the roof of the church collapsed, killing 40. The earthquake also damaged walls and destroyed statues at San Gabriel Mission, and is thought to have triggered an earthquake thirteen days later that damaged several missions in the Santa Barbara area (Deng and Sykes, 1996). Strong aftershocks that occurred for several days after the main earthquake collapsed many buildings that had been damaged by the main shock. The Wrightwood earthquake would have been felt in the Yucca Valley area, with Modified Mercalli (MM) intensities in the IV to V range (see Table 1-1).



Source: Jennings, 1994; SCEC earthquake catalog; NEIC earthquake catalog

N
W E
S

0 20
Miles

Explanation

- Magnitude 7+
- Magnitude 6 - 7
- Magnitude 5 - 6
- Quaternary faults
- 1899 Earthquakes discussed further in the text

Earth Consultants International

Project Number: 3114
Date: 2011

Notable Regional Earthquakes

Figure 1-3

1.3.2 San Jacinto Earthquake of 1899

This earthquake occurred at 4:25 A.M. on December 25, 1899. The main shock is estimated to have had a magnitude of 6.5. Several smaller aftershocks followed the main shock, and in the city of San Jacinto as many as thirty smaller tremors were felt throughout the day. The epicenter of this earthquake is not well located, but damage patterns suggest the location shown on Figure 1-3, near the city of San Jacinto, with the causative fault most likely being the San Jacinto fault. The cities of San Jacinto and Hemet both reported extensive damage, with nearly all brick buildings either badly damaged or destroyed. Six people were killed in the Soboba Indian Reservation as a result of falling adobe walls. In Riverside, chimneys toppled and walls cracked (Claypole, 1900). The main earthquake was felt over a broad area that includes San Diego to the southwest, Needles to the northeast, and Arizona to the east. No surface rupture was reported, but several large "sinks" or subsidence areas were reported about 10 miles to the southeast of San Jacinto. It is estimated that the Yucca Valley area would have been impacted with effects consistent with MM intensities in the IV range.

1.3.3 San Jacinto Earthquake of 1918

This magnitude 6.8 earthquake occurred on April 21, 1918 at 2:32 P.M. Pacific Standard Time (PST) near the town of San Jacinto. The earthquake caused extensive damage to the business districts of San Jacinto and Hemet, where many masonry structures collapsed, but because it occurred on a Sunday, when these businesses were closed, the number of fatalities and injuries was low. Several people were injured, but only one death was reported. Minor damage as a result of this earthquake was reported outside the San Jacinto area, and the earthquake was felt as far away as Taft (west of Bakersfield), Seligman (Arizona), and Baja California.

Strong shaking cracked the ground, concrete roads, and concrete irrigation canals, but none of the cracks are thought to have been caused directly by surface fault rupture. The shaking also triggered several landslides in mountain areas. The road from Hemet to Idyllwild was blocked in several places where huge boulders rolled down slopes. Two men in an automobile were reportedly swept off a road by a landslide, and would have rolled several hundred feet down a hillside had they not been stopped by a large tree. Two miners were trapped in a mine near Winchester, but they were eventually rescued, uninjured. The earthquake apparently caused changes in the flow rates and temperatures of several springs. Sand craters (due most likely to liquefaction) were reported on one farm, and an area near Blackburn Ranch "sunk" approximately three feet (one meter) during the quake (/www.scecdc.scec.org/quakedex.html).

1.3.4 North San Jacinto Fault Earthquake of 1923

This earthquake occurred about 7 miles south of San Bernardino on July 22, 1923, at 11:28 P.M. PST. The M_L 6.3 earthquake on the San Jacinto fault caused minor damage primarily in the cities of San Bernardino and Redlands, where chimneys collapsed and windows broke. Two public buildings in San Bernardino, the San Bernardino County Hospital and the Hall of Records, were badly damaged, and extensive damage was sustained by the State Hospital building in Patton. However, most of the buildings that sustained damage were deemed of poor construction. Slight damage was reported in Los Angeles. Two people were critically injured, but no deaths were reported. The shaking was felt as far away as

Needles and Santa Barbara. Seismic shaking in the Yucca Valley area as a result of this earthquake is estimated at MM intensity V.

1.3.5 Long Beach Earthquake of 1933

The M_w 6.4 Long Beach earthquake occurred on March 10, at 5:54 P.M. PST, following a strong foreshock the day before. The earthquake killed 115 people and caused $40 to 50 million in property damage (www.scecdc.scec.org/quakedex.html). The earthquake ruptured the Newport-Inglewood fault, and shaking was felt from the San Joaquin Valley to Northern Baja California (Mexico). The epicenter was located at the boundary between Huntington Beach and Newport Beach, although the earthquake was called "the Long Beach earthquake" because the worst damage was focused in the city of Long Beach. This earthquake would have been felt only slightly in the Yucca Valley area, and is therefore discussed herein only because it led to code changes that apply to all of California. Specifically, the regional significance of this earthquake is that damage to school buildings was especially severe, which led to the passage of the Field and Riley Acts by the State legislature. The Field Act regulates school construction and the Riley Act regulates the construction of buildings larger than two-family dwellings.

1.3.6 Desert Hot Springs Earthquake of 1948

This magnitude 6.5 earthquake struck on December 4, 1948 at 3:43 P.M. PST. The fault involved is believed to be the South Branch of the San Andreas (or Banning fault, depending on nomenclature used), with the epicenter located about 13 miles to the south-southwest of Yucca Valley. The shaking from this earthquake was felt over a large area (as far away as central Arizona, parts of Mexico, Santa Catalina Island, and Bakersfield), and caused damage in regions far from the epicenter. In the Los Angeles area, a 5,800-gallon water tank split open, water pipes broke at UCLA and in Pasadena, and plaster cracked and fell from many buildings. In San Diego, a water main broke. In Escondido and Corona, walls cracked. The administration building of Elsinore High School was permanently closed, due to the damage it sustained, as was a building at the Emory School in Palm City. Numerous other instances of minor structural damage were reported. Closer to the epicenter, landslides and ground cracks were reported, and a road leading to the Morongo Indian Reservation was badly damaged (Louderback, 1949). In Palm Springs, the city hit hardest by the quake, merchandise was thrown from shelves with losses in the thousands of dollars. Part of a furniture store collapsed. Two people were injured when a crowd fled a movie theater in panic. Fortunately, despite the damage brought on by this earthquake, no lives were lost. Shaking in Yucca Valley was strong to severe, estimated at about 0.2g, with MM intensities in the VIII to IX range.

1.3.7 Borrego Mountain Earthquake of 1968

This magnitude 6.5 earthquake struck on April 8, 1968 at 6:29 P.M. PST. It resulted in about 18 miles of surface rupture along the Coyote Creek fault (a branch of the San Jacinto Fault Zone), and triggered slip was observed on fault systems up to 40 miles away. When the Borrego Mountain earthquake struck, it was the largest and most damaging quake to hit southern California since the Kern County earthquake of 1952. It was felt as far away as Las Vegas, Fresno, and even Yosemite Valley. The quake caused damage across most of southern California – power lines were severed in San Diego County, plaster cracked in Los Angeles, and the Queen Mary, in dry-dock at Long Beach, rocked back and forth on its keel blocks for 5 minutes. A few ceilings collapsed at various places in the Imperial

Valley. Close to the epicenter, the quake caused landslides, hurling large boulders downslope, damaging campers' vehicles at Anza-Borrego Desert State Park, and caused minor surface rupture, cracking Highway 78 at Ocotillo Wells (Lander, 1968).

The event apparently caused small displacements along the Superstition Hills fault (2.2 cm, <1 inch), Imperial fault (1.2 cm, < 0.5 inch), and the Banning-Mission Creek fault (0.9 cm; 0.35 inch), 45, 70, and 50 km (28, 43.5, and 31 miles), respectively, from the epicenter. These fresh breaks and displacements were not noticed immediately after the mainshock, but no other significant events occurred at that time that could have caused them. These are probably among the first noted instances of triggered slip, and they proved to be some of the most intriguing features of the Borrego Mountain earthquake.

1.3.8 San Fernando (Sylmar) Earthquake of 1971

This magnitude 6.6 earthquake occurred on the San Fernando fault, the westernmost segment of the Sierra Madre fault zone, on February 9, 1971, at 6:00 A.M. PST. The surface rupture caused by this earthquake was nearly 20 km (12 miles) long , and occurred in the Sylmar-San Fernando area of Los Angeles. Maximum slip measured at the surface was nearly 2 meters (6 feet). The earthquake caused over $500 million in property damage and 65 deaths. Most of the deaths occurred when the Veteran's Administration Hospital collapsed. Several other hospitals, including the Olive View Community Hospital in Sylmar suffered severe damage. Newly constructed freeway overpasses also collapsed, in damage scenes similar to those that occurred 23 years later in the 1994 Northridge earthquake. Loss of life could have been much greater had the earthquake struck at a busier time of the day. As with the Long Beach earthquake, legislation was passed in response to the damage caused by the 1971 earthquake. In this case, the building codes were strengthened and the Alquist-Priolo Special Studies (now called the Earthquake Fault Zone) Act was passed in 1972.

1.3.9 Homestead Valley Earthquake Sequence of 1979

Several moderate-magnitude earthquakes occurred in the Homestead Valley area near Landers starting on March 15 1979, and continuing until at least October of that year. In September 1979 approximately two seismic events per day were being recorded in the region (McJunkin, 1980). Five of the largest events occurred between 12:17 P.M. PST and 3:17 P.M. PST on March 15th. These events ranged in magnitude between 4.1 and 5.2. Surface cracks, surface displacements suggesting fault rupture, ground lurching, rock slides, and the lateral movement of a water tank, a house, a stove, and a water bed were reported in the epicentral area following the main shock of magnitude 5.2. The house, a detached garage, and the water tank were damaged. These structures were all located near to and south of the section of the Johnson Valley fault that experienced minor surface fault rupture (Stierman and others, 1980; McJunkin, 1980; Williams and McWhirter, 1980). Based on these observations, McJunkin (1980) estimated that ground accelerations exceeding 0.4g were experienced in the immediate vicinity of the epicenter, with accelerations attenuating rapidly away from the epicentral location. The largest offsets measured on these cracks showed up to 10 cm (4 inches) of cumulative, horizontal, right-lateral movement, and up to 5 cm (2 inches) of vertical displacement (Hawkins and McNey, 1979; Hill and others, 1980).

Felt effects associated with the M 5.2 main shock, which occurred approximately 23 km (14 miles) north of Yucca Valley, is estimated to have been in the MM intensity VI range in Yucca Valley.

1.3.10 North Palm Springs Earthquake of 1986

This magnitude 5.6 earthquake occurred on July 8, 1986 at 2:21 A.M. PDT, along either the Banning fault or the Garnet Hill fault. The epicenter was about 10 km (6 miles) northwest of Palm Springs, and about 21 km (13 miles) to the west-southwest of Yucca Valley. The North Palm Springs earthquake was responsible for at least 29 injuries and the destruction or damage of 51 homes in the Palm Springs-Morongo Valley area. It also triggered landslides in the region. Damage caused by this quake was estimated at over $4 million. Ground cracking was observed along the Banning, Mission Creek, and Garnet Hill faults, but these cracks were due to shaking, not surface rupture (Person, 1986). Most of the ground fractures occurred on the northern side of the fault, between Whitewater Canyon on the west, and Highway 62 on the east. Fractures varied from single, discontinuous breaks less than 1 mm (0.04 inch) wide, to extensively fractured zones 30 to 40 meters (100 to 120 feet) wide (Morton and others, 1989).

1.3.11 Joshua Tree Earthquake of 1992

This magnitude 6.1 earthquake struck on April 22, 1992 at 9:50 P.M. PDT, approximately 19 km (12 miles) to the south of downtown Yucca Valley. This event resulted from right-lateral strike-slip faulting and was preceded by a magnitude 4.6 foreshock. The Joshua Tree earthquake raised some concern due to its proximity to the San Andreas fault. A San Andreas Hazard Level B was declared following this quake, meaning that the San Andreas fault was given a 5 to 25% chance of generating an even larger earthquake within three days. Although this did not happen, the concern caused by the Joshua Tree earthquake was at least partially warranted: about two months and 6,000 aftershocks later, the Landers earthquake broke the surface of the Mojave Desert in the largest quake to hit southern California in 40 years. The aftershocks of the Joshua Tree quake indicated that the fault that slipped is a north- to northwest-trending, right-lateral strike-slip fault at least 14 km (9 miles) long (Jones and others, 1995). Based on these data, and the location of the shocks, researchers suggested that the Eureka Peak fault may have been the fault responsible for this earthquake.

Damage caused by the Joshua Tree earthquake was slight to moderate in the communities of Joshua Tree, Yucca Valley, Twentynine Palms, Desert Hot Springs, and Palm Springs. Thirty-two people had to be treated for minor injuries. Though somewhat forgotten in the wake of the Landers earthquake, the Joshua Tree event was significant on its own, and was felt as far away as San Diego, Santa Barbara, Las Vegas, Nevada, and even Phoenix, Arizona (Person, 1992). In Yucca Valley, MM intensities in the VII range are estimated.

1.3.12 Landers Earthquake of 1992

On June 28, 1992, most people in southern California were awakened at 4:57 A.M. PDT by the largest earthquake to strike California in 40 years. Centered near Landers, the earthquake had a magnitude of 7.3, and was associated with more than 80 km (50 miles) of surface rupture on five separate but related faults: the Johnson Valley, Landers (or Kickapoo), Homestead Valley, Emerson, and Camp Rock faults (Sieh and others, 1993). The average right-lateral strike-slip displacement on these faults was about 3 to 4.5 meters

(10 to 15 feet); the maximum was up to 5.5 meters (18 feet). Other nearby faults, including faults that extend through Yucca Valley, also experienced triggered slip and minor surface rupture. The Landers earthquake released about four times as much energy as the very destructive Loma Prieta (northern California) earthquake of 1989, but because it occurred in a relatively unpopulated area about 190 km (120 miles) from Los Angeles and the energy released was directed away from the more densely populated areas to the south, the earthquake caused relatively little damage for its size (Brewer, 1992), and did not claim many lives (one child unfortunately died when a chimney collapsed). Seismic intensities of MM level VIII were reported in the Town of Yucca Valley (http://pasadena.wr.usgs.gov/shake/ca/STORE/XLanders/ciim_display.html).

1.3.13 Big Bear Earthquake of 1992

This magnitude 6.4 earthquake struck approximately 3 hours after the Landers earthquake on June 28, 1992 at 8:05 A.M. PDT, and is technically considered an aftershock of the Landers earthquake (indeed, the largest aftershock), although it occurred more than 32 km (20 miles) west of the Landers rupture, on a fault with a different orientation and sense of slip than those involved in the main shock. From its aftershocks, the causative fault was determined to be a northeast-trending left-lateral fault. This orientation and slip are considered "conjugate" to the faults that slipped in the Landers rupture. The Big Bear earthquake did not break the ground surface, and, in fact, no surface trace of a fault with the proper orientation has been found in the area. The Big Bear earthquake caused a substantial amount of damage in the Big Bear area, but fortunately, it claimed no lives. However, landslides triggered by the quake blocked roads in the mountainous areas, making the clean-up and rebuilding process from the Landers earthquake even more difficult (http://www.data.scec.org/chrono_index/bigbear.html). Its effects in Yucca Valley are consistent with MM intensity V (http://earthquake.usgs.gov/earthquakes/dyfi/events/ci/bigbear/us/index.html).

1.3.14 Northridge Earthquake of 1994

On January 17th, 1994, at 4:31 A.M. PST, a M_w 6.7 earthquake struck the San Fernando Valley in the Los Angeles region. This moderate-sized tremor is to date the most expensive earthquake in United States history, due primarily to its proximity to the heavily populated northern Los Angeles area. The rupture occurred on the previously unidentified eastern continuation of the Oak Ridge fault, a blind thrust fault. The earthquake (whose epicenter is just outside and west of the area covered in Figure 1-3) produced widespread ground accelerations of about 1g, some of the highest ever recorded for an earthquake of its size. The earthquake caused 57 deaths, 1,500 injuries and damaged 12,500 structures, knocking out of commission several major freeways for days to months. Most damage was focused in the northern Los Angeles area; MM intensities of between about level II and IV (see Table 1-1) were recorded in the Landers – Twentynine Palms area. No responses specific to Yucca Valley are available in the U.S. Geological Survey's database of seismic shaking (http://pasadena.wr.usgs.gov/shake/ca/STORE/XNorthridge/ciim_stats_8).

1.3.15 Hector Mine Earthquake of 1999

Southern California's most recent large earthquake was a widely felt magnitude M_w 7.1. It occurred on October 16, 1999, at 2:46 A.M. PDT, in the Mojave Desert, about 53 km (33 miles) to the north-northeast of Yucca Valley, in a remote area. Although this earthquake occurred on northwest-trending strike-slip faults within the Eastern California Shear Zone

similar to those that ruptured during the Landers earthquake, the Hector Mine event is not considered an aftershock of the Landers earthquake (Haukson and others, 2002). With no towns or communities nearby, the earthquake was named after an open pit quarry, the Hector Mine, located about 22 km (14 miles) northwest of the epicenter. Geologists documented nearly 48 km (26 miles) of surface rupture on the Lavic Lake fault, the central section of the Bullion fault, and small sections of the Mesquite Lake and West Calico faults (Teiman and others, 2002). Average displacements of 2.5 meters (8.2 feet) and a maximum of 5.5 meters (18 feet) of right-lateral offset were measured on the Lavic Lake fault. MM intensities of V (http://earthquake.usgs.gov/eqcenter/dyfi/events/ci/hectormi/us/index.html; see Table 1-1) were reported in the Yucca Valley area, based on more than 100 responses to the U.S. Geological Survey's "Did You Feel It" survey (http://pasadena.wr.usgs.gov/shake/ca/).

1.3.16 Baja California Earthquake of 2010

A magnitude 7.2 earthquake that occurred just south of the U.S. / Mexico border on Easter Sunday, April 4, 2010, at 3:40 P.M. PDT, was felt throughout Mexico, southern California, Arizona, and Nevada. Researchers believe that there were two sub-events: first a magnitude 6 earthquake that ruptured an 18-km (11.2-mile) long section of the Pescadores fault, followed, about 15 seconds later, by a larger event on the Borrego fault. Both of these faults are part of the Laguna Salada fault system, which is the southern extension of the Elsinore fault. The total length of the zone of surface rupture is approximately 120 km (75 miles), extending across several faults, some unknown prior to the earthquake. Maximum surface fault rupture of about 4.3 meters (14 feet) of predominantly right-lateral displacement was measured on the Pescadores fault; both right-lateral strike-slip and down-to-the-east vertical displacements were observed along the zone of fault rupture.

Surface rupture continued northward to just past the border into California. The main earthquake caused triggered slip of up to a few centimeters on several faults in the Salton Sea area, and as far north as the Mecca Hills, about 13 km (8 miles) to the southeast of the city of Coachella (Weldon, 2010; Wei and others, 2011). Secondary effects, including liquefaction, rockfalls and shattering were reported along a wide area in the El Centro and Brawley region, and westward toward San Diego. A peak instrumental ground acceleration of 1.1g was recorded at the Salton Sea. Similar or stronger shaking may have occurred closer to the epicenter, but given the lack of instrumentation in that area, went unrecorded. Based on observations reported by at least 140 residents, shaking in the Town of Yucca Valley as a result of this earthquake was weak to light, in the MM intensity III range (http://earthquake.usgs.gov/earthquakes/dyfi/events/ci/14607652/us/index.html).

By November 2010, more than 10,000 aftershocks had been recorded (Haukson and others, 2010). Many of the aftershocks occurred along the Elsinore, San Jacinto, and the southern extension of the San Andreas fault through the Brawley area. The largest aftershock was a magnitude 5.7 event on June 14, 2010 that occurred just north of the International Border, about 8 km (5 miles) from Ocotillo. A M_s 5.4 aftershock occurred on the San Jacinto fault on July 7, 2010, with its epicenter about 24 km (15 miles) northwest of Borrego Springs.

In addition to the earthquakes described above, thousands of small earthquakes have occurred and will continue to occur in the immediate vicinity of Yucca Valley. This is

discussed further in Section 1.4 below.

1.4 Seismic Ground Shaking

Seismic shaking and fault rupture are the geologic hazards that have the greatest potential to severely impact the Yucca Valley area, given that the town is intersected by and located near several significant seismic sources (faults) that have the potential to cause moderate to large earthquakes. Plate 1-1 shows the approximate epicentral locations of earthquakes instrumentally detected between 1932 and December 2011 in and around the Town of Yucca Valley, and the approximate location of earlier earthquakes extending back to 1800. The epicentral locations of earlier earthquakes are approximate because prior to 1932 there were no instruments available to measure the location and magnitude of an earthquake. The map shows most seismic activity in Yucca Valley is coincident with the location of the north-south trending faults that extend through the General Plan area that ruptured in 1992. In fact, a large percentage of the seismic events shown on Plate 1-1 are aftershocks of the 1992 Landers earthquake, with most of these occurring in the 1990s. Some aftershocks of the Landers sequence have continued into the new millennium. The east-trending Pinto Mountain fault has a relatively low number of earthquakes associated with it, possibly suggesting that the section of the fault that extends through the Yucca Valley area is locked. A ***locked fault*** is one that is not slipping because the frictional forces on the fault exceed the shear forces across the fault. A locked fault stores strain that is eventually released, typically during an earthquake.

In order to provide a better understanding of the shaking hazard posed by these local faults and other, more distant seismic sources, we conducted a deterministic seismic hazard analysis for a central point in the town and several other randomly selected points within town limits using the software program EQFAULT by Blake (2000). This analysis estimates the Peak Horizontal Ground Accelerations (PHGA) that could be expected at these locations due to earthquakes occurring on any of the known active or potentially active faults within a given distance; 100 km (62 miles) was used for the analyses reported herein. The fault database (including fault locations and earthquake magnitudes of the maximum magnitude earthquakes for each fault) used to conduct these calculations is that used by the California Geological Survey (CGS) and the U.S. Geological Survey (USGS) for the National Seismic Hazard Maps (Petersen and others, 1996; Cao and others, 2003). However, as described further in the text, paleoseismic studies suggest that some of these faults may actually generate even larger earthquakes than those used in the analyses. Where appropriate, this is discussed further below.

PHGA depends on the size of the earthquake (which is dependent on the rupturing fault's dimensions), the proximity of the rupturing fault to the study area, and local soil and rock conditions. The effects of the underlying soil (or rock) on the ground motions are estimated by use of attenuation relationships that have been derived empirically by several researchers from analyses of recordings of earthquake shaking in similar soils during earthquakes of various sizes and at various distances. The underlying geologic conditions, as described in Chapter 2, were considered in the Yucca Valley study, with sites underlain by alluvial deposits analyzed using alluvium as the underlying material, and sites underlain by rock analyzed using rock. Different attenuation equations, including those by Campbell and Bozorgnia (1997), Bozorgnia, Campbell and Niazi (1999), Boore and others (1997), Sadigh and others (1997), and Abrahamson and Silva (1997) were used to obtain a range of potential ground motions that could be felt in different areas

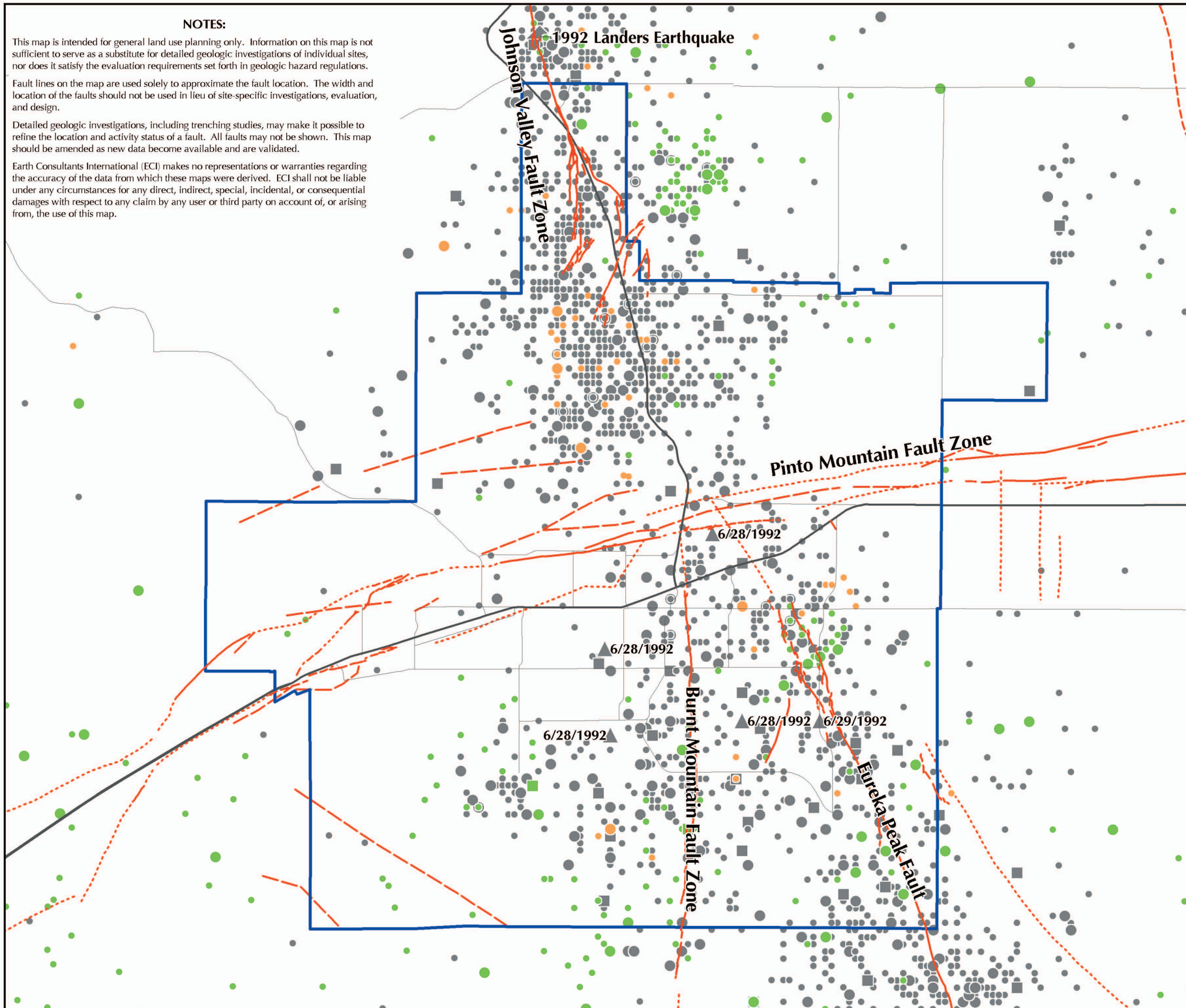
NOTES:

This map is intended for general land use planning only. Information on this map is not sufficient to serve as a substitute for detailed geologic investigations of individual sites, nor does it satisfy the evaluation requirements set forth in geologic hazard regulations.

Fault lines on the map are used solely to approximate the fault location. The width and location of the faults should not be used in lieu of site-specific investigations, evaluation, and design.

Detailed geologic investigations, including trenching studies, may make it possible to refine the location and activity status of a fault. All faults may not be shown. This map should be amended as new data become available and are validated.

Earth Consultants International (ECI) makes no representations or warranties regarding the accuracy of the data from which these maps were derived. ECI shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to any claim by any user or third party on account of, or arising from, the use of this map.



Faults and Historical (1800-2011) Seismicity Map

Yucca Valley, California

Explanation

Earthquake Magnitude

- 7+
- 6 to 7
- 5 to 6
- 4 to 5
- 3 to 4
- 2 to 3

Pre-1992 earthquakes in green
1992 - 1999 earthquakes in gray
2000 - 2011 earthquakes in orange

Quaternary Fault; solid where well located, dashed where approximately located, dotted where concealed or inferred.

Yucca Valley Town Boundary

N
W E
S

5000 0 5000
Feet

1500 0 1500
Meters

Scale: 1:60,000

Base Map: From Town of Yucca Valley.
Sources: Southern California Earthquake Center (January 1932 to December 2011); National Earthquake Information Center (1800 to 1931); US Geological Survey (2011).

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2012

Plate 1-1

around Yucca Valley. The ground motions presented in Table 1-2 are the ranges of the acceleration values calculated using these various attenuation equations.

Based on the ground shaking analyses described above, those faults that can cause peak horizontal ground accelerations of about 0.1g or greater (Modified Mercalli Intensities greater than VII) in the Yucca Valley area are listed in Table 1-2. For maps showing most of these faults, refer to Figures 1-1 and 1-2, and Plate 1-2. Those faults included in Table 1-2 that could have the greatest impact on the Yucca Valley area, or that are thought to have a higher probability of causing an earthquake, are described in more detail in the following pages. The deterministic analyses indicate that the Pinto Mountain, Burnt Mountain, and Eureka Peak faults have the potential to generate very strong ground shaking in Yucca Valley, with median PHGA values as high as 0.7g to 0.8g. Shaking at these levels can cause significant damage to older structures, and moderate damage to even newer buildings constructed in accordance with the latest building code provisions.

Table 1-2 shows:

- The approximate distance, in miles and kilometers, between the fault and various points in the Yucca Valley area, given as a range. Since these measurements are based on specific, but randomly selected points in the study area; other points in the town could be closer or farther away from the faults than the distances provided herein;
- The maximum magnitude earthquake (M_{max}) each fault is estimated capable of generating;
- The range in peak horizontal ground accelerations (PHGA), provided both for the median (50th percentile) and median plus 1 sigma standard deviation (84th percentile), or intensity of ground motion, expressed as a fraction of the acceleration of gravity (g), that could be experienced in different areas of Yucca Valley if the M_{max} occurs on the faults listed; and
- The range in Modified Mercalli seismic Intensity (MMI) values estimated for the Yucca Valley area.

The peak horizontal ground accelerations and intensities summarized in Table 1-2 are shown from largest to lowest for each fault; these should be considered as approximate values, since different areas of Yucca Valley are expected to feel and respond to each earthquake differently in response to site-specific conditions. As mentioned before, peak ground accelerations and seismic intensity values generally decrease with increasing distance away from the causative fault. However, local site conditions, such as deep basins or reflection off the hard rock forming the mountains in the region, can amplify the seismic waves generated by an earthquake, resulting in localized higher accelerations than those listed here. Please note that the PHGA analyses conducted for this study provide a general indication of relative earthquake risk throughout the Yucca Valley General Plan area. For individual projects however, site-specific analyses that consider the precise distance from a given site to the various faults in the region, as well as the local, near-surface soil types, should be conducted. The most significant faults in Table 1-2 are discussed in greater detail in the subsections below.

Table 1-2: Estimated Horizontal Peak Ground Accelerations and Seismic Intensities in the Town of Yucca Valley Area

Fault or Fault Segment	Approx. Distance to Yucca Valley (miles)	Approx. Distance to Yucca Valley (km)	Magnitude of M_{max}	PGHA (g) from M_{max} (median, median + 1 sigma)	MMI from M_{max}
Pinto Mountain	0 – 4.8	0 – 7.8	7.2	0.8 – 0.35, 1.2 – 0.58	XII – IX
Burnt Mountain	0 – 5.4	0 – 8.7	6.5	0.75 – 0.21, 1.2 – 0.34	XII - VIII
Eureka Peak	0 – 6.0	0 – 9.6	6.5	0.74 – 0.16, 1.2 – 0.27	XII - VII
Landers (faults involved in the Landers 1992 earthquake)	0 – 6.8	0 - 10.9	7.3	0.65 – 0.23, 1.0 – 0.39	XI - IX
Emerson – South Copper Mountain	6.8 – 16.5	11 – 26.5	7.0	0.37 – 0.10, 0.58 – 0.18	X - VII
North Frontal (East segment)	7.7 – 15.5	12.4 – 24.9	6.7	0.36 – 0.15, 0.57 – 0.25	X – VIII
Johnson Valley (Northern)	8.5 – 17.2	13.6 – 27.7	6.7	0.25 – 0.09, 0.39 – 0.15	X - VII
San Andreas (entire southern)	11.3 – 31.1	18.2 – 50.1	8.0	0.38 – 0.19, 0.57 – 0.29	X – VIII
San Andreas (San Bernardino + SG-GH + Coachella)	11.3 – 31.1	18.2 – 50.1	7.7	0.33 – 0.17, 0.49 – 0.26	X – VIII
San Andreas (San Bernardino S + N)	21.5 – 30.8	34.6 – 49.6	7.5	0.30 – 0.15, 0.44 – 0.25	X - VIII
San Andreas (SG-GH + Coachella)	22 – 31.1	35.4 – 50.1	7.2	0.26 – 0.12, 0.45 – 0.21	IX – VIII
Calico – Hidalgo	14.2 – 23.1	22.9 – 37.2	7.3	0.26 – 0.10, 0.38 – 0.16	IX - VII
Pisgah – Bullion Mountain. – Mesquite Lake	15.6 – 25.1	25.1 – 40.4	7.3	0.24 – 0.09, 0.31 – 0.15	IX – VII
Lenwood – Lockhart - Old Woman Springs	15.8 – 24.5	25.4 – 39.4	7.5	0.23 – 0.11, 0.37 – 0.19	IX - VII
North Frontal (West Segment)	22.9 – 30.6	36.9 – 49.2	7.2	0.18 – 0.08, 0.29 – 0.12	IX – VII
Helendale – South Lockhart	27 – 35.1	43.5 – 56.6	7.3	0.13 – 0.07, 0.22 – 0.11	IX – VI

Abbreviations used in Table 1-2:
mi – miles; **km** – kilometer; **M_{max}** – maximum magnitude earthquake; **PHGA** – peak horizontal ground acceleration as a percentage of **g**, the acceleration of gravity; **MMI** – Modified Mercalli Intensity.

The ground motions presented in Table 1-2 are based on the largest earthquake that each fault, or fault segment, is believed capable of generating, referred to as the ***maximum magnitude earthquake*** (M_{max}). This deterministic approach is useful to study the effects of a particular earthquake on a building or community. However, since many potential earthquake sources pose a hazard to the region, it is also important to consider the overall likelihood of damage from a plausible suite of earthquakes, including earthquakes of different sizes on the same fault. This approach is called ***probabilistic seismic hazard analysis*** (PSHA), and typically considers the

likelihood of exceeding a certain level of damaging ground motion that could be produced by any or all faults within a given radius of the project site, or in this case, the Town of Yucca Valley. Most seismic hazard analyses consider a distance of 100 km (62 miles), but this is arbitrary. PSHA has been utilized by the U.S. Geological Survey to produce national seismic hazard maps such as those used by the Uniform Building Code (ICBO, 1997), the International Building Code (ICC, 2009) and the California Building Code (CBSC, 2010).

We ran the interactive ground motion module from the California Geological Survey (http://www.consrv.ca.gov/CGS/rghm/pshamap/pshamap.asp) and that by the U.S. Geological Survey (http://earthquake.usgs.gov/research/hazmaps/design/; https://geohazards.usgs.gov/deaggint/2008/) to estimate the ground motions that have a 10 and 2% probability, respectively, of being exceeded in 50 years in the vicinity of Town Hall. [Seismic design parameters in the 2010 California Building Code are based on the maximum considered earthquake, with a ground motion that has a 2% probability of being exceeded in 50 years and a recurrence interval of about 2,500 years.] For Yucca Valley, the estimated level of ground motion that has a 10% probability of being exceeded in 50 years is approximately 0.5g. The level of ground motion with a 2% probability of being exceeded in 50 years is nearly 1.0g. The principal sources responsible for these levels of shaking are the Pinto Mountain and Burnt Mountain faults, with the Pinto Mountain fault contributing most to the seismic hazard. These levels of shaking are in the moderate to very high range for southern California, and can be expected to cause significant damage, particularly to older and poorly constructed buildings.

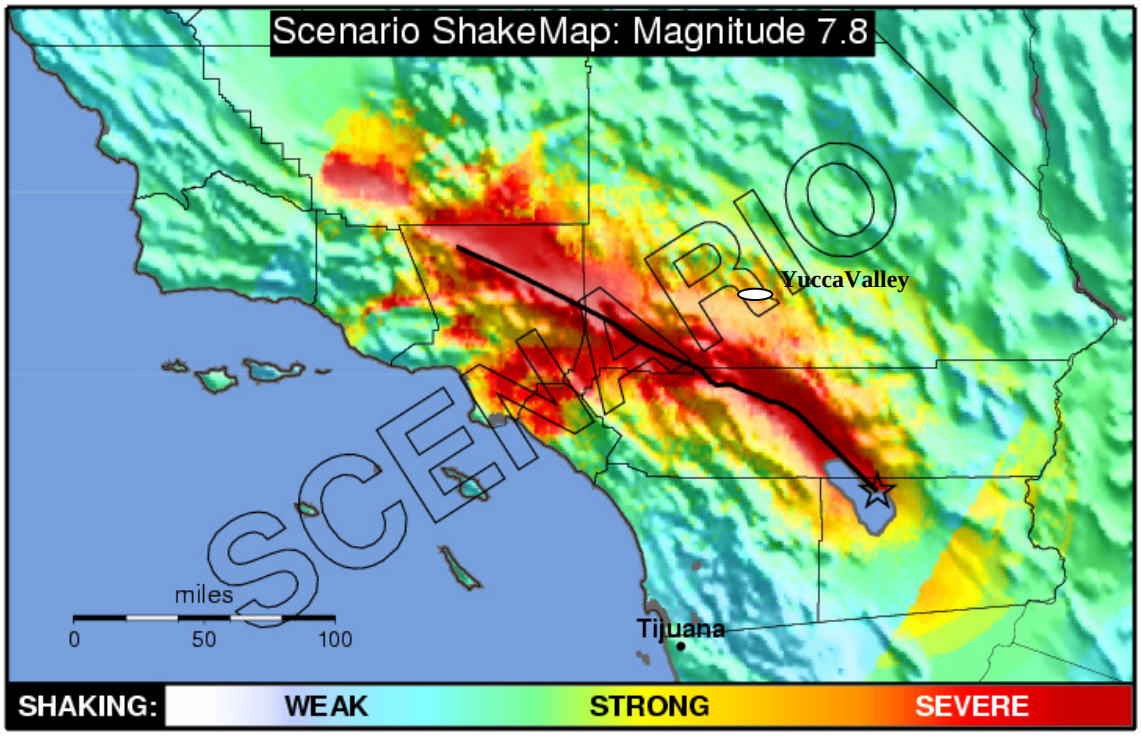
Regardless of which fault causes a damaging earthquake, there will always be ***aftershocks***. By definition, these are smaller earthquakes that happen close to the ***mainshock*** (the biggest earthquake of the sequence) in time and space. These smaller earthquakes occur as the Earth adjusts to the regional stress changes created by the mainshock. As the size of the mainshock increases, there typically is a corresponding increase in the number of aftershocks, the size of the aftershocks, and the size of the area in which they might occur.

On average, the largest aftershock will be 1.2 magnitude units less than the mainshock. Thus, a M_W 6.9 earthquake will tend to produce aftershocks up to M_W 5.7 in size. This is an average, and there are many cases where the biggest aftershock is larger than the average predicts. The key point is this: any major earthquake will produce aftershocks large enough to cause additional damage, especially to already weakened structures. Consequently, post-disaster response planning must take damaging aftershocks into account.

Another way to communicate the seismic shaking hazard is with the use of ShakeMaps. A ShakeMap is a representation of the various levels of ground shaking throughout the region where an earthquake occurs. ShakeMaps are compiled from the California Integrated Seismic Network (CISN) – a network of seismic recording instruments located throughout the state – and are automatically generated following moderate to large earthquakes. Preliminary real-time maps are posted within minutes on the Internet (http://earthquake.usgs.gov/eqcenter/shakemap/) giving disaster response personnel an immediate picture of where the most damage likely occurred. Although several shaking parameters can be illustrated on ShakeMaps, such as peak acceleration and peak velocity, most people can relate more easily to maps illustrating the intensity of ground shaking. Using actual instrumental ground motion recordings and comparing them to observed

Modified Mercalli Intensities from recent California earthquakes, scientists can now estimate shaking intensities within a few minutes after an earthquake.

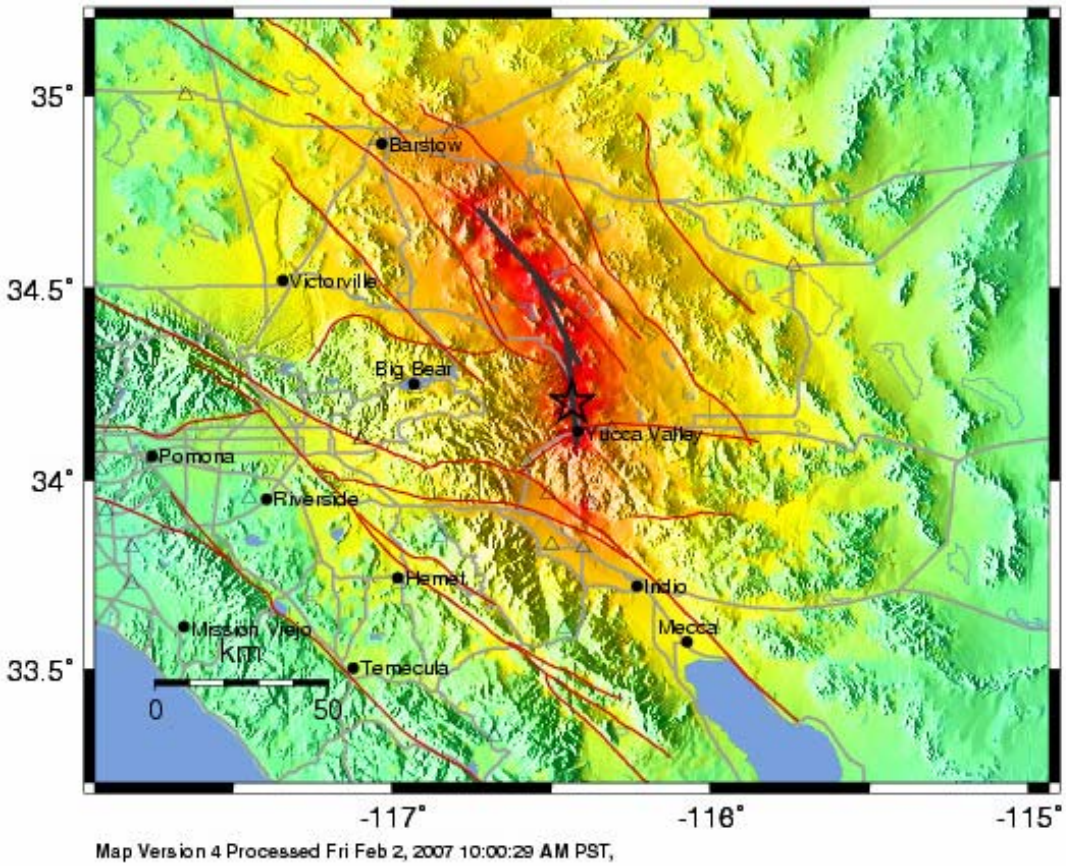
Figure 1-4:
ShakeMap for a Magnitude 7.8 Earthquake Scenario on the Southern San Andreas Fault



Source: http://earthquake.usgs.gov/eqcenter/shakemap/sc/shake/ShakeOut2_full_se/#Decorated

ShakeMaps can also be used for planning and emergency preparedness by creating hypothetical earthquake scenarios. These scenarios are not predictions – knowing when or how large an earthquake will be in advance is still not possible. However, using realistic assumptions about the size and location of a future earthquake, we can make predictions of its effects, and use this information for loss estimations and emergency response planning. Figure 1-4 is an intensity ShakeMap for the hypothetical magnitude 7.8 "Shakeout" earthquake scenario that involves rupture of the entire southern San Andreas fault south and west of the Town of Yucca Valley. The ShakeMap shows that the area in and around Yucca Valley would experience strong shaking. As a comparison, Figure 1-5 shows the intensity ShakeMap for the 1992 Landers earthquake, which is based on actual reports of damage observed and shaking felt by residents throughout the region. Seismic ground shaking in the Town of Yucca Valley was perceived as severe to violent. As strong as this earthquake was felt in Yucca Valley, had the faults that caused the Landers earthquake ruptured from north to south, instead of from south to north, the shaking in Yucca Valley would have most likely been perceived as violent to extreme.

Figure 1-5: Modified Mercalli Intensity ShakeMap for the June 28, 1992 Landers Earthquake



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Source: http://earthquake.usgs.gov/eqcenter/shakemap/sc/shake/9108645/

1.4.1 Pinto Mountain Fault Zone

The ***Pinto Mountain fault*** is a prominent left-lateral strike-slip fault zone that bounds the north side of the Little San Bernardino Mountains and extends in a westerly direction through the heart of Yucca Valley (see Section 1.5) and on to the Morongo Valley, where it is known as the ***Morongo Valley fault***. The fault zone is at least 73 km (45 miles) long, and possibly as much as 90 km (56 miles) long, ending at its west end against the San Andreas fault. Relative recent studies show that this fault has ruptured repeatedly in the last 14,000 years, with at least four surface-rupturing earthquakes within the past about 9,400 years (Cadena and others, 2004). Current estimates on its rate of slip (rate of movement averaged over time) suggest a rate of between 1.1 and 2.3 mm/yr (40 to 90 inches/1000 yr). Additional studies may refine those estimates further. A magnitude 7.2 earthquake on this fault could generate median peak horizontal ground accelerations in

the Yucca Valley area of about 0.8g to 0.35g (at the 84th percentile, the peak ground motions range between 1.2g and 0.58g). Such an earthquake would cause extensive damage typical of MM intensities of between XII and IX. A potentially larger magnitude 7.5 earthquake on the Pinto Mountain fault could generate stronger ground shaking and more damage in the Yucca Valley area. Rupture of the Pinto Mountain fault is considered the worst-case scenario for Yucca Valley.

1.4.2 Burnt Mountain Fault

Like several other Mojave (or Eastern California) Shear Zone faults, the Burnt Mountain fault was unknown prior to late June 1992, when a 6-km (3.7-mile) length of this fault ruptured at the ground surface, probably during a large aftershock of the Landers earthquake, experiencing about 6 cm (2.4 inches) of right-lateral offset. Geologists later mapped the area and determined that the Burnt Mountain fault has a total length of about 21 km (13 miles). Based on their location, the Burnt Mountain and Eureka Peak faults are thought to be important structures that are accommodating the transfer of strain from the San Andreas fault system to the Eastern California Shear Zone (http://www.data.scec.org/fault_index/burntmtn.html).

The Burnt Mountain fault is thought to have a long-term slip rate of about 0.5 mm/yr (20 inches/1000 yr), but fault-specific studies are needed to better define the fault's earthquake history and rate of slip. Based on its length (using the relations by Wesnousky, 1986), this fault is thought capable of producing a magnitude 6.0 to 6.5 earthquake. However, larger magnitude earthquakes are possible if this fault ruptures together with other faults in the area. Using the California Geological Survey preferred magnitude of 6.5, the Burnt Mountain fault is capable of generating peak ground horizontal accelerations in the Yucca Valley study area of between about 0.75g and 0.21g (and at the 84th percentile, of between 1.2g and 0.34g), with MM intensities in the XII to VIII range.

1.4.3 Eureka Peak Fault

This 20-km (12 miles) long, right-lateral strike-slip fault was "discovered" when it broke the ground surface during the 1992 Landers earthquake sequence, in part as a result of a large aftershock (Hough and others, 1993). Although the maximum surface offset measured on the 11-km (6.8-mile) long section of the fault that ruptured was only 21 cm (8 inches), and therefore considerably less than the 2- to 3-meter (6- to 9-foot) offsets measured elsewhere, this small amount of offset allowed geologists to map the fault and discover the nearby Burnt Mountain fault (http://www.data.scec.org/fault_index/eureka.html). Creepmeters installed along the fault following the Landers earthquake suggest that the fault slipped about 12 cm (4.7 inches) immediately following the main earthquake sequence, and that it has since continued to slip (Behr and others, 1994). In fact, geologists think that most of the slip on this fault occurred in two separate but closely spaced events, plus some afterslip. The first rupture is thought to have occurred about 30 seconds after the Landers mainshock, whereas the second rupture episode was probably as a result of a magnitude 5.7 aftershock that occurred less than three minutes after the mainshock. Seismologists have also suggested that the Eureka Peak fault caused the Joshua Tree earthquake in April 1992, and transferred strain onto the faults that ruptured during the Landers earthquake, three months later (Jones and others, 1995).

Slip rate on this fault is estimated at 0.6 mm/yr (24 inches/1000 yr), but its earthquake history prior to 1992 is poorly resolved. Based on its length, the Eureka Peak fault alone is though capable of generating M_w 5.5 to 6.8 earthquakes, and, as the Landers earthquake showed, if combined with other faults, it has the potential to generate even larger earthquakes. Using a magnitude 6.5 earthquake (slightly larger than the magnitude 6.4 event that the California Geological Survey (Cao and others, 2003) prefers as the maximum magnitude event on this fault), the Eureka Peak fault is estimated capable of generating median peak ground accelerations in the Yucca Valley area of between about 0.74g and 0.16g (and ground motions in the 1.2g to 0.27g at the 84th percentile), with MM intensities in the XII to VII range.

1.4.4 Landers (or Kickapoo) Fault

The Landers fault was the name given to the group of faults that ruptured during the 1992 Landers earthquake, including the Homestead Valley, Kickapoo, and Johnson Valley faults, and segments of the Burnt Mountain and Eureka Peak faults. [The name Landers fault is also used to refer to the Kickapoo fault, but in this report we use the term Landers to refer to the group of faults that ruptured in 1992.] The interval between major ruptures on these faults is uncertain, but is probably in the thousands of years, which is why these faults were unknown or poorly known prior to 1992. As a result of the 1992 earthquake some of these faults experienced significant lateral displacements – the Kickapoo fault moved laterally nearly 3 meters (9.5 feet) (Sieh and others, 1993). Individually, these faults could rupture in smaller earthquakes (similar to the 1979 Homestead Valley earthquake swarm that ruptured a portion of the southern Johnson Valley and Homestead Valley faults), but their combined lengths allowed for the magnitude 7.3 earthquake that shook southern California on the morning of June 28, 1992. Ground shaking in the Yucca Valley area due to a Landers-type earthquake on these faults with an epicenter closer to the Town is estimated at median horizontal ground accelerations of between 0.65g and 0.23g (1.0g to 0.39g at the 84th percentile), with MM intensities in the XI to IX range.

1.4.5 Emerson South – Copper Mountain Fault Zone

The right-lateral strike-slip Emerson South fault last ruptured on June 28, 1992, during the M_w 7.3 Landers earthquake. This earthquake illustrated the transfer of strain from one fault segment to the next: rupture on the South Johnson Valley fault was transferred to the Emerson fault by the right-stepping Kickapoo (Landers) and Homestead Valley faults, and rupture on the Emerson fault was in turn transferred northward to the Camp Rock fault.

The ***Emerson South fault*** is about 55 km (34 miles) long, and is estimated to slip at a rate of about 0.5 mm/yr (20 inches/1000 yr). The penultimate (prior to 1992) surface-rupturing earthquake on this fault is thought to have occurred about 9,000 years ago, so this fault seems to have long periods of dormancy between ruptures (Rubin and Sieh, 1997). Alone, the fault is thought capable of rupturing in a magnitude 6.5 earthquake, but the fault is essentially continuous with the Copper Mountain fault to the south. The ***Copper Mountain fault*** is about 17 km (11 miles) long, and is also thought to slip at about 0.5 mm/yr (20 inches/1000 yr). Its past earthquake history is uncertain, but its most recent rupture is thought to have occurred in the Holocene. An earthquake on the combined Emerson South – Copper Mountain faults of estimated magnitude 7.0 would generate median peak ground accelerations in Yucca Valley of about 0.37g to 0.1g (with values in the 0.58g to 0.18g range at the 84th percentile). The Southern California Earthquake Center suggests

that these faults could generate an even larger magnitude 7.3 earthquake, consistent with the size of the Hector Mine earthquake of 1999 that ruptured the northern section of the Emerson fault (http://www.data.scec.org/fault_index/emerson.html). That event would generate slightly stronger seismic shaking in the Town of Yucca Valley.

1.4.6 North Frontal Fault Zone

This south-dipping, partially blind reverse fault zone along the east flank of the San Bernardino Mountains consists of several fault splays that have a combined total length of approximately 65 km (40 miles). Several of the fault splays interact with other nearby faults; the most significant of these is the Helendale fault, which seems to right-laterally offset the North Frontal fault zone, dividing it into two main segments (referred to as the East and West segments; Meisling, 1984; Bryant, 1986b).

The North Frontal fault is thought to have moved in the past 10,000 years, making it an active fault. However, the fault has not been studied in detail, and its recurrence interval, slip rate and other fault parameters are not well understood, although a slip rate of about 0.5 mm/yr (20 inches/1000 yr) is attributed to it. Furthermore, movement on this fault is thought to be responsible for uplift of the San Bernardino Mountains at an average rate of about 1 mm/yr (40 inches/1000 yr). Based on its length, the East segment of the North Frontal fault zone is thought capable of generating a maximum magnitude 6.7 earthquake. An earthquake of that size on this fault would be felt in Yucca Valley with median peak ground accelerations of between about 0.36g and 0.15g, and felt effects consistent with MM intensities in the X to VIII range. If the more distant West segment of the North Frontal fault zone ruptured in a 7.2 earthquake, the Yucca Valley area is expected to experience ground shaking of between about 0.18g and 0.08g, with MM intensities in the IX to VII range.

1.4.7 Johnson Valley Fault

The ***Southern Johnson Valley fault*** is one of the five faults that ruptured during the 1992 Landers earthquake, whereas its northern extension, the ***Northern Johnson Valley fault***, did not. Trenching studies have shown that the Northern Johnson Valley fault last ruptured about 5,800 and 7,500 years ago in large earthquakes. A smaller earthquake may have ruptured the fault about 11,500 years ago (Rockwell and others, 2000). These data suggest that the Northern segment of the Johnson Valley fault is at or near the end of its cycle, and is a likely candidate for an earthquake on the not-too-distant future. The California Geological Survey (Cao and others, 2003) assign a magnitude 6.7 to this fault segment. An earthquake of that size would generate median peak ground shaking in the Town of Yucca Valley of about 0.25g to 0.09g (between 0.39g and 0.15g at the 84th percentile), with felt effects consistent with MM intensities in the IX to VII range. Rockwell and others (2000), however, estimate that the Northern fault segment is capable of generating a slightly larger magnitude 6.8 earthquake. Furthermore, the trenching studies suggest that the Northern and Southern segments of the fault, in addition to the Kickapoo fault, all ruptured together in the penultimate event about 5,800 years ago, suggesting that all three faults could be involved in a future, larger-than-magnitude-7.0 earthquake.

1.4.8 San Andreas Fault Zone

The San Andreas fault is the principal boundary between the Pacific and North American plates. The fault extends nearly 1,300 km (800 miles), from near Cape Mendocino in

northern California to the Salton Sea region in southern California. This fault is considered the "Master Fault" in southern California because it has frequent, large earthquakes and controls the seismic hazards of the area. Many refer to an earthquake on the San Andreas fault as "The Big One," and for many parts of southern California, this is indeed true. However, as shown above, several other faults closer to Yucca Valley have the potential to cause stronger ground shaking, and therefore more local damage, than the San Andreas fault. Nevertheless, the San Andreas fault should be considered in all seismic hazard assessment studies in southern California given its high probability of causing an earthquake in the near future. In 2007-2008, a group of scientists referred as the 2007 Working Group on California Earthquake Probabilities (WGCEP, 2008) calculated that the southern San Andreas fault had a 59% probability of causing an earthquake of at least magnitude 6.7 in the next 30 years. That probability increases with each passing year without an earthquake.

Large faults, such as the San Andreas fault, are often divided into segments or sections in order to evaluate their future earthquake potential. The sections are typically based on physical characteristics along the fault, particularly changes in dip and/or strike, and style of faulting. Each fault section is assumed to have a characteristic slip rate, recurrence interval (time between moderate to large earthquakes), and displacement (amount of offset during an earthquake). Historical records and studies of prehistoric earthquakes show it is possible for more than one section to rupture during a large quake or for ruptures to overlap into adjacent sections. For example, the last major earthquake on a portion of the southern San Andreas fault (and the largest earthquake reported in California) was the 1857 Fort Tejon (magnitude 8) event. The 1857 earthquake ruptured the Cholame, Carrizo, Big Bend, and Mojave North and Mojave South sections of the fault, resulting in displacements of as much as 9 meters (27 feet) along the rupture zone. There are data that suggest that these sections and portions of sections, which are combined into a fault segment, tend to rupture together time and time again in what is referred to as a "characteristic earthquake."

The definition and naming of the various sections, segments, fault strands and fault splays have varied over time, the result of many investigators working on different aspects and parts of the fault zone, and the recent efforts to compile these data into a unified model. In this report, the fault nomenclature used follows that defined by the 2007 Working Group on California Earthquake Probabilities (2008). The southern San Andreas fault is now divided into ten sections named, from north to south, Parkfield, Cholame, Carrizo, Big Bend, Mojave North, Mojave South, San Bernardino North, San Bernardino South, San Gorgonio-Garnet Hill, and Coachella (WGCEP, 2008). The southernmost sections are discussed further below as these are the sections closest to the Yucca Valley area. Specifically, the Yucca Valley area is, at a minimum, about 34.6 km 2 (1.5 miles) from the San Bernardino South section,18 km (11 miles) from the San Gorgonio–Garnet Hill segment, and 35.4 km (22 miles) from the Coachella segment. Each of these sections is discussed further in the following paragraphs.

The ***San Bernardino (South and North) segments*** combined are about 70 km (43 miles) long and extend from the Burro Flats area northward to approximately Cajon Pass. These faults, like the Coachella section, appear to be nearly vertical, and are predominantly strike-slip in motion. Slip rate on the San Andreas fault in this area decreases southward.

At the north end of the San Bernardino North segment, in the area of Cajon Pass and Pittman Canyon, the fault has a slip rate of 22±6 mm/yr (72.2±2 feet/1000 yr). To the south, some of the slip is being transferred to the San Jacinto fault through the Crafton Hills fault and related structures, so that slip on the San Bernardino South segment is estimated at 16±6 mm/yr (5.25± 2 feet/1000 yr) (WGCEP, 2008). Both segments appear to have last ruptured in 1812. If both sections rupture together in the future, the resultant magnitude 7.5 earthquake could cause peak ground accelerations in the Town of Yucca Valley of between about 0.44g and 0.15g. If these fault sections rupture in conjunction with the Mojave and/or Coachella Valley segments, higher ground motions could be expected in the region.

The ***San Gorgonio-Garnet Hill section*** is about 66 km (41 miles) long, and extends northwesterly and westerly from just north of the city of Indio, through the San Gorgonio Pass, to just south of Burro Flats. From south to north, this section is comprised of two main branches (the Banning fault on the south, and the Mission Creek fault on the north) in addition to several other faults, including the Garnet Hill fault. At its western end, the Garnet Hill fault merges with the San Gorgonio Pass fault. Unlike the San Bernardino and Coachella sections to the north and south, respectively, this section is very complex, being mostly oblique strike-slip, with a major thrust component of movement (Yule and Sieh, 2003). Each of these faults that are part of the San Gorgonio-Garnet Hill section is discussed further in the paragraphs below.

The *Banning fault* is an older, right-lateral strike-slip structure dating back to latest Miocene time (about 4 or 5 to 7.5 million years ago), when it is thought to have served as an ancestral strand of the San Andreas fault (Matti and Morton, 1993). Based on geologic and geomorphic characteristics, as well as the fault's tectonic history during the last two million years, Matti and others (1992) divided the Banning fault into three segments. The western segment, extending from the San Jacinto fault southeastward to the Calimesa area, is considered not active because it does not break Quaternary alluvium and has no surface expression (the location of the fault has been inferred from gravity data and other indirect geologic evidence). The central segment, which extends from Calimesa to Cottonwood Canyon, for the most part also does not affect Quaternary deposits, and has been overprinted by reverse and thrust faults that are probably related to development of the San Gorgonio Pass fault zone. There is, however, a 3-km (2-mile) long section of the central Banning fault with thrust-type motion that offsets young alluvium in Millard Canyon. Therefore, the fault is active in that area (Yule and Sieh, 2003). The easternmost portion of the ancestral Banning fault, from Cottonwood Canyon to its junction with the Coachella section of the fault near the Indio Hills, has been reactivated during Quaternary time, and has many geomorphic characteristics of youthful strike-slip activity.

The *Mission Creek fault* has right-lateral strike-slip motion along most of its trace, but gradually evolves into thrust-type motion at its western end. Some researchers have suggested this fault is either an older strand of the San Andreas that is less active than other strands, or that is no longer active (Matti and others, 1992; Yule and Sieh, 2003). This is most likely true for the northern end of the fault, but trenching near its southern end, at Thousand Palms Oasis, has shown that at this site, the fault has experienced four, and probably as many as five, surface-rupturing earthquakes in the past about 1,200 years

(Fumal and others, 2002). The most recent earthquake on this strand is most likely the same A.D. 1680 event reported by Sieh (1986) and Sieh and Williams (1990) at a site in Indio. Comparison of data obtained at the Thousand Palms Oasis site with data from the Indio site to the south, and the Wrightwood site about 120 km (75 miles) to the northwest, suggests that the southernmost 200 km (125 miles) of the San Andreas fault have ruptured together, and thus has the potential to rupture again together in large earthquakes (Fumal and others, 2002; Fumal, Rymer and Seitz, 2002).

The *Garnet Hill fault* parallels the trend of the Banning fault, extending from a few miles west of Whitewater south to Thousand Palms, where the fault trace dies out. The fault is primarily a right-lateral strike-slip fault along most of its trace, but splays into a series of oblique reverse faults at its western end. Based on seismological data, Yule and Sieh (2003) concluded that the Garnet Hill fault and the Banning fault merge at a depth of about 5 km (3.1 miles), and that the single fault plane below this depth was the source of the 1986 North Palm Springs earthquake. They further suggested that the Garnet Hill fault merges with the San Gorgonio Pass fault zone to carry slip between the disconnected segments of the San Andreas fault, thus making the Banning-Garnet Hill-San Gorgonio Pass system a significant seismic source in the region.

The *San Gorgonio Pass fault zone* consists of a series of north-dipping reverse and thrust faults linked by strike-slip tear faults, giving its surface trace an irregular, saw-tooth appearance (Yule and Sieh, 2003). This zone begins near Cottonwood Canyon and extends westward to the Calimesa area. Faults within this east-west trending zone have thrust ancient crystalline rock southward over younger sedimentary rock and alluvial sediments. These faults formed during the Pleistocene in response to compression created by the bend and the step-over in the trace of the San Andreas fault; activity of some of these faults has continued into the Holocene, as indicated by many youthful scarps that are present in young alluvium (Matti and others, 1992; Yule and Sieh, 2003).

The San Gorgonio-Garnet Hill section is thought to have last ruptured in 1812, although additional studies need to be conducted to confirm this (Yule and others, 2006; Dawson and others, 2008). Paleoseismic data also suggest that the Coachella, San Gorgonio-Garnet Hill, and San Bernardino sections ruptured simultaneously in earthquakes that occurred around A.D. 1500, and possibly A.D. 1680 (Dawson and others, 2008, summarizing data by Fumal and others, 2002, Yule and others, 2006, and McGill and others, 2002). Investigators suggest that some of the strain is also being transferred northward onto the faults in the Indio Hills and probably the Eastern California Shear Zone. The 2007 WGCEP (2008) assigned a slip rate of 10±6 mm/yr (32.8±0.5 feet/1000 year) to the San Gorgonio-Garnet Hill section.

The ***Coachella segment*** comprises the relatively straight, predominantly right-lateral strike-slip fault that extends from Bombay Beach in the Salton Sea northward to the Biskra Palms area north of Indio, a distance of about 67.6 km (42 miles). This section is the only section of the southern San Andreas fault that has not produced a major earthquake in historic times (Sieh and Williams, 1990; Fumal and others, 2002; Philibosian and others, 2011). Paleoseismic studies suggest that the last surface-rupturing earthquake on this section occurred more than 320 years ago, around A.D 1680 (Sieh and Williams, 1990) or A.D. 1690 (Philibosian and others, 2011). The data also suggest that in the A.D. 1680

earthquake, the Coachella section ruptured together with the San Gorgonio-Garnet Hill and San Bernardino segments, and that this also happened in an earthquake around A.D. 1450. The 2007 WGCEP assigned a slip rate of 20±3 mm/yr (65.6±10 feet/1000 year) to this segment. Rupture of the Coachella fault segment in a magnitude 6.8 earthquake is estimated capable of generating peak ground accelerations in Yucca Valley of about 0.18g to 0.08g.

Based on the paleoseismic record, however, larger earthquakes that involve rupture of several segments of the southern San Andreas fault should be considered. Rupture of the Coachella and San Gorgonio-Garnet Hill fault segments in a magnitude 7.2 earthquake is estimated capable of generating peak ground accelerations in Yucca Valley of about 0.26g to 0.12g (0.45g to 0.21g at one standard deviation above the mean). If the San Bernardino (South and North), San Gorgonio-Garnet Hill and Coachella sections rupture together in a magnitude 7.7 earthquake, Yucca Valley would experience peak ground accelerations of between 0.33g and 0.17g (0.49g to 0.26g at the 84th percentile). These are strong to very strong ground motions. If these sections ruptured together with the Mojave sections to the north in a magnitude 8.0 earthquake, peak horizontal ground accelerations of between about 0.57g and 0.19g could be anticipated in the Yucca Valley area.

1.4.9 Calico – Hidalgo Fault Zone

The ***Calico fault*** is a 55-km (34-mile) long, right-lateral strike-slip structure that exhibited triggered slip during the 1992 Landers earthquake and was the source of a M_L 5.3 earthquake that shook the eastern California area on March 18, 1997. The 1997 earthquake is considered the last large aftershock of the 1992 Landers earthquake, and its epicenter was on the northern section of the fault, about 19 km (12 miles) east-northeast of Barstow, near the Calico Mountains.

The Calico fault is the longest and possibly the fastest-slipping of the faults in the Eastern California Shear Zone, with a slip rate estimated at about 1.8±0.3 mm/yr (5.9±1 feet/1000 yr). The recurrence interval between earthquakes on this fault is estimated at about 1,500 years (http://www.scecdc.scec.org/fault_index/), although researchers have suggested that in this portion of the southern California fault system, earthquakes recur in clusters, with long periods of inactivity between clusters (Rockwell and others, 2000). Geologists have been conducting paleoseismic studies of the Calico fault in an effort to better understand its past earthquake history and test the strength of the earthquake clustering hypothesis (Oskin and others, 2007). Ganev and others (2010) excavated trenches across the Calico fault and have found evidence for four surface-rupturing earthquakes on this fault in the past about 9,000 years. The most recent of these events occurred between about 600 and 2,000 years ago, whereas the two prior events occurred clustered in time, between about 5,000 and 6,000 years ago.

Based on its length, the Calico fault is thought capable of generating a M_w 6.5 to 7.1 earthquake; however, the Calico fault is essentially continuous with the ***West Calico*** and ***Hidalgo faults*** to the south, and all three of these faults could rupture at the same time, potentially producing a larger magnitude earthquake. The 40-km- (25-mile-) long Hidalgo fault is thought to have a slower slip rate of only about 0.5 mm/yr (20 inches/1000 yr), and its earthquake history is unknown. Alone, the Hidalgo fault is thought capable of

generating a M_w 6.4 to 7.1 earthquake. For the purposes of this study, and in conformance with the California Geological Survey's fault parameters database (Cao and others, 2003), these faults are assumed to break together in a M_w 7.3 earthquake. Such an event would produce median peak horizontal ground accelerations in the Town of Yucca Valley of between about 0.26g and 0.10g (and between 0.38g and 0.16g at the 84th percentile), with MM intensities in the IX to VII range.

1.4.10 Pisgah – Bullion Mountain – Mesquite Lake Fault Zone

The ***Pisgah fault*** is a 34-km- (21-mile-) long, right-lateral strike-slip fault that experienced triggered slip in 1992, as a result of shaking from the Landers earthquake. The fault is thought to have last moved in the Holocene, but the interval between surface-rupturing earthquakes is unknown. The fault is thought to have a slip of about 0.8 mm/yr (2.6 feet/1000 yr), but geologic studies need to be conducted to confirm these estimates. If only the Pisgah fault ruptured in an earthquake, the resulting event would have a magnitude M_w between 6.0 and 7.0. However, the Pisgah fault may also rupture together with the 55-km- (34-mile-) long ***Bullion fault*** to the south, and the 40-km- (22-mile-) long ***Mesquite Lake fault*** farther south. The Bullion fault last ruptured on October 16, 1991 during the M_w 7.1 Hector Mine earthquake. Prior to that, both the Bullion and Mesquite Lake faults appear to have ruptured during a large earthquake in the mid to late Holocene (Madden and others, 2006).

Relatively recent studies of the Mesquite Lake fault have shown that this fault has had three large surface-rupturing earthquakes in the past about 10,200 years, each creating an apparent vertical offset of between 1.0 and 1.2 meters (3.3 to 3.9 feet), suggesting similar-sized earthquakes. The trenching data indicate this fault has a horizontal slip rate of between 0.7 and 0.9 mm/yr (2.3 and 3 feet/1000 yr), consistent with the slip rates estimated for several other faults in the Eastern California Shear Zone. The paleoseismic data also seem to suggest that earthquakes on this fault occur in clusters, separated by seismically quiet periods that last several thousands of years in between, and that seismic activity in the shear zone flip flops between the eastern and western faults in the region (Madden and others, 2006).

A magnitude 7.3 earthquake is estimated if all three fault segments – the Pisgah, Bullion Mountain and Mesquite Lake – ruptured together. An earthquake of that size on these faults would generate median peak horizontal ground accelerations in the Yucca Valley area of about 0.24g to 0.1g (0.31g to 0.15g at the 84th percentile), with MM intensities of IX to VII.

1.4.11 Lenwood – Lockhart – Old Woman Springs Faults

Another of the Eastern California Shear Zone faults, the ***Lenwood fault*** is a right-lateral strike slip fault approximately 75 km (47 miles) long with a slip rate of about 0.8 mm/year (2.6 feet/1000 yr). Trenching studies have shown that the fault has ruptured at least three times in the Holocene, roughly 200-400, 5,000-6,000, and 8,300 years ago, for a recurrence between major surface ruptures of 4,000 to 5,000 years. Prior to the 1992 Landers earthquake, when the fault experienced triggered slip near its southeast end, aseismic creep on this fault had been recorded but not verified (http://www.scecdc.scec.org/fault_index/).

The ***Lockhart fault*** is a right-lateral strike-slip fault approximately 70 km (44 miles) long north of the Lenwood fault. The ***North Lockhart fault*** – a segment that shows no evidence of Holocene activity – adds 10 km (6 miles) to the length above. The interval between major surface-rupturing earthquakes on the Lockhart fault is estimated at between 3,000 and 5,000 years (Jennings, 1994), with the central portion of the fault having ruptured during the Holocene, and segments both to the north and south believed to have last ruptured in the Quaternary (http://www.data.scec.org/fault_index/lockhart.html).

The ***Old Woman Springs fault*** segment is the main trace of a complex system of faulting at the junction between the Eastern segment of the North Frontal Fault Zone and the Lenwood fault. The Old Woman Springs trace is about 10 km (6 miles) long and exhibits right-lateral strike-slip movement with some vertical slip. The fault is thought to have last moved in the Holocene (http://www.scecdc.scec.org/fault_index/), and is therefore considered active.

Although the Lenwood and Lockhart faults form essentially a continuous, 150-km- (90-mile-) long system, there is no evidence that both of these faults have ruptured together in the past. Nevertheless, such an event might be possible, as evidenced by the rupture of five separate fault segments during the Landers earthquake. For the purposes of this study, these faults, together with the Old Woman Springs fault, are assumed to rupture together in a magnitude 7.5 maximum magnitude earthquake. Such an event would generate median peak ground accelerations in the Town of Yucca Valley of between about 0.23g and 0.11g, and MM intensities in the IX to VII range. If only one of these faults ruptures in an earthquake, the smaller magnitude event would cause lesser ground motions in Yucca Valley than those reported above.

1.4.12 Helendale – South Lockhart Fault

The ***Helendale fault*** is the westernmost of the right-lateral strike-slip faults that combined are referred to as the Eastern California Shear Zone. The Helendale fault is 90 km (56 miles) long, but it also seems to form a continuous fault with the South Lockhart fault to the north. Towards its southern end, the Helendale fault seems to offset the North Frontal fault, separating it into East and West segments, as discussed above, in Section 1.4.6.

The ***South Lockhart fault*** is a right-lateral strike-slip fault with a minor dip-slip component (Bryant, 1987). The central and southern segments of the South Lockhart fault display evidence of Holocene rupture, including deformed Holocene sediments and well-defined scarps (Bryant, 1987). The northern segment of the South Lockhart fault is poorly defined and does not show evidence of Holocene rupture, indicating that the whole fault may not rupture at the same time. Rupture of multiple segments of both the Helendale and the South Lockhart faults may result in a large-magnitude earthquake that would be greater than if the South Lockhart, or the Helendale fault ruptured alone.

Petersen and Wesnousky (1994) calculated a slip rate for the Helendale fault of 0.8 mm/yr (2.6 feet/1000 yr) and a recurrence interval for large surface-rupturing events of 3,000 to 5,000 years. Paleoseismic studies of the Helendale fault indicate, however, a recurrence interval of 6,000 to 11,000 years (Bryan and Rockwell, 1995), with evidence of as many as three earthquakes in the past 16,500 years. Paleoseismic studies on the South Lockhart fault are required to better understand the earthquake history of this fault. Based on the

data available at this time, the California Geological Survey uses a maximum earthquake of magnitude 7.3 to estimate the ground motion hazard resulting from the combined Helendale-South Lockhart faults. An earthquake of that size is anticipated to generate horizontal peak ground accelerations in Yucca Valley of between about 0.13g and 0.07g (0.22g to 0.11g at the 84th percentile), with MM intensities of between IX and VI.

1.5 Surface Fault Rupture

1.5.1 Definitions

Primary fault rupture refers to fissuring and displacement of the ground surface along a fault that breaks in an earthquake. Primary fault rupture is rarely confined to a simple line along the fault trace. As the rupture reaches the brittle surface of the ground, it commonly spreads out into complex fault patterns of secondary faulting and ground deformation. In the 1992 Landers earthquake, the zone of deformation around the main trace was locally hundreds of feet wide (Lazarte and others, 1994). Surface displacement and distortion associated with secondary faulting and deformation can be relatively minor or can be large enough to cause significant damage to structures.

Primary ground rupture due to fault movement typically results in a relatively small percentage of the total damage in an earthquake, yet being too close to a rupturing fault can result in extensive damage. It is difficult and generally costly to safely reduce the effects of this hazard through building and foundation design. Therefore, the preferred and traditional mitigation measure for this hazard is to avoid active faults by setting structures back from the fault zone. In California, application of this measure is subject to requirements of the Alquist-Priolo Earthquake Fault Zoning Act and guidelines prepared by the California Geological Survey – previously known as the California Division of Mines and Geology (CGS Note 42 by Hart and Bryant, 2007). The final approval of a fault setback lies with the local reviewing agency.

Secondary fault rupture refers to ground surface displacements along faults other than the main traces of active regional faults. Secondary ground deformation includes fracturing, shattering, warping, tilting, uplift and/or subsidence. Unlike the regional faults, most of these subsidiary faults are not deeply rooted in the Earth's crust and are not capable of producing damaging earthquakes on their own. Movement along these faults generally occurs in response to movement on a nearby regional fault. The zone of secondary faulting can be quite large, even in a moderate-sized earthquake. For instance, in the 1971 San Fernando quake, movement along subsidiary faults occurred as much as 2 km (1.2 miles) from the main trace (Ziony and Yerkes, 1985). Triggered slip as a result of a regionally large earthquake can also occur in faults many kilometers away from the causative fault. For example, as a result of the 1992 Landers earthquake, triggered surface slips were documented in the Coachella Valley area (Rymer, 2000). Similarly, following the 1999 Hector Mine earthquake, triggered surface slips were recorded in the Salton Trough (Rymer and others, 2002; Meltzner and others, 2006). More recently, as a result of the April 4, 2010 Sierra El Mayor earthquake in Baja California, triggered slip was reported on the San Andreas, Superstition Hills, Imperial and Brawley fault zones.

Faults have formed over millions of years, usually in response to regional stresses. Shifts in these stress regimes do occur over millennia. As a result, some faults change in character. For example, a thrust fault in a compressional environment may become a strike-slip fault in a transpressive (oblique compressional) environment. Other faults may be abandoned altogether, and previously not active faults may be reactivated. Consequently, the State of California, under the guidelines of the Alquist-Priolo Earthquake Fault Zoning Act of 1972 (Hart and Bryant, 1999, 2007; http://www.conservation.ca.gov/cgs/rghm/ap/Pages/main.aspx), classifies faults according to the following criteria:

- ***Active***: faults showing proven displacement of the ground surface within the past 11,000 years (within the Holocene Epoch), that are thought capable of producing earthquakes;

- ***Potentially Active***: faults showing evidence of movement within the past 1.6 million years, but that have not been shown conclusively whether or not they have moved in the past 11,000 years; and

- ***Not active***: faults that have conclusively NOT moved in the past 11,000 years.

The Alquist-Priolo classification is used primarily for residential subdivisions. Different definitions of activity are used by other agencies or organizations depending on the type of facility being planned or developed. For example, longer periods of inactivity are generally required for dams or nuclear power plants. An important subset of active faults is those with historical earthquakes. In California, that means faults that have ruptured since 1769, when the Spanish first arrived and settled in the area. However, since many parts of the State were not settled until well into the middle of the 1800s, some historical earthquakes most likely went un-noticed and therefore unreported.

The underlying assumption in this classification system is that if a fault has not ruptured in the past 11,000 years, it is not likely to be the source of a damaging earthquake in the future. In reality, however, most potentially active faults have been insufficiently studied to determine their hazard level. For example, and especially significant for the Yucca Valley area and adjacent communities, some of the faults that ruptured in the 1992 Landers and 1999 Hector Mine earthquakes were previously thought to be not active, as they appeared to have not moved in at least 11,000 years. Also, although simple in theory, the evidence necessary to determine whether a fault has or has not moved during the past 11,000 years can be difficult to obtain.

1.5.2 Faults in the Town of Yucca Valley Area

There are several main faults and several secondary faults zoned by the State of California under the criteria of the Alquist-Priolo Act within the limits of the Yucca Valley General Plan Update area (see Plate 1-2). The main fault zones include the Pinto Mountain, Burnt Mountain, Eureka Peak, and Johnson Valley (southern segment). The Alquist-Priolo Earthquake Fault Zone maps for these fault zones in the Yucca Valley area include the following quadrangles: Yucca Valley North, Yucca Valley South, Joshua Tree South (all three became official maps on July 1, 1993), and Joshua Tree North (became official March 1, 1988). Secondary faults that have been zoned include several short fault traces associated with the Pinto Mountain fault zone, a cross fault associated with the Eureka

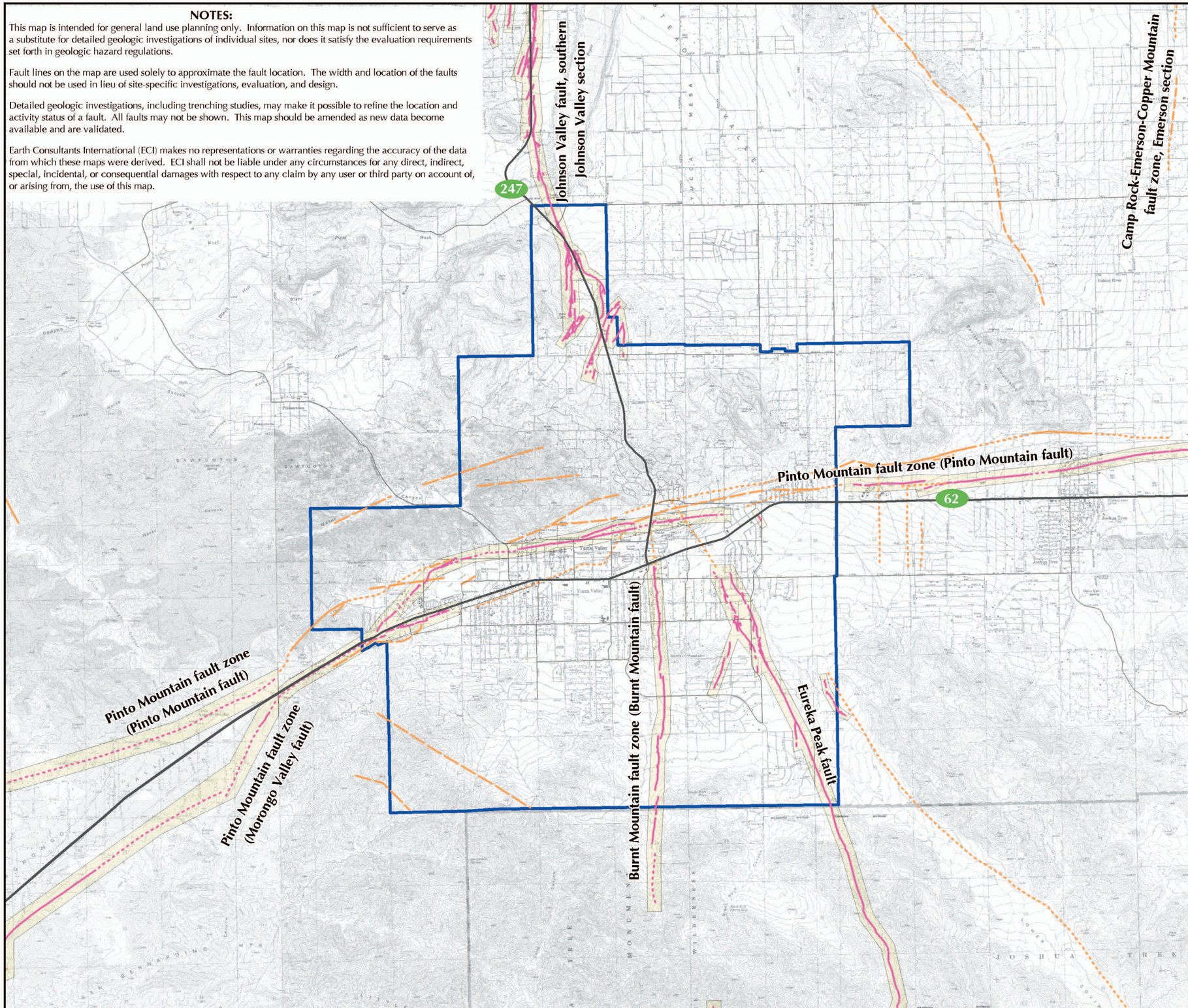
NOTES:

This map is intended for general land use planning only. Information on this map is not sufficient to serve as a substitute for detailed geologic investigations of individual sites, nor does it satisfy the evaluation requirements set forth in geologic hazard regulations.

Fault lines on the map are used solely to approximate the fault location. The width and location of the faults should not be used in lieu of site-specific investigations, evaluation, and design.

Detailed geologic investigations, including trenching studies, may make it possible to refine the location and activity status of a fault. All faults may not be shown. This map should be amended as new data become available and are validated.

Earth Consultants International (ECI) makes no representations or warranties regarding the accuracy of the data from which these maps were derived. ECI shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to any claim by any user or third party on account of, or arising from, the use of this map.



Fault Map

Yucca Valley, California

Explanation

Faults; solid where location is known, dashed where approximate, dotted where inferred or concealed under young deposits.

- Alquist-Priolo Earthquake Fault; active in the Holocene. From CGS (2002).
- Alquist-Priolo Earthquake Fault Zone. From CGS (2002).
- Fault; active in the Holocene or Late Quaternary but not zoned under the Alquist-Priolo Act. From USGS (2003), USGS and CGS (2006), and Dibblee (1967).
- Yucca Valley Town Boundary

N W E S

7000 0 7000
Feet

1500 0 1500 3000
Meters

Scale: 1:84,000

Base Map: USGS Topographic Map from Sure!MAPS RASTER, 1997 and Town of Yucca Valley.
Source: Alquist-Priolo Earthquake Fault Zones [Reproduced with permission CGS CD-ROM 2001-05 (2002)], USGS and CGS (2006) Quaternary fault and fold database for the United States, accessed April 2010, from USGS web site: http://earthquakes.usgs.gov/regional/qfaults, Dibblee (1967), and USGS (2003).

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2012

Plate 1-2

Peak fault that also ruptured in 1992, and a zone of *en-echelon* fractures that were mapped east of the Eureka Peak fault following the Landers earthquake. Secondary faults in the area that are not zoned by the State of California include several fault splays associated with the Pinto Mountain fault, two faults subparallel to and north of the Pinto Mountain fault, two northwest-trending faults in bedrock in the southeastern portion of the Town, the northern extensions of the Burnt Mountains and Eureka Peak faults, and the northwestern terminus of the Lower Covington Flat fault inferred by Dibblee (1967b). The most significant of these faults are discussed further below.

1.5.2.1 Pinto Mountain Fault Zone

According to Bryant (2000), the Pinto Mountain fault was first recognized by Vaughan in 1922, but it was Hill (1928) who first named and mapped it. Subsequent mapping of the Pinto Mountain fault, or sections of it, was conducted by Bader and Boyle (1960), Dibblee (1967b, 1968a), Bacheller (1978), Grimes (1981), Bryant (1986a), Howard and others (1995), and Hopson (1996). The western extension of the fault zone, consisting of two branches that bound the Morongo Valley, were mapped by Allen (1957) and Dibblee (1967c). The Pinto Mountain was evaluated for zoning purposes by the California Division of Mines and Geology (now the California Geological Survey) in 1986 (Fault Evaluation Report 181 by Bryant, 1986a). A supplement to this study for the western segment of the Pinto Mountain fault (and for the Mesquite Lake and East Airfield faults in and near Twentynine Palms) was issued in 1988 (Bryant, 1988).

In the Yucca Valley area, the Pinto Mountain fault is complex, with several subparallel fault traces mapped or inferred along a zone approximately 1 km (3,000 feet) wide. Some of the fault traces clearly offset late Quaternary to early Holocene sediments, whereas other traces appear to not offset late Quaternary sediments. Based on an analysis of aerial photographs, in addition to a limited field reconnaissance, Bryant (1986a) defined those traces considered to be most well-defined and sufficiently active. The fault traces that met these criteria were then zoned by the State Geologist in accordance with the Alquist-Priolo Earthquake Fault Zone Act (red fault traces shown on Plate 1-2). However, given the relatively rapid rate of deposition in the Yucca Valley area, faults with little to no geomorphic expression in alluvium (orange faults in Plate 1-2 that are shown as dotted through the alluvium in the valley) should be considered active until proven otherwise by direct geologic methods such as trenching.

Case in point, a section of the fault shown as buried by alluvium (Dibblee, 1967b) was trenched by Bush and Rasmussen (1979, as referenced by Bryant, 1986a). The trenches exposed several fractures in alluvium in a 70-meter (230-foot) wide zone. Because the fractures were oriented similarly to the regional trend of the Pinto Mountain fault, Bryant (1986a) opined that these could very well be faults, even though the consultants proposed that they were associated with ground shaking rather than fault rupture. Bryant (1986a) ultimately chose to zone this fault. Farther to the east, in the Twentynine Palms area, Bryant (1986a), refers to trenching studies by James (1986) just north of Twentynine Palms Highway, between Panorama Drive on the east, and Sunrise Road on the west. The trenches exposed a broad zone of Holocene-age, down-to-the-south normal faults in between fault traces that, given their stronger geomorphic expression, had been mapped by Bader and Boyle, Dibblee, and Bacheller.

Bryant (1986a) postulated that the Pinto Mountain fault in the Yucca Valley area is a left-lateral oblique fault, with a larger component of vertical displacement than other sections of the fault farther east. Furthermore, he suggested that the fault in this area is stepping left (south) and transferring strain onto the Morongo Valley fault, now considered the western extension of the Pinto Mountain fault zone (Bryant, 2000). These suggestions, in addition to the recency of activity of the various fault strands mapped in the area, have not been evaluated further, as no paleoseismic trenching studies of the Pinto Mountain fault have been conducted in the Yucca Valley area.

The only paleoseismic study to date of the Pinto Mountain fault evaluated the central branch of the Pinto Mountain fault in the Twentynine Palms area. This study conducted by Cadena and others (2004), included the excavation of a trench about 100 m (300 ft) west of the Oasis of Mara, where the fault was observed to extend upwards to within 0.5 m (1.6 ft) of the ground surface. Several fault strands within the zone were interpreted as having ruptured repeatedly in the past about 14,000 years; the faulted sediments suggest five to six ruptures in that time frame, with four events occurring in the past about 9,400 years, for an approximate recurrence interval of about 2,500 to 3,000 years. Although the fault has not ruptured historically, sections of it did experience minor slip associated with the 1992 Landers earthquake (Bryant, 1992; Hart and others, 1993).

1.5.2.2 Burnt Mountain Fault

This is one of two "new" faults first identified following the 1992 Landers earthquake (the second fault, the Eureka Peak fault, is discussed below). The Burnt Mountain fault is north- to northwest-trending and at least 21 km (13 miles) long. At its southern end, it appears to step left and transfer strain onto the East Wide Canyon fault. Only a 6-km (3.7-mile) long section of the Burnt Mountain fault ruptured the ground surface in 1992, displaying no more than about 5.5 cm (2.2 inches) of right-lateral offset. The width of the zone was generally less than about 1 meter (3 feet), with only a few sections being as wide as 5 meters (16 feet). Geologists mapping the surface rupture following the Landers earthquake also found a short – about 0.5-km (0.3-mile) – zone of right-stepping fractures trending in a northeasterly direction (Treiman, 1992). The right-stepping nature of the cracks indicate that the feature has an overall left-lateral sense of movement. This cross fault was also zoned in accordance with the Alquist-Priolo Earthquake Fault Zone Act.

A review of historical aerial photographs and topographic maps (Bryant, 1992) shows that the Burnt Mountain fault was expressed in the landscape before the Landers earthquake but had not been recognized as a fault by geologists that had worked in the area prior to 1992. Geomorphic characteristics that were there for someone to recognize as fault-controlled include a west-facing scarp north of Burnt Mountain, vegetation lineaments along the southwest side of Burnt Mountain, a subtle north-trending linear ridge in older alluvium, aligned ridges, and a straight canyon margin farther south (Bryant, 1992). All of these features indicate that the Burnt Mountain fault has ruptured the ground surface in the Holocene or late Pleistocene, prior to 1992. However, to date, there are no published paleoseismic studies of the fault, so data on past earthquakes, earthquake recurrence, and slip rate are not currently available for the Burnt Mountain fault.

1.5.2.3 Eureka Peak Fault

This north- to northwest-trending fault experienced as much as 21 cm (8.3 inches) of right-lateral offset as a result of the 1992 Landers earthquake sequence, with additional slip occurring in the weeks and months after the main shock. Witness accounts suggest that at least part of the rupture on this fault occurred in response to a M_w 5.7 aftershock that occurred about 3 minutes after the main Landers shock (Sieh and others, 1993; Hough and others, 1993) that propagated southward for about 11 km (6.8 miles) (Heaton and others, 1992 as reported by Treiman, 1992). Geologists mapping the surface rupture extended the length of the fault southward for a total length of about 20 km (12 miles), based on geomorphic evidence that had not been recognized previously.

Pre-1992 evidence for the Eureka Peak fault is less well defined than that for the Burnt Mountain fault, but there were some landscape features identified from older aerial photographs that hinted at the fault's presence. These features include the "linear margin of a ridgeline, several straight stream channels and some vegetation lineaments" (Treiman, 1992). Field mapping of the 1992 rupture after the Landers earthquake showed that the fault follows the top of the margin or bank of a wash that drains Lower Covington Flat. Land immediately to the west of the fault, on the side opposite the wash, dropped down in this area, suggesting that the wash is not controlled by faulting.

Near its northern end, just south of Joshua Drive, the fault split into two branches, with the area between the two branches dropping down slightly. The eastern branch was found to be better defined, with discrete minor faults that could be mapped northward to just south of Yucca Trail. The western branch consisted of several minor faults and fractures spread across a zone nearly 100 meters (330 feet) wide (Treiman, 1992). Two zones of fracturing were also identified to the west of the main zone of rupture. The southernmost of these zones was mapped just east and north of the eastern end of Andreas Road, where the fractures coalesced into two main traces, a north-trending trace that terminated against the main trace of the Eureka Peak fault, and a northwesterly trace parallel to but about 150 meters (500 feet) west of the main fault trace. The second, more northerly, zone consisted of several diffuse right-stepping cracks that extended in a northeasterly direction for more than 900 meters (3,000 feet) approximately in between Emerson Avenue on the east and Balsa Avenue on the west. Both of these zones were included in the official Alquist-Priolo Earthquake Fault Zone map issued by the California Geological Survey for the Yucca South Quadrangle after the Landers earthquake.

Gary Rasmussen and Associates (1992) trenched the southern end of the westerly branch of the Eureka Peak fault in the vicinity of Palomar Avenue. The trenches exposed a complex zone of faulting 9 to 13.7 meters (30 to 45 feet) wide consisting of two main fault splays and numerous fractures. The main splays showed evidence of past (pre-1992) surface rupturing events in the Holocene and late Pleistocene that indicate that this fault has been active in the past and has the potential to rupture again in the future.

1.5.2.4 Lower Covington Flat Fault

This feature had been mapped as an inferred fault before the Landers earthquake (Dibblee, 1967b), although it was not named. Treiman (1992) gave it this name because the fault extends across the Lower Covington Flat, a geomorphic surface to the southeast of Yucca

Valley. The fault did not rupture during Landers except for a zone of left-stepping cracks less than about 1 km (0.6 mile) long near its northern end (Treiman, 1992). The left-stepping nature of the cracks indicates that the overall slip on this structure, as minor as it appears to be, is right lateral. To date, we are not aware of any trenching studies of this feature that would provide additional information on whether or not this is a deep-seated fault that has had recurrent movement in the Holocene. The feature should be investigated if development is proposed across it.

1.5.2.5 Southern Johnson Valley Fault

The Johnson Valley fault zone consists of a series of sub-parallel, northwest-trending, predominantly right-lateral strike-slip faults. The main trace is approximately 60km (37 miles) long, but it can be extended northward to include the Upper Johnson Valley fault, for a total length of about 85 km (53 miles). The southern part of the fault zone, within Yucca Valley and to the north, last ruptured during the 1992 Landers earthquake.

In 1988, prior to the Landers earthquake, sections of the fault zone in the Yucca Valley North and Landers 7.5-minute quadrangle maps had been included in an Alquist-Priolo Earthquake Fault Zone because of fault-related features in the landscape that suggested Holocene activity (Bryant, 1986a). Sections of the fault had also experienced minor surface rupture during the March 1979 Homestead Valley earthquake swarm (Manson, 1986; Bryant, 1986a; Hill and others, 1980). The 1992 surface rupture of the Johnson Valley fault was complex, the result of the fault rupturing through unconsolidated granular alluvium. The fault zone varied in width from a few meters to more than 100 meters (330 feet), and consisted of multiple strands, left-stepping *en echelon* fractures and fissures, scarps, moletracks, grabens, minor pressure ridges and thrust faults (Bryant, 1992). Maximum right-lateral strike slip displacement of nearly 3.10 meters (10.2 feet) was measured just west of Acoma Road, approximately 0.8 km (½ mile) north of the community of Flamingo Heights. Closer to this community, just south of Hondo Road, Herzberg (1996; as summarized in Rockwell and others, 2000) excavated a trench across the main trace of the fault. Two other trenches farther north were excavated across the 1992 rupture on the Johnson Valley fault as well. The data obtained from these trenches indicate that the Johnson Valley fault has ruptured 5 times in the last about 25,000 years, for an average recurrence interval of 5,000 years.

1.5.3 Mitigation of Primary Fault Rupture

In most cases, it is impractical to reduce the damage potential of surface fault rupture by engineering design, and most regulatory agencies, following the position of the California Geological Survey, currently do not allow engineering design for habitable structures (although this is being reconsidered for "minor" faults at this time). Therefore, the most often-used mitigation measure is to simply avoid placing structures on or near active fault traces.

In accordance with the requirements of the Alquist-Priolo Earthquake Fault Zone Act, geologic investigations, which generally include fault trenching, need to be performed if conventional structures designed for human occupancy are proposed within an Alquist-Priolo zone. These studies must evaluate whether or not an active segment of the fault extends across the area of proposed development, generally following the guidelines for evaluating the hazard of fault rupture presented in Note 49, published by the CGS, which

is available on the worldwide web at http://www.consrv.ca.gov/CGS/rghm/ap/index.htm. Geologic investigations to locate and better characterize the recency of activity should be conducted for other east-trending and north- to northwest-trending faults in the Yucca Valley area not currently included in an Alquist-Priolo Earthquake Fault Zone, especially if a critical or high-occupancy facility is proposed across one of these traces. The results of these studies should be submitted to the California Geological Survey for appropriate action regarding the future zoning of these faults if the studies indicate that they have had activity in the Holocene.

Based on the results of these geologic studies, appropriate structural setbacks may be recommended to prevent the placement of the proposed structures directly on top or within a certain distance from the fault. A common misperception regarding setbacks is that they are always 50 feet from the active fault trace. In actuality, as part of a geologic investigation, the project geologist is required to characterize the ground deformation associated with an active fault. Based on these studies, specific setbacks are recommended. If a fault trace is narrow, with little or no associated ground deformation such as folding or fracturing, a setback distance less than 50 feet could be recommended. Conversely, if the fault zone is wide, with multiple splays, or is poorly defined, a setback distance greater than 50 feet may be warranted.

As it occurred in 1992 on the Burnt Mountain and Eureka Peak faults, several of the faults across or near the Yucca Valley study area could move sympathetically (triggered slip) with movement on a regional fault such as the Pinto Mountain. Although offsets due to secondary faulting are typically measured in inches or fractions of inches, if structures placed across these features are not designed properly, structural damage could occur. Geotechnical investigations for future development and redevelopment should consider this hazard. The methodology for evaluating these features is similar to that used for evaluating primary fault rupture (CGS Note 49, as discussed above).

Lazarte and others (1994) outlined three approaches to mitigation of fault rupture hazard, which could be applied to secondary deformation as well. The first is avoidance using structural setback zones. The second is referred to as "geotechnical engineering." This method consists of placing a compacted fill blanket, or a compacted fill blanket reinforced with horizontal layers of geogrid, over the top of the fault trace. Rationale behind this second method is based on observations that the displacement across a distinct bedrock fault is spread out and dissipated in the overlying fill, thus reducing the severity of the displacement at the surface. The third method is "structural engineering," and involves strengthening foundation elements to withstand a limited amount of ground deformation. Studies of foundation performance in the Landers earthquake showed that structures overlying major fault ruptures suffered considerable damage but did not collapse. Application of the second and third methods requires a thorough understanding of the geologic environment and thoughtful engineering judgment because quantifying the extent of future displacement is difficult, and there are no proven engineering standards in place to quantify the amount of mitigation needed (for instance how thick a fill blanket is needed). However, extensive research in this area has been and is being conducted by Bray (2001) and others. This will hopefully lead to an increase in the use of these techniques to mitigate the hazard of secondary ground deformation, provided that the CGS

and local regulatory agencies are willing to consider and approve the use of alternatives to structural setbacks.

1.6 Ground Failure due to Earthquake Shaking

Various types of ground failure that are the result of earthquake shaking can cause substantial damage to the built environment. The most destructive of these failures include liquefaction and slope failure, but other tectonically induced forms of ground failure are also possible. These are described further below.

1.6.1 Liquefaction

Liquefaction is a geologic process that causes various types of ground failure. It typically occurs within the upper15 meters (50 feet) of the surface, in saturated, loose, fine- to medium-grained sandy to silty soils in the presence of ground accelerations over 0.2g (Borchardt and Kennedy, 1979; Tinsley and Fumal, 1985). Earthquake shaking suddenly increases pressure in the water that fills the pores between soil grains, causing the soil to have a total or substantial loss of shear strength, and behave like a liquid or semi-viscous substance. This process can be observed at the beach by standing on the wet sand near the surf zone. Standing still, the sand will support your weight. However, when you tap the sand with your feet, water comes to the surface, the sand liquefies, and your feet sink.

Liquefaction can cause structural distress or failure due to ground settlement, a loss of bearing capacity in the foundation soils, and the buoyant rise of buried structures. That is, when soils liquefy, the structures built on them can sink, tilt, and suffer significant structural damage. In addition to loss of bearing strength, liquefaction-related effects include ground oscillations, lateral spreading and flow failures or slumping. The excess water pressure is relieved by the ejection of material upward through fissures and cracks; water or water-soil slurries may bubble onto the ground surface, resulting in features called "sand boils," "sand blows," "sand volcanoes," or "mud spouts." Seepage of water through cracks may also be observed.

The types of ground failure typically associated with liquefaction are explained below.

Lateral Spreading – Lateral displacement of surficial blocks of soil as the result of liquefaction in a subsurface layer is called lateral spreading. Even a very thin liquefied layer can act as a hazardous slip plane if it is continuous over a large enough area. Once liquefaction transforms the subsurface layer into a fluid-like mass, gravity plus inertial forces caused by the earthquake may move the mass down-slope towards a cut slope or free face (such as a river channel or a canal). Lateral spreading most commonly occurs on gentle slopes that range between 0.3 degrees and 3 degrees, and can displace the ground surface by several feet to tens of feet. Such movement damages pipelines, utilities, bridges, roads, and other structures. During the 1906 San Francisco earthquake, lateral spreads with displacements of only a few feet damaged every major pipeline in the area. Thus, liquefaction compromised San Francisco's ability to fight the fires that caused about 85% of the damage (Tinsley and others, 1985). Lateral spreading was also reported in and around the Port of Los Angeles

during both the 1933 and 1994 earthquakes (Barrows, 1974; Stewart and others, 1994; Greenwood, 1998).

Flow Failure – The most catastrophic mode of ground failure caused by liquefaction is flow failure. Flow failure usually occurs on slopes greater than 3 degrees. Flows are principally liquefied soil or blocks of intact material riding on a liquefied subsurface. Displacements are often in the tens to hundreds of feet, but under favorable circumstances, soils can be displaced for tens of miles, at velocities of tens of miles per hour. For example, the extensive damage to Seward and Valdez, Alaska, during the 1964 Great Alaskan earthquake was caused by submarine flow failures (Tinsley and others, 1985).

Ground Oscillation – When liquefaction occurs at depth but the slope is too gentle to permit lateral displacement, the soil blocks that are not liquefied may separate from one another and oscillate on the liquefied zone. The resulting ground oscillation may be accompanied by the opening and closing of fissures (cracks) and sand boils, potentially damaging structures and underground utilities (Tinsley and others, 1985).

Loss of Bearing Strength – When a soil liquefies, loss of bearing strength may occur beneath a structure, possibly causing the building to settle and tip. If the structure is buoyant, it may float upward. During the 1964 Niigata, Japan earthquake, buried septic tanks rose as much as 1 meter (3 feet), and structures in the Kwangishicho apartment complex tilted as much as 60 degrees (Tinsley and others, 1985).

Ground Lurching – Soft, saturated soils have been observed to move in a wave-like manner in response to intense seismic ground shaking, forming ridges or cracks on the ground surface. At present, the potential for ground lurching to occur at a given site can be predicted only generally. Areas underlain by thick accumulation of colluvium and alluvium appear to be the most susceptible to ground lurching. Under strong ground motion conditions, lurching can be expected in loose, cohesionless soils, or in clay-rich soils with high moisture content. In some cases, the deformation remains after the shaking stops (Barrows and others, 1994).

As indicated above, there are three general conditions that need to be met for liquefaction to occur. The first of these – strong ground shaking of relatively long duration – can be expected to occur in the Yucca Valley area as a result of an earthquake on any of the several active faults in the region. The second condition – geologically young, loose, unconsolidated sediments – occurs locally in some areas, typically along the active drainages, and on the young alluvial fans. Note the distribution of Holocene-aged Quaternary-aged deposits on Plate 2-1. The third condition – water-saturated sediments within about 15 meters (50 feet) of the surface, has not been reported historically in the Yucca Valley area, and as a result, the hazard of liquefaction occurring in the alluvial sediments underlying the valley portion of the study area is currently considered low to very low (see Plate 1-3).

The Pinto Mountain fault is known to form a barrier to groundwater contained in the sediments at the base of the Pinto Mountains. As the water in the basin rises, it is forced up to the ground surface, forming springs, such as the one that feeds the Oasis of Mara in

the Twentynine Palms area. In the Yucca Valley area, several of the faults that combined form the Pinto Mountain fault zone form groundwater barriers, but at depths greater than 50 feet. Extensive pumping in the area beginning in the 1960s has caused significant declines in the groundwater levels. With the replenishment of water back into the aquifers, first with State Project water, and then with reclaimed water, the groundwater levels have recovered, and could theoretically rise to within 50 feet or less of the ground surface (the groundwater basins are floored by impermeable bedrock and are bounded by faults that act as barriers to water, so the basins act as bathtubs, with water levels increasing or decreasing substantially if surface water is recharged into or pumped out of the basins, respectively. As a result, if unchecked recharge occurs in the area, liquefaction susceptibility could increase in the future. However, personnel from both the U.S. Geological Survey and the Hi-Desert Water District are aware of this issue and, as reclaimed water is recharged into some of the sub-basins in the area, they will reportedly monitor and maintain groundwater levels below the critical 50-foot depth to avoid developing a liquefaction susceptibility condition (M. Ban, Hi-Desert Water District, personal communication, July 2012).

At this time, site-specific geotechnical studies to evaluate the liquefaction potential of properties in Yucca Valley are not deemed necessary, given the depth to groundwater (see Plate 1-3).

1.6.2 Earthquake-Induced Slope Failure

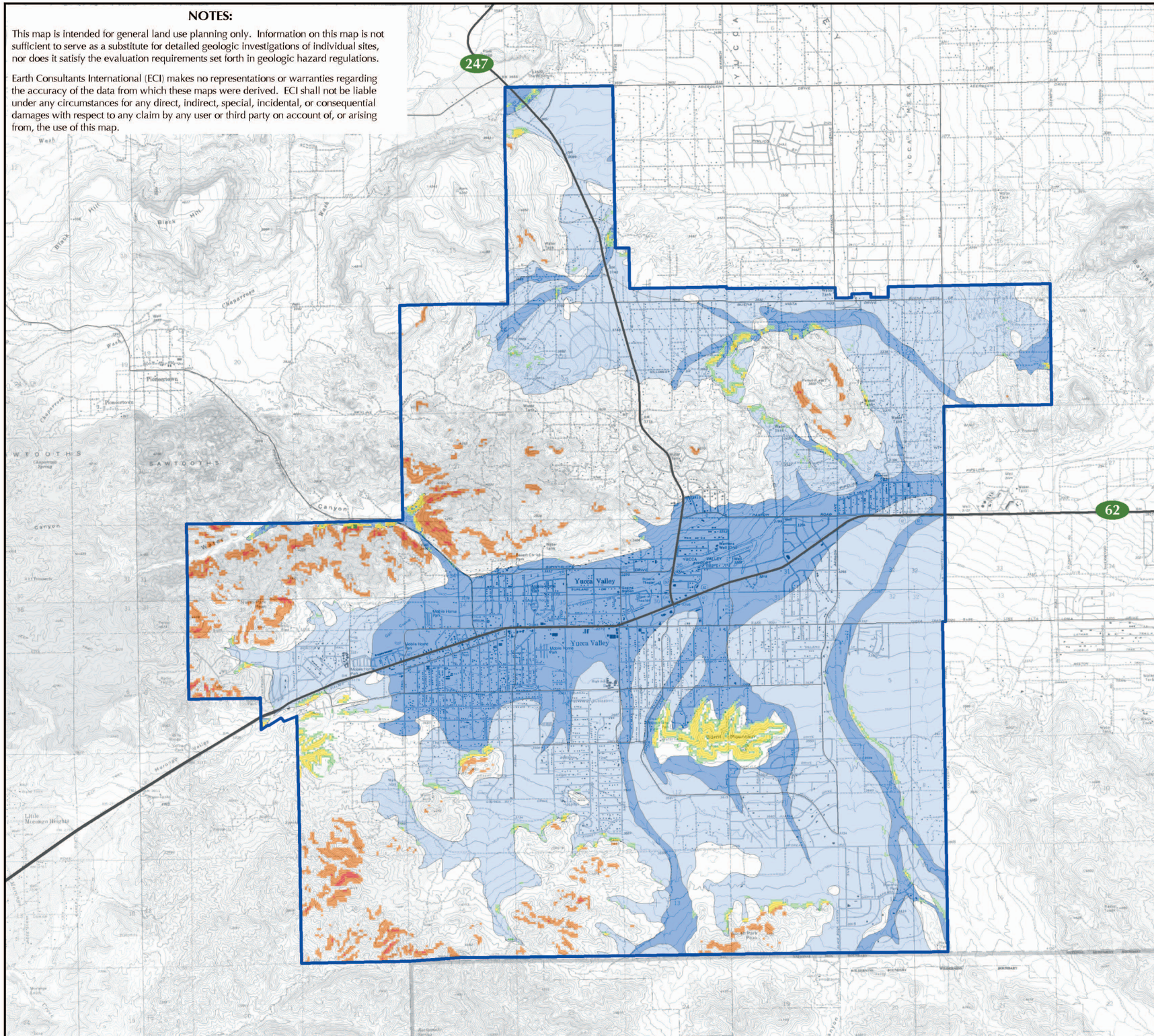
Strong ground motions can worsen existing unstable slope conditions. Seismically induced landslides can overrun structures, harm people or damage property, sever utility lines, and block roads, thereby hindering rescue operations after an earthquake. Over 11,000 landslides were mapped shortly after the 1994 Northridge earthquake, all within a 45-mile radius of the epicenter (Harp and Jibson, 1996). Although numerous types of earthquake-induced landslides have been identified, the most widespread type generally consists of shallow failures involving surficial soils and the uppermost weathered bedrock in moderate to steep hillside terrain (these are also called disrupted soil slides). Rockfalls and rock-slides on very steep slopes are also common. The 1989 Loma Prieta and Northridge earthquakes showed that reactivation of existing deep-seated landslides can also occur (Spittler and others, 1990; Barrows and others, 1995).

A combination of geologic conditions leads to landslide vulnerability. These include high seismic potential; rapid uplift and erosion resulting in steep slopes and deeply incised canyons; highly fractured and folded rock; and rock with inherently weak components, such as silt or clay layers. The orientation of the slope with respect to the direction of the seismic waves (which can affect the shaking intensity) can also control the occurrence of landslides. Ground water conditions at the time of the earthquake also play an important role in the development of seismically induced slope failures. For instance, the 1906 San Francisco earthquake occurred in April, after a winter of exceptionally heavy rainfall, and produced many large landslides and mudflows, some of which were responsible for several deaths. The 1987 Loma Prieta earthquake however, occurred in October during the third year of a drought, and slope failures were limited primarily to rockfalls and reactivation of older landslides that was manifested as ground cracking in the scarp areas but with very little movement (Griggs and others, 1991).

NOTES:

This map is intended for general land use planning only. Information on this map is not sufficient to serve as a substitute for detailed geologic investigations of individual sites, nor does it satisfy the evaluation requirements set forth in geologic hazard regulations.

Earth Consultants International (ECI) makes no representations or warranties regarding the accuracy of the data from which these maps were derived. ECI shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to any claim by any user or third party on account of, or arising from, the use of this map.



Seismic Hazard Zones

Yucca Valley, California

Explanation

Liquefaction Susceptibility

Low — Areas underlain by coarse-grained Holocene age sediments, groundwater depth greater than 100 feet or unknown.

Very Low to None — Areas underlain by coarse-grained Pleistocene sediments, groundwater depth greater than 100 feet or unknown.

Earthquake-Induced Slope Instability

Rock Falls, **Rock Slides** — Areas underlain by bedrock where the local topographic, geological, and geotechnical conditions indicate a potential for permanent ground displacements, such that mitigation may be required. Refer to text for additional information.

Soil Falls, **Soil Slides**, **Soil Slumps** — Areas underlain by Holocene and Pleistocene sediments where the local topographic, geological, and geotechnical conditions indicate a potential for earthquake-induced soil block falls, slides, or soil slumps. Mitigation measures may be required if these areas are developed. Refer to text for additional information.

Yucca Valley Town Boundary

N
W E
S

5000 0 5000
Feet

1500 0 1500 3000
Meters

Scale: 1:60,000

Base Map: USGS Topographic Map from Sure!MAPS RASTER, 1997 and Town of Yucca Valley.
Sources: Slope gradients used in the slope instability analysis derived from the USGS 30m Digital Elevation Model. Geological descriptions used in the analyses derived from Dibblee (2008).

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2012

Plate 1-3

Keefer and Wilson (1989) conducted a survey of the slope failures caused by over 40 earthquakes around the world and found that seismic shaking is one of the most important triggers of landslides in arid and semi-arid regions such as the Yucca Valley area. Even in regions that receive very little precipitation, earthquakes larger than about magnitude 6 have caused hundreds to thousands of slope failures.

One of the most comprehensive and still widely used landslide classification schemes is that by Varnes (1978). His classification emphasizes the type of movement (falls, topples, rotational slides, translational slides, lateral spreads, flows, and combinations of the above), followed by the type of material involved (bedrock and engineering soils, with soils further divided into predominantly coarse-grained and predominantly fine-grained). Keefer (1984) and Keefer and Wilson (1989) used a modification of Varnes' (1978) scheme to classify earthquake-induced landslides. Their primary criteria include material, mechanism of movement and amount of internal disruption; secondary criteria include water content, velocity, depth, and geologic environment. Keefer and Wilson (1989) consider only two types of material – bedrock and soil, with soil comprising all uncemented or slightly cemented aggregate of mineral grains, including young sedimentary deposits, the regolith or weathered deposits that mantle bedrock, and man-made fill slopes. A review of their classification shows that earthquake-induced landslides that occur in rock and sedimentary deposits under dry conditions fall, with one exception, into their Category I landslides. The landslides in this category are all highly or very highly disrupted, having occurred rapidly or extremely rapidly. With the exception of rock avalanches, the materials involved are mostly shallow, generally less than 3 meters (10 feet) deep. The specific types of landslides in this category include rock falls, rock slides, rock avalanches, soil falls, and soil slides. These types of slope failures are described further in Table 1-3 and below. The geologic and slope conditions commonly necessary for these failures to occur were used to evaluate the earthquake-induced slope instability potential in the Yucca Valley area and develop the potential earthquake-induced landslide zones shown on Plate 1-3.

Rockfalls may happen suddenly and without warning, but are more likely to occur in response to earthquake-induced ground shaking, during periods of intense rainfall, or as a result of man's activities, such as grading and blasting. Wilson and Keefer (1985) reported that ground acceleration of at least 0.10g in steep terrain is necessary to induce earthquake-related rockfalls. Although exceeding this level of shaking does not guarantee that rockfalls will occur, this is certainly a concern in the Sawtooth Mountains given the high ground accelerations anticipated in the area when the Pinto Mountain fault ruptures next. The hazard is compounded by several bouldery outcrops in the area that, although picturesque, can be precariously perched, ready to roll downhill if dislodged by shaking. This has happened in the past. The Joshua Tree earthquake in April 1992, plus several of its aftershocks, caused hundreds of landslides, mostly in the form of rock falls, in the Little San Bernardino Mountains near Yucca Valley (Rymer, 2000). The 1992 Landers earthquake also caused several blocky soil failures along Old Woman Springs Road, near its intersection with Aberdeen Road, just north of the Town of Yucca Valley.

The last type of slope failure included in Table 1-3, soil slumps, falls into Keefer and Wilson's (1989) Category II. This landslide category is characterized by relatively coherent slides that move slower than Category I slides, and are generally deep-seated. Soil slumps may occur in both dry and wet soil conditions.

Topographically, Yucca Valley includes a wide range of landscapes. The broad central valley is bounded both to the north and south by gently sloping alluvial fans that rise to mountains. The alluvial fans generally consist of massive to poorly bedded sand and gravel that have been uplifted above the active drainages. To the northwest, the Sawtooth Mountains have rounded forms with granitic boulder outcrops; some of these boulders can be shaken loose by strong ground shaking (see Figure 1-6). To the south, the alluvial fans and foothills rise to the Little San Bernardino Mountains. These mountains, unlike the Sawtooths, are steep, jagged, and with far fewer rock outcrops, a reflection of the underlying gneissic rock. The steeper parts of the hills in the Yucca Valley area are for the most part currently undeveloped, although some development is encroaching onto the Sawtooths, westerly from Old Woman Springs Road. Some of these access roads, in addition to the structures built at the base of these steeper slopes could be susceptible to earthquake-induced slope failures. To the west-southwest, Pioneertown Road extends through some very steep terrain that is susceptible to rock slides, rock falls and soil slides.

Figure 1-6: View of Steep Slope of the Sawtooth Mountains Showing Abundant Rounded Boulders, Many of Them Perched Atop Other Boulders.
Notice the Boulders Upslope from the Residences to the Left.

In addition to the slopes identified within or adjacent to the Town, there are many areas in the Little San Bernardino Mountains and Pinto Mountains to the south and west of Yucca Valley that could fail during an earthquake. Slope failures onto Highway 62 as it approaches Yucca Valley from the west have the potential to significantly impede traffic into and out of the area immediately and for several days after an earthquake. This could impact Yucca Valley' residents and visitors, in addition to restricting access to and from the area by emergency response teams.

The hills and mountains in the Yucca Valley area have not been mapped within a State-delineated Seismic Hazard Zone for seismically induced landsliding because this mapping program has not yet been funded for San Bernardino County. Nevertheless, mapping procedures similar to those used by the California Geological Survey (CGS) were used to identify the potentially unstable slopes identified in Plate 1-3. Until an official map of seismic hazards is issued for this area by the CGS, Plate 1-3 should be used as the official map for the area. Following the intent of the SHMA, all development projects proposed within or near the potentially unstable slopes identified in Plate 1-3 should be evaluated to determine their potential for seismically induced landsliding. These studies should be conducted and reviewed by State-licensed engineering geologists and/or civil engineers (for landslide investigation and analysis, this typically requires both) following the guidelines published by the State for evaluating and mitigating seismically induced landslides (CDMG, 1997; CGS, 2008). Another helpful source is the Southern California Earthquake Center-sponsored publication entitled "Recommended Procedures for Implementation of DMG Special Publication 117" (Blake and others, 2002)

For suspect slopes, appropriate geotechnical investigation and slope stability analyses should be performed for both static and dynamic (earthquake) conditions. Protection from rockfalls or surficial slides can often be achieved by protective devices such as barriers, retaining structures, catchment areas, or a combination of the above. The runout area of the slide at the base of the slope, and the potential bouncing of rocks must also be considered. If it is not feasible to mitigate the unstable slope conditions, building setbacks should be imposed.

Table 1-3: Earthquake-Induced Slope Failures in Arid Environments

Landslide Type	Geologic Material. Environment	Minimum Slope (in degrees)	Velocity; Depth; Type of Movement	Potential Location in Yucca Valley
Consolidated Bedrock (Igneous, Metamorphic and Sedimentary)				
Rock Falls	Weakly cemented, intensely fractured or weathered; with conspicuous planes of weakness dipping out of slope; precariously perched boulders. Common near ridge crests and on ledges; artificially cut slopes, and slopes undercut by active erosion.	34	Extremely rapid (>10 ft/sec); shallow (<10 ft deep); bouncing, falling and free-falling.	Throughout the Sawtooth Mountains, where rounded granitic boulders crop out, forming picturesque rock formations, some precariously perched. Locally in the Little San Bernardino Mountains.
Rock Slides	Weakly cemented, intensely fractured or weathered; conspicuous planes of weakness dipping out of slope, or boulders surrounded by weak matrix. Common in hillside flutes and channels, artificially cut slopes, and slopes undercut by active erosion.	25	Rapid to extremely rapid (>1 ft/sec); shallow (<10 ft deep); translational (planar or gently undulatory) sliding on basal shear surface, typically a pre-existing discontinuity such as bedding, joint, or fault.	Throughout the Sawtooth and Little San Bernardino Mountains, where the bedrock types include planes of weakness along which surficial landslides could occur.
Unconsolidated and Weakly Consolidated Deposits (Older Alluvium, Alluvium, Colluvium, Soil, Artificial Fill)				
Soil Falls	Granular soils that are slightly cemented or contain clay binder. Generally common on bluffs and steep slopes such as stream banks, terrace faces, and artificially cut slopes.	34 – 40 (possible); >40 (more likely)	Extremely rapid to very slow (>1 ft/5 yr to >10 ft/sec); bouncing, falling, free falling.	The steep slopes necessary for this type of slope failure occur locally in the Planning Area, along Pioneertown Road.
Soil Slides	Holocene and Pleistocene loose, unsaturated sands, coarse-grained sediments, sensitive clays.	15	Moderate to rapid (>1 ft/sec); shallow (<10 ft deep); translational sliding on basal shear surface or zone of weakened sensitive clay.	Throughout the Town, in areas underlain by Older Alluvium and Very Old Alluvium Fanglomerate where exposed in steep slopes, canyon walls and over-steepened stream banks.
Soil Slumps	Loose, dry to wet sand or silt; uncompacted or poorly compacted man-made fill consisting of sand, silt or clay; pre-existing soil slump deposits. Common on embankments built on soft, saturated materials; in hillside cut-and-fill areas; and on river floodplains.	10	Slow to rapid (> 5ft/year to < 1 ft/sec; deep (> 10 ft); sliding on basal shear surface with a component of headward rotation.	May occur along gentler slopes in the Sawtooth and Little San Bernardino Mountains, on the slopes of Burnt Mountain, and along canyon walls and stream banks.

Sources: Modified from Varnes (1978), Keefer (1984), Keefer and Wilson (1989) and CGS (2008).

1.6.3 Seismically Induced Settlement

Under certain conditions, strong ground shaking can cause the densification of soils, resulting in local or regional settlement of the ground surface. During strong shaking, soil grains become more tightly packed due to the collapse of voids and pore spaces, resulting in a reduction of the thickness of the soil column. This type of ground failure typically occurs in loose granular, cohesionless soils, and can occur in either wet or dry conditions. Unconsolidated young alluvial deposits are especially susceptible to this hazard. Artificial fills may also experience seismically induced settlement. Damage to structures typically occurs as a result of local differential settlements. Regional settlement can damage pipelines by changing the flow gradient on water and sewer lines, for example. As shown in Plate 2-1, certain areas of the Town of Yucca Valley are underlain by young, unconsolidated alluvial deposits, and artificial fill. These sediments are susceptible to seismically induced settlement.

Mitigation measures for seismically induced settlement are similar to those used for liquefaction. Recommendations are provided by the project's geologist and soil engineer, following a detailed geotechnical investigation of the site. Overexcavation and recompaction is the most commonly used method to densify soft soils susceptible to settlement. Deeper overexcavation below final grades, especially at cut/fill, fill/natural or alluvium/bedrock contacts may be recommended to provide a more uniform subgrade. Overexcavation should also be performed so that large differences in fill thickness are not present across individual lots. In some cases, specially designed deep foundations, strengthened foundations, and/or fill compaction to a minimum standard that is higher than that required by the UBC may be recommended.

1.6.4 Deformation of Sidehill Fills

Sidehill fills are artificial fill wedges typically constructed on natural slopes to create roadways or level building pads. Deformation of sidehill fills was noted in earlier earthquakes, but this phenomenon was particularly widespread during the 1994 Northridge earthquake. Older, poorly engineered road fills were most commonly affected, but in localized areas, building pads of all ages experienced deformation. The deformation was usually manifested as ground cracks at the cut/fill contacts, differential settlement in the fill wedge, and bulging of the slope face. The amount of displacement on the pads was generally about three inches or less, but this resulted in minor to severe property damage (Stewart and others, 1995). This phenomenon was most common in relatively thin fills (about 27 feet or less) placed near the tops or noses of narrow ridges (Barrows and others, 1995).

This hazard could occur locally in Yucca Valley along some of the roads and building pads cut onto the sides of the Sawtooth Mountains, where grading involving the placement of fill was required to make a level pad for the building foundation or road crossing. Settlement of sidehill fill could also occur along the approaches to several of the bridges that extend across Yucca Wash, where minor settlement of the bridge embankments could result in a step up of a few inches to the actual bridges.

Hillside grading designs are typically conducted during site-specific geotechnical investigations to determine if there is a potential for this hazard. There are currently no proven engineering standards for mitigating sidehill fill deformation, consequently current published research on this topic should be reviewed by project consultants at the time of their investigation. It is thought that the effects of this hazard on structures may be reduced by the use of post-tensioned foundations, deeper overexcavation below finish grades, deeper overexcavation on cut/fill transitions, and/or higher fill compaction criteria.

1.6.5 Ridgetop Fissuring and Shattering

Linear, fault-like fissures occurred on ridge crests in a relatively concentrated area of rugged terrain in the Santa Cruz Mountains during the 1989 Loma Prieta earthquake. Shattering of the surface soils on the crests of steep, narrow ridgelines occurred locally in the 1971 San Fernando earthquake, but was widespread in the 1994 Northridge earthquake. Ridgetop shattering (which leaves the surface looking as if it was plowed) by the Northridge earthquake was observed as far as 35 km (22 miles) away from the epicenter. In the Sherman Oaks area, severe damage occurred locally to structures located at the tops of relatively high (greater than 100 feet), narrow (typically less than 300 feet wide) ridges flanked by slopes steeper than about 2.5:1 (horizontal:vertical). It is generally accepted that ridgetop fissuring and shattering is a result of intense amplification or focusing of seismic energy due to local topographic effects (Barrows and others, 1995).

Ridgetop shattering may occur locally in the mountains bordering the Yucca Valley area, including the Sawtooths and Little San Bernardinos. Particularly susceptible to this hazard would be the long, narrow ridgetop dominating the view to the north when entering the Town of Yucca Valley from the west, both to the west-southwest and northeast of Pioneertown Road. To the south, ridgetop shattering could also occur locally along the top of Burnt Mountain, and at the top of the mountain flanking South Park.

Projects located or proposed in steep hillside areas should be evaluated for this hazard by a Certified Engineering Geologist. Although it is difficult to predict exactly where this hazard may occur, avoidance of development along the tops of steep, narrow ridgelines is probably the best mitigation measure. Alternatively, recontouring of the topography to reduce the conditions conducive to ridgetop amplification, along with overexcavation below finish grades to remove and recompact weak, fractured bedrock might reduce this hazard to an acceptable level.

1.7 Other Potential Seismic Hazards

1.7.1 Seiches

A ***seiche*** is defined as a standing wave oscillation in an enclosed or semi-enclosed, shallow to moderately shallow water body or basin. Seiches continue (in a pendulum fashion) after the cessation of the originating force, which can be tidal action, wind action, or a seismic event. Reservoirs, lakes, ponds, swimming pools

and other enclosed bodies of water are subject to these potentially damaging oscillations (sloshing). Whether or not seismically induced seiches develop in a water body is dependent upon specific earthquake parameters (e.g., frequency of the seismic waves, distance and direction from the epicenter), as well as site-specific design of the enclosed bodies of water, and is thus difficult to predict. Whether an earthquake will create seiches depends upon a number of earthquake-specific parameters, including the earthquake location (a distant earthquake is more likely to generate a seiche than a local earthquake), the style of fault rupture (e.g., dip-slip or strike-slip), and on the configuration (length, width and depth) of the basin.

Amplitudes of seiche waves associated with earthquake ground motion are typically less than 0.5 m (1.6 feet high), although some have exceeded 2 m (6.6 ft). A seiche in Hebgen Reservoir, Montana, caused by an earthquake in 1959 near Yellowstone National Park, repeatedly overtopped the dam, causing considerable damage to the dam and its spillway (Stermitz, 1964). The 1964 Alaska earthquake produced seiche waves 0.3 m (1 ft) high in the Grand Coulee Dam reservoir, and seiches of similar magnitude were reported in fourteen other bodies of water in the state of Washington (McGarr and Vorhis, 1968).

Given the lack of large bodies of water in Yucca Valley, seiches as a result of ground shaking are not likely to occur in the study area. Water in swimming pools is known to slosh during earthquakes, but in most cases, the sloshing does not lead to significant damage. However, property owners down-gradient from pools that could seiche during an earthquake should be aware of the potential hazard to their property should the pool lose substantial amounts of water during an earthquake. Small seiches could occur in the existing and proposed reservoirs used for groundwater recharge. The amplitude of the seiche waves that could occur in these water bodies cannot be predicted given that several parameters combine to form these waves, although, given the relatively shallow depth of these bodies of water, the seiches are anticipated to be relatively minor.

Damage as a result of sloshing of water inside water reservoirs is discussed further in the chapter on Flooding Hazards (Chapter 3). Site-specific design elements, such as baffles, to reduce the potential for seiches are warranted in tanks and in open reservoirs or ponds where overflow or failure of the structure may cause damage to nearby properties. Damage to water tanks in recent earthquakes, such as the 1992 Landers-Big Bear sequence and the 1994 Northridge, resulted from seiching. As a result of those earthquakes, the American Water Works Association (AWWA) developed new Standards for Design of Steel Water Tanks (D-100) that provide new criteria for seismic design (Lund, 1994).

1.7.2 Tsunami

A ***tsunami*** is a sea wave caused by any large-scale disturbance of the ocean floor that occurs in a short period of time and causes a sudden displacement of water. The most frequent causes of tsunamis are shallow underwater earthquakes and submarine landslides, but tsunamis can also be caused by underwater volcanic

explosions, oceanic meteor impacts, and even underwater nuclear explosions. Tsunamis can travel across an entire ocean basin, or they can be local. Tsunamis are characterized by their length, speed, low period, and low observable amplitude: the waves can be up to 200 km (125 mi) long from one crest to the next, they travel in the deep ocean at speeds of up to 950 km/hr (600 mi/hr), and have periods of between 5 minutes and up to a few hours (with most tsunami periods ranging between 10 and 60 minutes). Their height in the open ocean is very small, a few meters at most, so they pass under ships and boats undetected (Garrison, 2002), but may pile up to heights of 30 m (100 ft) or more on entering shallow water along an exposed coast, where they can cause substantial damage. The highest elevation that the water reaches as it runs up on the land is referred to as wave runup, uprush, or inundation height (McCulloch, 1985; Synolakis and others, 2002). Inundation refers to the horizontal distance that a tsunami wave penetrates inland (Synolakis and others, 2002).

Because of the substantial increase in population in the last century and extensive development along the world's coastlines, a large percentage of the Earth's inhabitants live near the ocean. As a result, the risk of loss of life and property damage due to tsunami has increased substantially.

Given Yucca Valley's inland location, the tsunami hazard in the Town is nil. However, everyone, including Yucca Valley residents visiting or vacationing in coastal areas, should be aware of the hazards posed by tsunami, and should be able to recognize when to evacuate to higher ground. Essentially, if a moderate to strong earthquake is felt, or if the ocean recedes suddenly, coastal residents and visitors should immediately move to higher ground, at least 50 to 100 feet above mean sea level. Because tsunami surges can continue for several hours, it is best to stay at high ground for at least 12 hours; 24 hours is better.

1.8 Vulnerability of Structures to Earthquake Damage

Although it is not possible to prevent earthquakes from occurring, their destructive effects can be minimized, especially since most of the loss of life and injuries due to an earthquake are related to the collapse of hazardous buildings and structures. [FEMA (1985) defines a hazardous building as "any inadequately earthquake resistant building, located in a seismically active area, that presents a potential for life loss or serious injury when a damaging earthquake occurs."]

Therefore, the vulnerability of a community to earthquake damage can be reduced with a comprehensive hazard mitigation program that includes the identification and mapping of hazards, prudent planning and enforcement of building codes, and expedient retrofitting and rehabilitation of weak structures.

As discussed previously, building codes have generally been made more stringent following damaging earthquakes. To mitigate for seismic shaking in new construction, recent building codes use amplification factors to account for the impacts that soft sediments and proximity to earthquake sources have on ground motion. Three main

effects are considered: (1) soft soils, (2) proximity to earthquake sources (referred to as near-source factors), and (3) the seismic characteristics of the nearby earthquake sources (seismic source type). Each of these effects is discussed further below.

- **Soft-Soil Effects**: The soft soil amplification factors were developed from observations made after the 1985 Mexico City, 1989 Loma Prieta and other earthquakes that showed the amplifying impact that underlying soil materials have on ground shaking. The ground-shaking basis for code design includes six soil types based on the average soil properties for the top 30 feet (100 feet) of the soil profile (see Plate 1-4).

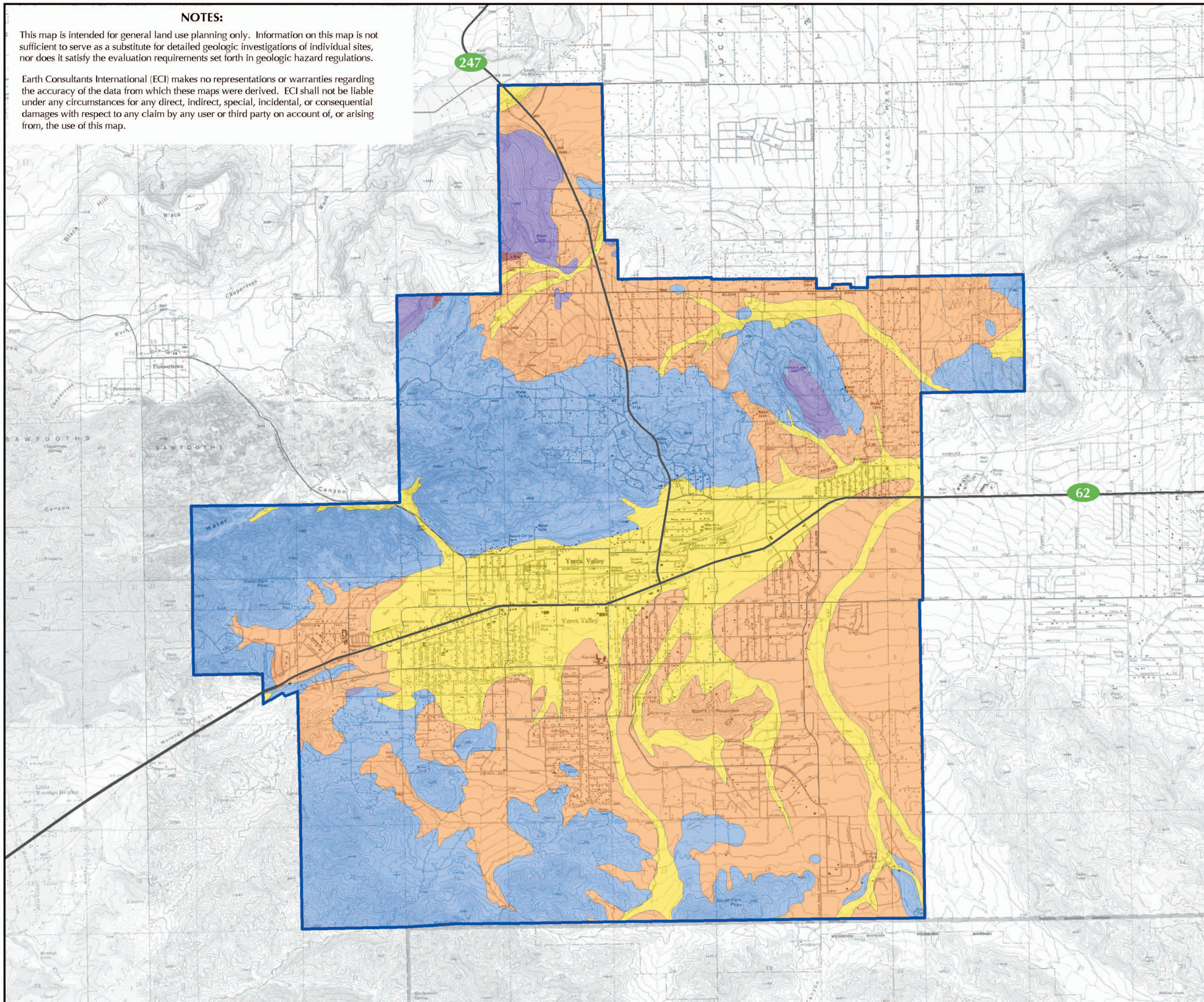
- **Near-Source Factors***:* The Yucca Valley area is subject to near-source design factors given that there are several faults that extend across portions of the town, or within 15 km (9.3 miles) (see Table 1-2). These parameters, which first appeared in the 1997 Uniform Building Code (UBC), address the proximity of potential earthquake sources (faults) to the site. These factors were present in earlier versions of the UBC for implementation into the design of seismically isolated structures, but are now included for all structures. The adoption into the 1997 code of all buildings in UBC Zone 4 was the result of observations of intense ground shaking at levels higher than expected near the fault ruptures at Northridge in 1994, and again one year later, in Kobe, Japan. The 1997 UBC also included a near-source factor that accounted for directivity of fault rupture. The direction of fault rupture was observed to play a significant role in distribution of ground shaking at Northridge and in Kobe, Japan. For Northridge, much of the earthquake energy was released into the sparsely populated mountains north of the San Fernando Valley, while at Kobe, the rupture direction was aimed at the city and was a contributing factor in the extensive damage. Directivity also played a factor in the 1992 Landers earthquake, with the rupture unzipping toward the north, away from the more densely populated center of Yucca Valley, and the cities to the south, in the Coachella Valley. However, the rupture direction of a given source cannot be predicted, and as a result, the UBC required a general increase in estimating ground shaking of about 20% to account for directivity.

- **Seismic Source Type***:* Near-source factors also include a classification of seismic sources based on slip rate and maximum magnitude potential. These parameters are used in the classification of three seismic source types (A, B and C) summarized on Table 1-4.

NOTES:

This map is intended for general land use planning only. Information on this map is not sufficient to serve as a substitute for detailed geologic investigations of individual sites, nor does it satisfy the evaluation requirements set forth in geologic hazard regulations.

Earth Consultants International (ECI) makes no representations or warranties regarding the accuracy of the data from which these maps were derived. ECI shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to any claim by any user or third party on account of, or arising from, the use of this map.



Engineering Site Classes

Yucca Valley, California

(Based on Soil Profile Types per CBC, 2010)

Symbols

Yucca Valley Town Boundary

For Site Class Descriptions and Properties See Plate 1-4b

N
W E
S

5000 0 5000
Feet

1500 0 1500
Meters

Scale: 1:60,000

Base Map: USGS Topographic Map from Sure!MAPS RASTER, 1997 and Town of Yucca Valley.
Sources: Based on data from Dibblee, 2008 and CBC, 2010.

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2011

Plate 1-4a

Symbols

Town of Yucca Valley Boundary

Site Class Definitions (Based on Soil Profile Types) (from CBC, 2010)

Site Class	Soil Profile Name/Generic Description	Average Soil Properties for the Upper 100 feet		
		Shear Wave Velocity (feet/second)	Standard Penetration Resistance (blows/foot)	Undrained Shear Strength (psf)
A	Hard Rock	>5,000	N/A	N/A
B	Rock	2,500 to 5,000	N/A	N/A
C	Very dense soil and soft rock	1,200 to 2,500	>50	>2,000
D	Stiff soil profile	600 to 1,200	15 to 50	1,000 to 2,000
E	Soft soil profile	<600	<15	<1,000
	Any profile with more than 10 feet of soil having the following characteristics: 1. Plasticity index PI > 20 2. Moisture Content w>= 40%, and 3. Undrained shear strength < 500 psf			
F	Any profile containing soil having one or more of the following characteristics: 1. Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils. 2. Peats and/or highly organic clays, where the thickness of this section is more than 10 feet. 3. Very high plasticity clays (more than 25 feet of clay with plasticity index PI > 75). 4. Very thick soft/medium stiff clays (thickness of the soil > 120 feet).			

From Table 1613.5.2 of the 2010 California Building Code
psf = pounds per square foot

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2011

Explanation for Engineering Site Classes

Plate 1-4b

Table 1-4: Seismic Source Type

Seismic Source Type	Seismic Source Description	Seismic Source Definition	
		Maximum Moment Magnitude, M	Slip Rate, SR (mm/yr)
A	Faults which are capable of producing large magnitude events and which have a high rate of seismicity.	$M \geq 7.0$ and	$SR \geq 5$
B	All faults other than Types A and C.		
C	Faults which are not capable of producing large magnitude earthquakes and which have a relatively low rate of seismic activity.	$M < 6.5$	$SR \leq 2$

Type A faults are highly active and capable of producing large magnitude events. Most segments of the San Andreas and San Jacinto faults, for example, are classified as Type A. The Type A slip rate (>5 mm/yr; >16.4 feet/1000 yr) is common only to tectonic plate boundary faults. Type C seismic sources are considered not capable of producing large magnitude events such that their potential ground shaking effects can be ignored. Type B sources include most of the active faults in California and include all faults that are neither Type A nor C. The Type A fault closest to Yucca Valley is the San Andreas fault. Type B faults in the region include the Pinto Mountain, Johnson Valley, Mesquite Lake, Emerson South–Copper Mountain, Calico–Hidalgo, Landers, Lenwood–Lockhart–Old Woman Springs, and others listed in Table 1-2 (Cao and others, 2003). The Burnt Mountain and Eureka Peak faults are right at the boundary between Type B and Type C faults given the size of the maximum magnitude earthquake that they are anticipated to generate (M 6.5) and their relatively low slip rate, currently estimated at 0.5 mm/yr (~20 inches/1000 yr). Detailed paleoseismic studies of these faults are necessary to further characterize their seismic potential.

Current building codes based on the United States-focused International Building Code, including the 2010 California Building Code, incorporate the seismic-source and near-source factors by using the maps prepared by the U.S. Geological Survey National Hazards Mapping Project. These maps are based on seismic hazard computations for all regions of the United States and incorporate the most recent fault and seismic source data to develop the "maximum considered earthquake" ground motions for a given site. The user provides the site location using either an address or coordinates, and provides the soil-site effects in accordance with the classifications presented in Plates 1-4a and 1-4b. Future building codes, starting with the 2012 International Building Code, will be using what they have termed a "risk-targeted maximum considered earthquake." The ground motions that the new buildings codes will use are based on computational models that consider the likelihood of a building collapsing as a result of seismic shaking (FEMA, 2009).

Building damage is commonly classified as either structural or non-structural. Structural damage impairs the building's support. This includes any vertical and lateral force-resisting systems, such as frames, walls, and columns. Non-structural damage does not

affect the integrity of the structural support system, but includes such things as broken windows, collapsed or rotated chimneys, unbraced parapets that fall into the street, and fallen ceilings.

During an earthquake, buildings get thrown from side to side and up and down. Given the same acceleration, heavier buildings are subjected to higher forces than lightweight buildings. Damage occurs when structural members are overloaded, or when differential movements between different parts of the structure strain the structural components. Larger earthquakes and longer shaking duration tend to damage structures more. The level of damage can be predicted only in general terms, since no two buildings undergo the exact same motions, even in the same earthquake. Past earthquakes have shown us, however, that some types of buildings are far more likely to fail than others. This section assesses the general earthquake vulnerability of structures and facilities common in the southern California area, including in Yucca Valley. This analysis is based on past earthquake performance of similar types of buildings in the United States. The effects of design earthquakes on particular structures within the Town are beyond the scope of this study.

1.8.1 Unreinforced Masonry Buildings

Unreinforced masonry buildings (URMs) are prone to failure due to inadequate anchorage of the masonry walls to the roof and floor diaphragms, lack of steel reinforcing, the limited strength and ductility of the building materials, and sometimes, poor construction workmanship. Furthermore, as these buildings age, the bricks and mortar tend to deteriorate, making the buildings even weaker. As a result, the State Legislature passed Senate Bill 547, addressing the identification and seismic upgrade of URMs.

It is unknown whether there are any unreinforced masonry structures in the Town of Yucca Valley. Inventory requests from the Seismic Safety Commission in 2003 and 2006 to the Town of Yucca Valley appear to have gone unanswered.

1.8.2 Soft-Story Buildings

Of particular concern are soft-story buildings (buildings with a story, generally the first floor, lacking adequate strength or toughness due to too few shear walls). Apartments above glass-fronted stores, and buildings perched atop parking garages are common examples of soft-story buildings. Collapse of a soft story and "pancaking" of the remaining stories killed 16 people at the Northridge Meadows apartments during the 1994 Northridge earthquake (EERI, 1995). There are many other cases of soft-story collapses in past earthquakes. In response, the State encourages the identification and mitigation of seismic hazards associated with these types of potentially hazardous buildings, and others such as pre-1971 concrete tilt-ups, mobile homes, and pre-1940 homes. The Town of Yucca Valley should consider conducting an inventory of their soft-stories, and encouraging the structural retrofit of these structures to withstand collapse during an earthquake.

1.8.3 Wood-Frame Structures

Most wood-frame structures in Yucca Valley can be anticipated to experience slight to extensive damage as a result of ground shaking expected in the region, the level

of damage generally associated with the age of the structure, its condition, and its location relative to the causative fault, among other conditions. Structural damage to wood-frame structures often results from an inadequate connection between the superstructure and the foundation. These buildings may slide off their foundations, with consequent damage to plumbing and electrical connections. Unreinforced masonry chimneys may also collapse. These types of damage are generally not life threatening, although they may be costly to repair. Wood frame buildings with stud walls generally perform well during an earthquake, unless they have no foundation or have a weak foundation constructed of unreinforced masonry or poorly reinforced concrete. In these cases, damage is generally limited to cracking of the stucco, which dissipates much of the earthquake's induced energy. The collapse of wood frame structures, if it happens, generally does not generate heavy debris, but rather, the wood and plaster debris can be cut or broken into smaller pieces by hand-held equipment and removed by hand in order to reach victims (FEMA, 1985).

1.8.4 Pre-Cast Concrete Structures

Partial or total collapse of buildings where the floors, walls and roofs fail as large intact units, such as large pre-cast concrete panels, cause the greatest loss of life and difficulty in victim rescue and extrication (FEMA, 1985). These types of buildings are common not only in southern California, but abroad. Casualties as a result of collapse of these structures in past earthquakes, including Mexico (1985), Armenia (1988), Nicaragua (1972), El Salvador (1986 and 2001), the Philippines (1990), Turkey (1999) and China (2008) add to hundreds of thousands. In southern California, many of the parking structures that failed during the Northridge earthquake, such as the Cal-State Northridge and City of Glendale Civic Center parking structures, consisted of pre-cast concrete components (EERI, 1995).

Collapse of this type of structure generates heavy debris, and removal of this debris requires the use of heavy mechanical equipment. Consequently, the location and extrication of victims trapped under the rubble is generally a slow and dangerous process. Extrication of trapped victims within the first 24 hours after the earthquake becomes critical for survival. In most instances, however, post-earthquake planning fails to quickly procure equipment needed to move heavy debris. The establishment of Heavy Urban Search and Rescue teams, as recommended by FEMA (1985), has improved victim extrication and survivability. Buildings that are more likely to fail and generate heavy debris need to be identified, so that appropriate mitigation and planning procedures are defined prior to an earthquake.

1.8.5 Tilt-up Buildings

Tilt-up buildings have concrete wall panels, often cast on the ground, or fabricated off-site and trucked in, which are then tilted upward into their final position. Connections and anchors have pulled out of walls during earthquakes, causing the floors or roofs to collapse. A high rate of failure was observed for this type of construction in the 1971 San Fernando and 1987 Whittier Narrows earthquakes. Tilt-up buildings can also generate heavy debris.

1.8.6 Reinforced Concrete-Frame Buildings

Reinforced concrete frame buildings, with or without reinforced infill walls, display low ductility. Earthquakes may cause shear failure (if there are large tie spacings in columns, or insufficient shear strength), column failure (due to inadequate rebar splices, inadequate reinforcing of beam-column joints, or insufficient tie anchorage), hinge deformation (due to lack of continuous beam reinforcement), and non-structural damage (due to the relatively low stiffness of the frame). A common type of failure observed following the Northridge earthquake was confined column collapse (EERI, 1995), where infilling between columns confined the length of the columns that could move laterally in the earthquake.

1.8.7 Multi-Story Steel-Frame Buildings

Multi-story steel frame buildings generally have concrete floor slabs. However, these buildings are less likely to collapse than concrete structures. Common damage to these types of buildings is generally non-structural, including collapsed exterior curtain wall (cladding), and damage to interior partitions and equipment. Overall, modern steel frame buildings have been expected to perform well in earthquakes, but the 1994 Northridge earthquake broke many welds in these buildings, a previously unanticipated problem.

Older, pre-1945 steel frame structures may have unreinforced masonry such as bricks, clay tiles and terra cotta tiles as cladding or infilling. Cladding in newer buildings may be glass, infill panels or pre-cast panels that may fail and generate a band of debris around the building exterior (with considerable threat to pedestrians in the streets below). Structural damage may occur if the structural members are subject to plastic deformation, which can cause permanent displacements. If some walls fail while others remain intact, torsion or soft-story problems may result.

1.8.8 Mobile Homes

Mobile homes are prefabricated housing units that are placed on isolated piers, jackstands, or masonry block foundations (usually without any positive anchorage). Floors and roofs of mobile homes are usually of plywood, and outside surfaces are covered with sheet metal. Mobile homes typically do not perform well in earthquakes. Severe damage occurs when they fall off their supports, severing utility lines and piercing the floor with jackstands. Loss estimation analyses typically show that a large percentage of the mobile homes in the southern California area are likely to experience more than moderate damage as a result of an earthquake on a local fault. As discussed in the Fire Hazards Chapter (Chapter 4), when manufactured homes fall off their supports, gas line connections are often severed. The resultant gas leaks can ignite, which can lead to the complete loss of the structure due to fire.

1.8.9 Combination Types

Buildings are often a combination of steel, concrete, reinforced masonry and wood, with different structural systems on different floors or different sections of the building. Combination types that are potentially hazardous include: concrete frame buildings without special reinforcing, precast concrete and precast-

composite buildings, steel frame or concrete frame buildings with unreinforced masonry walls, reinforced concrete wall buildings with no special detailing or reinforcement, large-capacity buildings with long-span roof structures (such as theaters and auditoriums), large un-engineered wood-frame buildings, buildings with inadequately anchored exterior cladding and glazing, and buildings with poorly anchored parapets and appendages (FEMA, 1985). Additional types of potentially hazardous buildings may be recognized after future earthquakes.

In addition to building types, there are other factors associated with the design and construction of the buildings that also have an impact on the structures' vulnerability to strong ground shaking. Some of these conditions are discussed below:

- **Building Shape**: A building's vertical and/or horizontal shape can also be important. Simple, symmetric buildings generally perform better than non-symmetric buildings. During an earthquake, non-symmetric buildings tend to twist, as well as shake. Wings on a building tend to act independently during an earthquake, resulting in differential movements and cracking. The geometry of the lateral, load-resisting systems also matters. For example, buildings with one or two walls made mostly of glass, while the remaining walls are made of concrete or brick, are at risk. Asymmetry in the placement of bracing systems that provide a building with earthquake resistance can result in twisting or differential motions.

- **Pounding**: Site-related seismic hazards may include the potential for neighboring buildings to "pound," or for one building to collapse onto a neighbor. Pounding occurs when there is little clearance between adjacent buildings, and the buildings "pound" against each other as they deflect during an earthquake. The effects of pounding can be especially damaging if the floors of the buildings are at different elevations, so that, for example, the floor of one building hits a supporting column of the other. Damage to a supporting column can result in partial or total building collapse.

1.9 Summary and Recommendations

Since it is not possible to prevent an earthquake from occurring, local governments, emergency relief organizations, and residents are advised to take action and develop and implement policies and programs aimed at reducing the effects of earthquakes. Individuals should also exercise prudent planning to provide for themselves and their families in the aftermath of an earthquake. This is particularly important in the Yucca Valley area and other areas immediately adjacent to or bisected by active faults.

Earthquake Sources, Design Earthquake Scenarios and Fault Rupture:

- Geologists, seismologists, engineers and urban planners typically use maximum magnitude and maximum probable earthquakes to evaluate the seismic hazard of a region, the assumption being that if we plan for the worst-case scenario, smaller earthquakes that are more likely to occur can be dealt with more effectively.

- The Pinto Mountain fault is the most significant seismic source in the Town of Yucca Valley General Plan area. The fault extends across the Town in an east to east-northeast direction, locally underlying Highway 62, and extending across all north-south access roads that connect Highway 62 with the northern part of Town. A high pressure gas transmission line that extends across the Town both extends along and locally crosses the Pinto Mountain fault zone, a condition that can result in dozens of breaks of the pipeline in Yucca Valley when the Pinto Mountain fault ruptures next. This fault has not caused an earthquake in historic times, but paleoseismic studies indicate that it has a recurrence interval of between about 2,500 and 3,000 years.

- Several faults within 100 km (62 miles) of Yucca Valley can generate earthquakes as large or larger than the M_w 6.7 Northridge earthquake, the single most-expensive earthquake yet to impact the United States. Unfortunately, we cannot predict when a fault will break causing an earthquake, but we can anticipate the size of the resulting earthquake and estimate the level of damage that the earthquake would generate in the region. Strong to moderate ground shaking due to future earthquakes on regional sources, including the Pinto Mountain and San Andreas faults, should be expected and designed for.

- The Landers earthquake occurred at Yucca Valley's back door, so to speak. However, surface fault rupture through Yucca Valley was minor, measured for the most part in inches, and the strongest shaking was directed away from the center of Town. Rupture of the Pinto Mountain fault through the heart of the Town would be the worst-case earthquake for Yucca Valley, with surface rupture potentially measuring tens of feet, and strong ground shaking made worse by seismic waves bouncing off the mountains to the north and south. A M7.2 earthquake on this fault would result in significant damage in the Town.

Secondary Earthquake Effects:

- The California Geological Survey (CGS) has not conducted mapping in the Yucca Valley area under the Seismic Hazards Mapping Act. This report presents a liquefaction susceptibility map that was prepared using a similar method used by the California Geological Survey (CGS). Shallow ground water levels (less than about 50 feet from the ground surface) have not been reported historically in Yucca Valley. Therefore, although young alluvial sediments underlie the valley, and strong ground shaking can occur in the region, the liquefaction susceptibility of the Yucca Valley area is currently considered low to none. Recharging of the groundwater sub-basins could result in the rise of water to levels of concern. The Hi-Desert Water District and the U.S. Geological Survey reportedly will monitor the rise in groundwater to prevent the potential for liquefaction from becoming a reality.

- Soil falls, slides and slumps may occur in the hillside areas of the Sawtooth Mountains, on Burnt Mountain, at the northern edges of the Little San Bernardino Mountains, and along the edges of several of the drainages in the area. All of these

types of slope failure can occur as a result of strong ground shaking.

- Precariously perched rocks are common in some areas of the Sawtooth Mountains. Earthquake-induced ground shaking could dislodge some of these rocks, posing a rockfall hazard to areas adjacent to and below these slopes.

- Those areas of Yucca Valley underlain by youthful unconsolidated alluvial sediments may be susceptible to seismically induced settlement. Geotechnical studies to evaluate this potential hazard should be conducted in areas underlain by Holocene sediments where developments are proposed. If the sediments are found to be susceptible to this hazard, mitigation measures designed to reduce settlement should be incorporated into the design.

Earthquake Hazard Reduction:

- Most of the loss of life and injuries that occur during an earthquake are related to the collapse of hazardous buildings and structures, or from non-structural components, including contents, in those buildings. Especially hard-hit structures include manufactured homes, and residential structures other than single-family homes (that is, multi-family residential buildings, including duplexes, condominiums and apartments).

- The High Desert Medical Center in Joshua Tree, located less than 1 mile from the Pinto Mountain fault, would experience severe shaking during an earthquake on that fault, and is not expected to be more than 50% functional immediately following the earthquake (Earth Consultants International, 2009). As a result, the hospital may not be able to meet the demand for medical care in the aftermath of a large earthquake in the area, given that it services several of the communities that would be hard-hit by such an event. Emergency management personnel and planners need to develop a contingency plan that provides for medical care at facilities other than the local hospital, such as the Robert E. Bush Naval Hospital within the Twentynine Palms Marine Base, in addition to agreements with hospitals outside of the region that can provide assistance. Given the extensive damage anticipated to the local transportation system, critical victims that need to be transported elsewhere for treatment may have to be airlifted out of the area.

- The inventory and retrofit of potentially hazardous structures, such as pre-1952 wood-frame buildings, concrete tilt-ups, pre 1971- reinforced masonry, soft-story buildings and especially mobile homes, are recommended.

- The best mitigation technique in earthquake hazard reduction is the constant improvement of building codes with the incorporation of the lessons learned from past earthquakes. This is especially true in areas not yet completely developed. In addition, current building codes should be adopted for re-development projects that involve more than 50% of the original cost of the structure. Current building codes incorporate two significant changes that impact the Town of Yucca Valley. First, there is recognition that soil types can have a significant impact on the

amplification of seismic waves, and second, the proximity of earthquake sources will result in high ground motions and directivity effects. However, for those areas of Yucca Valley already developed, and given that building codes are generally not retroactive, the adoption of the most recent building code is not going to improve the existing building stock, unless actions are taken to retrofit the existing structures. Retrofitting existing structures to the most current building code is in most cases cost-prohibitive and not practicable. However, specific retrofitting actions, even if not to the latest code, that are known to improve the seismic performance of structures should be attempted.

- While the earthquake hazard mitigation improvements associated with the latest building code address new construction, the retrofit and strengthening of existing structures requires the adoption of ordinances. The Town of Yucca Valley could consider the implementation of ordinances aimed at retrofitting older wood-frame residential buildings that are not tied-down to their foundations, pre-cast concrete buildings, steel-frame buildings, soft-story structures, and manufactured housing. Although retrofitted buildings may still incur severe damage during an earthquake, their mitigation results in a substantial reduction of casualties by preventing collapse.

- Effective management of seismic hazards in Yucca Valley includes technical review of consulting reports submitted to the Town by licensed engineering geologists and/or civil engineers having competence in the evaluation and mitigation of seismic hazards (CCR Title 14, Section 3724). Because of the interrelated nature of geology, seismology, and engineering, most projects will benefit from review by both the geologist and civil engineer. The California Geological Survey has published guidelines to assist reviewers in evaluating site-investigation reports (CDMG, 1997; CGS, 2008).

- Rupture of the Pinto Mountain fault through the Town of Yucca Valley has the potential to result in hundreds to thousands of leaks and breaks in the potable water system. Hardest hit areas may be without water at the tap for weeks to months. The Town and its lifeline service providers should consider retrofitting the older pipelines in these systems, to reduce the number of potential breaks as a result of corrosion and age, in addition to developing plans to truck in water that is delivered directly to the Town residents. Residents should be encouraged to store at least a 7-day supply of water for all family members, including pets, so that they can be self-sufficient immediately following the earthquake, until service is restored or, if necessary, the Town can arrange for water to be trucked in.

CHAPTER 2: GEOLOGIC HAZARDS

Geologic hazards are generally defined as surficial earth processes that have the potential to cause loss or harm to the community or the environment. The basic elements involved in the assessment of geologic hazards are geology, soils, topography, climate, and land use. The geologic setting and types of geologic hazards affecting the Town of Yucca Valley are discussed in the following sections.

2.1 Physiographic Setting

The high-desert Town of Yucca Valley encompasses highly variable terrain that includes a broad central valley, gently sloping alluvial fans, and rugged mountains. Within the Town limits, the gradient of the central east-west trending valley falls very gently to the east, from an elevation of about 3,400 feet above sea level (asl) at its western edge, to about 3,100 feet asl at its eastern edge. North of the valley, the Sawtooth Mountains form rounded hills with picturesque bouldery outcrops. In addition to the Sawtooths, the valley is framed by the San Bernardino Mountains to the west, the Bartlett Mountains to the east, and the Little San Bernardino Mountains to the south. Peaks within the Town have elevations of between 3,800 and 4,500 feet asl, with the highest peak within the Town's southern boundary reaching up to an elevation of about 4,600 feet asl. South of Yucca Valley, the Little San Bernardino Mountains rise to more than 5,000 feet asl. Compared to the Sawtooths, the Town's sparsely vegetated hillsides to the south are moderately steep, jagged, and have considerably fewer outcrops – a reflection of the variation in the underlying rock types within Yucca Valley.

The most extensively developed area of Yucca Valley lies along State Highway 62, which generally coincides with the axis of the central valley. Development near the highway is predominantly commercial with a few multi-family residential units. Single family homes comprise most of the remaining development away from Highway 62, with the highest concentration of homes spreading across the valley floor and up the gently sloping alluvial fans. Scattered rural and semi-rural residential development has spread out into hilly areas to the north and south. More than half of the Town's area is still undeveloped however, including many of the steeper hills and ridgelines. The mountains that border the Town on the south are dedicated to open space and recreation, as part of Joshua Tree National Park and Big Morongo Canyon Preserve.

2.2 Geologic Setting

Southern California is divided into distinct geomorphic provinces, that is, regions having their own unique physical characteristics formed by geologic, topographic, and climatic processes. Yucca Valley is located at the boundary of two very distinct provinces. The northern part of the Town, generally north of State Highway 62, lies within the Mojave Desert Province, an arid region of alluvial fans, desert plains, dry lakebeds, and scattered mountain ranges. This province covers a large portion of eastern California, stretching from the southern end of the Sierra Nevada Mountains to the Colorado River. Faults in the Mojave Desert Province have a predominant northwesterly trend; however, some faults with a trend more aligned with the Transverse Ranges described below are also present.

In contrast, the southern part of the Town reaches up the north flank of the Little San Bernardino Mountains, a moderately high range that is the southernmost extension of the Transverse Ranges Province. This province is a region whose characteristic features are a series of generally east-west trending ranges that include the San Gabriel and San Bernardino Mountains. These ranges are called "transverse" because they lie at an oblique angle to the prominent northwesterly structural grain of the southern California landscape, a trend that is generally aligned with the San Andreas fault. The Transverse Ranges are being intensely compressed by active tectonic forces, therefore they are some of the fastest rising (and fastest eroding) mountains in the world. In Yucca Valley, the boundary of these two provinces is defined by the Pinto Mountain fault, a wide zone of multiple fault strands.

The physical features of the area's landscape are a result of geologic and climatic processes that have affected this region in the last few million years. The most striking feature is the dramatic contrast between the desert plains and the adjacent mountains – a direct result of movement along geologically young faults that have both elevated and down-dropped great blocks of the Earth's crust. As a result, the mountains are composed of rocks that have been sheared and intensely fractured under the strain of tectonic movement. The down-dropped blocks form deep basins that are filled with multiple generations of overlapping alluvial fans having a range of ages coincident with the rise of the local mountains. Yucca Valley overlies two such basins: The Warren Valley Groundwater Basin underlies the main valley and gently sloping terrain to the south; the southwestern edge of the Copper Mountain Groundwater Basin underlies the northern part of the Town, with the Sawtooth Mountains, the Pinto Mountain fault zone, and the Bartlett Mountains forming a barrier between the two basins (California Department of Water Resources, 2004). The Warren Valley Basin is estimated to be deepest along the Pinto Mountain fault zone, however its actual depth is unknown since very few of the local groundwater wells, the source of most geologic data for the basin, have been drilled deep enough to reach the bottom. Geophysical data however, suggest the basin is more than 3,000 feet deep at its deepest part (Nishikawa and others, 2003). The maximum depth of the section of the Copper Mountain Basin that underlies the Yucca Valley area is unknown. Like other valleys in the region, sediments beneath Yucca Valley are estimated to range in age from Holocene near the surface, to more than 1 million years old at great depth. Deposition is still ongoing, with the youngest sediments filling active drainage channels and blanketing the Yucca Wash floodplain.

The physiographic and geologic histories of the Yucca Valley area are important in that they control to a great extent the geologic hazards, as well as the natural resources, within the area. For example, erosion and flooding pose significant hazards in Yucca Valley due to the fractured condition of the rock in the local mountains, the sandy nature of the valley sediments, and the intense thunderstorms that occur in the high desert. On the other hand, deep, alluvium-filled basins which are bounded at depth by relatively impermeable rock and faults function as natural underground reservoirs (aquifers) for groundwater, the area's primary source of drinking water.

2.3 Geologic Units and Their Engineering Properties

To a large degree, past study and characterization of the geology in the Yucca Valley region has been undertaken in order to understand the source, quality, and availability of groundwater or other natural resources (Bader and Moyle, 1960; Lewis, 1972; Huff and others, 2002; Nishikawa and others, 2003; and many others). The general distribution of geologic units that are exposed at

the surface is shown on the Geologic Map (Plates 2-1a and 2-1b). This map is a modified, composite version of geologic maps published for this area (Bortugno and Spittler, 1986; Dibblee, 2008a,b; and Nishikawa and others, 2003). In the sections that follow, the general physical and engineering characteristics of each geologic unit in Yucca Valley, from youngest to oldest, are summarized using the descriptions derived from the published maps and reports (Dibblee, 1967a,b,c and 2008a,b; in addition to those mentioned above). General engineering characteristics are shown on the Engineering Materials Map (Plates 2-2a and 2-2b).

There are isolated deposits of man-made fill throughout Yucca Valley, including fills associated with roadway embankments, levees, and graded developments. These deposits vary widely in size, age, and composition, and although some may cover a significant area, due to the scale of Plate 2-1a, they are not shown on the Geologic Map.

2.3.1 Sedimentary Deposits

2.3.1.1 Surficial Sediments

Surficial geologic units comprise those sedimentary deposits that overlie bedrock in the area. In Yucca Valley these units consist predominantly of unconsolidated or semi-consolidated sand, silt, and gravel. The youngest sediments are water-laid alluvium deposited in active or recently active gullies, washes and floodplains. Gently sloping areas in the southern and northern parts of the Town consist of older, slightly elevated alluvial fan sediments that have been dissected by the active washes and gullies. Erosional remnants of very old fans are present in isolated areas, where they form deeply incised hills, such as Burnt Mountain. These sedimentary units and their estimated ages have been categorized by researchers primarily by noting the degree of soil development on the surface, stratigraphic position, degree of stream incision, relative uplift, and other physical characteristics. Most of the units do not have formal names, but they have been labeled with symbols that emphasize their age and mode of deposition. At depth, this sequence of alluvial sediments is underlain by crystalline bedrock similar to that exposed in the surrounding mountains.

Young Alluvium (Map Symbol: Qya)

Young alluvium includes sediments deposited by water in washes, on small fans emanating from canyons within the local hills and mountains, and as floodplain deposits on the valley floor. These deposits predominantly consist of unconsolidated, coarse-grained sediments filling the major active drainage courses, including the Yucca Wash, Water Canyon, Covington Wash, West Burnt Mountain Creek, East Burnt Mountain Creek, and Pipes Wash, as well as silt, sand and gravel in numerous unnamed washes and gullies that cross the older alluvial fans. The upper reaches of these drainages, especially near the mountains, may contain very large boulders deposited during flash floods. Finer-grained alluvium, including fine sand, silt, and clay, is generally present where past floodwaters have spread out on the valley floor. Young alluvium has no pedogenic soil development on the surface, and is typically reworked by floodwaters or buried by new sediment during storms. Young alluvium is Holocene in age, and may be up to about 100 feet thick (Nishikawa and others, 2003).

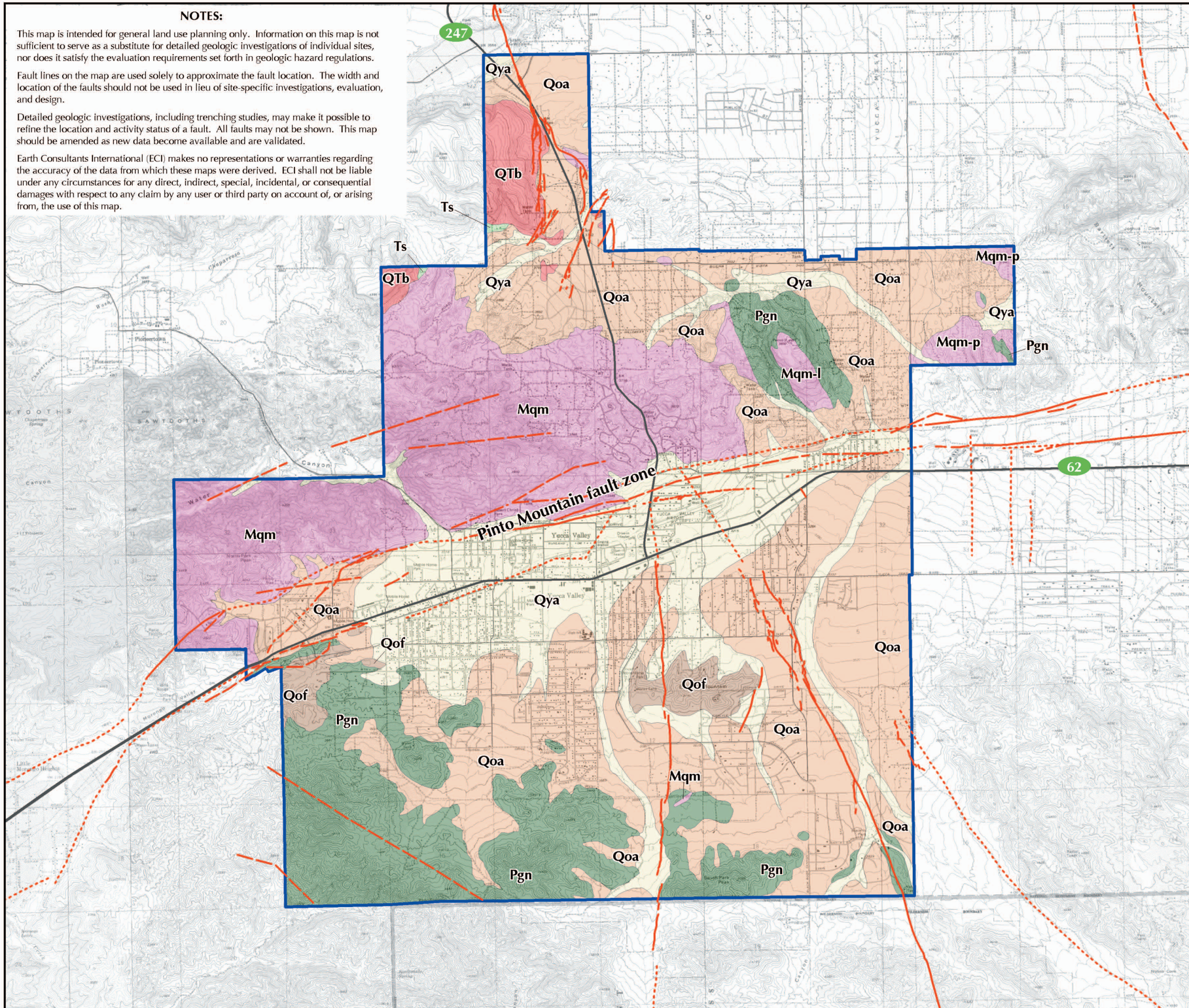
NOTES:

This map is intended for general land use planning only. Information on this map is not sufficient to serve as a substitute for detailed geologic investigations of individual sites, nor does it satisfy the evaluation requirements set forth in geologic hazard regulations.

Fault lines on the map are used solely to approximate the fault location. The width and location of the faults should not be used in lieu of site-specific investigations, evaluation, and design.

Detailed geologic investigations, including trenching studies, may make it possible to refine the location and activity status of a fault. All faults may not be shown. This map should be amended as new data become available and are validated.

Earth Consultants International (ECI) makes no representations or warranties regarding the accuracy of the data from which these maps were derived. ECI shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to any claim by any user or third party on account of, or arising from, the use of this map.



Geologic Map

Yucca Valley, California

For Geologic Unit Descriptions
See Plate 2-1b

N
W E
S

5000 0 5000
Feet

1500 0 1500
Meters

Scale: 1:60,000

Base Map: USGS Topographic Map from Sure!MAPS RASTER (1997) and Town of Yucca Valley.
Sources: Modified from Dibblee (2008).

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2012

Plate 2-1a

Geologic Unit Descriptions

SEDIMENTARY DEPOSITS

Surficial Sediments

Qya Young Alluvium - Unconsolidated, undissected sand and gravel filling valleys, stream channels, and washes; contains some fine sand, silt, and clay in valley areas. Late Pleistocene to Holocene age.

Qoa Older Alluvium - Massive to poorly-bedded sand and gravel valley fill, now slightly elevated; dissected by active drainages. Predominantly sand, pebbles, and cobbles; or coarse sand and cobbles. Pleistocene age.

Qof Very Old Alluvium (Fanglomerate) - Massive, weakly consolidated sand, gravel, and boulders of ancient alluvial fan deposits. Only erosional remnants remain. Probable early Quaternary or possible Tertiary age.

Sedimentary Rock

Ts Sandstone - Massive to faintly bedded, light-colored, fine- to medium-grained sandstone; locally contains lenses of pebble-cobble conglomerate. Probable late Tertiary age.

CRYSTALLINE ROCK UNITS

Igneous Rocks

QTb Basalt - Dark-colored lava flows exposed on flat-topped hills and ridges in the northern part of the town. Probable late Tertiary or Quaternary age.

Mqm Quartz Monzonite - Massive, light-colored, medium- to coarse-grained granitic rock. Exposed primarily in rocky hills north of the Pinto Mountain fault zone. Probable Cretaceous or possible Jurassic age (Mesozoic).

- **Mqm-l** Leuocratic quartz monzonite; faintly gneissoid locally.
- **Mqm-p** Monzonite porphyry; contains abundant, large, rectangular phenocrysts of orthoclase feldspar. Early Cretaceous to late Jurassic age.

Metamorphic Rocks

Pgn Gneissic Rocks. Composition is variable, ranging from quartz monzonite to quartz diorite. Exposed primarily in the hills south of the Pinto Mountain fault zone. Within Yucca Valley, rock foliation dips steeply to the northwest. Age unknown, but possibly as old as Precambrian.

Symbols

Fault; solid where location known, dashed where approximate, dotted where concealed. (for more information refer to Plate 1-2)

Geologic Contact

Yucca Valley Town Boundary

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2012

Explanation for Geologic Map

Plate 2-1b

Engineering Properties of Young Alluvium: How and where these young sediments were deposited have a significant bearing on the properties of these materials. At the base of the mountains and hills, where it is generally deposited rapidly, alluvium is coarse-grained, poorly sorted, and often has organic debris. As a result, the major engineering issues affecting these geologically young deposits are: 1) compressibility, which occurs when additional loads are applied, and 2) collapse (hydroconsolidation) upon introduction of irrigation water if the deposit is dry. Being unconsolidated, sandy alluvium is highly susceptible to erosion. Alluvium filling mountain drainages with gradients steeper than about 27 degrees (50 percent slope) may form mudflows if it becomes saturated. Boulders in the alluvium near the base of slopes and in active channels may be a hindrance to earthwork and foundation construction. Alluvium is suitable for use as fill, once organic materials and oversized rocks are removed, however alluvium typically requires the addition of water to achieve the level of compaction needed to support a building or structure. Alluvial deposits also have moderate to high permeability, except where silt or clay layers may retard the downward percolation of water. The potential for expansive soils is generally low, except where deposits of silt and clay are exposed. Most young alluvium in the Yucca Valley area is not water-bearing.

Older Alluvium (Map Symbol: Qoa)

Older alluvial fan deposits are Pleistocene in age (ranging from about 11,000 to 1 million years old), and generally consist of massive to crudely stratified sand and pebble-cobble gravel eroded from bedrock exposed in the adjacent hills and mountains. Deposits closer to the mountains are typically coarse grained, transitioning to finer-grained sediments (silty sand) downslope, near the valley axis. Well drillers logs indicate layers of clay, sandy clay and gravelly clay are present throughout the sedimentary sequence. The oldest deposits are commonly tilted, folded, and/or faulted near the major active fault zones.

Engineering Properties of Older Alluvium*:* Older alluvium is generally denser than young alluvium, and therefore will provide better support for foundations and structures. Clayey pedogenic soils that develop on the fan surface, or clayey beds within the unit would be in the expansive range. Slope stability can be a problem where slopes have become oversteepened, typically by stream erosion or man's activities. These deposits are less permeable than the young alluvium, nevertheless the deeper part of the sequence is the main water-bearing unit in Yucca Valley, yielding most of the Town's well water.

Very Old Alluvium (Map Symbol: Qof)

This unit is classified as a fanglomerate, meaning it was deposited in an alluvial fan environment and is comprised mostly of boulders and cobbles in a sand matrix. Where exposed at the surface, the fanglomerate is light gray in color, massive, and contains sub-rounded rock fragments transported from mountains to the south and northwest. At depth, this unit underlies the sequence of young and old alluvium filling the mid to upper part of the basin, and is estimated to be at least 2,000 feet thick. The fanglomerate is estimated to be early Quaternary to possible late Tertiary age (1 million to about 5 million years old).

Engineering Properties of Very Old Alluvium: Except for the uppermost weathered surface, the fanglomerate should provide good foundation support. If clayey pedogenic soils have developed on the surface, these may be expansive; otherwise the unweathered

portion generally has low expansion potential. Boulders are likely to be a hindrance to earthwork and foundation construction. This unit is not water-bearing near the surface, but despite its increased consolidation with depth, it does contribute a small percentage of the area's water supply to deep wells.

2.3.1.2 Sedimentary Rock (Map Symbol: Ts)

Sedimentary rock consisting of buff-colored, fine- to medium-grained sandstone, locally with lenses of rounded pebble-cobble conglomerate and minor thin lenses of siltstone, is present in the northern part of the Town. Sediments in this unit were deposited on the quartz monzonite rock described below, and were then buried by the basaltic lava flows that cap the hills in this area. Consequently, exposure of this unit at the surface by erosion is very limited. The sandstone is described as friable (grains are not well cemented together), and massive to very faintly bedded. Based on its position between the monzonite and the basalt, it is estimated to be Tertiary in age (between about 1.6 and 65 million years old).

Engineering Properties of Sedimentary Rock: Friable, massive sandstone generally provides good foundation stability, being relatively dense, low in expansion potential, and resistant to slope failure. Nevertheless, it is susceptible to erosion, and would generally not perform well in slopes steeper than 50 percent (2:1 horizontal:vertical). This unit is not water-bearing.

2.3.2 Crystalline Rocks

The oldest geologic units in the Yucca Valley area consist of hard, crystalline rock that is exposed in the mountains and buried beneath the alluvium. Crystalline rock classifications are based primarily on genesis, texture, and mineral composition. Because the rocks are highly variable in texture and mineralogy, often grading from one type to another, the units are usually named for the dominant rock type. Numerous studies have discussed the mineralogy and character of the rocks in the region, along with their genesis (Bacheller, 1978; Dibblee, 1967a,b,c, 2008a,b; Miller, 1938; Rogers, 1954, 1958, 1961). Based on genesis alone, the rocks in this area can be classified into three main groups: 1) igneous rocks that crystallized from molten lava that flowed out on the surface (volcanic rocks); 2) igneous rocks that crystallized from the molten state deep within the Earth's crust (plutonic rocks); and 3) rocks of sedimentary origin that have recrystallized under extreme conditions of heat and pressure deep below the Earth's surface (metamorphic rocks).

2.3.2.1 Igneous Rocks

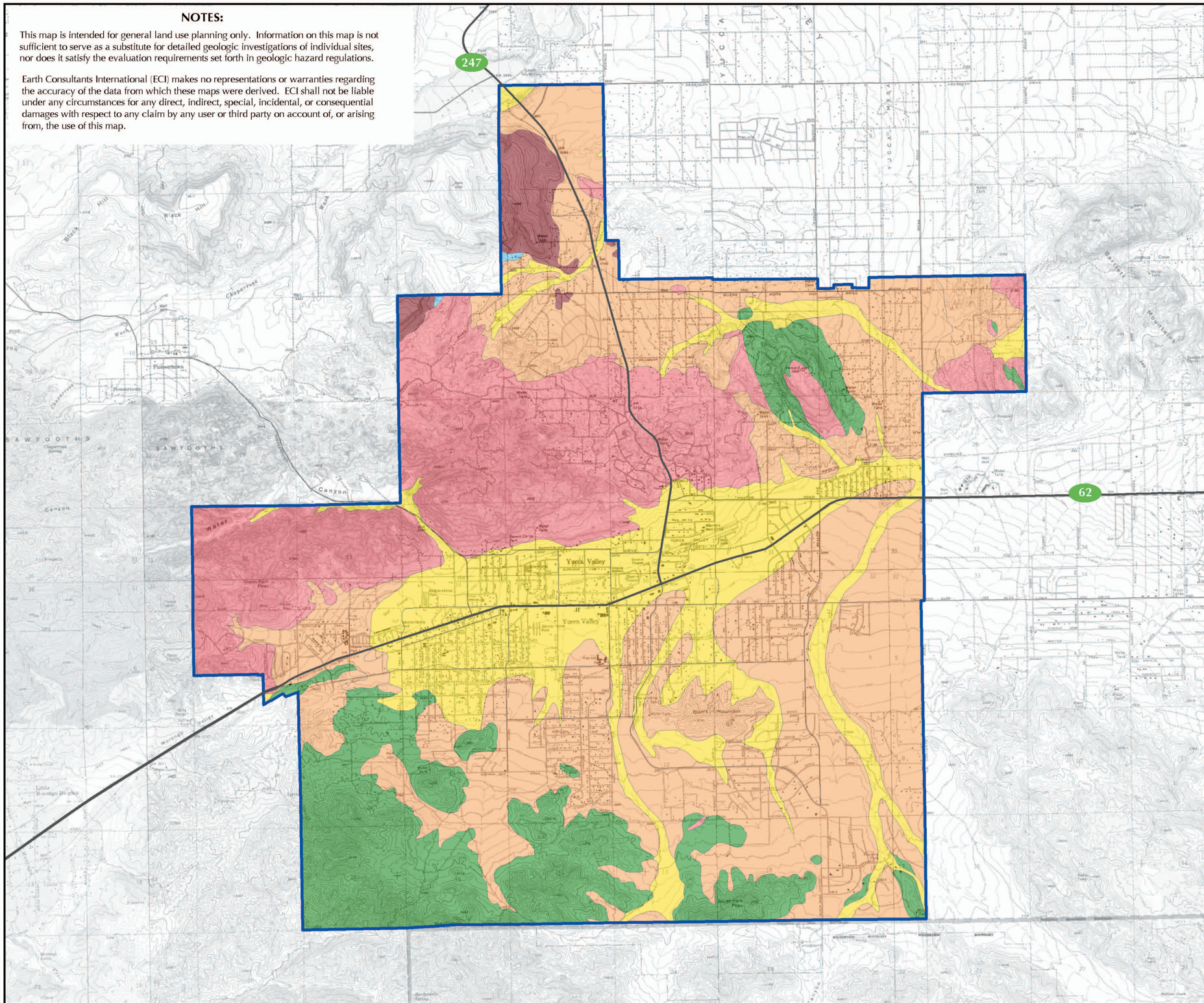
Volcanic Rock: Basalt (Map Symbol: QTb)

Volcanic rocks are those that solidified on the ground surface. Because these rocks cooled very quickly, they are very fine grained (microcrystalline). Classified as basalt, these rocks are black, hard, massive, and vesicular (meaning they have small voids caused by gas bubbles trapped in the flowing lava). This unit is resistant to erosion and tends to form relatively flat-topped hills and ridges.

NOTES:

This map is intended for general land use planning only. Information on this map is not sufficient to serve as a substitute for detailed geologic investigations of individual sites, nor does it satisfy the evaluation requirements set forth in geologic hazard regulations.

Earth Consultants International (ECI) makes no representations or warranties regarding the accuracy of the data from which these maps were derived. ECI shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to any claim by any user or third party on account of, or arising from, the use of this map.



Engineering Materials Map

Yucca Valley, California

Symbols

Yucca Valley Town Boundary

For Engineering Materials Descriptions See Plate 2-2b

N
W E
S

0 7000 14000 Feet

0 2000 4000 Meters

Scale: 1:84,000

Base Map: USGS Topographic Map from Sure!MAPS RASTER (1997) and Town of Yucca Valley.
Sources: Based on data from Dibblee (2008).

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2012

Plate 2-2a

GENERAL ENGINEERING CHARACTERISTICS OF GEOLOGIC UNITS IN THE YUCCCA VALLEY GENERAL PLAN AREA

SEDIMENTARY MATERIALS

Young Alluvium (Qya)
COMPOSITION: Variable, but commonly contains locally derived silt, sand, and gravel; may also contain vegetation and debris, or boulders near the mountains. DENSITY: Low; compressible. EXPANSION POTENTIAL: Generally low; locally moderate, depending on fine-grained fraction. SLOPE STABILITY: Generally poor. EROSION/SEDIMENTATION POTENTIAL: Highly susceptible to erosion, especially where water flow is concentrated; locally subject to sedimentation carried by floodwaters and debris flows. PERMEABILITY: Moderate to High. EASE OF EXCAVATION: Easy. SUITABILITY AS FILL: Generally good after organics, debris, and oversize rocks are removed. Clay or organic-rich deposits should not be placed near finish grades.

Old Alluvium (Qoa, Qof)
COMPOSITION: Variable mix of silt, sand, gravel and boulders; weathered surface may be enriched with clay due to pedogenic soil development. DENSITY: Generally dense below the upper few feet. EXPANSION POTENTIAL: Generally low; locally moderate to high, depending on original composition and degree of pedogenic soil development. SLOPE STABILITY: Good except where oversteepened by stream erosion or man's activities. EROSION/SEDIMENTATION POTENTIAL: Moderate. PERMEABILITY: Highly variable, but overall less permeable than young alluvium. Although generally not water-bearing near the surface, both Qoa and Qof have water-bearing layers (aquifers) at depth. EASE OF EXCAVATION: Easy. SUITABILITY AS FILL: Generally good; oversize rocks may require special handling.

Sandstone (Ts)
COMPOSITION: Fine- to medium-grained sand with lenses of rounded pebbles and cobbles. DENSITY: Generally dense below the upper weathered surface. EXPANSION POTENTIAL: Low. SLOPE STABILITY: Good except where oversteepened by stream erosion or man's activities. EROSION/ SEDIMENTATION POTENTIAL: Moderate. PERMEABILITY: Generally moderate, due to lack of cementation. Generally not water-bearing. EASE OF EXCAVATION: Easy. SUITABILITY AS FILL: Generally good.

CRYSTALLINE ROCKS

Basalt (Qtb)
COMPOSITION: Massive, microcrystalline. DENSITY: Very dense. EXPANSION POTENTIAL: Low. SLOPE STABILITY: Generally good in cut and natural slopes that are not oversteepened. EROSION POTENTIAL: Very low. PERMEABILITY: Low. EASE OF EXCAVATION: Difficult to very difficult where unweathered. May require blasting. SUITABILITY AS FILL: Relatively poor for unweathered rock, as excavation may produce significant oversize rock fragments. Blasting may produce smaller rock sizes that can be used for rock fills, however these require greater amounts of applied water, and compaction is difficult to verify.

Quartz Monzonite (Mqm, Mqm-l, Mqm-p)
COMPOSITION: Fractured, homogeneous, fine- to coarse-grained granitic rocks. DENSITY: Very dense. EXPANSION POTENTIAL: Low. SLOPE STABILITY: Generally good in cut slopes that are not oversteepened. Localized shear zones may provide planes of weakness. Natural slopes are typically covered with large boulders that pose a rockfall hazard. EROSION POTENTIAL: Very low. PERMEABILITY: Low. EASE OF EXCAVATION: Difficult to very difficult where unweathered. May require blasting. SUITABILITY AS FILL: Good for weathered, decomposed granitics. Relatively poor for unweathered rock, as excavation may produce significant oversize rock fragments. Blasting may produce smaller rock sizes that can be used for rock fills, however these require greater amounts of applied water, and compaction is difficult to verify.

Gneissic Rocks (Pgn)
COMPOSITION: Fractured heterogeneous mix of metamorphosed sedimentary rocks; faintly laminated; laminae are steeply dipping to near vertical and locally undulating. DENSITY: Very dense. EXPANSION POTENTIAL: Very low. SLOPE STABILITY: Good in natural slopes. Generally good in cut slopes. Localized shear zones may provide planes of weakness. Due to steeply dipping foliation, cut slopes that are oversteepended (such as road cuts) may be unstable. EROSION POTENTIAL: Very low. PERMEABILITY: Low. EASE OF EXCAVATION: Difficult to very difficult where unweathered. May require blasting. SUITABILITY AS FILL: Moderate to poor, as excavation may produce significant oversize rock fragments. Blasting may produce smaller rock sizes that can be used for rock fills, however these require greater amounts of applied water, and compaction is difficult to verify.

Plutonic Rocks: Quartz Monzonite (Map Symbol: Mqm, Mqm-l, Mqm-p)
Commonly referred to as "granitic," these rocks generally have large grains that can easily be seen without magnification. They often have a spotted appearance and have somewhat variable mineral assemblages. Most of these rocks crystallized from magmas that were emplaced over a period of time ranging between about 65 million and 225 million years ago, during the latter part of the Mesozoic Era, probably during the Cretaceous, or possibly as old as late Jurassic.

In the Yucca Valley area, the predominant mineral assemblage is a light-colored, massive, medium- to coarse-grained rock composed mainly of quartz and feldspars, with various accessory minerals such as biotite, sphene, zircon, apatite, and iron oxides. The quartz monzonite in Yucca Valley includes a subgroup labeled "porphyry" (Mqm-p). A porphyritic rock contains very large crystals (called "phenocrysts") embedded within a finer grained matrix. In this area, the monzonite porphyry is light gray, medium-grained, and has large phenocrysts of potassium feldspar. Leucocratic quartz monzonite ((Mqm-l) is very light colored (white to light gray), fine- to medium-grained, massive, and faintly gneissoid. These rocks form hills in the easternmost end of the Sawtooth Mountains, and the western part of the Bartlett Mountains.

2.3.2.2 Metamorphic Rocks

Gneissic Rocks (Map Symbol: Pgn)
The most ancient rocks in the Yucca Valley area are metamorphic rocks that are possibly as old as Precambrian in age (more than about 500 million years old). These rocks occur predominantly in the mountains south of the central valley, but are also present in isolated areas north of the Pinto Mountain fault zone. This group consists of gneissic rocks ranging in mineral composition from quartz monzonite to quartz diorite. The minerals in gneissic rocks are separated into layers, commonly giving the rock a banded appearance. The bands may be relatively straight, undulating, or contorted.

Engineering Properties of Crystalline Rock: The various crystalline rock types have similar engineering properties. They are very hard where not highly weathered, and tend to form steep, rugged slopes and deep canyons. They are typically non-water bearing, except where extensively jointed and fractured. Accordingly, these materials have low to moderately low permeabilities, except where joints, shears and foliation surfaces provide avenues for water to move in and around the rock mass. Metamorphic rocks tend to break along fracture surfaces, yielding pebble to cobble size fragments. Fractured granitic rocks tend weather into boulder-covered slopes, as well as decomposing along grain boundaries, resulting in abundant sand-size detritus. Unweathered rock cannot be excavated easily; blasting is typically required.

Because these rocks are brittle and have been subjected to millions of years of tectonic activity, they are typically very fractured and may be sheared near fault zones. These types of deformation, along with the inherent jointing or foliation (banding of minerals) present in the rocks, locally serve as planes of weakness along which slope instability can occur. Large prehistoric landslides have been mapped in similar rock types in the San Bernardino Mountains. However, no landslides have been mapped in or adjacent to Yucca Valley.

2.4 Geologic Hazards in the Yucca Valley Area

2.4.1 Slope Instability

A significant part of Yucca Valley encompasses hillside terrain. At present, many of the steepest hills and mountains remain largely undeveloped. However, scattered rural and semi-rural homesites are built out in the rocky slopes of the Sawtooths north of the main valley and into the lower reaches of the Little San Bernardino Mountains on the south. In addition, many homes are present in gently sloping areas along the base of mountain slopes. As the Town's population increases, the pressure to develop hillside homes will most likely intensify. Consequently, slope instability remains a hazard in Yucca Valley. Although a slope failure tends to affect a relatively small area (as compared to an earthquake or major flood), and is generally a problem for only a short period of time, the dollar loss can be high. Homeowner's insurance policies typically do not cover land slippage, and this can add to the anguish of the affected property owners.

The bedrock underlying the mountains and hills of Yucca Valley is generally not prone to landsliding. Nevertheless, areas of high topographic relief, such as steep canyon walls, are likely to be impacted by rockfalls and rockslides, typically in response to strong seismic shaking. Soil slips and mudflows during or after periods of intense rainfall not only impact canyon areas, but also valley areas downstream.

2.4.1.1 Types of Slope Failures

Slope failures occur in a variety of forms, and there is usually a distinction made between gross failures (sometimes also referred to as "global" failures) and surficial failures. Gross failures include deep-seated or relatively thick slide masses, such as landslides, whereas surficial failures can range from minor soil slips to destructive mud or debris flows. Failures can occur on natural or man-made slopes. For man-made slopes, most failures occur on older slopes, many of which were built at slope gradients steeper than those allowed by today's grading codes. Although infrequent, failures can also occur on newer, graded slopes, generally due to poor engineering or poor construction. Furthermore, slope failures often occur as elements of interrelated natural hazards in which one event triggers a secondary event, such earthquake-induced rockfall, fire-flood sequences, or storm-induced mudflows.

Gross or Global Failures

Landslides are movements of relatively large landmasses, either as nearly intact bedrock blocks, or as jumbled mixes of bedrock blocks, fragments, debris, and soils. Landslide materials are commonly porous and very weathered in the upper part and along the margins of the slide. They may also have open fractures and joints. The head of the slide may have a graben (pull-apart area) that has been filled with soil, bedrock blocks and fragments.

From an engineering perspective, landslides are generally unstable (may be subject to reactivation), and may be compressible, especially around their margins, which are typically highly disturbed and broken. The headscarp area above the landslide mass is also unstable, since it may be over-steepened, cracked, and subject to additional failures. The type of movement is generally described as follows:

- Translational – slippage on a relatively planar, dipping layer;
- Rotational – circular-shaped failure plane; or
- Wedge – movement of a wedge-shaped block from between intersecting planes of weakness, such as fractures, faults and bedding.

The potential for gross slope failure is dependent on many factors and their interrelationships. Some of the most important factors include slope height, slope steepness, shear strength and orientation of weak layers in the underlying geologic unit, as well as pore water pressures. Joints and shears, which weaken the rock fabric, allow penetration of water leading to deeper weathering of the rock along with increased pore pressures, increased plasticity of weak clays, and increased weight of the landmass. For engineering of earth materials, these factors are combined in calculations to determine if a slope meets a minimum safety standard. The generally accepted standard is a factor of safety of 1.5 or greater (where 1.0 is equilibrium, and less than 1.0 is failure). Natural slopes, graded slopes, or graded/natural slope combinations must meet these minimum engineering standards where they impact planned homes, subdivisions, or other types of developments. Slopes adjacent to areas where the risk of economic losses from landsliding is small, such as parks and roadways, are often allowed, at the discretion of the local reviewing agency, a lesser factor of safety.

Surficial Failures

Surficial failures typically occur in drainage swales and in the thick colluvial sediments and deeply weathered bedrock near the base of steep slopes. Surficial failures happen most often during particularly heavy and/or prolonged rainfall. The most common types of surficial instability are described below.

Slope creep in general involves deformation and movement of the outer soil or rock materials that cover a slope, due to the forces of gravity overcoming the shear strength of the material. Movement is imperceptibly slow and relatively continuous on moderate to steep slopes. Creep occurs most often in soils that develop on fine-grained bedrock units. Rock creep is a similar process, and involves permanent deformation of the outer few feet of the rock face resulting in folding and fracturing. Rock creep is most common in highly fractured, fine-grained rock units, such as siltstone, claystone and shale, but can also occur in igneous rocks, such as those that form the local mountains.

Creep also occurs in graded fill slopes. This is thought to be related to the alternate wetting and drying of slopes constructed with fine-grained, expansive soils. The repeated expansion and contraction of the soils at the slope face leads to loosening and fracturing of the soils, thereby leaving the soils susceptible to creep. While soil creep is not catastrophic, it can cause damage to structures and improvements located at the tops of slopes. Soil creep and creep of graded fill slopes is not a widespread hazard in Yucca Valley, since most soils in this area are coarse-grained and non-expansive.

Soil slip is generated by strong storms, and is widespread in steeper slope areas, particularly after winters with prolonged and/or heavy rainfall. Failure occurs on canyon

sideslopes, and in soils that have accumulated in swales, gullies and ravines. Slope steepness has a strong influence on the development of soil slips, with most slips occurring on slopes having gradients between about 27 and 56 degrees (50 to 150 percent slope) (Campbell, 1975). Slopes within this range of gradients are present in the foothills and mountains within and surrounding Yucca Valley (see Plate 2-3).

Debris flows are the most dangerous and destructive of all types of slope failure. A debris flow (also called mudflow, mudslide, and debris avalanche) is a rapidly moving slurry of water, mud, rock, vegetation and debris. Larger debris flows are capable of moving trees, large boulders, and even cars. This type of failure is especially dangerous as it can move at speeds as fast as 40 feet per second, is capable of crushing buildings, and can strike with very little warning. As with soil slips, the development of debris flows is strongly tied to exceptional storm periods of prolonged rainfall. Failure typically occurs during an intense rainfall event, following saturation of the soil by previous rains.

A debris flow most commonly originates as a soil slip in the rounded, soil-filled “hollow” at the head of a drainage swale or ravine. The rigid soil mass is deformed into a viscous fluid that moves down the drainage, incorporating into the flow additional soil and vegetation scoured from the channel. Debris flows also occur on canyon walls, often in soil-filled swales that do not have topographic expression. The velocity of the flow depends on the viscosity, slope gradient, height of the slope, roughness and gradient of the channel, and the baffling effects of vegetation. Even relatively small amounts of debris can cause damage from inundation and/or as a result of crashing into a structure (Ellen and Fleming, 1987; Reneau and Dietrich, 1987). Recognition of this hazard led FEMA to modify its National Flood Insurance Program to include inundation by "mudslides."

Watersheds that have been recently burned typically yield greater amounts of soil and debris than those that have not burned. Erosion rates during the first year after a fire are estimated to be 15 to 35 times greater than normal, and peak discharge rates range from 2 to 35 times higher. These rates drop abruptly in the second year, and return to normal after about 5 years (Tan, 1998). In addition, debris flows in burned areas can develop in response to small storms and do not require a long period of antecedent rainfall. These kinds of flows are common in small gullies and ravines during the first rains after a burn, and can become catastrophic when a severe burn is followed by an intense storm season (Wells, 1987).

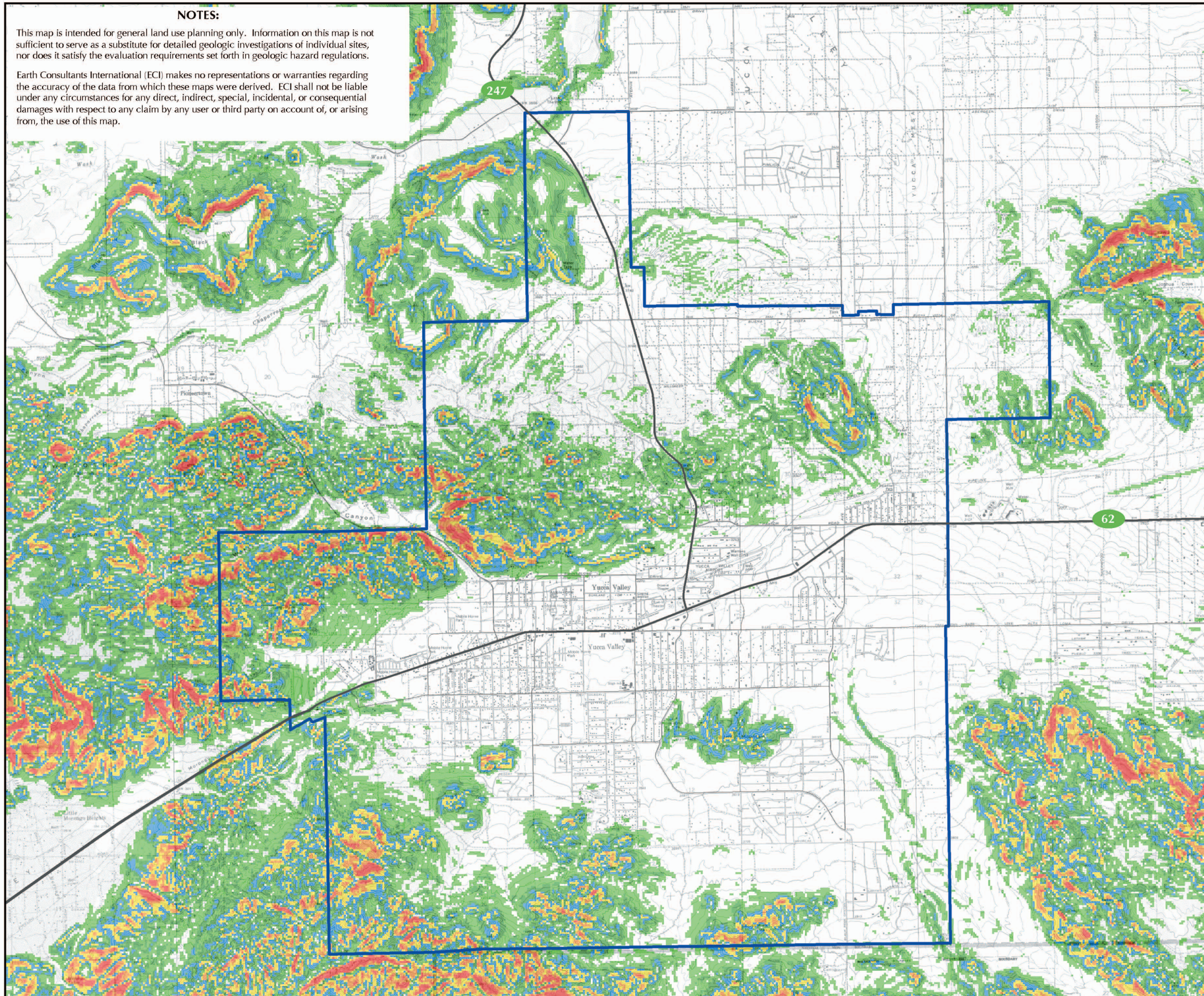
Rockfalls are free-falling to tumbling masses of bedrock that have broken off steep canyon walls or cliffs. The debris from repeated rockfalls typically collects at the base of extremely steep slopes in cone-shaped accumulations of angular rock fragments called talus. Rockfalls can happen wherever fractured rock slopes are oversteepened by stream erosion or man’s activities.

The granitic bedrock that forms the Sawtooth and Bartlett Mountains commonly weathers into large boulders that perch precariously on slopes, posing a rockfall hazard to areas adjacent to and below these slopes. Rockfalls can occur suddenly and without warning, but are more likely to occur in response to earthquake-induced ground shaking, during periods of intense rainfall, or as a result of man’s activities, such as grading and blasting.

NOTES:

This map is intended for general land use planning only. Information on this map is not sufficient to serve as a substitute for detailed geologic investigations of individual sites, nor does it satisfy the evaluation requirements set forth in geologic hazard regulations.

Earth Consultants International (ECI) makes no representations or warranties regarding the accuracy of the data from which these maps were derived. ECI shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to any claim by any user or third party on account of, or arising from, the use of this map.



Slope Distribution Map

Yucca Valley, California

Explanation

Slope (in % grade)

- 0 to 10
- 10 to 20
- 2 0 to 30
- 30 to 40
- 40 to 50
- 50 to 60
- 60 and greater

Town of Yucca Valley Boundary

N
W E
S

0 7000 14000 Feet

0 2000 4000 Meters

Scale: 1:84,000

Base Map: USGS Topographic Map from Sure!MAPS RASTER (1997) and Town of Yucca Valley.
Source: Derived from USGS 30m Digital Elevation Model.

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2012

Plate 2-3

2.4.1.2 Susceptibility to Slope Failure

Developments that encroach upon the edges of natural slopes may be impacted by slope failures. Even if a slope failure does not reach the adjacent property, the visual impact will generally cause alarm to homeowners. The natural hillsides in Yucca Valley are vulnerable to the types of slope instability mentioned above, mostly in the form of surficial failures and rockfalls. Table 2-1 below summarizes the geologic conditions in the parts of Yucca Valley that provide the environment for slope instability to occur. These conditions usually include such factors as terrain steepness, rock or soil type, condition of the rock (such as degree of fracturing and weathering), and internal structures within the rock (such as joints and foliation). Catalysts that ultimately allow slope failures to occur in vulnerable terrain are most often water (intense and/or prolonged rainfall), erosion and undercutting by streams, man-made alterations to the slope, and seismic shaking. For additional information on rockfall and seismic shaking see Chapter 1 – Seismic Hazards.

Table 2-1: General Slope Instability Potential within Yucca Valley

Location	Existing Geologic Conditions	Types of Potential Slope Instability
Sawtooth and Bartlett Mountains	Moderate to steep natural slopes, many in excess of 26 degrees (50% slope gradient). Fractured and faulted bedrock; soils and loose debris at the toes of slopes and in drainage courses. Locally, small to large boulders perched on slopes.	***Most Probable:*** Rockfalls and rockslides, falling boulders, soil slips, slumping of over-steepened stream banks; small to large debris flows in canyons; sedimentation at the mouths of canyons and downstream. ***Least Probable:*** Large, deep-seated landslides.
Little San Bernardino Mountains	Moderate to steep natural slopes, many in excess of 26 degrees (50% slope gradient). Fractured and faulted bedrock; soils and loose debris at the toes of slopes and in drainage courses. Foliation dipping steeply to the northwest.	***Most Probable:*** Rockfalls and rockslides, soil slips, slumping of over-steepened stream banks; small to large debris flows in canyons; sedimentation at the mouths of canyons, and downstream. ***Least Probable:*** Large, deep-seated landslides.
Burnt Mountain	Moderate to steep slopes. Although the sediments forming these hills are generally granular with massive to crude bedding, there is a localized potential for slope failure if natural slopes are over-steepened by erosion or grading operations.	***Most Probable:*** Slumps on over-steepened slopes; soil slips, small debris flows, sedimentation at the mouth of canyons. ***Least Probable***: Large, deep-seated landslides.

2.4.1.3 Mitigation of Slope Instability in Future Development

Careful land management in hillside areas can reduce the risk of economic and social losses from slope failures. This generally includes land use zoning and ordinances to restrict development in unstable areas and to preserve ridgelines, scenic vistas and unique outcrops; and grading codes for earthwork construction that include requirements for

geologic and soil engineering investigation and review, evaluation of the local drainage patterns, and where warranted, placement of engineered drainage structures. Other important factors in the mitigation of slope instability include risk assessments (which may include landslide susceptibility maps), a concerned local government, and an educated public.

Geotechnical studies should analyze any slopes that may impact the future use of a property, as well as any impact to adjacent properties. This includes existing slopes that are to remain natural, and any proposed graded slopes. The investigation may include borings to collect geologic data and soil samples, laboratory testing to determine soil strength parameters, and engineering calculations. Numerous soil-engineering methods are available for stabilizing slopes that pose a threat to development. These methods include designed buttresses (replacing the weak portion of the slope with engineered fill); reducing the height of the slope; designing the slope at a flatter gradient; and adding reinforcements such as soil cement or layers of geogrid (a tough, polymeric net-like material that is placed between the horizontal layers of fill). Most slope stabilization methods include a subdrain system to prevent excessive ground water (typically landscape water) from building up within the slope area. If it is not feasible to mitigate the slope stability hazard, building setbacks are typically imposed.

Yucca Valley has adopted the 2010 California Building Code, along with certain amendments for erosion control and the requirements for geotechnical reports. As the Town develops its own hillside ordinances, policies, and development codes, some suggested items for inclusion are:

- Develop standards and guidelines for design and construction in hillside areas based on slope steepness.
- Utilize steeper hillside areas for open space or rural, low-density development.
- Allow higher density development on the lower hillside slopes.
- Protect and preserve as much as possible existing landforms, drainage patterns, natural ridgelines and rock outcroppings, scenic vistas, and native vegetation.
- Discourage mass grading, terracing and unnatural contours.
- Encourage variety in design.
- Provide safe traffic circulation in hillside areas.
- Mitigate slope instability, erosion, and sedimentation by requiring soils reports, and where necessary, engineered drainage facilities.
- Set forth parameters for design that will retain the natural beauty of the area while protecting residents and property from slope failures and wildfires.

Temporary slope stability is also a concern, especially where earthwork construction is taking place next to existing improvements. Temporary slopes are those made for slope stabilization backcuts, fill keys, alluvial removals, retaining walls, and underground utility lines. The risk of slope failure is higher in temporary slopes because they are generally cut at a much steeper gradient. In general, temporary slopes should not be cut steeper than 1:1 (horizontal:vertical), and depending on actual field conditions, flatter gradients or shoring may be necessary. The potential for slope failure can also be reduced by cutting

and filling large excavations in segments, and not leaving temporary excavations open for long periods of time. The stability of large temporary slopes should be geotechnically analyzed prior to construction, and mitigation measures provided as needed.

For debris flows, assessment of this hazard for individual sites should focus on structures located or planned in vulnerable positions. This generally includes canyon areas; at the toes of steep, natural slopes; and at the mouth of small to large drainage channels. Mitigation of soil slips and debris flows is usually directed at containment (debris basins), or diversion (impact walls, deflection walls, diversion channels, and debris fences). A system of baffles may be added upstream to slow the velocity of a potential debris flow. Other methods include removal of the source material, placing subdrains in the source area to prevent pore water pressure buildup, or avoidance by restricting buildings to areas outside of the potential debris flow path.

There are numerous methods for mitigating rockfalls. Choosing the best method depends on the geological conditions (i.e., slope height, steepness, fracture spacing, bedding orientation), safety, type and cost of construction repair, and aesthetics. A commonly used method is to re-grade the slope, however this may go against the Town's desire to protect natural outcroppings. Possible alternatives could include locally trimming hazardous overhangs. Another group of methods focuses on holding the fractured rock in place by draping the slope with wire mesh, or by installing tensioned rock bolts, tie-back walls, or even retaining walls. A third type of mitigation includes catchment devices at the toe of the slope, such as ditches, walls, or combinations of both. Designing the width of the catchment structure requires analysis of how the rock will fall. For instance, the slope gradient and roughness of the slope determines if rocks will fall, bounce, or roll to the bottom (Wyllie and Norrish, 1996).

2.4.1.4 Mitigation of Slope Instability in Existing Development

There are a number of options for the management of potential slope instability where development has already taken place. Implementation of these options should reduce the hazard to an acceptable level, including reducing or eliminating the potential for loss of life or injury, and reducing economic loss to tolerable levels. Mitigation measures may include:

- Protecting existing development and population where appropriate by physical controls such as improved drainage, slope-geometry modification, protective barriers, and retaining structures;
- Posting warning signs in areas of potential slope instability;
- Encouraging homeowners to install landscaping consisting primarily of drought-resistant, preferably native vegetation that helps stabilize the hillsides;
- Incorporating recommendations for potential slope instability into geologic and soil engineering reports for building additions and new grading; and
- Providing public education on slope stability, including the importance of maintaining drainage devices and avoiding heavy irrigation. U.S. Geological Survey Fact Sheet FS-071-00 (May, 2000) and California Geological Survey Note

33 (March, 2004) provide public information on landslide and mudslide hazards. Both of these are available on the World Wide Web.

2.4.2 Compressible Soils

Compressible soils are typically geologically young, unconsolidated sediments of low density that may compress under the weight of proposed fill embankments and structures. The settlement potential and the rate of settlement in these sediments can vary greatly, depending on the soil characteristics (texture and grain size), natural moisture and density, thickness of the compressible layer(s), the weight of the proposed load, the rate at which the load is applied, and drainage.

In Yucca Valley, compressible soils are most likely to occur where young Holocene-age deposits are present. This would generally include the modern and prehistoric floodplains of Yucca Wash and other major drainages. Compressible soils are also commonly found in hillside areas, typically in canyon bottoms, swales, and at the base of natural slopes. Although the older alluvium in the Yucca Valley area is relatively dense, the upper few feet, which are commonly weathered and/or disturbed, are typically compressible. Deep fill embankments, generally those more than about 60 feet deep, will also compress under their own weight.

When development is planned within areas that contain potentially compressible soils, a geotechnical soil analysis is required to identify the presence of this hazard. The analysis should consider the characteristics of the soil column in that specific area, and also the load of any proposed fills and structures that are planned, the type of structure (i.e., a road, pipeline, or building), and the local groundwater conditions. Removal and recompaction of the near-surface soils is generally the minimum that is required. Deeper removals may be needed for heavier loads, or for structures that are sensitive to minor settlement. Based on the location-specific data and analyses, partial removal and recompaction of the compressible soils is sometimes performed, followed by settlement monitoring for a number of months after additional fill has been placed, but before buildings or infrastructure are constructed. In cases where it is not feasible to remove the compressible soils, buildings can be supported on specially engineered foundations that may include caissons or piles.

2.4.3 Collapsible Soils

Hydroconsolidation or soil collapse typically occurs in Holocene-age soils that were deposited in an arid or semi-arid environment. Soils prone to collapse are commonly associated with wind-deposited sands and silts, and alluvial fan or debris flow sediments deposited during flash floods. These soils are typically dry and contain minute pores and voids. The soil particles may be partially supported by clay, silt or carbonate bonds. When saturated, collapsible soils undergo a rearrangement of their grains and a loss of cementation, resulting in substantial and rapid settlement under relatively light loads. An increase in surface water infiltration, such as from irrigation, or a rise in the groundwater table, combined with the weight of a building or structure, can initiate rapid settlement and cause foundations and walls to crack. Typically, differential settlement of structures occurs when landscaping is heavily irrigated in close proximity to the structure's foundation.

The young alluvial sediments in the Yucca Valley area may be locally susceptible to this hazard due to their low density, granular nature, rapid deposition in the alluvial fan environment, and the generally dry condition of the near-surface soils.

The potential for soils to collapse should be evaluated on a site-specific basis as part of the geotechnical studies for development. If the soils are determined to be collapsible, the hazard can be mitigated by several different measures or combination of measures, including excavation and recompaction, or pre-saturation and pre-loading of the susceptible soils in place to induce collapse prior to construction. After construction, infiltration of water into the subsurface soils should be minimized by proper surface drainage design, which directs excess runoff to catch basins and storm drains.

2.4.4 Expansive Soils

Fine-grained soils, such as silts and clays, may contain variable amounts of expansive clay minerals. These minerals can undergo significant volumetric changes as a result of changes in moisture content. The upward pressures induced by the swelling of expansive soils can have significant harmful effects upon structures and other surface improvements.

The valley is underlain by alluvial sediments that are composed predominantly of granular materials (silty sand, sand, and gravel). Such units typically have a low expansion potential, although pockets of fine-grained expansive soils are present within these units. Silt and clay beds within the older alluvium, although not prevalent, are potentially expansive. Argillic (secondary clay from weathering) soil profiles that have developed on the older fan deposits probably fall in the moderately expansive range. The rock units in Yucca Valley are generally not expansive, except where they have been chemically altered (by natural processes), are very weathered, or contain clayey sheared zones. In some cases, engineered fills may be expansive and cause damage to improvements if such soils are incorporated into the fill near the finished surface.

The best defense against this hazard in new developments is to avoid placing expansive soils near the surface. If this is unavoidable, building areas with expansive soils are typically "pre-saturated" to a moisture content and depth specified by the geotechnical engineer, thereby "pre-swelling" the soil prior to constructing the structural foundation or hardscape. This method is often used in conjunction with stronger foundations that can resist small ground movements without cracking. Good surface drainage control is essential for all types of improvements, both new and old. Property owners should be educated about the importance of maintaining relatively constant moisture levels in their landscaping. Excessive watering, or alternating wetting and drying, can result in distress to improvements and structures.

2.4.5 Corrosive Soils

Corrosive soils can, over time, cause extensive damage to buried metallic objects, commonly impacting such things as buried pipelines (such as water mains), and even affecting steel elements within foundations. The electrochemical and bacteriological processes that take place between the soil and the buried structure are complex and depend on a number of factors involving the structure type and certain soil characteristics. For instance, the type, grade, length, and size of the piping, as well as the materials used in

pipe connections, can determine which electrochemical reactions will take place in differing soils. For soils, the most common factor used in identifying the potential for corrosion is electrical resistivity. Soils with low resistivity are especially susceptible to corrosion reactions. Other soil characteristics that increase the risk of corrosion to metals are low pH (acidic soils), wet soils, high chloride levels, low oxygen levels, and the presence of certain bacteria.

Soils with high concentrations of soluble sulfates are not directly corrosive to metals, however the presence of sulfate-reducing bacteria in the soil may cause sulfates to convert to sulfides, which are compounds that do increase the risk for corrosion. If the concentration of soluble sulfates is high enough, the soil will be corrosive to concrete.

Corrosion testing is an important part of geotechnical investigations. Onsite soils, as well as any imported soils, are typically tested in the laboratory for resistivity, pH, chloride, and sulfates. For treatment of high sulfate content, special cement mixes and specified water contents are typically used for concrete that will be in contact with the soil. For corrosion of metals, there are a number of procedures used to protect the structure, including cathodic protection, coatings such as paint or tar, or wrapping with protective materials. As mentioned above, the corrosion processes are complex; consequently, the site-specific recommendations must be provided by an engineer who is a corrosion specialist.

2.4.6 Land Subsidence due to Groundwater Withdrawal

Land subsidence is the gradual settling or sinking of the ground surface with little or no horizontal movement. Most ground subsidence is man-induced. In the areas of southern California where subsidence has been reported (such as the Coachella Valley and the Mojave Desert), this phenomenon is usually associated with the extraction of groundwater from below the surface in sediment-filled valleys and floodplains. Land subsidence can also occur during a moderate to major earthquake in the region (see Chapter 1 – Seismic Hazards).

Ground-surface effects related to regional subsidence can include earth fissures, sinkholes or depressions, and disruption of surface drainage. Damage is generally restricted to structures sensitive to slight changes in elevations, such as canals, levees, underground pipelines, and drainage courses; however, significant subsidence can result in damage to wells, buildings, roads, railroads, and other improvements. Subsidence due to the overdraft of groundwater supplies can also result in the permanent loss of aquifer storage capacity (Sneed and others, 2003).

In the Mojave region, groundwater occurs in sediment-filled basins that are floored by crystalline rock, and bounded by faults or various types of impervious rock – all of which act as barriers to groundwater movement. For the most part, natural groundwater replenishment (recharge) in the aquifers occurs by infiltration of stormwater runoff that percolates through the alluvial sediments. During the early years of population growth in the high desert, the rate of groundwater extraction exceeded the natural replenishment, resulting in declining water levels and overdraft of the groundwater supply in more densely populated areas, including Yucca Valley. Since then, overdraft has been greatly reduced in many of the affected areas by careful management of local water supplies, including

reducing pumping of local wells, importing water, and the use of artificial recharge (Johnson, 1998; Stewart and others, 1998, California Regional Water Quality Control Board, 2010).

Because surface water is scarce, Yucca Valley, like many other high desert communities, relied entirely on groundwater from the underlying aquifers for their domestic supply since the early 1900s to the mid 1990s. The main sources of Yucca Valley's water supply are wells in the northern part of the Warren Valley Groundwater Basin. This basin underlies the Town's alluvial area south of the Pinto Mountain fault zone. The Warren Valley Basin was in a state of overdraft for many years, with water levels in some areas dropping as much as 300 feet between 1940 and 1994. This condition led a to court ruling in 1977 to establish groundwater extraction rights. Since 1995, recharge sites (percolation ponds) located in the Yucca Valley region receive water from the California Aqueduct via the Morongo Basin Pipeline, and water levels in the Warren Valley Basin have recovered significantly. Further, excess imported water can be "banked" in the local aquifer during wet years, thereby increasing the reserves for dry years when local and State Water Project supplies may be limited. A significant amount of recharge to the Warren Valley Basin is also supplied by irrigation and septic system return flows that percolate back into the ground (Kennedy/Jenks, 2011).

Groundwater is distributed to the community by the Hi-Desert Water District (HDWD). The HDWD service area includes Yucca Valley and the unincorporated area to the north called Yucca Mesa. The District currently has thirteen active production wells, 16 storage tanks, about 12.66 million gallons of tank storage capacity, and nearly 300 miles of distribution pipelines, serving a population of about 24,000. All but one of their wells are located in the Warren Valley Basin. In addition to the District wells, there are currently two commercial businesses extracting water from the Basin and 16 individual minimal producers (HDWD, 2012). The HDWD also owns and operates the area's three recharge ponds.

2.4.6.1 Subsidence in Yucca Valley

Recognizing the potential for declining water levels to induce or renew land subsidence, the United States Geological Survey (USGS), in cooperation with the Mojave Water Agency (MWA), has been conducting geologic and hydrologic studies in portions of the high desert region, including the detection and measurement of subsidence (Sneed and others, 2003; Stamos and others, 2009). Four locations within their study area showed minor subsidence during the study period of 1992–1999, although the subsidence could not be tied definitively to groundwater levels, due to insufficient groundwater data. However, during the time that measurements were recorded, groundwater levels in these areas were at or below historically low levels. In 2009 the USGS reported that ground deformation, mostly subsidence, occurred in the same four areas for time intervals between 1999 and 2000, and between 2003 and 2004. The USGS continues to monitor these areas, but has not yet published their latest results. The closest of the known subsidence areas to Yucca Valley is Lucerne Valley, approximately 35 miles to the northwest.

To date, subsidence has not been reported in Yucca Valley. However, the thick alluvial deposits comprising these aquifers may be susceptible to compaction (with resulting

subsidence at the surface) should rapid groundwater withdrawal occur beneath the area in response to the water needs of the Town's growing population.

2.4.6.2 Prevention of Subsidence

Prevention of ground subsidence, while insuring a low-cost, sustainable supply of quality water for the future, requires a comprehensive approach to groundwater conservation and recharge. To that end, the following elements will promote, either directly or indirectly, the prevention of ground subsidence:

- Continue to increase the understanding of the geology, hydrology, and hydraulic control within and between the local groundwater basins. To help achieve that end, the Mojave Water Agency has developed a searchable digital database of maps, publications, reports, and updated information about their current research regarding the geology and hydrology of the high desert area (http://ca.water.usgs.gov/mojave/).
- Determine the safe yields of groundwater basins so that available supplies can be balanced with extraction.
- Increase natural recharge by developing spreading basins to capture and percolate stormwater runoff. In rural areas, individual property owners should be encouraged to collect stormwater in rain barrels or cisterns.
- Water recycling. At the current time, the HDWD does not recycle water. At a minimum, the Town should consider requiring developers of new or redeveloped commercial and multi-unit projects to install dual water systems in order to accommodate future recycling should it become available.
- Continue to monitor the groundwater levels in both HDWD wells and available private wells.
- Monitor ground elevations in areas where groundwater levels are decreasing.
- Minimize adverse land use effects on the supply and quality of the local groundwater. For example, there is currently no community-wide sewage treatment and disposal system in Yucca Valley. Wastewater is discharged to individual septic tanks and leaching systems. This is thought to contribute to high concentrations of nitrate locally in groundwater wells of the Warren Valley Basin (Nishikawa and others, 2003). As a consequence, the California Regional Water Quality Control Board - Colorado River Basin Region, has recommended a septic prohibition for parts of Yucca Valley (2010) and adopted the prohibition in the form of an amendment to the Basin Plan for the Colorado River Basin Region (2011). The HDWD has developed a plan for a centralized sewer collection and wastewater treatment facility. Treated water would be returned to Warren Valley Basin aquifer. See Chapter 5 – Hazardous Materials Management for further information on this plan.
- Continue to encourage water conservation and protection of water quality through public education and water conservation programs.
- Many of these basin management objectives, as well as others, are outlined in the HDWD 2010 Urban Water Management Plan (Kennedy/Jenks, 2011).

The HDWD has already implemented several water saving programs, including discouraging the wasteful use of water, and providing public information on water conservation, desert landscaping, and resource management. Information on these programs is available on the HDWD website at http://www.hdwd.com/Education.

According to the HDWD's 2010 Urban Water Management Plan (Kennedy/Jenks, 2011), the District currently has water supply capabilities to meet daily demands as well as future demands into the year 2035, even for multi-dry years. This supply includes local groundwater, future imported water allotments, and imported groundwater currently banked in the Warren Valley Basin aquifer. In addition, the HDWD has contingency plans for long-term and short-term shortages, and catastrophic interruption in services due to regional power outages or earthquakes, for example.

Consequently, for the entire Yucca Valley region, meeting future demands will require aggressive water management, the development of wastewater treatment where groundwater is impaired, the continued development of new water sources, continuing public education, the widespread use of native desert plants in landscaping, and the implementation and enforcement of stringent water conservation measures.

2.4.7 Erosion and Sedimentation

Erosion and sedimentation are influenced by several factors, including topography, rock and soil types, climate, and vegetation. The topographic relief between the desert and the adjacent mountains makes erosion and sedimentation an important issue for communities built on alluvial fans and within hillside areas. The fractured and weathered condition of the bedrock forming the mountains, combined with rapid geologic uplift leads to high erosion rates. Further, erosion can increase significantly when mountain slopes are denuded by wildfires.

Sediments forming the alluvial fans in Yucca Valley are typically dry, loose, and sandy, resulting in a high susceptibility to erosion, particularly of the youngest, unconsolidated materials. Flooding due to infrequent but violent thunderstorms can result in severe erosion, especially if flows are concentrated. Thunderstorms that follow a season of mountain wildfires can transport great volumes of sediment onto the low-lying areas below.

The natural erosion processes mentioned above are often accelerated through man's activities – whether they are for agricultural or land development uses. Development often increases the potential for erosion and sedimentation by removing protective vegetation, altering natural drainage patterns, and constructing cut and fill slopes that may be more susceptible to erosion than the original, natural slope conditions. Developments also reduce the surface area available for infiltration, leading to increased runoff and erosion downstream of the project.

Because man-made flood control structures are scarce, and most runoff travels throughout the Town in natural washes and gullies or by sheet flow, erosion is a significant hazard in Yucca Valley. New developments should not be placed where they obstruct natural flows, or direct flows to neighboring properties. Homes on natural slopes should not be

permitted at the head of steep drainage channels or gullies without protective measures against headward erosion of the gully. Buildings placed near the base of slopes and/or near the mouths of small canyons, swales, washes, and gullies will need protection from sedimentation. Developments in the valley that are adjacent to natural drainage channels should be adequately set back from eroding channel banks. Alternatively, modification of the channel to reduce erosion should be included in the project design.

Mitigation of erosion and sedimentation typically includes structures to slow down stream velocity, such as check dams and drop structures, energy dissipaters at the point of discharge, devices to collect and channel the flow, catchment basins, and berms. Interceptor ditches, swales, and slope down-drains are commonly lined with asphalt or concrete, however ditches can also be lined with gravel, rock, or decorative stone. Elevating structures above the surrounding area is another mitigation measure used often. Homes can be constructed on short piles or columns, such that the home is elevated a foot or two above the ground. Along with the minimal alteration of the land's natural contours, this not only protects the home from flooding and sedimentation, but also allows natural drainage patterns to continue largely uninterrupted.

There are many options for protecting manufactured slopes from erosion, such as terracing slopes to minimize the velocity attained by runoff, the addition of berms and v-ditches, and installing adequate storm drainage structures. Other measures include establishing protective vegetation, and placing mulches, rock facings (either cemented on non-cemented), gabions (rock-filled galvanized wire cages), or building blocks with open spaces for plantings on the slope face. All slopes within developed areas should be protected from concentrated water flowing over the tops of the slopes by the use of berms or walls. All hillside building pads should be engineered to prevent water from flowing over the tops of slopes.

Temporary erosion control measures must be provided during the construction phase of a development, as required by local building codes and ordinances, as well as State and Federal stormwater pollution regulations (see Chapter 5). In addition, permanent erosion control and clean water runoff measures are required for new developments. These measures might include desilting basins, percolation areas to cleanse runoff from the development, proper care of drainage control devices, appropriate irrigation practices, rodent control, temporary and permanent plantings, and mulching. Erosion control devices should be field-checked following periods of heavy rainfall to assure they are performing as designed and have not become blocked by debris.

2.5 Summary of Issues

The Yucca Valley area is highly diverse geologically. This diversity is strongly related to the youthful (in geologic terms) seismic setting of the surrounding region, which includes the ongoing uplift of the surrounding mountains – a result of tectonic movement along the Pinto Mountain fault and other major fault zones. This, along with the local climate, geology, and hydrology, has resulted in a landscape that is complex in geologic processes. These elements combine in various ways to create geologic hazards, as well as benefits to the community. Hazards that have the greatest impact on the Yucca Valley are summarized below.

Most of Yucca Valley's existing development is situated on the broad valley floor, with scattered residential development in the surrounding hillsides. As Yucca Valley's population grows in the next decades, new development will be needed to meet the demand for homes. When meeting this demand, it is imperative to manage land uses in a responsible way, as development disrupts natural processes, often leading to negative impacts on the environment as well as on the development and adjacent properties. The impacts of land development can be minimized, however, if both site-specific and regional planning elements are recognized and considered, the project incorporates knowledge gained from scientific research in developing and implementing a design appropriate to the area, and protective measures are constructed and maintained for the lifetime of the project.

Slope instability is a potential hazard where development has encroached onto the hills and mountains. The rock types forming the local mountains are generally resistant to deep-seated landsliding, so future slope failures are more likely to consist of surficial soil failures and the erosion of sandy geologic materials. Such failures typically occur during exceptional and/or prolonged rainfall, and may manifest as mud or debris flows. Large debris flows may impact properties in the valley downslope, sometimes at considerable distance from the source. Rockfall is a hazard in and near the base of the Sawtooth and Bartlett Mountains, in areas where the bedrock forms bouldery outcrops. Rockfall is more likely to occur as a result of earthquake-induced ground shaking, posing a threat to structures and passing motorists.

Potentially compressible and/or collapsible soils underlie a significant part of Yucca Valley, typically where geologically sediments have been deposited, such as active or recently active alluvial fans, floodplains, washes, and canyon bottoms. These sediments generally have low density and variable amounts of organic materials. Under the added weight of fill embankments or buildings, these sediments can settle, causing distress to improvements.

Although not prevalent, some of the geologic units in Yucca Valley may have fine-grained components that are likely to be expansive. These materials may be present at the surface or may be exposed by grading activities. Man-made fills can also be expansive, depending on the soils used to construct them.

Sediments in the valley areas may be corrosive to metallic objects, such as pipelines, that are in contact with the soil. All foundation soils and soils used to bury metal pipelines should be tested for corrosion potential; if and where necessary, mitigation measures developed by a corrosion engineer should be implemented during the construction of these works.

Regional ground subsidence from groundwater withdrawal is a potential hazard that can proactively be prevented by aggressive water management, the reuse of treated wastewater, the continued development of new water sources, continuing public education, the widespread use of drought-tolerant plants in landscaping, and the implementation and enforcement of stringent water conservation measures, especially during droughts. The Town should also consider requiring new subdivisions or commercial developments to install the infrastructure for water recycling, so that these sites can be connected to recycled water mains as they become available. With the expected increase in population, water shortage is one of the most serious challenges ahead.

Overdraft of the aquifers underlying Yucca Valley could result in ground subsidence, with resultant negative impact on the area's environmental quality.

Because of the topographic relief in and around Yucca Valley, erosion and sedimentation are inherently significant elements of the natural setting. Land development can have adverse impacts on these elements by altering the natural processes, topography, and protective vegetation, in addition to reducing the area of natural infiltration. This in turn can lead to damage from increased flooding, erosion, and sedimentation in other areas, typically downstream. Erosion and sedimentation are also important considerations on a site-specific basis, with respect to developments adjacent to slopes and drainage channels. These issues are not only critical during the design of a project, but also during construction and during the long-term maintenance of the developed site.

Losses resulting from geologic hazards are generally not covered by insurance policies, causing additional hardship on property owners. The potential for damage can be greatly reduced by:

- Strict adherence to grading ordinances – many of which have been developed as a result of past disasters;
- Sound land planning and project design that avoids severely hazardous areas;
- Detailed, site-specific geotechnical investigations, followed by geotechnical oversight during grading and during construction of foundations and underground infrastructure;
- Effective geotechnical and design review of projects performed by qualified, California-registered engineering geologists, soil engineers, and design engineers; and
- Public education that focuses on reducing losses from geologic hazards, including the importance of proper irrigation and landscaping practices, in addition to the care and maintenance of slopes and drainage devices.

CHAPTER 3: FLOOD HAZARDS

Floods are natural and recurring events that only become hazardous when man encroaches onto alluvial fans and floodplains, modifying the landscape and building structures in the areas meant to convey excess water during floods. Unfortunately, these areas have been alluring to populations for millennia, since they provide level to gently sloping terrain, have fertile soils suitable for agriculture, and have access to water supplies and transportation routes. Notwithstanding, these benefits come with a price – flooding is one of the most destructive natural hazards in the world, responsible for more deaths per year than any other natural hazard. Furthermore, average annual flood losses (in dollars) have increased steadily over the last decades as development in flood-prone areas has expanded.

Yucca Valley and the surrounding areas are, like most of southern California, subject to unpredictable seasonal rainfall. Most years, the scant winter rains are barely sufficient to turn the hills green for a few weeks, but every few years the region is subjected to periods of intense and sustained precipitation that results in flooding. Historic flood events in southern California have resulted in an increased awareness of the potential for public and private losses as a result of this hazard, particularly in urbanized parts of floodplains and alluvial fans. As the population in the area increases, there is increased pressure to build on flood-prone areas, and in areas upstream of previously developed land. With increased development also comes an increase in impervious surfaces, such as concrete and asphalt. Water that used to be absorbed into the ground becomes runoff to downstream areas. New construction can also block or divert natural flow patterns, causing flooding and erosion to areas that have not flooded in the past. This is especially true for developments near the base of the mountains and downstream from canyons that have the potential to convey mudflows.

3.1 Storm Flooding

3.1.1 Hydrologic and Geomorphic Setting

The Town of Yucca Valley is located at the western edge of the Mojave Desert, an arid region with hot summers, cool winters, and infrequent, but potentially violent rainstorms. The southern part of the Town consists largely of a gently sloping alluvial plain shaped by a combination of sediments deposited by floodwaters emerging from canyons in the nearby mountains, and by past flooding of the valley's main drainage course, the Yucca Wash. North of Yucca Wash, the rugged, rocky, Sawtooth Mountains divide the southern valley from volcanic hills and sparsely populated alluvial fans in the northernmost part of the Town. The Little San Bernardino Mountains frame the Town on the south, where they exert tremendous influence on the local climate, and ultimately, on the flood hazard in Yucca Valley.

Yucca Valley has no perennial rivers or streams. When a storm arrives, the normally dry rocky canyons of the adjacent hills and mountains disperse runoff into broad desert washes or onto alluvial fans and plains – all of which are laced with a complex and dynamic drainage network that ultimately terminates in desert playas several miles to the east and northeast of the Town. Drainage channels in the local mountains are well incised; however, they lose their strong definition upon reaching the alluvial plain, where sediment-laden water is carried in shallow washes and by sheet flow. Drainage channels

that are dry most of the year can quickly become dangerous torrents of water, sand, mud and rocks, capable of transporting boulders, trees, and even cars.

The valley in the southern part of the Town receives runoff from small to very large canyons in the Little San Bernardino Mountains. These canyons disperse floodwaters into numerous washes crossing the valley, including Covington Wash, East and West Burnt Mountain Creeks, Long Canyon, and Hospital Canyon, as well as smaller unnamed drainages – all having the potential to carry flash floods into the most densely populated parts of the Town. Several large drainages emerge from the southern flank of the Sawtooths as well, including Pinon Creek and Water Canyon. Runoff from mountains to the north and south of the valley is collected in the east-flowing Yucca Wash, the main drainage channel. North of the Sawtooths, stream channels also flow eastward, either passing through the gap between the Sawtooth and Bartlett Mountains to Yucca Wash, or continuing eastward north of the Bartlett Mountains.

Floods on alluvial fans have characteristics that are significantly different from those caused by river flooding. Although typically shallow in depth, flows can strike with little warning, travel at very high speeds, and carry tremendous amounts of sediment and debris. The Federal Emergency Management Agency (FEMA) defines an active alluvial fan flood hazard based on three related criteria: 1) unpredictable flow paths; 2) abrupt deposition and erosion; and 3) an environment where the combination of sediment availability, slope, and topography creates an ultra-hazardous condition. The active portions of the fan generally have shallow, braided stream channels, and sparse vegetation. FEMA also defines an inactive alluvial fan surface as one that has relatively stable flow paths and a low level of sedimentation/erosion such that it does not cause instability in the established flow paths. Inactive surfaces usually have some soil development as well as incised, typically single-strand channels that behave more like rivers during floods. At their downstream margins, fans merge with the flatter topography of the valley floor.

Alluvial fans, including those in Yucca Valley, are highly diverse because of variations in geology, vegetation, topography of the source area, climate, tectonism (fault movements), and land uses. A particular fan may show characteristics of both active and inactive processes, especially if it has been modified by man-made structures. Therefore, it is generally not reasonable to assume that the flood risk on a fan surface is uniform. Furthermore, these characteristics make realistic assessments of flood risk and development of reliable mitigation measures particularly challenging.

3.1.2 Weather and Climate

The mountains that frame the Mojave Desert have a powerful effect on the climatic conditions in the high desert region. Capturing precipitation from strong Pacific storms that pass through, the mountains separate the semi-arid environment to the west from the dry, desert regions to the east. Most precipitation in southern California occurs in the winter months, between November and April. However, high-intensity, short-duration tropical thunderstorms arriving from the south can occur during the summer and fall, typically during July through September. Flash flooding associated with these powerful storms frequently results in damage to roadways, power poles, trees, and structures. These storms are highly localized, drenching one area with several inches of rain in a short period of time, while leaving nearby areas completely dry. Mountain thunderstorms can inundate

the adjacent desert areas with floodwaters, mud, rock and debris, even if no rain actually falls on the desert.

Not only does rainfall vary from one location to the next, often within short distances, it is also extremely variable from year to year. The average yearly precipitation (often informally referred to as the "normal" amount) in the Yucca Valley area is less than 10 inches, as measured over several decades (see Tables 3-1 and 3-2). The concept of "normal" is deceiving however, as the annual rainfall in a single year can range from almost none to nearly four times the average amount. In fact, in the high desert areas, it is not unusual to receive half the yearly average amount in a single storm, and sometimes within a few hours.

Table 3-1: Average Annual Rainfall* by Month for the Twentynine Palms Weather Station (elevation: 1,975 feet above mean sea level)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Inches	0.5	0.3	0.4	0.1	0.1	0.0	0.6	0.7	0.4	0.3	0.3	0.5	4.3

Data based on 55 complete years between 1935 and 1995.
Source: http://www.worldclimate.com/
*Average rainfall = Mean monthly precipitation, including rain, snow, hail, etc.

Table 3-2: Average Annual Rainfall* by Month for the Morongo Valley Weather Station (elevation: 2,562 feet above mean sea level)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Inches	2.1	1.1	1.1	0.5	0.1	0.0	0.4	0.3	0.3	0.2	1.1	1.7	9.0

Data based on 26 complete years between 1942 and 1972.
Source: http://www.worldclimate.com/
*Average rainfall = Mean monthly precipitation, including rain, snow, hail, etc.

Most flood damage is from winter storms, but it is often a consequence of flash flooding from intense summer thunderstorms as well, as described below. The hazards associated with these storms, other than flooding, which is covered in this section, are discussed in more detail in Chapter 6.

Winter storms are characterized by heavy and sometimes prolonged precipitation over a large area. These storms usually occur between November and April, and are responsible for most of the precipitation recorded in southern California. The storms originate over the Pacific Ocean and move eastward (and inland). Mountain ranges, such as the San Bernardino Mountains, form a rain shadow, slowing down or stopping the eastward movement of this moisture. A significant portion of the moisture is dropped on the mountains as snow. If large storms are coupled with snowmelt from these mountains, large peak discharges can be expected in the main watersheds at the base of the mountains.

Some of the severe winter storm seasons that have historically impacted southern California have been related to El Niño events. El Niño is the name given to a

phenomenon that originates every few years, typically in December or early January, in the southern Pacific Ocean, off the western coast of South America, but whose impacts are felt worldwide. Warmer than usual water in the southern Pacific is statistically linked with increased rainfall in both the southeastern and southwestern United States (including the desert areas), droughts in Australia, western Africa and Indonesia, a reduced number of hurricanes in the Atlantic Ocean, and an increased number of hurricanes in the Eastern Pacific. Two of the largest and most intense El Niño events on record occurred during the 1982-83 and 1997-98 water years. [A water year is the 12-month period from October 1 through September 30 of the following year. Often a water year is identified only by the calendar year in which it ends, rather than by giving both years, as above.] In recent history, these are two of the worst storm seasons in southern California.

More recently, the severe storms of December 2004 and January 2005 have been blamed on a different climatic condition, one where the sub-tropical jet stream carries moisture-laden air directly from the tropics to the west coast of California. Because it passes over the Hawaiian Islands, it is commonly referred to as the "Pineapple Express." In December 2004, as this condition was developing, the northern jet stream shifted towards the California coast allowing storms from the north to tap into the deep tropical moisture, dramatically increasing the rainfall in southern California (NOAA, 2005a). Powerful winter storms during February 2005, however, have been attributed to a weak but persistent El Niño condition, combined with an atmospheric condition that blocked or slowed the normal eastward movement of the storms (NOAA, 2005b). These events combined to give southern California, including the high desert, record-breaking rainfall in the 2005 water year.

Monsoon storms typically develop in late summer to fall, and are usually most prevalent in the higher mountains and the deserts, but can also move into nearby valleys. They develop when moist, unstable air moves into our area from Mexico through Arizona (Mexican monsoons), from the Sea of Cortez (Gulf Surge), or at times from tropical storms or hurricanes originating off the coast of Baja California. Once the monsoonal moisture enters California and flows up steep mountain slopes, explosive thunderstorms can develop. Although these high-intensity, short-duration storms typically impact relatively small areas, they often release torrential rainfall that causes flash flooding and mudslides. Frequently packing lightning, hail, very strong wind gusts, and even small tornadoes, thunderstorms cause power outages and damage to people and property. Such storms have impacted Yucca Valley and the surrounding area in the past.

During the late 1800s and 1900s (the approximate length of historical records), the overall climate in the Mojave Desert has fluctuated as well. For instance, from about the turn of the 20th century until 1946, the region experienced wetter than usual winters. From 1947 to 1976, there was a drought, and from 1977 to 1998, there was higher-than average rainfall. Between 1999 and 2004, the region saw below-average rainfall, suggesting that another drought period has begun (Brooks and Minnich, 2006). Scientists believe these climatic changes in the desert are ultimately related to changes in ocean-surface water temperatures and atmospheric pressure in the eastern Pacific. Even small changes in climate are important in the desert ecosystem because they ultimately affect sediment yield, frequency of runoff (floods), recharge of shallow aquifers, vegetation density, fire

frequency and intensity, and the landscape's ability to recovery from man-made disturbances (Hereford and Longpre, 2009).

Much research in the last decade has focused on the study of a meteorological phenomenon called the ***Atmospheric River*** (AR). ARs are narrow streams of water vapor transported in the lower atmosphere that are probably responsible for most of the very large storms on the west coast of the United States. Typically packing high wind speeds, ARs are no more than 400 to 500 kilometers wide, but are thousands of kilometers long, sometimes extending across whole ocean basins. When ARs traveling across the Pacific Ocean collide with the mountain ranges in the west coast, the vapor is forced upwards, where it condenses and rains out, leading to significant flooding (Ralph and Dettinger, 2011).

The U.S. Geological Survey's Multi Hazards Demonstration Project (MHDP) has been combining various science disciplines to test and improve the resiliency of communities to natural disasters. By developing a disaster scenario (such as the 2008 ShakeOut Earthquake Scenario discussed in Chapter 1) scientists, engineers, and other experts are engaging emergency planners, first responders, businesses, universities, insurance companies, government agencies and the public in preparing for a major natural disaster. The second major project of the MHDP is a catastrophic winter storm scenario consisting of a hypothetical (but not unrealistic) Pacific storm striking the west coast of California, similar in intensity to the 1861-1862 series of storms that resulted in state-wide flooding that left the central coast impassible, the capital underwater for three months, and the State bankrupt. Named the ***ARkStorm*** (for Atmospheric River 1,000), the impacts of such a storm today are expected to overwhelm the State's flood protection system, which is normally designed to control the 100- to 200-year storm runoff. Property damages and business disruptions from the ARkStorm are estimated to be on the order of $725 billion, nearly three times the loss expected for the hypothetical southern California ShakeOut earthquake (Porter and others, 2011). The USGS report indicates an ARkStorm is not only plausible, but probable, and may not be a worst case. The geological record suggests that six megastorms have occurred in California in the last 1,800 years – all more severe than the 1862 event. The products of the ARkStorm Scenario are intended to be used by emergency planners, policymakers and other to review disaster preparedness, conduct risk assessments and disaster drills, explore ways to adequately fund response and recovery, plan future hazards mapping, and educate the public.

Although ARkStorm flooding in the high desert is predicted to be less severe than in southern California coastal areas, Yucca Valley would be impacted by shallow landsliding in the local hills and mountains. Much of the damage in Yucca Valley would likely be from alluvial fan flooding and debris flows. Additional information on this megastorm scenario can be obtained from http://pubs.usgs.gov/of/2010/1312/.

3.1.3 Past Flooding

Because of the arid climate and dry washes, the casual visitor might be surprised to learn that desert environments such as those in Yucca Valley are the sites of infrequent but catastrophic flooding. Even residents often quickly forget about the flood risk once the streets are cleared of debris and dry weather returns. The flood hazards in Yucca Valley can be classified into two general categories: 1) flash flooding down natural and man-

made channels, and 2) sheet flooding across the alluvial fans, plains, and valleys upon which most of the development in the Town currently lies.

Flash floods are short in duration, but have high peak volumes and high velocities. This type of flooding occurs in response to the local geology and geography, and the built environment (man-made structures). The local mountains are steep, sparsely vegetated, and consist of rock types that are fairly impervious to water. Consequently, little precipitation infiltrates the ground. When a major storm moves in, water collects rapidly and runs off quickly, making a steep, rapid descent from the mountains onto the valley floor. Because of the steep terrain, and the constant shedding of debris from mountain slopes (primarily as dry ravel and rock falls), flood flows often carry large amounts of mud, sand, and rock fragments. Sheet flow occurs when the capacities of the existing channels (either natural or man-made) are exceeded or when channels become blocked, causing water to flow into the adjacent areas.

Historical descriptions suggest the flood of 1862 was probably the largest recorded event in southern California, although very little data on discharge or rainfall rates are available for that year. During the last century, one of the most disastrous southern California storm periods on record occurred during February 27 to March 4, 1938, when a series of strong storms centered over the San Gabriel and San Bernardino Mountains unleashed record-breaking rainfall in areas already saturated by previous storms. Many high desert communities were isolated as roads and bridges were destroyed, and hundreds of people were left homeless (San Bernardino County Flood Control District, 2006). Stream gages on rivers emanating from the mountains, including the Mojave River, logged record discharges, and losses were estimated at more than $78 million (1938 dollars) due to the extensive development that had taken place on the floodplains of major rivers (Troxell, 1942). Prior to 1938, citizens had already developed an awareness of the need for flood control and water conservation, however the 1938 floods made it clear that growing cities in the region did not have adequate flood protection. This led to the formation of new flood control districts in San Bernardino and Riverside counties, as well as other areas of southern California.

In January and February of 1969, a series of closely spaced, intense storms in the mountains again released heavy rainfall on saturated ground. Total precipitation in the San Bernardino Mountains (Lake Arrowhead rain gage) reached more than 80 inches for the two-month period. As a result, storm flows in the Mojave River reached all the way to Soda Lake, causing heavy damage to highways, bridges, and properties. Erosion of stream banks, channels, and flood plains, as well as the deposition of sediment was severe (Waananen, 1969). Many desert areas had flooding up to 2 feet in depth, with resultant damage to homes, streets, and utilities (FEMA, 2008).

Intense rainfall and damaging floods also occurred in January 2005. The western part of the Morongo Basin (Yucca Valley) was the hardest hit, as roadways were washed out or buried by sand and mud, and extensive damage to structures occurred. Communities to the east of Yucca Valley escaped serious damage from the storm, but were temporarily isolated due to access to the west being cut off.

Figure 3-1: Yucca Valley's Dry, Arid Landscape is Deceiving.
Flash floods can rapidly inundate major roadways with water and debris, cutting off access temporarily to residents and emergency personnel.

Southern California's winter storms generally impact a wide area, including parts of the Mojave Desert, and the events described above are some of the most severe winter storms on record. However, significant flood damage in Yucca Valley area occurs during summer thunderstorms that tend to be localized, but of high intensity. Just in the last decade, flood damage from summer storms has resulted in major road closures due to washouts or inundation by rocks, mud, sand, and debris, power outages, uprooted trees, and structure damage from wind and water. The toll on residents includes injuries from traffic accidents, vehicles stranded by or trapped within mud or swift-moving water, and temporary isolation due to road closures. One of the worst incidents occurred during August 2003, when a car was swept into a flooded channel, just east of Yucca Valley, killing two of the occupants and a rescuer. The consequences of flooding are therefore emotional and social, as well as financial and environmental.

3.1.4 National Flood Insurance Program (NFIP)

Because floods are the leading cause of natural disaster losses in the United States, the nation invests significant resources to reduce the risk of flooding. Because floods can be widespread and cause catastrophic losses, insurance companies generally consider flood hazards too costly to insure (National Research Council, 2009). In order to manage the increasing flood losses, the Federal Emergency Management Agency (FEMA) was mandated by the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 to evaluate flood hazards and provide affordable flood insurance to residents in communities that regulate future floodplain development. To that end, FEMA created

Flood Insurance Rate Maps **(FIRMS)** for the purpose of setting flood insurance premiums and for regulating the elevations and flood proofing of structures in mapped flood zones.

The National Flood Insurance Program (NFIP) is required to offer federally subsidized flood insurance to property owners in those communities that adopt and enforce floodplain management ordinances that meet minimum criteria established by FEMA. Floodplain management may include such measures as requirements for zoning, subdivisions, and building construction, as well as special-purpose floodplain ordinances. The National Flood Insurance Reform Act of 1994 further strengthened the NFIP by providing a grant program for State and community flood mitigation projects. The Act also established the ***Community Rating System*** **(CRS)**, a system for crediting communities that implement measures to protect the natural and beneficial functions of their floodplains, and managing their erosion hazard.

The Town of Yucca Valley has participated as a regular member in the NFIP since 1997 (Community ID No. 060750#), and the required floodplain regulations are set forth in Chapter 8.04 of the Yucca Valley Town Code. The Town's most current effective FIRM maps are dated August 2008 (six community panels), however maps and flood elevations are amended periodically to reflect changes in estimated flood zones.

Because Yucca Valley is a participating member of the NFIP, flood insurance is available to any property owner in the General Plan area. In fact, to secure financing to buy, build, or improve structures in a Special Flood Hazard Zone (SFHZ – see definition below), property owners are required to purchase flood insurance. Lending institutions that are federally regulated or federally insured must determine if the structure is located in a SFHZ and must provide written notice requiring flood insurance.

FEMA recommends that most property owners, whether residential or commercial, purchase and keep flood insurance, even if they are not located in a mapped flood hazard zone. Keep in mind that approximately 20 to 25% of all flood claims occur outside of mapped high flood risk areas, and typical homeowner or business insurance policies do not cover flooding. Residents or business owners that rent property can also purchase coverage for the contents of their homes or business inventories. In low to moderate risk areas, property owners should ask their agents if they are eligible for the FEMA Preferred Risk Policy, which provides inexpensive flood insurance protection. Insured property owners can be reimbursed for all covered losses, even if the flood is not officially declared a Federal disaster area. Residents should also be aware that localized flooding could be caused by a temporary situation, such as a storm drain inlet or culvert that becomes blocked by debris during a storm. Hillside areas are generally outside of mapped flood zones, however these areas can be vulnerable to mudslides, which are also covered under flood insurance.

FEMA also recommends that residents do not forgo purchasing insurance, assuming instead Federal disaster assistance will pay for flood damage. In order to receive assistance, a community must first be declared a Federal disaster area, and these declarations are issued in less than 50% of flood events. Remember also that Federal assistance is usually in the form of a loan, which must be repaid with interest. Furthermore, if uninsured property

owners do receive Federal assistance, they must purchase flood insurance to remain eligible for future disaster relief.

3.1.5 FEMA Flood Zone Mapping

Flood risk information presented on FIRMs is based on historic, meteorological, hydrologic, and hydraulic data, as well as topographic surveys, open-space conditions, flood-control works, and existing development. Rainfall-runoff and hydraulic models are utilized by the FIRM program to analyze flood potential, adequacy of flood protective measures, surface-water and groundwater interchange characteristics, and the variable efficiency of mobile (sand bed) flood channels. For riverine flooding, the extent of potential flooding is predicted from statistical analyses and hydrologic models that rely heavily on data from U.S. Geological Survey stream gages and land surface topography.

Some FEMA flood map features that are relevant to the residents of the Yucca Valley area include:

Flood Insurance Study (FIS). To prepare FIRMs that illustrate the extent of flood hazards in a flood-prone community, FEMA conducts engineering studies referred to as Flood Insurance Studies. The Yucca Valley General Plan area is included in the FIS for San Bernardino County, currently updated in August 2008. This document includes community descriptions, flooding sources (including Yucca Wash), information on historical flooding, existing flood protection measures, hydrologic and hydraulic analyses, and definition of potential flood areas.

Special Flood Hazard Area (SFHA). Using information gathered in FIS studies, FEMA engineers and cartographers delineate Special Flood Hazard Areas on FIRMs. SFHAs are those areas subject to a high risk of inundation by a "base flood" which FEMA sets as a 100-year flood. As mentioned above, SFHAs are regulated zones, requiring the mandatory purchase of flood insurance. They are also subject to special standards and regulations that apply to new construction, and in some cases, existing buildings. Floodplain regulations required by the NFIP apply only to properties located in a SHFA. However, these are minimum requirements, and local jurisdictions may regulate areas outside of the SHFAs, based on knowledge specific to their area.

Base Flood. The base flood, also called the 100-year flood, is defined by looking at the long-term average period between floods of a certain size, and identifying the size of the flood that has a one (1) percent chance of occurring during any given year. This base flood has a 26% chance of occurring during a 30-year period, the length of most home mortgages. However, a recurrence interval such as "100 years" represents only the long-term average period between floods of a specific magnitude; rare floods can in fact occur at much shorter intervals or even within the same year.

The base flood is a regulatory standard used by the NFIP as the basis for insurance requirements nationwide. The Flood Disaster Protection Act requires owners of all structures in identified SFHAs to purchase and maintain flood insurance as a condition of receiving Federal or federally related financial assistance, such as mortgage loans from federally insured lending institutions.

The base flood is also used by Federal agencies, as well as most County and State agencies, to administer floodplain management programs. The goals of floodplain management are to reduce losses caused by floods, while preserving and restoring the natural and beneficial value of the floodplain.

Base Flood Elevation (BFE). This is the calculated elevation of the water surface during a base flood event. The BFE is important because it is the regulatory standard used for the elevation or flood proofing of structures. Further, the height of the first floor elevation above the BFE determines the amount of the flood insurance premium. BFEs are shown on FIRMs for those flooding sources that have been analyzed using detailed methods. BFEs on the maps have been rounded to whole-foot elevations and are intended for use in flood insurance rating purposes only. For construction or floodplain management, data in the FIS should be utilized as well.

Floodway. The basis of floodplain management is the concept of the "floodway." FEMA defines this as the channel of a river or other watercourse, and the adjacent land areas that must be kept free of encroachment in order to discharge the base flood without cumulatively increasing the water surface elevation more than a certain height. The intention is not to preclude development, but to assist communities in managing sound development in areas of potential flooding. The community is responsible for prohibiting encroachments into the floodway unless it is demonstrated by detailed hydrologic and hydraulic analyses that the proposed development will not increase the flood levels downstream.

Mapped flood areas outside of the 100-year flood zone. FIRMs in the Yucca Valley area also show the estimated limits of areas with moderate to low risk of flooding. The flood having a 0.2% annual chance of occurring (also called the 500-year flood) is usually the basis for these categories, with moderate risk defined as the zone between the limits of the 100-year and 500-year floods, and low risk defined as the area outside of the 500-year flood limits. These zones may also include areas where the base flood is less than one foot deep, where the drainage basin is small (less than one square mile), or areas that are protected from the base flood by levees. Flood insurance is available for properties in these zones, but is not mandated by the NFIP.

Letter of Map Revision (LOMR). A Letter of Map Revision is a modification to the FIRM or floodway boundaries, generally based on physical changes that affect the hydraulic or hydrologic characteristics of the flood source (usually as a result of development or new flood control facilities). The letter is typically accompanied by an annotated copy of the portion of the map that has been revised. Modifications to the FIRM maps are usually made in response to an agency supplying new hydraulic data that show that the flooding hazard in a specific area has changed or been abated.

In addition to their original purpose of setting insurance rates and regulating flood hazards, FIRMs are now widely used by local and regional planners for other purposes, including land-use planning, emergency preparedness and response, natural resource management, and risk assessment. Therefore, it should be noted that there are many uncertainties inherent in the establishment of FEMA flood zones (Larson, 2009). Given the importance

of these maps, some of the limitations that communities should be aware of are discussed below:

- It is important to realize that FIRMs only identify potential flood areas based on the conditions at the time of the study, and do not consider the impacts of future changes in the area. Conditions that affect the maps and decisions made on their basis may include changes in corporate boundaries, changes in population, man-made and natural changes to the landscape, removal of vegetation, changes to hydrologic systems, construction of flood control facilities, and potential climate changes. These changes in the environment may increase or reduce the area susceptible to flooding.

- The level of detail studied and presented on the maps, as well as the boundaries of the area studied, depend on the type of flood hazard, the funding available, and the risk of flood damage at the time. For instance, areas studied by approximate methods do not provide BFEs on the map, and some study areas are limited in extent.

- The maps do not necessarily identify all areas susceptible to flooding, such as drainages of small size, areas of localized ponding during storms, or areas where drainages are restricted by temporary or permanent structures.

- The analytical process used to construct these maps relies on many assumptions and limited data. The data used may be too old, incomplete, interpolated, and/or inaccurate. For example, in relatively flat floodplains, small elevation errors in the topography can result in large errors in flood zone boundaries.

- One major drawback is the very short time period for which we have meteorological records. Research on some parts of southern California has shown that slight climate fluctuations between wet and dry cycles have occurred since the late 1800s (Hereford and Longpre, 2009). Global climate change is still intensely debated, but many scientists now believe even slight global warming could bring an increase in precipitation overall, although the specific effects on the Yucca Valley region are not known.

- Long-term changes in the watershed or floodplain, primarily the result of man's activities, are even harder to predict. Flood control structures, such as berms and levees, can actually increase the flood risk to other areas. The design of high-density developments often requires taking drainages that used to be spread over a wide area and constricting them into narrow channels, thereby increasing the velocity and erosive power of the flow, and perhaps leading to overtopping. Consequently, there are clearly limitations in using hydrologic calculations based on past, imperfect records to predict the future.

- Larson (2009) also argues that the process of placing a line on a map (flood zone boundaries) conveys a sense of certainty about the risk to the public and policy makers that does not exist.

Flood Map Modernization Program. Because many flood maps and related products were outdated, FEMA started its Map Modernization (Map Mod) Program in 2003 to reduce reliance on paper maps and transition to digital processes for distributing and reading flood maps. The program also includes collecting new flood data for unmapped areas. In response to funding limitations and feedback from stakeholders, FEMA changed its goals mid-way through the program, in 2006. Rather than try to create digitized flood maps for the entire nation, it was decided to improve the accuracy of the newly updated maps by establishing two criteria: 1) a floodway boundary standard that would insure flood maps match the topographic data used (although use of the standard itself does not validate the accuracy of the topographic data); and 2) guidelines for determining whether an existing flood study is adequate for current use or if an updated study is needed. The adjusted goal is to have 65% of the continental United States land area and 92% of the population covered by digital maps (National Research Council, 2009). The FIRMs covering Yucca Valley were updated in 2008.

Risk MAP Program. With the Risk Mapping, Assessment and Planning (MAP) Program approved in March 2009, FEMA is moving from simply portraying flood hazard zones on maps to more accurately communicating and assessing the flood risk of local communities. Building on the digitized maps that are already available, FEMA has developed a 5-year plan to fill in data gaps, increase public awareness, increase their outreach on flood risks, support state and local agencies in risk-based mitigation planning, and provide an enhanced digital platform that improves communication and sharing of risk data.

3.1.6 Flood Zone Mapping in the Town of Yucca Valley

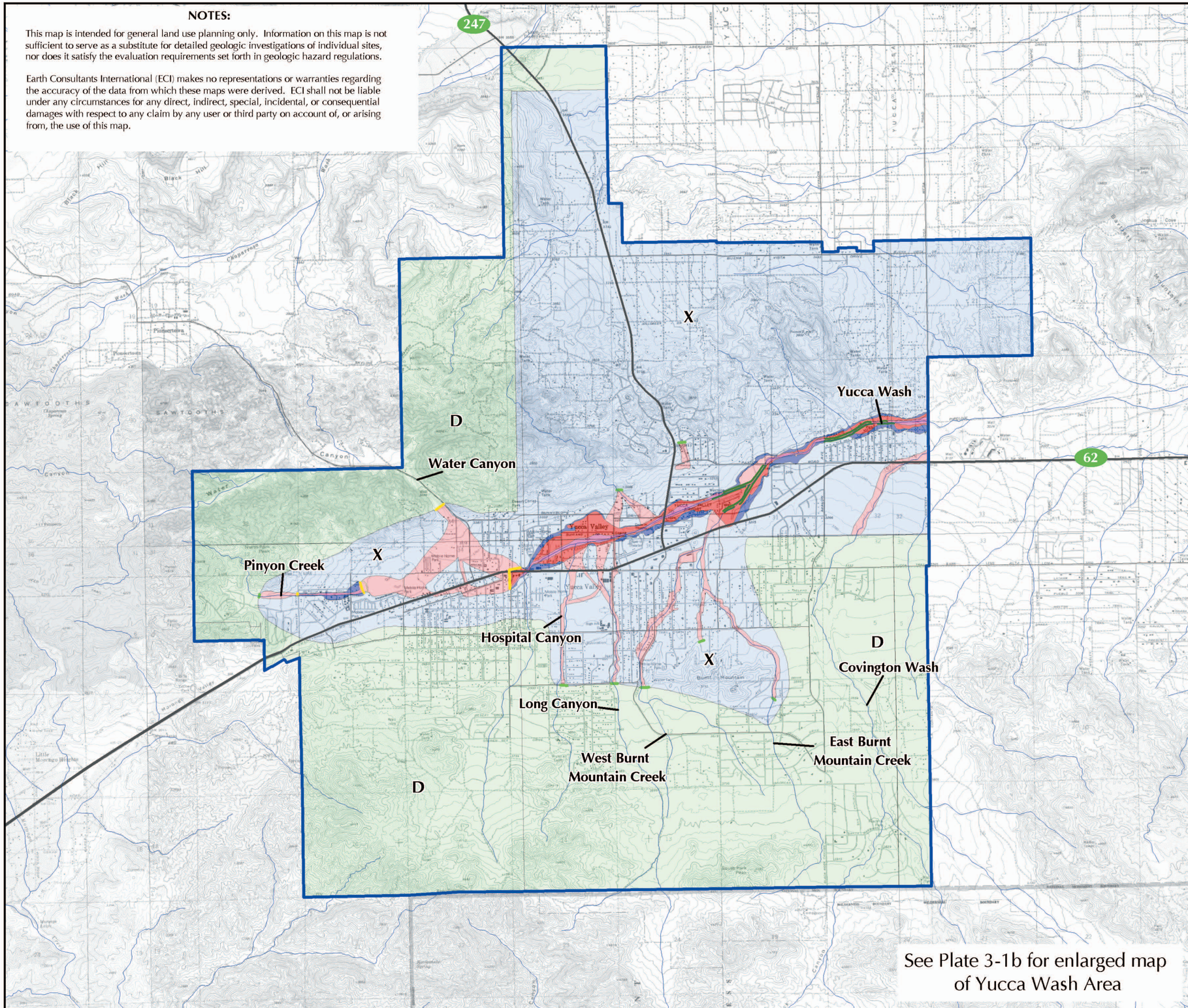
As part of the National Flood Insurance Program, the extent of flooding on portions of Yucca Valley has been analyzed through the Flood Insurance Study (FIS) for San Bernardino County (FEMA, 2008). The potential flood zones mapped by FEMA are published in Flood Insurance Rate Maps. The Flood Hazard Maps for Yucca Valley (Plates 3a and 3b) show the FIRM inundation limits for the 100-year and 500-year flood, however it should be noted that the study areas are limited and the flood zoning for the entire Town is incomplete. Consequently, there are areas outside of the mapped flood zones that are likely to be subject to flood hazards. San Bernardino County has also published flood hazard zones, most of which coincide with the FEMA zones.

The flood areas identified on Plates 3a and 3b generally cover the low-lying parts of the Town along Yucca Wash, the alluvial fan at the mouth of Water Canyon, and washes that carry runoff from the mountains through populated areas, including the lower reaches of Pinon Creek, Hospital Canyon, Long Canyon, West and East Burnt Mountain Creeks, and Covington Wash. It should be noted that the mid to upper reaches of these drainages are not identified as SFHZs because they have not been studied by FEMA. These areas, as well as other unmapped portions of Yucca Valley, are still vulnerable to flood inundation. Numerous residences, businesses, and mobile homes are within mapped 100-year SFHZs. The Yucca Valley Airport and several schools are within a 100-year flood SFHZ, including Our Lady of the Desert High School, Calvary Baptist Church School, and Yucca Valley Community Day School.

NOTES:

This map is intended for general land use planning only. Information on this map is not sufficient to serve as a substitute for detailed geologic investigations of individual sites, nor does it satisfy the evaluation requirements set forth in geologic hazard regulations.

Earth Consultants International (ECI) makes no representations or warranties regarding the accuracy of the data from which these maps were derived. ECI shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to any claim by any user or third party on account of, or arising from, the use of this map.



Flood Hazard Map
Yucca Valley, California

Explanation

FEMA Flood Insurance Rate Zones
High Risk Areas (Special Flood Hazard Areas)

- **A** — Zone that corresponds to the 100-year flood areas, as determined by approximate methods. Because detailed hydraulic analyses were not performed, no base flood elevations or depths have been determined. Mandatory flood insurance is required.
- **AE** — Zone that corresponds to the 100-year flood areas, as determined by detailed hydraulic analyses. In most cases, base flood elevations are shown at selected intervals.* Mandatory flood insurance is required.
- **AE** — Floodway zone*. Watercourse channel that generally must be kept free of encroachment. Development is subject to special regulations.

Moderate and Low Risk Areas

- **X** — Zone that corresponds to areas between the limits of the 100-year and 500-year floods. No base flood elevations or depths have been determined. Flood insurance is available but not required.
- **X** — Zone that corresponds to areas outside of the 500-year flood or areas protected from the 100-year flood by levees. Flood insurance is available but not required.
- **D** — Zone outside of FEMA Study - flood hazard is undetermined.
- Limit of detailed study.
- Limit of FEMA Study.
- Levee
- Yucca Valley Town Boundary

* See FEMA Flood Insurance Rate Maps and FEMA FLood Insurance Study for San Bernardino County for Base Flood Elevations.

N W E S

Scale: 1:60,000

5000 0 5000 Feet

1000 0 1000 Meters

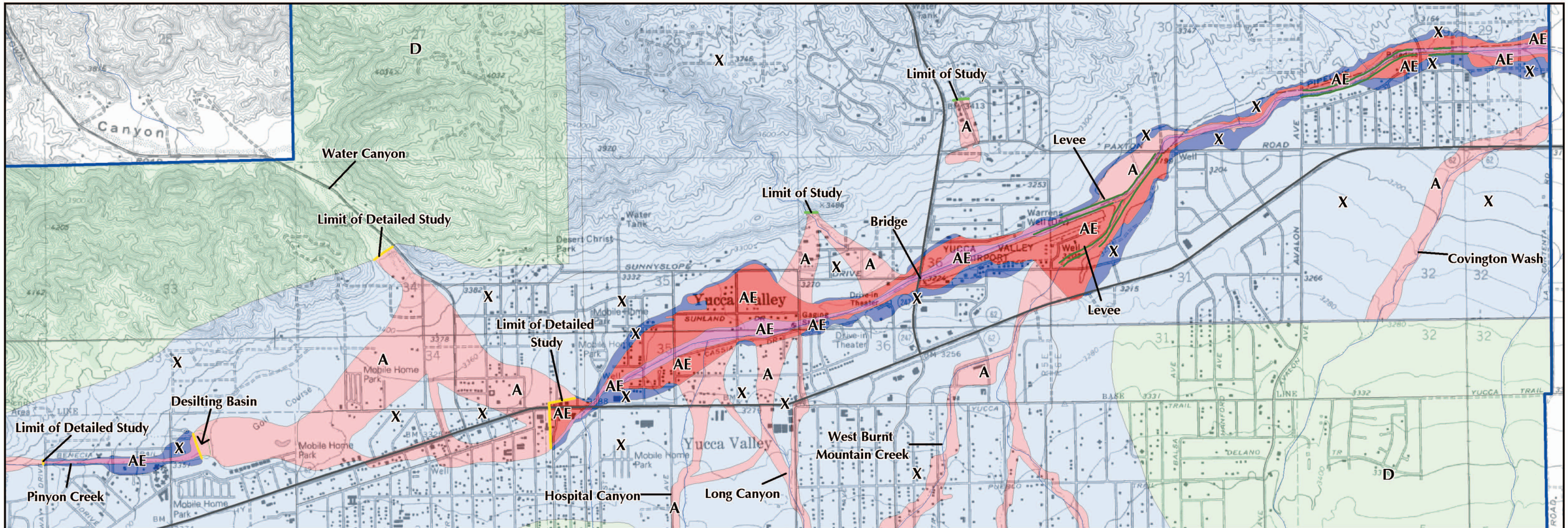
Base Map: USGS Topographic Map from Sure!MAPS RASTER, 1997 and Town of Yucca Valley. Source: Federal Emergency Management Agency, San Bernardino County, Flood Insurance Rate Maps (Panel Numbers: 06071C8115H, 06071C8120H, 06071C8140H, 06071C8855H, 06071C8860H, 06071C8880H).

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2012

Plate 3-1a



N
W E
S

Scale: 1:24,000

2000 0 2000
Feet

500 0 500
Meters

Explanation

FEMA Flood Insurance Rate Zones

Moderate and Low Risk Areas

- X — Zone that corresponds to areas between the limits of the 100-year and 500-year floods. No base flood elevations or depths have been determined. Flood insurance is available but not required.
- X — Zone that corresponds to areas outside of the 500-year flood or areas protected from the 100-year flood by levees. Flood insurance is available but not required.
- D — Zone outside of FEMA Study - flood hazard is undetermined.
- Limit of FEMA Study.
- Limit of detailed study.
- Levee
- Yucca Valley Town Boundary

High Risk Areas (Special Flood Hazard Areas)

- A — Zone that corresponds to the 100-year flood areas, as determined by approximate methods. Because detailed hydraulic analyses were not performed, no base flood elevations or depths have been determined. Mandatory flood insurance is required.
- AE — Zone that corresponds to the 100-year flood areas, as determined by detailed hydraulic analyses. In most cases, base flood elevations are shown at selected intervals.* Mandatory flood insurance is required.
- AE — Floodway zone*. Watercourse channel that generally must be kept free of encroachment. Development is subject to special regulations.

See Plate 3-1a for enlarged map of the entire town.

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2012

* See FEMA Flood Insurance Rate Maps and FEMA FLood Insurance Study for San Bernardino County for Base Flood Elevations.

Base Map: USGS Topographic Map from Sure!MAPS RASTER, 1997 and Town of Yucca Valley. Source: Federal Emergency Management Agency, San Bernardino County, Flood Insurance Rate Maps (Panel Numbers: 06071C8115H, 06071C8120H, 06071C8140H, 06071C8855H, 06071C8860H, 06071C8880H).

Flood Hazard Map
Yucca Wash Area
Yucca Valley, California

Plate 3-1b

Storms smaller than the estimated 100-year event have caused localized flooding and sedimentation problems in Yucca Valley, including areas outside of the mapped FEMA zones. Many of the drainage courses in the Town are unimproved and have insufficient capacity, leading to flooding, erosion, and sedimentation on nearby properties. Damage to structures occurs mostly in older buildings that are not adequately elevated above the ground surface, and/or have inadequate floodproofing. The Yucca Valley area still has many unpaved roads in residential areas, and these, along with the natural drainage channels, are vulnerable to erosion and sedimentation. Sediment loads are deposited when the stream velocity slows down, resulting in property damage, or in some cases, parts of the community being temporarily isolated due to eroded or flooded access roads.

As the population of Yucca Valley grows, the consequences of flooding are likely to increase. In light of the uncertainties with respect to estimating floods, land use planning in the Town could benefit from additional mapping, a conservative approach to permitting, and a strong adherence to an area-wide, long-term vision for flood safety as individual projects are considered.

3.1.7 Flood Management Policies

The NFIP provides Federal funds, emergency aid, and/or assistance in the event of a major flood. However, the key to reducing the flood risk lies at the local and County level, primarily in the form of proactive land use planning, zoning, and the enforcement of building codes. Responsibility also lies with individual property owners, especially in rural areas, since they are the stewards of many of the natural drainage channels.

As mentioned above, to qualify for the NFIP, cities and counties are required to adopt and enforce minimum flood hazard management standards. In Yucca Valley, general provisions for flood hazard reduction are provided in the Town Code and these apply to all lands in Areas of Special Flood Hazard. These areas are based on the FEMA maps, however the areas shown to be at risk in these maps are a minimum. Based on local conditions, additional areas may be included in the application of these provisions. The goal is to reduce flood losses by protecting floodways (major drainages that periodically convey dangerous, turbulent floodwater and debris) from encroachment, regulate land uses in areas vulnerable to flooding, minimize the disturbance of natural drainage patterns, prevent the obstruction of flow paths that would divert floodwater to other areas, and provide and implement standards designed to increase a building's resistance to damage from water or debris.

Much of Yucca Valley is rural or semi-rural, and drainage issues are typically addressed on a parcel-by-parcel basis. In order to obtain permits for new construction, applicants are required to evaluate the proposed project's impact on the existing drainage, including the cumulative effect of the project when combined with all other existing and anticipated development. The permit applications are reviewed to determine if the project will be reasonably safe from flooding, erosion, sedimentation, and mudslides, and will not cause or increase the potential for such hazards downstream. The code also provides minimum standards of construction, such as anchoring, placement and type of utility equipment, building materials, building elevation, and floodproofing (i.e., water-tight walls and resistance to hydrostatic pressures and buoyancy).

3.1.8 Existing Flood Control

As mentioned previously, a significant portion of Yucca Valley encompasses alluvial fans or plains that slope down gradually from the base of the mountains. Most of these areas have at least scattered development, however, higher density development is present on the alluvial fans in the main valley, between the Sawtooth and Little San Bernardino Mountains. Most of the existing development in Yucca Valley has been completed without significant alteration to the natural terrain. As a result, natural drainage courses pass through developed or semi-developed areas. Small channels pass through private yards, and some structures are built within the flow paths of shallow drainages. Most streets, many of which are unpaved, follow the natural contours of the land, crossing arroyos and gullies without the benefit of culverts or bridges. These crossings can quickly become filled with high velocity floodwaters, trapping vehicles or washing them downstream. Where flows are concentrated or obstructed, the sandy soils that are prevalent can easily erode, forming new gullies and undermining structures.

Development in Yucca Valley has occurred in a piecemeal fashion over the years, much of it before the Town incorporated, and without the benefit of a planned drainage network. Many existing drainage courses are unimproved, and brief but intense storms can quickly overwhelm them, pushing water and sediment over low-lying areas and making unpaved roads impassible. The number of flood control facilities in the Town is limited, and these are located primarily in the lowest part of the main valley, along Yucca Wash. Some of these improvements have been made under the direction of the San Bernardino County Flood Control District (SBCFCD), and others have been constructed by developers as a condition of approval for their projects.

Regional Facilities. The SBCFCD operates and maintains regional flood control facilities along Yucca Wash and small portions of several tributaries, including Old Woman Springs Creek, Covington Wash, Burnt Mountain Creek, Long Canyon, High School Canyon, Hospital Canyon, and Church Street. These improvements consist mostly of open, graded earth channels, locally with rock reinforcements. Levees are present along the eastern portion of the Yucca Wash and Burnt Creek channels. Desilting basins are present in Long Canyon and Old Woman Springs Creek.

Local Facilities. The Town of Yucca Valley has the responsibility of maintaining local flood control improvements. These mostly consist of small unlined earth channels, although some sections are locally lined with concrete or have some form of slope protection. Some streets are constructed with high curbs, so that they function as flood control channels during storms.

3.1.9 Future Flood Control

The existing flood control structures have provided some protection to the central, most densely populated part of the Town; nevertheless, additional protection is needed. Because of the natural drainage patterns in Yucca Valley and the widespread rural and semi-rural character over much of the General Plan area, a comprehensive Town-wide stormdrain network, typical of more urban areas, is not practical. The Town of Yucca Valley Master Plan of Drainage (MPD), prepared for the San Bernardino County Flood Control District in 1999, presents detailed plans for improving and extending the existing facilities throughout the densely populated valley and into the sparsely developed areas to

the south and north. The MPD is meant to be a guideline for planning and building future regional and local drainage facilities, and intends to largely make use of existing drainage courses by improving them as open concrete-lined or rock-lined channels, supplemented with storm drain pipes and detention/debris basins. Other planned improvements include new or improved culverts at road crossings, more streets improved to carry storm flows, and all-weather road crossings. For the rural parts of the Town, the study recommends maintaining the natural washes as managed floodplains.

The MPD also recommends utilizing rock for channel stabilization as much as possible for aesthetic reasons, utilizing detention basins for groundwater recharge, utilizing drainage facilities for wildlife corridors and recreational use, and developing Town ordinances to regulate development in areas where floodplain management is necessary.

As new developments are considered, it is important that hydrologic studies be conducted to assess the impact that increased development may have on the existing development down gradient. These studies should quantify the effects of increased runoff and alterations to natural stream courses. Such constraints should be identified and analyzed in the earliest stages of planning. If any deficiencies are identified, the project proponent needs to prove that these can be mitigated to a satisfactory level prior to proceeding forward with the project, in accordance with California Environmental Quality Act (CEQA) guidelines.

The methodology for analysis and design of regional flood-control structures is set forth by the San Bernardino County Flood Control District (SBCFCD). Future responsibilities for operation of regional flood control facilities will be with the SBCFCD, whereas the local storm drains and other structures outside of the regional system, if constructed in the future, would be the responsibility of the Town. Therefore, both agencies must be involved in the planning and approval of mitigation measures, to assure compatibility.

Across the United States, substantial changes in the philosophy, methodology and mitigation of flood hazards are currently in the works. For example:

- Some researchers have questioned whether or not the current methodology for evaluating average flood recurrence intervals is still valid, since we are presently experiencing a different, warmer and wetter climate. Even small changes in climate can cause large changes in flood magnitude (Gosnold and others, 2000).
- Flood control in undeveloped areas should not occur at the expense of environmental degradation. Certain aspects of flooding are beneficial and are an important component of the natural processes that affect regions far from the particular area of interest. For instance, lining major channels with concrete reduces the area of recharge to the underlying groundwater table. Thus there is a move to leave nature in charge of flood control. The advantages include lower cost, preservation of wildlife habitats and improved recreation potential.
- Floodway management design in land development projects can also include areas where stream courses are left natural or as developed open space, such as parks or golf courses. Where flood control structures are unavoidable, they are often

designed with a softer appearance that blends in with the surrounding environment.

- Environmental legislation is increasingly coming in conflict with flood control programs. Under the authority of the Federal Clean Water Act and the Federal Endangered Species Act, development and maintenance of flood control facilities has been complicated by the regulatory activities of several Federal agencies including the U.S. Army Corps of Engineers, the Environmental Protection Agency, and the U.S. Fish and Wildlife Service. For instance, FEMA requires that San Bernardino County and its incorporated cities maintain the carrying capacity of all flood control facilities and floodways. However, this requirement can conflict with mandates from the U.S. Fish and Wildlife Service regarding maintaining the habitat of endangered or threatened species. Furthermore, the permitting process required by the Federal agencies is lengthy, and can last several months to years. Yet, if the floodways are not cleared of vegetation and other obstructing debris in a timely manner, future flooding of adjacent areas could develop.

3.1.10 Flood Protection Measures for Property Owners

As discussed above, flooding remains a significant risk to structures and residents Yucca Valley. The Town and property owners can take measures, however, to promote safety during future floods and reduce damages.

At the Community level:

- Develop a system whereby storm warnings are issued in real time, and, if necessary, evacuations can be conducted in short notice.
- Continue public education regarding dangers of fast-moving floodwaters, especially considering the influx of new residents from non-desert areas.
- Continue to educate the public on the risks of flooding, including the uncertainties inherent in flood hazard zoning.
- Establish easements for entrenched flow paths.
- Create local flood zone designations, based on scientific mapping and local knowledge of the problems areas.
- Create flood overlays for zoning and land use maps.
- Provide information regarding the potential flood hazards outside the 100-year flood zone; residents in these areas may consider purchasing flood insurance once they understand the risks.
- In existing developments, continue efforts to channel floodwaters down streets with the use of berms.
- Create an atmosphere of working with nature and the natural processes inherent in the desert environment, rather than trying to control them (which often comes with unintended consequences).

For Property Owners:

- Elevate homes on fill pads or piers.
- Orient homes and pads to provide minimum obstruction to the direction of flow, and do not force flows onto adjacent properties.
- Try to accommodate natural flows rather than restrict them.

- Any grading to direct flow around the home should include directing it back to its natural path downstream.
- Minimize the disturbance to the surrounding soil and native vegetation.
- Protect foundations or piers from erosion and scour.
- Numerous methods are available for flood protection – which methods are most appropriate for an individual lot should be based on local conditions surrounding and upstream from the lot.
- Some lots may require special engineering studies to determine the hazard and design appropriate mitigation.

FEMA has identified several flood protection measures that can be implemented by property owners to reduce flood damage. These include: installing waterproof veneers on the exterior walls of buildings; putting seals on all openings, including doors, to prevent the entry of water; raising electrical components above the anticipated water level; and installing backflow valves that prevent sewage from backing up into the house through the drainpipes. Obviously, these changes vary in complexity and cost, and some need to be carried out only by a professional licensed contractor. For additional information and ideas, refer to the FEMA web page at www.fema.gov. Structural modifications require a permit from the Town's Building and Safety Division of the Community Development Department. Refer to them for advice regarding whether or not flood protection measures would be appropriate for your property.

3.1.11 Bridge Scour and Flood Channel Crossings

Scour at roadway bridges involves sediment-transport and erosion processes that cause streambed material to be removed from the bridge vicinity. Nationwide, several catastrophic collapses of highway and railroad bridges have occurred due to scouring and a subsequent loss of support of foundations. This has led to a nationwide inventory and evaluation of bridges (Richardson and others, 1993).

Scour processes are generally classified into separate components, including pier scour, abutment scour, and contraction scour. Pier scour occurs when flow impinges against the upstream side of the pier, forcing the flow in a downward direction and causing scour of the streambed adjacent to the pier. Abutment scour happens when flow impinges against the abutment, causing the flow to change direction and mix with adjacent main-channel flow, resulting in scouring forces near the abutment toe. Contraction scour occurs when flood-plain flow is forced through a narrow opening at the bridge, where the resultant increase in the velocity of the surface water can produce scour. Total scour for a particular site is the combined effects from all three components. Scour can occur within the main channel, on the flood plain, or both. While different materials scour at different rates, the ultimate scour attained for different materials is similar and depends mainly on the duration of peak stream flow acting on the material (Lagasse and others, 1991).

In the Yucca Valley area, scour could occur at any of the several bridges crossing existing flood control channels. Because the channels only carry floodwaters occasionally, any scouring that occurs during the very sporadic but high-intensity storms may go undetected. Therefore, bridges should be inspected during and after a flood event to determine whether or not there is scour damage that could impact their foundations. Any damage observed near the bridge supports should be repaired as soon as possible, before the next storm

event or storm season, as appropriate. These bridges are particularly important because to serve as "all-weather" crossings, especially for emergency personnel during a flood.

3.2 Seismically Induced Inundation

3.2.1 Dam Failure

Seismically induced inundation refers to flooding that occurs when water retention structures, such as dams, fail due to an earthquake. Statutes governing dam safety are defined in Division 3 of the California State Water Code (California Department of Water Resources, 1986). These statutes empower the California Division of Dam Safety to monitor the structural safety of dams that are greater than 25 feet in dam height or have more than 50 acre-feet in storage capacity. Currently there are no water storage reservoirs with dams that impact the Yucca Valley General Plan area. There are however, five planned detention/debris basins and one existing basin (Long Canyon) that fall under the jurisdiction of the State (due to embankment height and/or storage capacity), even though they will contain stormwater only on a temporary basis. Old Woman Springs Basin does not come under State jurisdiction (John M. Tettemer & Associates, 1999).

3.2.2 Inundation From Above-Ground Water Storage Tanks

Seismically induced inundation can also occur if strong ground shaking causes structural damage to aboveground water tanks. If a tank is not adequately braced and baffled, sloshing water can lift a water tank off its foundation, splitting the shell, damaging the roof, and bulging the bottom of the tank (causing what is referred to as "elephant's foot") (EERI, 1992). Movement can also shear off the pipes leading to the tank, releasing water through the broken connections. These types of damage occurred during southern California's 1992 Landers, 1992 Big Bear, and 1994 Northridge earthquakes. The Northridge earthquake alone rendered about 40 steel tanks non-functional (EERI, 1995), including a tank in the Santa Clarita area that failed and inundated several houses below. As a result of lessons learned from recent earthquakes, new standards for design of steel water tanks were adopted in 1994 (Lund, 1994). The new tank design includes flexible joints at the inlet/outlet connections to accommodate movement in any direction.

The Hi-Desert Water District maintains sixteen aboveground water tanks, with a total capacity of 12.9 million gallons. All the tanks are located within the Town limits except Reservoir 33, which is located to the northeast, in the Yucca Mesa area. The two newest tanks were constructed in recent years (2000 and 2003), however many of the older tanks were constructed 20 years ago or more, before the adoption of newer earthquake design standards. Older tanks may not meet the new construction requirements for safety, lacking the flexible joints and other seismic upgrades that can help limit the damage that a failed water tank could cause to areas downstream. According to the District, some of the tanks have been retrofitted with seismic valves.

If there is the potential for a water tank or its associated pipe connections to fail catastrophically during an earthquake, its inundation path should be identified to evaluate whether or not habitable structures are located within the floodway. The evaluation should also address whether a water reservoir is self-contained. Specifically, in the event of a catastrophic breakage, will the water be contained within the site, or will it pose a hazard to properties downstream? This hazard should be considered during the review of

any future tank projects. All existing tanks within Yucca Valley should be evaluated for inundation impacts, and the hazard mitigated if there is a threat to downstream structures.

Table 3-3: Above-ground Water Tanks in the Yucca Valley General Plan Area

Tank No.	Capacity (millions of gallons)	Year Built	Seismic Valves
Tank 14	2.0	1983	Yes
Tank 18	1.0	1986	Yes
Section 19	0.15	1966	No
Section 23	0.15	2003	No
Section 30	0.50	1969	No
Palomar	0.98	1978	No
FWH	0.98	1978	No
Alta Loma	1.00	1977	No
Golden Bee	0.42	1988	No
Hospital	0.21	ND	No
Homestead	0.50	2000	No
Lower Fox	2.22	1992	No
Upper Fox	1.50	1992	Yes
Lower Ridge	0.01	1992	Yes
Upper Ridge	0.50	ND	Yes

Source: Hi-Desert Water District.
Abbreviations: ND = No Data

In addition to the potential inundation of downslope properties, tank failures can significantly reduce the water resources available to suppress earthquake-induced fires. Damaged tanks and water mains can also limit the amount of water available to residents. Similar damage can be expected to the groundwater wells in the region, also limiting the water available to the community after an earthquake. Therefore, it is of paramount importance that the water storage tanks in the area retain their structural integrity during an earthquake, so water demands after an earthquake can be met. In addition to evaluating and retrofitting water reservoirs to meet current standards, this also requires that the tanks be kept at or near full capacity at all times.

3.3 Summary

Yucca Valley encompasses broad, gently sloping alluvial plains surrounded by rocky hills and steep mountains. The most concentrated development occupies the main valley floor, along Yucca Wash. Although the existing flood control structures have helped to alleviate flooding problems, numerous structures identified in the County's Master Plan of Drainage remain to be funded and built. Yucca Valley's areas of rural to semi-rural development have been built out with only minor alterations to the natural topography. As a result, facilities that can help reduce the flood hazard, such as underground pipelines, culverts and bridges are rare. This leads to localized flooding, road closures, erosion damage, and even temporary isolation during and following strong storms, particularly when the area is hit by high-intensity summer thunderstorms or winter storms that occur when the ground is already saturated.

Drainages within Yucca Valley that will be flooded by the 100-year flood, as identified by FEMA, include the Yucca Wash, Water Canyon, Old Woman Springs Creek, Covington Wash, East and West Burnt Mountain Creeks, Long Canyon, Hospital Canyon, and Pinon Creek. Many homes and businesses are impacted by these drainages. In addition, it is important to note that the FEMA flood zones are based on limited studies, and large portions of Yucca Valley have never been evaluated. Further, storms smaller than the 100-year-event frequently result in property damage or flooded roadways in localized areas. For these reasons FEMA encourages property owners outside of the Special Flood Hazard Areas to purchase flood insurance.

FEMA's National Flood Insurance Program makes federally subsidized flood insurance available in communities that agree to adopt and enforce floodplain management ordinances to reduce future flood damage. Owners of structures within the FEMA-mapped Special Flood Hazard Areas (100-year flood) are required to purchase and maintain flood insurance as a condition of receiving a federally related mortgage or home equity loan on that structure. Residents and business owners outside of the regulated zones should be encouraged to buy flood insurance as well, because between 20 and 25% of the National Flood Insurance Program claims are for structures located outside the designated 100-year flood zones, where insurance is not required. Yucca Valley is a member of the National Flood Insurance Program; consequently, flood Insurance is available to residents and property owners.

For those portions of the Yucca Valley where flooding is a persistent problem, the Town should have evacuation plans in place. Critical facilities such as schools should also have evacuation plans that cover the possibility of flooding. Facilities using, storing, or otherwise involved with substantial quantities of onsite hazardous materials should not be permitted in the flood zones, unless all standards of elevation, anchoring, and flood proofing have been satisfied, and hazardous materials are stored in watertight containers that are not capable of floating.

The Town should continue to require that future planning for new developments consider the impact on flooding potential, as well as the impact of flood control structures on the environment, both locally and regionally. Flood control should not be introduced in the undeveloped areas at the expense of environmental degradation. Land development planning should continue to consider leaving watercourses natural wherever possible, or continuing to develop them as parks, nature trails, golf courses or other types of recreation areas that can withstand inundation.

Because many of the natural drainages cross private yards in rural areas, the citizens of Yucca Valley should make an effort to be educated about their drainage and flooding issues, and not rely entirely on the local agencies. Drainage channels need to be kept free of debris and should not be altered in such a way that runoff is obstructed or significantly changed.

Water tanks in the area are placed on hilltops or sideslopes, above the properties that they supply with domestic water. Emergency planning should consider the potential for water tanks to fail, impacting developed properties below. Given the anticipated extensive damage to the regional potable water system (including tanks, water mains, and distribution lines) resulting from a large-magnitude earthquake on nearby active faults, it is very important that the water storage tanks in the area remain structurally sound, and that they be maintained as full of water as possible. Thus, even if the water distribution pipelines are damaged, the Town would have access to stored water that can be distributed to the community using water trucks or other similar methods, at least until water can be imported while the pipelines are repaired.

CHAPTER 4: FIRE HAZARDS

4.1 Wildfires

Wildfires are a significant hazard throughout the United States, and especially in the West, where they occur often. Large areas of southern California are particularly susceptible to wildfire due to the region's weather, topography and native vegetation. The typically mild, wet winters characteristic of our Mediterranean climate result in an annual growth of grasses and plants that dry out during the hot summer months. This dry vegetation provides fuel for wildfires in the autumn. Although wildfires are often considered highly disruptive and even dangerous, the fact is that wildland fires are a necessary part of the natural ecosystem of southern California, and have been part of the natural environment for millennia. Many of the native plants require periodic burning to germinate and recycle nutrients that enrich the soils. Native Americans took advantage of this, and used fire extensively to control their environment by enhancing feed for wildlife, decreasing insects and diseases that impact wild foods, increasing the abundance and density of edible tubers, greens and other useful plants, and clearing underbrush to ease travel and provide increased visibility (Anderson, 2006).

Wildfires become a hazard when they extend out of control into developed areas, with a resultant loss of property, and sometimes unfortunately, loss of life. The wildfire risk in the United States has in general increased in the last few decades with the encroachment of residences and other structures into the wildland environment, and the increasing number of people living and playing in wildland areas. According to the National Interagency Fire Center, between 2001 and 2008, humans caused approximately 84% of the wildland fires in the U.S. (519,193 human-caused fires vs. 95,294 lightning fires); however, fires caused by lightning strikes burned nearly 1.7 times more land (approximately 35.3 million acres burned by lightning vs. 20.5 million acres burned by man) (http://www.nifc.gov/). The most common human causes of wildfires are arson, sparks from brush-clearing equipment and vehicles, improperly maintained campfires, improperly disposed cigarettes, and children playing with matches.

As the 2003, 2006, 2007 and 2009 fires in southern California have shown, the containment of wildfires that consume hundreds of thousands of acres of vegetated property require the participation of a multi-jurisdictional emergency response effort, with thousands of people at or near the fire lines combating the flames, clearing brush ahead of the fire to establish defensible zones, and assisting evacuees (Figures 4-1 and 4-2). Under the right wind conditions, multiple ignitions can develop as a result of the wind transport of burning cinders (called brands) over distances of a mile or more. Wildfires in those areas where the wildland approaches or interfaces with the urban environment (referred to as the ***urban-wildland interface*** area or ***UWI*** area) can be particularly dangerous and complex, posing a severe threat to public and firefighter safety, and potentially causing devastating losses of life and property. This is because when a wildland fire encroaches onto the built environment, ignited structures can then sustain and transmit the fire from one building to the next. It has become increasingly clear that continuous planning, preparedness, and education are required to reduce the fire hazard potential and limit the destruction caused by fires. These mitigation measures are discussed in this document.

Wildfires usually last only a few hours or days, but their effects can last much longer, especially in the case of intense fires that develop in areas where large amounts of dry, combustible vegetation have been allowed to accumulate. If wildland fires are followed by a period of intense rainfall,

debris flows off the recently burned hillsides can develop. Flood control facilities may be severely taxed by the increased flow from the denuded hillsides and the resulting debris that washes down. Studies (Cannon, 2001) suggest that in addition to rainfall and slope steepness, other factors that contribute to the formation of post-fire debris flows include the underlying rock or sediment type, the shape of the drainage basin, and the presence or absence of water-repellent soils (during a fire, the organic material in the soil may be burned away or decompose into water-repellent substances that prevents water from percolating into the soil.) If this debris overwhelms the flood control structures, widespread damage can ensue in areas down gradient from the failed structures. As an example, in San Bernardino County 16 people died as a result of debris flows during the 2004 storms that followed the 2003 fire season. During the storms of 2010, the Los Angeles County Public Works Department and several cities had crews cleaning out the debris basins between the mountains and the communities at the foot of the 250-square-mile area that burned during the Station Fire. These efforts helped significantly in reducing the hazard of mudflows, although unfortunately nearly 50 homes and dozens of cars were still seriously damaged by mudflows in the communities of La Crescenta, La Canada Flintridge, and Acton.

Figure 4-1: View of the Cedar Fire of October 2003 Moving Down Oak Canyon, Toward the 52 Freeway, in San Diego County.

This fire burned more than 270,000 acres, destroyed 2,820 structures, damaged 63 others, and killed 14 people. The fire was cased by a signal flare set off by a lost hunter.

Other effects of wildfires are economic and social. Homeowners who lose their house to a wildfire may not be able to recover financially and emotionally for years to come. Recreational areas that have been affected may be forced to close or operate at a reduced scale. In addition, the buildings that are destroyed by fire are usually eligible for re-assessment, which reduces income to local governments from property taxes.

With some exceptions, the impact of wildland fire on plant communities in southern California is generally beneficial, although it often takes time for plant communities to re-establish themselves. If a grassland area has been burned, it will re-sprout the following spring. Chaparral plant

communities will usually re-sprout in three to five years. Oak woodland, if it has had most of the seedlings and saplings destroyed by fire, will require at least five to ten years for a new crop to take hold. On the other hand, some of the dominant plant species in the deserts bioregion, such as shadscale, blackbrush, creosote bush, brittlebrush, and cacti are killed by fire and will not re-sprout. Others, such as Mojave yucca, banana yucca, and Joshua trees, are top-killed, with sprouting generally stimulated by fire. Joshua trees will re-sprout, but if most or all of their foliage is scorched or destroyed by the fire, they will generally die within 5 years. Because many fires in the desert are patchy and of low intensity, plants will often survive in unburned islands (Brooks and Minnich, 2006). With the introduction of non-native species that burn at higher intensities, however, the damage will generally be more widespread. Furthermore, the non-native, invasive species re-sprout more quickly and spread faster, crowding out the native desert plants in the process.

Figure 4-2: View of a Backfire to the Station Fire Behind Homes in La Crescenta.
The 2009 Station fire burned 160,557 acres, 209 structures and caused 2 deaths. It is considered the 10th largest California fire by acreage burned
(http://cdfdata.fire.ca.gov/incidents/incidents_statsevents).
(Photograph by Jae C. Hong/AP Photo, taken on September 1, 2009).

4.1.1 Local Characteristics and History on Local Fires

The fire hazard of an area is typically based on the combined input of several parameters. These conditions include: 1) fuel loads – that is, the type of fuel or vegetation, and its density and continuity, 2) topography – elevation and slope, 3) weather, 4) wildfire history, 5) dwelling density, and 6) existing local mitigation measures that help reduce the area's fire rating – such as fuel modification zones, fire-rated construction, fire hydrants, etc. These conditions as they pertain to the Town of Yucca Valley and immediate surrounding areas are discussed further below.

4.1.1.1 Fuel Loads and Topography

Yucca Valley is located in the lower Mojave section of the Southeastern Deserts Bioregion, an area characterized by isolated, steep-sided mountain ranges separated by broad alluvial basins. The predominant natural vegetation assemblage in the lower elevation areas of the Mojave section is desert shrub, which may include alkali sink vegetation, creosote bush scrub, and succulent scrub (Brooks and Minnich, 2006). Significantly, more than one-third of the desert floor in the Mojave section is typically barren of vegetation (Figure 4-3). The limited amount of vegetation and low surface fuel loads typically hinder the spread of fire.

Figure 4-3: **Typical Fuel Loads in the Yucca Valley Region.**
View to the west of the southern portion of Yucca Valley showing scattered stands of scrubland and Joshua Trees separated by areas barren of vegetation.
The Little San Bernardino Mountains can be in the distance, at left.

At higher elevations both inside and outside the Town, including areas such as Joshua Tree National Park, the major vegetation types include Joshua Tree woodland, shad-scale scrub, creosote bush scrub, blackbrush scrub, and desert scrub-steppe. Given the increased diversity of surface fuel, and relatively higher loads and continuity of vegetation, the spread of fire in these regions is higher than in the desert floor. This is reflected in the higher number of fires reported historically in Joshua Tree National Park and in the mountains to the northwest, compared with the Yucca Valley area proper.

As discussed previously, unlike the primary vegetation types common in other bioregions of southern California, desert plants do not need fire to reproduce, and many of the native

plants common to this area are highly susceptible to and killed off by fire. Furthermore, native desert plant communities may take decades to re-establish after a fire, whereas non-native grasses are quick to invade burned areas, generally at the expense of the native plants. Researchers have argued that the introduction by livestock ranchers, in the early 20th century, of non-native annual grasses to the desert has resulted in a marked increase in the number and size of the fires reported in the region. This trend has been particularly noticeable since the mid 1970s: before about 1977, fires in the eastern deserts generally burned less than 300 acres; fires since then have typically burned thousands of acres. Brooks and Minnich (2006) report that although some of the most significant recent fires in Joshua Tree National Park were fueled by large "stands of native trees, shrubs and perennial grasses," fire spread was "facilitated by stands of the non-native annual grasses red brome and cheat grass." This was especially the case in areas that had previously burned and as a result, the cover of these non-native grasses was particularly high.

Joshua Tree National Park representatives are particularly concerned about the potential future arrival of buffelgrass (*Pennisetum ciliare*), a very invasive grass native to the African savannah that was introduced in the Sonoran desert in Arizona, and has been found to quickly crowd out native species. When stands of buffelgrass burn, they can generate fires that burn almost three times hotter than those generated by flammable native vegetation. Fires this hot are highly detrimental to cacti and native trees, with the potential to eliminate them from the environment (http://www.buffelgrass.org/introduction.php). The potential future arrival of buffelgrass to the area may increase the fire frequency and fire danger in the lower elevation areas of Joshua Tree National Park and the surrounding areas, including Yucca Valley (K. Messaros, Joshua Tree National Park Service, personal communication, October 2009).

4.1.1.2 Weather

As discussed in the Flood Hazards section (Chapter 3), the Yucca Valley area is predominantly arid due to the rain shadow effect caused by the Peninsular Ranges. Average annual precipitation in Yucca Valley is about 6.8 inches, based on precipitation recorded at the Yucca Valley California Department of Forestry station for the water years between 1956-57 and 1992-93 (Kennedy/Jenks/Chilton, 2001). Precipitation is somewhat evenly distributed throughout the year, with higher levels generally reported in the fall and winter months, between November and March. In some years, precipitation associated with thunderstorms emanating from the Gulf of Mexico makes a substantial contribution to the rainfall levels for July and August.

The rainfall measurements made between 1956 and 1993 also show that variations in annual precipitation for this region are relatively high: some years the region received less than 3 inches of rainfall (water years 1984-85, 1988-89, 1989-90, 1995-96), whereas other years total rainfall exceeded 10 inches (1957-58, 1968-69, 1975-76, 1977-78, 1978-79, 1979-1980, 1982-83). As a result, there is a significant variation in the frequency and extent of wildland fires in the area. In years when rainfall is above average, an increased amount of fine fuels in the desert floor can result in an increase in fire spread. Long-term variations in rainfall rates have also been noted in the desert bioregion, with high rainfall and drought periods that last about 20 to 30 years. For example, a mid-century drought was reported between 1946 and 1977, followed by a high-rainfall period between 1977

and 1998. More recently, below-average rainfall was recorded between 1999 and 2004, suggesting that the region has entered a new drought cycle. If this is the case, it may be that the region may see a reduction in frequency and size of wildland fires in the next several years (Brooks and Minnich, 2006).

The summer thunderstorms that sometimes sweep through the Yucca Valley area often include lightning. In fact, lightning frequency is higher in the desert than in any other bioregion in California; the Mojave section averages 30 lightning strikes per 100 square kilometers per year (based on Bureau of Land Management detection data by van Wagtendonk and Cayan, 2008, as reported in Brooks and Minnich, 2006). As discussed in the opening paragraphs, lightning is responsible for a significant percentage of the acreage burned by wildfires in the United States, although human-caused fires are far more common. Many of the large fires recently reported in the region have been the result of lightning. In fact, records kept by Joshua Tree National Park staff indicate that 74% of the fires in the park since 1945 have been caused by lightning. Outside of the park, however, in the Mojave section, human-caused fires were 3.6 times more common than lightning-caused fires for the period between 1980 and 2001 (Brooks and Minnich, 2006).

4.1.1.3 Wildfire History

According to data by the California Department of Forestry and Fire Protection (Cal Fire; http://frap.cdf.ca.gov/data/frapgismaps/download.asp), there have been a few but significant large fires (defined as 300 acres or greater by Cal Fire, and ten acres or greater by the U.S. Forest Service) in the Yucca Valley area between 1910 and 2008 (see Plate 4-1). Some of these fires are discussed further below, in chronological order from most recent to oldest.

The 2008 Acoma fire (blue area in the southern part of Yucca Valley in Plate 4-1) began on June 7, 2008, was 100% contained within 24 hours, and was completely controlled a few days later. The fire burned 356 acres and threatened about 200 homes, prompting voluntary evacuations. The only mandatory evacuation order, as a precaution, was issued for the Desert Manor Board and Care Facility. One outbuilding was destroyed and one resident was treated for smoke inhalation. The fire was human-caused, but whether it was ignited on purpose or as a result of an accident is yet undetermined (http://firefighterparamedicstories.blogspot.com/2008/06/acoma-fire-news-coverage.html).

The Covington and Whispering Pines fires of July 2006 impacted Joshua Tree National Park. Both of these fires were ignited by lightning. The Covington fire burned about 300 acres, whereas the Whispering Pines fire burned nearly 1,000 acres. The Covington fire started at approximately 1:30 PM local time on Thursday, July 21, and by the end of the day had burned about 225 acres and was threatening 550 homes in the southeastern portion of Yucca Valley. Voluntary evacuations were called along Santa Barbara Drive and Joshua Lane. The Whispering Pines blaze began in the early evening of Saturday, July 23rd, and about 450 fire personnel from several different fire departments responded and built containment lines to prevent the blaze from moving into Yucca Valley. The fire destroyed two uninhabited structures and damaged a third in the community of Whispering Pines. Two fire-fighters suffered heat-related injuries, and another person was injured in a traffic accident while moving fire-fighting equipment (based on articles in the

Los Angeles Times dated July 21 and July 25, 2006, respectively, http://articles.latimes.com/2006/jul/21/local/me-fires21 and http://articles.latimes.com/2006/jul/25/local/me-fires25). Also in July 2006, the Pushwalla Complex fire burned more than 2,000 acres in Joshua Tree National Park.

The largest historical fire to have impacted the area is the July 2006 Sawtooth-Millard-Heart Complex fire that combined burned approximately 85,700 acres in the Yucca Valley – San Gorgonio areas (blue zone to the west-northwest of Yucca Valley in Plate 4-1). The Sawtooth Complex fire was started by lightning on July 9 at 8:30 AM local time in the mountains near Big Bear Lake, and in the afternoon of July 14th, it merged with the Millard Complex Fire. The fire was contained on July 19th. Several communities to the northwest of Yucca Valley were placed on mandatory evacuation. Ultimately, the Sawtooth Complex fire alone burned approximately 61,700 acres (250 square kilometers), and destroyed 50 homes, 8 mobile homes, 13 garages, 171 outbuildings, 194 vehicles (including 3 recreational vehicles), 27 trailers, 2 railcars, and 9 tractors. Twelve additional residences were damaged. Seventeen individuals were injured, and one civilian died. The fire cost nearly $17 million to battle, and 861 fire personnel from various agencies, including the California Department of Forestry, San Bernardino County Fire Department, U.S. Forest Service, Los Angeles County Fire Department, the California Department of Corrections and Rehabilitation, the California Highway Patrol, the Red Cross and the California Office of Emergency Services, were involved in the response (http://cdfdata.fire.ca.gov/incidents/incidents_details_info?incident_id=94).

The Pioneer fire of June 2005 burned 1,900 acres. The fire started on June 18th, at about 4:30 in the afternoon near Pioneertown, about 4 miles west of Yucca Valley, and by 11:00 that evening had threatened 1,000 acres. Voluntary evacuations occurred in Pioneertown while 380 fire personnel completed a 3-mile long fire break with dozers and hand-crews to keep the fire from advancing and impacting the Pipes Canyon Preserve and approximately 250 homes (http://wildfirenews.com/archive/070805.shtml).

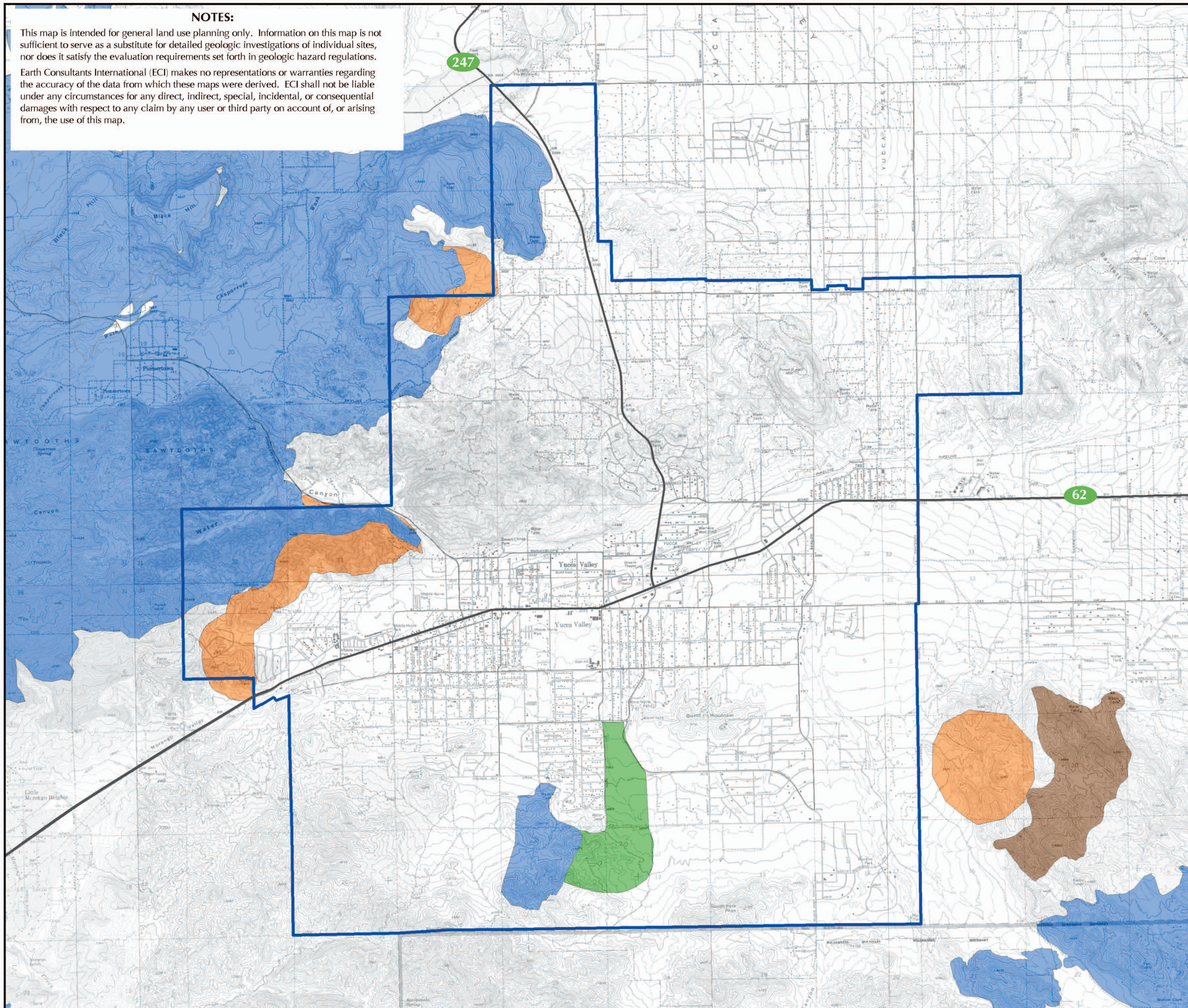
The Paradise fire started on June 22, 2005 at 12:53 PM local time and was 100% contained by June 24, 2005 at 7:00 in the morning. This fire, in the Morongo Valley off Highway 62, destroyed six residences and damaged one more. One minor injury was reported. In total, 3,022 acres were burned and 1,030 fire personnel responded.

Another significant fire near Yucca Valley was the 1999 Juniper Complex fire which burned 13,894 acres in Joshua Tree National Park (JTNP) and extended at its closest approach about 1.5 miles south of Yucca Valley, within the park boundaries (just outside the area covered in Plate 4-1, to the south of the Town).

NOTES:

This map is intended for general land use planning only. Information on this map is not sufficient to serve as a substitute for detailed geologic investigations of individual sites, nor does it satisfy the evaluation requirements set forth in geologic hazard regulations.

Earth Consultants International (ECI) makes no representations or warranties regarding the accuracy of the data from which these maps were derived. ECI shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to any claim by any user or third party on account of, or arising from, the use of this map.



Historical Wildland Fires (1910-2008)

in and Near Yucca Valley, California

Explanation

Year of Last Burn

- 2000-2008
- 1980-1990
- 1990-2000
- 1970-1980

Yucca Valley Town Boundary

N W E S

5000 0 5000
Feet

1500 0 1500
Meters

Scale: 1:60,000

Base Map: USGS Topographic Map from Sure!MAPS RASTER, 1997 and Town of Yucca Valley.
Source: California Fire and Resource Assessment Program (FRAP) @ http://frap.fire.ca.gov/data/frapgisdata/select.asp

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2012

Plate 4-1

As Plate 4-1 shows, most wildland fires in and around Yucca Valley have occurred and are more likely to occur in the future in the hillside and foothill areas, and not in the valley proper. In the developed, relatively flat areas of the Town, vegetation fires are not considered a significant hazard, as the topography, lack of fuel loading (either as a result of little to no vegetation, or due to carefully maintained, drought-tolerant landscaping), combine to mitigate the potential for wildland fires. This is not to say that vegetation fires do not occur in developed areas, but these tend to be smaller and less intense in heat. This is discussed further in the sections below that address regulatory mapping of fire hazard areas.

4.1.2 Regulatory Context and Fire Risk Areas

Since the early 1970s, several fire hazard assessment and classification systems have been developed for the purpose of quantifying the severity of the fire hazard in a given area. Many of these are regulatory in that they were implemented as a result of legislation enacted either at the State or Federal level. Early systems characterized the fire hazard of an area based on a weighted factor that typically considered fuel, weather and topography. More recent systems rely on the use of Geographic Information System (GIS) technology to integrate the factors listed above to map the hazards, and to predict fire behavior and the impact on watersheds.

4.1.2.1 HUD Study System

In April 1973, the California Department of Forestry (CDF – now the California Department of Forestry and Fire Protection) published a study funded by the Department of Housing and Urban Development (HUD) under an agreement with the Governor's Office of Planning and Research (Helm and others, 1973). As is the case with several other more recent programs, the study was conducted in response to a disaster: During September and October 1970, 773 wildfires burned more than 580,000 acres of California land. The HUD mapping process relied on information obtained from U.S. Geological Survey (USGS) 15- and 7.5-minute quadrangle maps on fuel loading (vegetation type and density) and slope, and combined it with fire weather information (now available in real-time at http://gacc.nifc.gov/oscc/predictive/fuels_fire-danger/index.htm) to determine the ***Fire Hazard Severity*** of an area. This system was the basis for several subsequent studies and programs that have been conducted as a result of more recent legislation, as described further below.

4.1.2.2 California Department of Forestry and Fire Protection – State Responsibility Areas System

Legislative mandates passed in 1981 (Senate Bill 81, Ayala, 1981) and 1982 (Senate Bill 1916, Ayala, 1982) that became effective on July 1, 1986, required the California Department of Forestry and Fire Protection (CDF) to develop and implement a system to rank fire hazards in California. Areas were rated as moderate, high or very high based primarily on fuel types. Thirteen different fuel types were considered using the 7.5-minute quadrangle maps by the USGS as base maps (Phillips, 1983). Areas identified as having a fire hazard were referred to as **State Responsibility Areas** (SRAs) (Public Resources Code Section 4125). These are non-federal lands covered wholly or in part by timber, brush, undergrowth or grass, for which the State has the primary financial responsibility of preventing and suppressing fires.

The Town of Yucca Valley is surrounded by State Responsibility Areas to its east and west (purple areas in Plate 4-2). The area within the Sawtooth Mountains to the west is classified as a very high fire hazard severity zone, whereas other areas of lower relief are classified as either high or moderate fire hazard severity zones. ***Federal Responsibility Areas* (FRAs)** (CDF, 2007) have been mapped to the south of the Town, within Joshua Tree National Park boundaries, and both inside and outside the Town limits, as shown by the orange shading in Plate 4-2. Most of the Town and the area to the north-northeast are located within Local Responsibility Areas (LRAs), as described further below.

4.1.2.3 Bates Bill Process

The Bates Bill (Assembly Bill 337, September 29, 1992) was a direct result of the great loss of lives and homes in the Oakland Hills Tunnel Fire of 1991. Briefly, the CDF, in cooperation with local fire authorities was tasked to identify ***Very High Fire Hazard Severity Zones* (VHFHSZs)** in ***Local Responsibility Areas* (LRAs).** To accomplish this, the CDF formed a working group comprised of state and local representatives that devised a point system that considers subjective criteria for fuels, fire history, terrain influences, housing density, and occurrence of severe fire weather. To qualify as a VHFHSZ, an area had to score ten or more points in the grading scale. The original VHFHSZ maps that were prepared as a result of the Bates Bill are now more than ten years old and outdated. In the last few years, the CDF has been re-mapping both SRAs and LRAs using GIS technology and new data and science to better describe the potential fire behavior and fire probability for a give area. Areas are being mapped in the Moderate, High and Very High categories. The CDF (2008) has included most of the Town of Yucca Valley as a Local Responsibility Area, with the higher relief areas classified as having a Very High to High fire hazard, and the lower relief areas having a Moderate fire hazard (red zones in Plate 4-2).

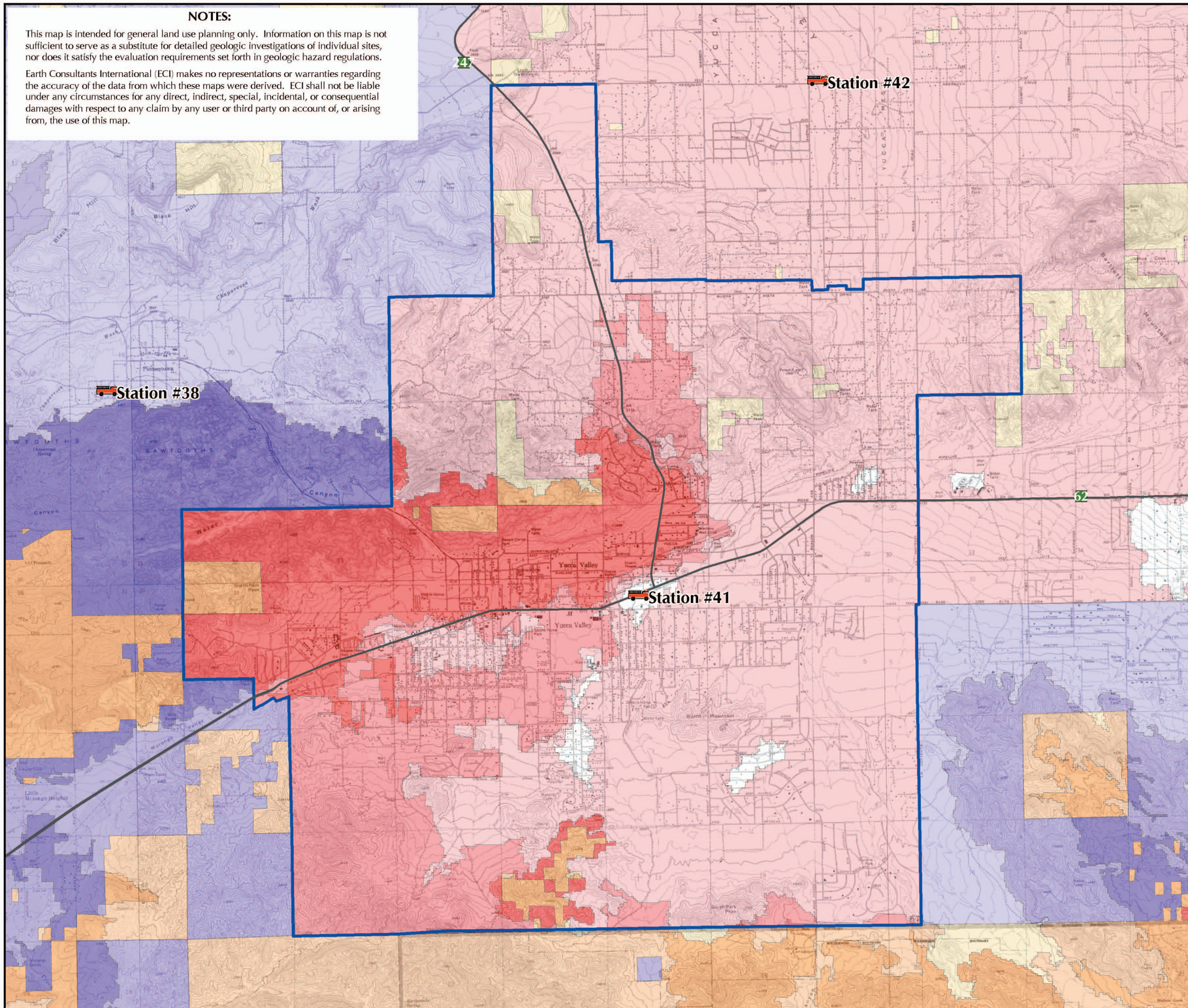
4.1.2.4 California Fire Plan

The 1996 California Fire Plan is a cooperative effort between the State Board of Forestry and Fire Protection and the CDF (California Board of Forestry, 1996). The main objective of the California Fire Plan is to reduce total costs and losses from wildland fire in the State by protecting assets at risk before a fire occurs. To do so, the plan identifies pre-fire management prescriptions that can be implemented to reduce the risk, and analyzes policy issues and develops recommendations for changes in public policy (http://cdfdata.fire.ca.gov/fire_er/fpp_planning_cafireplan).This system ranks the fire hazard of all wildland areas of the State using four main criteria: fuels, weather, assets at risk, and level of service (which is a measure of the Fire Department's success in initial-attack fire suppression). The California Fire Plan uses GIS-based data layers to conduct the initial evaluations, and local CDF Ranger Units are then tasked with field validation of the initial assessment. The final maps use a Fire Plan grid cell with an area of approximately 450 acres, which represents 1/81 of the area of a 7.5-minute quadrangle map (called Quad 81). The fire hazard of an individual cell is ranked as very high, high or moderate. The high and very high fire hazard zones are based on the availability of fuel (fuel load), terrain and assets at risk. In some cities in southern California, the high and very high fire threat areas include high-density residential subdivisions that are located at the urban-wildland interface. These are the areas where even though hardscape (concrete, asphalt and structures) and landscaping vegetation predominate, the high concentration of structures can allow fires to jump from one building to the next, and the loss due to fire would be

NOTES:

This map is intended for general land use planning only. Information on this map is not sufficient to serve as a substitute for detailed geologic investigations of individual sites, nor does it satisfy the evaluation requirements set forth in geologic hazard regulations.

Earth Consultants International (ECI) makes no representations or warranties regarding the accuracy of the data from which these maps were derived. ECI shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to any claim by any user or third party on account of, or arising from, the use of this map.



High Fire Hazard Areas

in and Near Yucca Valley, California

Explanation

Local Responsibility Area

- Very High Fire Hazard Severity Zone
- High Fire Hazard Severity Zone
- Moderate Fire Hazard Severity Zone
- Urban Unzoned

Federal Responsibility Area

- Very High Fire Hazard Severity Zone
- High Fire Hazard Severity Zone
- Moderate Fire Hazard Severity Zone

State Responsibility Area

- Very High Fire Hazard Severity Zone
- High Fire Hazard Severity Zone
- Moderate Fire Hazard Severity Zone

- Fire Station
- Yucca Valley Town Boundary

N W E S

5000 0 5000
Feet
1000 0 1000
Meters

Scale: 1:60,000

Base Map: USGS Topographic Map from Sure!MAPS RASTER (1997) and Town of Yucca Valley.
Sources: Fire and Resource Assesment Program, California Department of Forestry and Fire Protection (2007), http://www.yucca-valley.org/departments/fireprotection.html

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2012

Plate 4-2

greatest. These are therefore the areas where enhanced onsite protection for structures and people is necessary.

Under the California Plan, and given the area's vegetation types and slope characteristics, the Town of Yucca Valley is mapped as having a **moderate** to **high** fuel rank and potential fire behavior, with the high fuel rank areas located in the hillsides to the south and west-northwest of the Town (http://frap.cdf.ca.gov/data/frapgismaps/download.asp).

4.1.2.5 National Fire Plan

During the year 2000 fire season, wildfires burned millions of acres of land throughout the United States, prompting politicians, fire managers and government agencies to re-think their approach to fire management. Under Presidential Executive Order, the Secretaries of Agriculture and the Interior were tasked with preparing a report that outlined recommendations to minimize both the short- and long-term impacts of wildfires with a broader effort and closer cooperation between agencies and fire programs. The resulting report, entitled the "National Fire Plan," has as its main purposes to protect communities and restore ecological health on Federal lands (http://www.forestsandrangelands.gov/NFP/index.shtml). The Plan outlines five key points: 1) firefighting, 2) rehabilitation and restoration, 3) hazardous fuel reduction, 4) community assistance, and 5) accountability. The Plan, which was first funded in 2001, commits to funding for a continued level of "Hazardous Fuel Reduction" and new funding for a "Community Assistance/Community Protection Initiative." The intent of the Community Assistance initiative is to provide communities that interface with federal lands an opportunity to get technical assistance and funding to reduce their threat of wildfires.

As part of the Community Assistance/Community Protection Initiative, the National Fire Plan funded a study to identify areas that are at high risk of damage from wildfire. Under this program, Federal fire managers authorized State foresters to determine which communities are at significant risk from wildland fire on Federal lands. In California, this task was undertaken by the ***California Fire Alliance*** (CFA), a cooperative group of State, Federal and local agencies that in 2001 generated a list of communities at risk. Given California's extensive Urban-Wildland Interface (UWI), the list of communities extends beyond just those on Federal lands. To date, the CFA has identified 1,289 fire-threatened communities in California, and in 2001 the Town of Yucca Valley was identified as a ***Community at Risk***, given that it has and is adjacent to federally regulated lands with a high wildland fire hazard (http://www.cafirealliance.org/communities_at_risk/).

Under the auspices of the National Fire Plan, the CDF also produced a Wildland Fire Threat Map, released on October 20, 2005, that takes into account the combined effects of potential fire behavior (fuel rank) and expected fire frequency (fire rotation) from the past 50 years to create four threat classes for risk assessment. These threat classes are extreme, very high, high and moderate. Areas that do not support wildland fuels (such as open water, and agricultural lands) were not considered in the analysis. Most large urbanized areas receive a moderate fire threat classification to account for fires carried by ornamental vegetation and flammable structures. The Fire Threat Map (available at http://www.frap.fire.ca.gov/data/frapgismaps/download.asp) shows that the hillside areas of the Town of Yucca Valley are mapped as having either a **high** or **very high** fire threat,

whereas the valley portion is mapped as having a **moderate** fire threat. Immediately south of the Town, Joshua Tree National Park has been mapped as having mostly a **very high** fire threat. Wildland fires that begin in the undeveloped, upland areas of the park could spread north into the southern portion of Yucca Valley.

4.1.2.6 California Fire Alliance (CFA)

In addition to generating and updating the Communities at Risk list described above, the CFA funds a variety of projects designed to reduce the threat of wildfire before it happens. As part of this effort, the CFA encourages the development of Community Wildfire Protection Plans (CWPP), as defined by the Healthy Forest Restoration Act (HFRA) of 2003. CWPPs enable a community to plan how it will reduce its risk of wildfire by identifying strategic sites and methods for fuel reduction projects across the landscape and jurisdictional boundaries. Benefits of having a CWPP include National Fire Plan funding priority for projects identified in a CWPP. The USDA Forest Service and Bureau of Land Management can expedite the implementation of fuel treatments identified in a CWPP through alternative environmental compliance options offered under the HFRA. The CWPP must be agreed to by three entities: the local government, the local Fire Department, and the CDF. Communities developing CWPPs are encouraged to integrate their CWPP planning process into other planning processes, including the Safety Element of the General Plan (i.e., this document), Local Hazard Mitigation Plans, Flood Mitigation Plans, and other local hazard, evacuation and emergency plans. The Town of Yucca Valley does not have a Community Wildfire Protection Plan on file with the California Department of Forestry and Fire Protection.

4.1.2.7 Real-Estate Disclosure Requirements

California state law [Assembly Bill 6; Civil Code Section 1103(c)(6)] requires that fire hazard areas be disclosed in real estate transactions; that is, real-estate sellers are required to inform prospective buyers whether or not a property is located within a wildland area that could contain substantial fire risks and hazards, such as a Local, State or Federal Responsibility Area.

Real-estate disclosure requirements are important because in California the average period of ownership for residences is only five years (Coleman, 1994). This turnover creates an information gap between the several generations of homeowners in fire hazard areas. Un-informed homeowners may attempt landscaping or structural modifications that could be a detriment to the fire-resistant qualities of the structure, with potentially negative consequences.

Although Federal, State and to some degree, local agencies have inventoried and classified the fire hazard of a given area, some users are in need of additional detail, or need to evaluate the fire conditions of an area at a specific time of the year, or under specific fuel loading and weather conditions. The tools below are not regulatory, but in that they are used by specific industry groups, or have applications that can be useful to an agency such as the County Fire Department or the National Forest Service, they are described further.

- **FireLine System**: The Insurance Services Office (ISO) developed a program used by the insurance industry to identify those areas where the potential loss due to wildfire is

greatest (ISO, 1997). ISO retained Pacific Meridian Resources of Emeryville, California to develop the FireLine software, which uses satellite-imagery interpretation to evaluate the factors of fuel types, slope and roads (access) to develop the risk rating. Most insurance companies that provide insurance services to homeowners in California now use this system. This software is only available through ISO and Verisk Analytics. Updated versions of this system are being developed that include the factors of elevation, aspect, and relative slope position.

- **BEHAVE, FARSITE, FlamMap and Other Models**: These are computer programs, typically PC-based, that can be used by fire managers to calculate potential fire behavior in a given area using GIS data inputs for terrain and fuels. The purpose of these models is to predict fire behavior. Data inputs that can be used in the analyses include elevation, slope, aspect, surface fuel, canopy cover, stand height, crown base height and crown bulk density.

  The oldest of these models, used since 1984, is the **BEHAVE** Fire Behavior Prediction and Fuel Modeling System (Burgan and Rothermel, 1984; Burgan, 1987; Andrews, 1986; Andrews and Chase, 1989; Andrews and Bradshaw, 1990). A newer version of it is referred to as the BehavePlus Fire Modeling System (Andrews and Bevins, 1999). This software has been updated on a regular basis to make it more user-friendly and provide additional fire modeling capabilities. **FARSITE** (Fire Area Simulator; Finney, 1995, 1998) is a GIS-based software that "simulates the growth and behavior of a fire as it spreads through variable fuel and terrain under changing weather conditions" (http://fire.org/). This software can be used to project the growth of ongoing wildfires and prescribed fires in two dimensions (unlike BEHAVE, which is a one-dimensional model), and can be used as a planning tool for fire prevention, fire suppression, and fuel assessment. **FlamMap**, whose continued development is funded by the Bureau of Land Management, combines elements of the two older models, BEHAVE and FARSITE, but is not a replacement for either. The software computes potential fire behavior characteristics such as fire spread, flame length, fireline intensity, etc., over an entire FARSITE landscape using constant weather and fuel moisture conditions. Some other models also used by fire managers include EMBYR, DYNAFIRE, LANDFIRE, NEXUS, FireFamily Plus, and FOFEM (http://www.forestencyclopedia.net/p/p452).

- **Brian Barrette's Structural Vulnerability System**: This system starts with the State Responsibility Area fire hazard severity rating described above, but also includes structural elements as rating factors (Barrette, 1999). The structural elements considered include roofing, siding, vegetation clearance, roads and signage, chimneys, structural accessories, water supply, and the location of the structure in relation to the surrounding conditions. This system is intended for use in assessing individual parcels, and is therefore not likely to be used by agencies, as it is time- and personnel-intensive. However, the system is easy to use and can therefore be used by individual homeowners or insurance companies to determine whether or not a specific property has a high fire hazard and is therefore a good candidate for specific fire hazard mitigation measures.

4.1.3 Fire Prevention and Suppression Programs and Regulations

There are several fire prevention and suppression programs that communities can implement to reduce their wildland fire hazard. Some of these programs aim to control the type, density and continuity of fuel (vegetation) available for a fire to burn; others are directed at the strengthening of structures to be more fire resistant. Given that the increase in catastrophic, human-caused wildland fires is associated with an increased number of people living and playing in wildland areas, limiting human-wildland interaction during periods of heightened fire risk can also help reduce the likelihood of human-caused fires in an area. Finally, the effective containment of a wildland fire before it impacts vulnerable structures is in great part the result of the suppression resources available to the agencies fighting the fire, and the fire department's accessibility to the impacted area. Some of these programs are described in more detail below.

4.1.3.1 Vegetation Management

Experience and research have shown that vegetation management is an effective means of reducing the wildland fire hazard. Therefore, in those areas identified as susceptible to wildland fire, land development is governed by special State, county and local codes, and property owners are required to follow maintenance guidelines aimed at reducing the amount and continuity of the fuel (vegetation) available. Requirements for vegetation management at the urban-wildland interface (UWI) in California were revisited following the 1993 wildland fires that impacted large areas of Orange, Los Angeles and Ventura counties. The International Fire Code Institute formed a committee to develop a Wildland-Urban Interface Code under the direction of the California State Fire Marshal. The first draft of this code was published in October 1995. Then, in 2003, the International Fire Code Institute consolidated into the International Code Council. The 2012 Wildland-Urban Interface Code issued by the International Code Council contains provisions addressing fire spread, accessibility, defensible space, and water supply for buildings constructed near wildland areas.

Hazard reduction and ***fuel modification*** are the two methods that communities most often employ to reduce the risk of fire at the UWI. Both methodologies use the principle of reducing the amount of combustible fuel available, which reduces the amount of heat, associated flame lengths, and the intensity of the fire that would threaten adjacent structures. The purpose of these methods is to reduce the hazard of wildfire by establishing a defensible space around buildings or structures in the area. ***Defensible space*** is defined as an area, either natural or man-made, where plant materials and natural fuels have been treated, cleared, or modified to slow the rate and intensity of an advancing wildfire, and to create an area for firefighters to suppress the fire and save the structure. These standards require property owners in the UWI to conduct maintenance, modifying or removing non-fire-resistive vegetation around their structures to reduce the fire danger. This affects any person who owns, leases, controls, operates, or maintains a building or structure in, upon, or adjoining the UWI.

Fuel or vegetation treatments often used include mechanical, chemical, biological and other forms of biomass removal (Greenlee and Sapsis, 1996) within a given distance from habitable structures. The intent of this hazard-reduction technique is to create a defensible space that slows the rate and intensity of the advancing fire, and provides an area at the

urban-wildland interface where firefighters can set up to suppress the fire and save the threatened structures. ***Hazard reduction*** includes requirements for the maintenance of existing trees, shrubs, and ground cover within a setback zone, to reduce the amount of fuel on those sides of any structure that face the UWI. These requirements include: clearing all dead or dying foliage; planting fire-resistive vegetation; keeping clearances between tree stands, bushes and shrubs, and between trees and structures; irrigating ground covers, storing firewood and combustible materials away from habitable structures; using fire-resistant roofing and construction materials; cleaning vegetation debris from roofs and rain gutters; and using spark arresters on chimneys.

In some communities or developments adjacent to a wildland area, residents are required to comply with ***fuel modification*** requirements. A ***fuel modification zone*** is a ribbon of land surrounding a development within a fire hazardous area that is designed to diminish the intensity of a wildfire as it approaches the structures. Fuel modification includes both the thinning (reducing the amount) of combustible vegetation, and the removal and replacement of native vegetation with fire-resistive plant species. These modification zones may be owned by individual property owners or by homeowners' associations. Emphasis is placed on the space near structures that provides natural landscape compatibility with wildlife, water conservation and ecosystem health. Immediate benefits of this approach include improved aesthetics, increased health of large remaining trees and other valued plants, and enhanced wildlife habitat.

The Town of Yucca Valley recommends the clearance of all flammable vegetation (creating a defensible space) within a minimum distance of 30 feet from any flammable building materials or finished structures. If sitting on a hill, the downhill defensible area should be wider than 30 feet, as fire travels upslope very quickly. Fire-resistant shrubs and trees are preferred, especially near structures.

Before European settlers arrived, many areas of the United States experienced small but frequent wildfires that impacted primarily the grasses and low-lying bushes, without severely damaging the tree stands. Native Americans in California reportedly used fire to reduce fuel load; the increased visibility and access this provided helped them hunt and forage. It is thought that as much as 12% of the State was burned every year by various tribes (Coleman, 1994). European settlers, on the other hand, considered wildfires unacceptable, and in the early 20th century, as development started to encroach onto the foothills, the Fire Service began campaigns to prevent wildfires from occurring. Over time this has led to an increased volume of fuel per acre, that, combined with longer periods between fires, has resulted in an increase in fire risk as wildfires that impact areas with fuel buildup are more intense and significantly more damaging to the ecosystem than periodic, low-intensity fires. This makes it harder for firefighters to suppress fires, increases safety issues and reduces productivity for fire crews on perimeter lines, and increases taxpayer costs while increasing losses of life, property and resources.

Recognition of these problems has led to vegetation management programs such as those described above, and in some areas, ***prescribed fires***. A prescribed fire is deliberately set under carefully controlled and monitored conditions. The purpose is to remove brush and other undergrowth that can fuel uncontrolled fires. Prescribed fire is used to alter, maintain

or restore vegetative communities, achieve desired resource conditions, and to protect life and property that would be degraded by wildland fire. Prescribed fire is only accomplished through managed ignition and should be supported by planning documents and appropriate environmental analyses.

Since 1981, prescribed fire has been the primary means of fuel management in Federal- and State-owned lands. Approximately 500,000 acres — an average of 30,000 acres a year — have been treated with prescribed fire under the vegetation management program throughout California alone. In the past, the typical vegetation management project targeted large wildland areas. Now, increasing development pressures (with increased populations) at the urban-wildland interface often preclude the use of large prescribed fires. Nevertheless, many still find the notion of "prescribed fire" difficult to accept given that it goes against nearly a century of common practice and beliefs. Prescribed fire does carry a risk, as relatively recent experiences in New Mexico, Arizona, and Orange County have shown. In 2000, in Los Alamos, New Mexico, the Cerro Grande fire began when a prescribed burn escaped, destroying several hundred homes and burning more than 50,000 acres. This fire triggered revisions in the guidelines for performing prescribed burns. In Orange County, the U.S. Forest Service lost control of a prescribed burn in the Santa Ana Mountains. The Sierra Fire burned for about ten days in February 2006 causing road and highway closures and resident evacuations, but no damaged structures. In all, the Sierra Fire burned 10,584 acres of land and cost about $6.9 million. Furthermore, a recent program review by the CDF has identified needed changes, with focus on citizen and firefighter safety, and the creation of wildfire safety and protection zones.

Joshua Tree National Park prefers the use of manual and mechanical methods for hazard fuel reduction for the sole purpose of maintaining defensible space areas around structures (National Park Service, 2005).

4.1.3.2 Notification and Abatement

Typically, city codes specify that property owners are required to mitigate the fire hazard in their properties by implementing vegetation management practices. *The Town of Yucca Valley addresses the issue of weeds and other vegetation as a potential fire hazard and identifies the steps that the Town takes to abate this hazard in the Town's Municipal Code, Chapter 6.04.* Specifically, the Town considers it unlawful and a nuisance for a property to have weeds, dry grass, rubble, brush, litter, or any flammable material which by its volume, extent or nature endangers the public safety by creating a fire hazard. The Town Manager, code enforcement officer or his/her designee has the authority to give the property owner of record a notice of violation requiring him/her to abate the hazard. If the owner does not abate the hazard during the time period specified in the notice, the Town may take further action to reduce the fire hazard in the form of tax liens and fines. San Bernardino County Fire Department personnel are planning to conduct courtesy home inspections in the urban-wildland interface areas to educate homeowners on being fire safe and maintaining a defensible space.

4.1.3.3 Building to Reduce the Fire Hazard

Building construction standards for such items as roof coverings, fire doors, and fire resistant materials help protect structures from external fires and contain internal fires for

longer periods. The portion of a structure most susceptible to ignition from a wildland fire is its roof, which is exposed to burning cinders (or brands) generally carried by winds far in advance of the actual fire. Roofs can also be ignited by direct contact with burning trees and large shrubs (Fisher, 1995). The danger of combustible wood roofs, such as wooden shingles and shakes, has been known to fire fighting professionals since 1923, when California's first major urban fire disaster occurred in Berkeley. It was not until 1988, however, that California was able to pass legislation calling for, at a minimum, Class C roofing in fire hazard areas (Class C roof coverings are effective against light fire exposures; under such exposures roof coverings of this class are not readily flammable, afford a measurable degree of fire protection to the roof deck, do not slip from position, and do not produce flying brands). Then, in the early 1990s, there were several other major fires, including the Paint fire of 1990 in Santa Barbara, the 1991 Tunnel fire in Oakland/Berkeley, and the 1993 Laguna Beach fire, whose severe losses were attributed in great measure to the large percentage of combustible roofs in the affected areas. In 1994-1996, new roofing materials standards were approved by California for Very High Fire Hazard Severity Zones (see Plate 4-2).

To help consumers determine the fire resistance of the roofing materials they may be considering, roofing materials are rated as to their fire resistance into three categories that are based on the results of test fire conditions that these materials are subjected to under rigorous laboratory conditions, in accordance with test method ASTM-E-108 developed by the American Society of Testing Materials. The rating classification provides information regarding the capacity of the roofing material to resist a fire that develops outside the building on which the roofing material is installed (The Institute for Local Self Government, 1992). The ratings are as follows:

- **Class A**: Roof coverings that are effective against severe fire exposures. Under such exposures, roof coverings of this class are not readily flammable, afford a high degree of fire protection to the roof deck, do not slip from position; and do not produce flying brands.

- **Class B**: Roof coverings that are effective against moderate fire exposures. Under such exposures, roof coverings of this class are not readily flammable, afford a moderate degree of fire protection to the roof deck, do not slip from position, and do not produce flying brands.

- **Class C**: Roof coverings that are effective against light fire exposures. Under such exposures, roof coverings of this class: are not readily flammable, afford a measurable degree of fire protection to the roof deck, do not slip from position, and do not produce flying brands.

Roofing materials can also be:

- **Non-Combustible**: Roof made of non-combustible materials like metal. Although metal roofs don't burn, they are excellent heat conducts, and during an intense fire, heat can be conducted through the metal to the underlying, combustible materials.

- **Non-Rated**: Roof coverings have not been tested for protection against fire exposure. Under such exposures, non-rated roof coverings may be readily flammable; may offer little or no protection to the roof deck, allowing fire to penetrate into attic space and the entire building; and may pose a serious fire brand hazard, producing brands that could ignite other structures a considerable distance away.

The Town of Yucca Valley accepts construction with Class A, B and C roofs. Most new construction uses Class A (Battalion Chief Dave Benfield, written communication, June 2012).

Attic ventilation openings are also a concern regarding the fire survivability of a structure. Attics require significant amounts of cross-ventilation to prevent the degradation of wood rafters and ceiling joists. This ventilation is typically provided by openings to the outside of the structure, but these opening can provide pathways for burning brands and flames to be deposited within the attic. To prevent this, it is important that all ventilation openings be properly screened. Additional prevention measures that can be taken to reduce the potential for ignition of attic spaces is to "use non-combustible exterior siding materials and to site trees and shrubs far enough away from the walls of the house to prevent flame travel into the attic even if a tree or shrub does torch" (Fisher, 1995).

The type of exterior wall construction used can also help a structure survive a fire. Ideally, exterior walls should be made of non-combustible materials such as stucco or masonry. During a wildfire, the dangerous active burning at a given location typically lasts about 5 to 10 minutes (Fisher, 1995), so if the exterior walls are made of non-combustible or fire-resistant materials, the structure has a better chance of surviving. For the same reason, the type of windows used in a structure can also help reduce the potential for fire to impact a structure. Single-pane, annealed glass windows are known for not performing well during fires; thermal radiation and direct contact with flames cause these windows to break because the glass under the window frame is protected and remains cooler than the glass in the center of the window. This differential thermal expansion of the glass causes the window to break. Larger windows are more susceptible to fracturing when exposed to high heat than smaller windows. Multiple-pane windows, and tempered glass windows perform much better than single-pane windows, although they do cost more. Fisher (1995) indicates that in Australia, researchers have noticed that the use of metal screens helps protect windows from thermal radiation.

The latest version of the California Building Code (2010) has specific construction requirements for new buildings located in State Responsibility Areas, any Local Agency Very High Fire Hazard Severity Zone, and any Urban-Wildland Interface Fire Area (Chapters 7A and 15 of Title 24, California Code of Regulations,). The California Building Code also has specific fire-resistance-rated construction requirements for all types of construction, based on occupancy type and construction type. *The Town of Yucca Valley has adopted and enforces the most recent edition (currently the 2010) of the California Building Code for all new construction (Town Ordinance 220 and Municipal Code Title 8).*

4.1.3.4 Restricted Public Access

In addition to the fire-susceptibility conditions described before, the wildfire susceptibility of an area changes throughout the year, and from year to year in response to local variations in precipitation, temperature, vegetation growth, and other conditions. To map these changes, the EROS Data Center (EDC) in Sioux Falls, South Dakota, has produced since the early 1990s weekly and biweekly maps for the 48 contiguous states and Alaska (available at http://edc.usgs.gov/). These maps, prepared under the Greenness Mapping Project, display plant growth and vigor, vegetation cover, and biomass production, using multi-spectral data from satellites of the National Oceanic and Atmospheric Administration (NOAA). The EDC also produces maps that relate vegetation conditions for the current two weeks to the average (normal) two-week conditions during the past seven years. EDC maps provide comprehensive growing season profiles for woodlands, rangelands, grasslands, and agricultural areas. With these maps, fire departments and land managers can assess the condition of all vegetation throughout the growing season, which improves planning for fire suppression, scheduling of prescribed burns, and study of long-term vegetation changes resulting from human or natural factors.

Another valuable fire management tool developed jointly by the U.S. Geological Survey and the U.S. Forest Service is the Fire Potential Index (FPI). The FPI characterizes relative fire potential for woodlands, rangelands, and grasslands, both at the regional and local scale. The index combines multi-spectral satellite data from NOAA with geographic information system (GIS) technology to generate 1-km resolution fire potential maps. Input data include the total amount of burnable plant material (fuel load) derived from vegetation maps, the water content of the dead vegetation, and the fraction of the total fuel load that is live vegetation. The proportion of living plants is derived from the greenness maps described above. Water content of dead vegetation is calculated from temperature, relative humidity, cloud cover, and precipitation. The FPI is updated daily to reflect changing weather conditions.

Local fire authorities can obtain data from either of the two sources above to better prepare for the fire season. When the fire danger is deemed to be of special concern, local authorities can rely on increased media coverage and public announcements to educate the local population about being fire safe. For example, to reduce the potential for wildfires during fire season, hazardous fire areas can be closed to public access during at least part of the year. Typically, the fire season in southern California begins in May and lasts until the first rains in November, but different counties or jurisdictions can opt to start the fire season earlier and end it later. With more site-specific data obtained from the FPI or Greenness Mapping Project, however, the fire hazard of an area can be assessed on a weekly or bi-weekly basis (for more information see http://edc.usgs.gov/greenness/index.html). These data can also be used to establish regional prevention priorities that can help reduce the risk of wildland fire ignition and spread, and help improve the allocation of suppression forces and resources, which can lead to faster control of fires in areas of high concern.

Having said the above, Joshua Tree National Park is always open and may be visited anytime of the year, consistent with the 1916 National Park Service Organic Act that directs the U.S. Parks Service to provide for the "public enjoyment of the scenery, wildlife

and natural and historical resources of national parks." The Park Service recognizes, however, that a severe fire can affect operations, and may require temporary closure of the park to protect the public from the threat of an approaching fire and the effects of smoke (National Park Service, 2005).

4.1.3.5 Fire Safety Education

Individuals can make an enormous contribution to fire hazard reduction if provided with the information and tools to do so. In addition to the specific code requirements and guidelines mentioned in the sections above regarding defensible space and appropriate landscaping and construction materials, homeowners can take on several measures to reduce their fire risk. Some of these tasks are listed below:

- Do not mow or use gas-powered landscaping tools during the hottest time of the day.
- Use care when refueling garden equipment and maintain it regularly.
- Dispose of cuttings and debris promptly, according to local regulations.
- Store firewood away from structures.
- If an irrigation system is used, keep it well maintained.
- Store and use flammable liquids properly.
- Dispose of smoking materials carefully.
- Do not light fireworks.
- Become familiar with local regulations regarding vegetation clearings, disposal of debris, and fire safety requirements for equipment.
- Follow manufacturers' instructions when using fertilizers and pesticides.
- When building, selecting or maintaining a home, consider the slope of the terrain. Be sure to build on the most level portion of the lot since fire spreads rapidly on slopes, even minor ones.
- Watch out for construction on ridges, cliffs, or drainage embankments. Keep a single-story structure at least 30 feet away from the edge of a cliff or ridge; increase this distance if the structure exceeds one story.
- Use construction materials that are fire-resistant or non-combustible whenever possible.
- For roof construction, the Town of Yucca Valley follows the requirements of the California Building Code. Class A, B and C roofing materials are permissible, but Class A is used preferentially for new construction. Class A asphalt shingles, slate or clay tile, metal, cement and concrete products, or terra-cotta tiles have the highest fire-resistant ratings.
- Install an approved automatic fire sprinkler system. The California Building Code has fire sprinkler requirements for new buildings according to occupancy and construction type, but all types of structures can benefit from having a fire sprinkler system installed. This is particularly true of older construction.
- Driveways should provide easy access for fire engines. Driveways and access roads should be well maintained, clearly marked, and include ample turnaround space near houses.
- So that everyone has a way out, provide at least two ground level doors for safety exits and at least two means of escape (doors or windows) in each room.
- Keep gutters, eaves, and roofs clear of leaves and other debris.

- Occasionally inspect your home, looking for deterioration, such as breaks and spaces between roof tiles, warping wood, or cracks and crevices in the structure.
- If an all-wood fence is attached to your home, a masonry or metal protective barrier between the fence and house is recommended.
- Use non-flammable metal when constructing a trellis and cover it with high-moisture, non-flammable vegetation.
- Prevent combustible materials and debris from accumulating beneath patio decks or elevated porches. Screen, or box in, areas that lie below ground level with wire mesh.
- Make sure an elevated wooden deck is not located at the top of a hill where it will be in the direct line of a fire moving up slope.
- Install automatic seismic shut-off valves for the main gas line to your house. Information for approved devices, as well as installation procedures, is available from the Southern California Gas Company.

4.2 Structure Fires

Based on the 2010 census, the Town of Yucca Valley has a permanent population of about 20,700 (U.S. Census Bureau, 2010 at http://2010.census.gov/2010census). A large percentage of the housing stock in the Town of Yucca Valley area consists of single-family, detached structures, but approximately 11.5% of the housing stock in town consists of apartments, condominiums, and other multi-occupancy structures. Multiple-family and multiple-occupancy units have special fire protection needs, including the requirement to have fire and life-safety systems in place, such as automatic fire sprinklers and smoke detectors, in conformance with the Town's Building and Fire Codes. Given that only since January 2011 has the State required one- and two-family dwellings and townhouses to be fitted with fire sprinklers, most of Yucca Valley's residential stock is likely to be un-sprinklered.

In the United States, deaths from fires and burns are the third leading cause of fatal injury, and four out of five fire deaths in 2008 occurred in homes (Karter, 2009, as reported by the Center for Disease Control and Prevention at http://www.cdc.gov/HomeandRecreationalSafety/FirePrevention/fires-factsheet.html). Smoking is the leading cause of fire-related deaths, and cooking is the primary cause of residential fires (Ahrens, 2009a, as reported by the Center for Disease Control and Prevention). Although the number of fatalities and injuries caused by residential fires has declined in the last decades, residential fire-related deaths and injuries still pose a significant public health issue. The good news is that residential fire-related deaths and injuries can be prevented.

When a fire develops in a newer, single-family residential structure constructed of fire-resistant materials and with internal fire sprinklers, the fire can generally be contained to the room of origin, unless the building contents are highly flammable. In older residential areas where the building materials may not be fire-rated, and the structures are not fitted with fire sprinklers, there is a higher probability of a structural fire impacting adjacent rooms, and even adjacent structures, unless there is ample distance between structures, there are no strong winds, and the local fire department is able to respond quickly. Fire losses, as a percentage of the total area of the building, are thus potentially higher in older buildings not built with fire-resistant materials (such as gypsum wallboard) that help slow down the spread of fire from the ignition source to other rooms in the

structure. Older structures are also less likely to have the redundant exits and window-height requirements that allow occupants to more easily evacuate the building if needed.

In high-density residential areas, especially in older neighborhoods, fire can easily spread from one structure or unit to the next, and the narrow spaces between structures and property lines provide limited room for emergency access, hindering fire suppression and evacuation efforts. Emergency access and exits may also be compromised if obstructions, such as bay windows and roof awnings, project into the setback between structures, or if non-structural items, such as garbage cans or sheds are stored in those areas. Newer multiple-family units typically meet special fire protection requirements, including automatic fire sprinklers and smoke detectors, and fire-resistant construction materials, in conformance with the more recent California Building and Fire Codes. These improvements help retard the spread of fire between dwelling units.

Post-fire forensic data show that fire safety in structures is controlled to a great degree by the contents in the structure: upholstered furniture, bedding, curtains, mattresses and floor coverings (such as carpets and rugs) allow for quick fire spread and fire growth, and ignition of these materials is responsible for more deaths and injuries than the collapse of structures due to fire (Canadian Wood Council, 2000). Most injuries or deaths due to fire are in fact the result of smoke or toxic fumes inhalation, and not burns (Hall, 2001), so smoke detectors and/or fire alarm systems, combined with window and door openings that allow the occupants to evacuate safely, are very important in managing the impact of a structure fire. Approximately 40% of the home fire deaths occur in homes without smoke alarms (Ahrens, 2009b as reported by the Center for Disease Control and Prevention).

Data provided by the San Bernardino County Fire Department shows that between 2009 and 2012, only about 2.5% of the incident calls received by Fire Stations 41 and 42 were for fires. How many of these were structural or vegetation fires is unknown. Response activity statistics for Stations 41 and 42 for the years 2009-2012 are summarized further in Table 4-1 below. The data show that the number of calls received by the local fire department has increased from one year to the next, at an average rate of just under 4% per year, roughly consistent with the population growth during the same time period.

Table 4-1: Response Statistics for the Yucca Valley Fire Stations for Fiscal Years 2009 to 2012

Station No.	Year	Fires	Medical Calls	Other*	Total Calls
41	2009-2010	74	2,664	657	3,395
	2010-2011	56	2,662	737	3,455
	2011-2012	69	2,828	764	3,661
42	2009-2010	22	711	215	948
	2010-2011	31	704	231	966
	2011-2012	36	736	252	1,024

Data provided by the San Bernardino County Fire Department, written communication from Battalion Chief Dave Benfield, June 2012.

* Other calls include issues like downed power lines, false alarms, smoke investigations, carbon dioxide and smoke alarm investigations, etc.

These statistics are for two stations only and limited to calls within the Town of Yucca Valley.

Losses due to fires, as the data in Table 4-1 show, vary from year to year. The reality is that one fire incident in a high consequence structure (see below) could alter the yearly statistics significantly. Although mostly residential, some of the businesses and land-uses in and around Yucca Valley could result in chemical fires. Issues associated with the storage, use and disposal of hazardous materials are discussed in more detail in Chapter 5, whereas a discussion of chemical fires is provided in Section 4.4 below. Finally, fires after earthquakes are a real concern in southern California, given the region's seismic potential. This is discussed further in Section 4.5.

4.2.1 Target Fire Hazards and Standards of Coverage

In order to quantify the structural fire risk in a community, it is necessary for the local fire departments to evaluate all occupancies based upon their type, size, construction type, built-in protection (such as internal fire sprinkler systems) and risk (high-occupancy versus low-occupancy) to assess whether or not they are capable of controlling a fire in the occupancy types identified. Simply developing an inventory of the number of structures present within a fire station's response area is not sufficient, as those numbers do not convey all the information necessary to address the community's fire survivability. As mentioned above, in newer residential areas where construction includes fire-resistant materials and internal fire sprinklers, most structure fires can be confined to the building or property of origin. In older residential areas where the building materials may not be fire-rated, and the structures are not fitted with fire sprinklers, there is a higher probability of a structure fire impacting adjacent structures, unless there is ample distance between buildings, there are no strong winds, and the Fire Department is able to respond in a timely manner.

Fire departments quantify and classify structural fire risks to determine where a fire resulting in large losses of life or property is more likely to occur. The structures at risk are catalogued utilizing the following criteria:

- Their size, height, location and type of occupancy;
- The risk presented by the occupancy (probability of a fire and the consequence if one occurs);
- The unique hazards presented by the occupancy (such as the occupant load, the types of combustibles therein and any hazardous materials);
- Potential for loss of life;
- The presence of fire sprinklers and fire-resistant construction materials;
- Proximity to exposures;
- The estimated dollar value of the occupancy;
- The needed fire flow versus available fire flow; and
- The ability of the on-duty forces to control a fire therein.

These occupancies are called "Target Hazards." Target Hazards encompass all significant community structural fire risk inventories. Typically, fire departments identify the major target hazards and then perform intensive pre-fire planning, inspections and training to address the specific fire problems in that particular type of occupancy (for example, training to respond to fires in facilities that handle hazardous materials is significantly different than training to respond to a fire in a high-occupancy facility such as a mall,

auditorium or night club). Typically, the most common target hazard due to its life-loss potential, 24-hour occupancy, risk, and frequency of events, is the residential occupancy. However, the consequences of residential fires can be high or low, depending on the age of the structure, location, size, and occupancy load, among other factors. Four classifications of risk are considered, as follows:

- **High Probability/High Consequences:** such as multi-family dwellings and residential buildings like apartments and condominiums, single-family residential homes in the older sections of the Town, hazardous materials occupancies, and large shopping stores and high-occupancy facilities like movie theaters, convention centers, and meeting halls.
- **Low Probability/High Consequences:** such as the medical offices, mid-size shopping centers, industrial occupancies, and large office complexes.
- **High Probability/Low Consequences:** such as older, detached single-family dwellings.
- **Low Probability/Low Consequences:** such as newer, detached single-family dwellings, and small office buildings.

The Fire Department (Battalion Chief Benfield, written communication, June 2012) has indicated that the largest target hazards in Yucca Valley include the following facilities:

- Wal-Mart / Stater Bros. Shopping Center on Hilton Road and Highway 62,
- Stater Bros. Shopping Center on Highway 62, east of Barberry Avenue,
- The Home Depot on Highway 62, east of Avalon Avenue,
- The Best Western Motel at 56525 Highway 62, east of Palm Avenue,
- Amerigas Propane on Old Woman Springs Road and Buena Vista Drive,
- Ferrelgas located at Yucca Trail and Cherokee Trail,
- G&K Propane located at Yucca Trail and Wall Street,
- Santa Fe Assisted Living at 55475 Santa Fe Trail, west of Shawnee Trail,
- Sky Harbor Convalescent at 57333 Joshua Lane, east of Hardesty Drive, and
- Desert Manor Convalescent at 8515 Cholla Avenue, off of Golden Bee Drive.

Other high probability/high consequence risks of concern include high-rise buildings due to the specialized fire-fighting equipment needed, the limited routes of access into and out of a building, and the potential for great loss of life. Fire departments typically define a high-rise as a building with floors for human occupancy located 55 feet or more above the lowest level of fire department access, as provided by their truck-mounted ladders. High-rise buildings are now required to have several redundant fire and life safety systems in place, including automatic fire sprinklers and fire alarm detectors. There are currently no high-rise buildings meeting those criteria in Yucca Valley. The tallest structure in the Town of Yucca Valley is currently the Best Western Hotel & Suites on Highway 62, which is three stories high.

4.2.2 Regulatory Context

Effective fire protection cannot be accomplished solely through the acquisition of equipment, personnel and training. The area's infrastructure also must be considered, including adequacy of nearby water supplies, transport routes and access for fire equipment, addresses, and street signs, as well as maintenance.

The Town of Yucca Valley has adopted the 2010 California Fire Code as amended by the County, a modification of the International Fire Code. These provisions include sprinkler and fire hydrant requirements in new structures and remodels, road widths and configurations designed to accommodate the passage of fire trucks and engines, and requirements for minimum fire flow rates for water mains. The San Bernardino County Fire Department Chief is authorized and directed to enforce the provisions of the California Fire Code throughout the Town. The Town has also adopted the most recent (currently 2010) version of the California Building Code that includes sections on fire-resistant construction material requirements based on building use and occupancy. The construction requirements are a function of building size, purpose, type, materials, location, proximity to other structures, and the type of fire suppression systems installed.

Some of the more significant Fire Code items that help reduce the hazard of structural fire include requirements regarding fire-extinguishing systems such as automatic fire sprinklers. Fire sprinklers can help contain a fire that starts inside a structure from spreading to other nearby structures, and also help prevent total destruction of a building. The most recent version of the California Fire Code requires fire sprinklers in all new one- and two-family residential structures built after January 1, 2011.

Fire apparatus access to a burning structure is critical to the rapid containment of a fire. Given the size and weight configurations of fire engines, access roads need to comply with minimum width, maximum grade and surface requirements. Approved fire apparatus access roads need to be provided for every facility or building in Town. Fire apparatus roads need to extend to within 150 feet of all of the facility and all portions of the exterior walls of the first story of the building. In some areas, more than one road may be required if and when it is determined that access by a single road may be impaired by vehicle congestion, difficult terrain, weather conditions which could result in dangerous situations or other factors that could limit access. Furthermore, appropriate signage is important to identify the emergency access roads, and to identify the street number of a property, and the buildings therein.

Fire flow is the flow rate of water supply (measured in gallons per minute – gpm) available for fire fighting, measured at 20 pounds per square inch (psi; equal to 138 kPa) residual pressure. Available fire flow is the total water flow available at the fire hydrants, also measured in gallons per minute. The California Fire Code lists the minimum required fire-flow and flow duration for buildings of different floor areas and construction types; a reduction in required fire flow of 50 to 75% is allowed when the building is provided with an approved automatic sprinkler system. Fire flow requirements within commercial projects are based on square footage and type of construction of the structures. Minimum fire flow for any commercial structure is 1,500 gallons per minute (gpm) at a residual pressure of 20 psi, and can rise to 8,000 gpm, per Table A-III of the California Fire Code. For additional information regarding the required fire-flow for your building, contact the Town's Building and Safety Department and the San Bernardino County Fire Department. The Fire Department conducts inspections of all public fire hydrants in the Town of Yucca Valley to make sure that they are working properly at the appropriate flows for the area.

Emergency water storage is critical, especially when battling large structural fires or fires after earthquakes. During the 1993 Laguna Beach fire, water streams sprayed on burning houses sometimes fell to a trickle (Platte and Brazil, Los Angeles Times, 1993), primarily because of dwindling water pressure, inadequate pipeline connections and insufficient pumping capacity: most water reservoirs in Laguna Beach were located at lower elevations than the fire, and the water district could not supply water to the higher elevations as fast as the fire engines were using it.

Many of the sixteen existing water tanks owned by Hi-Desert Water District in Yucca Valley are located at higher surface elevations than the neighborhoods that they serve. This allows for a gravity-fed mechanism for water distribution. Nevertheless, regional gravity-fed water distribution systems can still be compromised, especially as a result of an earthquake. While the majority of pipeline failures during earthquakes occur due to fault rupture and lateral spreading, about 40% of the failures are due to wave propagation effects, such as amplification in sedimentary basins (O'Rourke and Liu, 1999). Studies conducted by Eguchi (1991) [as referenced in O'Rourke and Liu (1999)] indicate that damage to X-grade welded steel pipes as a result of wave propagation is typically an order of magnitude less than that for ductile iron pipes, and nearly two orders of magnitude less than that for welded steel gas-welded joint, concrete or asbestos cement pipes. Thus, municipalities that have an older utilities system that includes some of these more vulnerable pipe types should consider upgrading their systems to prevent significant pipeline failures during an earthquake.

Furthermore, as the Town grows to the south and north, and onto higher elevations, the existing water storage tanks may not be able to provide water to all these structures, unless the water is pumped. During and after an earthquake, if there is loss of electric power with a resultant failure of the water pumps, and there are substantial breaks in the water mains due to surface fault rupture, other types of surface failure, and ground shaking, large portions of Town may be left without water for days or weeks. Also important to consider is the fact that more than half of the existing water reservoirs in Yucca Valley do not have the seismic valves, flexible joints and other seismic upgrades that are now required in newer tanks (see Chapter 3, Section 3.2.2), based on lessons learned from the 1992 Landers and 1994 Northridge earthquakes. Damage to these tanks during an earthquake, in addition to leaking irrigation lines and open valves in damaged homes can reduce the amount of water available to fire fighters. A minimum seven-day emergency storage supply is recommended, especially in areas likely to be impacted by fires after earthquakes, due to the anticipated damage to the main water distribution system as a result of ground failure and/or weaknesses in the pipes due to corrosion or age.

4.3 Fire Suppression Services

Fire suppression services in the Town of Yucca Valley are provided by the San Bernardino County Fire Department, Division 5. The Fire Department provides all fire services including fire suppression, inspection, fire safety, rescue and emergency response (emergency medical and paramedic ambulance transportation). The San Bernardino County Fire Department also monitors the fire hazard in the Town, and has ongoing programs for public education, and the investigation and mitigation of hazardous situations. Fire-fighting resources in Yucca Valley include the fire

stations listed in Table 4-2 below. Stations 41 and 42 provide year-round service, whereas Station 38 is only manned when necessary, typically during the high-fire season months. The general telephone number for the Yucca Valley Fire Department is **760-365-3335. For emergencies, dial 911.**

Table 4-2: Fire Stations In and Near the Town of Yucca Valley

Station No.	Address, Phone, Service Area	Equipment, Personnel
41	57201 Twentynine Palms Hwy. (Hwy. 62), Yucca Valley, CA 92284 760-228-2160 Services the valley and southern portion of the Town, and responds to incidents as needed in Joshua Tree, Twentynine Palms, Morongo Valley. Assists the CDF with fire response in Joshua Tree National Park.	1 Type I engine, 1 Type III brush engine, 2 paramedic ambulances, 1 swift water rescue unit. The Type I engine and ambulances are regularly staffed. The brush engine and swift water unit are cross-staffed with the regular duty crew when necessary. Between the hours of 8AM and 8PM, the station is staffed with 6 people. At night, between 8PM and 8AM, the station is staffed with 4 people, with one of the ambulances taken out of service.
42	58612 Aberdeen Road Yucca Valley, CA 92284 760-228-1991 Services the Yucca Mesa area north of town, and responds to incidents in Landers, Johnson Valley, Pioneertown and Joshua Tree. Assists the CDF on all State Responsibility Areas west of Highway 247.	1 Type I Engine, 1 Water Tender, 1 Paramedic Ambulance, and 1 OES-rated light duty rescue unit. The water tender and rescue unit are cross-staffed as needed by the regular crew. Also houses 1 Type I reserve engine and 2 reserve ambulances.
38	5380 Mountain View Lane, Pioneertown, CA 92268 760-365-3650	1 utility unit staffed by one paid local firefighter that lives in the area.

San Bernardino County Fire Department's Division 5 administration, operations and community safety functions are located at 6942 Airway Avenue, Suite A, in Yucca Valley.

4.3.1 Response Objectives and Statistics

The National Fire Protection Association (NFPA Standard 1710, 2010) recommends the following objectives for fire departments:

- An alarm answering time of not more than 15 seconds for at least 95% of the alarms received, and not more than 40 seconds for at least 99% of the alarms received;
- When the alarm is received at a public safety answering point (PSAP) and transferred to a secondary answering point (or communication center), the agency responsible for the PSAP should have an alarm transfer time of not more than 30 seconds for at least 95% of all alarms processed;
- The responding fire department should have an alarm processing time (the time interval from when the alarm is acknowledged at the communication center until response information begins to be transmitted via voice or electronic means to emergency response facilities and emergency response units) of not more than 60 seconds for at

least 90% of the alarms, and not more than 90 seconds for at least 99% of the alarms;

- Turnout time for fire and special operations of 80 seconds, and turnout time for Emergency Medical Service (EMS) response of 60 seconds;
- Travel time of 240 seconds (4 minutes) or less for the arrival of the first arriving engine company at a fire suppression incident and 480 seconds (6 minutes) or less travel time for the deployment of an initial full alarm assignment at a fire suppression incident;
- Travel time of 240 seconds (4 minutes) or less for the arrival of a unit with first responder with automatic external defibrillator (AED) or higher level capability at an emergency medical incident;
- Travel time of 480 seconds (6 minutes) or less for the arrival of an advanced life support unit at an emergency medical incident, where this service is provided by the fire department, provided that a first responder with AED or basic life support unit arrived in 240 seconds (4 minutes) or less travel time.

The time recommendations for fire suppression incidents are based on the demands created by a structure fire: It is critical to attempt to arrive and intervene at a fire scene prior to the fire spreading beyond the room of origin, and this typically occurs within 8 to 10 minutes after ignition. In reality however, response times are going to vary depending on the distance between the responding fire stations and the incident location, the setting (urban, rural or outlying), traffic density and patterns, and conditions specific to the area that may hamper fire response times.

According to the San Bernardino County Fire Department, average response time for Station 41 is 6 minutes, 42 seconds. Average response time for Station 42 is 12 minutes, 20 seconds (Battalion Chief Benfield, written communication, June 2012). These averages include both response to calls close to the stations, and calls to the extreme limits of the stations' response areas, including areas outside of the Town of Yucca Valley. Station 42 services an extremely large area. As a result, response times can actually take 20 minutes or more because of the distance from the fire station to the incident. In addition to the large response area serviced by the Fire Department, response times in the Town of Yucca Valley can be impacted by a number of conditions. The most significant of these include congestion on Highway 62 during the late afternoons and early evenings, and the numerous unpaved (dirt) roads that limit driving speeds. Weather can impact response times too. Some of the Town roads are prone to flooding during storms. For example, Yucca Mesa Road and Old Woman Springs Road are the main arteries providing connection between the areas serviced by Station 42 (in northern Yucca Valley) and Station 41 (southern Yucca Valley). However, the intersection of Yucca Mesa Road and Barron Drive is typically closed due to flooding during storms, forcing all traffic between the two areas onto Old Woman Springs Road. Deep snow at higher elevations during the winter can also hinder or slow down emergency response.

The Insurance Services Office (ISO) provides rating and statistical information for the insurance industry in the United States. To do so, ISO evaluates a community's fire protection needs and services, and assigns each community evaluated a Public Protection Classification (PPC) rating. The rating is developed as a cumulative point system, based on the community's fire-suppression delivery system, including fire dispatch (operators, alarm

dispatch circuits, telephone lines available), fire department (equipment available, personnel, training, distribution of companies, etc.), and water supply (adequacy, condition, number and installation of fire hydrants). Insurance rates are based upon this rating. The worst rating is a Class 10. The best is a Class 1. The Town of Yucca Valley currently has a Class 5 ISO rating in the developed portions of the Town, and a rating of 9 in its outlying areas. As development in the area increases, additional fire stations will be required to serve the increasing population in a timely manner.

Another potential issue that can impact emergency response is multiple emergency alarms. These do occur occasionally, and when this happens, and simultaneous or numerous calls are received, the Fire Department dispatches the next closest available resource to the new incident. If necessary, the Fire Department relies on its Automatic and Mutual Aid Agreements with neighboring communities, as discussed further in Section 4.3.2.

In addition to the response time, there is another component called "set up" time. This is the time it takes firefighters to get to the source of a fire and get ready to fight the fire. This may range from 2 minutes at a small house fire to 15 minutes or more at a large or multi-story occupancy, such as a large apartment complex. Structure fire response requires numerous critical tasks to be performed simultaneously, and the number of firefighters required to perform the tasks varies based upon the risk.

The number of firefighters needed at a maximum high-risk occupancy, such as a shopping mall or large industrial occupancy is significantly higher than for a fire in a lower-risk occupancy. Given the large number of firefighters that are required to respond to a high-risk, high-consequence fire, Fire Departments routinely rely on automatic and mutual aid agreements to address the fires suppression needs of their community. If additional resources are needed due to the intensity or size of the fire, a second alarm may be requested. The second alarm results in the response of at least another two engine companies, and a ladder truck. Beyond this response, additional fire units are requested via the automatic or mutual aid agreements. These agreements are discussed further below.

4.3.2 Automatic and Mutual Aid Agreements

Although Stations 41 and 42 are tasked with the responsibility of fire prevention and fire suppression in Yucca Valley, in reality, fire-fighting agencies team up and work together during emergencies. These teaming arrangements are handled through automatic and mutual aid agreements, which obligate fire departments to help each other under pre-defined circumstances. ***Automatic aid*** agreements require the nearest fire company to respond to a fire regardless of the jurisdiction. ***Mutual aid*** agreements obligate fire department resources to respond outside of their district upon request for assistance.

The California Disaster and Civil Defense Master Mutual Aid Agreement (California Government Code Section 8555-8561) states: "Each party that is signatory to the agreement shall prepare operational plans to use within their jurisdiction, and outside their area." These plans include fire and non-fire emergencies related to natural, technological, and war contingencies. The State of California, all State agencies, all political subdivisions, and all fire districts signed this agreement in 1950.

Section 8568 of the California Emergency Services Act, (California Government Code, Chapter 7 of Division 1 of Part 2) states that "the State Emergency Plan shall be in effect in each political subdivision of the State, and the governing body of each political subdivision shall take such action as may be necessary to carry out the provisions thereof." The Act provides the basic authorities for conducting emergency operations following the proclamations of emergencies by the Governor or appropriate local authority, such as the Town Manager. The provisions of the act are further reflected and expanded on by appropriate local emergency ordinances. The act further describes the function and operations of government at all levels during extraordinary emergencies, including war (www.scesa.org/cal_govcode.htm). Therefore, local emergency plans are considered extensions of the California Emergency Plan.

The Town of Yucca Valley is one of 24 cities and towns (in addition to several self-governed Special Districts) that are part of the San Bernardino County Operational area. The Operational Area is part of the Standardized Emergency Management System (SEMS), further described below, which promotes effective disaster management, response and cooperation across jurisdictional boundaries. As a result of being part of an Operational Area group, all of the jurisdictions have mutual aid agreements that allow them to obtain additional emergency resources as needed from non-affected members in the group. Given their geographic locations, the fire stations in Joshua Tree and Landers (County Stations 36 and 19, respectively) are the first responders to mutual aid requests from the Town of Yucca Valley. Furthermore, each of these cities is signatory to a Joint Powers Agreement that provides for the joint use and operation of machinery, equipment, vehicles and personnel in the event of a fire, disturbance or other local emergency that cannot be met solely by the requesting city or jurisdiction. The automatic aid agreements provide for automatic dispatch of surrounding agencies when needed to replace units that are already responding to other calls (multiple alarms), in areas where two or more agencies border each other, or when the call type requires more units than the local area can provide. Mutual aid calls for units over and above what a first alarm assignments provide, generally on large incidents (like a fire in a large shopping center or apartment complex). In both automatic aid and mutual aid agreements, fire units are provided free of charge for the first 12 hours. After 12 hours, the agency with jurisdiction reimburses the assisting agencies for their costs.

Automatic aid and mutual aid agreements with other surrounding agencies include Morongo Valley Fire, CalFire, the Bureau of Land Management (BML), the National Park Service, Twentynine Palms Fire Department, and the Combat Center (Twentynine Palms Marine Base) Fire Department. Numerous other agencies are available to assist the San Bernardino County Fire Department if needed. These include the San Bernardino County Sheriff's Office and California Highway Patrol, who, depending on the location of the incident, would provide support during evacuations and to discourage people from traveling to the incident area to observe Fire Department operations, as this can hinder fire suppression and emergency response efforts. In addition to the agencies mentioned above, several other State and Federal agencies have roles in fire hazard mitigation, response and recovery, depending on the type of incident and its location. These agencies include the Office of Emergency Services, Office of Aviation Services, National Weather Service, the Department of the Interior and, in extreme cases, the Department of Defense. In forest and

open areas, agencies that provide fire suppression services include the National Park Service, U.S. Forest Service, National Association of State Foresters, Fish and Wildlife Service, and the Department of Agriculture. Private companies and individuals may also be asked to provide assistance in some cases.

4.3.3 Standardized Emergency Management System (SEMS) and National Incident Management System (NIMS)

The **SEMS** law refers to the ***Standardized Emergency Management System*** described by the Petris Bill (Senate Bill 1841; California Government Code Section 8607, made effective January 1, 1993) that was introduced by Senator Petris following the 1991 Oakland fires. The intent of the SEMS law is to improve the coordination of State and local emergency response in California. It requires all jurisdictions within the State of California to participate in the establishment of a standardized statewide emergency management system.

When a major incident occurs, the first few moments are absolutely critical in terms of reducing loss of life and property. First responders must be sufficiently trained to understand the nature and the gravity of the event to minimize the confusion that inevitably follows catastrophic situations. The first responder must then put into motion relevant mitigation plans to further reduce the potential for loss of lives and property damage, and to communicate with the public. According to the State's Standardized Emergency Management System, local agencies have primary authority regarding rescue and treatment of casualties, and making decisions regarding protective actions for the community. This on-scene authority rests with the local emergency services organization and the incident commander.

Emergency response in every jurisdiction in the State of California is handled in accordance with SEMS. Depending on the type of incident, several different agencies and disciplines may be called in to assist with emergency response. Agencies and disciplines that can be expected to be part of an emergency response team include medical, health, fire and rescue, police, public works, and coroner. The challenge is to accomplish the work at hand in the most effective manner, maintaining open lines of communication between the different responding agencies to share and disseminate information, and to coordinate efforts. The responsibilities of individual city agencies and personnel are typically defined in the city's Emergency Plan, a document that every jurisdiction is required to have. These documents describe the different levels of emergencies, the local emergency management organization, and the specific responsibilities of each participating agency, government office, and city staff.

The framework of the SEMS system is the following:

- Incident Command System – a standard response system for all hazards that is based on a concept originally developed in the 1970s for response to wildland fires;
- Multi-Agency Coordination System – coordinated effort between various agencies and disciplines, allowing for effective decision-making, sharing of resources, and prioritizing of incidents;
- Master Mutual Aid Agreement and related systems – agreement between cities,

counties and the State to provide services, personnel and facilities when local resources are inadequate to handle and emergency;

- Operational Area Concept – coordination of resources and information at the county level, including political subdivisions within the county; and
- Operational Area Satellite Information System – a satellite-based communications system with a high-frequency radio backup that permits the transfer of information between agencies using the system.

The SEMS law requires the following:

- Jurisdictions must attend training sessions for the emergency management system;
- All agencies must use the system to be eligible for funding for response costs under disaster assistance programs; and
- All agencies must complete after-action reports within 120 days of each declared disaster.

The September 11, 2001 terrorist attacks, and later, the 2004 and 2005 hurricane seasons demonstrated the need for improve the country's emergency management, incident response capabilities and coordination processes. On February 28, 2003, the President issued Homeland Security Presidential Directive 5 (HSPD-5), and in response, on March 1, 2004, the Department of Homeland Security unveiled the basic framework guiding the development and administration of the ***National Incident Management System*** (**NIMS**). NIMS provides a nationwide template that is meant to enable Federal, State, tribal, and local governments, in addition to non-governmental organizations and the private sector, to work together to "prevent, protect against, respond to, recover from, and mitigate the effects of incidents, regardless of cause, size, location, or complexity." NIMS is a core set of doctrines, concepts, principles, terminology and organizational processes that enable effective, efficient and collaborative incident management. NIMS works hand in hand with the National Response Framework (NRF), which provides the structure and mechanisms for national-level policy for incident management.

NIMS is the following:

- A comprehensive, nationwide systematic approach to incident management, including the Incident Command System, Multiagency Coordination Systems, and Public Information;
- A set of preparedness concepts and principles for all hazards;
- Essential principles for a common operating picture and interoperability of communications and information management;
- Standardized resource management procedures that enable coordination among different jurisdictions and organizations;
- Scalable, so that it may be used for all incidents (from day-to-day to large-scale); and
- A dynamic system that promotes ongoing management and maintenance.

NIMS components include:

- Preparedness;
- Communications and Information Management;
- Resource Management;
- Command and Management; and
- Ongoing Management and Maintenance.

HSPD-5 requires all Federal departments and agencies to adopt NIMS and use it in all their individual incident management and activities. *Furthermore, the directive requires Federal departments and agencies to make adoption of NIMS by State, tribal and local (i.e., cities) organizations a condition for receiving Federal preparedness assistance.* Given that the basic framework for NIMS was put together in short order, it was understood that it would be a work in progress. In the years since 2004, the NIMS process has been reviewed continuously to incorporate best practices and lessons learned from recent incidents. In 2005, all state, local and tribal jurisdictions were to adopt NIMS for all Departments/Agencies, and were to revise and update their emergency operations plans, standard operating procedures, and standard operating guidelines to incorporate NIMS and National Response Framework components, principles and policies. In 2008, local jurisdictions were to use existing resources, such as programs, personnel and training facilities to coordinate and deliver NIMS training requirements. These training requirements are based on a group of training courses at different levels have been developed and that all appropriate emergency response personnel at all levels of government are required to take to satisfy the NIMS objectives. The most recently published NIMS compliance metrics can be obtained from the Federal Emergency Management Agency (FEMA) website at http://www.fema.gov/emergency/nims/ and from the California Emergency Management Agency (CalEMA) at http://www.calema.ca.gov/PlanningandPreparedness/Pages/National-Incident-Management-System.aspx.

Consistent with both SIMS and NIMS requirements, San Bernardino Fire County personnel are required to train regularly. In fact, training is mandated to be a minimum of two hours per day, per person, at each station, time permitting. Each employee trains either individually and/or in groups, and participates in a formalized program of instruction (with a lesson plan, instructor, or instructional device) to acquire the skills and knowledge necessary to improve the employee's performance in his or her current position. Once a month, multiple crews train together in multi-company drills. Other annual training requirements that they meet include classes on confined-space entry, wildland fire training annual refreshers, etc. The County's training facility, at the Richard Sewell Training Center, provides continuing education courses, both online and in the classroom, for medical and hazardous materarials certifications, and a variety of specialized skills, such as knots and ropes equipment, thermal imaging, firefighter self survival, inspection and maintenance of fire extinguishers, swift water awareness, structural fireground strategy and tactics, fire behavior and fire weather, fire shelter deployment, etc.

4.4 Chemical Fires

Chemical substances are often unstable under high temperatures. Other chemicals are reactive to water or oxygen, and can self-ignite if exposed to water or air. For example, sulfuric acid, one of the most abundant and widely distributed chemicals produced in the U.S., is highly reactive when exposed in its concentrated form to water. Other substances if mixed together can also generate a fire. Therefore, when dealing with chemical fires it is important to know what type of chemicals are present in the area and where they are being stored or used. It is also important to note that when dealing with chemical fires, time is critical: the longer chemicals are exposed to extreme heat, the more likely that they will react violently, increasing the severity of the fire. Fire fighters can better respond to a situation with the appropriate equipment if they have the information needed to make these decisions immediately available to them. This is what the business plans and the Material Safety Data Sheets (MSDS) discussed in Chapter 5 – Hazardous Materials Management – are intended to provide.

Firefighters recognize four main different types of fires:

- **Class A** fires involve ordinary materials like paper, lumber, cardboard, and some types of plastics.
- **Class B** fires involve flammable or combustible liquids such as gasoline, kerosene, and common organic solvents.
- **Class C** fires involve energized electrical equipment, such as appliances, switches, panel boxes, power tools, and hot plates. Water is a particularly dangerous extinguishing medium for class C fires because of the risk of electrical shock.
- **Class D** fires involve combustible metals, such as magnesium, titanium, potassium and sodium, as well as pyrophoric organometallic reagents such as alkyllithiums, Grignards and diethylzinc. These materials burn at high temperatures and will react violently with water, air, and/or other chemicals.

It is not uncommon for fires to be a combination of the types discussed above. Therefore, it is typically recommended that fire extinguishers obtained for household and office use have an ABC rating, which means that they have the capacity to fight Class A, B and C fires.

Common types of extinguishers include:

- **Water extinguishers**, which are suitable for class A (paper, etc.) fires, but not for class B, C and D fires, because the water can make the flames spread.
- **Dry chemical extinguishers**, which are useful for class ABC fires and are the best all-around choice. They have an advantage over CO_2 extinguishers because they leave a blanket of non-flammable material on the extinguished material that reduces the likelihood of re-ignition. There are two kinds of dry chemical extinguishers:
  - Type BC fire extinguishers contain sodium or potassium bicarbonate, and
  - Type ABC fire extinguishers that contain ammonium phosphate.
- **CO_2 (carbon dioxide) extinguishers** are for class B and C fires. They do not work very well on class A fires because the material usually re-ignites. CO_2 extinguishers have an advantage over dry chemical extinguishers in that they leave behind no harmful residue – a good choice for an electrical fire on a computer or other delicate instrument. Note that

CO_2 is a bad choice for flammable metal fires such as Grignard reagents, alkyllithiums and sodium metal because CO_2 reacts with these materials. CO_2 extinguishers are not approved for class D fires.

- **Metal/Sand Extinguishers** are for flammable metals (class D fires) and work by simply smothering the fire.

Not only is it imperative to control chemical fires as soon as possible, but two main "by-products" of these types of fires require special attention, including special handling and evacuation procedures. These by-products include the "smoke plume" and water run-off from the fire-extinguishing process. The smoke plume has the potential to pose a severe hazard to those exposed to it: chemicals in the vapor phase can be mildly to extremely toxic if inhaled, depending on the chemicals involved. Smoke inhalation is a hazard in itself, but when chemicals are part of the smoke, it can have severe negative impacts on the health of those nearby, including fire-fighting personnel and individuals not evacuated in time to prevent them from inhaling the smoke. Soot from some types of fires can also cause chemical burns on skin. Therefore, depending on the types of chemicals involved in the fire, an evacuation of the immediate area and especially of those areas down-wind should be conducted.

If water is used to fight a fire, the runoff could include chemicals or substances that pose a hazard to the environment. Therefore, the runoff should be contained to prevent it from flowing into storm drains or leach fields. Containing the water runoff from a fire is difficult but possible, especially if the special equipment to do so is available.

4.5 Fires Following Earthquakes

Although wildland fires can be devastating, history shows that earthquake-induced fires have the potential to be the worst-case fire-suppression scenarios for a community because an earthquake typically causes multiple ignitions distributed over a broad geographic area, with the potential to severely tax the local fire suppression agencies. Furthermore, if fire fighters are involved with search and rescue operations, they are less available to fight fires. Fire suppression efforts can also be limited by a water distribution system that has been impaired by the earthquake. Thus, many factors affect the severity of fires following an earthquake, including ignition sources, types and density of fuel, weather conditions, functionality of the water systems, and the ability of firefighters to suppress the fires. The principal causes of earthquake-related fires are open flames, electrical malfunctions, gas leaks, and chemical spills. Downed power lines may ignite fires if the lines do not automatically de-energize. Unanchored gas heaters and water heaters are common problems, as these readily tip over during strong ground shaking (State law now requires new and replaced gas-fired water heaters to be attached to a wall or other support).

The major urban conflagrations of yesteryear in major cities were often the result of closely built, congested areas of attached buildings with no fire sprinklers, no adequate fire separations, no Fire Code enforcement, and narrow streets. In the past, fire apparatus and water supplies were also inadequate in many large cities, and many fire departments were comprised of volunteers. Many of these conditions no longer apply to the cities of today. Nevertheless, major earthquakes can result in fires and the loss of water supply, as it occurred in San Francisco in 1906, and more recently in Kobe, Japan in 1995. A large portion of the structural damage caused by the great San Francisco earthquake of 1906 was the result of fires rather than ground shaking. The moderately

sized, M6.7 Northridge earthquake of 1994 caused 15,021 natural gas leaks that resulted in three street fires, 51 structure fires (23 of these caused total ruin) and the destruction, by fire, of 172 mobile homes. In one incident, the earthquake severed a 22-inch gas transmission line and a motorist ignited the gas while attempting to restart his stalled vehicle. Response to this fire was impeded by the earthquake's rupture of a water main; as a result, five nearby homes were destroyed. Elsewhere, one mobile home fire started when a ruptured transmission line was ignited by a downed power line. In many of the destroyed mobile homes, fires erupted when inadequate bracing allowed the houses to slip off their foundations, severing gas lines and igniting fires.

Closer to home, the 1992 Landers earthquake caused two residential fires in Landers, most likely the result of propane gas leaks from overturned appliances; both structures burned down completely. In Yucca Valley, two mobile homes fell off their supports and ignited, also most likely as a result of severed propane gas lines or overturned gas appliances. One of these mobile homes was completely destroyed. Despite multiple breaks in the water distribution system, the San Bernardino County Fire Department reported sufficient water supply to fight these fires (EERI, 1992).

As the examples above indicate, fires following earthquakes can cause severe losses. In some instances, these losses can outweigh the losses from direct damage, such as the collapse of buildings and disruption of lifelines. This potential hazard is particularly applicable to the southern California area given its high seismic potential, and to the Town of Yucca Valley, given its location near several major active faults. Some of the faults that could cause significant ground shaking in Yucca Valley include the Pinto Mountain, Burnt Mountain, Eureka Peak, the South Johnson Valley and other faults that ruptured in the Landers earthquake, to mention a few. A strong earthquake on any of these faults could trigger multiple fires and disrupt lifelines services (such as the water supply) in Yucca Valley. The first four faults in the list above could also cause surface fault rupture in or near Yucca Valley, in addition to other forms of ground failure that could disrupt the local and regional infrastructure. For additional information regarding these seismic hazards, refer to Chapter 1.

The potential impact of fire following an earthquake in the Town of Yucca Valley could be evaluated using the loss-estimation software HazUS, a program developed for FEMA that estimates the losses that could occur as a result of a given earthquake scenario. This program uses a Monte Carlo simulation model to estimate the number of ignitions and the potential burn area resulting from a fire-after-earthquake scenario. Although a complete fire-following-earthquake model requires extensive input about the readiness of the local fire department and the types and availability (functionality) of the local water system, a simplified approach can be used to obtain a rough estimate of the potential losses associated with this hazard. The forecasting ability of the software is expected to improve as data garnered after future earthquakes provides a better understanding of the fire damage associated with different levels of ground shaking, differences in building construction type, and other factors.

A regional earthquake scenario that involves rupture of the entire southern section of the San Andreas fault was conducted in 2008 for the ShakeOut Scenario (Jones and others, 2008; Scawthorn, 2008). The scenario estimates that as a result of a magnitude 7.8 earthquake on the southern San Andreas, a total of 234 ignitions would occur in San Bernardino County. This estimate does not include ignitions that are suppressed by responding citizens. Of the estimated

234 ignitions that will require fire department response, 151 would develop into large fires, each requiring the response of more than one fire engine company. The estimated ultimate burnt area in the County would be equivalent to about 1,000 single-family dwellings (Scawthorn, 2008). Using the 1994 Northridge earthquake as proxy, about half of the ignitions are expected to be electric related, about a quarter would be gas related, and the rest would be the result of a variety of causes, including chemical reactions. Also based on the Northridge earthquake, about 70% of all ignitions will occur in residential structures. Although city-specific estimates were not computed as part of the ShakeOut scenario, the data clearly highlight the hazard associated with earthquake-induced fires. Response to these fires will be hindered by a damaged water distribution system, overwhelmed local fire department resources, overwhelmed 911 centers, and extremely delayed response from strike teams coming in from outlying areas due to damage to the transportation system and traffic disruption (Scawthorn, 2008).

Rupture of the Pinto Mountain fault through the heart of Yucca Valley could result in a significant number of earthquake-induced fires due to damage to the natural gas system. This is especially true if the natural gas system in Town includes several older sections that have not been seismically retrofitted. In support of this argument consider the following example from the Los Angeles area: In 1988 the California Division of Mines and Geology (now the California Geological Survey; Toppozada and others, 1988) published a study that identified projected damages in the Los Angeles area as a result of an earthquake on the Newport-Inglewood fault, a near-surface fault similar to the Pinto Mountain fault that extend across Yucca Valley. The Newport-Inglewood earthquake scenario estimated that thousands of gas leaks would result from damage to pipelines, valves and service connections. This study prompted the Southern California Gas Company to start replacing their distribution pipelines with flexible plastic polyethylene pipe, and to develop ways to isolate and shut off sections of supply lines when breaks are severe. Nevertheless, as a result of the 1994 Northridge earthquake, which occurred on a buried thrust fault that did not cause surface fault rupture, the Southern California Gas Company reported 35 breaks in its natural gas transmission lines and 717 breaks in its distribution lines. About 74% of the leaks were corrosion related. Thus, in an area like Yucca Valley where the local gas and water distribution systems have the potential to be impacted by surface fault rupture, a high percentage of breaks can be expected if the Pinto Mountain or any of the other faults through Town ruptures.

The San Bernardino County Fire Department (Battalion Chief Benfield, written communication, June 2012) has standard operating procedures immediately following an earthquake that include pulling all units out of the stations, checking the stations for damage, and then driving the local area to conduct damage surveys. If an earthquake is more severe, the local stations call for more resources as needed, including the activation of emergency operations centers, and the County's Office of Emergency Services. All County fire stations are equipped with emergency generators, and all have the ability to draft water from swimming pools and other bodies of water, a capability of great value, especially if the water distribution system has been damaged and the Fire Department has to resort to alternative water sources to fight fires.

4.6 Summary and Recommended Programs

The San Bernardino County Fire Department manages the fire hazard in the Town of Yucca Valley by providing fire prevention, suppression and public education programs, in addition to medical emergency response and transport. The Town and the County have invested and continue to

invest on infrastructure and equipment that help the Fire Department be as responsive as possible. However, their coverage area is large, and traffic congestion and bad weather at times hinder the Fire Department's response time to emergency calls. Yucca Valley's ISO ratings of 5 for the developed area and 9 for the outlying areas reflect the Insurance Services Office's assessment that fire suppression capabilities, especially in the outlying areas, are still in need of improvement. Mutual aid agreements with neighboring communities to the east, west and north help with response times, but additional fire resources will be necessary as the Town continues to grow.

Wildland fires have been and continue to pose a threat to the outlying areas of the Town, both to west-northwest and south. Several significant fires have encroached onto Yucca Valley from the Sawtooth Mountains and Joshua Tree National Park. As a result, the California Department of Forestry and Fire Protection (CDF) has identified the hillside areas of the Town as having a high to very high fire threat. The Town is also in the list of Communities at Risk, in part due to its location adjacent to or within Federal responsibility areas with a high to very high fire hazard. The National Park Service indicates that the potential future arrival of invasive, non-native grasses, such as buffelgrass, could result in a substantial change in the fire regime of the region, with an increase in the number and size of wildland fires, and an increase in the fire danger due to the high temperatures at which these grasses burn.

Several historical wildland fires have impacted the Yucca Valley area and surrounding communities (Plate 4-1). Cal FIRE has delineated several different areas in Town and surrounding areas as Federal, State or Local Responsibility Areas. The boundaries of these regions are shown on Plate 4-2. Residents of and near these high and very high fire hazard areas should be encouraged to practice fire-safe procedures, including maintaining a fire-safe landscape, and keeping combustibles (such as fire wood) a safe distance away from all structures. Similarly, the County and the Town of Yucca Valley should continue to enforce the weed abatement and notification program, to reduce the potential for vegetation fires to occur in vacant or poorly maintained lots.

Based on data provided by the San Bernardino County Fire Department for the years 2009 to 2012, fires in Yucca Valley account for about 2% of the annual emergency calls that the Fire Department receives. These data do not distinguish between vegetation fires and structure fires. Nevertheless, because of the potential losses, structure fires are considered a significant threat, and the Fire Department has identified several target hazards in Yucca Valley. These include the larger stores and shopping centers where a fire could result in high consequences. Other target hazards of concern include multi-family residential structures, especially older structures not fitted with internal fire sprinklers, and mobile homes, as these buildings typically do not perform well in fires. Thus, structure fires can represent a large percent of the total annual fire losses, especially if these are the result of an earthquake (see below). Programs that can be continued or implemented to reduce these losses should be encouraged.

An earthquake centered in the Town of Yucca Valley, especially if on the Pinto Mountain fault, has the potential to cause substantial damage to the Town and its infrastructure. Extensive damage to the water distribution system would result in substantial reduction in water available to fight fires immediately following the earthquake. Fire Station 41 is located near the Pinto Mountain fault, and although surface fault rupture is not likely to impact the station itself, damage to the surrounding streets and main arteries is expected to hinder the fire station's response, especially to the northern half of Yucca Valley, north of the Pinto Mountain fault zone. Structure fires caused by

an earthquake, the result of electric malfunctions, gas leaks, or toppled-over heat or flame sources, can occur simultaneously at several different locations throughout the Town. The multiple ignitions could severely tax the Fire Department, especially if the damaged roads hinder emergency response. Given the length and extent of the Pinto Mountain fault, other fire stations in adjacent communities (such as Joshua Tree, Twentynine Palms and Morongo Valley) that would normally provide support to the stations in Yucca Valley would find themselves responding to emergencies within their own service areas, further limiting response to impacted areas in Yucca Valley.

Specific actions that the Town of Yucca Valley and the San Bernardino County Fire Department can implement to increase their resiliency to fires are discussed below:

- Encourage residents in areas identified as having a high fire threat to continue fire-safe practices, including the maintenance of a fire-safe landscape, keeping combustibles a safe distance from all structures, etc. The Town and County Fire Department should also continue to enforce the weed abatement program to reduce the potential for vegetation fires.
- Continue to regularly reevaluate specific fire hazard areas and adopt reasonable safety standards, covering such elements as adequacy of nearby water supplies, routes or throughways for fire equipment, clarity of addresses and street signs, and maintenance.
- The Town should coordinate with Joshua Tree National Park to develop abatement procedures to control the spread of buffelgrass and other non-native invasive plant species before they take hold in the region.
- Encourage owners of non-sprinklered properties, especially high-occupancy structures, to retrofit their buildings and include internal fire sprinklers.
- Conduct emergency response exercises, including mock earthquake-induced fire-scenario exercises to prepare for the multiple ignitions that an earthquake is expected to generate. Civilians should be encouraged to participate in these exercises as much as possible also, to empower neighborhoods to be self-reliant in the face of a natural or man-made disaster. These training sessions should use the adopted emergency management systems (SEMS and NIMS).
- The Town should encourage the local gas purveyors and the owners of the high-pressure gas lines that extend through the Town to review and retrofit their pipelines, especially those sections that cross the Pinto Mountain, Burnt Mountain or Eureka Peak faults. The pipelines should be retrofitted, replaced or relocated where necessary. Shut-off valves and/or other mitigation measures designed to limit the release of gas or other products in the event of pipe breakage should be considered for those sections of pipelines that extend across, or overlie the faults that extend across the Town.
- The Hi-Desert Water District should review and improve as needed the adequacy of their water storage capacity and distribution network considering that surface fault rupture and ground failure can impact their systems during an earthquake. Priority should be given to older water lines that may be partially corroded and may therefore be more susceptible to breakage during an earthquake. Redundant systems should be considered and implemented in the downtown, developed portion of the Town on or near the Pinto Mountain fault, where ground failure could result in breaks to both the water and gas

mains, with the potential for significant fire damage.

- Continue to conduct regular assessments of the Fire Department's response objectives, to identify those areas that, because of increasing population and associated congestion, will require an increase in fire department presence and improved responsiveness. Specifically, as the Town's population increases, additional fire stations may be required, their locations to be selected based on population demands, and sited so as to avoid areas with a potential for surface fault rupture, landsliding, or flooding. Funding for the construction of these new fire stations could be supported in part by developers of proposed large-scale master-planned communities.

CHAPTER 5: HAZARDOUS MATERIALS MANAGEMENT

5.1 Setting and Definitions

A high standard of living has driven our increasing dependence on chemicals. Chemicals like hydrocarbon fuels, chlorine, pesticides and herbicides are used on a daily basis and in large quantities. Because of the high demand for these types of chemicals, their storage and transportation is necessary. Some industrial, commercial, manufacturing and military facilities also use hazardous materials, and releases of these compounds onto the environment, either intentionally or accidentally, even if it was years or decades ago, can still pose a threat to public health. Compounds that were used extensively decades ago, when regulations regarding the manufacture, use and storage of these substances were lax, have been found to be hazardous to human health and to the environment. In response to these concerns, which began in the late 1960s, Federal, State, and local regulations have been implemented to dictate the use, storage, transportation, handling and clean-up of hazardous materials and wastes. It is the aim of these regulations to minimize the risk of exposure to hazardous materials by the general public.

The United States Environmental Protection Agency (herein referred to as the EPA) has defined hazardous waste as substances: 1) that may cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness; 2) that pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of or otherwise managed; and 3) whose characteristics can be measured by a standardized test or reasonably detected by generators of solid waste through their knowledge of their waste. Hazardous waste is also ignitable, corrosive, or reactive (explosive) (EPA 40 CFR 260.10). A material may also be classified as hazardous if it contains defined amounts of toxic chemicals. The EPA has developed a list of specific hazardous wastes that are in the forms of solids, semi-solids, liquids, and gases. Producers of such wastes include private businesses, and Federal, State, and local agencies.

The State of California further defines hazardous materials as substances that are toxic, ignitable or flammable, reactive, and/or corrosive. The State also defines an extremely hazardous material as a substance that shows high acute or chronic toxicity, carcinogenity, bioaccumulative properties, is persistent in the environment, or is water reactive (California Code of Regulations, Title 22).

5.2 Regulatory Context and Lists of Sites

Various Federal and State programs regulate the use, storage, and transportation of hazardous materials. These will be discussed in this section as they pertain to the Town of Yucca Valley area and the Town's management of hazardous materials. The goal of the discussions presented herein is to provide information that can be used to reduce or mitigate the danger that hazardous substances may pose to the town's residents and visitors, both in normal, day-to-day conditions, and as a result of a regional disaster, such as an earthquake.

Several of the existing Federal and State programs are summarized in the subsections below.

5.2.1 Federal Clean Water Act (33 U.S.C. §1251 et seq., 1972) and California Water Code

In decades past, "out of sight, out of mind" used to be the traditional approach to dealing with trash, sediment, fertilizer-laden irrigation water, used motor oil, unused paint and

thinner, and other hazardous substances that people would dump onto the ground, or into the sewer and storm drains. What we now know is that substances dumped into the storm drain system will make their way into drainages, lakes, rivers, and eventually the ocean. Contaminants in these waterways can endanger aquatic organisms and wildlife dependent on these water sources, and can impact human health and the environment. Some substances dumped onto the ground will eventually make their way into the groundwater, with the potential for contamination of our drinking water resources. Soils contaminated with hazardous substances also require cleanup, as these soils are unacceptable as growing medium for crops, or as a foundation for buildings.

In part to deal with these issues, the Federal government enacted the Clean Water Act in 1972. This Act establishes the framework by which discharges of pollutants into the waters of the United States are regulated, including the establishment of quality standards for surface waters. One of the earliest programs established under the Act was the National Pollutant Discharge Elimination System (NPDES) to control wastewater discharges from various industries and wastewater treatment plants known as a "point sources." A point source is defined by the EPA as a discrete, easily discernible source of pollution, such as a smokestack or sewer. Then, in 1987, the Water Quality Act amended the NPDES permit system to include "non-point source" (NPS) pollution. NPS pollution refers to the introduction of bacteria, sediment, oil and grease, heavy metals, pesticides, fertilizers and other chemicals from less well-defined sources into our rivers, lakes, bays and oceans. These pollutants are not released at one specific, identifiable point, but rather, from a number of points that are spread out and are thus difficult to identify and control. The pollutants are washed away from roadways, parking lots, yards, farms and other areas by rain and dry-weather urban runoff into the storm drain system (if there is one), from where they are ultimately conveyed to the area's water bodies and the ocean. Contaminants can also be carried directly into the soil and the underlying groundwater basin by water infiltrating the soil. NPS pollution is now thought to account for most water quality problems in the United States. Therefore, strict enforcement of this program at the local level, with everybody doing his or her part to reduce NPS pollution, can make a significant difference.

The NPDES program is handled at the State-level by the California State Water Resources Control Board, with regional offices of the Board overseeing implementation and enforcement of the program at the local level. The regional office of the Board that oversees the Town of Yucca Valley area is Region 7 – Colorado River Basin, with their main office located at 73-720 Fred Waring Drive, Suite 100, Palm Desert, California 92260. Their general telephone number is (760) 346-7491. In accordance with the Clean Water Act, and the Porter-Cologne Water Quality Control Act (contained in Division 7 of the California Water Code), the Water Resources Control Board is responsible for the formulation and adoption of state policy for water quality control. This includes the development of water quality principles and guidelines for ground waters, surface waters and the use of reclaimed water; the formulation, adoption and periodic review and revision of water quality control plans; and the formulation and enforcement of waste discharge requirements (WDRs).

The Federal Clean Water Act states that individual households that are connected to a municipal system, use a septic system, or do not have a surface discharge, do not need an NPDES permit, but cities and facilities must obtain a permit if their discharges go directly to surface waters. Given that currently all wastewater in the Yucca Valley region is disposed through septic systems, and that discharges do not go to surface waters, the Town is not required to have a NPDES permit. However, the California Water Code states that anyone who is discharging or proposing to discharge wastewater onto land shall file a report with the Regional Water Quality Control Board. After review, and following any necessary hearings, the Board may impose waste discharge requirements on that individual or facility. All dischargers, except for small, residential, on-site systems, are required to complete and submit to the Regional Board a Report of Waste Discharge. The appropriate forms, including descriptions and instructions for each, can be obtained at http://www.waterboards.ca.gov/coloradoriver/water_issues/programs/permits.shtml.

Given that Yucca Valley obtains all of its drinking water from water wells in the area, protecting the groundwater from contamination is a priority. However, at this time all residents and businesses in the Town of Yucca Valley "use septic systems and subsurface disposal systems to treat and dispose of . . . wastewater" (Hi-Desert Water District 2010 Urban Water Management Plan by Kennedy/Jenks, 2011). This has contributed to an increase in the concentration of nitrates in the groundwater. A study conducted by the U.S. Geological Survey, in cooperation with the Hi-Desert Water District and the Mojave Water Agency (Nishikawa and others, 2003), showed that septage from septic tanks is the primary source for the high concentration of nitrate detected in several local wells after the Hi-Desert Water District began a groundwater recharge program in 1995. Recognizing the impact that septic systems can have on groundwater quality, the Regional Water Quality Control Board, in its 2004 Triennial Review and Workplan (final published in 2005), identified the Town of Yucca Valley, together with Twentynine Palms, Joshua Tree, Coachella Valley and Pinyon Pines, as areas of concern where they needed to evaluate and revise the Board's guidelines for sewage disposal from land developments. The workplan specifically discusses the need to consider sewer versus septic wastewater disposal, and the need to prohibit or limit the density of septic systems.

Starting in 2003, the Hi-Desert Water District used nitrate removal systems at some of its wells to reduce, to levels below the State's regulatory limits, the concentration of nitrates in the drinking water in its service area. Having achieved those goals, the program has been discontinued, but the equipment is still in place if needed again (M. Ban, Hi-Desert Water District, personal communication, July 2012). Following the U.S. Geological Survey's (Nishikawa and others, 2003) study, and recognizing that a long-term solution to the contamination of the regional groundwater resources was necessary, the Colorado River Basin office of the California Regional Water Quality Control Board, the Hi-Desert Water District, and the Town of Yucca Valley have developed plans for wastewater treatment and water reclamation of the basin. Specifically, in 2009, the Hi-Desert Water District adopted a revised Sewer Master Plan that includes a three-phase development of new sewer collection and treatment systems. The treated wastewater would then be used for groundwater recharge. The District plans to construct a water reclamation facility that will use a tertiary advanced treatment system to treat wastewater and generate effluent that

would then be delivered to recharge basins where it would percolate into and recharge the Warren Valley groundwater basin.

Phase 1 of this plan, which involves the construction of the water treatment facility and sewer connections in the central portion of Town, along the 29 Palms Highway corridor, is scheduled to be completed by 2016 to comply with the California Regional Water Quality Control Board's Resolution No. R7-2011-0004. This resolution stipulates certain prohibitions against the use of septic systems in the Town of Yucca Valley. For additional information and progress reports on the District's Water Reclamation Facility, Wastewater Treatment Plant and Sewer Collection System Project, refer to the Hi-Desert Water District's website at http://www.hdwd.com.

The Regional Board also monitors development projects during the construction stage. Specifically, all dischargers whose projects will disturb one or more acres of soil, or whose projects are less than one acre in size but that are part of a larger development that in total will disturb one or more acres of land are required to obtain a General Permit for Discharges of Storm Water Associated with Construction Activity, under Construction General Permit Order 2009-0009-DWQ adopted on September 2, 2009, and amended by Order No. 2010-0014-DWQ, effective February 14, 2011. Construction activity includes clearing, grading and disturbances such as stockpiling or excavation. The Construction General Permit requires the development of a Storm Water Pollution Prevention Plan (SWPPP). For additional information regarding this program, copies of the appropriate forms, and specifics regarding the contents of a SWPPP, refer to http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml.

5.2.2 Comprehensive Environmental Response, Compensation and Liability Act

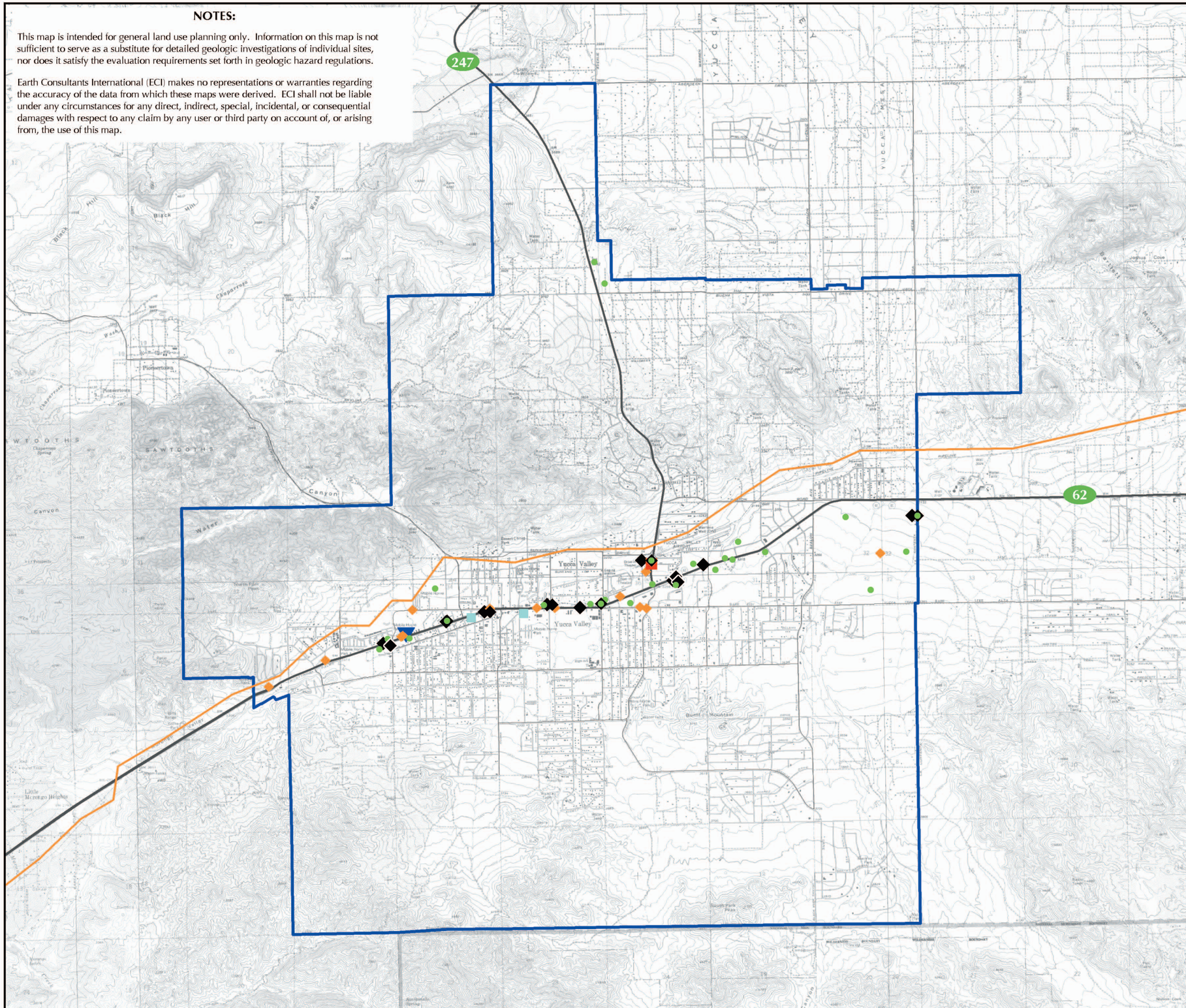
The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) is a regulatory or statute law developed to protect the water, air, and land resources from the risks created by past chemical disposal practices. This act is also referred to as the Superfund Act and contains the National Priority List (NPL) of sites, which are referred to as Superfund sites. Superfund is the name of the environmental program and fund established by CERCLA to address abandoned hazardous waste sites. The fund allows the EPA to clean up these sites and compel responsible parties to do the cleanup or to reimburse the government for the EPA-led cleanup. There are two main types of response actions authorized under CERCLA: 1) removal actions, and 2) remedial actions. Removal actions are short-term responses, often to address emergency situations that require a prompt response, such as the finding of abandoned drums containing hazardous materials or soils contaminated with a substance that poses an acute risk to human health or the environment. Remedial actions are typically long-term responses at sites in the National Priorities List (NPL) with the objective of permanently and significantly reducing the risk associated with the past release of hazardous substances at these sites.

According to the EPA (http://cfpub.epa.gov/supercpad/cursites/srchsites.cfm), there are no Superfund sites in the Town of Yucca Valley. However, in the EPA CERCLIS database (CERCLIS EPA ID CAN000908491), the Yucca Mercury Spill site at 7050 La Contenta

NOTES:

This map is intended for general land use planning only. Information on this map is not sufficient to serve as a substitute for detailed geologic investigations of individual sites, nor does it satisfy the evaluation requirements set forth in geologic hazard regulations.

Earth Consultants International (ECI) makes no representations or warranties regarding the accuracy of the data from which these maps were derived. ECI shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to any claim by any user or third party on account of, or arising from, the use of this map.



Hazardous Materials Site Map

Yucca Valley, California

Explanation

- EPA-Registered Large Quantity Hazardous Waste Generator (LQG) Facility
- EPA-Registered Small Quantity Hazardous Waste Generator (SQG) Facility
- EPA-Registered Hazardous Waste Generator Facility (size unknown)
- Leaking Underground Storage Tank (LUST) Site (closed cases shown in black)
- Permitted Underground Storage Tank (UST) Site
- Land Disposal Site
- Gas Transmission Line
- Yucca Valley Town Boundary

N
W E
S

Scale: 1:60,000

5000 0 5000
Feet

1200 0 1200
Meters

Base Map: USGS Topographic Map from Sure!MAPS RASTER, 1997
Source: http://iaspub.epa.gov/enviro; http://cfpub.epa.gov/supercpad/cursites/srchrslt.cfm; http://www.epa.gov/tri; http://www.dtsc.ca.gov/database/Transporters/trans_cnty.cfm; http://iaspub.epa.gov/enviro; http://geotracker.swrcb.ca.gov; http://nhdgeo.usgs.gov/viewer.htm

Earth Consultants International

YUCCA VALLEY GENERAL PLAN

Project Number: 3114
Date: 2011

Plate 5-1

Road, in Yucca Valley 92284 is listed as a Superfund site, although not included on the National Priority List. The site is also known as La Contenta Middle School, and was cleaned up with EPA fund-financed monies on an emergency basis on March 24-25, 2007. The cleanup consisted of removal of the contaminant, in this case, mercury. Given the one-time release and that the spill was cleaned up, this site is not included in Plate 5-1.

5.2.3 Emergency Planning and Community Right-To-Know Act

The primary purpose of the Federal Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 is to inform communities and citizens of chemical hazards in their area. Sections 311 and 312 of EPCRA require businesses to report the locations and quantities of chemicals stored on-site to state and local agencies. These reports help communities prepare to respond to chemical spills and similar emergencies.

The EPA maintains and publishes a database that contains information on toxic chemical releases and other waste management activities that are reported annually by certain industry groups and federal facilities. The database is referred to as the Toxics Release Inventory (TRI), and it was first established under the EPCRA and expanded by the Pollution Prevention Act of 1990. EPCRA's power has allowed for the mandate that Toxic Release Inventory (TRI) reports be made public. TRI reports provide information about potentially hazardous chemicals and their uses in an attempt to give the community more power to hold companies accountable and to make informed decisions about how such chemicals should be managed.

Section 3131 of EPCRA requires manufacturers to report releases to the environment of more than 600 designated toxic chemicals. These reports are submitted to the EPA and State agencies. The EPA compiles these data into an on-line, publicly available national digital TRI. These data are readily available on the EPA website at http://www.epa.gov/tri/. The facilities are required to report on releases of toxic chemicals to the air, soil, and water. They are also required to report on off-site transfers of waste for treatment or disposal at separate facilities. Pollution prevention measures and activities and chemical recycling must also be reported. All reports must be submitted on or before July 1 of every year and must cover all activities that occurred at the facility during the previous year. Reporting by facilities is based on the following factors:

- If the facility has ten or more full-time employees;
- If the facility manufactures or processes over 25,000 pounds of approximately 600 designated chemicals, or 28 chemical categories specified in the regulations, or uses more than 10,000 pounds of any designated chemical or category; and
- If the facility engages in certain manufacturing operations in the industry groups specified in the U.S. Government Standard Industrial Classification Codes (SIC) 20 through 39; or
- If the facility is a Federal facility.

A search of the TRI database on November 10, 2011 showed that there are no records of on-site or off-site disposed or otherwise released chemicals in zip codes 92284 and 92286,

the two zip codes that encompass the Town of Yucca Valley area. The database includes the most recent data released to the public on December 2010 with data for the year 2009. The EPA web site (http://www.epa.gov/tri/) should be reviewed periodically for updates to this information, including the potential future presence of other TRI sites in the Town of Yucca Valley area.

5.2.4 Resources Conservation and Recovery Act

The Resources Conservation and Recovery Act (RCRA) is the principal Federal law that regulates the generation, management and transportation of waste materials. Hazardous waste management includes the treatment, storage, or disposal of hazardous waste. Treatment is defined as any process that changes the physical, chemical, or biological character of the waste to make it less of an environmental threat. Treatment can include neutralizing the waste, recovering energy or material resources from the waste, rendering the waste less hazardous, or making the waste safer to transport, dispose of, or store. Storage is the holding of waste for a temporary period of time. The waste is treated, disposed of, or stored at a different facility at the end of the storage period. Disposal is the permanent placement of the waste into or on the land. Disposal facilities are usually designed to contain the waste permanently and to prevent the release of harmful pollutants to the environment.

Many different types of businesses can be producers of hazardous waste. Small businesses like dry cleaners, auto repair shops, medical facilities or hospitals, photo processing centers, and metal plating shops are usually generators of small quantities of hazardous waste. The EPA (Title 40 of the Code of Federal Regulations) defines a small quantity generator as a facility that produces between 100 and 1,000 kilograms (Kg) of hazardous waste per month (approximately equivalent to between 220 and 2,200 pounds, or between 27 and 275 gallons). A "conditionally exempt" small quantity generator is a business that generates 220 pounds (27 gallons) or less of hazardous waste per month.

Since some of these facilities are often small, start-up businesses that come and go, the list of small-quantity generators in a particular area typically changes over time. Sometimes, a facility remains, but the name of the business changes with new ownership. For this reason, please contact the San Bernardino County Fire Department, Hazardous Materials Division, or the EPA website for up-to-date information about generators of hazardous materials in the Town of Yucca Valley. As of November 10, 2011, there were 26 facilities in the Yucca Valley area reported as small-quantity generators. In addition, two sites are on the EPA list but their handler type (small-quantity generator, large quantity generator, or transporter) is unspecified. These facilities are included in Table 5-1, below, and their locations are depicted on Plate 5-1.

Larger businesses are sometimes generators of large quantities of hazardous waste. These generally include some gas stations, chemical manufacturers, large electroplating facilities, petroleum refineries, and military installations. The EPA defines a large-quantity generator as a facility that produces over 1,000 Kg (2,200 pounds or about 275 gallons) of hazardous waste per month. Large-quantity generators are fully regulated under RCRA. The EPA identifies one large-quantity generator in the Yucca Valley area as of November 2011 (see

top of Table 5-1 and Plate 5-1). Please note that these lists can change; therefore, to determine whether the list has been updated, and to obtain a more recent list, if available, contact the San Bernardino County Fire Department, Hazardous Materials Division, or refer to the EPA website.

Table 5-1: EPA-Registered Small- and Large-Quantity Generators of Hazardous Materials in the Town of Yucca Valley

Facility Name, Address	EPA ID	Type Facility
SCE Twentynine Palms Service Center 6999 Old Woman Springs Road, Yucca Valley 92284	CAR000195958	Large-Quantity Generator
Airway Surgicenter, Inc. 57463 29 Palms Highway, Suite 206, Yucca Valley 92284	CAD983651324	Small-Quantity Generator
Arco Facility No. 05215 57858 29 Palms Highway, Yucca Valley 92284	CAR000103549	Small-Quantity Generator
Arco Facility No. 09720 56888 29 Palms Highway, Yucca Valley 92284	CAR000104091	Small-Quantity Generator
Big K Mart No. 3811 57725 29 Palms Highway, Yucca Valley 92284	CAR000129478	Small-Quantity Generator
Bills Diesel Repair 4695 Old Woman Springs Road, Yucca Valley 92284	CAR000085654	Small-Quantity Generator
Blairs Body & Paint 56806 29 Palms Highway, Yucca Valley 92284	CAD982031486	Small-Quantity Generator
CALTRANS District 8 Paradise Valley 6690 La Contenta Road, Yucca Valley 92284	CAD982417784	Small-Quantity Generator
Circle K Store #902 6940 Old Woman Springs Rd., Yucca Valley 92284	CAD981679400	Small-Quantity Generator
City of Yucca Valley 58928 Business Center Drive, Yucca Valley 92284	CAR000069328	Small-Quantity Generator
George's Radiator Shop 56448 29 Palms Highway, Yucca Valley 92284	CAD982348559	Small-Quantity Generator
Hi Desert Disposal 7112 Miami Trail, Yucca Valley 92284	CAD982337933	Small-Quantity Generator
Hi Desert Disposal 4878 Newton Lane, Yucca Valley 92284	CAD983619560	Small-Quantity Generator
Home Depot USA HD 6971 58705 29 Palms Highway, Yucca Valley 92284	CAR000187336	Small-Quantity Generator
Laidlaw Transit 59267 Sunny Slope, Yucca Valley 92284	CAR000070995	Small-Quantity Generator
Norge Village Cleaners 56438 29 Palms Highway, Yucca Valley 92284	CAD981631393	Small-Quantity Generator
Oasis Cleaners 57109 29 Palms Highway, Yucca Valley 92284	CAD982488025	Small-Quantity Generator
Palm Springs Oil No. 15 55716 29 Palms Highway, Yucca Valley 92284	CAD981661135	Small-Quantity Generator
Phelps Chevrolet Nissan 57909 29 Palms Highway, Yucca Valley 92284	CAR000174698	Small-Quantity Generator
Phelps Chevrolet Nissan 56916 29 Palms Highway, Yucca Valley 92284	CAD98200261	Small-Quantity Generator

Facility Name, Address	EPA ID	Type Facility
Rite Aid No. 5686 57646 29 Palms Highway, Yucca Valley 92284	CAR000107680	Small-Quantity Generator
Truck and Equipment Service 4695 Old Woman Springs Road, Yucca Valley 92284	CAR000085654	Small-Quantity Generator
Valley Cleaner 55435 29 Palms Highway, Yucca Valley 92284	CAD981623531	Small-Quantity Generator
Walgreens No. 6399 58133 29 Palms Highway, Yucca Valley 92284	CAR000108894	Small-Quantity Generator
Walmart No. 1915 57980 29 Palms Highway, Yucca Valley 92284	CAR000206607	Small-Quantity Generator
Yucca Valley Chrysler Center 55288 29 Palms Highway, Yucca Valley 92284	CAD983588617	Small-Quantity Generator
Yucca Valley Ford Lincoln Mercury 55189 29 Palms Highway, Yucca Valley 92284	CAD981615495	Small-Quantity Generator
Circle K Store #539 55899 29 Palms Highway, Yucca Valley 92284	CAD981679897	Unknown
CQ of Yucca Valley, No. 7714 56315 29 Palms Highway, Yucca Valley 92284	CAR000216036	Unknown

Source: EPA's EnviroMapper data search performed November 10, 2011.

According to the RCRA database, there is one facility in the Town of Yucca Valley listed as a transporter (Scott Crane at 56826 Mountain View Trail, Yucca Valley 92284). However, this company is not registered in the Department of Toxic Substances Control (DTSC) official database of hazardous waste transporters in the state of California (http://www.dtsc.ca.gov/database/Transporters/trans_city.cfm). Since all transporters of hazardous waste have to be registered with the DTSC in order to operate in the state, this company is most likely no longer in business or operating as a transporter. For this reason, this company is not included in Plate 5-1. The DTSC database does not include any transporters registered in Yucca Valley. Notwithstanding the fact that there are no transporters of hazardous waste registered in Yucca Valley, hazardous waste is being transported through the area by transporters registered or based elsewhere. This is discussed further in Section 5.6.

5.2.5 Cortese List

This California legislation (Government Code § 65962.5) was originally enacted in 1985, and became effective on January 1, 1992. The code required several different State agencies to compile and update annually a list of hazardous materials sites as indicated below, and submit these lists to the Secretary for Environmental Protection. The Secretary was to consolidate all the information received and then forward the complete list of sites to each city and county with sites on the composite list.

1. The California Department of Toxic Substances Control (DTSC) [Subsection 65962.5. (a)] was to compile information on:

- All hazardous waste facilities subject to corrective action pursuant to Section 25187.5 of the Health and Safety Code;
- All land designated as hazardous waste property or border zone property pursuant to Article 11 (commencing with Section 25220) of Chapter 6.5 of Division 20 of the Health and Safety Code;
- All information received by the Department of Toxic Substances Control pursuant to Section 25242 of the Health and Safety Code on hazardous waste disposals on public land;
- All sites listed pursuant to Section 25356 of the Health and Safety Code; and
- All sites included in the Abandoned Site Assessment Program.

2. The State Department of Health Services [Subsection 65962.5. (b)] was to compile data on:

   - All public drinking water wells that contain detectable levels of organic contaminants and that are subject to water analysis pursuant to Section 116395 of the Health and Safety Code.

3. The State Water Resources Control Board [Subsection 65962.5. (c)] was to compile:

   - All underground storage tanks for which an unauthorized release report is filed pursuant to Section 25295 of the Health and Safety Code (this list is now available from GeoTracker, see Section 5.3);
   - All solid waste disposal facilities from which there is a migration of hazardous waste and for which a California Regional Water Quality Control Board office has notified the Department of Toxic Substances Control pursuant to subdivision (e) of Section 13273 of the Water Code; and
   - All cease and desist orders issued after January 1, 1986, pursuant to Section 13301 of the Water Code, and all cleanup or abatement orders issued after January 1, 1986, pursuant to Section 13304 of the Water Code, that concern the discharge of wastes that are hazardous materials.

4. The local enforcement agency, as designated pursuant to Section 18051 of Title 14 of the California Code of Regulations, shall submit to the California Integrated Waste Management Board [Subsection 65962.5. (d]:

   - All solid waste disposal facilities from which there is a known migration of hazardous waste.

Most of this information is now available directly from the various individual state agencies that make the data available on their respective websites. Furthermore, some of the activities required under this code are no longer being implemented, and in some cases, the information to be contained in the Cortese list does not exist (http://www.calepa.ca.gov/sitecleanup/corteselist/Background.htm). There are no sites in Yucca Valley listed in the Cortese List. The closest site is the Twentynine Palms Marine Air

to Ground Combat Center north of Twentynine Palms and, at a minimum, 20 miles to the northeast of the Town of Yucca Valley.

5.2.6 Hazardous Materials Disclosure Program

Both the Federal government (Code of Federal Regulations, EPA, SARA and Title III) and the State of California (California State Health and Safety Code, Division 20, Chapter 6.95, Sections 25500–25520; California Code of Regulations, Title 19, Chapter 2, Sub-Chapter 3, Article 4, Sections 2729-2734) require all businesses that handle more than a specified amount of hazardous materials or extremely hazardous materials, termed a reporting quantity, to submit a Hazardous Materials Emergency/Contingency Plan (also known as the Hazardous Materials Business Plan) to its local Certified Unified Program Agency (CUPA). The CUPA with responsibility for the Town of Yucca Valley is the Hazardous Materials Division of the San Bernardino County Fire Department (SBCFD-HMD). The Business Plan includes the Business Owner/Operator Identification page, Hazardous Materials Inventory – Chemical Description page, and an Emergency Response Plan and Training Plan.

According to the guidelines spelled out in the website of the San Bernardino County Fire Department – Hazardous Materials Division (http://www.sbcfire.org/hazmat/forms_guidelines.aspx#Hazardous), the preparation, submittal and implementation of a Business Activity Form is required by all businesses that handle a hazardous material or a mixture containing a hazardous material in quantities equal to, or greater than, those outlined below:

- All hazardous waste generators, regardless of quantity generated or size of container.
- Any business that uses, generates, processes, produces, treats, stores, emits, or discharges a hazardous material in quantities at or exceeding:
  - 55 gallons or more of a liquid;
  - 500 pounds or more of a solid; or
  - 200 cubic feet (compressed) of gas

  at any one time in the course of a year.
- Any business that handles, stores, or uses Category (I) or (II) pesticides, as defined by the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), regardless of amount.
- Any business that handles Department of Transportation (DOT) Hazard Class 1 (Explosives, as defined in Title 49 of the Code of Federal Regulations) regardless of amount.
- Any business that handles extremely hazardous substances in quantities exceeding the threshold planning quantity, as listed in Title 40 of the Federal Code of Regulations, Part 355.
- Any business subject to the EPCRA (also known as SARA Title III; see Section 5.2.3 above). Generally EPCRA includes facilities that handle hazardous substances above 10,000 pounds, or extremely hazardous substances above threshold

planning quantities. Some exceptions include retail gas stations with up to 75,000 gallons of gasoline or 100,000 gallons of diesel if their underground storage tanks meet the 1998 upgrade requirements.

- Any business that handles radioactive materials in quantities for which an emergency plan is required to be adopted, pursuant to Parts 30, 40 or 70 of Chapter 10, Title 10, Code of Federal Regulations (CFR), or pursuant to any regulations adopted by the State in accordance with those regulations.

All Business Plans need to be updated by March 1st of each year (beginning January 1, 2013, all CUPA forms will have to be submitted electronically), or within 30 days of a substantial change. Businesses are required to submit an amendment to their business plan to the CUPA if any of the following events occur:

- A change in inventory;
- Any change in site conditions that may significantly impact emergency response;
- Change of mailing address, phone number or business location; change of emergency contact person;
- Change of ownership; or
- Change of business name.

Business plans must include an inventory of the hazardous materials at the facility. The entire Business Plan needs to be reviewed and re-certified every three years. Business plans are required to include emergency response plans and procedures to be used in the event of a significant or threatened significant release of a hazardous material. These plans need to identify the procedures to follow for immediate notification to all appropriate agencies and personnel of a release, identification of local emergency medical assistance appropriate for potential accident scenarios, contact information for all emergency coordinators of the business, a listing and location of emergency equipment at the business, an evacuation plan, and a training program for business personnel. All facilities must keep a copy of their plan on site.

Additional and specific information regarding business plans and the CUPA forms required by the San Bernardino County Fire Department are available at http://www.sbcfire.org/hazmat/forms_guidelines.aspx#Hazardous. The offices of the Hazardous Materials Division are located at 620 South "E" Street, San Bernardino, California 92415-0153, and they are available by phone at (909) 386-8401 between 8:00 AM and 5:00 PM, Monday through Friday.

Business plans are designed to be used by responding agencies, such as the San Bernardino County Fire Department, during a release or spill to allow for a quick and accurate evaluation of each situation for appropriate response. Businesses that handle hazardous materials are required by law to provide an immediate verbal report of any release or threatened release of hazardous materials if there is a reasonable belief that the release or threatened release poses a significant present or potential hazard to human

health and safety, or to property or the environment. Fines of up to $25,000 per day and one year in prison may be awarded to an individual or business if a release or threatened release is not reported. If a release involves a hazardous substance listed in Title 40 of the Code of Federal Regulations in an amount equal to or exceeding the reportable quantity for that material, a notice must be filed with the California Office of Emergency Services within 15 days of the incident.

The San Bernardino County Fire Department Hazardous Materials Division is charged with the responsibility of conducting compliance inspections of regulated facilities in San Bernardino County (with the exception of Victorville). Specialists are assigned countywide to address the wide variety of complex issues associated with hazardous substances. For example, all new installations of underground storage tanks require an inspection, along with the removal, under strict chain-of-custody protocol, of the old tanks (see Section 5.3 below).

5.2.7 Hazardous Materials Incident Response

There are thousands of different chemicals available today, each with unique physical characteristics; what might be an acceptable mitigation practice for one chemical could be totally inadequate for another. Therefore it is essential that agencies responding to a hazardous material release have as much available information as possible regarding the type of chemical released, the amount released, and its physical properties to effectively and quickly evaluate and contain the release. The EPA-required business plans are an excellent resource for this type of information. Other sources of information are knowledgeable facility agents or employees present onsite.

In 1986, Congress passed the Superfund Amendments and Reauthorization Act (SARA). Title III of this legislation requires that each community establish a Local Emergency Planning Committee (LEPC) that is responsible for developing an emergency plan to prepare for and respond to chemical emergencies in their community.

This emergency plan must include the following:

- An identification of local facilities and transportation routes where hazardous materials are present;
- The procedures for immediate response in case of an accident (this must include a community-wide evacuation plan);
- A plan for notifying the community that an incident has occurred;
- The names of response coordinators at local facilities; and
- A plan for conducting exercises to test the plan.

The plan is reviewed by the State Emergency Response Commission (SERC) and publicized throughout the community. The LEPC is required to review, test, and update the plan each year.

The San Bernardino County Office of Emergency Services (OES), the San Bernardino County Fire Department, the Hazardous Materials Division, and the Town of Yucca Valley Emergency Preparedness Division are all responsible for coordinating hazardous material and disaster preparedness planning and appropriate response efforts with other Town of Yucca Valley departments, as well as local and State agencies. The goal is to improve public and private sector readiness, and to mitigate local impacts resulting from natural or man-made emergencies. The OES is a branch of the San Bernardino County Fire Department that deals with the planning for and response to natural and technological disasters in the County, whereas the Fire Department's Hazardous Materials Division deals with the coordination and inspection of hazardous materials facilities in the County and in the Town of Yucca Valley. The San Bernardino County Fire Department has developed and teaches a Community Emergency Response Team (CERT) training program to help county residents prepare for potential disasters. The CERT training generally consists of seven sessions, one evening a week over a seven-week period, for a total of 20 hours of instruction. The program is certified by the Federal Emergency Management Agency (FEMA) and the State OES. For more information on the CERT program, contact the San Bernardino County Office of Emergency Services CERT Program at (909) 356-3998 or visit http://www.sbcfire.org/oes/csc_cert.aspx. Information on CERT training held locally in Yucca Valley is also available at Town Hall. The Town of Yucca Valley is one of nine jurisdictions within the County currently supporting a Citizens Corps Program. This program is designed to engage residents in community and family safety programs by helping families and neighbors prepare for a disaster. For additional information, refer to the California Service Corps website at http://www.csc.ca.gov.

In 1984, San Bernardino County formed a regional hazardous materials emergency response team through a joint effort of the San Bernardino County Fire Chiefs Association, the San Bernardino County Department of Environmental Health Services, and the County's Communications Center (http://www.sbcfire.org/hazmat/ER.aspx). The formation of this response team was motivated by the need for highly trained personnel and expensive, specialized equipment to respond to hazardous materials incidents. The County's Hazardous Materials Response team now has more than 100 personnel, all trained to the State Fire Marshal-approved Hazardous Material Specialist level, and 19 response vehicles equipped to respond to hazardous release incidents. The County's Hazardous Materials Response Team is divided into three geographic locations, allowing them to quickly respond to hazardous materials incidents anywhere within the county. County Fire Station 36 in Joshua Tree has trained HazMat technicians and equipment, allowing them to make quick assessments and provide resource and mitigation recommendations to the incident commander in real time. The Twentynine Palms Combat Center Fire Department also has fully trained hazardous materials technicians and a large compliment of equipment. They are available to assist on any and all hazardous materials incidents in the Town of Yucca Valley. Finally, the County's Hazardous Materials Response Team in San Bernardino can and will respond to incidents in Yucca Valley (Battalion Chief Benfield, written communication, June 2012).

San Bernardino County Fire Department Hazardous Materials Team members are capable of monitoring unknown atmospheres, identifying unknown chemicals, plugging, patching

and intervening in large chemical leaks, conducting mass decontamination, and handling confined space entry rescue operations. The hazardous materials team members often also assist local fire stations with medical emergencies, structural fires and mass casualty incidents.

5.2.8 Hazardous Material Spill/Release Notification Guidance

All significant spills, releases, or threatened releases of hazardous materials must be immediately reported. **To report all significant releases or threatened releases of hazardous materials, first call 911** (or the local emergency response agency), and then call the Governor's OES Warning Center at 1-800-852-7550.

This guidance summarizes pertinent emergency notification requirements and applies to all significant releases of hazardous materials. Requirements for immediate notification of all significant spills or threatened releases cover: Owners, Operators, Persons in Charge, and Employers. Notification is required regarding significant releases from facilities, vehicles, vessels, pipelines and railroads.

State notification requirements for a spill or threatened release include (at a minimum):

- Identity of caller,
- Location, date and time of spill, release, or threatened release,
- Substance and quantity involved,
- Chemical name (if known; also report whether or not chemical is extremely hazardous), and
- Description of what happened.

Federal notification requires additional information for spills (CERCLA chemicals) that exceed Federal-reporting requirements. This information includes:

- Medium or media impacted by the release,
- Time and duration of the release,
- Proper precautions to take,
- Known or anticipated health risks, and
- Name and phone number for more information.

Many State statutes require emergency notification of a hazardous chemical release. These statutes include:

- Health and Safety Codes §25270.7, 25270.8, and 25507,
- Vehicle Code §23112.5,
- Public Utilities Code §7673, (PUC General Orders #22-B, 161),
- Government Code §51018, 8670.25.5 (a),

- Water Codes §13271, 13272, and
- California Labor Code §6409.1 (b)10.

In addition, all releases that result in injuries, or workers harmfully exposed, must be immediately reported to Cal/OSHA (CA Labor Code §6409.1 (b)). For additional reporting requirements, also refer to the Safe Drinking Water and Toxic Enforcement Act of 1986, better known as Proposition 65, and §9030 of the California Labor Code.

The California Accidental Release Prevention Program (CalARP) became effective on January 1, 1997 in response to Senate Bill 1889. The CalARP replaced the California Risk Management and Prevention Program (RMPP). Under the CalARP, the Governor's Office of Emergency Services must adopt implementing regulations and seek delegation of the program from the EPA. The CalARP aims to be proactive and therefore requires businesses to prepare Risk Management Plans (RMPs), which are detailed engineering analyses of:

- The potential accident factors present at a business, and
- The mitigation measures that can be implemented to reduce this accident potential.

In most cases, local governments have the lead role in working directly with businesses in this program. The County of San Bernardino Fire Department, Hazardous Materials Division is designated as the Administering Agency for hazardous materials in the Town of Yucca Valley.

5.3 Leaking Underground Storage Tanks

Leaking underground storage tanks (LUSTs) have been recognized since the early 1980s as the primary cause of groundwater contamination by gasoline compounds and solvents. In California, regulations aimed at protecting against underground storage tank (UST) leaks have been in place since 1983, one year before the Federal Resource Conservation and Recovery Act (RCRA) was amended to add Subtitle I requiring UST systems to be installed in accordance with standards that address the prevention of future leaks. These Federal laws are found in the Code of Federal Regulations (CFR), parts 280-281. The State law and regulations are found in the California Health and Safety Code, Division 20, Chapter 6.7, and in the California Code of Regulations Title 23, Division 3, Chapter 16, commonly referred to as the "Underground Tank Regulations." Federal and State programs include leak reporting and investigation regulations, and standards for clean up and remediation. UST cleanup programs are available to fund the remediation of contaminated soil and ground water caused by leaking tanks. California's program is more stringent than the Federal program, requiring that all tanks be double walled, and prohibiting gasoline delivery to non-compliant tanks. The State Water Resources Control Board (SWRCB) has been designated the lead regulatory agency in the development of UST regulations and policy.

Older tanks were typically single-walled steel tanks. Many of these leaked as a result of corrosion and detached fittings. As a result, the state of California required the replacement of older tanks with new double-walled, fiberglass tanks with flexible connections and monitoring systems. UST owners were given a ten-year period to comply with the new requirements, and the deadline came

due on December 22, 1998. However, many UST owners did not act by the deadline, so the State granted an extension for the Replacement of Underground Storage Tanks (RUST) program to January 1, 2002. Nevertheless, in that RUST loan funds are still available in 2011 indicates that there are still UST owners, typically small, independent operators that have yet to comply with the RUST requirements. RUST loans, ranging from $10,000 to $750,000 (maximum per person or entity), can be used to finance up to 100% of the costs to upgrade USTs by installing containment sumps, double-walled piping, dispensers, under-dispenser containment boxes or pans, electronic monitoring systems, and enhanced vapor recovery systems. The funds can also be used to conduct enhanced leak detection tests. For additional information on this program, refer to http://www.swrcb.ca.gov/water_issues/programs/ustcf/rust.shtml.

The California legislature established the Barry Keene Underground Storage Tank Cleanup Fund Act of 1989 to provide a means for petroleum UST owners and operators to meet the Federal and state requirements, and to assist small businesses and individuals by providing reimbursement for unexpected and catastrophic expenses associated with the cleanup of leaking petroleum USTs. The fund also provides money to the Regional Water Quality Control Boards to cleanup abandoned sites or abate emergency situations that pose a threat to human health, safety and the environment as a result of a petroleum release from an UST (http://www.swrcb.ca.gov/water_issues/programs/ustcf/). Revenues for the Fund are generated by a storage fee for every gallon of petroleum product placed into a UST. The State Board of Equalization collects these fees on a quarterly basis from owners of active USTs. In the last few years, the fund has experienced a cash shortage. As a result, in May 2009, the State Water Resources Control Board passed Resolution No. 2009-0042 that defines specific actions that the Regional Boards are to take to improve administration of the UST Cleanup Fund and the UST Cleanup Program. The most significant decision in this resolution is that the Regional Boards are to review the open UST cleanup cases and identify those where continued investigation, remediation or monitoring poses little to no environmental benefit. Those sites open for more than five years that are found to not pose a threat to water quality or sensitive receptors, will be recommended for closure.

Recently, the State Water Resources Control Board received a federal grant from the U.S. Environmental Protection Agency using American Recovery and Reinvestment Act funds to cleanup leaks from underground storage tanks. The funds are available to eligible applicants under a new program called the Orphan Site Cleanup Fund (OSCF) or Orphan Site Fund. Orphan sites are sites contaminated by leaking petroleum underground storage tanks where there is no financially responsible party. Additional information on this program, including eligibility requirements and copies of the application for funding can be obtained at http://www.swrcb.ca.gov/water_issues/programs/ustcf/oscf.shtml.

The California Regional Water Quality Control Board (CRWQCB), in cooperation with the Office of Emergency Services, maintains an inventory of leaking underground storage tanks (LUSTs) in a Statewide database called GeoTracker, which is available at http://geotracker.swrcb.ca.gov/. The database lists ten reported LUST cases in the Yucca Valley area. According to the LUST database, all ten sites have been remediated and closed. The ten cases are listed in Table 5-2, below, and their approximate location is shown on Plate 5-1. Given that there are at least 13 permitted underground storage tank (UST) locations in the Town of Yucca Valley area (see Plate 5-1), new

leaks from these USTs could be reported in the future. Therefore, the GeoTracker list should be reviewed periodically for information regarding any new leaks.

Because of the deep groundwater table in the Town of Yucca Valley area, all ten reported leaks listed in Table 5-2 reportedly impacted the soil only; that is, none of the leaks impacted groundwater. In cases like these, the stained soils are generally excavated and replaced with clean soil, and the contaminated soil is then shipped to a facility that accepts hazardous materials. Specific information about each of these sites, including any reports submitted to the Regional Board by the consultants that conducted the cleanups, if available, can be found at the GeoTracker site (http://geotracker.swrcb.ca.gov/).

Table 5-2: Leaking Underground Fuel Tanks Reported in the Town of Yucca Valley

Site Name	Address	State Case No.	Case Type	Status, Contaminant (Date Case Closed)	Date Leak Discovered
7-11 Station	55277 29 Palms Highway	T0607100988	S	5, G (7/23/1999)	11/23/1998
Arco #9720	56888 29 Palms Highway	T0607161914	S	5, G (5/9/2003)	7/3/2001
Bills Service	56504 29 Palms Highway	T0607100990	S	5, FO, G (8/26/2004)	4/14/1999
Caltrans Paradise Valley	6690 La Contenta Road	T0607100985	S	5,G (9/21/1990)	4/28/1987
Circle K #902	6940 Old Woman Springs Road	T0607100984	S	5, G (2/24/1988)	6/11/1987
EZ Serve Station	56079 29 Palms Highway	T060710987	S	5, G (9/9/1999)	8/15/1995
Goodyear Tire	57672 29 Palms Highway	T0607100986	S	5, O (4/21/1995)	11/16/1994
Mag Gas	55716 29 Palms Highway	T0607100989	S	5, G (8/25/1999)	11/9/1998
San Bernardino Co. Yucca Valley Forest Fire	7105 Airway Avenue	T0607100983	S	5, G (7/16/1984)	7/16/1984 & 9/9/1999
Thrifty Oil Station #350	56888 29 Palms Highway	T0607125003	S	5, G (9/19/1990)	7/12/1989

Source: GeoTracker (http://geotracker.swrcb.ca.gov/), based on search conducted November 10, 2011.

Abbreviations Used for Case Type: S = **Soil contaminated, groundwater not impacted**; **G** = Aquifer used for drinking water supply impacted; **O** = Other groundwater (uses other than drinking water); **U** = Under investigation.
Abbreviations Used for Status: 1 = Case Opened; **2** = Site Assessment; **3** = Remediation; **4** = Assessment and Interim Remedial Action; **5 = Case Closed.**
Abbreviations Used for Contaminant: D = Diesel; G = Gasoline; **S** = Other Solvent or Non-Petroleum Hydrocarbon; **O = Waste Oil / Motor / Hydraulic / Lubricating**; **P** = Petroleum / Fuels / Oils, Volatile Organic Compounds; **FO = Fuels Oxygenate**.

5.4 Drinking Water Quality

Most people in the United States take for granted that the water that comes out of their kitchen taps is safe to drink. In most areas, this is true, thanks to the efforts of behind-the-scene individuals that continually monitor the water supplies for contaminants, in accordance with the drinking water standards set by the EPA. Primary authority for EPA water programs was established by the 1986 amendments to the Safe Drinking Water Act (SDWA) and the 1987 amendments to the Clean Water Act (CWA).

The National Primary Drinking Water Standard protects drinking water quality by limiting the levels of specific contaminants that are known to occur or have the potential to occur in water and can adversely affect public health. All public water systems that provide service to 25 or more people are required to satisfy these legally enforceable standards. Water purveyors must monitor for these contaminants on fixed schedules and report to the EPA when a Maximum Contaminant Level (MCL) has been exceeded. MCL is the maximum permissible level of a contaminant in water that is delivered to any user of a public water system. Drinking water supplies are tested for a variety of contaminants, including organic and inorganic chemicals (minerals), substances that are known to cause cancer (carcinogens), radionuclides (such as uranium and radon), and microbial contaminants. The contaminants for which the EPA has established MCLs are listed at http://www.epa.gov/safewater/mcl.html. Changes to the MCL list are typically made every three years, as the EPA adds new contaminants or, based on new research or new case studies, revised MCLs for some contaminants are issued.

The principal drinking water provider for residents of the Town of Yucca Valley and adjacent portions of unincorporated San Bernardino County is the Hi-Desert Water District (HDWD or District). The HDWD estimates that they serve a population of approximately 24,000 people through approximately 10,000 connections (www.hdwd.com). Other smaller water systems are likely to occur in the area, but these would serve less than 25 people, as they are not listed in the EPA Safe Drinking Water Information System (SDWIS) database (www.epa.gov/enviro/html/sdwis/sdwis_ov.html). Groundwater is the primary water source type used by the HDWD, which owns and operates 18 groundwater wells (13 of which are active), ten booster stations, and 16 reservoirs. The District extracts approximately 3,000 acre-feet of groundwater per year, with its wells having a combined pumping capacity of about 6,200 gallons per minute (Hi-Desert Water District 2010 Urban Water Management Plan by Kennedy/Jenks, 2011). The District supplements its groundwater output with State Water Project (SWP) water as needed, and also uses SWP water to recharge the groundwater basins. The HDWD has a SWP maximum allocation of 4,282 acre-feet per year (http://www.hdwd.com/LinkClick.aspx?fileticket=2cbTAxlFQZc%3d&tabid=106&mid=664). Once the Wastewater Treatment Plant and Water Reclamation Facility is completed (see Section 5.2.1), treated wastewater will also be used to recharge the groundwater basin.

5.4.1 Contaminants of Concern in Groundwater

5.4.1.1 Coliform

One of the contaminants checked for on a regular basis is the coliform count. Coliform is a group of bacteria primarily found in human and animal intestines and wastes. These bacteria are widely used as indicator organisms to show the presence of such wastes in water and the possible presence of pathogenic (disease-producing) bacteria. Pathogens in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. These

pathogens may pose a special health risk for infants, young children, and people with compromised immune systems. One of the fecal coliform bacteria that water samples are routinely tested for is Escherichia coli (E. coli). To fail the monthly Total Coliform Report (TCR), the following must occur:

- For systems testing more than 40 samples, more than 5% tested positive for Total Coliform, or
- For those systems testing less than 40 samples, more than one sample tested positive for Total Coliform.

According to the EPA Safe Drinking Water Information System (SDWIS), the HDWD has had only one monitoring violation since 2000 (www.epa.gov/enviro/html/sdwis/sdwis_ov.html based on data extracted on October 15, 2011 and accessed December 13, 2011). This monitoring, repeat minor violation occurred between March 1 and March 31, 2008, and had to do with the reporting of coliform sampling. Essentially, monitoring and reporting violations occur when the water system fails to complete all samples, or the sampling is not done in a timely manner. The HDWD has had no health-based violations in the last ten years. This record compares well with the national record, as the EPA indicates that in 2005, the last fiscal year for which the EPA has complete data, 24% of all water purveyors had a reporting/monitoring violation, 6.1% reported a maximum contaminant level (MCL) violation, and 1.5% reported a treatment technique violation.

5.4.1.2 Perchlorate

A contaminant that California water agencies are increasingly testing for is perchlorate. Perchlorates are negatively charged molecules that are highly persistent in the environment, lasting decades under typical groundwater and surface conditions. Perchlorate salts are used extensively in several industries. For example, ammonium perchlorate is used as a booster or oxidant for solid fuel powering rockets and missiles, in explosives, and for chemical processes and pyrotechnics. Ammonium perchlorate typically constitutes 60 to 75% of missile propellant and about 70% of space shuttle rocket motors. Potassium perchlorate is also used as a solid rocket fuel oxidizer, and in flares and pyrotechnics. Sodium perchlorate is used as a precursor to potassium and ammonium perchlorate, and in explosives. Magnesium perchlorate is used in military batteries (Rogers, 1998). Perchlorate salts are used in automobile air bags, as a component of air bag inflators, and in nuclear reactors and electronic tubes. Other commercial and industrial uses of perchlorate salts include: as additives in lubricating oils; as fixatives (mordants) for fabrics and dyes, in the production of paints and enamels, tanning and finishing of leathers; electroplating; aluminum refining; and the manufacture of rubber (Siddiqui and others, 1998).

Humans exposed to perchlorate are likely to absorb this compound primarily through ingestion, either by drinking water with perchlorate, or possibly by ingesting produce (such as lettuce or other vegetables that store water) that has been irrigated with water containing perchlorate. Although studies indicate that most ingested perchlorate is eliminated rapidly in the urine without being metabolized (Eichler and Hackenthal, 1962; Anbar and others, 1959), small amounts of perchlorate can displace iodide in the thyroid gland. In adults,

this can lead to hypothyroidism and goiter (enlarged thyroid). Symptoms and effects of hypothyroidism include depression and slow metabolism. In children, the thyroid plays a major role in proper development. Impairment of thyroid function in expectant mothers and newborns can result in delayed development and decreased learning capability. Even temporary disruptions in thyroid function can cause permanent physical and mental impairment, including mental retardation, speech impairments, deafness and/or mutism, impaired fine motor skills, delayed reflexes and gait disturbances.

In 2004, the California's Office of Environmental Health Hazard Assessment (OEHHS) established a public health goal (PHG) of 6.0 micrograms per liter (µg/L) for perchlorate (www.dhs.ca.gov/ps/ddwem/chemicals/perchl/perchlorateMCL.htm). Effective October 2007, perchlorate became a regulated drinking water contaminant in California, with a maximum contaminant level (MCL) of 6 µg/L. In January 2011, and following the review of new data on environmental exposures to and possible effects of perchlorate primarily on infants, the OEHHS submitted a proposal to reduce perchlorate's Public Health Goal (PHG) from 6 µg/L to 1 µg/L.

High levels of perchlorate have been found in hundreds of water wells in San Bernardino County, including in the cities of Rialto, Barstow, Fontana, San Bernardino, Redlands, Ontario, and Loma Linda. High levels have also been detected in Lake Havasu. Perchlorate at low concentrations, significantly below the PHG, have been detected in water samples from some of the wells at the Marine Corps Air Ground Combat Center north of the city of Twentynine Palms (https://www.denix.osd.mil/portal/pls/portal/DENIX_CHLORINE.RPT_PERCH_SUMM.SHOW?p_arg_names=ps_id&p_arg_values=349), and in other parts of the western Mojave Desert (where it is now believed to be naturally occurring; Jackson and others, 2010). To date, perchlorate has not been detected in any of the wells in the Yucca Valley area.

5.4.1.3 Arsenic

Arsenic is a naturally occurring, toxic element that occurs in rocks, soils and groundwater. Because it can cause skin, bladder and other cancers, the Environmental Protection Agency and the California Department of Public Health limit the amount of arsenic that can be present in drinking water. The current (as of July 2011) maximum contaminant level (MCL) allowed for arsenic in drinking water is 10 micrograms per liter (µg/L), equivalent to 10 parts per billion (ppb). However, arsenic at concentrations above this regulatory level occurs in groundwater in several parts of the United States, especially in the southwest and California.

Naturally occurring arsenic at concentrations that intermittently exceed the MCL has been detected in two of the Hi-Desert Water District wells that tap into the deeper aquifer in the Warren Valley groundwater basin. According to the District's 2010 Urban Water Management Plan (Kennedy/Jenks, 2011), one of these wells has been taken off-line until a solution to reduce the arsenic levels is implemented. Water from the other well is blended with water from two other water wells that have low arsenic levels. Both wells produce less than 250 gallons per minute (gpm) of water and are not considered critical producing production wells (Kennedy/Jenks, 2011).

5.4.1.4 Nitrate and Nitrite

Nitrate and nitrite are nitrogen-oxygen combinations that occur in several organic and inorganic compounds. Nitrates are used extensively in fertilizers and are thus found in agricultural areas and landscaped areas where fertilizers are used extensively. Other sources of nitrates include leaks from septic tanks and leaching fields, and erosion of natural deposits. Nitrate does not bind well with soil and typically makes its way into the groundwater where it can impact the drinking aquifers. Drinking water with high concentrations of nitrates can have a serious health hazard, especially to infants. The maximum contaminant level for nitrate is 10 parts per million (ppm or mg/L) as nitrogen, and 45 mg/L as nitrate (http://water.epa.gov/drink/contaminants/basicinformation/nitrate.cfm).

Prior to the groundwater recharge program started by the Hi-Desert Water District in 1995, background nitrate levels in the water wells in the area averaged about 10 ppm as nitrate. By 1997, nitrate at concentrations above the MCL was detected in water from some wells in Yucca Valley, especially in the midwest and mideast hydrogeologic units (with the water in at least one well containing as much as 150 ppm nitrate; Nishikawa and others, 2003). Nitrate removal systems were emplaced at those wells to reduce the concentrations to levels below the MCL. The nitrates concentration has since been reduced so significantly that the removal systems no longer need to be used, although the equipment is available if high nitrate levels are detected again. The District's Consumer Confidence Report for 2010 (the most current report available when this document was finalized) indicates that in 2010 nitrate was detected in the District's groundwater at a concentration of 15.2 mg/L (approximately equivalent to ppm) as nitrate, with a range of between less than 2 and 40 mg/L.

5.4.1.5 Hexavalent Chromium

Hexavalent chromium has been detected in hundreds of wells in San Bernardino County, including several wells in the Hi-Desert Water District service area. The 2009 Consumer Confidence Report issued by the Hi-Desert Water District reports a total chromium concentration of 3.6 ppb (with a range of between 1.2 and 7.7 ppb) in its drinking water. These concentrations are significantly below the maximum contaminant level of 50 ppb for total chromium. In December 2010, however, the California Office of Environmental Health Hazard Assessment proposed a Public Health Goal for hexavalent chromium of 0.02 µg/L, with a maximum contaminant level for hexavalent chromium (independent of total chromium) expected to be established in the near future. This means that the hexavalent chromium levels in groundwater in Yucca Valley (and many other jurisdictions in the region) exceed this PHG value. In January 2011, the U.S. Environmental Protection Agency recommended that public water systems conduct enhanced testing and monitoring for hexavalent chromium, in addition to total chromium, to better inform their users (the consumers) about the presence of chromium-VI in their drinking water (http://water.epa.gov/drink/info/chromium/guidance.cfm).

5.5 Household Hazardous Waste and Recycling

According to The American Red Cross (1994), most victims of chemical accidents are injured at home. These accidents usually result from ignorance or carelessness in using flammable, combustible or corrosive materials. This is not surprising considering that households do use environmentally significant quantities of hazardous materials. For example, FEMA estimates that in an average city of 100,000 residents, 23.5 tons of toilet bowl cleaner, 13.5 tons of liquid household cleaners, and 3.5 tons of motor oil are discharged into the sewer and storm drain systems each month (http://www.fema.gov/hazard/hazmat/backgrounder.shtm). However, with the development of new, "greener" products, and recognizing that sensitive individuals can react to many of the chemicals used in these products, many people find themselves with unused household hazardous waste that they need to dispose off properly. Good, usable leftovers of these products can be donated to willing recipients, such as family members, neighbors and community organizations like churches. But others will want to deliver these substances to an appropriate collection center.

The San Bernardino County Solid Waste Management Department has adopted a Household Hazardous Waste and Oil-Recycling program free to residents, in accordance with the California Integrated Solid Waste Management Act of 1989 (AB 939). The County has established several regional household hazardous waste collection centers, in addition to regional Antifreeze, Batteries, Oil (and Filters), and Paint (Latex only) (ABOP) only collection centers. Those facilities within approximately 50 miles of the Town of Yucca Valley are listed in Table 5-3 below. Personnel who have been trained in hazardous waste handling and emergency response procedures operate these facilities.

At the permanent waste collection centers, a variety of household toxics are accepted, including: chlorine bleach, disinfectants, hair dyes, fiberglass and epoxy resins, paint stripper, paint thinner and turpentine, chemicals used in photo processing, insecticides, pesticides and herbicides, motor oils, rodent poisons, pool/spa chemicals, camp propane tanks, outdated medications, etc. The waste needs to be in its original container or labeled properly. Containers also need to be in good condition, sealed, and not leaking, and the total amount of waste cannot exceed 15 gallons or 125 pounds per trip. Container volume cannot exceed 5 gallons. Materials not accepted include radioactives, explosives, medical waste and asbestos. Also, waste from businesses and non-profit organizations are not accepted at these collection centers. Proof of residency in San Bernardino County may be required. For a complete list of acceptable and non-acceptable materials and tips on how to transport these materials, refer to **http://www.sbcfire.org/hazmat/hhwcollection.aspx#Desert%20Region or call the Household Hazardous Waste Information Hotline at (1-800) OILY CAT (645-9228)**. At the ABOP only centers, they accept only Antifreeze, Batteries (various kinds, including vehicle batteries), Oil (used motor oil and oil filters), and Paint (latex only).

Several other businesses in and around the Town of Yucca Valley, such as The Home Depot, UPS Mailing Centers, Office Depot and similar stores may receive and recycle certain kinds of materials such as used batteries, spent light bulbs, and old electronics. To obtain additional information regarding these facilities, their hours of operation, and the types of waste that they receive, call them directly.

Table 5-3: Regional Household Hazardous Waste Collection Centers

Type	Name	Address	Other Information
Collection Facility	Joshua Tree	62499 29 Palms Hwy.	West of Solid Management Building 3rd Saturday of the month 9:00 AM to 1:00 PM
Collection Facility	Apple Valley	13450 Nomwaket Rd.	Saturdays 10:00 AM to 2:00 PM
ABOP only	Lucerne Valley	33269 Old Woman Springs Road	Behind Fire Station 3rd Saturday of the month 9:00 AM to 12 Noon

Waste collection, in the form of curbside pick-up and recycling services, in the Town of Yucca Valley is provided by **Burrtec**. Their phone number is **(760) 365-2015**, and their website is http://www.burrtec.com/yucca-valley. Burrtec has a series of programs designed to reduce the amount of waste that is taken to the landfill. Their waste reduction and recycling programs include separate containers for recyclable materials (paper, glass, aluminum, cardboard, etc.), and non-recyclable trash. Additional residential services provided by Burrtec include pick-up of bulky items, Christmas tree recycling, pick-up of electronic waste, and used motor oil collection. Information on which items are recyclable and which are non-recyclable, motor oil recycling and the recycling of electronic waste is provided on Burrtec's website.

Burrtec operates three material recovery facilities (MRFs), six transfer stations and seven landfills in southern California. In a material recovery facility, workers sort and process recyclables. All three material recovery facilities operated by Burrtec are more than 50 miles from Yucca Valley. Transfer stations are facilities that serve as local collection points prior to the final disposal site, where waste is separated into types, and sent to the appropriate final destinations. The transfer station closest to Yucca Valley is located in Twentynine Palms, and the closest landfill is located in Landers (see Table 5-4).

There is one land disposal site in the Yucca Valley area listed in GeoTracker. This site is also summarized in Table 5-4 below, and its location is shown on Plate 5-1.

Table 5-4: Active Landfills, Transfer Stations, and Land Disposal Sites Near the Town of Yucca Valley

Name	Address	GeoTracker ID No.	Comments
Landers Sanitary Landfill	59200 Winters Road, Landers, CA 92285 (909) 386-8701	Not in GeoTracker	Operated by Burrtec. Accepts solid waste, household refuse, yard trimmings, furniture, appliances, televisions and computers, and electronic waste. Open 8:00 AM to 4:30 PM, Monday through Saturday.
29 Palms Transfer Station	7501 Pinto Mountain Rd., Twentynine Palms, CA	Not in GeoTracker	Operated by Burrtec. Open 8:00 AM to 4:30 PM, Monday through Saturday.
Trail's End	10780 Malibu Trail,	Not in	Owned and operated by the San Bernardino

Name	Address	GeoTracker ID No.	Comments
Transfer Station	Morongo Valley	GeoTracker	County Solid Waste Management Department. For unincorporated County residents only. Open 8:00 AM to 4:30 PM Thursday through Sunday.
Hi-Desert Water District Land Disposal Site	55439 29 Palms Hwy., Yucca Valley 92284	L10001524666	Land disposal site listed as an open case by the Colorado Basin Regional Water Quality Control Board. No site history or cleanup history provided.

Sources: http://www.burrtec.com/; http://www.sbcounty.gov/dpw/solidwaste/sites.asp; http://geotracker.swrcb.ca.gov/

5.6 Releases due to Transportation Accidents and Pipeline Failures

State Route 62 (Twentynine Palms Highway) traverses the Town of Yucca Valley from west to east, whereas State Route 247 (Old Woman Springs Road) extends across the north-central portion of the Town in a north to northwesterly direction. According to the National Hazardous Materials Route Registry maintained by the Federal Motor Carrier Safety Administration, a division of the U.S. Department of Transportation, both State Routes 62 and 247 are prescribed or permitted to carry hazardous materials. All types of hazardous materials are permitted on both of these roads, and they are both recommended for the transport of Class 1 Explosives. Other roads identified by the U.S. Department of Transportation that are within about 50 miles of Yucca Valley are also included in Table 5-5 below.

Table 5-5: Routes Through Yucca Valley and Surrounding Areas Used to Transport Hazardous Materials and Explosives

Route	Comments / Restrictions	Designation Date
State 62 from Interstate 10 to Arizona	Recommended for Class 1 – Explosives. All types of hazardous materials permitted.	1/1/1995
State 247 from State 18 to State 62	Recommended for Class 1 – Explosives. All types of hazardous materials permitted.	1/1/1995
Adobe Road from Amboy Road to State 62	Recommended for Class 1 – Explosives. All types of hazardous materials permitted.	1/1/1995
Amboy Road from National Trails Highway (near Amboy) to Adobe Road	Recommended for Class 1 – Explosives. All types of hazardous materials permitted.	1/1/1995
Interstate 10 from Arizona to Interstate 405	Recommended for Class 1 – Explosives. All types of hazardous materials permitted.	10/28/1992
Interstate 10 from Arizona to State Route 60	Poisonous Inhalation Hazard.	4/16/1992
Interstate 40 from Arizona to Interstate 15	Preferred route for Class 1 – Explosives, Poisonous Inhalation Hazard, and Radioactive materials. All types of hazardous materials permitted.	1/1/1995; radioactive route designated on 10/25/1994

As a result, these roads pose a potential for spills or leaks from non-stationary sources to occur within the area. Vehicles carrying hazardous materials are required to have placards that indicate at a glance the chemicals being carried, and whether or not they are corrosive, flammable or explosive. The conductors are required to carry detailed "material data sheets" for each of the substances on board. These documents are designed to help emergency response personnel assess the situation immediately upon arrival at the scene of an accident, and take the appropriate precautionary and mitigation measures. The California Highway Patrol is in charge of spills that occur in or along freeways, with Caltrans, the San Bernardino County Fire Department – Hazardous Materials Division and local sheriffs providing additional resources as needed.

Train accidents or derailments can result in a release of hazardous substances. However, there are no railroad tracks extending across the Yucca Valley area, so this hazard is not applicable to the study area.

One Southern California Gas Company transmission pipeline extends in an easterly direction across and near the Town of Yucca Valley (https://www.npms.phmsa.dot.gov/searchp/Application.asp) (see Plate 5-1). This gas transmission pipeline crosses and runs over sections of the Pinto Mountain fault zone along a good portion of the Town of Yucca Valley study area, especially in the central portion of town. Given the large displacements expected along the Pinto Mountain fault when this fault ruptures next (an average of about 5 meters of left-lateral displacement could occur if the fault ruptures along its entire length), the pipeline can be expected to rupture where it crosses or overlies the fault. Gas would be released into the air, and if there are ignition sources nearby, fires could ensue.

Pipeline operators are responsible for the continuous maintenance and monitoring of their pipelines to evaluate and repair, when necessary, corroded sections of pipe that no longer meet pipeline-strength criteria. All excavations or drilling operations near pipelines, or anywhere else, for that matter, should be conducted only after proper clearance by the appropriate utility agencies or companies. California law requires that all excavations be cleared in advance. This is done locally by the **Underground Service Alert of Southern California,** or **DigAlert** (http://www.digalert.com or www.call811.com). Their telephone number is **8-1-1.** Calls need to be made at least two (2) working days before digging, and the proposed excavation area needs to be delineated or marked.

Pipeline and power line failures during an earthquake are more often the result of permanent ground deformations, including fault rupture, liquefaction, landslides, and consolidation of loose granular soils. Tectonic uplift or subsidence can also impact a pipeline. Seismic shaking typically has less of an impact on buried utilities than it does on aboveground structures. The Town of Yucca Valley is underlain by several active faults, so the hazard of surface fault rupture and its potential impact on the town's utilities distribution system is high. In addition, Yucca Valley is located near several other major seismic sources, including the San Andreas fault and other faults of the Eastern California Shear Zone (see Chapter 1), any of which could generate significant ground shaking in the area. Earthquake-induced settlement as a result of an earthquake on any of these seismic sources has the potential to locally impact pipelines, power lines, communication towers, and other lifelines that service the town.

5.7 Earthquake-Induced Releases of Hazardous Materials

Isolated unauthorized releases of hazardous materials can occur at any time, but natural disasters, such as an earthquake or flood, have the potential to cause several incidents at the same time. Strong seismic shaking can lead to the release of hazardous materials by damaging storage facilities and transport infrastructure. During an earthquake, chemical storage tanks could buckle or, if improperly secured and fastened, could easily be punctured and/or tipped over. Improperly segregated chemicals could react forming a toxic gas cloud. Even small amounts of chemicals, if kept in breakable containers and stored together (like in the same chemical closet at a high school chemistry lab or the same aisle at the grocery store), could result in a potentially hazardous situation if the containers break and the chemicals react with each other. As discussed in the section above, pipelines are especially vulnerable to damage as they can be pulled apart or ruptured by strong ground motion and surface ground deformation. Natural gas lines pose a significant hazard due to the high number of pipelines in urban environments and because gas leaks from ruptured lines can lead to secondary fires.

As a result of the Northridge earthquake, 134 locations reported hazardous materials issues, 60 of which required emergency responses. The majority of these events occurred where structural damage was minimal or absent (Perry and Lindell, 1995). The earthquake caused 1,377 breaks in the natural gas pipeline system and half a dozen leaks in a 10-inch crude oil pipeline (Hall, 1994). A train derailment following the Northridge earthquake included a train with 29 cars and one locomotive. One of the cars spilled an estimated 2,000 gallons of sulfuric acid, and 1,000 gallons of diesel fuel spilled from the locomotive.

The M5.9 Whittier Narrows earthquake in 1987 was nearly 100 times smaller than the ShakeOut earthquake scenario on the San Andreas fault mentioned in Chapter 1, and yet, 22 hazardous materials release incidents were reported as a result of the shaking. The most significant of these incidents was the release, from a collapsed tank in a chlorine re-packaging facility, of nearly one ton of chlorine gas (FEMA, 1997; Eguchi and Ghosh, 2008). This leak caused the evacuation of a neighborhood in Santa Fe Springs. The Whittier Narrows earthquake also caused over 1,400 natural gas leaks, three of which caused subsequent fires. At least 5,000 pounds of anhydrous ammonia were released in 1989, during the Loma Prieta earthquake, at a food processing plant in Watsonville (ABAG, 1990; Seligson and others, 1992).

The facilities listed in previous sections of this report that manufacture, use or store hazardous materials are for the most part using chemical substances that occur in a liquid or solid state at normal temperatures and pressures. A leak of any of these substances (such as gasoline, diesel and motor oil used at gas stations and vehicle repair centers, and solvents used in dry cleaners) could impact the underlying soils. While such a release and subsequent contamination would be unfortunate and would require extensive resources to cleanup, it would not pose an immediate danger to the surrounding population. Past studies of hazardous materials release scenarios as a result of an earthquake have concentrated on the two substances that are thought to pose the biggest threat to a community during an earthquake: Chlorine and anhydrous ammonia. These substances, under normal temperature and pressures, occur in a gas state, and thus if released to the atmosphere, form clouds that can spread to adjacent areas, posing a threat to the surrounding community.

Chlorine is one of the products most often used as a disinfectant by swimming pool, drinking water and wastewater facilities, making chlorine one of the most prevalent extremely hazardous substances. Chlorine is typically found in the form of a colorless to amber-colored liquid, or as a greenish-yellow gas with a characteristic odor. The liquid solutions are generally very unstable, reacting with acids to release chlorine gas (such as bleach mixed with vinegar or toilet bowl cleaner containing hydrochloric acid). Mixing bleach with other products is the largest single source of inhalation exposure reported to poison control centers (http://www.emedicine.com/EMERG/topic851.htm). Chlorine gas is heavier than air and therefore stays close to the ground, where it can impact individuals. Exposure to chlorine gas generally impacts the respiratory system, with coughing, shortness of breath, chest pain, and burning sensation in the throat reported as the most common symptoms. Respiratory distress can occur at even low concentrations of less than 20 parts per million (ppm). At high concentrations (> 800 parts per million – ppm) chlorine gas is lethal.

Ammonia is a compound of hydrogen and nitrogen that is used extensively, either directly or indirectly, in several different types of applications, including the manufacture of pharmaceuticals, fertilizers, and commercial cleaning products. The colorless gas has a strong pungent odor, an unlike chlorine gas, is lighter than air. Exposure to high concentrations of ammonia can lead to lung damage and death. Solutions of ammonia can be irritating to the eyes and mucous membranes, and to a lesser extent, the skin. Mixture of an ammonia solution with a chlorine-containing compound, such as bleach, can result in the formation of a highly poisonous gas.

Chlorine pellets, chlorine solutions and ammonia solutions can be found at supermarkets, hardware stores and other locations that sell pool supplies and cleaning products. Bleach and ammonia solutions can be found in almost every household and in commercial and industrial facilities, including hotels, hospitals, medical and veterinary facilities, etc. Proper storage and usage practices are required at all of these locations to reduce or eliminate the potential for a toxic release of chlorine, ammonia, or worse, a mixture of the two. Chlorine and/or ammonia may be used at the wastewater treatment plants proposed to be built in Yucca Valley. Chlorine is also likely to be used by the Hi-Desert Water District at its water storage facilities to treat the municipal supply of drinking water. Proper operations and maintenance procedures are required at these facilities to prevent equipment and process failures that could lead to the unauthorized release of these substances at concentrations that could impact the surrounding areas. These facilities are required to maintain a comprehensive program of personnel training, security enforcement and equipment monitoring to reduce the risk of an accidental or intentional (terrorist) release.

A key point to remember regarding the management of hazardous materials spills in the aftermath of an earthquake is that it is substantially more difficult to do so than under non-earthquake conditions. Hazardous material response teams responding to a release as a result of an earthquake have to deal with potential structural and non-structural problems of the buildings housing the hazardous materials, potential leaks of natural gas from ruptured pipes, and/or downed electrical lines or equipment that could create sparks and cause a fire. When two hazards with potentially high negative consequences happen coincidently, the challenges of managing each are greatly increased. During an earthquake response, hazardous material emergencies become an additional threat that must be integrated into the response management system.

5.8 Other Potential Hazardous Materials Release Incidents

Petroleum contains several components that are considered hazardous by the state of California, such as benzene, a known carcinogen. Oil field activities often include the use of hazardous materials like fuels and solvents. Day-to-day practices in some of the earlier oil fields were not environmentally sensitive, and oil-stained soils and other contaminants can often be found in and around oil fields. This typically becomes an issue when the oil field is no longer economically productive, and the property is developed, usually for residential purposes. Assessing the feasibility of developing an oil field property requires comprehensive site investigations in order to accurately identify and characterize any soil and groundwater contamination that may have resulted from the oil field operations. These site investigations are required by local and/or regional environmental laws and regulations, and vary in scope according to applicable government regulations, generally accepted standards of practice, and site-specific conditions (Fakhoury and Patton, 1992).

According to records from the California Division of Oil, Gas and Geothermal Resources (CDOGGR; http://www.conservation.ca.gov/dog/maps/Pages/index_map.aspx), no oil or geothermal wells have been drilled in the Yucca Valley area. Thus, no issues associated with oil and gas production are anticipated in the region.

5.9 Hazard Analysis

The primary concern associated with a hazardous materials release is the short- and/or long-term effect to the public from exposure to the hazardous substance, especially if a toxic gas is involved. The best way to reduce the risk posed by a hazardous material release is enforcement of stringent regulations governing the storage, use, manufacturing, and handling of hazardous materials.

The Town of Yucca Valley, like all of San Bernardino County, observes the most current version of the California Fire Code (currently the 2010 edition that was adopted in January 2011) for usage, storage, handling and transportation requirements for hazardous materials. Risk minimization criteria include secondary containment, segregation of chemicals to reduce reactivity during a release, sprinkler and alarm systems, monitoring, venting and auto shutoff equipment, and treatment requirements for toxic gas releases.

There is currently one reported Significant Hazardous Materials Site in the Town of Yucca Valley. A Significant Hazardous Materials Site, as used herein, includes facilities identified in Federal and/or State databases as Superfund-Active or Archived Sites (CERCLIS), Cortese List, RCRA/RCRIS-EPA registered Large-Quantity Hazardous Waste Generators, and Toxic Release Inventory Sites (TRIs). There are also 26 reported Small-Quantity Generators of hazardous materials in the Town, and two facilities whose classification as either small- or large-quantity generators were not identified. Compared to other cities in southern California, Yucca Valley at this time has a relatively small number of facilities that use or store hazardous materials. Nevertheless, several of the existing hazardous materials generators are located within about 1 mile of schools in the community. As the town continues to grow, more, especially small-quantity generators of hazardous materials are expected to be located in the area. Town planners are advised to encourage the establishment of future significant hazardous materials sites in areas far away from

critical facilities with evacuation constraints, such as schools and nursing homes. Facilities that use, store, generate or transport hazardous materials are also expected to come and go; so these lists, or comparable lists, should be updated at least once a year. Residents and property and business owners that are interested in obtaining current data for a particular area or site should request it from the San Bernardino County Fire Department, Hazardous Materials Division, or by visiting the appropriate websites referenced herein.

The Town of Yucca Valley is underlain by the Pinto Mountain, Burnt Mountain, Eureka Peak and southern extension of the Johnson Valley faults. The Town is also located near the San Andreas fault and several faults of the Eastern California Shear Zone. The San Andreas fault especially, is thought to have a relatively high probability of generating an earthquake in the next 30 years (see Chapter 1). Therefore, all hazardous materials sites in Yucca Valley could be subject to moderate to severe seismic shaking. Their business plans should address, provide and implement mitigation measures designed to reduce the potential for releases of hazardous materials during an earthquake. It has been shown in previous urban earthquakes that hazardous materials spills can occur even when the building does not suffer significant damage. Hazardous material containers not properly secured and fastened could easily be punctured and/or tipped over, pipes may rupture, and storage tanks may fail. Containers may also explode if subject to high temperatures, such as those generated by a fire. Improperly segregated chemicals could react forming a toxic gas cloud. In a worst-case scenario, several hazardous materials releases could occur simultaneously. The one large-quantity generator of hazardous waste in Yucca Valley is located very close to the mapped surface trace of the Pinto Mountain fault. Surface fault rupture at this facility could result in structural damage and release of the chemical substances stored therein.

The large-quantity generator of hazardous waste, and some of the small-quantity hazardous waste generators are also located within the FEMA-defined 100-year flood zone, or between the limits of the 100- and 500-year flood zones (see Chapter 3). This is generally not recommended, unless all standards of elevation, anchoring and flood proofing have been satisfied, and the hazardous materials are stored in watertight containers designed to not float. Avoidance of the 100-year flood zones by facilities using or storing hazardous materials should be considered in the future.

5.10 Summary of Findings

Federal Clean Water Act and California Water Code

Given that currently all wastewater in the Yucca Valley region is disposed through septic systems, and that discharges do not go to surface waters, the Town of Yucca Valley is not required to have a National Pollutant Discharge Elimination System (NPDES) permit. However, anyone who is discharging or proposing to discharge wastewater onto land needs to file a report with the Regional Water Quality Control Board. The Board can impose waste discharge requirements on that individual or facility. All dischargers, except for small, residential, on-site systems are required to complete and submit to the Board a Report of Waste Discharge. Furthermore, and more importantly, releases from septic tanks in the Yucca Valley area have been shown to have degraded the groundwater quality of the Warren Valley groundwater basin. Specifically, in the 1990s nitrate concentrations in the groundwater increased from a background level of about 10 parts per million (ppm) to as much as about 150 ppm in at least one well. The Hi-Desert Water District has successfully used nitrate removal systems at some of its wells, but to further reduce the

impact of septage on the groundwater resources of the region, the Board passed Resolution No. R7-2011-0004 which phases out, over the next several years, the use of septic systems in the Town of Yucca Valley. The Hi-Desert Water District has developed a plan to construct a water treatment and water reclamation facility that will also involve the construction of sewer connections in town. The first phase of this plan is scheduled for 2016.

Superfund, Hazardous Waste, and Toxic Release Inventory Sites

According to EPA data, there are no Superfund (CERCLIS) sites in the Yucca Valley area, although the La Contenta Middle School is included in the National Priority List due to a mercury release that was cleaned-up with EPA fund-financed monies on an emergency basis in March 2007. The EPA reports that there is one permitted Large-Quantity Generator of hazardous materials (SCE Twentynine Palms Service Center). There are no sites listed in the Toxic Release Inventory (TRI) database, and no sites are included in the CORTESE list. These databases should be reviewed periodically to obtain the most recent information for the area. As of November 10, 2011, there were 26 permitted Small-Quantity Generators of hazardous materials located throughout the town, and two sites listed as unknown. The number of hazardous waste generators is expected to increase as Yucca Valley grows. There is also one business listed in the RCRA database as a transporter of hazardous waste in the Yucca Valley area, but this facility is not listed in the Department of Toxic Control Substances official database of registered transporters of hazardous waste in California.

Hazardous Materials Disclosure Program

Both the Federal government and the State of California require businesses that handle more than a specified amount of hazardous materials or extremely hazardous materials, termed a reporting quantity, to submit a business plan to the local Certified Unified Program Agency (CUPA). In the Town of Yucca Valley, the local CUPA is the San Bernardino County Fire Department, Hazardous Materials Division (SBCFD-HMD). They are responsible for reviewing the annually submitted business plans. For more information refer to their website (http://www.sbcfire.org/hazmat), or contact them by phone at (909) 386-8401.

Leaking Underground Fuel Tanks

According to data from the State Water Quality Control Board, ten leaking underground storage tank (LUST) sites were reported in Yucca Valley between 1984 and 2001. All ten sites have been remediated and/or are not considered to pose a risk to human health and the environment; their cases have been closed by the appropriate regulatory agency. None of the leaks reportedly impacted the groundwater given that groundwater in the region occurs at significant depth. The California Regional Water Quality Control Board (CRWQCB), in cooperation with the County of San Bernardino Fire Department– Hazardous Materials Division provides oversight and conducts inspections of all underground tank removals and installation of new ones. Given that there are at least 13 permitted underground storage tanks in the town, future leaks could be reported. The GeoTracker database should be reviewed periodically for updates.

Water Quality

The Hi-Desert Water District provides drinking water to the residents of the Town of Yucca Valley and unincorporated areas nearby. According to the EPA Safe Drinking Water Violation Report, in the last ten years, the Hi-Desert Water District has had only one minor reporting violation, and no

health-based violations. The monitoring violation occurred in March 2008, and had to do with the reporting of coliform sampling. Compared to State statistics for drinking water violations, the Hi-Desert Water District's record is good.

Substances that have the potential to impact the drinking water aquifers that provide water to the residents of the Town of Yucca Valley include coliform and other bacteria present in human and animal wastes, arsenic (which in this area is naturally occurring), nitrates, hexavalent chromium (which may also be naturally occurring in this area), and man-made contaminants such as pharmaceuticals that are present in septic tanks septage. The concentrations of all these compounds in the groundwater used for drinking purposes are monitored on a regular basis by the Hi-Desert Water District. In the late 1990s and early 2000s, nitrates were detected in water samples from the Warren Valley groundwater basin at levels above the maximum contaminant level. The presence of nitrates in the groundwater is attributed to leakage from the septic tanks. The levels of nitrates in groundwater have since decreased substantially, to concentrations below the State-defined Maximum Contaminant Level for nitrate in drinking water.

Household Hazardous Waste

San Bernardino County has adopted a Household Hazardous Waste and Oil-Recycling program that is free to county residents, in accordance with the California Integrated Solid Waste Management Act of 1989. There are a few facilities in the region where residents from Yucca Valley can drop off their unwanted household hazardous waste; the closest site is located in Joshua Tree, at 62499 29 Palms Highway. For a list of collection sites, their schedules of operation, and types of materials accepted, refer to the San Bernardino County Solid Waste Management Department at http://www.sbcfire.org/hazmat/hhwcollection.aspx#Desert%20Region or call the Household Hazardous Waste Information Hotline at (1-800) OILY CAT (645-9228).

The Town of Yucca Valley, together with Burrtec, their trash hauler, have programs designed to reduce the amount of waste taken to the landill. Waste reduction and recycling programs include: curb-side collection service with separate containers for grass clippings and composting materials, recyclables, and non-recyclable trash. For additional information regarding the services provided by Burrtec refer to their website at http://www.burrtec.com/yucca-valley, or call (760) 365-2015. Burrtec operates a transfer station in Twentynine Palms (at 7501 Pinto Mountain Road), and the closest landfill to Yucca Valley is the Landers landfill at 59200 Winters Road. There is one site in the Town of Yucca Valley identified as a land disposal site in the GeoTracker database; information on this site, referred to as the Hi-Desert Water District land disposal site, was not available.

Releases due to Transportation Accidents and Pipeline Failures

Both State Rout 62 and State Route 247 are permitted to transport hazardous materials, including Class I explosives. Other routes in the region, within about 50 miles of the Town of Yucca Valley are also used to transport hazardous material, including Interstates 10 and 40, and internal roads leading to the Twentyine Palms Air to Ground Combat Training Center north of Twentynine Palms. Spills or leaks from a non-stationary source could occur on these roads in the event of an accident involving a vehicle carrying hazardous substances. All transportation of hazardous materials needs to be conducted under strict protocol. Material data sheets for each substance being transported need to be carried by the conductor. These data sheets are designed to help

emergency response personnel identify the most appropriate action to contain the specific substances involved in the spill. The California Highway Patrol is in charge of spills that occur in or along freeways, with Caltrans, the San Bernardino County Fire Department – Hazardous Materials Division and local sheriffs providing additional resources as needed.

One gas transmission line extends across the Town of Yucca Valley in an easterly direction, generally extending across or along mapped traces of the Pinto Mountain fault. Rupture of any portion of this pipeline could adversely impact the surrounding area. Pipeline operators are responsible for the continuous maintenance and monitoring of their pipelines, including the repair, when necessary, of corroded sections of pipe. All excavations or drilling operations near pipelines should be conducted only after proper clearance by the appropriate utility agencies or companies. California law requires that all excavations be cleared – this is done by the Underground Service Alert of California or DigAlert (http://www.digalert.com or www.call811.com). Their telephone number is **8-1-1.** Calls need to be made at least two (2) working days before digging, and the proposed excavation area needs to be delineated or marked.

Oil Fields

There are no oil or gas fields in or near Yucca Valley. Environmental issues associated with oil and gas fields are not anticipated in the study area.

Hazard Analysis

The primary concern associated with a hazardous materials release is the short- and/or long-term effect to the public from exposure to the hazardous materials released. The best way to reduce the possibility for a hazardous material release is by implementing and enforcing stringent regulations governing the storage, use, manufacturing and handling of hazardous materials. Given that the Pinto Mountain, Burnt Mountain, Eureka Peak and Southern Johnson Valley faults extend across the Town of Yucca Valley, the hazards of surface fault rupture, ground deformation and strong ground shaking, and the impact that these geologic conditions may have on the structural integrity of the storage containers and pipelines carrying hazardous materials need to be considered and planned for.

The entire area will be subjected to intense ground shaking as a result of an earthquake on the southern segment of the San Andreas fault, or on the Pinto Mountain, Burnt Mountain, Eureka Peak or Southern Johnson Valley faults that extend across the planning area (for more information refer to Chapter 1). It has been observed in previous urban earthquakes that hazardous materials spills can occur even when the building housing the materials does not suffer significant damage. Hazardous material containers not properly secured and fastened can easily be punctured and/or tipped over. Improperly segregated chemicals could react, forming a toxic gas cloud. In a worst-case scenario, several hazardous materials releases could occur simultaneously. Therefore, hazardous material sites in Yucca Valley should be designed with secondary containment systems, tank bracing systems, and other engineering solutions to reduce the potential for tanks and containers to tip over during an earthquake. All business plans for sites within the city should address the hazard of intense ground shaking and identify specific measures to be taken to reduce this hazard to an acceptable level.

The one significant hazardous materials site identified in Yucca Valley is located within the flood zone; several of the small-quantity generators of hazardous materials are also located within either the 100- or 500-year flood zones. It is recommended that future hazardous materials sites in Yucca Valley not be located in the 100-year floodplain, unless very specific containment measures are implemented to reduce the potential for hazardous materials to leak during a flood. Furthermore, street flooding as a result of intense storms and inadequate storm drain capacity could result in the flooding of some of the hazardous materials facilities. Therefore, the business plans for all hazardous materials businesses should address the hazards of flooding and of strong ground shaking during an earthquake, and provide for mitigation measures to be implemented to reduce the potential for hazardous materials to leak during a natural disaster.

Several of the existing hazardous materials sites are also located within 1 mile of schools and other facilities with populations with special evacuation needs. It is advisable to encourage the establishment of any future significant hazardous materials sites in areas far away from critical facilities with evacuation concerns. Furthermore, these critical facilities should have plans that include protocol to be followed in the event of a leak of hazardous materials that would require them to evacuate.

CHAPTER 6: SEVERE WEATHER HAZARDS

Severe weather, including high winds, hail, excessive precipitation, wildfires, blizzards, snowstorms and ice storms, dust storms, heat spells and drought, have the potential to cause significant damage to property and infrastructure, cause serious social disruption, and result in injuries and/or loss of life. Many of these hazards can create conditions that disrupt essential systems such as public utilities, telecommunications, and transportation routes. Flooding associated with excessive precipitation and wildfires are discussed in other chapters, although wildfires fanned by winds are also included herein. This chapter discusses primarily high winds, hail, snow storms, heat spells and drought. Historical occurrences of these conditions in the high deserts and San Bernardino Mountains region are summarized as background information, in addition to definitions and terminology associated with each. Finally, where appropriate, based on the historical data presented, mitigation measures that can reduce the potential impacts of these hazards are provided.

6.1 High Winds

This section discusses the specific hazards associated with unusual and potentially damaging wind activity based on scientific data and historical records. In southern California, strong winds may be associated with Santa Ana conditions, thunderstorm-related strong winds and tornadoes, and macrobursts and microbursts. Each of these strong wind conditions is discussed further in the subsections below. In addition, strong wind activity combined with loose soil in an arid or semi-arid environment such as southern California's can result in dust storms. These are also discussed below.

6.1.1 Definitions and Setting

Wind is air that is in motion relative to the earth. It generally has both horizontal and vertical components, but the horizontal component generally dominates (National Research Council, Committee on Natural Disasters – NRC, CND, 1993). Due to friction, wind speed drops off at the ground surface, with approximately 50% of the transition in wind speed due to the frictional forces exerted by the ground surface occurring in the first six feet above the ground. As a result, "near-surface wind is the most variable of all meteorological events" (NRC, CND, 1993), and it generally consists of a combination of high-frequency oscillations in both speed and direction superimposed on a more consistent flow with a prevailing speed and direction. With an increase in wind speed, the high-frequency oscillations can become more abrupt and of greater amplitude – these are referred to as wind gusts. Because wind speeds vary as a function of height, time and the terrain upwind, it is difficult to obtain a value that is representative of the wind speeds over a large region. The recommended convention for measuring wind speed is at a height of 33 feet (10 m), in flat, open terrain, such as that provided by an airport field. Temporal variations are taken into account by averaging speed and direction over a given time, typically 1-minute averages for sustained wind, and 2- to 5-second averages for peak or extreme winds. The mean annual wind speed for the contiguous 48 states is 8 to 12 miles per hour (mph), with most areas of the country frequently experiencing 50-mph winds (NRC, CND, 1993).

To better appreciate the impact that wind has on the sea and land, and the wind speeds required to move different objects, refer to the Beaufort Scale in Table 6-1, below. This

scale was developed by Sir Francis Beaufort in 1805 to illustrate and measure the effect that varying wind speed can have on sea swells and structures. Note that the highest wind speeds in the Beaufort Scale approach the lowest wind speed on the Fujita Scale presented in Table 6-2.

Table 6-1: The Beaufort Scale

Beaufort Force	Wind Speed (mph/ knots)	Wind Description – State of Sea – Effects on Land
0	< 1; <1	Calm – Mirror-like – Smoke rises vertically.
1	1 - 3 / 1 - 3	Light – Scaly ripples; no foam crests – Smoke drifts show direction of wind, but wind vanes do not.
2	4 - 7 / 4 - 6	Light Breeze – Small but pronounced wavelets; crests do not break – Wind vanes move; leaves rustle; you can feel wind on face.
3	8 - 12 / 7 - 10	Gentle Breeze – Large wavelets; crests break; glassy foam; a few whitecaps – Leaves and small twigs move constantly; small, light flags are extended.
4	13 - 18 / 11 - 16	Moderate Breeze – Small (1-4 ft) waves; numerous whitecaps – Wind lifts dust and loose paper; small tree branches move.
5	19 - 24 / 17 - 21	Fresh breeze – Moderate (4-8 ft) waves taking longer to form; many whitecaps; some spray – Small trees with leaves begin to move.
6	25 - 31 / 22 - 27	Strong Breeze – Some large (8-13 ft) waves; crests of white foam; spray – Large branches move; wires whistle.
7	32 - 38 / 28 - 33	Near Gale – Sea heaps up; waves 13-20 ft; white foam from breaking waves blows in streaks with the wind – Whole trees move; resistance felt walking into the wind.
8	39 - 46 / 34 - 40	Gale – Moderately high (13-20 ft) waves of greater length; crests break into spin drift, blowing foam in well-marked streaks; Twigs and small branches break off trees; difficult to walk.
9	47 - 54 / 41- 47	Strong Gale – High waves (20 ft) with wave crests that tumble; dense streaks of foam in wind; poor visibility from spray – Slight structural damage; shingles blow off roofs.
10	55 - 63 / 48 - 55	Storm – Very high (20-30 ft) waves with long, curling crests; sea surface appears white from blowing foam; heavy tumbling of sea; poor visibility – Trees broken or uprooted; considerable structural damage.
11	64 – 73 / 56 - 63	Violent Storm – Waves high enough (30-45 ft) to hide small and medium-sized ships; sea covered with patches of white foam; edges of wave crests blown into froth; poor visibility – Seldom experienced inland; considerable structural damage.
12	> 74 / > 64	Hurricane – Sea white with spray; foam and spray render visibility almost non-existent; waves over 45 ft high – Widespread damage; very rarely experienced on land.

Sources: www.spc.noaa.gov/faq/tornado/beaufort.html; http://www.stormfax.com/beaufort.htm

6.1.2 Types of High Winds in Southern California

6.1.2.1 Santa Ana Winds

Most incidents of high wind in southern California are the result of ***Santa Ana wind*** conditions. Santa Anas are generally dry, often dust-bearing, winds that blow from the east or northeast toward the coast, and offshore (Figure 6-1). These winds commonly develop when a region of high atmospheric pressure builds over the Great Basin – the arid high plateau that covers most of Nevada and parts of Utah, between the Sierra Mountains on

the west and the Rocky Mountains to the east. Clockwise circulation around the center of this high-pressure area forces air downslope from the plateau. As the air descends toward the California coast, it warms at a rate of about 5 degrees Fahrenheit per 1,000 feet elevation. Since the air originates in the high deserts of Utah and Nevada, it starts out already very low in moisture; as it is heated, it dries out even further. The wind picks up speed as it hits the canyons and passes in the coastal ranges of southern California, blowing with exceptional speed through the Santa Ana Canyon (from where these strong winds derive their name). Forecasters at the National Weather Service usually reserve the use of "Santa Ana" winds for those with sustained speeds over 25 knots (1 knot = 1.15 mph); as they move through canyons and passes, these winds may reach speeds of 35 knots, with gusts of up to 50 to 60 knots (see Table 6-1).

Santa Ana winds are common in the southern California area, with Santa Ana conditions expected yearly in the region, typically in the fall through early spring. For the most part these winds are a nuisance, bringing dust indoors, breaking tree branches, and causing minor damage. For people with respiratory ailments, however, Santa Ana winds often mean headaches, sinus pain, difficulty breathing, and even asthma attacks. Strong Santa Ana winds can cause extensive damage to trees, utility poles, vehicles and structures, and can even be deadly. In 2003, for example, two deaths were blamed on these strong winds: a downed tree struck and killed a woman in San Diego, and a passenger in a vehicle was struck by a flying pickup truck cover (http://cbsnews.com/ January 8, 2003 article). Wildfires in the region often occur during Santa Ana wind conditions, when the air humidity is low to very low. Because the winds fan and help spread these fires, Santa Ana wind conditions always are serious concerns to fire fighters.

6.1.2.2 Thunderstorm-Related Tornadoes

A variety of mechanisms give rise to ***thunderstorms***, but most often these develop when warm, moist air meets a cold front, producing strong winds, and sometimes tornadoes, and hail. More than 100,000 thunderstorms occur every year in the United States, and more than 10,000 of these are considered severe, resulting in annual property losses in excess of $1 billion (National Research Council's Committee on Natural Disasters, 1993). Most of these occur in the central Great Plains and the southeastern coastal states, but thunderstorms do occur in every state. A thunderstorm is officially labeled as severe if: 1) it produces a tornado, 2) has winds in excess of 58 mph, or 3) produces surface hail greater than 0.75 inch in diameter. An exceptionally severe thunderstorm can generate several tornadoes and downbursts.

Tornadoes are "violently rotating columns of air extending from a thunderstorm to the ground (http://www.nssl.noaa.gov/edu/safety/tornadoguide.html; see Figure 6-2). Although tornadoes occur in many parts of the world, they are most common during the spring and summer months in the Central Plains of the United States, east of the Rocky Mountains. In the spring, tornadoes often form where warm, moist air from the east meets hot, dry air from the west (this boundary is called a "dryline"). In the winter and early spring, tornadoes can form when strong frontal weather systems originating in the Central states move eastward. Thunderstorms, and associated tornadoes, can also form at the range front, where near-ground air is forced to move "upslope" along the ascending mountain slopes. In California, tornadoes are occasionally generated by strong storms. Although the number of tornadoes reported in California is only a fraction of those reported in the

central states, California does get its share of these. In the 30 years between 1959 and 1988, 133 tornadoes were reported in California, for an average of 4 tornadoes a year (NRC-CND, 1993).

Tornadoes can also accompany tropical storms and hurricanes as they move on land, where they usually occur ahead of the path of the storm center as it comes onshore (http://www.nssl.noaa.gov/edu/safety/tornadoguide.html). Weak tornadoes that form over warm water are called ***waterspouts***. Occasionally, waterspouts can move on land and become tornadoes. ***Funnel clouds*** are cone-shaped or needle-like clouds that extend downward from the main cloud base but do not extend to the ground surface. If a funnel cloud touches the ground, it becomes a tornado; if it touches or moves across water, it is a waterspout. Waterspouts that have moved onto land are more often reported in southern California in the fall and winter, but some have also been reported in the spring. For example, on April 6, 1926, a waterspout that came on land at National City, near San Diego, unroofed several homes and injured eight people; one on February 12, 1936 unroofed two homes, blew down five oil derricks and injured six people.

Figure 6-1: View From Space of Smoke from the October 2003 Fires in Southern California, Carried Offshore by Strong Santa Ana Winds

Source: Image by Jacques Descloitres, MODIS Rapid Response Team at NASA/GSFC, obtained from the archives at http://visibleearth.nasa.gov/

Figure 6-2: View of a Tornado

Source:
http://www.photolib.noaa.gov/700s/nssl0123.jpg

To measure the intensity, area and strength of a tornado, in 1973 Dr. Ted Fujita (then with the University of Chicago) and Allen Pearson (at the time director of the National Severe Storm Forecast Center) introduced the Fujita-Pearson Tornado Intensity Scale (see Table 6-2). An improvement over the scale first published by Dr. Fujita in 1971, this scale

compared the estimated wind velocity with the corresponding amount of damage to human-built structures and vegetation (a component first introduced by Fujita) and the width and length of the tornado path (the component added by Pearson). The scale classified tornadoes into six levels (from F0 to F5) with larger numbers indicating more damaging and larger tornadoes (the Fujita scale smoothly divided wind speed between the highest Beaufort level and Mach 1.0 into 12 levels – F0 through F12, but recognized that an F6 tornado would be inconceivable, and indeed no tornado above F5 has ever been measured. The Fujita-Pearson scale was used to classify all tornadoes reported after its introduction, in addition to retroactively classify all tornadoes reported since 1950 that were listed in the National Oceanic and Atmospheric Administration's (NOAA) national tornado database.

Table 6-2: The Fujita-Pearson Tornado Damage Scale

Scale	Wind Speed Estimate (mph)	Average Damage Path Width (feet)	Typical Damage
F0	40 - 72	30 - 150	**Light** damage (gale tornado). Some damage to chimneys and television antennas; twigs and branches break off trees; winds push over shallow-rooted trees; sign boards are damaged.
F1	73 – 112	100 - 500	**Moderate** damage (weak tornado). Winds peel off roofs; windows break; light trailer homes are pushed off their foundations or overturned; some trees are uprooted or snap; moving autos are pushed off the road; attached garages may be destroyed. Hurricane speed starts at 74 mph.
F2	113 – 157	360 - 820	**Considerable** damage (strong tornado). Roofs are torn off frame houses, leaving strong walls upright; weak rural buildings are demolished; trailer homes are destroyed; large trees snap or are uprooted; railroad boxcars are pushed over; light objects become airborne missiles; cars are blown off highways.
F3	158 – 206	650 – 1,650	**Severe** damage (severe tornado). Roofs and some walls are torn off well-constructed frame structures; some rural buildings are completely demolished; trains are overturned; steel-framed hangars and warehouse-type structures are torn; cars are lifted off the ground; most trees are uprooted, snapped or leveled.
F4	207 – 260	1,300 – 3,000	**Devastating** damage (devastating tornado). Well-constructed frame houses are leveled, leaving piles of debris; steel structures are badly damaged; trees are de-barked by small flying objects; cars and trains are thrown some distances or roll considerable distances; large objects become missiles.
F5	261 – 318	~ 3,600	**Incredible** damage (incredible tornado). Strong, whole-frame houses are lifted off their foundations and carried considerable distances; steel-reinforced concrete structures are badly damaged; automobile-sized missiles are generated and carried through the air >100 meters; trees are debarked.
F6	319 – 379		**Inconceivable** damage: These winds are unlikely. Should a tornado with maximum speed in excess of F5 occur, the extent and type of damage may not be conceived. A number of airborne missiles, such as refrigerators, water heaters, storage tanks, automobiles, etc. create serious secondary damage on structures.

Fujita's wind estimates have since been found to be inaccurate, with the original wind speed estimates higher than the wind speeds actually required to incur the damage described in each category, especially for tornadoes classified as F3 or larger. In response to these criticisms, a new **Enhanced Fujita** (EF) **Scale** for tornado damage was developed between 2004 and 2006. The EF scale, which was officially implemented in the United States on February 1, 2007, is considered an improvement over the old scale: engineers and meteorologists estimated the wind speeds in the new scale (although actual speed winds have not been empirically measured), and records of past tornadoes were reviewed to better equate the wind speeds with the storm damage reported. The new scale also includes more types of structures and vegetation in the damage assessment, and better accounts for differences in construction quality. Similar to the original Fujita scale, the EF Scale also has six levels of tornado damage, EF-0 to EF-5 (see Table 6-3). A researcher assigning a level of damage to a tornado using the EF scale needs to refer to a list of 28 different damage indicators (DI) or types of structures and vegetation, and then the degree of damage (DoD) for each. Damage indicators include barns or farm outbuildings, residences, manufactured homes (with distinctions made for single-wide and double-wide), apartments, masonry buildings, strip malls, automobile lots, elementary schools, low-, middle- or high-rise buildings (each a different category of indicator), electrical transmission lines, free-standing towers, and softwoods or hardwood trees. The new scale is likely to be modified or updated as new tornado data become available.

Table 6-3: Enhanced Fujita Scale

Scale	Wind Speed Estimate		Relative Frequency (%)
	mph	Km/h	
EF-0	65 - 85	105 - 137	53.5
EF-1	86 - 110	138 - 178	31.6
EF-2	111- 135	179 – 218	10.7
EF-3	136 – 165	219 – 266	3.4
EF-4	166 – 200	267 – 322	0.7
EF-5	> 200	> 322	< 0.1

6.1.2.3 Macrobursts and Microbursts

Storm researcher Dr. Ted Fujita first coined the term "***downburst***" to describe a strong, straight-direction surface wind in excess of 39 miles per hour (mph) caused by a small-scale, strong downdraft from the base of a thundershower and thunderstorm cell. Unlike tornadoes, the origin of a downburst is downward-moving air from a thunderstorm's core (as opposed to the upward movement of air associated with tornadoes). Downbursts are further classified into macrobursts and microbursts.

Macrobursts are downbursts with winds up to 117 mph that spread across a path greater than 2.5 miles wide at the surface, and which last from five to 30 minutes. ***Microbursts*** are confined to smaller areas, less than 2.5 miles in diameter from the initial point of downdraft impact. An intense microburst can result in winds near 170 mph but often lasts less than five minutes. Like tornadoes, microbursts can do significant damage: When a microburst hits a tree, the winds strip the limbs and branches off it; a microburst that hits a house has the potential to flatten the structure. After striking the ground, a powerful

outward-running gust can generate significant damage along its path. Damage associated with a microburst appears to have been caused by a tornado, except that the damage pattern away from the impact area is characteristic of straight-line winds, rather than the twisted pattern typical of tornado damage.

Microbursts are particularly dangerous to aircraft landing or taking off, and have caused several planes to crash, with resultant loss of life. Microbursts have also been responsible for capsizing and sinking ships, causing structural damage in many communities, lifting roofs off structures, downing electrical lines, and generally causing millions of dollars in damage. Most of the microbursts reported have occurred in the northeastern and central parts of the United States, including New York, New Jersey, Massachusetts, Ohio, and Kansas, but microbursts have also been reported in Arizona and Utah (http://en.wikipedia.org/wiki/Microburst#Danger_to_aircraft), and in southern California. On March 29, 1998, in a Lake Elsinore neighborhood, an apparent microburst uprooted a tree and ripped two 20-foot sections of roofing tiles from a home. A funnel cloud was also spotted that afternoon near Dulzura, to the east-southeast of San Diego.

6.1.2.4 Dust Storms

Dust storms are high wind events common in arid and semi-arid regions. Strong winds pick up sand and other particulates and transport them by saltation and suspension to another location, where they are deposited. Dust storms are significant erosive agents, with both short- and long-term impacts on people, structures and other property, and on the environment. In the short-term, a dust storm causes reduced visibility, which can affect motorists and aircraft. Fine particulates in the air will enter the respiratory pathways and can cause serious health conditions, including nose, ear and eye infections, sinus infections, asthma, dry eyes (a condition that if left untreated can led to blindness), silicosis, and even premature death. Dust storms can also spread virus spores and contaminants that can result in skin rashes and other infections. Long-term impacts of dust storms include loss of productivity from agricultural fields that have had their organic-rich, topsoil removed, whereas the deposition of sand and dirt elsewhere can bury and destroy crops and landscaping. Sandblasting of buildings, signs, fences, and vehicles can have both an aesthetic and structural impacts; in the long term the damage due to continuous pitting may require the replacement of a structure. For additional information regarding blowing sand refer to Chapter 2.

6.1.3 Historic Southern California Windstorms

As mentioned above, Santa Ana winds are common in the southern California region, typically in the fall through spring. Some of the strong winds in the winter are associated with winter storms emanating from Alaska and Canada. The high desert areas are also subjected to high winds associated with short-duration tropical thunderstorms emanating from the south. These storms typically occur in the summer months, between July and September.

As of the writing of this document, the National Climatic Data Center (NCDC) listed 134 high wind events and thunderstorms in San Bernardino County between 1996 and March 20, 2011 (http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms). Those storms in the NCDC database that impacted the San Bernardino Mountains and high desert are included below. Previously, the database included storms dating back to 1973; many of

these are also included in Table 6-4. Events that have occurred since March 2011 were culled from online local newspapers. Table 6-4 also includes exceptional historical storms that impacted the southern California area, causing extensive damage either directly, or indirectly, by fanning wildfires that consumed thousands of acres and destroyed many homes. Please note that this list will most likely not include all damaging windstorms that have impacted the Town of Yucca Valley, as some events may have been so localized as to have not made it into the National Climatic Data Center database.

Table 6-4: Major Southern California Windstorms (1858 - 2011) and Strong Winds Reported in the Yucca Valley Area (1973 - October 2011)

Date	Description, Including Location and Damage Reported
October 2, 1858	Category 1 hurricane hits San Diego. Sustained winds to 75 mph are estimated based on the extensive damage to property reported.
May 23, 1932	Strong winds and low humidity; 12 serious brush fires, blackening nearly 2,000 acres in San Diego County were reported. The biggest fire was in Spring Valley.
September 24-25, 1939	Tropical storm that lost hurricane status shortly before moving onshore at San Pedro had sustained winds of 50 mph. At least 48 people died from sinking boats.
November 19-29, 1956	Strong and prolonged Santa Ana winds fanned a fire north of Descanso that burned 44,000 acres and killed 11. Two wooden bridges and a power plant were destroyed. A 100 mph gust was recorded on November 20 at a forest lookout near Sagus.
November 21-22, 1957	Extremely destructive Santa Ana winds fan a 28,000-acre brush fire west of Crystal Lake. Flying debris forced people indoors in some areas. Extreme turbulence due to a downdraft injured 12 out of 33 people on an airplane near Ontario.
November 5-6, 1961	Strong Santa Ana winds fan fires in Topanga Canyon, Bel Air and Brentwood; 103 firemen are injured; $100 million in economic losses, including 484 buildings (mostly residential) and 6,090 acres scorched.
August 20, 1962	A severe thunderstorm struck Twentynine Palms, blowing down many trees and breaking several windows.
July 13, 1967	Strong thunderstorm produced damaging winds in the high desert. Telephone and power poles were knocked down, causing widespread power outages.
January 18-28, 1969	Strong storm winds cause power outages and falling trees in southern California; 4 killed by downed trees.
September 26-29, 1970	Gusts to 60 mph in Cuyamaca Rancho State Park. Fires from Cuyamaca to Alpine, including the Laguna Fire, resulted in 400 homes destroyed, 185,000 acres burned, and 8 killed.
August 15, 1971	Heavy thunderstorms strike the Joshua Tree region, causing flash floods that cause extensive damage to the roads in the area.
September 10, 1976	Hurricane Kathleen brought to the Southwest US the highest sustained winds associated with an eastern Pacific tropical cyclone; sustained winds of 57 mph at Yuma, Arizona.
November 30 – December 1, 1982	Widespread strong winds associated with a big storm result in 1.6 million homes without power.
March 26, 1984	Winds of 60-90 mph in the Mojave Desert cause power outages and road closures. Car had its windows blown out; another had a door ripped off. Peak gust of 103 mph at Mojave; 66 mph in Daggett.
November 23, 1986	Strong Santa Ana winds hit Los Angeles, its foothills and mountains. Gusts to 54 mph recorded; gusts to 70 mph estimated. An unfinished house in Glendale is blown to bits; numerous beach rescues needed for sailors and windsurfers. Two sailboat masts were snapped in a boat race in the Channel Islands.

Date	Description, Including Location and Damage Reported
January 20, 1987	Wind gusts to 80 mph below Cajon Pass, 70 mph in San Bernardino, 60 mph in Mt. Laguna, and 40 mph at El Toro. Winds cause thick dust clouds; trucks blown over; trees toppled. 100 power poles downed in the Inland Empire. Numerous power outages force school closures. Brush fires started.
March 15, 1987	Widespread strong storm winds; winds of 25-35 mph sustained all day, gusts to 40 mph in San Diego. Result in power outages all over the San Diego metropolitan area; motor homes toppled in the desert; light standard fell over onto cars in Coronado; boats flipped over in harbors; a 22-foot boat turned over at Mission Beach jetty; Catalina cruise ships delayed, stranding 1,200 tourists there.
December 12-13, 1987	Strong Santa Ana winds in San Bernardino, with 60-80 mph gusts. 38-mph winds recorded in San Diego. 80 power poles blown down within a ½-mile stretch in Fontana and Rancho Cucamonga; downed tree limbs damaged cars, homes and gardens; 1 injured when tree fell on truck; power poles and freeway signs damaged; parked helicopter blown down a hillside in Altadena; trees downed and power outages in San Diego County. In Spring Valley, 1 dead when eucalyptus tree fell on truck.
December 15, 1987	Strong storm winds of 100 mph at Wheeler Ridge, 80 mph in San Bernardino County; up to 70-mph gusts at Point Arguello; 60-mph gusts in Orange County and the San Gabriel Mountains. One truck overturned.
January 21-22, 1988	Strong offshore winds following major Pacific storm with gusts to 80 mph at the Grapevine, 60 mph in Ontario, and 80 mph in San Diego County. Power poles, road signs and big rigs knocked down in the Inland Empire. In San Diego County, 6 injured; roofs blown off houses, trees toppled, and crops destroyed. Barn demolished and garage crushed by tree in Pine Valley; 20 buildings damaged or destroyed at Viejas; avocado and flower crops destroyed at Fallbrook and Encinitas, respectively, with 5 greenhouses damaged in Encinitas.
February 16-19, 1988	Very strong Santa Ana winds with gusts to 90 mph in Newport Beach, 70+ mph in the San Gabriel Mountain foothills; gusts to 76 mph at Monument Peak – Mt. Laguna; 63 mph at Ontario, and 50 mph at Rancho Cucamonga. Numerous trees and power lines downed resulting in power outages along the foothills of the San Gabriel and San Bernardino mountains. Mobile home overturned and shingles torn off roofs in Pauma Valley; Fontana schools closed due to wind damage; 3 killed when truck overturned and burned; 1 killed when stepped on downed power line. Power outages impacted 200,000 customers in Los Angeles and Orange counties. Grass fires. Roof damage widespread in communities around Glendale and Burbank, and at John Wayne Airport. Boats torn from moorings at Newport Harbor.
December 8, 1988	Strong Santa Ana winds across southern California, with gusts to 92 mph at Laguna Peak. Winds fanned several major fires; buildings were unroofed; trees and power lines downed. $20 million in estimated damages.
November 28, 1989	Strong Santa Ana winds with gusts to 70 mph at Rialto Airport. Several tractor-trailer trucks were overturned east of Los Angeles.
December 11, 1989	Strong Santa Ana winds with gusts to 100 mph near the Grapevine. Winds reduced visibility to near zero in the desert areas and closed major interstate highways east of Ontario.
August 4, 1993	Thunderstorms and strong winds reported in the central portion of San Bernardino County.
October 26-27, 1993	Strong Santa Ana winds with gusts to 62 mph at Ontario. Twenty fires in the southern California area, including the Laguna Hills Fire. 4 dead, 162 injured, $1 billion in property losses alone; 194,000 acres destroyed.
June 30, 1994	Thunderstorms and strong winds reported in Barstow. The winds reportedly caused about $1K in property damage.

Date	Description, Including Location and Damage Reported
July 28, 1996	Thunderstorms and strong winds to 50 knots reported in Barstow, Daggett and Twentynine Palms airport. In Twentynine Palms, the winds caused about $50K in property damage.
November 22, 1996	Thunderstorms and strong winds in the San Bernardino County desert caused about $20K in property damage.
November 25, 1996	Thunderstorms and strong winds throughout the southern California area, from San Diego to Ventura counties, and inland in the San Bernardino County mountains and valleys, with winds to 85 knots.
November 28, 1996	Strong northwest winds ahead of a cold front impacted the entire southern California area, with sustained winds of about 40 mph, and gusts up to 60 mph. Many downed trees and power lines were reported.
December 14, 1996	Strong Santa Ana winds with gusts to 111 mph at Fremont Canyon and 92 mph in Rialto, toppled trees and electric poles, smashed windows, knocked out power to tens of thousands across southern California. Two deaths in Fontana; one man killed by a live power line that was blown on him; the second died when a tree branch fell onto his van. Minor injuries (3 total) in Orange and San Diego counties. In Crestline, a radio tower was blown down and the roof blown off the transmitter building. I-15 near Devore closed for 15 hours where two trailers flipped.
December 17, 1996	Santa Ana winds with gusts to 66 knots downed trees and power poles. In Rancho Cucamonga, winds toppled a 500,000 kilovolt electric power, sparking a fire that burning 250 acres and forced evacuation of 80 homes.
January 6, 1997	High winds to 86 knots throughout southern California injured four: Three students at the CSU campus at San Bernardino, and a man that suffered cuts when his trailer overturned. Fourteen tractor trailer rigs tipped over in the I-15 between Devore and Corona forcing closure of the freeway; over 900,000 customers lost power; vehicle pile-ups in the Coachella Valley.
January 29, 1997	Santa Ana winds with gusts to 100 mph in Fremont Canyon, 87 mph in Rialto, cause big rigs on the freeway to topple over.
February 13, 1997	Strong Santa Ana winds uprooted trees, downed power lines and toppled rigs. One firefighter suffered minor injuries when the winds blew boards off a truck and onto him while he was trying to extinguish a fire. The Interstate 10/15 transition roads were closed for hours. Sporadic power outages were reported due to downed power lines.
February 24-25, 1997	Gusty Santa Ana winds occurred below selected passes and canyons, with gusts to 80 mph measured in Fremont Canyon. The winds knocked down power lines, fanned several small fires, and forced closure of the I-215 in San Bernardino County for one hour. One of the fires destroyed an abandoned house in San Bernardino.
May 11, 1997	Thunderstorm activity spawned a tornado in Apple Valley and produced strong winds in the high desert areas. The twister destroyed a metal shed, uprooted trees and ripped shingles off of roofs. Strong winds to 70 knots, lightning and rain caused additional property damage in Apple Valley and Hesperia.
May 18, 1997	Thunderstorm produced two tornadoes and a wet microburst north of the Apple Valley airport. First tornado flattened a few buildings; second tornado blew down several power poles and destroyed several small structures. The damage caused was sporadic as it did not contact the ground continuously. The microburst ripped a 55-foot awning from a mobile home and blew it against a car, pinning, and slightly injuring a girl.
June 6, 1997	Cluster of thunderstorms produced strong winds with 60-mph gust at Twentynine Palms airport. No damage reported.
August 3, 1997	Severe thunderstorms dropped hail and heavy rains in **Landers**, flooded and closed five roads around **Joshua Tree** and produced 50 mph sustained winds with a gust of 85 mph at Twentynine Palms airport.
September 1,	Thunderstorm generates several strong winds throughout the day, with three gusts of

Date	Description, Including Location and Damage Reported
1997	90 knots (104 mph) recorded at Twentynine Palms airport. No damage reported.
October 13-14, 1997	Santa Ana winds of 30-40 mph with frequent gusts over 60 mph developed below Cajon Pass, in Orange County, and valley areas of San Bernardino County. Fire in Orange County burned almost 6,000 acres and destroyed two buildings. Trees and power lines blown down in Rialto and Fontana; a shed was destroyed at the Banning/Beaumont border.
December 10-12, 1997	Santa Ana winds with gusts to 96 mph at Pine Valley; 87 mph in Upland. Flying debris killed 2 construction workers, one in Riverside, another in Irvine. Fish farm in Sun City reported more than $1 million in structural damages; extensive damage to the avocado crop; boats damaged and sunk at Coronado and Avalon.
December 18-22, 1997	Gusts to 60 mph in Rialto; 67 mph at Idyllwild and below Cajon Pass. Driver near Pedley killed when he lost control of his van because of strong wind gust; his passenger was injured. Fires; downed trees; and widespread wind damage. More than 9,500 homes and businesses without power in Ontario, Rancho Cucamonga, Fontana, and Chino. On the 22nd, strong winds toppled at least 6 trucks on the I-15 and 60 freeways. In the Coachella Valley, winds uprooted many trees in Palm Desert and overturned several big-rig trucks near Indio. Several trees and signs downed in Desert Hot Springs.
December 28, 1997	Santa Ana winds with gusts to 80 mph snapped a dozen power poles near Corona, cutting power to dozens of rural customers. A downed tree crushed a car in Riverside. In Mira Loma, a dozen power poles were downed, leaving hundreds without power and closing Hamner Avenue for two days. Heavy blowing dust and restricted visibility created hazardous driving conditions on the Interstate 15.
February 3-4, 1998	Strong storm winds with gusts to 60 mph and heavy downpours. The strongest winds were clocked in Orange County and the mountains of San Bernardino County in advance of the storm. Wind gusts to 60 mph downed trees and caused scattered power outages. Moderate to heavy rain flooded intersections in coastal areas; snow fell as low as 4,500 feet. Two young illegal immigrants near Campo died, and 12 others suffered from exposure to strong winds, cold temperatures and rain.
July 28, 1998	Thunderstorm winds in Twentynine Palms snapped two power poles knocking out electricity in a two-block area. A storage shed was blown onto the roof of a nearby house and got caught in electrical wires. $10K in property damage reported.
August 31, 1998	Strong thunderstorm-related winds with gust to 63 mph were recorded at Twentynine Palms Marine Corps Base, and a gust to 58 mph was recorded at the Twentynine Palms airport. No damage was reported.
December 9-10, 1998	Santa Ana winds with 101-mph gusts at Modjeska Canyon, 93-mph gusts at Fremont Canyon, 52-mph gusts in Santa Ana, and 83-mph gusts at Ontario disrupted transportation, power and daily activities. Winds toppled trees and power lines, overturned vehicles, and caused property damage. 180,000 customers without electric power; 17 trucks were blown over along I-15 and Highway 60. 7 students at CSU in San Bernardino were knocked down and injured. Trees fell on passing motorists in Fontana. A total of 24 injuries reported, with property damage amounting to $1.1 million.
January 8, 1999	Strong Santa Ana winds to 61 knots in San Bernardino and Riverside counties broke tree braches, downed power lines and blew dust across freeways. $10K in property damage.
January 20-21, 1999	80-mph gust in the Salton Sea area; 70-mph gust in the Coachella Valley; 47-mph gust in Palm Springs; and 36-mph gust in Thermal.
February 10-12, 1999	Santa Ana winds with gusts to 85 mph at Rialto; gusts to 80 mph on the I-8, forcing the closure of several major roads and interstates. Extensive property damage throughout and west of San Gorgonio Pass. Freshly plowed field west of San Gorgonio Pass was

Date	Description, Including Location and Damage Reported
	stripped of its top soil; 30 Beaumont residents treated for breathing problems and skin rashes associated with the dust storm. Trees and signs were blown down; large commercial building in Lake Elsinore was blown down; 150-foot tall tree was blown over and crushed a trailer home. $950K in property damages reported.
April 8, 1999	Strong winds to 54 knots reported in Apple and **Yucca valleys**, the Coachella Valley, San Bernardino County mountains, San Diego County mountains, and Santa Ana mountains and foothills. $10K in property damage reported.
May 3, 1999	Strong winds to 65 knots reported in Apple and **Yucca valleys**, San Bernardino County mountains, and San Diego County deserts and mountains. Five miles east of Jacumaba, along I-8, a semi tractor-trailer rig and a motor home were blown over. $150K in property damage.
July 10, 1999	Thunderstorms dumped moderate to heavy rain for about 1 hour in the **Joshua Tree** area. Runoff caused road closures but no significant damage. Gusty winds associated with the storm destroyed a large sun porch in one residence. $3K in property damages reported.
July 11, 1999	Wind gusts to 55 mph were recorded at the Twentynine Palms Marine Corps Base where power poles were downed and two buildings were damaged. Strong thunderstorms produced heavy rain and gusty winds across the desert. Travel along I-15 and I-40 affected as heavy rain reduced visibility to near zero in some areas, and runoff covered sections of the roads. $15K in property damage reported.
July 28, 1999	Strong wind gusts associated with nearby thunderstorm ripped the roof off a house just east of Twentynine Palms, causing $10K in damages.
October 17, 1999	Santa Ana winds caused wind damage in the mountains and valleys of Orange, Riverside, and San Bernardino counties. In San Bernardino, 40 mph wind gusts caused a fire that damaged 11 houses and a 12-plex apartment building; other fires in the Inland Empire fanned by the gust winds. $30K in property damage reported.
November 21-22, 1999	Santa Ana winds with gusts to 54 knots caused power outages throughout the Inland Empire and the Santa Ana mountains and foothills. A semi-tractor trailer was toppled over at the I-15 and Highway 60 intersection. Farther south on I-15, tumbleweeds caused traffic hazards. $190K in property damage and 1 injury reported.
December 3-4, 1999	Strong Santa Ana winds with gusts to 90 mph at San Bernardino and 68 mph in Fontana. Ten power poles knocked down just below Cajon Pass, and in Muscoy, Rialto, Fontana, Murrieta and Lake Elsinore. Most major highways in the Inland Empire and through the Santa Ana Mountains were closed due to semi-tractor trailers overturned, blowing dust reduced visibility and road signs and debris blown around. Two barns were destroyed when their roofs were lifted off; six horses received minor injuries. $210K in property damages reported.
December 10-11, 1999	Strong winds in the Coachella Valley, valleys in Riverside and San Bernardino counties, and Santa Ana mountains and foothills. Winds downed power lines and traffic signs. Gust to 60 mph clocked in Palm Springs. Blowing sand and dust caused poor visibility and forced road closures and cancellation of outdoor events. Several trees were knocked over. $50K in property damage, $10K in crop damages, and one injury reported.
December 21-22, 1999	Strong Santa Ana winds; 68-mph gust at Campo, 53-mph gust at Huntington Beach; 44-mph gust in Orange. Widespread power and phone outages due to fallen trees knocking down lines and snapped poles. Large dust cloud over the San Jacinto Valley that reached height of 500 feet closed highways and sandblasted cars. Gusty winds spread a fire in Glendale to an adjacent house, causing two injuries and $50K in damages. Three wildfires in San Diego County. $227K in property damage reported throughout the region.
January 5-6,	Santa Ana winds with 93-mph gust at Fremont Canyon; 60-mph gust at Ontario; 58-

Date	Description, Including Location and Damage Reported
2000	mph gust at Devore. Winds blew over four semi-tractor trailer rigs on I-10, I-15, I-215 and Highway 60 causing 10-hour delay between Apple Valley and the Inland Empire. Elsewhere in the Inland Empire, blowing sand and dust reduced visibilities to near zero. Roof damage in Rialto. Power outages to 10,000 customers due to downed power lines and poles. Two injuries and $400K in property damage reported.
February 12, 2000	Wind gusts 50 mph or greater were recorded at Horse Thief Springs, Squaw Springs and Twentynine Palms.
March 20-21, 2000	Santa Ana winds in the Coachella Valley, valleys in Riverside and San Bernardino counties, San Diego County and Santa Ana Mountains and foothills. Winds downed power poles, felled trees on cars and houses, knocked fruit off trees, and blew sand and dust, lowering visibility to near zero. Semi-tractor trailer was blown over near Pedley. $425K in property damage and $865K in crop damage reported.
March 31- April 1, 2000	Strong Santa Ana winds caused $375K in property damage in the Inland Empire area. Twenty-five power poles were toppled in the Sun City area; several others fell in Yucaipa. A large tree was blown down in Beaumont. Blowing dust reduced visibility along most highways.
June 22, 2000	Fierce thunderstorm winds damaged a hangar at Barstow-Daggett Airport and knocked out the electricity for runway lights. $25K in property damage reported.
August 26, 2000	A dry microburst (large dust devil) swept through a demolition project in **Yucca Valley** causing a roof to collapse and injuring one worker. $1K in property damage.
November 7, 2000	Santa Ana winds with 82-mph gust at Fremont Canyon caused damage in Orange, San Bernardino and Riverside counties. In San Bernardino County, strong winds knocked power lines together causing them to spark; the sparks ignited wildfires. In Colton, blowing sand covered the I-215. Two semi-tractor trailers overturned at the intersection of the I-15 and Highway 60. $167K in property damages reported.
December 25-26, 2000	Santa Ana winds; 87-mph gust at Fremont Canyon. Damage and injuries reported in Mira Loma, and in Orange and Riverside counties. 50-mph winds in northern Orange County toppled utility poles leaving about 25,000 customers in Tustin, Garden Grove, Orange, Santa Ana and Westminster without power for a few hours. Across the Inland Empire, winds knocked down power poles, trees, signs and fences at 23 separate locations. Many trees were uprooted. Power disrupted to 9,000 homes and businesses. Four injuries and $665K in property damage reported.
May 12, 2001	Downdraft winds associated with thunderstorms impacted the north slopes of the San Bernardino mountains and across the Apple Valley floor, blowing dust and reducing visibility to near zero. Gusts to 82 mph were recorded at Granite Mountain just north of Apple Valley.
August 7, 2001	Strong thunderstorm winds in Twentynine Palms knocked down several power lines near City Hall and the local library; both buildings had to be evacuated. One of the power lines also fell onto a car, trapping the woman inside. The woman was not injured but the car was damaged slightly. $5K in property damage reported.
December 7-8, 2001	Santa Ana winds with gust to 87-mph at Fremont Canyon affected most of southern California. Trees, power lines and signs were toppled. Two construction workers were injured when a 20-foot-high brick wall they were working next to collapsed. Several major freeways were closed to high profile vehicles. Power outages affected about 40,000 customers. Three injuries and $250K in property damage. Winds fanned the Potrero Fire.
January 23-24, 2002	Santa Ana winds throughout the mountains and valleys of Riverside, San Bernardino, San Diego and Orange counties. Semi-tractor trailer rig blown over in Fontana. Strong winds fanned several wildfires. In San Bernardino, one house was damaged and a few outlying structures were destroyed by the wind-fanned flames. $190K in property damage.

Date	Description, Including Location and Damage Reported
February 8-13, 2002	Santa Ana winds with 80-mph gust at Descanso, 78-mph gust at Fremont Canyon, and 76-mph gust at San Bernardino. Blown-over semi-tractor trailer rigs forced closure of I-15, I-215 and I-8 for a day. Twelve million pounds of avocados blown off of trees. Winds fanned several fires caused by downed power lines. In Orange County, fire that started in Corona burned 2,400 acres. In Tijuana, fire destroys 50 buildings, and kills one woman. Gavilan fire spreads from Fallbrook to Camp Pendleton, torching 5,783 acres, destroying 44 houses and damaging 14 others, destroying 40 vehicles and injuring 19. $2 million in property damage and $7.8 million in crop damage.
March 18, 2002	Thunderstorm-related winds to 56 knots in San Bernardino County valleys; whiteout conditions in the High Desert areas with snow down to the 2,500 foot level; hail in Apple Valley; lightning in San Diego struck an aircraft on final approach to the San Diego International Airport.
November 8, 2002	Strong winds associated with the first winter storm of the season reported in Apple and **Yucca valleys**, Coachella Valley, and San Bernardino mountains and valleys. Winds downed power lines and caused damage to roofs and signs. $550K in property damage.
December 16, 2002	Strong winds in Apple and **Yucca valleys**, San Bernardino County mountains, and San Diego coastline. Car windows blown out at Cajon Pass; power lines and trees blown down at Arrowhead and Big Bear City; motor home blown over in Hesperia. Tractor trailer blown over west of Phelan. Visibility reduced to zero due to blowing dust in local highways. Two injuries and $750K in property damage reported.
January 5-7, 2003	Strong, widespread Santa Ana winds with 100-mph gust at Fremont Canyon, 90-mph gust at Ontario; 80-mph gust at Upland. Winds toppled power poles in Orange; blew over a mobile derrick in Placentia, crushing two vehicles; and delayed Metrolink rail service. Interstates 8, 10 and 15 were blocked for several hours due to large trucks blown over. Dust storms forced closure of I-215. One commercial plane sustained damage at Ontario Airport; others had to be diverted. As a result of the winds and toppled poles, thousands of people in northeastern Orange County were without power. Two dead, 11 injured. Widespread property damage, road closures, wildfires, 20 million pounds of avocado lost. $3.3 million in property damage and $28 million in crop damage.
February 2, 2003	High winds blew down trees in Redlands, Jurupa and Riverside. Blowing sand and dust disrupted traffic in the Coachella Valley.
March 26, 28-29, 2003	Area of low pressure off the California coast brought strong winds to portions of the Mojave Desert. Winds with gusts to nearly 50 mph blew shingles off several roofs in Twentynine Palms, causing $5K in property damage. Elsewhere, wind blew trees over, falling on cars and power lines. A semi-tractor trailer was blown over in I-8 in the San Diego County mountains. A total of $140K in property damages reported.
September 4, 2003	Tornado-like winds associated with a series of powerful thunderstorms ripped off the roof from a house and damaged about ten other houses near **Yucca Valley**. Funnel clouds, heavy rain and hail the size of walnuts were reported.
October 25-27, 2003	Strong Santa Ana winds; 45-mph at Ontario, 43-mph at Fremont Canyon. Extensive wildfires consumed hundreds of thousands of acres; killed more than 20 people, and caused more than $1 billion in damage.
November 22, 2003	High winds knocked down trees, power lines and signs, causing about $175K in damages.
December 25, 2003	High winds to 56 mph knocked down many trees that then fell on power lines, cars, houses and roads in Crestline and Forest Falls. $500K in property damage.
February 26, 2004	Winter storm moving southeasterly from the Gulf of Alaska picked up moisture before moving onshore. Strong winds occurred in the mountains, and heavy rains reported throughout southern California. Most roads along the foothills of the San Bernardino

Date	Description, Including Location and Damage Reported
	Mountains, both on the north and south sides were closed due to flooding and mudslides.
April 27, 2004	Low-pressure system pushing through the Mojave Desert produced strong winds with gusts to 67 mph recorded at Squaw Springs and 53 mph in the Opal Mountains.
December 16, 2004	Santa Ana winds with sustained speeds of 51 mph and 78-mph gusts at Fremont Canyon; gusts to 69-mph northwest of San Bernardino and 66 mph near Pine Valley. At least five big rigs were blown over in Inland Empire roads; the I-15 was closed temporarily. Trees were blown over and power lines were downed. $150K in property damage reported.
January 7, 2005	Strong winds and thunderstorms throughout the southern California area, including Apple and **Yucca valleys**. Very saturated soils and wind gusts in excess of 50 mph knocked down hundreds of trees. The felled trees knocked out power, blocked roads, and damaged many cars and property. One woman injured when tree fell onto her car. $600K in property damage reported throughout the region.
February 3, 2005	Strong storm-related winds to 70-mph impacted the region. At least 15 homes in Idyllwild were damaged by felled trees; downed power lines in the Inland Empire; big rig was overturned on the I-8. $1 million in property damage.
March 28-31, 2005	Strong southwest winds reported across the San Bernardino County deserts with wind gusts to 52 mph. $50K in property damage.
July 22, 2005	Strong thunderstorm winds cause major damage to three houses in Twentynine Palms. Described as either a tornado or a microburst, the winds also broke the window of a parked car and lifted a trampoline into the air and slammed it into a utility pole. Other utility poles were knocked down, forcing road closures.
January 2, 2006	Post-frontal 50+-mph winds widespread throughout the region. Winds downed trees, power lines, and power poles onto houses and cars. In Crestline, 20 houses were so damaged as to be uninhabitable. In San Diego Bay, boats broke loose from their moorings. In Apple Valley, winds toppled power poles, downed trees and caused damage to numerous homes. A trailer home was knocked off its supports in Hesperia. $210K in property damage reported.
January 22-24, 2006	Santa Ana winds; peak winds of 71 mph at Fremont Canyon on the 24th; gusts exceeded 60 mph on 19 hourly observations. Seven big rigs overturned in Fontana; downed power lines and trees caused power outages and property damage. Dust storm closed the Ramona Expressway.One fatality when spooked horse threw off its rider. $80K in property damage.
October 26, 2006	Offshore winds blew to 40-mph in the Banning Pass. An arsonist started the Esperanza Fire; it burned 40,200 acres from Cabazon to San Jacinto, destroying 43 homes and killing 5 firefighters.
November 29, 2006	Offshore winds with sustained speeds of 54 mph and 73-mph gust at Fremont Canyon; 58-mph gust at Ontario, caused widespread property damage and power outages as a result of downed power lines, poles and trees. Caltrans reported more than 100 calls in 4 hours reporting downed street signs, trees and power lines. About 15,000 people lost power in Orange County. $30K in property damage.
January 5 & 7, 2007	Strong winds across southern California. Damaged or downed power poles; damage to trees or tree limbs; blowing dust reduced visibility to near zero along I-215 and the Ramona Expressway; small, wind-driven wildfires along I-15. In the mountains, high winds forced vehicles to slide across icy stretches of road near Rim Forest. Large trees fell on homes and cars in the Lake Arrowhead area. $700K in property damage.
February 27, 2007	Widespread wind activity on the desert slopes of the San Bernardino Mountains; strong winds caused property damage to three homes in Palm Springs. One house had its roof ripped off; the others reported broken fences, damaged solar panels and downed trees. Poor visibility due to blowing dust forced closure of several roads in

Date	Description, Including Location and Damage Reported
	the Coachella Valley. Gust to 52 mph recorded at Thermal Airport; gust to 57 mph recorded at a golf course in La Quinta.
March 20, 2007	Strong winds caused extensive damage in North Palm Springs, where 14 power poles were knocked down; several snapped in half. This affected nearly 500 SCE customers. Isolated gust at 81 mpg was measured at the Burns Canyon Remote Automated Weather Station (RAWS) located a few miles to the northwest of **Yucca Valley**.
March 27, 2007	Strong down-slope winds and mountain wave activity caused a palm tree to fall on a home in Indian Wells and leaving 79,000 customers in the valley without power. Peak wind of 53 mph was measured in Thermal, and gust to 48 mph was measured in Palm Springs. A 60-mph gust was measured at the Burns Canyon RAWS.
July 24-30, 2007	Thunderstorms, strong winds and flash flooding in the Mojave Desert. Strong winds to 52 knots reported in Twentynine Palms on the 26th.
October 21-22, 2007	Strong Santa Ana winds caused widespread damage across the Inland Empire, with gusts in excess of 70 mph snapping power poles, toppling trees, overturning big rigs and damaging roofs. Sustained winds over 50 mph were recorded at several locations for several hours. Winds fanned the flames of several large wildfires. $35 million in property damage reported.
December 25, 2007	Gusty winds in the Inland Empire downed power lines, uprooted trees, and overturned several semi-tractor trailer rigs. $50K in property damage reported.
January 17, 2008	Strong Santa Ana winds caused widespread tree and property damage in the Inland Empire area. Numerous tractor-trailers were blown over, one hangar at Corona airport sustained major damage; power was knocked out, $250K in property damages reported.
January 30 - February 1, 2008	High winds with gusts to 80 mph caused widespread property damage and knocked out power to thousands of homes in the **Morongo Basin**. Hundreds of homes were impacted with damage to roofs, fences, storage sheds and other structures. Two power poles were toppled on Twentynine Palms Highway near Indio Avenue, **Yucca Valley**, blocking traffic for hours.
July 12, 2008	Monsoon moisture from the southeast brought severe storms and flash flooding to the Mojave Desert, including Twentynine Palms.
August 3-4, 2008	Monsoon moisture from the southeast brought severe storms and flash flooding to the Mojave Desert. In Twentynine Palms, the winds blew down three power poles and broke off several large tree limbs. Flash flooding reported throughout the area. $25K in property damage.
December 13-17, 2008	Strong winds with gusts to 72 mph accompanied a pair of winter storms that brought rain and snow to the region. Blizzard conditions forced closure of mountain highways.
December 25, 2008	Winds that gusted to nearly 70 mph caused extensive damage in the Morongo Basin, knocking down 10 to 12 power poles and 38 circuits in the Twentynine Palms area, leaving nearly 8,000 customers without power for several hours. An additional 8 to 10 power poles, a billboard and a sign were downed in **Yucca Valley**.
February 16, 2009	High winds, with gusts to 68 mph, were caused by a low pressure cell and cold front that swept through the southern California area.
March 22, 2009	High winds with gusts up to 73 mph knocked down trees, freeway signs and power lines in the mountains and deserts of southern California. Winds fanned two fires in the region that damaged structures and trees.
April 3, 2009	Wind gusts in excess of 58 mph were measured in the afternoon at the Burns Canyon Remote Automated Weather Station (RAWS) located about 13 miles to the northwest of **Yucca Valley**. The high winds downed power lines and caused minor roof damage. A fire fanned by the winds burned at least two homes in Palm Springs.
April 14, 2009	High winds with peak gusts of 64 mph were measured at the Burns Canyon RAWS.

Date	Description, Including Location and Damage Reported
	The winds, caused by a low-pressure trough combined with a surface cold front, caused damage to power lines, trees, and overturned tractor-trailers in the mountains and deserts.
May 29, 2009	Strong thunderstorms in the Hesperia – Victorville area caused damage to four horse shelters and downed power lines. Lightning from the thunderstorm set a brush fire near **Yucca Valley**.
October 27, 2009	High winds with gusts of 60 mph at the Burns Canyon RAWS were felt throughout the mountains and deserts of southern California. The strong winds downed several eucalyptus trees and caused a few power outages in the region.
December 9, 2009	A powerful winter storm brought high winds, rain and some snow to the region. Gusts to 62 mph were measured at the Burns Canyon RAWS. Due to the rain-soaked ground and gust winds, several trees throughout the region were uprooted, damaging vehicles and buildings. Over 100,000 customers lost electric power during the storm.
December 12, 2009	Powerful winter storm with sustained winds near 50 mph, and gusts up to 100 mph measured in the high desert, in the Lucerne and Apple valleys, impacted the region. The strong winds blew shingles off roofs, damaged a trailer, and downed several trees. Power lines arched and some were knocked down, resulting in power outages. Heavy rain caused minor roadway flooding and a flash flood. Parts of Highway18 were closed due to large rocks on the roadway. Two motorists had to be rescued from a vehicle that was trapped in a flooded intersection in Perris.
December 22, 2009	Wind gusts in excess of 58 mph were measured at the Burns Canyon RAWS, with a peak wind gust of 68 mph. The strong winds associated with this winter storm affected the mountains and deserts.
January 18, 2010	In the early afternoon, strong winds tore down about 20 road signs along Interstate 15 in the Cajon Pass area. A peak wind gust of 65 mph was measured at the Burns Canyon RAWS. The storm also brought heavy rain and mountain snow. The winds and rain caused widespread damage, estimated at about $50K, including urban flooding, a few flash floods and minor debris flows.
January 19, 2010	A strong southerly jet stream ahead of a cold front contributed to moderate low-level wind shear with high winds and a peak wind gust of 73 mph measured at Burns Canyon RAWS. The thunderstorms brought in waterspouts, at least one tornado, and hurricane-force winds in Orange County. In San Diego County, the winds contributed to structural damage and one fatality.
January 20, 2010	The third storm of the week brought widespread heavy rain, snow in the mountains, and strong winds with a peak gust of 85 mph measured at Burns Canyon RAWS.
April 27-29, 2010	Multiple upper level low pressure areas brought winter-like weather to southern California during the last part of April, between the 21st and the 29th. Rain and mountain snow were common, with strong gusty winds reported between the 27th and the 29th. Gusts between 58 and 62 mph were measured at the Burns Canyon RAWS in the afternoon and early evening of the 28th.
January 14, 2011	Moderately high Santa Ana winds estimated at between 40 and 50 mps downed three power lines and a transformer in San Bernardino. Three residents that stepped outside to try to extinguish spot fires caused by sparks were electrocuted and died. A water line also ruptured in one of the houses and 2,700 customers lost power because of the downed lines. Gusty winds were also reported in the mountains.
February 2-4, 2011	A strong cold upper level, low-pressure system moved southward from the Four Corners region into northern Mexico. A strong surface high pressure settled over the region and brought strong offshore winds. The winds knocked over a 70- to 75-foot tall tree with a 30-inch diameter trunk over three units in an apartment development in Glen Avon. No injuries were reported, but the units were declared uninhabitable and the residents were relocated. Strong winds were also helpful in knocking over five big

Date	Description, Including Location and Damage Reported
	rigs near the Interstate 10-15 interchanged and contributed to a crash on Highway 60 near the Interstate 15. No injuries were reported. Other downed trees and power lines were reported. About $60K in property damage reported.
March 20, 2011	A strong low pressure system brought strong winds, heavy rain and heavy snow, with blizzard conditions in the mountains. Wind exceeded 110 mph at times in the high deserts, causing considerable damage in the Apple Valley area. Several inches of rain, hail and a few waterspouts were reported, causing some minor urban flooding.
March 28, 2011	Strong winds destroyed a barn at a horse-rescue facility in **Yucca Valley**.
August 27-28, 2011	Thunderstorms hit the Joshua Tree, Twentynine Palms area ripping roofing material off several businesses in Joshua Tree, and knocking down a line of power lines in Twentynine Palms that left hundreds of customers without power. Weather spotter clocked sustained winds up to 60 mph, with stronger gusts.
October 5, 2011	Non-thunderstorm winds with gusts up to 65 mph (at the Burns Canyon RAWS) were reported in the high desert and mountains of San Bernardino County. One mile NNW of **Yucca Valley**, a trained spotter reported that 3-inch diameter trees had been blown over, and that visibility was 40 to 50 yards due to blowing dust. An aluminum shed in **Yucca Valley** was blown over, and several power lines were downed in Lucerne Valley. The strong winds also forced a big rig with empty trailer onto incoming traffic on Highway 18; three vehicles were involved in the incident.

Sources: NCDC database (http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms), compilation by the National Weather Service office in San Diego (http://www.wrh.noaa.gov/sgx/document/weatherhistory.pdf), newspaper accounts in the archives of the High Desert Star (www.hidesertstar.com), and Los Angeles Times (http://articles.latimes.com/keyword/yucca-valley-ca).

As discussed above, although most tornado activity in the United States occurs in the Midwest states, ***tornadoes*** can and do occur in California. The Tornado Project, a company that researches, compiles and makes tornado information available on the web at www.tornadoproject.com, indicates that 24 tornadoes have been reported in San Bernardino County between 1914 and 1998; the National Oceanic and Atmospheric Agency (NOAA) lists 29, including six between 1999 and August 2008. In Riverside County, The Tornado Project list includes nine tornadoes between 1955 and 1998; NOAA includes an additional ten tornadoes between 1999 and January 2010, with the majority of these near Hemet and Temecula. A list compiled by the San Diego office of the National Weather Service includes a few additional tornadoes in both San Bernardino and Riverside County. Table 6-5 lists the tornadoes reported in San Bernardino County, and two tornadoes in Riverside County that occurred relatively close to the San Bernardino County line. The data available indicate that in the last about 60 years, tornadoes have caused five injuries and about $4 million in property damage in San Bernardino and Riverside counties. Table 6-5 also includes funnel clouds reported in the mountains and high deserts of San Bernardino County, which appear to occur primarily near Hesperia and Victorville, to the northwest of Yucca Valley.

Table 6-5: Tornadoes and Funnel Clouds Reported In and Near San Bernardino County Between 1914 and 2011

Date and Location	Time	Dead	Injured	Fujita Scale	Damage Description
San Bernardino County					
January 27, 1914	NA	0	0	F1	
November 11, 1944	21:00	0	0	F2	

Date and Location	Time	Dead	Injured	Fujita Scale	Damage Description
June 25, 1954 NE of Victorville	12:00	0	1	F2	
April 2, 1958 in San Bernardino	NA	0	0	NA	Roof was ripped off a garage at Baseline and Sterling
November 25, 1965	16:30	0	0	F1	$35K in property damage
July 22, 1966 in Victorville	18:45	0	0	F1	
October 22, 1974 in **Yucca Valley**	15:55	0	0	F1	$3K in property damage
September 4, 1976	19:45	0	0	F1	$25K in property damage
September 5, 1976	19:19	0	0	F1	
September 6, 1976	18:00	0	0	F1	
September 6, 1976	19:19	0	0	F1	
September 6, 1976	19:25	0	0	F1	
September 6, 1976	19:30	0	0	F1	
September 7, 1982 in Landers	15:30	0	2	F2	$25K in property damage.
August 1, 1983 in Landers	12:50	0	1	F0	$250K in property damage
July 21, 1986	13:45	0	0	F0	
July 27, 1987 in Twentynine Palms	18:51	0	0	F0	
August 14, 1990	18:45	0	0	F0	
September 29, 1990	18:00	0	0	F0	
March 20, 1991 in Muscoy	14:45	0	0	F0	
May 11, 1997 in Apple Valley	13:30	0	0	F1	Tornado destroyed a metal shed, knocked down several fences, uprooted trees, and ripped shingles off roofs. Part of thunderstorm that spawned strong winds, a dust storm, intense rain, and thunder and lightning.
May 18, 1997 in Apple Valley	15:37	0	0	M, F1	Thunderstorm caused two tornadoes and a wet microburst. First tornado moved through mostly open country, flattening a few buildings on its 3.5-mile path. Power lines arced and produced fires.
May 18, 1997 in Apple Valley. Estimated 130-140 mph winds	15:50	0	0	F1	Second tornado in sequence; moved east through Apple Valley south of Waalew Road. Caused sporadic damage as it did not make continuous contact with ground. Several power poles were blown down, small structures destroyed, and the roof was ripped off a garage. The wet microburst that followed ripped the awning off a mobile home and blew it against a car, pinning and slightly injuring a young girl.
June 6, 1997 in Hesperia	17:00	0	0	F0	Tornado overturned and destroyed a 300-pound fountain.
August 7, 1997 in	17:33	0	0	F0	Tornado touched down on open country

Date and Location	Time	Dead	Injured	Fujita Scale	Damage Description
Needles					near the Interstate 40.
March 14, 1998 in Hesperia	12:57	0	0	NA	A low-pressure center drifting over southwestern California spawned a funnel cloud near Hesperia that was visible for about 20 miles.
May 5, 1998 in San Bernardino and Rialto	NA	0	0	NA	"Apparent" tornado shredded metal siding in Rialto.
August 25, 1998 in Nipton	11:20	0	0	F0	Small tornado caught on video about 5 miles SW of Nipton. At about same time a hood was ripped off a dump truck and a truck was blown off Interstate 15 near Highway 164 (Nipton Road).
July 10, 1999 in Hesperia	17:30	0	0	NA	Funnel cloud reported 3 miles north of Hesperia. No damage reported.
June 23, 2000 in Hesperia	12:20 & 13:40	0	0	NA	Two funnel clouds reported near and in Hesperia. The first one was reported 7 miles west of Hesperia. No damage reported.
July 14, 2000 in Phelan	13:15	0	0	NA	Funnel cloud reported near Phelan. No damage reported.
April 21, 2001 in Needles airport	11:35	0	0	F1	
July 3, 2001 in Hesperia	NA	0	0	NA	Dust devil (possibly a microburst or other thunderstorm-generated wind) blows off roof.
July 7, 2001 in **Joshua Tree** and **Twentynine Palms**	12:45	0	0	F0	Caused minor damage to homes and businesses in Joshua Tree, including a roof torn off an abandoned house and a patio cover torn off another home. $10K in property damage reported
September 4, 2003 in **Joshua Tree – Yucca Valley**	NA	0	0	NA	Extensive damage to one residence and minor damage to eleven others, for $25K in property damage. No injuries reported.
August 14, 2004 in **Yucca Valley**	11:18	0	0	F0	Tornado with very intense rotation reported 14 miles NNW of Yucca Valley. No damage reported from tornado.
August 14, 2004 in Phelan	11:40	0	0	F0	Tornado occurred in open fields – no damage reported.
February 22, 2005 in Victorville	15:00	0	0	NA	Funnel cloud reported 15 miles north of Victorville. No damage reported.
March 4, 2005 in Fontana	12:20	0	0	F0	$20K in property damage; blew shingles off three homes, ripped the roof off a water-well building, felled several trees and downed power lines. Accompanied by hail.
July 30, 2005	11:38	0	0	NA	Funnel cloud was seen in the San Gorgonio Wilderness, about 5 miles east of Angelus Oaks. No damage was reported.
August 4, 2008 in Lucerne Valley (Johnson Valley)	13:00	0	0	F1	$10K in property damage; bent two flag poles, blew off a roof and uprooted a tree.

Date and Location	Time	Dead	Injured	Fujita Scale	Damage Description
August 6, 2008 in Yucaipa	13:55	0	0	NA	Funnel cloud associated with a severe thunderstorm near the Banning Pass was observed near Yucaipa. Tree damage was reported in Banning and Yucaipa.
May 29, 2009 in Hesperia	NA	0	0	NA	Strong thunderstorms produced a microburst or tornado that damaged four horse shelter roofs. One roof was completely removed. Winds also knocked down power lines in Hesperia and Victorville.
August 28, 2011 in Twentynine Palms and Joshua Tree	NA	0	0	NA	Possibly a microburst, it tore off sections of the roof of the Joshua Tree Branch Library; toppled a large billboard, and stripped off the aluminum roofs and siding from several metal sheds at Bargain Alley. Other structural and tree damage reported.
Riverside County					
December 22, 1996 in Cabazon	09:00	0	0	F1	Tornado was first noticed near the corner of Dell and Lemon; it moved northeastward for about 700 feet before dissipating. Lifted a 5-ton mobile home and deposited it 30 feet from its foundation, its roof and contents removed. Six other mobile homes suffered minor damage.
February 13, 2001	NA	0	0	NA	Funnel clouds in Palm Desert.

Sources: NCDC database (http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms), The Tornado Project (http://www.tornadoproject.com/), compilation by the National Weather Service office in San Diego (http://www.wrh.noaa.gov/sgx/document/weatherhistory.pdf); online newspaper accounts in the archives of the Hi Desert Star (www.hidesertstar.com).

The NCDC database lists eight ***dust storm*** events in San Bernardino County between 1998 and 2004. At least sixteen more events were culled from the windstorm descriptions provided in Table 6-4. Given the many instances of strong winds reported in the region, this list is very likely under-representing the hazard of dust storms in the region.

Table 6-6: Dust Storms Reported in San Bernardino County Between 1989 and 2011

Date	Description, Including Location and Damage Reported
December 11, 1989	Strong Santa Ana winds with gusts to 100 mph reduced visibility to near zero in the desert areas and closed major interstate highways east of Ontario.
December 28, 1997	Santa Ana winds with gusts to 80 mph resulted in heavy blowing dust and restricted visibility on the I-15, creating hazardous driving conditions.
November 8, 1998	Blowing sand and dust reported throughout the valleys to the north and east of the San Bernardino Mountains. Strong winds were reported from Hesperia, Twentynine Palms, Joshua Tree, Lucerne Valley, with the most severe wind events occurring between about 10:20 AM and 1:30 PM. Tents and portable toilets were knocked over at the Girl Scouts Campground. $40K in property damage reported.
December 9, 1998	Strongest Santa Ana wind event in two years. Blowing dust forced closure of the Ontario International Airport for several hours.
February 11, 1999	Santa Ana winds with gusts to 85 mph forced the closure of several major roads

Date	Description, Including Location and Damage Reported
	and interstates. Winds stripped the topsoil off a freshly plowed field west of San Gorgonio Pass and tracked it downstream for 15 miles; 30 Beaumont residents were treated for breathing problems and skin rashes associated with the dust storm.
December 3-4, 1999	Strong Santa Ana winds with gusts to 90 mph; blowing dust reduced visibility.
December 10-11, 1999	Strong winds with gusts to 60 mph resulted in blowing sand and dust. Forced the closure of roads and cancellation of outdoor events in the Coachella Valley and other areas.
December 22, 1999	Strong Santa Ana winds caused a large dust cloud that closed the San Jacinto Valley highways, sand-blasted cars, and reached a height of 500 feet. Winds carrying sand and dirt, and cross winds forced the cancellation of three flights and re-routing of two commercial airplanes from Ontario International Airport.
March 20-21, 2000	Santa Ana winds blew sand and dust, reducing visibility to near zero.
March 31 – April 1, 2000	Strong Santa Ana winds blew dust reducing visibility along most highways in the Inland Empire area.
May 12, 2001	Downdraft winds associated with thunderstorms impacted the north slopes of the San Bernardino Mountains and across the Apple Valley floor, blowing dust and reducing visibility to nearly zero.
August 17, 2001	Thunderstorms moved northwest across the Imperial Valley and Salton Sea. The 30-mph sustained winds caused a dust storm that reduced visibility to less than 1 mile over eastern San Diego County, the Coachella Valley and the Banning Pass.
October 12. 2001	Santa Ana winds blew dust and debris across several freeways between Fontana and Rialto, stopping traffic at times during the morning commute.
February 10, 2002	Santa Ana winds blew dust and sand, disrupting traffic by reducing visibility to near zero and sandblasting windshields. Signs, trees, power poles and fences were blown down in several communities in the Inland Empire.
March 13, 2002	Strong winds over 50 mph caused visibility to drop to near zero on Interstate 15 near Yermo. The low visibility caused two seven-car pileups, injuring several motorists. The interstate had to be closed for an hour due to the visibility issues and damaged vehicles.
November 25, 2002	Blowing dust caused visibility to be near zero from Perris to Moreno Valley; small rocks were blown across Highway 74 in the San Jacinto Valley. Strong winds reported throughout the southern California area.
December 16, 2002	Strong winds in Apple and Yucca valleys, San Bernardino Mountains and San Diego coastline. Visibility reduced to zero in local highways due to blowing dust.
January 6-7, 2003	Santa Ana winds impacted at least 60 communities in southern California. Blowing dust and sand reduced visibility to zero, forcing the closure of I-215. Planes were diverted from landing at Ontario International Airport; one large commercial transport airplane sustained damage.
August 24, 2003	Thunderstorm downdraft winds caused a dust storm in eastern Moreno Valley, north of Highway 60, with sustained winds to 40 mph.
November 27, 2003	Ash and soot from burned areas were picked up by east winds gusting between 40 and 60 mph. Visibility was reduced across the valleys, coasts, and the coastal waters out to San Clemente Island. Unhealthy air was measured in several cities in San Diego County. Hospitals reported twice the number of patients normally seen for breathing difficulties. 40 injuries reported.
March 10, 2004	Blowing sand and dust reduced visibility to within 50 feet in Rancho Cucamonga.
August 12, 2004	Dust storm reduced visibility to near zero on the Interstate 10 between Blythe and Desert Center.
February 27, 2007	Widespread wind activity on the desert slopes of the San Bernardino Mountains. Poor visibility due to blowing dust forced closure of several roads in the Coachella

Date	Description, Including Location and Damage Reported
	Valley.
October 5, 2011	Visibility to the north-northwest of **Yucca Valley** reported at 40 to 50 yards due to blowing dust.

Sources: NCDC database (http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms), compilation by the National Weather Service office in San Diego (http://www.wrh.noaa.gov/sgx/document/weatherhistory.pdf), and data presented in Table 6-4 above.

6.2 Other Extreme Weather Events

6.2.1 Hail

Hail is solid precipitation consisting of fragments of water ice called hailstones. These can be irregular in shape, oval or rounded, and can vary in size from 0.2 inch (5 mm) in diameter, to nearly 8 inches (20 cm), although hail more than 4 inches in diameter is unusual. The stones can range from soft to very hard. Hail is produced in thunderstorms with strong upward motion of the air, similar to a tornado, and freezing levels at relatively low elevations. A hailstone forms as a result of super-cooled water that freezes around an ice-condensing particle, such as a grain of sand, a bit of compacted snow, or even a particle of pollen or other debris carried up into the atmosphere by the thunderstorm updrafts. The resulting hailstone may be carried upward into colder sections of the atmosphere, all the while collecting additional super-cooled water droplets. Once it gets too heavy for the wind to keep it aloft, it either falls to the ground as hail. Hailstones have rings like an onion, with translucent ice layers alternating with white, opaque layers. It is believed that the translucent layers are formed in those sections of clouds where water occurs as droplets, whereas the opaque, white sections form in areas where water vapor predominates. Hailstones also form by accretion, with smaller stones sticking together to form larger, irregular stones. These are often lumpy or even spiky on the outside.

With current weather detection methods, such as weather satellites and radar, it is possible to detect thunderstorms that will produce hail. Severe weather warnings are generally issued in the United States for hail that is more than about 1 inch (2.5 cm) in diameter.

The NOAA website lists 54 hail events in San Bernardino County between 1966 and 2010. Twelve of those events specifically impacted Yucca Valley or nearby communities and are therefore listed in Table 6-7 below, together with two other events listed in the National Weather Service list issued by the San Diego office (last updated in February 2010). The data suggest that hail storms in the region have generated minor to moderate damage to property. No injuries or deaths were reported as a result of the hail storms listed, but the data may be incomplete.

Table 6-7: Hail Events In the Yucca Valley Area Between 1956 and 2011

Date	Description, Including Location and Damage Reported
July 24, 1956	Severe thunderstorm dropped hail "almost the size of baseballs" at Joshua Tree National Monument and vicinity, pelting a Marine Corps party.
September 2, 1960	Largest known hail to hit southern California; hail more than 2.75-inches in diameter and over 1 pound in weight reported in the San Diego and Riverside areas, causing considerable damage to structures. A severe thunderstorm also hit San Bernardino, blowing roofs off houses, smashing windows, and blowing down

Date	Description, Including Location and Damage Reported
	dozens of power poles.
July 18, 1985	Hail 1.75 inches in diameter reported in Twentynine Palms.
July 28, 1987	Hail to 1.00 inch in diameter reported in Twentynine Palms area.
May 19, 1997	Hail 0.75 inch in diameter was spotted in Twentynine Palms. No damage reported.
August 3, 1997	Severe thunderstorms dropped dime-sized hail and heavy rain in Landers, closed five roads around Joshua Tree, and caused 50-mph sustained winds at Twentynine Palms airport.
August 11, 1998	Golf-ball sized hail (up to 1.75 inches in diameter) was reported by the San Bernardino County Sheriff on Highway 62, near Twentynine Palms.
July 10, 1999	Thunderstorms dumped moderate to heavy rain (and hail) for over an hour around Joshua Tree. Runoff forced the closure of some roads and produced gusty winds that destroyed a sun porch, for property damage estimated at $3K.
July 11, 1999	Thunderstorm brought rain, gusty winds and hail to the San Bernardino county deserts, from Barstow south to Twentynine Palms. Travel along interstates 15 and 40 was significantly affected as the heavy rain reduced visibility to near zero and runoff covered road sections.
March 17-18, 2002	Small hail reported in Apple Valley. Part of a late-season winter storm that dropped snow down to the 2,500-foot elevation level.
September 4, 2003	Severe thunderstorm dropped golf-ball sized hail in Twentynine Palms. $50K in property damage reported.
August 12, 2004	Three-quarter inch hail was reported at the north entrance to Joshua Tree National Park. $5K in property damage reported.
August 14, 2004	Monsoon thunderstorms in the valleys, mountains and deserts produced a tornado north of **Yucca Valley** and dropped golf-ball sized (1.75 inch diameter) hail that dented several vehicles. About $10K in property damage reported.
August 1, 2005	Hail up to 0.75-inch in diameter reported in **Yucca Valley**.
August 26, 2007	Thunderstorms over the Mojave Desert dropped dime-sized hail over Twentynine Palms. The hail shower lasted about 15 minutes.
March 20-21, 2011	Strong low-pressure system that brought snow, heavy rains and strong winds to the southern California area, including the high desert. Hail and a few waterspouts were reported behind the front.
July 5, 2011	Thunderstorms brought heavy rain, lightning, high winds and hail to the southern California desert, about 15 miles north of **Yucca Valley**.
August 28, 2011	A 30-minute long thunderstorm hit the Joshua Tree area bringing pea-sized hail, nearly 1 inch of rain and strong winds.

Sources: NOAA database (http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms), compilation by the National Weather Service office in San Diego (http://www.wrh.noaa.gov/sgx/document/weatherhistory.pdf), http://www.kcdzfm.com/news/fullstory070611.html; http://www.kesq.com/news/28453825/detail.html; http://www.hidesertstar.com/news/article_d2d3f24a-0e2a-551b-aad1-0ec71209e9fb.html.

6.2.2 Heavy Snow and Ice

Snow and ice normally do not come to mind at the mention of southern California, but some of the mountain communities do receive substantial precipitation in the form of snow and ice during the winter months. Sudden drops in temperature, combined with reduced visibility due to the snow, have stranded hikers in the mountains of San Diego, Riverside and San Bernardino counties. The NCDC site lists 58 snow and ice events between 1994 and 2011 that have impacted the mountains in San Bernardino County. Additional events extending back to 1847 are included in the database maintained by the National Weather Service office in San Diego (last updated in 2010), although this list is not to be considered

comprehensive. The Town of Yucca Valley, given its location, occasionally receives sufficient snow and/or ice to hinder commuting and other activities. Those events listed in the NCDC and the National Weather Service databases that are known or inferred to have impacted the Yucca Valley area and vicinity are listed in Table 6-8. Since 1994, snow storms in San Bernardino County have directly contributed to at least four deaths and 102 injuries, in addition to more than $2 million in property damage.

Table 6-8: Significant Heavy Snow and Ice Events in Southern California That Likely Impacted the Yucca Valley Area Between 1848 and 2010

Date	Description, Including Location and Damage Reported
1848	Snow fell "to the depth of several feet, and covered the plains for a long time," with the plains referring to San Bernardino Valley. Thousands of cows died.
January 12-14, 1882	Fifteen inches of snow reported in San Bernardino, 25 inches in outlying San Diego, 5 inches in Riverside. Birds and livestock died; telegraph lines downed; citrus trees were damaged.
January 15, 1932	Extensive snow fall impacted the southern California area. Up to 2 inches of snow all over the Los Angeles Basin, including 1 inch at the Los Angeles Civic Center; beaches were whitened. Elsewhere, 18 inches in Julian, 17 inches at Mt. Laguna, 14 inches at Cuyamaca, and 6 inches at Descanso.
February 21, 1944	A heavy snowstorm struck the San Bernardino Mountains. Several snow slides, some 50 to 60 feet high, obliterated parts of the Rim of the World highway.
January 9-11, 1949	Another extensive snowstorm blanketed the region, with snow 4 to 8 inches deep down to the 1,000-foot elevation. Fourteen inches in Woodland Hills, 8 inches in La Canada and Catalina Island, 4 inches in Pasadena, 1 inch in Laguna Beach and Long Beach. Transportation throughout the area was greatly impacted. Power outages and emergencies throughout. A plane crash near Julian kills five and injures one. Camping group stranded at Cuyamaca.
January 13-18, 1952	Heavy snow in several waves impacts the San Bernardino Mountains. Forty inches of snow fell in Lake Arrowhead, 37 inches in Big Bear Lake. All mountain roads were blocked and closed because of snow slides.
January 20-22, 1962	Big snow storm extended to lower elevations, dropping 2 inches in Victorville, Barstow and Yucaipa, 27 inches in Big Bear Lake and 24 inches at Lake Arrowhead. Many highways closed.
December 9, 1963	Heavy snow in the mountains blocked highways and caused vehicular accidents. Five killed and 6 injured.
April 7-11, 1965	Strong late-season storm dropped heavy snow in the mountains, including 50 inches at Lake Arrowhead, 24 inches at Idyllwild, and 13 inches at Palomar Mountains, forcing the closure of many mountains roads.
December 13-19, 1967	Fifty inches of snow in 24 hours reported at Mt. Laguna, 38 inches in Idyllwild, 6 inches in Temecula, 4.5 inches at Anza Borrego State Park, and 2 inches in Carlsbad. Mt. Laguna recorded a total of 96.5 inches in 8 days. Numerous schools and highways closed. Transportation was disrupted, extensive power outages. One freezing death reported.
December 17-22, 1970	A series of storms dropped heavy snow in the San Bernardino Mountains; 32 inches at Idyllwild, 28 inches at Big Bear Lake, 26 inches at Palomar Mountain, and 24 inches at Lake Arrowhead.
December 26-28, 1971	Series of heavy storms that produced up to 2 feet of snow at Lake Arrowhead, 20 inches at Palomar Mountain, 15 inches at Big Bear Lake, and 13 inches at Idyllwild. Snow closed the Morongo Pass at **Yucca Valley** for some time.
January 3-5, 1974	Over 18 inches of snow in the San Bernardino Mountains; 17 inches in Victorville, the greatest daily amount on record. Flurries reported in Palm Springs on the 4th.

Date	Description, Including Location and Damage Reported
	Structures and a few roofs collapsed due to the weight of snow. Power lines and trees snapped.
January 30 – February 2, 1979	Widespread snow event; 56 inches in Big Bear Lake, the greatest snowfall on record. On January 31, snow fell heavily on Palm Springs, snow drifts shut down the I-10 on both sides of Palm Springs, isolating the city. Schools were closed and hundreds of cars were abandoned. All major interstates into Los Angeles were closed.
December 18-19, 1984	Major snowstorm brings up to 16 inches of snow to the mountains and upper deserts, including 13 inches to Lancaster. Edwards Air Force Base and the I-5, from Castaic to the San Joaquin Valley, were both closed.
February 2, 1985	Up to 2 inches of snow reported in Palm Springs.
November 11-13, 1985	A cold, slow-moving storm dropped 14 inches of snow in Mt. Laguna, 5 inches in Julian, and through the San Gabriel Mountains. Snow fell as low as Alpine (1,800-foot elevation). Interstates were closed for some time.
December 10-11, 1985	Cold storm brought heavy snow to the mountains and high desert; 17 inches in Mt. Laguna, 15 inches in Julian, 12 inches in Palomar Mountain, and up to 4 inches in Victorville and Warner Springs. The highways and schools were closed in the mountains and high desert.
February 22-25, 1987	Snow reported throughout the southern California area, with 24 inches at Mt. Laguna, 12-17 inches in the San Bernardino Mountains, 4 inches in one hour at Lake Hughes. Snow pellets reported in coastal areas, including 2 to 3 inches in Huntington Beach. Slight snow reported on the 25th in Tarzana, Northridge, Torrance, Fontana and Redlands. Roads and schools closed in the mountain areas. An aircraft accident due to a snow squall near Anza killed four.
December 16-17, 1987	Snow fell throughout southern California, including for two minutes at Malibu Beach. One foot of snow fell in the mountains north and east of Los Angeles, 24 inches in Julian. Disneyland closed due to weather; other theme parks and stretches of the I-5 and I-15 closed through the mountains. Numerous accidents resulted in fatalities. Due to the snow, all schools closed in the mountains of San Diego County and 16,000 students were sent home in the Santa Clarita Valley.
February 7-9, 1989	Snow reported from the beaches in Los Angeles to the desert in Palm Springs; 15 inches in the mountains, 3 inches at Palmdale. Major road closures and numerous traffic accidents reported.
March 17-20, 1991	Snow 2 to 5 feet deep in the mountains; on the 19th, 1 foot of snow fell on Mr. Laguna, 6 inches at Palomar Mountain and Cuyamaca. Schools and roads closed in the mountains, including the section of I-8 between Alpine and Imperial County. Many downed trees and power outages.
January 5-7, 1992	Six to 20 inches of snow in the mountains, 2 to 8 inches in the foothills and high desert floors.
January 3-4, 1995	Six to 12 inches of snow in the mountains, 2 inches of heavy, wet snow at 2,300-foot elevation in the high desert.
December 23, 1995	Up to 12 inches of snow in the San Bernardino Mountains, and up to 8 inches on the high desert floors.
February 25-28, 1996	Ten inches of snow at Idyllwild, 2 inches in Yucaipa a dusting at Hemet and Corona; 1-2 feet in the mountains, and up to 6 inches in the high desert.
January 5, 1997	Winter storm in southern California brought snow and strong winds to the mountains and high deserts. Snow was reported as low as 3,200 feet. Sleet, snow pellets and thunder accompanied the snow at several locations. Two to 3 inches of snow reported in the Apple and Lucerne valleys, 5 inches in the mountains.
January 12-15, 1997	Snowfall 1.5 to 3 feet deep common on elevations above 2,500 feet. In the San Gorgonio Wilderness, a blizzard accompanied by single-digit temperatures and 4 feet

Date	Description, Including Location and Damage Reported
	of snow stranded a family of hikers that were later rescued. In the high deserts around **Yucca Valley**, hundreds lost power and cable service when a relay tower was damaged by strong winds. Thirteen illegal immigrants died due to exposure near Pine Valley.
February 23, 1998	Snow levels dropped down to 1,400 foot elevation in the high deserts of San Bernardino County. Strong winds downed power lines, leaving thousands without power. In Apple Valley and Hesperia, flooding caused damage to many homes and businesses. In Apple Valley, two dozen families had to be evacuated and flooding caused $10 million in property damage.
March 28-29, 1998	Late season winter storm dropped 4 to 8 inches of snow between the 3,000- and 5,000-foot levels, and 1 to 3 feet above 5,000 feet. Strong winds with gusts to 60 mph accompanied the snow fall, causing snowdrifts that forced closure of some roads. Considerable damage to crops.
March 31-April 1, 1998	Cold front caused strong winds in the Victor Valley area, with heavy snow in the San Bernardino Mountains. Snow fell as low as 2,000 feet locally, while elevations above 5,500 feet saw 8 to 18 inches of snow. Strong winds caused occasional white-out conditions.
May 12, 1998	Unusual late season winter storm dropped snow down to the 4,000-foot level. Measured amounts ranged from about 6 inches at 5,800 feet to 2 feet above 8,000 feet. Thunder and lightning accompanied some of the heavier snow and ice-pellet showers. Weight of the snow snapped tree branches causing sporadic power outages.
December 4-6, 1998	First heavy snow storm of the season. Total snowfall at the 6,000-foot elevation was 9 to 10 inches; 4 to 6 inches were reported in the passes. The high valleys north of the San Bernardino mountains received 1 to 3 inches. This caused closure of 70 to 90% of the major roads and nearly 100% of the minor roads. Highway crews used 22 person-days of overtime to clear the roads in San Bernardino County alone. Several traffic accidents in Hesperia occurred as a result of the snow.
January 26, 1999	Eighteen inches of snow reported in the Angelus Oaks area at 5,600 feet elevation, and 22 inches of snow was reported between 6,200 and 7,200 feet levels, in the Green Valley, Arrow Bear, and Running Springs areas. Eighty percent of the primary roads and 90% of secondary roads were closed.
April 1-6, 1999	Eighteen inches of snow fell in 12 hours at Mt. Laguna, 7-9 inches at Pine Valleyand Descanso; heavy snow reported at Cherry Valley (3,000-foot elevation). By the 6th, snow level down to the 2,600-foot elevation. Eight illegal immigrants found dead near Descanso; 50 survived wearing only light clothing and tennis shoes, having been on foot for 3 days, and having never experienced snow.
March 4-6, 2000	Winter storm brought snow at high elevations and rain and flooding at lower elevations. The night of the 5th, the snow level lowered dramatically, with up to 17 inches of snow in 24 hours in the mountains. At least 30 people were trapped in the wilderness areas of San Diego County; three died and another 13 were hospitalized for hypothermia. Blizzard conditions were reported throughout the southern California mountains. $50K in property damage reported.
January 10-12, 2001	Second of three strong winter storms that week, snow between 3 and 19 inches deep reported between 2,600 and 4,500 foot elevation. Gusty winds the night of the 10th created blizzard conditions. Forty-five people were stranded in the snow; 15 suffered from hypothermia. $60K in property damage reported.
February 11-14, 2001	Winter storm caused near blizzard conditions throughout the southern California mountains, forcing the closure of all roads. The Wrightwood area received between 27 and 60 inches of snow; other areas in the mountains reported 18 to 31 inches. The Apple Valley received 5 to 12 inches of snow. Twenty-six people suffering from mild hypothermia were rescued by the Border Patrol. At lower elevations there was

Date	Description, Including Location and Damage Reported
	extensive flooding. Thirty-one injuries and $150K in property damage reported, including the rof of an ice rink that caved in at Blue Jay.
January 27-29, 2002	Cold Pacific storm brought snow to the mountains of southern California, with traces of snow reported down to the 1,000-foot elevation. Several semi-tractor trailers and trucks jackknifed or overturned in the snow and rain, forcing the closure of several major highways.
March 17-18, 2002	Whiteout conditions were reported over the high desert areas, with the snow down to the 2,500-foot-elevation level. Small hail reported in Apple Valley; 3 inches of snow in Apple Valley, 1 inch in Hesperia. Five different groups of people who were lightly clad were rescued from the San Diego Mountains near Pine Valley.
October 27, 2004	An storm brought 2 feet of snow to Big Bear, with most of this falling within a 12-hour period. Roads became impassable and the weight of the snow broke several tree branches and knocked out power to the area. Intense rain at lower elevations. Rainfall for the month totaled between 1,000 to 2,000% above normal in the coast, valley and deserts, while snow levels in the mountains were 500 to 900% above normal.
November 20-22, 2004	Snow storm that lasted for two days with snow level down to 1000-foot elevation. A spotter in **Yucca Valley** reported 12 inches of snow on the ground in under 6 hours. Eighteen to 20 inches of snow reported in the foothills south of **Yucca Valley**, 9-12 inches in Hesperia and Apple Valley. Nine inches of wet snow in Yucaipa and Calimesa caused tree limbs to snap and fall over cars, houses and roadways. Snow lined the sides of Interstate 10 for about 2 days after the storm.
January 3-4, 2005	Cold storm brought snow and wind to the local mountains; snow fell down to the 3,000-foot level in places like Hesperia, Descanso, Campo, Cajon Pass, and Warner Springs. Temperatures dropped significantly, down to 9 degrees in Big Bear, where the lake completely froze over by the end of the storm.
January 7, 2005	Strong storm dumped several feet of snow at higher elevations on the mountains. Nearly 200 motorists had to be rescued when hundreds of cars became stranded in near white-out conditions on Highway 18, in an area known as the Artic Circle. The rescue operation, using snowcats, took nearly 10 hours. Warm air in the afternoon changed the snow to rain, causing rocks and mud to start falling from the cliffs along the highway. $135K in property damage reported.
March 10-11, 2006	A very large, cold, low-pressure system brought strong winds and heavy snow accumulation to the mountain areas of southern California, and down to the 1,500-foot elevation. Numerous traffic accidents forced the closure of several roads, including the I-8, Highway 18, Highway 38, and Highway 243. Snowfalls ranged from about 1 to 3 feet. Light snow was reported in Hemet, Temecula, Devore, Sage, Yucaipa and Alpine. One person died and 7 were injured when their party became lost near Pine Valley in the storm. $160K in property damage reported.
January 12-13, 2007	Light snow was reported throughout the Inland Empire on the morning of the 12th, down to the 500-foot elevation. In most areas, the snow was about ½-inch deep, but up to 1 inch was reported in Highland and Redlands, and 3 inches were reported in Yucaipa.
January 23-25, 2008	Significant winter storm hit the western part of the San Bernardino mountains, with 24 to 38 inches of snow reported. Periods of heavy snow and whiteout conditions forced closure of sections of the I-15 and Highway 138. $150K in property damage reported.
December 13-17, 2008	Series of significant winter storms that dumped 2-3 feet of snow on the San Bernardino Mountains. Most highways were closed because of heavy snow and trapped motorists. Storm on the 17th dumped 18 inches of snow in Hesperia, Lucerne Valley, Palomar Mountain and Julian; 14 inches in Victorville and even 4 inches in Shelter Valley. Big Bear received an impressive 54 inches over the 5 day period. Heavy

Date	Description, Including Location and Damage Reported
	snow caused significant tree damage at the 3,500 to 4,000-foot elevation, especially to live oak trees. Many tree limbs snapped and fell on vehicles and structures. Significant flooding and mudslides reported at lower elevations. $100K in property damage.
February 5-10, 2009	Winter storm brought significant precipitation to the southern California area. Snow began to fall especially on the night of the 9th, with 20 inches reported in Big Bear by 14:00 the next day. Twelve inches of snow fell in 2 hours in Forest Falls. The heavy snow snapped tree limbs and power lines, leaving approximately 10,000 residents without power. Many mountain roads had to be closed, including Highway 18 where a pair of avalanches buried part of the road. About $50K in property damage reported.
February 16, 2009	A new storm brought additional snow, gusty winds, heavy rain and small hail to the southern California area. Snowfall up to 18-inches deep was reported in the mountains. Heavy rain in the foothills and coastal areas caused flooding along highways and areas with poor drainage.
January 21-22, 2010	The fourth and strongest in a series of storms that brought heavy rain, thunderstorms, several feet of snow in the mountains, and flooding in the foothills and coastal areas. Some areas received as much as 3 to 4 feet of snow in a 36-hour period. The weight of the snow caused damage to several mobile homes. $150K in property damage reported.
February 25-26, 2011	Very cold storm system from the Gulf of Alaska dropped south impacting the southern California area with snow down to the 1,000-foot elevation. Snow accumulations reported above 1,500 feet. Two feet of snow reported in Forest Falls, 24.5 inches in Wrightwood and 21 inches in Lake Arrowhead. Gusty winds contributed to areas of blowing snow, reducing visibility.
March 20-21, 2011	Strong low-pressure system brought very strong winds, heavy rain and heavy snow to southern California. Up to 20 inches of snow was reported in the San Bernardino Mountains, with heavy rain in the foothills. Very strong winds with gusts to 110 mph were reported in the high deserts, with considerable damage reported in the Apple Valley area. Hail and a few waterspouts were also reported behind the front.

Sources: NOAA database (http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms), and compilation by the National Weather Service office in San Diego (http://www.wrh.noaa.gov/sgx/document/weatherhistory.pdf.

6.2.3 Temperature Extremes

Temperature extremes are responsible for more deaths in the United States on a yearly basis than all other extreme weather events combined, including flooding. Based on data collected by the Centers for Disease Control and Prevention (CDC, as reported in Goklany, 2007), between 1979 and 2002, an average of 358 people were killed annually by excessive heat. Extreme cold is even more deadly; an average of 680 people died in the United States each year due to cold weather between 1979 and 2002 (Goklany, 2007). In addition to the significant loss of life and injuries, temperature extremes also cause significant economic losses in agricultural production, and in transportation, energy and infrastructure costs.

Heat waves, which are periods of excessive heat, typically exceeding 95 degrees Fahrenheit, often with high levels of humidity, and lasting more than three days, can be deadly by pushing the human body beyond its limits. The heat itself is not deadly, but dehydration and loss of salts through sweating can lead to blood clots that can result in

heart attacks or strokes; people with weak hearts may not be able to deal with the increased blood flow necessary to keep the body cool. Sensitive populations include older adults, children, and those that are sick or overweight. Those at greatest risk of dying during a heat wave are city-dwelling seniors that don't have access to an air-conditioned environment for at least part of the day. [Urban areas, due to the heat-absorbing properties of asphalt and concrete, are generally hotter than rural areas.] Athletes that don't take extra precautions or don't decrease their usual exercise routine in response to the high heat can also be impacted by a life-threatening, heat-induced illness such as heat exhaustion or heat stroke. These heat-induced illnesses can also impact outdoor workers, such as those in the agricultural or construction fields, that are not acclimatized, and do not have access to water and shade, or do not slow down and take cool-down breaks in the shade. Poor air quality often occurs during heat waves if a stagnant atmospheric condition develops, trapping dust and air contaminants near the ground surface. The resulting brown haze can cause serious respiratory problems in the elderly, infants, asthmatics, and others with compromised immune systems.

In addition to the potential injuries and loss of life brought on by heat waves, excessive heat can impact agricultural production, both of livestock and crops. Poultry, in particular, do poorly during heat waves. Millions of birds died during a severe heat wave that impacted the Midwestern states in 1980. Crops can also be adversely impacted by excessive heat and/or drought. Increased irrigation, with concurrent increased production costs, is generally necessary to prevent permanent damage to certain crops, such as vegetables and leafy greens.

High heat and ***excessive heat*** events that have occurred historically in the southern California area and that are known or inferred to have impacted the Yucca Valley area are listed in Table 6-9. High heat events are periods of high heat that either did not last for at least three days, or where the heat and/or humidity levels were not sufficiently high to be defined as an excessive heat event. The data provided in Table 6-9 is most likely not comprehensive, but it does suggest that periods of temperature extremes have occurred historically in the region, and thus, that periods of excessive heat can be anticipated in the future.

The definition and effects of ***extreme cold*** vary across different areas of the country. In southern California, where we are not generally accustomed to cold weather, temperatures near freezing are considered "extreme cold." A cold wave, where temperatures drop rapidly within a 24-hour period, can be devastating to susceptible and unprotected populations, crops, livestock and wildlife. Exposure to extreme cold can lead to several life-threatening health conditions, including frostbite and hypothermia. ***Frostbite*** is an injury to the body, typically to the extremities such as fingers, toes, ear lobes or nose, caused by freezing body tissue. The main symptoms include a loss of feeling in the affected area, often combined with a pale, gray, white or yellow, and possibly waxy, appearance. Immediate medical attention is generally required, and the affected area should be slowly re-warmed to avoid further tissue damage. ***Hypothermia*** is an abnormally low body temperature (typically below 95 degrees Fahrenheit). Warning signs include uncontrollable shivering, disorientation, memory loss, slurred speech, drowsiness, and apparent exhaustion. Medical attention should be provided immediately if at all possible, and the body should be slowly warmed.

Populations vulnerable to cold weather include (but are not limited to) the homeless, older adults, persons with medical conditions, including heart disease, diabetes, high blood pressure, mental illness, and cognitive disorders, infants and small children under the age of five, pregnant women, persons of limited economic resources that cannot afford to keep their home warm, people who are socially isolated, and people who are caught outside in the storm, unprepared. The use of space heaters, barbeques, and fireplaces to keep structures warm increase the potential for structural fires and the risk of carbon monoxide poisoning.

Crop damage and livestock kills due to cold weather have historically cost the southern California area billions of dollars. For example, the December 1990 winter storms cost the state of California $3.4 billion in direct and indirect losses, whereas the 2002 winter caused more than $2 million in crop and property damage to the southern California area alone. Extreme cold events that are known or inferred to have impacted the Yucca Valley area are listed in Table 6-9.

Table 6-9: Historical High Heat, Excessive Heat and Extreme Cold Events Reported in Southern California that Impacted or Are Inferred to Have Impacted the Yucca Valley Area

Date	Description, Including Location and Damage Reported
January 9, 1888	**Extreme cold:** Cold wave with freezing temperatures impacted the citrus-growing areas with substantial loss of the citrus crop.
December 23-30, 1891	**Extreme cold:** Cold wave impacted the southern California area; 1-inch thick ice on oranges on trees in Mission Valley, 0.5-inch thick ice in San Diego pools.
January 6-7, 1913	**Extreme cold:** 25 degrees at San Diego on the 7th, the lowest temperature on record. Killing freeze that caused extreme damage to the citrus crop all over California. Many other crops lost. Water pipes frozen, trolley lines disrupted. The damage directly led to the establishment of the U.S. Weather Bureau's Fruit Frost forecast program.
June 16, 1917	**Excessive heat:** The most destructive heat wave of record in California history climaxes at Mecca with a temperature of 124 degrees.
January 22, 1937	**Extreme cold:** 19 degrees at Palm Springs.
September 18-22, 1939	**Excessive heat:** Heat wave with 95-degree plus readings in San Diego, 106 degrees on the 21st. Los Angeles experienced 100-degree weather for seven consecutive days, with a peak of 107 degrees on the 20th. Eight heat-related deaths.
August 31 to September 7, 1955	**Excessive heat:** On September 1st, it was 110 degrees in Los Angeles, and all-time record, and 104 degrees in San Diego.
September 26, 1963	**High heat:** Hot weather throughout the southern California region, including the coastline, with 112 degrees at El Cajon, 109 degrees at Imperial Beach, 113 degrees at El Toro (the hot spot in the nation for that date), 108 degrees in Carlsbad. Crop damage and animal deaths reported. Schools dismissed; workers sent home early.
October 20-29, 1965	**Excessive heat:** Very long heat wave, with a peak of 104 degrees in San Diego on the 22nd. Los Angeles had ten consecutive days with afternoon highs reaching 100 degrees.
September 25-30, 1970	**Excessive heat:** Drought in southern California came to a climax, with hot Santa Ana winds that sent the temperature soaring to 105 degrees in Los Angeles, and 97 degrees in San Diego on the 25th. The Laguna Fire consumed entire communities in eastern San Diego County. Half a million acres burned, with $50 million in property damage.
January 29, 1979	**Extreme cold:** -25 degrees in Big Bear Lake, the lowest temperature ever recorded in southern California.

Date	Description, Including Location and Damage Reported
September 4-19, 1984	**High heat:** Tropical air from weakening hurricane Marie brought hot temperatures and high humidity to the region. 100 degrees in San Diego on the 8th and 9th. Numerous health problems reported due to the poor air quality and high humidity.
January 16-18, 1987	**Extreme cold:** Very cold air mass remained over the region, 22 degrees at Valley Center, 24 degrees in Poway, 26 degrees in El Cajon, 36 degrees in San Diego. Substantial avocado crop loss in the millions of dollars. Two homeless men died of hypothermia on the 17th.
October 3-4, 1987	**High heat:** Dry, hot weather, with 108 degrees both days in Los Angeles (a record for October), 109 degrees in El Cajon, 106 degrees in Chula Vista, Fallbrook and Santee, 104 degrees in San Diego on the 3rd. The dry weather and winds fueled the Palomar Mountain fire.
December 25-26, 1987	**Extreme cold:** Low temperatures caused extensive damage to the avocado and citrus crop. 9 degrees at Mt. Laguna and 22 degrees in Valley Center on the 25th; 15 degrees in Julian and Mt. Laguna, 16 degrees in Campo, 26 degrees in El Cajon, 30 degrees in Del Mar and 37 degrees in San Diego on the 26th.
March 25-26, 1988	**High heat:** Santa Ana conditions brought temperatures into the 90s all over the region, with record heat, and fanning of several brush fires. 102 degrees reported in Santee on the 25th, 97 degrees throughout the San Diego valleys, 95 degrees in Los Angeles and Santa Maria, 90 degrees in San Diego.
December 24-30, 1988	**Extreme cold:** A week of sub-freezing temperatures in southern California; 5 people died directly from the cold weather.
April 6-7, 1989	**Excessive heat:** Record high heat reported at all recording stations in southern California, including 112 degrees in Palm Springs, 106 degrees in Los Angeles, 104 degrees in Riverside, 103 degrees in Escondido, 101 degrees in Tustin, 95 degrees in Victorville, and 76 degrees in Big Bear Lake. Part of a major heat wave that lasted from late March into early April.
December 21-23, 1990	**Extreme cold:** An artic air mass produced record cold temperatures in the region, such as a low of 29 degrees at Redondo Beach on the 22nd. Throughout the state, December 1990 brought record-low temperatures to many areas, causing $3.4 billion in damages to public buildings, utilities, residential burst pipes, and especially, crop and fruit tree damage. Thirty-three counties were included in a disaster declaration, and as a result, the State established the State Agency Freeze Disaster Task Force, and the development of the State Agency Freeze Disaster Action Plan of 1991.
August 17, 1992	**High heat:** Tropical air brought high temperatures and heat index values to Los Angeles and vicinity the entire week. On the 17th, it was 99 degrees, with a heat index of 110 degrees.
August 1, 1993	**High heat:** 123 degrees in Palm Springs.
July 27-29, 1995	**Excessive heat:** Heat wave in the region; 123 degrees at Palm Springs on the 28th and 29th, 120 degrees in Coachella, 113 degrees in San Jacinto, 112 degrees in Riverside, 111 degrees in Banning, Moreno Valley and Sun City; 110 degrees in Yucaipa on the 27th.
August 2-7, 1997	**Excessive heat**: Dangerously hot weather across all of southern California except in the coastal areas. Riverside and Ontario both peaked at 110 degrees Fahrenheit. Intense heat also felt at higher elevations. Beaumont hit 113 degrees, Julian hit 101 degrees. Five deaths were directly attributed to hyperthermia. One female died near Dulzura on the 5th; an elderly female collapsed in her yard in Cabazon on the 6th. On the 7th, a man collapsed in a parking lot in Riverside, and another died at a residence in Flowing Wells. A woman from Campo was hospitalized on the 8th and died several days later. The heat made brush fires difficult to control.
December 26, 1997	**Extreme cold:** 0 degrees reported at Big Bear Lake, 4 degrees at Big Bear Airport.

Date	Description, Including Location and Damage Reported
July 27, 1998	**High heat:** 120 degrees at Palm Springs, 118 degrees at Borrego Springs, 127 degrees at Death Valley.
August 29-31, 1998	**Excessive heat:** Record heat in the region, with 112 degrees in Yorba Linda and the Wild Animal Park, 110 degrees at El Cajon, Hemet and Riverside; 108 degrees at Ramona, 106 degrees in Vista and Escondido, over 100 degrees in most of Orange County, 114 degrees in Dulzura on the 29th. Blazes at Camp Pendleton and Lake Jennings.
June 3, 1999	**Extreme cold:** Unseasonably cold air mass brings record low temperatures this late in the season to the southern California area. The high temperature of 38 degrees at Mt. Wilson became the lowest high temperature on record for June.
May 7-9, 2001	**Excessive heat:** Heat wave with 109 degrees at Palm Springs, Thermal and Borrego Springs, 103 degrees at Hemet, 102 degrees in San Bernardino.
January 28-31, 2002 February 1-3, 2002	**Extreme cold**: Very cold weather reported throughout the southern California area caused water pipes to freeze and burst, damaged vegetable and flower crops, and caused homeless shelters to fill to capacity. $230K in property damage and $1.8M in crop damage reported. One death directly attributed to cold spell. Most freezing damage occurred in January, but the hard freezes continued in the valleys and deserts into early February. Overnight lows in the single digits were common at mountain resort locations.
July 8-11, 2002	**Excessive heat**: Temperatures over 100 degrees Fahrenheit reported in the San Bernardino Mountains for three days. On the third day nine people were admitted to local hospitals for heat exhaustion. A smog alert was also issued due to the hot stagnant air over the area.
September 1, 2002	**High heat:** Tropical heat wave; 118 degrees in Dulzura, 113 degrees in Temecula, 112 degrees in Riverside and Menifee. Sharp temperature gradients, with areas adjacent to the coastline 10 to 30 degrees cooler than areas slightly farther inland (77 degrees at Newport Beach vs. 107 degrees in Santa Ana, 10 miles away; 72 degrees at Oceanside Harbor vs. 87 degrees at Oceanside Airport, 2 miles away).
July 20, 2003	**Excessive heat**: A truck a man and a woman were riding in became stuck near the Twentynine Palms Air-Ground Combat Center. They tried to walk for help, but were overcome by the heat and died.
April 26-27, 2004	**High heat:** Record highs for April set, with 103 degrees at the Wild Animal Park, 100 degrees at Yorba Linda on the 26th.
December 1-3, 2004	**Extreme cold:** 30s in the coast, 20s in the inland valleys and deserts, teens and single digits in the mountains, 8 degrees on all three mornings at Big Bear. Wrightwood reported a low of 9 degrees. Crop damage.
July 10-20, 2005	**Excessive heat**: Record heat reported throughout the area due to a strong high pressure, with temperatures soaring to 121 degrees at Thermal, 120 degrees at Palm Springs, and 116 degrees at Hesperia. No relief was to be found in the mountains either, where even at elevations above 7,000 feet temperatures reached into the mid and upper 90s. Big Bear Lake tied an all high record high of 94 degrees on the 18th, while Idyllwild hit a high of 98 degrees. Daytime temperatures in the inland valleys hit 100 degrees or higher on most days, with a slew of record high minimums reported. One teen died of heat exposure when he and his father went looking for help after their dune-buggy broke down in Anza-Borrego Desert State Park. Near record high power consumption.
July 21-27, 2006	**Excessive heat**: A strong high pressure centered over the SW US and monsoon moisture during the second half of July led to numerous daily high minimums and high maximum temperature records. Desert locations reported the all-time warmest month on record. Heat wave reached its peak on the 22nd; several highs were tied or broken that day. Temperature rose to 105 degrees in Julian, 114 degrees at Ontario, 120

Date	Description, Including Location and Damage Reported
	degrees at Indio and Thermal, and 121 degrees at Palm Springs. There were at least 16 deaths and 27 injuries reported as a result of the heat wave, but these numbers, especially the injuries, are thought to be underestimated. Some power outages occurred.
January 12-18, 2007	**Extreme cold:** A cold snap peaked on the 15th with -7 degrees at Fawnskin, -2 degrees at Big Bear Lake and Wrightwood, 5 degrees at Hesperia, 6 degrees at Mt. Laguna, 18 degrees at Thermal, 19 degrees in Hemet, and 20 degrees at Camp Pendleton. San Diego, Riverside and San Bernardino counties declared disaster areas. $114.7 million in crop damage in San Diego County, $86 million in Riverside County, and $11.1 million in San Bernardino County. $600K in damage from frozen pipes in San Bernardino County.
July 3-6, 2007	**Excessive heat**: A significant heat wave occurred in the mountains and the Coachella Valley, with high temperatures generally around 115 degrees reported in the lower deserts, 105 degrees in the mountains between 3,000 and 5,000 feet, 100 degrees between 5,000 and 6,000 feet, and 95 degrees between 6,000 and 7,000 feet. Most valleys and coastal cities west of the mountains were not affected because of a persistent marine layer, and as a result, there was little media coverage regarding the heat wave. The heat wave likely made many people ill, but the number is unknown.
September 1-4, 2007	**Excessive heat**: A strong high pressure and easterly flow brought hot, humid weather to much of southern California. Temperatures exceeded 110 degrees in the Inland Empire and high deserts, and 115 degrees in the lower deserts. Humidity levels were quite high for the region. At least six people died of heat-related causes; the actual number is probably higher.
June 20, 2008	**High heat**: High temperatures were recorded in the Inland Empire area, including 105-111 degrees in the valleys and 115-118 degrees in the lower deserts. The relatively short duration of the heat spell and the lack of humidity kept this episode from meeting the excessive heat criteria. News reports indicated that several people were treated for heat-related illnesses, but no specifics were provided.

Sources: NOAA database (http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms), and compilation by the National Weather Service office in San Diego (http://www.wrh.noaa.gov/sgx/document/weatherhistory.pdf).

6.3 Community Vulnerability to Severe Weather Damage

6.3.1 Hazards Assessment Summary

The previous sections describe the various extreme weather conditions that have impacted and are likely to impact again the Yucca Valley area. By reviewing the historical record we can better understand the geographic extent of the hazard, the intensity of the events likely to impact the study area, and their probability of occurrence. Each of the hazards covered above is discussed further in the paragraphs below, addressing these issues, with an emphasis on how they pertain specifically to the Yucca Valley area.

6.3.1.1 Windstorms

Windstorms are significant chronic events that cumulatively cause extensive damage, with property losses in the millions of dollars, in addition to injuries and loss of life. A windstorm event in the region can range from a short-term microburst or tornado lasting only a few minutes, to either Santa Ana or thunderstorm-related wind conditions that can last for several days.

The data in Table 6-4 show that high winds can occur in Yucca Valley almost any time during the year, but primarily in January, July, August, and December. More specifically, **Santa Ana wind** conditions occur most often in the fall and winter months, occurring as early as September, and as late as March, but mostly between December and January. These winds tend to impact a large geographic area. Similarly, high winds accompanying **winter storms** approaching from the north or northeast also occur most often between November and March, with most equally distributed between December, January and February. **Tropical storms** that make landfall in Baja California and move north into Arizona and California generally occur between May and September, with most taking place in July and August.

The data presented in Table 6-4 may give the impression that windstorm events have increased in frequency over time. However, this is most likely the result of an incomplete historical record rather than a change in wind frequency. The records are likely missing data because: 1) there were less people in the area that could be impacted by these natural hazards, and 2) only unusually damaging storms would be recorded in newspapers, journals and other sources. Using the record from the last decade only, the study area is impacted by windstorms approximately five times per year, on average, but there is significant variability from year to year. For example, in the years 2001 and 2004, only three high wind events were reported in the area, whereas in 2009, there were nine wind events, and in the year 2000, eight.

The records (see Table 6-5) indicate that **tornadoes** can occur in San Bernardino County at any time of the year, but that they do occur more often in July, followed by August and September. The tornado numbers also vary significantly from year to year. Using only the records between 1990 and 2011, which are deemed to be more complete than those for previous decades, we find that in some years there is substantial tornado activity, while in others, there is none. For example, several tornadoes were reported in the region in 1990, 1997, 1998, 2000, 2001, 2004, 2005, 2008, but no tornadoes were reported in 1992 through 1996, 2002, 2006, 2007, or 2010. Tornadoes and microbursts usually impact a relatively small geographic area. Tornadoes in the southern California area have for the most part been size F0 or F1, but even these tornadoes are capable of causing extensive property damage, injuries and loss of life.

Based on the data presented in Table 6-6, winds in San Bernardino County producing **dust storms** are for the most part the result of Santa Ana conditions, and occurring primarily between October and March. Less than 20% of the dust storms reported are the result of thunderstorms in May and August. For dust storms to occur, there has to be a source of sand, dirt, or ash present, generally the result of vegetation stripping either as a result of man-made activities (such as farming, grading during construction), an antecedent natural disaster (drought, forest fire, a flood event depositing loose sand and silt), or a natural condition (desert). Depending on the availability of sand and other debris, and the regional extent of the wind event responsible for picking up and transporting the dust, a dust storm will be either local or regional in extent. Santa Ana wind conditions, given their regional extent and their wind strength, have the capacity to move large amounts of dust, if there is a source available, great distances (see the Photo on Figure 6-1 showing ash and smoke from wildfires being transported hundreds of miles out to sea).

Unlike flooding hazards, which are generally confined to a discrete area that can be mapped, windstorms may travel in any direction, and are only partly affected by topography (with stronger winds usually observed in canyons and passes, where the winds are funneled by the surrounding topographic highs). Given that we cannot predict when or where a windstorm will occur, nor its intensity, the conservative approach is to assume that a windstorm event can take place anywhere in the Yucca Valley area anytime during the year, but preferentially in the summer (July and August) and winter (December and January).

6.3.1.2 Hail

The data presented in Table 6-7 suggest that most hail events in the Yucca Valley region are caused by late spring and summer thunderstorms, with most of these occurring between July and September. Based on the damage descriptions, these events are typically localized, impacting a relatively small area, most often around Twentynine Palms and Joshua Tree, and generally lasting 30 minutes or less. A few of the hail events reported have been associated with late-season winter storms, with most of these occurring in March. The hailstones produced by these storms have been relatively small in diameter, generally less than 1 inch, but the area impacted by the storm appears to be larger. No deaths or injuries as a result of these hail events were reported, with property damage generally amounting to less than $10,000. The one exception is a thunderstorm reported in 1960 that impacted a large regional area, with hail reported in San Diego, Riverside, and San Bernardino. The large hailstones produced by this storm (2.75 inches in diameter and over 1 pound in weight) caused significant property damage, although a dollar amount was not assigned. This particular event indicates that the southern California area can be affected by severe but unusual (low probability) thunderstorms with the right atmospheric conditions to produce large hailstones.

6.3.1.3 Heavy Snow and Ice

Winter storms that bring snow and ice to the San Bernardino Mountains occur on a yearly basis, with most storms occurring between December and March. However, a few autumn storms as early as October and November have been reported, and Table 6-8 also lists a few late-season storms in April and May. The storms that impact the high desert, including the Yucca Valley area, tend to be regional in scale, generally affecting a large portion of southern California, if not the entire region. Heavy snow and ice accumulation on roof-tops, overhead utility lines, and on tree branches, has been the primary cause of property damage in these events. Traffic accidents caused by unsafe road conditions and road closures due to slope failures and snowdrifts add to the property loss. Most property losses reported to date for an individual storm event vary between a few thousands dollars, to $160,000 (March 2006), but these numbers most likely don't capture all of the losses and are thus not misleading. If the storm impacts low-lying agricultural areas, the losses to crops and livestock can amount to millions of dollars.

6.3.1.4 Temperature Extremes

Table 6-9 includes fifteen **extreme cold** events that have impacted or are inferred to have impacted the Yucca Valley area between 1888 and 2010. Since 1987, eight deaths in the region have been directly attributed to cold weather. Most of these events, as expected, occurred in December, January and February, during the winter months. One extreme cold event was interestingly reported in early June (1999), when a winter storm brought

unseasonably low temperatures to the southern California area, with up to 3 inches of snow reported in the mountains above the 5,500-foot elevation in San Bernardino, Los Angeles, Riverside and San Diego counties. Property and crop damage is not well accounted for, but it amounts in the millions of dollars (the 2007 freeze alone caused $600 thousand in property damage and $11.1 million in crop damage in San Bernardino County).

Table 6-9 also includes 17 **extreme heat** and 10 **high heat** events between 1917 and 2008. At least 30 people reportedly died from high heat between 1997 and 2010, although this number may be underestimated. Most extreme and high heat events occurred between July and September, but at least one high heat event was reported as early as March, one extreme heat event occurred in April, and two events (one high heat and one extreme heat), were reported as late as October. Property and crop losses associated with these events amount to billions of dollars, especially if the damage as a result of the fires associated with these heat waves is included in the loss count.

Temperature extreme events tend to be regional in scale, although to some extent they are controlled by elevation, with high and extreme heat impacting low-lying inland areas preferentially, and extreme cold more likely to impact the higher elevation areas. Given that the Town of Yucca Valley is located at an approximate elevation of 3,300 feet above mean sea level, it enjoys cooler summers than the communities to the south, in the Coachella Valley, and generally milder winters than the mountain communities to the west and northwest.

6.3.2 Damage Assessment

As past events show, storms in the Yucca Valley area and elsewhere have the potential to impact life, property, utilities, infrastructure and transportation systems, causing damage to trees, power lines, utility poles, road signs, cars, trucks, and building roofs and windows. Structures and facilities can be impacted directly by high winds and/or can be struck by air-borne debris or downed trees and power poles. Windstorms can disrupt power to facilities and disrupt land-based communications as well. In fact, historically, trees downed during a windstorm have been the major cause of power outages in the southern California area. Uprooted trees and downed utility poles can also fall across the public right-of-way disrupting transportation.

Hail can and will cause significant damage to structures, vehicles, aircraft, and livestock (not to mention people that don't find cover). Hail can also cause significant damage to crops. The structural components most often damaged by hail include roofs (including glass roofs), skylights, window awnings, and windows. Vehicular accidents as a result of reduced visibility, and hail stones on the pavement acting as ball bearings, can be expected during these kinds of storms.

Extreme cold is typically only one of the hazards associated with winter storms. Thus, in addition to cold temperatures, residents and visitors to the area impacted by a storm have to deal with other potential hazards including icy roadways, strong winds, and power outages. Vehicular accidents and falls on icy sidewalks are two leading causes of injuries during winter storms.

These events can be major hindrances to emergency response and disaster recovery. For example, if transportation routes are compromised by fallen debris, and loss of power occurs in the area, emergency response facilities like hospitals, fire stations, and police stations may find it difficult to function effectively. Falling or flying debris, downed trees and power lines can also injure or kill motorists and pedestrians. As discussed previously, windstorms, especially Santa Ana winds, are often also associated with wildfires, which, if they occur in or near a populated area, can result in enormous losses to property, in addition to injuries and loss of life. Such an event may require the involvement of Town maintenance personnel responding to cleanup and repairs during and following the windstorm. Similarly, maintenance crews may be required to secure certain facilities ahead of a potential storm, provided sufficient advanced notice is available, and that municipal crews are available to respond on short notice.

6.3.2.1 Structural Damage

Depending on its age, condition, and structural design, any structure may be susceptible to windstorm damage. However, buildings with weak reinforcements are most susceptible. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift suction forces that pull building components and surfaces outward and/or upward. Under extreme wind forces, the roof or entire building can fail or sustain considerable damage. Mobile homes are particularly susceptible to windstorm damage. Debris carried by the wind may also contribute to loss of life and, indirectly, to the failure of building envelopes, sidings or walls.

A windstorm also has the potential to displace residents, which may require the Town to provide short-term and/or long-term shelters to accommodate these individuals, in addition to providing for other emergency response activities such as cleanup and repair. This has the potential to impact Yucca Valley economically, as Town funds would have to be tapped into to respond adequately to the needs of the impacted members of the community.

Heavy snow and ice can also cause structural damage. Flat roofs in particular, are susceptible to this hazard, given that as the snow or ice accumulates on the roof, the extra weight stresses the structural supports, causing the roof to collapse, or even damaging the whole structure. A roof collapse as a result of snow accumulation occurred in the Big Bear Lake area in January 2010, pinning down and injuring a teenager. Mobile homes in particular are susceptible to roof collapse due to snow accumulation. As a result of the same snow storm in 2010, four mobile homes in Big Bear Lake and two in Big Bear City suffered roof damage (http://www.bigbearcityfire.org/news_archives.php?id=71).

6.3.2.2 Lifelines and Critical Facilities

Historically, downed trees have been a major cause of power outages in the region during windstorms and winter storms. Some tree limbs can break in winds of about 45 mph, and the broken limbs can be carried by the wind more than 75 feet from their source. Thus, overhead power lines can be damaged even in relatively minor windstorm events. Downed trees can also bring electric power lines down to the pavement or ground, where they become serious, life-threatening, sources of electric shock. Winter storms often do

substantial damage to overhead utilities, usually the result of ice and snow breaking tree branches and limbs that then down power and telephone lines.

Lifelines and critical facilities should remain accessible, if at all possible, during a natural hazard event. The impact of closed transportation arteries may be increased if a blocked road or bridge is critical to access a hospital or other emergency facilities. Population growth and new infrastructure in the region could result in a higher probability for damage to occur from windstorms and winter storms as more lives and property are exposed to these hazards.

Cold waves can cause poorly insulated water pipes to freeze, which in turn can result in substantial property damage. Fires can become more hazardous in extreme cold conditions, especially if the water supply has become unreliable due to water main breaks that hinder firefighting efforts.

6.3.2.3 Infrastructure

As mentioned above, windstorms may damage buildings, power lines, and other property and infrastructure due to falling trees and branches. During wet winters, saturated soils cause trees to become less stable and more vulnerable to uprooting from high winds. Windstorms can also result in damaged or collapsed buildings, blocked roads and bridges, damaged traffic signals and streetlights, and damaged park facilities. Roads blocked by fallen trees during a windstorm may severely impact people attempting to access emergency services. Emergency response operations can be compromised when roads are blocked or when power supplies are interrupted. Industry and commerce can suffer losses from interruptions in electric services and from extended road closures. They can also sustain direct losses to buildings, personnel and other vital equipment.

In addition to the problems caused by downed trees and electrical wires blocking streets and highways, storms can also force the temporary closure of roads to vehicular traffic. This is especially true during extremely strong Santa Ana winds and winter storms, and as a result of microbursts or tornadoes associated with summer thunderstorms. Cold weather can also impact the transportation of goods, especially of produce and livestock, cause significant engine wear and tear, and the freezing and thawing can damage roadways.

The high demand for air-conditioning during a heat wave has a significant impact on the electric transmission system. The heat itself can cause overhead electric lines to sag and short-out. As a result of demand exceeding supply, in addition to the physical damage to the electric transmission lines, it is not uncommon for electric companies to institute or be forced to establish rolling black-outs during periods of excessive heat. Excessive heat can also buckle roads, stress engines, and distort rail lines. All of these conditions add up, increasing the costs of transporting goods. Heat waves also have an impact on the water resources and water infrastructure, with increased demand for water. If wildfires occur during a heat wave, there will be increased use of water for fire-fighting purposes, which can tax the available resources, reducing water supply and water pressure.

Widespread weather observation stations and networks, in addition to great advancements in computer modeling and a better, if not yet comprehensive understanding of atmospheric processes, have greatly facilitated the forecasting of meteorological events such as winter

storms, windstorms, and extreme temperature events. Weather forecasts, combined with an increased use of internet and media resources, permit the wide dissemination of weather warnings in real time, with the potential to greatly reduce the effect of extreme weather events on people and property. Utility companies, relief organizations, and government officials can and should use weather warnings to anticipate an increase in demand for electricity, heating oil or gas, shelters for the homeless, and maintenance and emergency response personnel.

APPENDIX A: REFERENCES and USEFUL WEBSITES

References and Other Useful Sources

Abrahamson, N.A. and Silva, W.J., 1997, Empirical Response Spectral Attenuation Relations for Shallow Crustal Earthquakes: *Seismological Research Letters*, Vol. 68, No.1, pp. 94-127.

Ahrens M., 2009a, Home structure fires: National Fire Protection Association, Quincy, MA.

Ahrens M., 2009b, Smoke alarms in U.S. home fires: National Fire Protection Association, Quincy, MA.

Ahrens M., 2003, The U.S. fire problem overview report: leading causes and other patterns and trends: National Fire Protection Association, Quincy MA.

Allen, C.R., 1957, San Andreas fault zone in San Gorgonio Pass, southern California: *Geological Society of America Bulletin*, Vol. 68, No. 3, pp. 315-350.

Alquist-Priolo Earthquake Fault Zoning Act, California Public Resources Code, Chapter 7.5 Earthquake Fault Zones, Section 2621 et seq., last updated October 2, 2007.

American Red Cross, 1994, Your Guide to Home Chemical Safety and Emergency Procedures, 24p.

American Society for Testing Materials (ASTM) E-108, Standard Test Methods for Fire Tests of Roof Coverings.

Anbar, M., Guttmann, S., and Lewitus, Z., 1959, The mode of action of perchlorate ions on the iodine uptake of the thyroid gland: *International Journal on Application of Radiating Isotopes*, Vol. 7, pp. 87-96.

Anderson, K., 2006, The Use of Fire by Native Americans in California; *in* Sugihara, N.G., van Wagtendonk, J.W., Shaffer, K.E., Fites-Kaufman, J., and Thode, A.E., (editors), 2006, Fire in California's Ecosystems: University of California Press, Berkeley and Los Angeles, California, pp. 417-430.

Andrews, P.L., 1986, BEHAVE: Fire behavior prediction and fuel modeling system BURN subsystem, part 1: US Department of Agriculture, Forest Service, General Technical Report INT-194, Intermountain Research Station, Ogden, Utah, 130p.

Andrews, P.L., and Bevins, C.D., 1999, Update and expansion of the BEHAVE Fire Modeling System: Fire Management Notes.

Andrews, P.L., and Bradshaw, L.S., 1990, RXWINDOW: Defining windows of acceptable burning conditions based on desired fire behavior: US Department of Agriculture, Forest Service, General Technical Report INT-273, Intermountain Research Station, Ogden, Utah, 54p.

Andrews, P.L., and Chase, C.H., 1989, BEHAVE: Fire behavior prediction modeling system-BURN subsystem Part 2: U.S. Department of Agriculture, Forest Service, General Technical Report INT-260, Intermountain Research Station, Ogden, Utah, 93p.

Andrews, R., 1995, Emergency response and recovery after the Northridge earthquake; *in* Woods, M.C., and Seiple, W.R., (editors), The Northridge, California, Earthquake of 17 January 1994: California Department of Conservation, Special Publication 116, pp. 241-245.

Association of Bay Area Governments (ABAG), 1990, Database of Hazardous Materials Releases Which have Occurred Due to Earthquakes: Oakland, California (as referenced in Seligson et al., 1992).

Bacheller, J., III, 1978, Quaternary geology of the Mojave Desert – eastern Transverse Ranges boundary in the vicinity of Twentynine Palms, California: Unpublished M.S. thesis, University of California – Los Angeles, 157p. + map at 1:24,000 scale.

Bader, J.S., and Moyle, W.R., 1960, Data on water wells and springs in the Yucca Valley – Twentynine Palms area, San Bernardino and Riverside Counties, California: California Department of Water Resources Bulletin No. 91-2, 163p., map scale 1:62,500.

Barrette, Brian, 1999, System for Rating Structural Vulnerability in SRA: Sacramento, California, dated September 1999.

Barrows, A.G., 1974, A review of the geology and earthquake history of the Newport-Inglewood structural zone, southern California: California Division of Mines and Geology Special Report 114, 115p.

Barrows, A.G., Irvine, P.J., and Tan, S.S, 1995, Geologic surface effects triggered by the Northridge earthquake; *in* Woods, M.C., and Seiple, W.R. (editors), The Northridge, California, Earthquake of 17 January 1994: California Division of Mines and Geology Special Publication 116, pp 65-88.

Barrows, A.G., Tan, S.S., and Irvine, P.J., 1994, Investigation of Surface Geologic Effects and Related Land Movement in the City of Simi Valley Resulting from the Northridge Earthquake of January 14, 1994: California Division of Mines and Geology Open File Report 94-09, 41p., 1 plate.

Behr, J., Bilham, R., Bodin, P., and Gross, S., 1994, Eureka Peak fault afterslip following the 28 June 1992 Landers earthquake: Bulletin of the Seismological Society of America, Vol. 84, No. 3, pp.826-834.

Blake, T.F., 2000, EQFAULT, A Computer Program for the Estimation of Peak Horizontal Ground Acceleration from 3D Fault Sources.

Blake, T.F., Hollingsworth, R.A., and Stewart, J.P., (editors), 2002, Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigating Landslide Hazards in California: Southern California Earthquake Center, 110p. + Appendix A.

Bolt, Bruce A., 1999, Earthquakes: W.H. Freeman and Company, New York, Fourth Edition, 320p.

Bonilla, M.G., 1973, Trench exposures across surface fault ruptures associated with the San Fernando Earthquake; *in* Geological and Geophysical Studies, Vol. 3 of San Fernando, California, earthquake of February 9, 1971: U.S. Department of Commerce, National Oceanographic and Atmospheric Administration, pp. 173-182.

Boore, D.M., Joyner, W.B., and Fumal, T.E., 1997, Equations for estimating horizontal response spectra and peak acceleration from western North American earthquakes: A Summary of recent work: Seismological Research Letters, Vol. 68, No. 1, pp. 128-153, plus erratum.

Borchardt, G., and Kennedy, M.P., 1979, Liquefaction Potential in Urban San Diego – A Pilot Study: California Geology, Vol. 32, pp. 217-221.

Bortugno, E.J., and Spittler, T.E., 1986, Geologic Map of the San Bernardino Quadrangle: California Division of Mines and Geology Regional Geologic Map Series, Map No. 3A, scale 1:250,000.

Bozorgnia, Y., Campbell, K.W., and Niazi, M., 1999, Vertical Ground Motion: Characteristics, Relationship with Horizontal Component, and Building Code Implications: Proceedings of the SMIP99 Seminar on Utilization of Strong-Motion Data, Oakland, California, pp. 23-50.

Bray, J.D., 2001, Developing Mitigation Measures for the Hazards Associated with Earthquake Surface Fault Rupture; in A Workshop on Seismic Fault-Induced Failures – Possible Remedies for Damage to Urban Facilities: Research Project 2000 Grant -in-Aid for Scientific Research (No. 12355020), Japan Society for the Promotion of Science, Workshop Leader, Kazuo Konagai, University of Tokyo, Japan, pp. 55-79, January 11-12, 2001.

Brewer, L., 1992, Preliminary damage and intensity survey: Earthquakes and Volcanoes, Vol. 23, No. 5, pp. 219-226.

Brooks, M.L., and Minnich, R.A., 2006, Southeastern Deserts Bioregion; *in* Sugihara, N.G., van Wagtendonk, J.W., Shaffer, K.E., Fites-Kaufman, J., and Thode, A.E., (editors), 2006, Fire in California's Ecosystems: University of California Press, Berkeley and Los Angeles, California, pp. 391-414.

Bryan K. A., and Rockwell, T. K., 1995, Holocene character of the Helendale fault zone, Lucerne Valley, San Bernardino County, California: Geological Society of America, Abstracts with Programs, Vol. 27, pp. 7.

Bryant, W.A., 1986a, Fault Evaluation Report for the Pinto Mountain, Mesquite Lake, Copper Mountain, and related faults, Southern San Bernardino County, California: California Division of Mines and Geology FER-181, 16p. + figures.

Bryant, W.A., 1986b, Fault Evaluation Report for the Western North Frontal Fault Zone and Related Faults, San Bernardino County, California: California Division of Mines and Geology FER-186, 16p. + figures.

Bryant, W.A., 1987, Fault Evaluation Report for the Recently active traces of the Harper, Blackwater, Lockhart and related faults near Barstow, San Bernardino County, California: California Division of Mines and Geology FER-189.

Bryant, W.A., 1988, East Airfield fault, Mesquite Lake fault, and western segment of the Pinto Mountain fault, San Bernardino County, California: California Division of Mines and Geology Supplement No. 2 to FER-181, dated January 8, 1988, 5p. + figures.

Bryant. W.A., 1992, Surface fault rupture along the Johnson Valley, Homestead Valley, and related faults associated with the Ms 7.5 28 June 1992 Landers earthquake: California Division of Mines and Geology Fault Evaluation Report FER-234, 21p., scale: 1:24,000.

Bryant, W.A., compiler, 2000, Fault number 118, Pinto Mountain fault zone (includes Morongo Valley fault) in Quaternary fault and fold database of the Unites States: U.S. Geological Survey website, http://earthquakes.usgs.gov/regional/qfaults

Burgan, R.E., 1987, Concepts and interpreted examples in advanced modeling: U.S. Department of Agriculture, Forest Service, General Technical Report INT-238, Intermountain Research Station, Ogden, Utah, 40p.

Burgan, R.E. and Rothermel, R.C., 1984, BEHAVE: Fire prediction and fuel modeling system-FUELsubsystem: U.S. Department of Agriculture, Forest Service, General Technical Report INT-167, Intermountain Forest and Range Experiment Station, Ogden, Utah, 126p.

Cadena, A.M., Rubin, C.M., Rockwell, T.K., Walls, C., Lindvall, S., Madden, C., Khatib, F., and Owen, L., 2004, Late Quaternary activity of the Pinto Mountain Fault at the Oasis of Mara: Implications for the Eastern California Shear Zone: Geological Society of America Abstracts with Programs, Vol. 36, No. 5, pp. 137. [Paper presented at the Annual Meeting in Denver, Colorado, Paper No. 51-5, Nov. 7-10, 2004.]

California Board of Forestry, 1996, California Fire Plan: A Framework for Minimizing Costs and Losses from Wildland Fires: a report dated March 1996.

California Building Standards Commission (CBSC), 2010, California Building Code, Title 24, Part 2, 2 Volumes, 1,600p.

California Building Standards Commission (CBSC), 2010, California Historical Building Code, Title 24, Part 8.

California Building Standards Commission (CBSC), 2010, California Existing Building Code, Title 24, Part 10.

California Building Standards Commission (CBSC), 2001, California Building Code.

California Department of Forestry and Fire Protection (CDF), Fire and Resource Assessment Program (FRAP), 2005a, Fire Threat Map, Scale: 1:1,100,000 at 34″ x 44″; Map ID: FTHREAT_MAP v05_1, published October 20, 2005.

California Department of Forestry and Fire Protection (CDF), Fire and Resource Assessment Program (FRAP), 2005b, Fuel Rank Potential Fire Behavior Map, Scale: 1:1,100,000 at 34" x 44"; Map ID: FRNK_MAP v05_2, published July 07, 2005.

California Department of Forestry and Fire Protection (CDF), 2007, San Bernardino County (South East) Fire Hazard Severity Zones Map, State Responsibility Area (SRA), adopted November 2007, available from www.fire.ca.gov/fire_prevention/fhsz_maps/fhsz_maps_sanbernardinose.php.

California Department of Forestry and Fire Protection (CDF), 2008, San Bernardino County (South East) Fire Hazard Severity Zones Map, Local Responsibility Area (LRA), recommended November 2008; available from www.fire.ca.gov/fire_prevention/fhsz_maps/fhsz_maps_sanbernardinose.php.

California Department of Forestry and Fire Protection, 2009, Fire Perimeters Map, Version 08_2, from http://frap.fire.ca.gov/data/frapgisdata/select.asp and http://frap.cdf.ca.gov/projects/fire_data/fire_perimeters/, last updated on January 09, 2009.

California Department of Water Resources, 1960, Data on water wells and springs in the Yucca Valley-Twentynine Palms Area, San Bernardino and Riverside Counties, California, Bulletin No. 91-2, dated June, 1960.

California Department of Water Resources (DWR), 1986, Statutes and Regulations Pertaining to Supervision of Dams and Reservoirs: Division of Safety of Dams, 46p.

California Department of Water Resources, 2004, California's Groundwater, Bulletin 118, last updated February 27, 2004.

California Division of Mines and Geology (now California Geological Survey), 1988, Earthquake Fault Zones map for Joshua Tree North Quadrangle, Official Map effective March 1, 1988; Scale: 1:24,000.

California Division of Mines and Geology (CDMG), 1992, Recommended Criteria for Delineating Seismic Hazard Zones in California: Special Publication 118, May 1992, Revised July 1999.

California Division of Mines and Geology (now California Geological Survey), 1993a, Earthquake Fault Zones map for Joshua Tree South Quadrangle, Official Map effective July 1, 1993; Scale: 1:24,000.

California Division of Mines and Geology (now California Geological Survey), 1993b, Earthquake Fault Zones map for Yucca Valley South Quadrangle, Official Map effective July 1, 1993; Scale: 1:24,000.

California Division of Mines and Geology (now California Geological Survey), 1993c, Earthquake Fault Zones map for Yucca Valley North Quadrangle, Official Map effective July 1, 1993; Scale: 1:24,000.

California Division of Mines and Geology (CDMG), 1997, Guidelines for Evaluating and Mitigating Seismic Hazards in California: Special Publication 117, 74p.

California Division of Mines and Geology (CDMG), 1998, Maps of known active fault near-source zones in California and adjacent portions of Nevada, to be used with the 1997 Uniform Building Code: International Conference of Building Officials.

California Environmental Quality Act, California Public Resources Code, Section 21000 et seq.

California Geological Survey, 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California: Special Publication 117A, Revised and Re-adopted September 11, 2008 by the State Mining and Geology Board, 98p. Available from http://www.conservation.ca.gov/cgs/shzp/webdocs/Documents/sp117.pdf

California Governor's Office of Planning and Research (OPR), 1998, General Plan Guidelines.

California Governor's Office of Planning and Research (OPR), 2011, Planning, Zoning and Development Laws.

California Regional Water Quality Control – Colorado River Basin Region, 2005, 2004 Triennial Review Workplan, final dated May 4, 2005, 19p.

California Regional Water Quality Control Board – Colorado River Basin Region, 2008, Final Draft 2007 Triennial Review List, 4p., released on January 18, 2008.

California Regional Water Quality Control Board – Colorado River Basin Region, 2010, Staff Report in Support of a Basin Plan Amendment to Prohibit Septic Tank Discharges in the Town of Yucca Valley, dated December 2010.

California Regional Water Quality Control Board – Colorado River Basin Region, 2011, Resolution No. R7-2011-004: Amending the Water Quality Control Plan for the Colorado River Basin Region to Prohibit Septic Tank Discharges in the Town of Yucca Valley, San Bernardino County.

California Seismic Safety Commission (CSSC), 2000, Status of the Unreinforced Masonry Building Law (Government Code Section 8875 *et. seq.*), 2000 Year Report to the Legislature, Adopted April 13, 2000, SSC 00-02.

California Seismic Safety Commission (CSSC), 2003, Status of the Unreinforced Masonry Building Law, 2003 Report to the Legislature, Adopted June 12, 2003.

California Seismic Safety Commission (CSSC), 2006, Status of the Unreinforced Masonry Building Law, 2006 Report to the Legislature, Adopted November 9, 2006, SSC Publication No. 2006-04, 12p. + 2 appendices.

Campbell, K.W., 1997, Empirical near-source attenuation relationships for horizontal and vertical components of peak ground acceleration, peak ground velocity, and pseudo-absolute acceleration response spectra: Seismological Research Letters, Vol. 68, pp. 154-179.

Campbell, K.W., and Bozorgnia, Y., 2000, New empirical models for predicting near-source horizontal, vertical, and V/H response spectra: Implications for design, in Proceedings, 6th International Conference on Seismic Zonation, Palm Springs, California.

Campbell, K.W., and Bozorgnia, Y., 2003a Erratum, Updated Near-Source Ground-Motion (Attenuation) Relations for the Horizontal and Vertical Components of Peak Ground Acceleration and Acceleration Response Spectra: Bulletin of the Seismological Society of America, Vol. 93, No. 4., pp. 1872.

Campbell, K.W., and Bozorgnia, Y., 2003b, Updated Near-Source Ground-Motion (Attenuation) Relations for the Horizontal and Vertical Components of Peak Ground Acceleration and Acceleration Response Spectra: Bulletin of the Seismological Society of America, Vol. 93, No. 1., pp. 314-331.

Campbell, R.H., 1975, Soil slips, debris flows, and rainstorms in the Santa Monica Mountains and vicinity, southern California: U.S. Geological Survey Professional Paper 851, 51p.

Campbell, R.H., Fleming, R.W., Prior, DB., Nichols, D.R., Varnes, D.J., Hampton, M.A., Sangrey, D.A. and Brabb, E.E., 1989, Landslide Classification and Identification of Mud Flows and Other Landslides; *in* Sadler, P.M., and Morton, D.M., (editors), Landslides in a Semi-Arid Environment with Emphasis on the Inland Valleys of Southern California: The Inland Geological Society, Volume 2, pp. 1-27.

Canadian Wood Council, 2000, Fire Safety in Residential Buildings: Building Performance Series, Bulletin No. 2, 11p.

Cannon, S.H., 2001, Debris-Flow Generation from Recently Burned Watersheds: *Environmental & Engineering Geosciences*, Vol. VII, No. 4, November 2001, pp. 321-341.

Cao, T., Bryant, W.A., Rowshandel, B., Branum, D., and Wills, C.J., 2003, The revised 2002 California probabilistic seismic hazard maps, dated June 2003, 11p. Available at http://www.consrv.ca.gov/cgs/rghm/psha/index.htm

Claypole, E.W., 1900, The earthquake at San Jacinto, December 25, 1899: *The American Geologist*, Vol. XXV, Feb. 1900, pp. 106-108, plate III.

Coleman, Ronny J., 1994, Policy Context on Urban-Widland Fire Problem: California State and Consumer Services Agency, A Special Report for the Governor Pete Wilson, dated January 19, 1994, 13p.

Dawson, T.E., Weldon, R.J., II, and Biasi, G.P., 2008, Appendix B: Recurrence Interval and Event Age Data for Type A Faults: U.S. Geological Survey Open File Report 2007-1437B, California Geological Survey Special Report 203B, Southern California Earthquake Center Contribution #1138B, Version 1.0, 38p.

Deng, J., and Sykes, L.R., 1996, Triggering of 1812 Santa Barbara earthquake by a great San Andreas shock: implications for future seismic hazards in southern California: Geophysical Research Letters, Vol. 23, pp. 1155-1158.

Dibblee, T.W., Jr., 1967a, Geologic map of the Deadman Lake quadrangle, San Bernardino County, California: U.S. Geological Survey Miscellaneous Field Investigation Map I-488.

Dibblee, T.W., Jr., 1967b, Geologic map of the Joshua Tree quadrangle, San Bernardino and Riverside Counties, California: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-516, 3p. pamphlet + map at 1:62,500 scale.

Dibblee,T.W., Jr., 1967c, Geologic Map of the Morongo Valley quadrangle, San Bernardino and Riverside Counties, California: U.S. Geological Survey Miscellaneous Geologic Investigations, Map I-517, 4p. pamphlet + map at 1:62,500 scale.

Dibblee, T.W., Jr., 1968a, Geologic Map of the Twentynine Palms quadrangle, San Bernardino and Riverside Counties, California: U.S. Geological Survey Miscellaneous Field Investigation Map -561, at 1:62,500 scale.

Dibblee, T.W., Jr., 1968b, Evidence of major lateral displacement on the Pinto Mountain fault, southeastern California (abstract): Geological Society of America Special Paper 115, 322p.

Dibblee, T.W. Jr., 2008a, Geologic map of the Deadman Lake & Lead Mountain 15 minute quadrangles, San Bernardino County, California: Dibblee Geology Center Map #DF-388, Scale 1:62,500.

Dibblee, T.W. Jr., 2008b, Geologic map of the Joshua Tree & Twentynine Palms 15 minute quadrangles, Riverside and San Bernardino Counties, California: Dibblee Geology Center Map #DF-390, Scale 1:62,500.

Earth Consultants International, 2009, Chapter 4: Safety | City of Twentynine Palms General Plan Update Technical Report, dated October 2009 (Updated March 2010), available at http://29palmsgeneralplan.com

EERI (Earthquake Engineering Research Institute), 1995, Northridge, California, 1994 Earthquake, Vol. 11, Issues S1 and S2.

EERI (Earthquake Engineering Research Institute), 1992, Landers and Big Bear earthquakes of June 28 & 29, 1992, Special Report, Newsletter, August 1992, pp. 1-12.

Eichler, O., and Hackenthal, E., 1962, Uber Ausscheidung und Stoffwechsel von Perchlorat gemessen mit 36ClO4 [Secretion and metabolism of perchlorate measured with 36ClO4]: Naunyn-Schmidedberg's Arch. Exp. Pathol. Pharmakol., Vol. 243, pp. 554-565.

Ellen, S.D., and Fleming, R.W., 1987, Mobilization of debris Flows from soil slips, San Francisco Bay region, California; *in* Costa, J.E. and Wieczorek, G.F. (editors), Debris

flows/avalanches: Process, recognition, and mitigation: Geological Society of America Reviews in Engineering Geology, Vol. VII, pp. 31-40.

Fakhoury, E., and Patton, K.R., 1992, A Practical Approach for Environmental Site Assessment of Oilfield Properties Prior to Redevelopment; *in* Stout, M.L. (editor), Proceedings of the 35th Annual Meeting, Association of Engineering Geologists, October 2-9, 1992, p. 268.

Federal Emergency Management Agency (FEMA), 1985, Comprehensive Earthquake Preparedness Planning Guidelines: City: Earthquake Hazard Reduction Series 2, FEMA-73, 80p.

Federal Emergency Management Agency (FEMA), 1987, FEMA-135, Abatement of Seismic Hazard to Lifelines: Water and Sewer Lifelines and Special Workshop Presentations: Earthquake Hazard Reduction Series No. 2, 181p.

Federal Emergency Management Agency (FEMA), 1987, FEMA-139, Abatement of Seismic Hazard to Lifelines: Proceedings of a Workshop on Development of an Action Plan – Volume 5: Papers on Gas and Liquid Fuel Lifelines: Building Seismic Safety Council; Earthquake Hazard Reduction Series No. 30, 134p.

Federal Emergency Management Agency (FEMA), 1988, FEMA-154, Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook: Applied Technology Council (ATC21), Earthquake Hazards Reduction Series No. 41, 185p.

Federal Emergency Management Agency (FEMA), 1988, FEMA-155, Rapid Visual Screening of Buildings for Potential Seismic Hazards: Supporting Documentation: Applied Technology Council (ATC-21-1), Earthquake Hazards Reduction Series No. 42, 137p.

Federal Emergency Management Agency (FEMA), 1989, FEMA-173, Establishing Programs and Priorities for the Seismic Rehabilitation of Buildings – Supporting Report: Building Systems Development, Inc., Integrated Design Services and Rubin, Claire B.; Earthquake Hazard Reduction Series No 46, 190p.

Federal Emergency Management Agency (FEMA), 1989, FEMA-174, Establishing Programs and Priorities for the Seismic Rehabilitation of Buildings – A Handbook Building Systems Development, Inc., Integrated Design Services and Rubin, Claire B.; Earthquake Hazard Reduction Series No 45, 122p.

Federal Emergency Management Agency (FEMA), 1989, FEMA-175, Seismic Evaluation of Existing Buildings: Supporting Documentation: Applied Technology Council (ATC-22-1); Earthquake Hazard Reduction Series No. 48, 160p.

Federal Emergency Management Agency (FEMA), 1989, FEMA-178, A Handbook for Seismic Evaluation of Existing Buildings (Preliminary): Applied Technology Council (ATC-22); Earthquake Hazard Reduction Series No. 47, 169p.

Federal Emergency Management Agency (FEMA), 1994, (Second Edition), Typical Costs for Seismic Rehabilitation of Existing Buildings: Volume 1: Summary: Prepared for FEMA by the Hart Consultant Group, Inc., Santa Monica, California, 70p., supersedes 1988 version.

Federal Emergency Management Agency (FEMA), 1995, (Second Edition), Typical Costs for Seismic Rehabilitation of Existing Buildings: Volume 2: Supporting Documentation. Second Edition: Prepared for FEMA by the Hart Consultant Group, Inc., Santa Monica, California, 102p., supersedes 1988 version.

Federal Emergency Management Agency (FEMA), 1996, Flood Insurance Rate Maps (FIRMs) for the Town of Yucca Valley, California; Community Panel Nos. 06071C8120H, 06071C8140H, 06071C8855H, 06071C8860H, 06071C8195H, and 06071C8880H.

Federal Emergency Management Agency (FEMA), 1997, Flood Insurance Study, San Bernardino County, California and Unincorporated Areas, Vol. 1 of 4, revised January 17, 1997.

Federal Emergency Management Agency (FEMA), 1998, Home Builder's Guide to Seismic Resistant Construction: Earthquake Hazard Reduction Series, FEMA-232, 75p.

Federal Emergency Management Agency (FEMA), 1998, Seismic Rehabilitation of Buildings: Strategic Plan 2005: Earthquake Hazard Reduction Series FEMA-315, 40p.

Federal Emergency Management Agency (FEMA), 2008, Flood Insurance Study, San Bernardino County, California, and Incorporated Areas, FIS No. 06071CV001A, Revised August 28, 2008.

Federal Emergency Management Agency (FEMA), 2009, NEHRP (National Earthquake Hazards Reduction Program) Recommended Seismic Provisions for New Buildings and Other Structures: FEMA P-750, 388p.

Fife, D.L., 1978, Airfield fault, Mesquite Playa, San Bernardino County, California: California Geology, Vol. 31, No. 3, pp. 51-53.

Fife, D.L., 1980, Giant dessication polygons and playa features; in Fife, D.L., and Brown, A.R., (editors), Geology and Mineral Wealth of the California Desert: South Coast Geological Society, published in conjunction with the October 11-12, 1980 field trip to the California Desert, pp. 414-429.

Finney, M.A., 1995, FARSITE- A Fire Area Simulator for Managers; *in* The Biswell Symposium: Fire Issues and Solutions in Urban Interface and Wildland Ecosystems: U.S. Department of Agriculture, Forest Service, General Technical Report PSW-158, Berkeley, California.

Finney, M.A., 1998, FARSITE: Fire Area Simulator-model development and evaluation: US Department of Agriculture, Forest Service, Research Paper RMRS-RP-4, Rocky Mountain Research Station, Ft. Collins, Colorado, 47p.

Fisher, F.L., 1995, Building Fire Safety in the Wildland Urban Intermix: The Role of Building Codes and Fire Test Standards: Report prepared for the California/China Bilateral Conference on Fire Safety Engineering held August 14-15, 1995 in Sacramento, California, 13p.

Fuis, G.S., and Mooney, W.D., 1990, Lithospheric structure and tectonics from seismic-refraction and other data: *in* Wallace, R.E., (editor), The San Andreas Fault System, California, U.S. Geological Survey Professional Paper 1515, pp. 207-238.

Fumal, T.E., Rymer, M.J., and Seitz, G.G., 2002, Timing of large earthquakes since A.D. 800 on the Mission Creek strand of the San Andreas fault at Thousand Palms Oasis, near Palm Springs: Bulletin of the Seismological Society of America, Special Issue on Paleoseismology of the San Andreas Fault System, Vol. 92, No.7 , pp. 2841-2860.

Fumal, T.E., Weldon II, R.J., Biasi, G.P., Dawson, T.E., Seitz, G.G., Frost, W., and Schwartz D.P., 2002, Evidence for large earthquakes on the San Andreas fault at the Wrightwood, California, Paleoseismic site: A.D. 500 to present: Bulletin of the Seismological Society of America, Special Issue on Paleoseismology of the San Andreas Fault System, Vol. 92, No. 7, pp. 2726-2760.

Ganev, P.N., Dolan, J.F., Blisniuk, K., Oskin, M., and Owen, L.A., 2010, Paleoseismologic evidence for multiple Holocene earthquakes on the Calico fault: Implications for earthquake clustering in the Eastern California shear zone: Lithosphere, Vol. 2, No. 4, pp. 287-298; doi:10.1130/L82.1

Garrison, T., 2002, Oceanography – An Invitation to Marine Science: Wadsworth Publishing House, Belmont, California, 4th Edition.

Glowacka, E., Nava, F.A., Díaz de Cossío, G., Wong, V., Farfán, F., 2002, Fault slip, seismicity, and deformation in Mexicali Valley, Baja California, Mexico, after the M 7.1 1999 Hector Mine earthquake: Bulletin of the Seismological Society of America, Vol. 92, No. 4, pp. 1290-1299.

Goklany, I.M., 2007, Death and Death Rates Due to Extreme Weather Events | Global and U.S. Trends, 1900-2006: International Policy Press, a division of International Policy Network, London, 15p.

Gosnold, William D., Jr., LeFever, Julie A., Todhunter, Paul E., and Osborne, Leon F., Jr., 2000, Rethinking Flood Prediction: Why the Traditional Approach Needs to Change: Geotimes, Vol. 45, No. 5, pp. 20-23.

Greenlee, J., and Sapsis, D., 1996, Prefire effectiveness in fire management: A summary and a review of the state-of-knowledge: International Association of Wildland Fire, Fairfield, WA, dated August 1996.

Greenwood, R.B., 1998, Section 1 - Liquefaction Evaluation Report: Liquefaction zones in the Long Beach 7.5-Minute Quadrangle, Los Angeles County, California: California Division of Mines and Geology Seismic Hazard Zone Report for the Long Beach 7.5-Minute Quadrangle, Los Angeles County, California, Open File Report No. 98-19, pp. 3-20.

Griggs, G.B., Marshall, J.S., Rosenbloom, N.A., and Anderson, R.S., 1991, Ground Cracking in the Santa Cruz Mountains in Baldwin, J.E. and Sitar, N. (editors), Loma Prieta Earthquake:

Association of Engineering Geologists, Engineering Geologic Perspectives, Special Publication No. 1, pp. 25-41.

Grimes, G.J., 1987, Geology at the convergence of the Pinto Mountain fault and Morongo Valley fault, southern California: unpublished M.S. thesis, California State University, Los Angeles, 102p., map scale 1:12,000.

Grimes, G.J., 1981, Geologic map of part of the Yucca Valley area: Unpublished map for the California Division of Mines and Geology Data Base Augmentation Program, Scale 1:24,000.

Grimes, G.J., 1992, Sediments in Yucca Valley adjacent to the Pinto Mountain fault: San Bernardino County Museum Association, Special Publication 92-2, prepared in conjunction with the 1992 Mojave Desert Quaternary Research Center Symposium, May 15-18, 1992, pp. 28-30.

Hall, J.R., 2001, Burns, toxic gases, and other hazards associated with fires: Deaths and injuries in fire and non-fire situations: National Fire Protection Association, Fire Analysis and Research Division, Quincy, MA.

Harp, E.L., and Jibson, R.W., 1996, Landslides triggered by the 1994 Northridge, California, Earthquake: Bulletin of the Seismological Society of America, Vol. 86, No. 1B, pp. S319-S332.

Hart, E.W., and Bryant, W.A., 1999, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps: California Division of Mines and Geology Special Publication 42.

Hart, E.W., and Bryant, W.A., 2007 Interim Revision, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps: California Division of Mines and Geology Special Publication 42, 42p., available from the web at http://www.consrv.ca.gov/cgs/rghm/ap/Pages/disclose.aspx.

Hart, E.W., Bryant, W.A., and Treiman, J.A., 1993, Surface faulting associated with the June 1992 Landers earthquake, California: California Geology, Vol. 46, pp. 10-16.

Haukson, E., Jones, L.M., and Hutton, K., 2002, The 1999 Mw 7.1 Hector Mine, California, earthquake sequence: Complex conjugate strike-slip faulting: Bulletin of the Seismological Society of America, Vol. 92, No. 4, pp. 1154-1170.

Hauksson, E., Stock, J., Hutton, K., Yang, W., Vidal-Villegas, J.A., and Kanamori, H., 2010, The 2010 Mw 7.2 El Mayor-Cucapah Earthquake Sequence, Baja California, Mexico and Southernmost California, USA: Active Seismotectonics along the Mexican Pacific Margin: Pure and Applied Geophysics, printed online 16 November 2010, 23p., doi: 10.1007/s00024-010-0209-7.

Hawkins, H.G., and McNey, J.L., 1979, Homestead Valley earthquake swarm, San Bernardino County, California: California Geology, Vol. 31, No. 10, pp. 222-224.

Helm, R., Neal, B., and Taylor, L., 1973, A Fire Hazard Severity Classification System for California's Wildlands: A report by the Department of Housing and Urban Development and the California Department of Conservation, Division of Forestry to the Governor's Office of Planning and Research, dated April 1, 1973.

Hereford and Longpre, 2009, Climate History of the Mojave Desert Region, 1982-1996, Including Data from 48 Long-Term Weather Stations and an Overview of Regional Climate Variation, U.S. Geological Survey, http://mojave.usgs.gov/climate-history/.

Herzberg, M., 1996, The Neotectonic History of the Johnson Valley fault, San Bernardino County, California: M.S. Thesis, San Diego State University, 68p.

Hi-Desert Water District (HDWD), 2012, District Facts, www.hdwd.com/AboutUs/District Facts.aspx

Hill, R.T., 1928, Southern California geology and Los Angeles earthquakes: Southern California Academy of Sciences, Los Angeles, 232p.

Hill, R.L., Pechman, J.C., Treiman, J.A., McMillan, J.R., Given, J.W., and Ebel, J.E., 1980, Geologic study of the Homestead Valley earthquake swarm of March 15, 1979: California Geology, Vol. 32, No. 3, pp. 60-67.

Hopson, R.F., 1996, Basement rock geology and tectonics of the Pinto Mountain fault, San Bernardino County, southern California: Unpublished M.S. thesis, California State University, Los Angeles, 132p.

Hough, S. E., Moil, J., Sembera, E., Glassmoyer, G., Mueller, C. and Lydeen, S., 1993, Southern surface rupture associated with the 1992 M 7.4 Landers earthquake: did it all happen during the mainshock?: Geophysical Research Letters, Vol. 20, pp. 2615-2618.

Howard, K.A., Bacheller, J. III, Fitzgibbon, T.T., Powell, R.E., and Allen, C.M., 1995, Geologic map of the Valley Mountain 15-minute quadrangle, San Bernardino and Riverside Counties, California: U.S. Geological Survey Open-File Report 95-528, scale: 1:62,500.

Huff, J.A., Clark, D.A., and Martin, P., 2002, Geologic and ground-water data for monitoring sites in the Mojave River and Morongo Ground-Water basins, San Bernardino County, California, 1992-98: U.S Geological Survey Open-File Report 02-354.

Institute for Local Self Government, 1992, Fire Retardant Roofing: How we can save lives and property: A guide for enacting local ordinances for fire and retardant roofing, 69p.

Insurance Services Office, Inc. (ISO), 1997, The Wildland/Urban Fire Hazard: ISO, New York, December 1997.

International Code Council (ICC), 2006, International Building Code.

International Code Council (ICC), 2009, International Building Code.

International Code Council (ICC), 2012, International Wildland-Urban Interface Code.

International Conference of Building Officials (ICBO), 2001, California Historical Building Code, California Building Standards Commission, Part 8, Title 24, California Code of Regulations.

International Conference of Building Officials (ICBO), 1997, Uniform Building Code.

International Conference of Building Officials (ICBO), 1998, California Building Code.

Jackson, W.A., Bohlke, J.K., Gu, B., Hatzinger, P.B., and Sturchio, N.C., 2010, Isotopic composition and origin of indigenous natural perchlorate and co-occurring nitrate in the Southwestern United States: Environmental Science Technology, Vol. 44, No. 13, pp. 4869-4876, DOI:10.1021/es903802j.

Jacoby, G.C. Jr., Sheppard, P.R., and Sieh, K.E., 1988, Irregular Recurrence of Large Earthquakes along the San Andreas Fault: Evidence from Trees: Science, Vol. 241, No. 4862, pp. 196-199.

James, H., 1986, Report of subsurface Alquist-Priolo investigation of Assessor's Parcel No. 615-221-03, 04, and 05, located northeast of the intersection at 29 Palms Highway and Sunrise Road, Twentynine Palms, California: Unpublished consulting report by Southern California Soil and Testing, Inc., of Palm Desert, California, for Warner Engineering; Project No. SCS&T 8531123, 4p. + 2 plates; dated February.

Jennings, Charles W., 1994, Fault Activity Map of California and Adjacent Areas with Location and Ages of Recent Volcanic Eruptions: California Division of Mines and Geology, California Geologic Data Map Series, Map No. 6, Map Scale: 1:250,000. (CD-2000-06: Digital Database of Fault Activity Map of California and Adjacent Areas).

John M. Tettemer & Associates, Inc., 1999, Yucca Valley Master Plan of Drainage, Final Report, prepared for the San Bernardino County Flood Control District, February 1999.

Johnson, I.A., 1998, Land Subsidence Due to Fluid Withdrawal in the United States - An Overview; *in* Borchers, J.W. (editor), Land Subsidence, Case Studies and Current Research: Association of Engineering Geologists, Proceedings of the Dr. Joseph F. Poland Symposium on Land Subsidence, Special Publication 8, pp.51-57.

Jones, L.M., 1995, Putting Down Roots in Earthquake Country: Southern California Earthquake Center (SCEC) Special Publication, Los Angeles, California.

Jones, L., Mori, J., and Hauksson, E., 1995, The Landers Earthquake: Preliminary Instrumental Results: Earthquakes and Volcanoes, Vol. 23, No. 5, pp. 200-208.

Jones, L.M., Bernknopf, R., Cox, D., Goltz, J., Hudnut, K., Mileti, D., Perry, S., Ponti, D., Porter, K., Reichle, M., Seligson, H., Shoaf, K., Treiman, J., and Wein, A., 2008, The ShakeOut Scenario: U.S. Geological Survey Open File Report 2008-1150, California Geological Survey Preliminary Report 25, version 1.0, 308p.

Karter, M.J., 2009, Fire loss in the United States during 2008: National Fire Protection Association, Fire Analysis and Research Division, Quincy, MA.

Keefer, D.K., 1984, Landslides caused by earthquakes: Geological Society of America Bulletin, Vol. 95, No. 4, pp. 406-421.

Keefer, D.K., and Wilson, R.C., 1989, Predicting earthquake-induced landslides with emphasis on arid and semi-arid environments; *in* Sadler, P.M., and Morton, D.M., (editors), Landslides in a Semi-Arid Environment with Emphasis on the Inland Valleys of Southern California: Inland Geological Society of Southern California, Volume 2, pp. 118-149.

Kennedy/Jenks Consultants, 2011, Final 2010 Urban Water Management Plan, prepared for the Hi-Desert Water District; K/J Project No. 1089057*00, dated June 2011.

Kennedy/Jenks/Chilton, 1991, Final Draft Report, Warren Valley Basin Management Plan; unpublished consulting report for the Warren Valley Basin Watermaster, K/J/C Project No. 904619.00, dated January 30, 1991.

Kohler, S., 2006, Aggregate Availability in California – Fifty-Year Aggregate Demand Compared to Permitted Aggregate Resources, Map Sheet 52: Department of Conservation, California Geological Survey, dated December 2006.

Lagasse, P.F., Schall, J.D., Johnson, F., Richardson, E.V., Richardson, J.R., Chang, F., 1991, Stream stability at highway structures: U.S. Department of Transportation No. FHWA-IP-90-014 Hydraulic Engineering Circular 20, 195p.

Lander, J.F., 1968, Seismological Notes: March and April 1968: Bulletin of the Seismological Society of America, Vol. 58, No. 5, pp. 1709-1714.

Langenheim, V.E., and Powell, R.E., 2009, Basin geometry and cumulative offsets in the Eastern Transverse Ranges, southern California: Implications for transrotational deformation along the San Andreas fault system: Geosphere (a publication of the Geological Society of America), Vol. 5, No. 1 (February edition), pp. 1-22; DOI: 10.1130/GES00177.1.

Larson, L., 2009, How Certain Are We About Our Flood Risk?: Natural Hazards Observer, Vol. XXXIII, No. 6, dated July 2009.

Lazarte, C.A., Bray, J.D., Johnson, A.M., and Lemmer, R.E., 1994, Surface breakage of the 1992 Landers earthquake and its effects on structures: Bulletin of the Seismological Society of America, Vol. 84, No. 3, pp 547-561.

Lewis, R.E., 1972, Ground-water Resources of the Yucca Valley – Joshua Tree Area, San Bernardino County, California: U.S. Geological Survey Water Resources Division, Open-File Report prepared in cooperation with the Mojave Water Agency, 51p.

Louderback, G.D., 1949, Seismological Notes, Desert Hot Springs Earthquake: Bulletin of the Seismological Society of America, Vol. 39, No. 1, pp. 57-65.

Lund, Le Val, 1994, Lifelines Performance in the Landers and Big Bear (California) Earthquakes of 28 June 1992: Bulletin of the Seismological Society of America, Vol. 84, No. 3, pp. 562-572.

Lund, Le Val, 1996, Lifeline Utilities Performance in the 17 January 1994 Northridge, California Earthquake: Bulletin of the Seismological Society of America, Vol. 86, No. 1B, pp. S350-S361.

Madden, C.L., Rubin, C.M., and Streig, A., 2006, Holocene and latest Pleistocene activity on the Mesquite Lake Fault near Twentynine Palms, Eastern California Shear Zone: Implications for Fault Interaction: Bulletin of the Seismological Society of America, Vol. 96, No. 4A, pp. 1305-1320, DOI 10.1785/0120020120.

Manson, M.W., 1986, Homestead Valley fault, Johnson Valley fault, and associated faults, San Bernardino County, California: California Division of Mines and Geology Fault Evaluation Report FER-180, Open-File Report 90-14, scale: 1:24,000.

Matti, J.C., and Morton, D.M., 1993, Paleogeographic evolution of the San Andreas fault in southern California: a reconstruction based on a new cross-fault correlation; *in* Powell, R.E., Weldon, R.J., II, and Matti, J.C., (editors), The San Andreas Fault System: Displacement, Palispastic Reconstruction, and Geologic Evolution: Geological Society of America Memoir, Vol. 178, pp. 107-159.

Matti, J.C., Morton, D.M., and Cox, B.F., 1992, The San Andreas fault system in the vicinity of the central Transverse Ranges province, southern California: U.S. Geological Survey Open-File Report No. 92-354, 40p., map at 1:250,000 scale.

McCulloch, D. S., 1985, Evaluating Tsunami Potential; *in* Ziony, I., (editor), Evaluating Earthquake Hazards in the Los Angeles Region: United States Geological Survey Professional Paper 1360, pp. 375-413.

McGarr, A., and Vorhis, R. C., 1968, Seismic Seiches from the March 1964 Alaska earthquake: U.S. Geological Survey Professional Paper 544-E, 43p.

McGill, S.F., Dergham, S., Barton, K., Berney-Ficklin, T., Grant, D., Hartling, C., Hobart, K., Minnich, R. Rodriguez, M., Runnerstrom, E., Russell, J., Schmoker, K., Stumfall, M., Townsend J., and Williams J., 2002, Paleoseismology of the San Andreas Fault at Plunge Creek, near San Bernardino, Southern California: Bulletin of the Seismological Society of America, Vol. 92, pp. 2803-2840, doi:10.1785/0120000607.

McJunkin, R.D., 1980, Strong-motion data for the Homestead Valley Earthquake Swarm, San Bernardino County, California, 15 March 1979: California Geology, Vol. 32, No. 1, pp. 11-13.

Meisling, K.E., 1984, Neotectonics of the north frontal fault system of the San Bernardino Mountains, southern California; Cajon Pass to Lucerne Valley: California Institute of Technology, unpublished Ph.D. dissertation.

Meltzner, A.J., Rockwell, T.K., and Owen, L.A., 2006, Recent and long-term behavior of the Brawley Fault Zone, Imperial Valley, California: An escalation in slip rate?: Bulletin of the Seismological Society of America, Vol. 96, No. 6, pp. 2304-2328; DOI: 10.1785/0120050233.

Messaros, Karin, 2009, Staff with the Joshua Tree National Park, e-mail communication on October 8, 2009.

Miller, W.J., 1938, Pre-Cambrian and associated rocks near Twentynine Palms, California: Geological Society of America Bulletin, Vol. 49, No. 3, pp. 417-446.

Morton, D.M., Miller, F.K., and Smith, C.C., 1980, Photo-reconnaissance maps showing young-looking fault features in the southern Mojave Desert, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1051, 7 sheets, Scale: 1:24,000.

Morton, D.M., Campbell, R.H., Jibson, R.W., Wesson, R.L., and Nicholson, C., 1989, Ground fracturing and landsliding produced by the July 8, 1986 North Palm Springs Earthquake; *in* Sadler, P.M., and Morton, D.M. (editors), Landslides in a Semi-Arid Environment with Emphasis on the Inland Valleys of Southern California: Inland Geological Society, Volume 2, pp. 183-196.

Morton, D.M., Matti, J.C., and Tinsley, J.C., 1987, Banning fault, Cottonwood Canyon, San Gorgonio Pass, southern California: Geological Society of America Centennial Field Guide-Cordilleran Section.

Morton, D.M., and Sadler, P.M., 1989, Landslides flanking the northeastern Peninsular Ranges and the San Gorgonio Pass area of southern California; *in* Sadler, P.M., and Morton, D.M. (editors), Landslides in a Semi-Arid Environment with Emphasis on the Inland Valleys of Southern California, Inland Geological Society, Vol. 2, pp. 338-255.

Murphy, Sean, 2009, GIS Specialist with the Joshua Tree National Park, e-mail communication via Karin Messaros on October 8, 2009.

MWH, 2007, Water System Master Plan, prepared for the HI-Desert Water District, July 2007.

National Climatic Data Center, 2010, Various Event Record Details, www4.ncdc.noaa.gov.

National Earthquake Information Center (NEIC) USGS Earthquake Hazards Program http://neic.usgs.gov/neis/epic/epic_rect.html

National Oceanic & Atmospheric Administration (NOAA), 2005a, NOAA identifies causes for latest wet weather in west, NOAA News Online (Story 2395) at www.noaanews.noaa.gov.

National Oceanic & Atmospheric Administration (NOAA), 2005b, Worsening drought in northwest, record rain in the southwest in January, NOAA News Online (Story 2389), at www.noaanews.noaa.gov.

National Park Service, Joshua Tree National Park, 2005, Fire Management Plan Environmental Assessment: document prepared by Mangi Environmental Group, McLean, VA, dated April 2005.

National Research Council, Committee on Natural Disasters, Commission on Engineering and Technical Issues, 1993, Wind and the Built Environment: U.S. Needs in Engineering and Hazard Mitigation: National Academy Press, Washington D.C., 230p.

National Research Council, Committee on Alluvial Fan Flooding, 1996, Alluvial Fan Flooding, ISBN: 0-209-5542-3, 182p.

National Research Council, Committee on FEMA Flood Maps, 2009, Mapping the Zone – Improving Flood Map Accuracy: National Academies Press, ISBN: 0-309-13058-1, 136p.

Nishikawa, T., Densmore, J.N., Martin, P., and Matti, J., 2003, Evaluation of the Source and Transport of High Nitrate Concentrations in Ground Water, Warren Subbasin, California: U.S. Geological Survey, Water-Resources Investigations Report 03-4009, prepared in cooperation with the Hi-Desert Water District and the Mojave Water Agency, 133p.

O'Rourke, Michael J., and X. Liu, 1999, Response of Buried Pipelines Subject to Earthquake Effects: American Society of Civil Engineers, Multidisciplinary Center for Earthquake Engineering Research Monograph #3, Buffalo, New York, 249p.

Oskin, M., Perg, L., Blumentritt, D., Muckopadhyay, S., and Iriondo, A., 2007, Slip rate of the Calico fault: implications for geologic versus geodetic rate discrepancy in the Eastern California Shear Zone: Journal of Geophysical Research - Solid Earth, Vol. 112, DOI:10.1029/2006JB004451.

Perry, R.W., and Lindell, M.K., 1995, Earthquake-initiated hazardous materials release: Lessons Learned from the Northridge Earthquake: George Washington University and Arizona State University.

Person, W. J., 1986, Earthquakes: July - August 1986: Earthquakes and Volcanoes, Vol. 19, No. 1, pp. 32-35.

Person, W. J., 1992, Earthquakes: March - April 1992: Earthquakes and Volcanoes, Vol. 23, No. 5, pp. 227-233.

Petersen, M.D., Bryant, W.A., Cramer, C.H., Cao, T., and Reichle, M.S., (California Division of Mines and Geology), Frankel, A.D., Lienkaemper, J.J., McCrory, P.A., and Schwartz, D.P., (U.S. Geological Survey), 1996, Probabilistic seismic hazard assessment for the State of California: California Division of Mines and Geology Open-File Report 96-08 and U.S. Geological Survey Open-File Report 96-706, 64 p.

Petersen, M. D. and Wesnousky, S.G., 1994, Fault slip rates and earthquake histories for active faults in southern California: Bulletin of the Seismological Society of America, Vol. 84, No. 5, pp. 1608-1649.

Philibosian, B., Fumal, T.E., and Weldon, R.J., 2011, San Andreas Fault Earthquake Chronology and Lake Cahuilla History at Coachella, California: Bulletin of the Seismological Society of America, Vol. 101, No. 1, pp. 13-38, doi: 10.1785/0120100050

Phillips, Clinton B., 1983, Instructions for Zoning Fire Hazard Severity in State Responsibility Areas in California: California Department of Forestry, dated December 1983.

Platte, M., and Brazil, J., 1993, Water Pressure Burned Laguna – Fire Distribution Problems, and Not Low Supply – Hindered Fight, Records Show: Los Angeles Times article, November 14, 1993; http://articles.latimes.com/1993-11-14/news/mn-56930_1_low-water-pressure.

Porter K., Wein, A., Alpers, C., Baez, A., Barnard, P., Carter, J., Corsi, A., Costner, J. Das, T., Dettinger, M., Done, J., Eadie, C., Eymann, M., Ferris, J., Gunturi, P., Hughes, M., Jarrett, R., Johnson, L., Le-Griffin, H., Mitchell, D., Morman, S., Neiman, P., Olsen, A., Perry S., Plumlee, F., Ralph, M., Reynolds, D., Rose, A., Schaefer, K., Serakos, J., Siembieda, W., Stock, J., Strong, D., Wing, I., Tang, A., Thomas, P., Topping, K., and Wills, C., Jones, L. (chief scientist), and Cox, D. (project manager), 2011, Overview of the Arkstorm Scenario, U.S. Geological Survey Open File Report 2010-1312, 183p. plus appendices.

Ralph, F.M., and Dettinger, M.D., 2011, Storms, Floods, and the Science of Atmospheric Rivers, in EOS, Transactions, American Geophysical Union, Vol. 92, No. 32, dated 9 August 2011.

Rasmussen, Gary S., & Associates, Inc., 1992, Subsurface Engineering Geology Investigation, Tract No. 10682-1 and -2, Lots 1-76 Immediately South of Onaga Trail, West of Palomar Avenue, Yucca Valley, California: unpublished consulting report for Redlands Financial Services, Inc., Project No. 3141, dated December 3, 1992.

Reneau, S.L., and Dietrich, W.E., 1987, The importance of hollows in debris flow studies; examples from Marin County, California; *in* Costa, J.E. and Wieczorek, G.F. (editors), Debris flows/avalanches: Process, recognition, and mitigation: Geological Society of America Reviews in Engineering Geology, Vol. VII, pp. 165-179.

Richardson, E.V., Harrison, L.J., Richardson, J.R., and Davis, S.R., 1993, Evaluating scour at bridges (2d ed.): U.S. Department of Transportation Hydraulic Engineering Circular 18, 132p.

Rockwell, T.K., Lindvall, S., Herzberg, M., Murbach, D., Dawson, T., and Berger, G., 2000, Paleoseismology of the Johnson Valley, Kickapoo and Homestead Valley faults: clustering of earthquakes in the Eastern California Shear Zone: Bulletin of the Seismological Society of America, Vol. 90, pp. 1200-1237.

Rogers, D. E., 1998, Perchlorate user and production information [memorandum with attachments to Annie M. Jarabek], Wright-Patterson Air Force Base, OH: Department of the Air Force, Air Force Materiel Command Law Office; October 30.

Rogers, J.J.W., 1954, Geology of a portion of Joshua Tree National Monument, Riverside County, in Jahns, R.H., ed., Geology of Southern California, California Division of Mines and Geology Bulletin 170, map sheet no. 24, 1:84,000.

Rogers, J.J.W., 1958, Textural and spectrochemical studies of the White Tank quartz monzonite, California, Geological Society of America Bulletin, v.69, no. 4, p. 449-464.

Rogers, J.J.W., 1961, Igneous and metamorphic rocks of the western portion of the Joshua Tree National Monument, Riverside and San Bernardino Counties, California, California Division of Mines and Geology Special Report 68.

Rubin, C.M., and Sieh, K., 1997, Long dormancy, low slip rate, and similar slip-per-event for the Emerson fault, eastern California shear zone: Journal of Geophysical Research, Vol. 102, pp. 15,319-15,333.

Rymer, M.J., 2000, Triggered surface slips in the Coachella Valley area associated with the 1992 Joshua Tree and Landers, California, earthquakes: Bulletin of the Seismological Society of America, Vol. 90, No. 4, pp. 832-848; DOI: 10.1785/0119980130.

Rymer, M.J., Boatwright, J., Seekins, L.C., Yule, J.D., and Liu, J., 2002, Triggered surface slips in the Salton Trough associated with the 1999 Hector Mine, California, earthquake: Bulletin of the Seismological Society of America, Vol. 92, No. 4, pp. 1300-1317.

Sadigh, K., Chang, C.Y., Egan, J.A., Makdisi, F., and Youngs, R.R., 1997, Attenuation Relations for Shallow Crustal Earthquakes Based on California Strong Motion Data: Seismological Research Letters, Vol. 68, No.1, pp. 180-189.

San Bernardino County, 2009, Land Use Plan, General Plan, Hazard Overlay Maps for Yucca Valley.

San Bernardino County Flood Control District, 2006, Flood History, updated October 5, 2006, http://www.co.san-bernardino.ca.us/flood.

San Bernardino County Flood Control District, 2009, Flood History, http://www.co.san-bernardino.ca.us.

San Bernardino County Flood Control District, 2011, Yucca Valley Flood Control System, 6-4054-00 through 6-486-00, SBCFCD file no. RM-D4-8, dated October 2011.

Scawthorn, C.R., 2008, The ShakeOut Scenario Supplemental Study: Fire Following Earthquake: U.S. Geological Survey Open File Report 2008-1150, dated March 3, 2008.

Seismic Hazards Mapping Act, California Public Resources Code, Section 2690 et seq., last updated May 13, 2003.

Seligson, H.A., Eguchi, R.T., and Tierney, K.J., 1992, A methodology for assessing the risk of hazardous materials release following earthquakes – a demonstration study for the Los Angeles area: Proceedings of the 4th U.S.-Japan Workshop on Earthquake Disaster Prevention for Lifeline Systems, U.S. Government Printing Office, Washington D.C., pp. 437-450.

Seligson, H.A., Eguchi, R.T., Tierney, K.J., and Richmond, K., 1996, Chemical Hazards, Mitigation and Preparedness in Areas of High Seismic Risk: A Methodology for Estimating the Risk of Post-Earthquake Hazardous Materials Release: National Center for Earthquake Engineering Research (NCEER) Technical Report 96-0013, dated November 7, 1996.

Siddiqui, M., LeChevallier, M. W., Ban, J., Phillips, T., and Pivinski, J., 1998, Occurrence of perchlorate and methyl tertiary butyl ether (MTBE) in groundwater of the American water system: American Water Works Service Company, Inc., Vorhees, NJ, September 30.

Sieh, K., 1986, Slip rate across the San Andreas fault and prehistoric earthquakes at Indio, California: Eos, Transactions of the American Geophysical Union, Vol. 67, No. 55, p. 1200.

Sieh, K., Jones, L., Hauksson, E., Hudnut, K., Eberhart-Phillips, D., Heaton, T., Hough, S., Hutton, K., Kanamori, H., Lilje, A., Lindvall, S., McGill, S., Mori, J., Rubin, C., Spotila, J. A., Stock, J., Thio, H., Treiman, J., Wernicke, B., and Zachariasen, J., 1993, Near-field investigations of the Landers Earthquake sequence, April to July, 1992: Science, Vol. 260, pp. 171-176.

Sieh, K., Stuiver, M. and Brillinger, D., 1989, A more precise chronology of earthquakes produced by the San Andreas fault in southern California: Journal of Geophysical Research, Vol. 94, pp. 603-623.

Sieh, K. and Williams, P., 1990, Behavior of the southernmost San Andreas fault during the past 300 years: Journal of Geophysical Research, Vol. 95, pp. 6629-6645.

Sneed, M., Ikehara, M.E., Stork, S.V., Amelung, F., and Galloway, D.L., 2003, Detection and measurement of land subsidence using interferometric synthetic aperture radar and global positioning system, San Bernardino County, Mojave Desert, California: U.S. Geological Survey Water-Resources Investigations Report 03-4015.

Southern California Earthquake Center (SCEC), 2001, Southern California Faults and Earthquakes, World-Wide Web Site: www.scecdc.scec.org.

Southern California Earthquake Center (SCEC), 2002, Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigation Landslide Hazards in California: Blake, T.F., Hollingsworth, R.A., and Stewart, J.P. (editors), 110p. + Appendix.

Spittler, T.E., Harp, E.L., Keefer, D.K., Wilson, R.C., and Sydnor, R.H., 1990, Landslide Features and Other Coseismic Fissures Triggered by the Loma Prieta Earthquake, Santa Cruz Mountains, California *in* McNutt, S.R., and Sydnor, R.H., (editors), The Loma Prieta (Santa Cruz Mountains), California, Earthquake of 17 October 1989: California Division of Mines and Geology Special Publication 104, pp. 59-66.

Stamos, C.L., Glockhoff, C.S., McPherson, K.R., and Julich, R.J., 2009, Water-level and land-subsidence studies in the Mojave River and Morongo groundwater basins: U.S. Geological Survey Scientific Investigations Report 2007-5097, unpaginated.

Stermitz, F., 1964, Effects of the Hebgen Lake Earthquake on Surface Water: U.S. Geological Survey Professional Paper 435, pp. 139-150.

Stewart, C.A., Colby, N.D, Kent, R.T., Egan, J.A., and Hall, N.T., 1998, Earth Fissuring, Ground-Water Flow, and Ground-Water Quality in the Chino Basin, California; in Borchers, J.W., (editor), Land Subsidence, Case Studies and Current Research: Association of Engineering Geologists Special Publication No. 8, Proceedings of the Dr. Joseph F. Poland Symposium on Land Subsidence.

Stewart, J.P., Bray, J.D., McMahon, D.J., and Knopp, A.l., 1995, Seismic performance of hillside fills: Reprint from Landslides under static and dynamic conditions-analysis, monitoring, and mitigation: Geotechnical Engineering Division/ASCE, held on October 23-27, 1995, San Diego, California.

Stewart, J.P., Bray, J.D., Seed, R.B., and Sitar, N., (editors), 1994, Preliminary report on the principal geotechnical aspects of the January 17, 1994 Northridge earthquake: University of California at Berkeley, College of Engineering Report No. UCB/EERC 94-08, 245p.

Stierman, D.J., Lee, T-C., Zappe, S.O., Seamount, D., 1980, Aftershocks of the Homestead Valley Earthquakes of March 15, 1979: California Geology, Vol. 32, No. 1, pp. 14-17.

Synolakis, C.E., Borrero, J., and Eisner, R., 2002, Developing Inundation Maps for Southern California; in Ewing, L. and Wallendorf, L., (editors), Solutions to Coastal Disasters '02: Conference Proceedings of the meeting held in San Diego, California on February 24-27, 2002: American Society of Civil Engineers, Reston, Virginia, pp. 848-862.

Tan, S.S., 1998, Slope failure and erosion assessment of the fire areas at Fillmore (April 1996) and Piru (August 1997), Ventura County: California: California Division of Mines and Geology Open-File Report 98-32.

Taylor, W.L., and Taylor, R.W., 2007, The Great California Flood of 1862: The Fortnightly Club of Redlands, California.

Tinsley, J.C., and Fumal, T.E., 1985, Mapping Quaternary Sedimentary Deposits for Aerial Variations in Shaking Response; in Ziony, J.I. (editor), Evaluating Earthquake Hazards in the Los Angeles Region – An Earth Science Perspective: U.S. Geological Survey Professional Paper 1360, pp. 101-125.

Tinsley, J.C., Youd, T.L., Perkins, D.M., and Chen, A.T.F., 1985, Evaluating Liquefaction Potential; in Ziony, J.I., (editor), Evaluating Earthquake Hazards in the Los Angeles Region – An Earth Science Perspective: U.S. Geological Survey Professional Paper 1360, pp. 263-316.

Toppozada, T.R., Real, C.R., and D.L. Parke, 1981, Preparation of Isoseismal Maps and Summaries of Reported Effects for Pre-1900 California Earthquakes: California Division of Mines and Geology Open File Report 81-11 SAC.

Townley, S.D., 1939, Earthquakes in California, 1769 to 1928: Bulletin of the Seismological Society of America, Vol. 29, No. 1, pp. 21-252.

Treiman, J.A., 1992, Eureka Peak and Burnt Mountain faults, two "new" faults in Yucca Valley, San Bernardino County, California: Southern California Section of the Association of Engineering Geologists Field Trip Guidebook, pp. 19-22.

Treiman, J.A., Kendrick, K.J., Bryant, W.A., Rockwell, T.K., and McGill, S.F., 2002, Primary surface rupture associated with the Mw 7.1 16 October 1999 Hector Mine earthquake, San Bernardino County, California: Bulletin of the Seismological Society of America, Vol. 92, No., 4, pp. 1171-1191.

Troxell, H.C., 1942, Floods of March 1938 in southern California: U.S. Geological Survey Water-Supply Paper 844.

Tsihrintzis, V.A, Murillo, B.N., Mulvihill, M.E., Trott, W.J., Baine, J.T., Tiamzon, N., 1991, Flood control design for development on alluvial fans: Hydraulic Engineering: Proceedings of the National Conference on Hydraulic Engineering, pp. 417-422.

Unreinforced Masonry Law, California Public Resources Code, Chapter 12.2 Building Earthquake Safety, Section 8875 et seq.

URS Corporation, 2007, County of San Bernardino 2007 General Plan, Adopted March 13, 2007, Effective April 12, 2007.

U.S. Geological Survey, 1994, Joshua Tree North quadrangle, 7.5 Minute Series (Topographic) Scale 1:24,000.

U.S. Geological Survey, 1994, Joshua Tree South quadrangle, 7.5 Minute Series (Topographic) Scale 1:24,000.

U.S. Geological Survey, 1994, Rimrock quadrangle, 7.5 Minute Series (Topographic) Scale 1:24,000.

U.S. Geological Survey, 1994, Yucca Valley North quadrangle, 7.5 Minute Series (Topographic) Scale 1:24,000.

U.S. Geological Survey, 1994, Yucca Valley South quadrangle, 7.5 Minute Series (Topographic) Scale 1:24,000.

U.S. Geological Survey, 2000, Landslide hazards, USGS Fact Sheet FS-071-00, available at http://pubs.usgs.gov/fs/fs-0071-00.

van Wagtendonk, J.W., and Cayan, D., 2008, Temporal and spatial distribution of lightning strikes in California in relation to large-scale weather patterns: Fire Ecology, Vol. 4, No. 1, pp.34-56.

Varnes, D.J., 1978, Slope movement types and processes; in Schuster, R.L. and Krizek, R.J. (editors), Landslides – Analysis and Control: National Academy of Sciences Transportation Research Board Special Report 176, pp. 12-33.

Vaughan, F.F., 1922, Geology of San Bernardino Mountains north of San Gorgonio Pass: University of California, Berkeley, Bulletin of the Department of Geological Sciences, Vol. 13, No. 9, pp. 319-411.

Waananen, A.O., 1969, Floods of January and February 1969 in central and southern California: U.S. Geological Survey, Water Resources Division, Open-File Report.

Wald, D.J., Quitorino, V., Heaton, T.H., and Kanamori, H., 1999, Relationships between peak ground acceleration, peak ground velocity, and Modified Mercalli Intensity in California: Earthquake Spectra, the Professional Journal of the Earthquake Engineering Research Institute (EERI), Vol. 15, No. 3, pp. 557-564.

Wei, M., Sandwell, D., Fialko, Y., and Bilham, R., 2011, Slip on faults in the Imperial Valley triggered by the 4 April 2010 Mw 7.2 El Mayor-Cucapah earthquake revealed by InSAR: Geophysical Research Letters, Vol. 38, L01308, doi:10.1029/2010GL045235.

Weldon, R.J., 2010, communication to the Southern California Earthquake Center's El Mayor – Cucapah Earthquake response team; available on the web at http://response.scec.org/node/273.

Wells, W.G., 1987, The effects of fire on the generation of debris flows in Southern California *in* Costa, J.E. and Wieczorek, G.F., (editors), Debris flows/avalanches: Process, recognition, and mitigation: Geological Society of America, Reviews in Engineering Geology, Vol. VII, pp. 105-114.

Wesnousky, S.G., 1986, Earthquakes, Quaternary faults, and seismic hazards in southern California: Journal of Geophysical Research, Vol. 19, No. B12, pp. 12587-12631.

Williams, F.J., and McWhirter, J., 1980, Landers Area Magnetometer Survey: California Geology, Vol. 32, No. 1, pp. 18-19.

Williams, P.L., McGill, S., Sieh, K., Allen, C.R., and Louie, J.L., 1986, North Palm Springs earthquake: Bulletin of the Seismological Society of America, Vol. 78, pp. 1112-1122.

Wills, C.J., Weldon II, R.J., and Bryant, W.A., 2008, Appendix A: California fault parameters for the National Seismic Hazard Maps and Working Group on California Earthquake Probabilities 2007: U.S. Geological Survey Open File Report 2007-1437A, California Geological Survey Special Report 203A, Southern California Earthquake Center Contribution #1138A, Version 1.0, 48p.

Wilson, R.C., and Keefer, D.K., 1985, Predicting areal limits of earthquake-induced landsliding; *in* Ziony, J.I. (editor), Evaluating Earthquake Hazards in the Los Angeles Region - An Earth-Science Perspective: U.S. Geological Survey Professional Paper 1360, pp. 316-345.

2007 Working Group on California Earthquake Probabilities, 2008, The Uniform California Earthquake Rupture Forecast, Version 2 (UCERF 2): USGS Open File Report 2007-1437, CGS Special Report 203, SCEC Contribution #1138, Version 1.0.

Wyllie, D.C., and Norrish, N.I., 1996, Stabilization of rock slopes *in* Turner, A.K., and Schuster, R.L. (editors), Landslides – investigation and mitigation: Transportation Research Board Special Publication 247, pp. 474-504.

Yule, D., Maloney, S., and Cummings, S., 2006, Using pollen to constrain the age of the youngest rupture of the San Andreas fault at San Gorgonio Pass: Seismological Research Letters, Vol. 77, No. 2, p. 245.

Yule, D., and Sieh, K., 2003, Complexities of the San Andreas fault near San Gorgonio Pass: Implications for large earthquakes: Journal of Geophysical Research, Vol. 108, No. B11, pp. 2548.

Zappe, D.P., 1997, Testimony of David P. Zappe, General Manager-Chief Engineer, Riverside County Flood Control and Water Conservation District, Impact of the Endangered Species Act of Flood Control Activities; available online at www.House.gov/resources/105cong/fullcomm/apr10.97/zappe.htm

Ziony, J.I., and Yerkes, R.F., 1985, Evaluating earthquake and surface-faulting potential; *in* Ziony, J.I. (editor), Evaluating Earthquake Hazards in the Los Angeles Region – An Earth-Science Perspective: U.S Geological Survey Professional Paper 1360, pp. 33-91.

Useful Websites

Geologic Hazards in General

http://geohazards.cr.usgs.gov/

USGS Hazard Team website. Hazard information on commonly recognized hazards such as earthquakes, landslides, and volcanoes. Contains maps and slide shows.

http://www.usgs.gov/themes/hazard.html

A webpage by the USGS on hazards such as hurricanes, floods, wildland fire, wildlife disease, coastal storms and tsunamis, and earthquakes. Also has information on their Hazard Reduction Program.

http://www.consrv.ca.gov/cgs/index.htm

Homepage for the California Geologic Survey (formerly the Division of Mines and Geology). Information their publications (geologic reports and maps), programs (seismic hazard mapping, Alquist-Priolo Earthquake Fault Study Zone maps); and other brochures (asbestos, natural hazard disclosure).

www.oes.ca.gov/

California Governor's Office of Emergency Services website. Contains information on response plans regarding natural disasters (earthquakes), terrorist attacks, and electrical outages, and information on past emergencies.

Geologic Maps

http://wrgis.wr.usgs.gov/wgmt/scamp/scamp.html

Homepage for the Southern California Aerial Mapping Project (SCAMP), which is the USGS' program to update geologic maps of Southern California at a 1:100,000 scale and release these in a digital GIS format.

Seismic Hazards, Faults, and Earthquakes

http://gmw.consrv.ca.gov/shmp/

Shows the current list of seismic hazard maps available from the California Geologic Survey. These can be downloaded in a pdf format.

www.scecdc.scec.org.

Southern California Earthquake data center (hosted by SCEC, USGS, and Caltech. Shows maps and data for recent earthquakes in Southern California and worldwide. Catalogs of historic earthquakes.

http://www.consrv.ca.gov/cgs/rghm/quakes/index.htm

List of California earthquakes (date, magnitude, latitude longitude, description of damage).

http://geohazards.cr.usgs.gov/eq/html/canvmap.html

Website at the USGS Earthquake Hazard's Program that lists seismic acceleration maps available for downloading.

www.seismic.ca.gov/

Homepage of the California Seismic Safety Commission. Contains information on California earthquake legislation, safety plans, and programs designed to reduce the hazards from earthquakes. Includes several publications of interest, including "The Homeowner's Guide to Earthquake Safety." Also contains a catalog of recent California earthquakes.

http://neic.usgs.gov/

Homepage of the National Earthquake Information Center. Maintains an extensive global seismic database on earthquake parameters. Its mission is to rapidly determine the location and size of all destructive earthquakes worldwide, and disseminate that information as quickly as possible to concerned national and international agencies, scientists, and the public in general.

http://www.scsn.org/

Site where Shakemaps for actual and scenario earthquakes can be obtained.

Landslides and Debris Flows

http://landslides.usgs.gov/index.html
USGS Landslide webpage. Links to their publications, recent landslide events, and bibliographic databases.

http://gmw.consrv.ca.gov/shmp/
California Geologic Survey website on Seismic Hazard maps.

http://vulcan.wr.usgs.gov/Glossary/Lahars/framework.html
USGS Volcanic Observatory website list of links regarding mudflows, debris flows and lahars.

http://www.fema.gov/hazards/landslides/landslif.shtm
Federal Emergency Management Agency (FEMA) fact sheet website about landslides and mudflows.

Flooding, Dam Inundation, and Erosion (Note: the information on some of these web sites has been removed due to safety concerns; but may be posted again in the future in limited form).

http://vulcan.wr.usgs.gov/Glossary/Sediment/framework.html
US Geological Survey Volcanic Observatory website list of links regarding sediment and erosion.

http://www.usace.army.mil/public.html#Regulatory
US Army Corps of Engineers website regarding waterway regulations.

http://www.fema.gov/fima/
FEMA website about the National Flood Insurance Program.

http://www.worldclimate.com/
Precipitation rates at different rain stations in the world measured over time.

http://waterdata.usgs.gov
Stream gage measurements for rivers throughout the US.

Others

http:// www.bsc.ca.gov
Site of the California Building Standards Commission. Provides information regarding the status of the building codes being considered for future approval in California.

APPENDIX B: GLOSSARY

Acceleration – The rate of change for a body's magnitude, direction, or both over a given period of time.

Active fault – For implementation of Alquist-Priolo Earthquake Fault Zoning Act (APEFZA) requirements, an active fault is one that shows evidence of having experienced surface displacement within the last 11,000 years. APEFZA classification is designed for land use management of surface rupture hazards. A more general definition by the National Academy of Sciences (1988) is "a fault that on the basis of historical, seismological, or geological evidence has the finite probability of producing an earthquake." The American Geological Institute (1972) defines an active fault as one along which there is recurrent movement, usually indicated by small, periodic displacements or seismic activity.

Acute – Quick, one-time exposure to a chemical.

Adjacent grade – Elevation of the natural or graded ground surface, or structural fill, abutting the walls of a building.

Aftershocks – Minor earthquakes following a greater one and originating at or near the same location.

Aggradation – The building up of earth's surface by deposition of sediment.

Alluvial – Pertaining to, or composed, of alluvium, or deposited by a stream or running water.

Alluvial fan – A low, outspread relatively flat to gently sloping surface consisting of loose sediment that is shaped like an open fan, deposited by a stream at the place where the stream comes out of a narrow canyon onto a broad valley or plain. Alluvial fans are steepest near the mouth of the canyon, and spread out, gradually decreasing in gradient, away from the stream source.

Alluvium – Surficial sediments of poorly consolidated gravels, sand, silts, and clays deposited by flowing water.

Amplitude – The height of a wave between its crest (high point) and its mid-point.

Anchor – To secure a structure to its footings or foundation wall in such a way that a continuous load transfer path is created and so that it will not be displaced by flood, wind, or seismic forces.

Apparatus – Fire apparatus includes firefighting vehicles of various types.

Aquifer – A body of rock or sediment that contains sufficient saturated permeable material to allow the flow of ground water and to yield economically significant quantities of ground water to wells and springs.

Argillic – Alteration in which certain minerals of a rock or sediments are converted to clay. Also said of a soil horizon characterized by the illuvial accumulation of clay.

Armor – To protect slopes from *erosion* and *scour* by *flood* waters. Techniques of armoring include the use of riprap, gabions, or concrete.

Arsenic – A naturally occurring, toxic element that occurs in rocks, soils and groundwater. Above certain concentrations, it can cause skin, bladder and other cancers.

Artesian – An adjective referring to ground water confined under hydrostatic pressure. The water level in wells drilled into an **artesian** aquifer (also called a confined aquifer) will stand at some height above the top of the aquifer. If the water reaches the ground surface, the well is referred to as a "flowing" **artesian** well.

Aspect – The direction a slope faces.

Atmospheric river – Narrow streams of water vapor transported in the lower atmosphere that are thought responsible for most of the storms on the west coast of the United States.

Attenuation – The reduction in amplitude of a wave with time or distance traveled.

Automatic aid agreement – An agreement between two or more agencies whereby such agencies are automatically dispatched simultaneously to predetermined types of emergencies in predetermined areas.

A zone – Under the *National Flood Insurance Program*, area subject to inundation by the *100-year flood* where wave action does not occur or where waves are less than 3 feet high, designated Zone A, AE, A1-A30, A0, AH, or AR on a *Flood Insurance Rate Map* (FIRM).

Basalt – Dark, fine-grained volcanic rock consisting primarily of plagioclase, pyroxene and olivine, with less than 20% quartz, that formed from rapid cooling of lava exposed at or near the ground surface (extrusive).

Base flood – *Flood* that has as 1-percent probability of being equaled or exceeded in any given year. Also known as the *100-year flood*.

Base Flood Elevation (BFE) – Elevation of the *base flood* in relation to a specified datum, such as the *National Geodetic Vertical Datum* or the *North American Vertical Datum*. The Base Flood Elevation is the basis of the insurance and *floodplain management* requirements of the *National Flood Insurance Program*.

Basement – Under the *National Flood Insurance Program*, any area of a building having its floor subgrade on all sides. (Note: What is typically referred to as a "walkout basement," which has a floor that is at or above grade on at least one side, is not considered a basement under the *National Flood Insurance Program*.)

Beaufort Scale – A scale devised in 1805 by Admiral Francis Beaufort of the British Navy to classify wind speed based on the wind's effect on the seas and vegetation. The scale goes from 0 (calm) to 12 (hurricane).

Bedding – The arrangement of a sedimentary rock or deposit in beds or layers of varying thickness and character.

Bedrock – Designates hard rock that is in its natural intact position and underlies soil or other unconsolidated surficial material.

Bench – A grading term that refers to a relatively level step excavated into earth material on which fill is to be placed. A bench is also a long, narrow, relatively level or gently inclined platform of land or rock bounded by steeper slopes above and below.

Bioregion – A major, regional ecological community characterized by distinctive life forms and distinctive plant and animal species.

Biotite – A general term to designate all ferromagnesian micas. More specifically, biotite is a widely distributed and important rock-forming mineral that is usually black, brown or dark green, and that is an original constituent of igneous and metamorphic rocks, or a detrital constituent of sedimentary rocks.

Blind thrust fault – A thrust fault is a low-angle reverse fault (where the top block is being or has been pushed over the bottom block). A "blind" thrust fault refers to one that does not reach the surface.

Braided stream – A stream that divides into or follows an interlacing or tangled network of several, small, branching and reuniting shallow channels separated from each other by channel bars. Also referred to as an **anastomosing** stream.

Brush – A collective term that refers to stands of vegetation dominated by shrubby, woody plants, or low-growing trees.

Brushfire – A fire burning in vegetation that is predominantly shrubs, brush, and scrub growth.

Building code – Regulations adopted by local governments that establish standards for construction, modification, and repair of buildings and other structures.

Carcinogen – Material capable of causing cancer in humans.

Cast-in-place concrete – Concrete that is poured and formed at the construction site.

CEQA – The California Environmental Quality Act (Chapters 1 through 6 of Division 13 of the Public Resources Code). A state statute that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible.

Chronic – Continual or repeated exposure to a hazardous material.

Cladding – Exterior surface of the building envelope that is directly loaded by the wind.

Clay – A rock or mineral fragment having a diameter less than 1/256 mm (4 microns, or 0.00016 inch). Term is commonly applied to any soft, adhesive, fine-grained deposit.

Climate – The average condition of weather over time in a given region.

Code official – Officer or other designated authority charged with the administration and enforcement of the code, or a duly authorized representative, such as a building, zoning, planning, or *floodplain management* official.

Coliform – A group of rod-shaped bacteria that are found in water, soil, and on vegetation, and are present in large numbers in the feces of warm-blooded animals. The coliform count is used as an indicator of the sanitary conditions of foods and water. Most genera of coliform are not harmful to humans, but a few kinds, including some strains of Escherichia coli (E. coli) can be debilitating to sensitive individuals, including children, seniors, and those with compromised immune systems.

Collapse – A relatively sudden change in the volume of a soil mass resulting in the local settlement of the ground surface, with the potential to cause significant damage to overlying structures. If due to strong ground shaking, the soil grains in the soil column are re-arranged by the shaking so that the pore space between grains is reduced and the grains become more tightly packed, resulting in the overall reduction of the thickness of the soil column. This is referred to as earthquake-induced subsidence. Collapse can also occur in certain types of sediments, where with the introduction of water (due to an increase in irrigation, for example), the cement between soil grains dissolves, allowing the soil particles to become more tightly packed, again resulting in the local settlement of the ground surface. This process is also referred to as **hydro-collapse** or **hydroconsolidation**.

Column foundation – Foundation consisting of vertical support members with a height-to-least-lateral-dimension ratio greater than three. Columns are set in holes and backfilled with compacted material. They are usually made of concrete or masonry and often must be braced. Columns are sometimes known as posts, particularly if the column is made of wood.

Compressible soil – Geologically young unconsolidated sediment of low density that may compress under the weight of a proposed fill embankment or structure.

Community at Risk – Wildland interface community in the vicinity of Federal lands that is at high risk from wildfire.

Complex (Fire) –Two or more individual incidents located in the same general area and assigned to a single incident commander or unified command.

Concrete Masonry Unit (CMU) – Building unit or block larger than 12 inches by 4 inches by 4 inches made of cement and suitable aggregates.

Conglomerate – A coarse-grained sedimentary rock composed of rounded to subangular fragments larger than 2 mm in diameter set in a fine-grained matrix of sand or silt, and commonly cemented by calcium carbonate, iron oxide, silica or hardened clay. The consolidated equivalent of gravel.

Connector – Mechanical device for securing two or more pieces, parts, or members together, including anchors, wall ties, and fasteners.

Consolidation – Any process whereby loosely aggregated, soft earth materials become firm and cohesive rock. Also the gradual reduction in volume and increase in density of a soil mass in response to increased load or effective compressive stress, such as the squeezing of fluids from pore spaces.

Corrosion-resistant metal – Any nonferrous metal or any metal having an unbroken surfacing of nonferrous metal, or steel with not less than 10 percent chromium or with not less than 0.20 percent copper.

Coseismic rupture - Ground rupture occurring during an earthquake but not necessarily on the causative fault.

Cretaceous – The final period of the Mesozoic era (before the Tertiary period of the Cenozoic era), thought to have occurred between about 136 and 65 million years ago.

Dead load – Weight of all materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings, stairways, built-in partitions, finishes, cladding, and other similarly incorporated architectural and structural items and fixed service equipment.

Debris – (Seismic) The scattered remains of something broken or destroyed; ruins; rubble; fragments. (Flooding, Coastal) Solid objects or masses carried by or floating on the surface of moving water.

Debris burning – Any fire originally set for the purpose of clearing land or for burning rubbish, garbage, range, stubble, or meadow burning.

Debris impact loads – Loads imposed on a structure by the impact of flood-borne debris. These loads are often sudden and large. Though difficult to predict, debris impact loads must be considered when structures are designed and constructed.

Debris flow – A saturated, rapidly moving saturated earth flow with 50 percent rock fragments coarser than 2 mm in size which can occur on natural and graded slopes.

Debris line – Line left on a structure or on the ground by the deposition of debris. A debris line often indicates the height or inland extent reached by *flood* waters.

Defensible space – An area, either natural or manmade, where material capable of causing a fire to spread has been treated, cleared, reduced, or changed in order to provide a barrier between an advancing wildland fire and the loss to life, property, or resources. In practice, defensible space is defined as an area with a minimum of 100 feet around a structure that is cleared of flammable brush or vegetation. Distance from the structure and the degree of fuels treatment vary with vegetation type, slope, density, and other factors.

Deflected canyons – A relatively spontaneous diversion in the trend of a stream or canyon caused by any number of processes, including folding and faulting.

Deformation - A general term for the process of folding, faulting, shearing, compression, or extension of rocks.

Design flood – The greater of either (1) the *base flood* or (2) the *flood* associated with the *flood hazard area* depicted on a community's flood hazard map, or otherwise legally designated.

Design Flood Elevation (DFE) – Elevation of the *design flood*, or the flood protection elevation required by a community, including wave effects, relative to the *National Geodetic Vertical Datum*, *North American Vertical Datum*, or other datum.

Development – Under the *National Flood Insurance Program*, any manmade change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation, or drilling operations or storage of equipment or materials.

Differential settlement – Non-uniform settlement; the uneven lowering of different parts of an engineered structure, often resulting in damage to the structure. Sometimes included with liquefaction as ground failure phenomenon.

Diorite – A group of igneous rocks that form at great depth beneath the earth's crust. These rocks are intermediate in composition between acidic and basic rocks.

Dispatch – The implementation of a command decision to move a resource or resources from one place to another.

Displacement - The length, measured in kilometers (km), of the total movement that has occurred along a fault over as long a time as the geologic record reveals.

DMA 2000 - Disaster Mitigation Act of 2000. Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended by Public Law 106-390, October 30, 2000. DMA 2000 is intended to establish a continuing means of assistance by the Federal Government to State and local governments in carrying out their responsibilities to alleviate the suffering and damage which result from disasters by (1) revising and broadening the scope of existing disaster relief programs; (2) encouraging the development of comprehensive disaster preparedness and assistance plans, programs, capabilities, and organizations by the States and by local governments; (3) achieving greater coordination and responsiveness of disaster preparedness and relief programs; (4) encouraging individuals, States, and local governments to protect themselves by obtaining insurance coverage to supplement or replace governmental assistance; (5) encouraging hazard mitigation measures to reduce losses from disasters, including development of land use and construction regulations; and (6) providing Federal assistance programs for both public and private losses sustained in disasters .

Dust storms – High wind events common in arid and semi-arid regions; strong winds pick up sand and other particulates and transport them by saltation and suspension to another location.

Dynamic analysis – A complex earthquake-resistant engineering design technique capable of modeling the entire frequency spectra, or composition, of ground motion. The method is used to

evaluate the stability of a site or structure by considering the motion from any source or mass, such as that dynamic motion produced by machinery or a seismic event.

Earth flow – Imperceptibly slow-moving surficial material in which 80% or more of the fragments are smaller than 2 mm, including a range of rock and mineral fragments.

Earthquake – Vibratory motion propagating within the Earth or along its surface caused by the abrupt release of strain from elastically deformed rock by displacement along a fault.

Earth's crust – The outermost layer or shell of the Earth.

Effective Flood Insurance Rate Map (FIRM) – See *Flood Insurance Rate Map*.

El Niño – Phenomenon that originates, every few years, typically in December or early January, in the southern Pacific Ocean, off of the western coast of South America, characterized by warmer than usual water. This warmer water is statistically linked with increased rainfall in both the southeastern and southwestern United States, droughts in Australia, western Africa and Indonesia, reduced number of earthquakes in the Atlantic Ocean, and increased number of hurricanes in the Eastern Pacific.

Emergency Planning and Community Right to Know (EPCRA) – The portion of SARA that specifically outlines how industries report chemical inventory to the community.

Encroachment – Any physical object placed in a floodplain that hinders the passage of water or otherwise affects the flood flows.

Engineering geologist – A geologist who is certified by the State as qualified to apply geologic data, principles, and interpretation to naturally occurring earth materials so that geologic factors affecting planning, design, construction, and maintenance of civil engineering works are properly recognized and used. An engineering geologist is particularly needed to conduct investigations, often with geotechnical engineers, of sites with potential ground failure hazards.

Environmental Protection Agency (EPA) – Federal agency tasked with ensuring the protection of the environment and the nation's citizens.

Ephemeral stream – A stream or reach of a stream that flows only briefly in direct response to precipitation.

Epicenter – The point at the Earth's surface directly above where an earthquake originated.

Erodible soil – Soil subject to wearing away and movement due to the effects of wind, water, or other geological processes during a flood or storm or over a period of years.

Erosion – Under the *National Flood Insurance Program*, the process of the gradual wearing away of landmasses. In general, erosion involves the detachment and movement of soil and rock fragments, during a flood or storm or over a period of years, through the action of wind, water, or other geologic processes.

Erosion analysis – Analysis of the short- and long-term *erosion* potential of soil or strata, including the effects of wind action, *flooding* or *storm surge*, moving water, wave action, and the interaction of water and structural components.

Evacuation – Movement of people from an area, typically their homes, to another area considered to be safe, typically in response to a natural or man-made disaster that makes an area unsafe for people.

Expansive soil – A soil that contains clay minerals that take in water and expand. If a soil contains sufficient amount of these clay minerals, the volume of the soil can change significantly with changes in moisture, with resultant structural damage to structures founded on these materials.

Extremely hazardous substance – A substance that shows high acute or chronic toxicity, carcinogenity, bioaccumulative properties, is persistent in the environment, or is water reactive (California Code of Regulations, Title 22).

Fanglomerate – A sedimentary rock consisting of a heterogeneous mix of fragments of all sizes, originally deposited in an alluvial fan and subsequently cemented into a firm rock. Generally said of the coarser, consolidated rock material that occurs in the upper part of an alluvial fan.

Fault – A fracture (rupture) or a zone of fractures along which there has been displacement of adjacent earth material.

Fault segment – A continuous portion of a fault zone that is likely to rupture along its entire length during an earthquake.

Fault slip rate – The average long-term movement of a fault (measured in cm/year or mm/year) as determined from geologic evidence.

Fault strand – A fault that is mappable as a single, fairly continuous feature.

Federal Emergency Management Agency (FEMA) – Independent agency created in 1979 to provide a single point of accountability for all Federal activities related to disaster mitigation and emergency preparedness, response and recovery. FEMA administers the *National Flood Insurance Program*.

Federal Insurance Administration (FIA) – The component of the *Federal Emergency Management Agency* directly responsible for administering the flood insurance aspects of the *National Flood Insurance Program*.

Feldspar – The most widespread of any mineral group; constitutes ~60% of the earth's crust. Feldspars occur as components of all kinds of rocks and, on decomposition, yield a large part of the clay of a soil.

Fill – Material such as soil, gravel, or crushed stone placed in an area to increase ground elevations or change soil properties.

Fire behavior – The manner in which a fire reacts to the influences of fuel, weather and topography.

Fire flow – The flow rate of a water supply expressed in gallons per minute (gpm), measured at 20 pounds per square inch (psi) residual pressure, that is available for fire fighting.

Fire frequency – The number of fires occurring within a defined area in a given time period.

Fire regime – The long-term fire pattern characteristic of a region or ecosystem described using a combination of seasonality, fire return interval, size, spatial complexity, intensity, severity, and fire type.

Fire resistant – A characteristic of a plant species that allows individuals to resist damage or mortality during a fire. Also used to describe construction materials that resist damage to fire.

FIRESCOPE – **FI**refighting **RES**ources of **C**alifornia **O**rganized for **P**otential **E**mergencies. A cooperative effort involving all agencies with fire fighting responsibilities in California. The goal of this group is to create and implement new applications in fire service management, technology and coordination, with an emphasis on incident command and multi-agency coordination. This dynamic state-wide program serves the needs of California fire service management as an ongoing program.

First responders – A group designated by the community as those who may be first to arrive at the scene of a fire, accident, or chemical release.

Fire weather – The weather conditions that influence fire behavior, including air temperature, atmospheric moisture, atmospheric stability, clouds and precipitation.

Five-hundred (500)-year flood – *Flood* that has as 0.2% probability of being equaled or exceeded in any given year.

Flash flood – A local and sudden flood or torrent overflowing a stream channel in an usually dry valley, carrying an immense load of mud and rock fragments, and generally resulting from a rare and brief but heavy rainfall over a relatively small area having steep slopes.

Flood – A rising body of water, as in a stream or lake, which overtops its natural and artificial confines and covers land not normally under water. Under the *National Flood Insurance Program*, either:

(a) a general and temporary condition or partial or complete inundation of normally dry land areas from:

(1) the overflow of inland or tidal waters,

(2) the unusual and rapid accumulation or runoff of surface waters from any source, or

(3) mudslides (i.e., mudflows) which are proximately caused by flooding as defined in (2) and are akin to a river of liquid and flowing mud on the surfaces of normally dry land areas, as when the earth is carried by a current of water and deposited along the path of the current, or

(b) the collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated

cyclical levels or suddenly caused by an unusually high water level in a natural body of water, accompanied by a severe storm, or by an unanticipated force of nature, such as flash flood or abnormal tidal surge, or by some similarly unusual and unforeseeable event which results in flooding as defined in (1), above.

Flood-damage-resistant material – Any construction material capable of withstanding direct and prolonged contact (i.e., at least 72 hours) with floodwaters without suffering significant damage (i.e., damage that requires more than cleanup or low-cost cosmetic repair, such as painting).

Flood elevation – Height of the water surface above an established elevation datum such as the *National Geodetic Vertical Datum*, *North American Vertical Datum*, or *mean sea level*.

Flood hazard area – The greater of the following: (1) the area of special flood hazard, as defined under the *National Flood Insurance Program*, or (2) the area designated as a flood hazard area on a community's legally adopted flood hazard map, or otherwise legally designated.

Flood insurance – Insurance coverage provided under the National Flood Insurance Program.

Flood Insurance Rate Map (FIRM) – Under the *National Flood Insurance Program*, an official map of a community, on which the *Federal Emergency Management Agency* has delineated both the special hazard areas and the risk premium zones applicable to the community. (Note: The latest FIRM issued for a community is referred to as the *effective FIRM* for that community.)

Flood Insurance Study (FIS) – Under the *National Flood Insurance Program*, an examination, evaluation, and determination of *flood* hazards and, if appropriate, corresponding *water surface elevations*, or an examination, evaluation, and determination of mudslide (i.e., mudflow) and/or flood-related erosion hazards in a community or communities. (Note: The *National Flood Insurance Program* regulations refer to Flood Insurance Studies as "flood elevation studies.")

Flood-related erosion area or flood-related erosion prone area – A land area adjoining the shore of a lake or other body of water, which due to the composition of the shoreline or bank and high water levels or wind-driven currents, is likely to suffer *flood*-related *erosion* damage.

Flooding – See *Flood*.

Floodplain – Under the *National Flood Insurance Program*, any land area susceptible to being inundated by water from any source. See *Flood*.

Floodplain management – Operation of an overall program of corrective and preventive measures for reducing *flood* damage, including but not limited to emergency preparedness plans, flood control works, and *floodplain management regulations*.

Floodplain management regulations – Under the *National Flood Insurance Program*, zoning ordinances, subdivision regulations, building codes, health regulations, special purpose ordinances (such as floodplain ordinance, grading ordinance, and erosion control ordinance), and other applications of police power. The term describes such state or local regulations, in any combination thereof, which provide standards for the purpose of *flood* damage prevention and reduction.

Floodway – The channel of a river or other watercourse, and the adjacent land areas that must be kept free of encroachment in order to discharge the base flood without cumulatively increasing the water surface elevation more than a certain height.

Flow failure – A type of liquefaction-induced failure that generally occurs in slopes greater than 3 degrees, and that is characterized by the displacement, often over tens to hundreds of feet, of blocks of soil riding on top of the liquefied substrate.

Footing – Enlarged base of a foundation wall, pier, post, or column designed to spread the load of the structure so that it does not exceed the soil bearing capacity.

Footprint – Land area occupied by a structure.

Freeboard – Under the *National Flood Insurance Program*, a factor of safety, usually expressed in feet above a *flood* level, for the purposes of *floodplain management*. Freeboard tends to compensate for the many unknown factors that could contribute to flood heights greater than the heights calculated for a selected size flood and floodway conditions, such as the hydrological effect of urbanization of the watershed.

Frostbite – Injury, typically to the extremities, such as fingers and toes, caused by freezing body tissue.

Fuel – The source of heat that sustains the combustion process. In wildland fires, fuel is the combustible plant biomass, including grass, leaves, ground litter, shrubs, plants and trees.

Fuel load – The amount of fuel that is potentially available for combustion.

Fuel moisture – The moisture content expressed as a percentage of the dry weight of the fuel.

Fuel modification zone – ribbon of land surrounding a development within a fire hazardous area that is designed to diminish the intensity of a wildfire as it approaches the structures.

Funnel clouds – Cone-shaped or needle-like clouds that extend down from the main cloud base but do not extend to the ground surface. If a funnel cloud touches the ground surface, it becomes a tornado.

Gabbro – A group of dark-colored, coarse-grained intrusive igneous rocks composed principally of plagioclase. These rocks cooled slowly, deep under the Earth's crust, allowing the minerals to form large crystals. The approximate intrusive equivalent of basalt.

Geomorphology – The science that treats the general configuration of the Earth's surface. The study of the classification, description, nature, origin and development of landforms, and the history of geologic changes as recorded by these surface features.

Geotechnical engineer – A licensed civil engineer who is also certified by the State as qualified for the investigation and engineering evaluation of earth materials and their interaction with earth retention systems, structural foundations, and other civil engineering works.

Gneiss – A metamorphic rock in which bands of granular minerals alternate with bands in which mineral have a flaky or prismatic habit, with less than 50 percent of the minerals showing preferred parallel orientation.

Grading – Any excavating or filling or combination thereof. Generally refers to the modification of the natural landscape into pads suitable as foundations for structures.

Granite – Broadly applied, any completely crystalline, quartz-bearing, plutonic rock.

Ground failure – Permanent ground displacement produced by fault rupture, differential settlement, liquefaction, or slope failure.

Ground lurching – A form of earthquake-induced ground failure where soft, saturated soils move in a wave-like manner in response to intense seismic ground shaking, forming ridges or cracks at the surface.

Ground oscillations – A type of liquefaction-induced failure where liquefaction occurs at depth, in an area where the ground surface is too level to permit the lateral displacement of the overlying soil blocks. The blocks instead separate from one another and oscillate above the liquefied layer. This may result in the opening and closing of fissures or cracks, and the formation of sand boils or volcanoes.

Ground rupture – Displacement of the earth's surface as a result of fault movement associated with an earthquake.

Hail – Solid precipitation consisting of fragments of ice water called hailstones.

Hazardous material (HAZMAT) – Substance that has the ability to harm humans, property or the environment. The United States Environmental Protection Agency defines hazardous waste as substances that:

1) may cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness;
2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of or otherwise managed; and
3) whose characteristics can be measured by a standardized test or reasonably detected by generators of solid waste through their knowledge of their waste.

Hazardous waste is also ignitable, corrosive, or reactive (explosive) (EPA 40 CFR 260.10). A material may also be classified as hazardous if it contains defined amounts of toxic chemicals.

Hazardous Waste Operations and Emergency Response (HAZWOPER) – The Occupational Safety and Health Agency (OSHA) regulation that covers safety and health issues at hazardous waste sites and response to chemical incidents.

Hazard reduction – Any treatment of a hazard that reduces the threat of ignition and fire intensity or rate of spread.

Heat wave – Periods of excessive heat, typically exceeding 95 degrees Fahrenheit, often with high levels of humidity, and lasting more than three days.
Hexavalent chromium – Compounds that contain the element chromium in its +6 (hexa) oxidation state. These compounds are used extensively in several different industries; however, it is a known human carcinogen and thus its use is now regulated. Groundwater in many parts of the country has been contaminated with varying levels of hexavalent chromium.

Highest adjacent grade – Elevation of the highest natural or regarded ground surface, or structural fill, that abuts the walls of a building.

Holocene – An epoch of the Quaternary period spanning from the end of the Pleistocene to the present time (the past about 11,000 years).

Hornblende – The most common mineral of the amphibole group. It is a primary constituent in many intermediate igneous rocks.

Hydrocompaction – Settlement of loose, granular soils that occurs when the loose, dry structure of the sand grains held together by a clay binder or other cementing agent collapses upon the introduction of water.

Hydrodynamic loads – Loads imposed on an object, such as a building, by water flowing against and around it. Among these loads are positive frontal pressure against the structure, drag effect along the sides, and negative pressure on the downstream side.

Hydrostatic loads – Loads imposed on a surface, such as a wall or floor slab, by a standing mass of water. The water pressure increases with the square of the water depth.

Hypocenter – The earthquake focus, that is, the place at depth, along the fault plane, where an earthquake rupture started.

Hypothermia – Abnormally low body temperature (typically below 95 degrees Fahrenheit) that is accompanied by any of several signs, including uncontrollable shivering, disorientation, memory loss, slurred speech, drowsiness, and apparent exhaustion.

Igneous – Type of rock or mineral that formed from molten or partially molten magma.

Ignition point – The location of the ignition.

Ignition source – The origin or source of a fire.

Infiltration – The process by which water seeps into the soil, as influenced by soil texture, soil structure, and vegetation cover.

Intensity – A measure of the effects of an earthquake at a particular place. Intensity depends on the earthquake magnitude, distance from the epicenter, and on the local geology.

Invasive plants – Plants that aggressively expand their ranges over the landscape, typically at the expense of native plants that are displaced or destroyed by the newcomers. Invasive species are typically considered a major threat to biological diversity.

ISO – Insurance Services Office. Private organization that formulates fire safety ratings based on fire threat and responsible agency's ability to respond to the threat. ISO ratings from one (excellent) to ten (no fire protection). Many insurance companies use ISO ratings to set insurance premiums. ISO may establish multiple ratings within a community, such as a rating of 5 in the hydranted areas and one of 8 in the non-hydranted areas.

Jet stream – A relatively narrow stream of fast-moving air in the middle and upper troposphere. Surface cyclones develop and move along the jet stream.

Joist – Any of the parallel structural members of a floor system that support, and are usually immediately beneath, the floor.

ka – thousands of years before present.

Ladder fuels – Fuels that provide vertical continuity between strata, allowing fire to move from the surface fuels to the crowns of shrubs and trees with relative ease.

Landslide – A general term covering a wide variety of mass-movement landforms and processes involving the downslope transport, under gravitational influence, of soil and rock material en masse.

Lateral force – The force of the horizontal, side-to-side motion on the Earth's surface as measured on a particular mass; either a building or structure.

Lateral spreading – Lateral movements in a fractured mass of rock or soil which result from liquefaction or plastic flow or subjacent materials.

Left-lateral fault – A strike-slip fault across which a viewer would see the block on the opposite side of the fault move to the left.

Level-of-service standard (LOS standard) – Quantifiable measures against which services being delivered by a service provider can be compared. Standards based upon recognized and accepted professional and county standards, while reflecting the local situation within which services are being delivered. Levels-of-service standards for fire protection may include response times, personnel per given population, and emergency water supply. LOS standards can be used to evaluate the way in which fire protection services are being delivered, for use in countywide fire planning efforts.

Lifeline system – Linear conduits or corridors for the delivery of services or movement of people and information (e.g., pipelines, telephones, freeways, railroads)

Lineament – Straight or gently curved, lengthy features of earth's surface, frequently expressed topographically as depressions or lines of depressions, scarps, benches, or change in vegetation.

Liquefaction – Changing of soils (unconsolidated alluvium) from a solid state to weaker state unable to support structures; where the material behaves similar to a liquid as a consequence of earthquake shaking. The transformation of cohesionless soils from a solid or liquid state as a result of increased pore pressure and reduced effective stress.

Litter – Recently fallen plant material that is only partially decomposed, forming a surface layer on some soils.

Live loads – *Loads* produced by the use and occupancy of the building or other structure. Live loads do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load, or dead load. See *Loads*.

Load-bearing wall – Wall that supports any vertical load in addition to its own weight.

Loads – Forces or other actions that result from the weight of all building materials, occupants and their possessions, environmental effects, differential movement, and restrained dimensional changes. Permanent loads are those in which variations over time are rare or of small magnitude. All other loads are variable loads.

Local Responsibility Area (LRA) – Lands in which the financial responsibility of preventing and suppressing fires is primarily the responsibility of the local jurisdiction.

Lowest floor – Under the *National Flood Insurance Program*, the lowest floor of the lowest enclosed area (including basement) of a structure. An unfinished or *flood*-resistant enclosure, usable solely for parking of vehicles, building access, or storage in an area other than a basement is not considered a building's lowest floor, provided that the enclosure is not built so as to render the structure in violation of *National Flood Insurance Program* regulatory requirements.

Lowest horizontal structural member – In an elevated building, the lowest beam, *joist*, or other horizontal member that supports the building. *Grade beams* installed to support vertical foundation members where they enter the ground are not considered lowest horizontal structural members.

Ma – millions of years before present.

Macroburst – A strong downdraft over 2.5 miles in diameter that can cause damaging winds lasting 5 to 20 minutes. Formed by an area of significantly rain-cooled air that after hitting ground levels spreads out in all directions.

Magnitude – A measure of the size of an earthquake, as determined by measurements from seismograph records. Also refers to both a fire's intensity and severity.

Main shock – The biggest earthquake of a sequence of earthquakes that occur fairly close in time and space. Smaller shocks before the main shock are called **foreshocks**; smaller shocks that occur after the main shock are called **aftershocks**.

Major earthquake – Capable of widespread, heavy damage up to 50+ miles from epicenter; generally near Magnitude range 6.5 to 7.0 or greater, but can be less, depending on rupture mechanism, depth of earthquake, location relative to urban centers, etc.

Manufactured home – Under the *National Flood Insurance Program*, a *structure*, transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when attached to the required utilities. The term "manufactured home" does not include a "recreational vehicle."

Masonry – Built-up construction of combination of building units or materials of clay, shale, concrete, glass, gypsum, stone, or other approved units bonded together with or without mortar or grout or other accepted methods of joining.

Mass casualty – Incident in which the number of victims exceeds the capability of the emergency management system to manage the incident effectively.

Material Safety Data Sheets (MSDS) – Information sheets for employees that provide specific information about a chemical that they may come in contact at their place of work, with attention to health effects, handling, and emergency procedures.

Maximum Considered Earthquake (MCE) – Starting with the 2006 International Building Code, a probabilistic analysis used for seismic design that calculates the earthquake size that would generate ground motions with a 2% probability of being exceeded in 50 years (approximately equivalent to a 2,500-year return period).

Maximum Contaminant Level (MCL) – Federal drinking water standard: "the maximum permissible level of a contaminant in water which is delivered to any user of a public water system" (Code of Federal Regulations [CFR], Title 40, Part 141.2).

Maximum Magnitude Earthquake (M_{max}) – The highest magnitude earthquake a fault is capable of producing based on physical limitations, such as the length of the fault or fault segment.

Maximum Probable Earthquake (MPE) – The design size of the earthquake expected to occur within a time frame of interest, for example within 30 years or 100 years, depending on the purpose, lifetime or importance of the facility. Magnitude/frequency relationships are based on historic seismicity, fault slip rates, or mathematical models. The more critical the facility, the longer the time period considered.

Mediterranean climate – The climate characteristic of the Mediterranean region and most of California, characterized by hot, dry summers, and cool, wet winters.

Metamorphic rock – A rock whose original mineralogy, texture, or composition has been changed due to the effects of pressure, temperature, or the gain or loss of chemical components.

Mean sea level (MSL) – Average height of the sea for all stages of the tide, usually determined from hourly height observations over a 19-year period on an open coast or in adjacent waters having free access to the sea. See *National Geodetic Vertical Datum*.

Microburst – A very localized zone of sinking air, less than 2.5 miles in diameter, producing damaging, straight-line, divergent winds at or near the ground surface lasting 2 to 5 minutes.

Mitigation – Any action taken to reduce or permanently eliminate the long-term risk to life and property from natural hazards.

Mitigation Directorate – Component of *Federal Emergency Management Agency* directly responsible for administering the flood hazard identification and *floodplain management* aspects of the *National Flood Insurance Program*.

Moderate earthquake – Capable of causing considerable to severe damage, generally in the range of Magnitude 5.0 to 6.0 (Modified Mercalli Intensity <VI), but highly dependent on rupture mechanism, depth of earthquake, and location relative to urban center, etc.

Modified Mercalli Intensity – A qualitative measure of the size of an earthquake based on people's description of how strongly the earthquake was felt, and the damage it caused to the built environment. The scale has 12 divisions, ranging from I (felt by only a very few people) to XII (total damage).

Moment magnitude (seismic moment, M_w) – A measure of earthquake size that is based on the amount of energy released when a fault ruptures. Considered the most meaningful and thus preferred measure of earthquake size.

Monsoon – A seasonal reversing wind that is accompanied by precipitation. In North America, the monsoon occurs between late June and early September; starts in Mexico and spreads northward into Arizona, New Mexico, West Texas, Nevada, Utah, Colorado and eastern California.

Mutual Aid Agreement – A reciprocal aid agreement between two or more agencies that defines what resources each will provide to the other in response to certain predetermined types of emergencies. Mutual aid response is provided upon request.

National Fire Protection Association (NFPA) – A group that issues fire and safety standards for industry and emergency responders.

National Fire Incident Reporting System (NFIRS) – A database of fire incident reports compiled at the local fire department level. NFIRS was an outgrowth of the 1974 National Fire Prevention and Control Act, Public Law 93–498. The U.S. Fire Administration (USFA), an entity of the Department of Homeland Security, developed NFIRS as a means of assessing the nature and scope of the fire problem in the United States.

National Flood Insurance Program (NFIP) – Federal program created by Congress in 1968 that makes *flood* insurance available in communities that enact and enforce satisfactory *floodplain management regulations*.

National Geodetic Vertical Datum (NGVD) – Datum established in 1929 and used as a basis for measuring flood, ground, and structural elevations, previously referred to as Sea Level Datum or *Mean Sea Level*. The *Base Flood Elevations* shown on most of the *Flood Insurance Rate Maps*

issued by the *Federal Emergency Management Agency* are referenced to NGVD or, more recently, to the *North American Vertical Datum*.

Natural Attenuation – Reduction in mass or concentration of a compound in groundwater over time or distance from the source of constituents of concern due to naturally occurring physical, chemical, and biological processes, such as biodegradation, dispersion, dilution, adsorption, and volatilization. (American Society for Testing and Materials, 2003).

Near-field earthquake – Used to describe a local earthquake within approximately a few fault zone widths of the causative fault which is characterized by high frequency waveforms that are destructive to above-ground utilities and short period structures (less than about two or three stories).

New construction – For the purpose of determining flood insurance rates under the *National Flood Insurance Program*, *structures* for which the start of construction commenced on or after the effective date of the initial *Flood Insurance Rate Map* or after December 31, 1974, whichever is later, including any subsequent improvements to such structures. (See *Post-FIRM structure*.) For *floodplain management* purposes, new construction means *structures* for which the *start of construction* commenced on or after the effective date of a *floodplain management regulation* adopted by a community and includes any subsequent improvements to such structures.

Nitrite and nitrate – Nitrogen-oxygen combinations that occur in several organic and inorganic compounds. High concentrations of nitrites in drinking water can pose serious health hazards, especially to infants.

Non-coastal A zone – The portion of the *Special Flood Hazard Area* in which the principal source of *flooding* is runoff from rainfall, snowmelt, or a combination of both. In non-coastal A zones, *flood* waters may move slowly or rapidly, but waves are usually not a significant threat to buildings. See *A zone* and *coastal A zone*. (Note: the *National Flood Insurance Program* regulations do not differentiate between non-coastal A zones and *coastal A zones*.)

Non-load-bearing wall – Wall that does not support vertical loads other than its own weight. See *Load-bearing wall*.

North American Vertical Datum (NAVD) – Datum used as a basis for measuring flood, ground, and structural elevations. NAVD is used in many recent *Flood Insurance Studies* rather than the *National Geodetic Vertical Datum*.

Oblique-reverse fault – A fault that combines some strike-slip motion with some dip-slip motion in which the upper block, above the fault plane, moves up over the lower block.

Offset ridge – A ridge that is discontinuous on account of faulting.

Offset stream – A stream displaced laterally or vertically by faulting.

One hundred (100)-year flood – See *Base flood*.

Orthoclase – One of the most common rock-forming minerals; colorless, white, cream-yellow, flesh-reddish, or grayish in color.

Paleoseismic – Pertaining to an earthquake that happened decades, centuries, or millennia ago.

Peak flood – The highest discharge or stage value of a flood.

Peak Ground Acceleration (PGA) – The greatest amplitude of acceleration measured for a single frequency on an earthquake accelerogram. The maximum horizontal ground motion generated by an earthquake. The measure of this motion is the acceleration of gravity (equal to 32 feet per second squared, or 980 centimeter per second squared), and generally expressed as a percentage of gravity.

Pedogenic – Pertaining to soil formation.

Pegmatite – An igneous rock with extremely large grains that are more than a centimeter in diameter.

Perched ground water – Unconfined ground water separated from an underlying main body of ground water by an unsaturated zone.

Perennial stream – A stream that flows continuously throughout the year.

Perchlorates – Negatively charged molecules highly persistent in the environment that can displace the iodide molecule in the thyroid gland, leading to hypothyroidism in adults, and impaired development in infants.

Plagioclase – One of the most common rock forming minerals.

Playa – Term used in the Southwestern US to describe a flat-floored, typically unvegetated area composed of thin, stratified sheets of fine clay, silt or sand that represent the bottom or central part of a shallow, completely closed or undrained desert lake basin where water accumulates after a rainstorm and quickly evaporates, leaving behind deposits of soluble salts.

Plutonic – Pertaining to igneous rocks formed at great depth.

Plywood – Wood structural panel composed of plies of wood veneer arranged in cross-aligned layers. The plies are bonded with an adhesive that cures on application of heat and pressure.

Pore pressure – The stress transmitted by the fluid that fills the voids between particles of a soil or rock mass.

Post foundation – Foundation consisting of vertical support members set in holes and backfilled with compacted material. Posts are usually made of wood and usually must be braced. Posts are also known as columns, but columns are usually made of concrete or masonry.

Post-FIRM structure – For purposes of determining insurance rates under the *National Flood Insurance Program*, structures for which the *start of construction* commenced on or after the

effective date of an initial *Flood Insurance Rate Map* or after December 31, 1974, whichever is later, including any subsequent improvements to such structures. This term should not be confused with the term *new construction* as it is used in *floodplain management*.

Potentially active fault – According to the Alquist-Priolo Earthquake Fault Zone Act guidelines, a fault showing evidence of movement within the last 1.6 million years but that has not been shown conclusively whether or not it has ruptured in the past about 11,000 years ago. The U.S. Geological Survey considers a fault potentially active if it has moved in the time period between about 11,000 years ago (the Holocene) and 750,000 years ago, and that is thought capable of generating damaging earthquakes.

Precast concrete – Structural concrete element cast elsewhere than its final position in the structure. See *Cast-in-place concrete*.

Prescribed fire – A fire ignited under known conditions of fuel, weather, and topography to achieve specific objectives.

Primary fault rupture - Fissuring and displacement of the ground surface along a fault that breaks in an earthquake.

Project – A development application involving zone changes, variances, conditional use permits, tentative parcel maps, tentative tract maps, and plan amendments.

Quartzite – A metamorphic rock consisting mostly of quartz.

Quartz monzonite – A plutonic rock containing major plagioclase, orthoclase and quartz; with increased orthoclase it becomes a granite.

Quaternary – The second period of the Cenozoic era, consisting of the Pleistocene and Holocene epochs; covers the last approximately 1.6 to 2 million years.

Rain shadow – A reduction in precipitation in an area on the leeward side of a mountain or range of mountains, caused by the release of moisture on the windward side.

Resonance – Amplification of ground motion frequencies within bands matching the natural frequency of a structure and often causing partial or complete structural collapse; effects may demonstrate minor damage to single-story residential structures while adjacent 3- or 4-story buildings may collapse because of corresponding frequencies, or vice versa.

Recurrence interval – The time between earthquakes of a given magnitude, or within a given magnitude range, on a specific fault or within a specific area.

Reinforced concrete – *Structural concrete* reinforced with steel bars.

Remote shutoff – Valve that can be used to shut off the flow of a substance or chemical from a location away from the spill or break.

Reportable quantity – A term used by the EPA and the Department of Transportation (DOT) to denote a quantity of chemicals that require some kind of action, such as reporting an inventory or reporting an accident involving a certain amount of chemicals.

Response spectra – The range of potentially damaging frequencies of a given earthquake applied to a specific site and for a particular building or structure.

Response Time – The time that elapses between the moment a 911 call is placed to the emergency dispatch center and the time that a first-responder arrives on scene. Response time includes dispatch time, turnout time (the time it takes firefighters to travel to the fire station, don their personal protection equipment, and prepare the apparatus), and travel time.

Retrofit – Any change made to an existing structure to reduce or eliminate damage to that structure from flooding, *erosion*, high winds, earthquakes, or other hazards.

Revetment – Facing of stone, cement, sandbags, or other materials placed on an earthen wall or embankment to protect it from *erosion* or *scour* caused by *flood* waters or wave action.

Rhyolite – A group of extrusive igneous rocks, generally exhibiting flow texture, with large crystals (phenocrysts) of quartz and alkali feldspar in a glassy to cryptocrystalline groundmass. The approximate extrusive equivalent of granite.

Ridgetop shattering – An earthquake-induced type of ground failure that occurs along at or along the top of ridges, forming linear, fault-like fissures, and leaving the area looking like it was plowed.

Right-lateral fault – A strike-slip fault across which a viewer would see the block on the opposite side of the fault move to the right.

Riprap – Broken stone, cut stone blocks, or rubble that is placed on slopes to protect them from *erosion* or *scour* caused by *flood* waters or wave action.

Rockfall – Free-falling to tumbling mass of bedrock that has broken off steep canyon walls or cliffs.

Sand boil – An accumulation of sand resembling a miniature volcano or low volcanic mound produced by the expulsion of liquefied sand to the sediment surface. Also called sand blows, and sand volcanoes.

Sandstone – A medium-grained, clastic sedimentary rock composed of abundant rounded or angular fragments of sand size set in a fine-grained matrix and more or less firmly united by a cementing material.

Santa Ana (or Santana) wind – Strong, typically extremely dry offshore winds that characteristically blow through southern California and northern Baja California in late fall and winter. They typically originate in the Great Basin or upper Mojave Desert, and can be either hot or cold. The winds tend to funnel down the valleys and canyons, where gusts can attain speeds of 60 to 90 miles per hour (mph). Several devastating wildfires in southern California have been associated with Santa Ana winds.

Saturated – Said of the condition in which the interstices of a material are filled with a liquid, usually water.

Scarp – A line of cliffs produced by faulting or by erosion. The term is an abbreviated form of escarpment.

Schist – A metamorphic rock characterized by a preferred orientation in grains resulting in the rock's ability to be split into thin flakes or slabs.

Scour – Removal of soil or fill material by the flow of *flood* waters. The term is frequently used to describe storm-induced, localized conical erosion around pilings and other foundation supports where the obstruction of flow increases turbulence. See *Erosion*.

Secondary fault rupture - Ground surface displacements along faults other than the main traces of active regional faults.

Sediment – Solid fragmental material that originates from weathering of rocks and is transported or deposited by air, water, ice, or that accumulates by other natural agents, such as chemical precipitation from solution, and that forms in layers on the Earth's surface in a loose, unconsolidated form.

Sedimentary rock – Type of rock composed of material deposited at the Earth's surface or at the bottom of bodies of water by the actions of water, wind, gravity, or ice. Sedimentary rocks generally differ from sediment in that the individual particles have been partially or fully cemented together by clay, silica, calcium carbonate or some other material, giving the rock strength.

Seiche – A free or standing-wave oscillation of the surface of water in an enclosed or semi-enclosed basin (such as a lake, bay, or harbor), that is initiated chiefly by local changes in atmospheric pressure, aided by winds, tidal currents, and earthquakes, and that continues, pendulum-fashion, for a time after cessation of the originating force.

Seismic Moment – A measure of the size of an earthquake that is associated with the amount of energy released (the force that was necessary to overcome the friction along the fault plane), the area of the fault rupture, and the average amount of slip.

Seismogenic – Capable of producing earthquake activity.

Seismograph – An instrument that detects, magnifies, and records vibrations of the Earth, especially earthquakes. The resulting record is a seismogram.

Shearwall – *Load-bearing wall* or *non-load-bearing wall* that transfers in-plane lateral forces from lateral *loads* acting on a structure to its foundation.

Sheet flow – An overland flow or downslope movement of water taking the form of a thin, continuous film over relatively smooth soil or rocks surfaces and not concentrated into channels larger than rills.

Shutter ridge – That portion of an offset ridge that blocks or "shutters" the adjacent canyon.

Sidehill fill – A wedge of artificial fill typically placed on the side of a natural slope to create a roadway or a level building pad.

Silt – A rock fragment or detrital particle smaller than a very fine sand grain and larger than coarse clay, having a diameter in the range of 1/256 to 1/16 mm (4-62 microns, or 0.00016-0.0025 in.). An indurated silt having the texture and composition of shale but lacking its fine lamination is called a siltstone.

Slip Rate – The speed at which a fault is moving, typically expressed in millimeters per year (mm/yr), and generally estimated by measuring the amount of offset that has occurred in a given, known amount of time.

Slope creep – Deformation and movement of the outer soil or rock that cover a slope due to the forces of gravity overcoming the shear strength of the material.

Slope ratio – Refers to the angle or gradient of a slope as the ratio of horizontal units to vertical units. For example, in a 2:1 slope, for every two horizontal units, there is a vertical rise of one unit (equal to a slope angle, from the horizontal, of 26.6 degrees).

Slump – A landslide characterized by a shearing and rotary movement of a generally independent mass of rock or earth along a curved slip surface.

Soft-story building – Building with a story, generally the ground or first floor, lacking adequate strength or toughness due to too few shear walls. Examples of this type of structure include apartments above glass-fronted stores, and buildings perched atop parking garages.

Soil horizon – A layer of soil that is distinguishable from adjacent layers by characteristic physical properties such as structure, color, or texture.

Special Flood Hazard Area (SFHA) – Under the *National Flood Insurance Program*, an area having special *flood*, mudslide (i.e., mudflow) and/or flood-related erosion hazards, and shown on a Flood Hazard Boundary Map or *Flood Insurance Rate Map* as Zone A, AO, A1-A30, AE, A99, AH, V, V1-V30, VE, M or E.

Spot fire – Ignition resulting from embers from the fireline transported aerially in front of the fireline and often increasing fire spread.

Standardized Emergency Management System (SEMS) – (Government Code § 8607). The group of principles developed for coordinating state and local emergency response in California. SEMS provides for organization of a multiple-level emergency response, and is intended to structure and facilitate the flow of emergency information and resources within and between the organizational levels--the field response, local government, operational areas, regions and the state management level. SEMS incorporates by reference: the Incident Command System (ICS); multi-agency or inter-agency coordination; the State's Mutual Aid Program; and Operational Areas.

State Responsibility Area (LRA) – Per California Public Resources Code 4125-4127, the lands in which the State has primary financial responsibility for preventing and suppressing fires.

Storage capacity – Dam storage measured in acre-feet or decameters, including dead storage.

Strike-slip fault – A fault with a vertical to sub-vertical fault surface that displays evidence of horizontal and opposite displacement.

Structural concrete – All concrete used for structural purposes, including *plain concrete* and *reinforced concrete*.

Structural engineer – A licensed civil engineer certified by the State as qualified to design and supervise the construction of engineered structures.

Structural fill – Fill compacted to a specified density to provide structural support or protection to a *structure*. See *Fill*.

Structure – Something constructed, such as a building, or part of one. For *floodplain management* purposes under the *National flood Insurance Program*, a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home. For insurance coverage purposes under the NFIP, structure means a walled and roofed building, other than a gas or liquid storage tank, that is principally above ground and affixed to a permanent site, as well as a *manufactured home* on a permanent foundation. For the latter purpose, the term includes a building while in the course of construction, alteration, or repair, but does not include building materials or supplies intended for use in such construction, alteration, or repair, unless such materials or supplies are within an enclosed building on the premises.

Subsidence – The sudden sinking or gradual downward settling of the Earth's surface with little or no horizontal motion.

Superfund Amendments and Reauthorization Act (SARA) – Law that regulates a number of environmental issues, predominantly for the chemical inventory reporting by industry to the local community.

Surficial failure – Type of slope failure that impacts the near-surface soil and weathered rock face, typically in response to the effects of gravity and precipitation.

Swale – In hillside terrace, a shallow drainage channel, typically with a rounded depression or "hollow" at the head.

Talus – The cone-shaped accumulation of angular fragments of rock or soil at the base of a cliff that has experienced rockfalls.

Target fire hazard – A facility or structure within a fire department's jurisdiction that if it caught fire, it could overwhelm the fire department's fire response capabilities. Target hazards typically include industrial buildings, facilities that use, store or manufacture hazardous materials, high-occupancy facilities, and structures that house sensitive populations, like schools and hospitals.

Tectonic plate – Any of several large pieces, or blocks, of the Earth's lithosphere that are slowly moving relative to each other as part of the process called plate tectonics.

Thrust fault – A fault, with a relatively shallow dip, in which the upper block, above the fault plane, moves up over the lower block.

Thunderstorm – A weather condition that develops when warm, moist air meets a cold front, producing strong winds, and sometimes tornadoes and hail.

Tornado – A localized but violently destructive windstorm occurring over land (at sea it is called a waterspout) characterized by a funnel-shaped cloud extending toward the ground.

Transform system – A system in which faults of plate-boundary dimensions transform into another plate-boundary structure when it ends.

Transpression – In crustal deformation, an intermediate stage between compression and strike-slip motion; it occurs in zones with oblique compression.

Tsunami – Great sea wave produced by submarine earth movement, volcanic eruption, oceanic meteor impact, or underwater nuclear explosion.

Typhoon – Name given to a *hurricane* in the area of the western Pacific Ocean west of 180 degrees longitude.

Unconfined aquifer – Aquifer in which the upper surface of the saturated zone is free to rise and fall.

Unconsolidated sediments – A deposit that is loosely arranged or unstratified, or whose particles are not cemented together, occurring either at the surface or at depth.

Underground Storage Tank (UST) – Tank, commonly used to store gasoline, diesel or other chemical, that is buried under the ground.

Undermining – Process whereby the vertical component of erosion or scour exceeds the depth of the base of a building foundation or the level below which the bearing strength of at the foundation is compromised.

Unreinforced Masonry (URM) structure – Building without adequate anchorage of the masonry walls to the roof and floor diaphragms and lack of steel reinforcement, of limited strength and ductility, and as a result, that tends to perform poorly when shaken during an earthquake.

Uplift – Hydrostatic pressure caused by water under a building. It can be strong enough lift a building off its foundation, especially when the building is not properly anchored to its foundation.

Urban-wildland interface area (UWI) – The area where wildland approaches or interfaces with the urban environment. Important in fire hazard studies where wildland fires have the potential to impact the built environment.

Variance – Under the *National Flood Insurance Program*, grant of relief by a community from the terms of a *floodplain management regulation*.

Violation – Under the *National Flood Insurance Program*, the failure of a structure or other development to be fully compliant with the community's *floodplain management regulations*. A *structure* or other *development* without the elevation certificate, other certifications, or other evidence of compliance required in Sections 60.3(b)(5), (c)(4), (c)(10), (d)(3), (e)(2), (e)(4), or (e)(5) of the NFIP regulations is presumed to be in violation until such time as that documentation is provided.

Watershed – A topographically defined region draining into a particular river or lake.

Waterspout – Tornado that forms over warm water.

Water surface elevation – Under the *National Flood Insurance Program*, the height, in relation to the *National Geodetic Vertical Datum* of 1929 (or other datum, where specified), of *floods* of various magnitudes and frequencies in the *floodplains* of coastal or riverine areas.

Water table – The upper surface of groundwater saturation of pores and fractures in rock or surficial earth materials.

Water year – The 12-month period from October 1 through September 30 of the following year.

Weather – The short-term state of the air or atmosphere with respect to heat or cold, wetness or dryness, calm or storm, clearness or cloudiness, or any other meteorologic phenomena.

X zone – Under the *National Flood Insurance Program*, areas where the *flood* hazard is less than that in the *Special Flood Hazard Area*. Shaded X zones shown on recent *Flood Insurance Rate Maps* (B zones on older maps) designate areas subject to inundation by the *500-year flood*. Un-shaded X zones (C zones on older *Flood Insurance Rate Maps*) designate areas where the annual probability of flooding is less than 0.2 percent.

Appendix G

Agency and Service Letter Responses

Appendices

This page intentionally left blank.

Yucca Valley General Plan Update Fire Department Questionnaire

1. The map is accurate. The San Bernardino County Fire Department (SBCoFD) covers all areas shown on the aerial map.
2. SBCoFD currently has a standard automatic aid/mutual aid agreement. The agreement is a reciprocal agreement that automatically provides for one fire engine from a surrounding agency for structure fires and vegetation fires only. Additional units can be requested as needed through a mutual aid request. SBCoFD currently has an auto aid/mutual aid agreement with Morongo Valley Fire. SBCoFD is currently in the process of establishing agreements with 29 Palms Fire Department and 29 Palms Marine Base Combat Center Fire Department. In addition to the agreements, Combat Center Fire has agreed to cover Yucca Valley and Joshua Tree stations as needed and provided they have units available for cover. In situations when the entire Morongo Basin is low in available resources SBCoFD can call for units from other SBCoFD divisions to move up and cover Yucca Valley stations.
3. Station 38 is paid call staffing. Equipment is one utility (SUV) vehicle with radios and basic life support medical gear.
   Station 41 has daily staffing consisting of 1 captain, 1 engineer, 2 firefighter paramedics, and two limited term firefighter/ambulance drivers. Station 41 is equipped with 1 paramedic engine, 1 brush engine, 2 paramedic ambulances, and 1 swift water rescue unit.
   Station 42 has daily staffing consisting of 1 captain, 1 engineer, 1 firefighter paramedic, and 1 limited term firefighter/ambulance driver. Station 42 is equipped with 1 paramedic engine, 1 paramedic ambulance, 1 water tender, 1 light duty urban search and rescue unit, and 1 utility vehicle. The station also houses a reserve engine and reserve ambulances as necessary.
   Station 36 in Joshua Tree has daily staffing consisting of 1 captain, 1 engineer, and 1 firefighter paramedic. Station 36 is equipped with a paramedic engine, an aerial ladder truck, and a hazardous materials response unit. All the above units respond in to the Town of Yucca Valley as necessary.
4. SBCoFD has a computer aided dispatch system that keeps track of unit status and locations. The system automatically dispatches the closest appropriate units, thus minimizing response times. Some emergency calls can be located very near a fire station and some can be many miles from a station. For this reason it is impossible to establish a minimum response time for calls. Crews always strive to be out the door and responding to a call in 30-60 seconds. Many factors such as traffic, time of day, call location, etc can affect response times.

DRAFT

5. Fire station 41 in downtown Yucca Valley has an average response time of 6:03 minutes. Fire station 42 (located north of the town limits) has an average response time 9:04 minutes. These statistics reflect calls generated only within the town limits. The response time begins when a station receives an alert and ends when the fire unit arrives on scene. This time includes receiving the call, donning personal safety gear as required, and driving to the incident. Safety rules and seat belt laws prohibit personnel from donning safety gear while en route to an incident.
6. Staffing and equipment levels are currently below optimum given the number of calls generated within the Town of Yucca Valley.
7. The current economic/fiscal crisis has affected SBCoFD drastically. It has forced us to shift our focus from staffing and equipment augmentation to staffing and equipment reduction. As the economy recovers and revenues eventually increase SBCoFD will begin rebuilding to previous staffing and equipment levels. Ultimately, as revenues continue to increase we can look to building staffing and equipment levels even further.
8. In a perfect world, an additional fire station with paramedics in the southern part of town and another station in the western part of town would greatly enhance services. This service enhancement would provide service for years to come as the town's population grows.
9. Any increase in population will increase demands placed on the fire department. Increased population will also affect traffic flow and ultimately increase response times. Additional stations and staffing would help SBCoFD deal with the increased call volume and other associated demands placed on the fire department. Hopefully as the population grows, revenues will increase to support additional fire protection.

DRAFT

From: Toms, Brad <[redacted]>
Sent: Tuesday, April 23, 2013 12:15 PM
To: Ryan Potter
Subject: RE: Yucca Valley General Plan EIR - follow up question

Follow Up Flag: Follow up
Flag Status: Flagged

Good Morning,

SBSD does not have an adopted per capita ratio.

Yucca Valley is maintaining approximately .60 officers per thousand, the industry strives for a 1 per 1000 residents. The ratio is determined by each contract city… does that help?

Brad Toms
Sheriff's Lieutenant / San Bernardino County Sheriff
Morongo Basin Station
6527 White Feather Road / Joshua Tree, CA 92252
[redacted]

CONFIDENTIALITY NOTICE: This communication contains legally privileged and confidential information sent solely for the use of the intended recipient. No one but the intended recipient is authorized to use it in any manner except to immediately destroy it and notify the sender.

From: Ryan Potter [redacted]
Sent: Wednesday, April 17, 2013 11:09 AM
To: Toms, Brad
Subject: Yucca Valley General Plan EIR - follow up question

Lieutenant Toms,

I am working with the Town of Yucca Valley on the Environmental Impact Report (EIR) for the Town's General Plan Update. I'm hoping to state the generation factor used to estimate the number of deputies needed at buildout (an estimated population of 64,565) as indicated by your questionnaire response:

> "Based on the projected population of 64,543, an increase of 187 %, the Town of Yucca Valley will need to increase their Police services from 11 deputies and equipment to 35 deputies and equipment, an increase of approximately 200%. Current response times are increasing, and continue to increase with population growth along with calls for service."

Can you please confirm the SBCSD's desired officer-to-population ratio? If there is no officially adopted ratio, can you state the ratio currently provided by the SBCSD? Thanks,

Ryan

Ryan Potter
Assistant Planner

THE PLANNING CENTER | DC&E
3 MacArthur Place Suite 1100 | Santa Ana CA 92707
714.966.9220 | 714.966.9221 (f)
[redacted]
www.planningcenter.com

Think environment before printing.

YUCCA VALLEY GENERAL PLAN UPDATE DRAFT EIR

1. Please confirm all areas of the Town of Yucca Valley (see figure 1, townwide aerial) are served by the San Bernardino County Sheriff's Department (SBCSD).

   All areas are served by SBCSD.

2. What is SBCSD's performance standard for responding to emergency and non-emergency call within its service area (i.e., minutes to reach the call location)?

   Emergency: under 5 minutes

   Non-emergency: 10-15 minutes

3. What is the current average response time (in minutes) for emergency and non-emergency calls in the Town?

   Emergency: 4:36 min

   Non-Emergency: 13:33 min

4. Are existing resources (personnel, equipment, and facilities) adequate to serve the Town under current conditions?

   "Yes"

5. Please summarize any additional resources (stations, equipment, personnel) needed to serve future development under the Yucca Valley General Plan Update.

   Based on the projected population of 64,543, an increase of 187 %, the Town of Yucca Valley will need to increase their Police services from 11 deputies and equipment to 35 deputies and equipment, an increase of approximately 200%. Current response times are increasing, and continue to increase with population growth along with calls for service.

What factors are used to project these needs?

Increased population.

Increased response times passed on increased population.

Calls for service.

6. Please describe any existing plans to expand police service and/or facilities in the area that serves the Town. Please also describe anticipated funding sources for those improvements.

   Plans would be based on an increased population, calls for service and increased response times. Funding for expanded police services would come from the Town of Yucca Valley.

7. Please provide any additional comments and/or information regarding police service for this project under the proposed General Plan Update (attach additional pages as necessary).

   N/A

If you would like to receive this questionnaire in MS Word format, please email Ryan Potter at rpotter@planningcenter.com.

1. Please summarize the Morongo Unified School District's service boundary relative to the Town of Yucca Valley's boundaries as shown in attached Figure 1, *Townwide Aerial*. Please confirm that the District serves all areas of the Town.

   The Morongo Unified School District boundaries encompass all of the Town of Yucca Valley, west to the Town of Morongo, north to Landers and west to the City of Twentynine Palms

2. Please provide any information available on the capacities and current enrollment of each of the schools outlined below.

School & Location	***Capacity Permanent Buildings***	***Capacity Portable Buildings***	***Total Capacity***	***Current Enrollment***
Onaga Elementary School 58001 Onaga Trail	525	425	950	719
Yucca Mesa Elementary School 3380 Avalon Avenue	502	200	850	427
Yucca Valley Elementary School 7601 Hopi Trail	675	175	850	568
La Contenta Middle School 7050 La Contenta Road	725	425	1150	765
Black Rock High School 59273 Sunnyslope Drive	200	100	300	123
Yucca Valley High School 7600 Sage Avenue	1500	375	1875	1280

3. Are the existing school facilities (classroom, athletic, recreational, or other facilities) adequate to serve the District under current conditions?

Athletic and recreational are at a minimal, level in meeting school needs.

4. Please indicate the District's student generation rates for residential land uses (e.g., single-family, multifamily). The Morongo Unified School District uses the State Generation figure of .7%.

5. Please summarize any additional resources (facilities, personnel) needed to serve future development under the General Plan Update.

   At this time the Morongo Unified School District is working with a minimal staffing requirement. Any growth would require additional staffing in both the classrooms and support services.

6. Please describe any existing plans to expand school facilities in the area that serves the Town (see Figure 1). Please also describe the anticipated funding source for such improvements.

   At this time there are no plans for future explanation of school facilities in the Yucca Valley area, as we have just added new permanent classrooms at Onaga Elementary, La Contenta Middle School, and will be starting Construction on a two story classroom building at Yucca Valley High School in June of 2013. (Replacing 12 portables). All future funding is questionable do to the lack of State Matching dollars for both new construction and modernization monies.

7. What school impact fees does the District currently charge by land use (e.g., residential, commercial, office)?

   STATUTORY SCHOOL FEES (DEVELOPER FEES) are

   Residential $2.63 per square foot.

   Commercial / Industrial $ .42 per square foot

8. Please provide any additional comments and/or information regarding school service for this project under the proposed General Plan Update (attach additional pages as necessary).

Response Prepared By:

Ron Smith	Director, Maintenance and Operations
Name	**Title**
Morongo Unified School District	March 05, 2013
Agency	**Date**

San Bernardino County Library
Response to Town of Yucca Valley General Plan Update Draft EIR

1. The current Library facility in Yucca Valley is leased from the Town. It contains 40,000 items and 12 computers in a space that is 8,250 square feet. The Library offers a variety of special programs to children, teens, and adults. Specialized programs include story times, preschool age activities, Friends of the Library special events and book sales, summer reading programs, and adult book clubs and discussion groups.

2. See below

3. The current Library space, collection size, and computer count is not adequate for the Town of Yucca Valley. The California State Library uses a ratio of per capita 0.46 of square feet of library space in ratio to population size, and 3.62 items per capita for materials. Based on the current population for the town, these ratios would expand the current site close to 2,000 square feet and increase the collection by 40,000 items. When taking into consideration the space needed to present dynamic children's programs and space for the community to meet, the space and resource needs should be expanded.

4. The Library would benefit from a multipurpose room equipped with audio visual hardware.

5. The County Library is currently planning to remodel the existing facility which will include new carpet, new paint, addition of computers, and a new layout.

6. No comments at this time.

Prepared by:

Leonard Hernandez
County Librarian
San Bernardino County Library
02-26-2013

YUCCA VALLEY GENERAL PLAN UPDATE DRAFT EIR
Library Services Questionnaire – San Bernardino County Library

---

If you would like to receive this questionnaire in MS Word format, please email Ryan Potter at rpotter@planningcenter.com.

1. Please summarize existing library facilities, resources, and services (library building square footages, collection volume, capacity), and special services provided (i.e., computer labs, summer reading programs, tutoring) to residents of the Town.

2. Are existing library facilities and resources (books, computers, etc.) adequate for the system's service population? If not, what is the estimated deficit of space and/or volumes?

3. What factors or standards are used to estimate library facility and resource requirements (e.g. square feet of library facility floor area per capita and book volumes per capita)?

4. Please summarize any additional resources and/or facilities needed to provide library services for future development under the General Plan Update.

5. Please describe any existing plans to expand library service and/or facilities that would serve the Town. Please also describe the anticipated funding sources for those improvements.

6. Please provide any additional comments and/or information regarding the provision of library services under the proposed General Plan Update (attach additional pages as necessary).

Response Prepared By:

Name **Title**

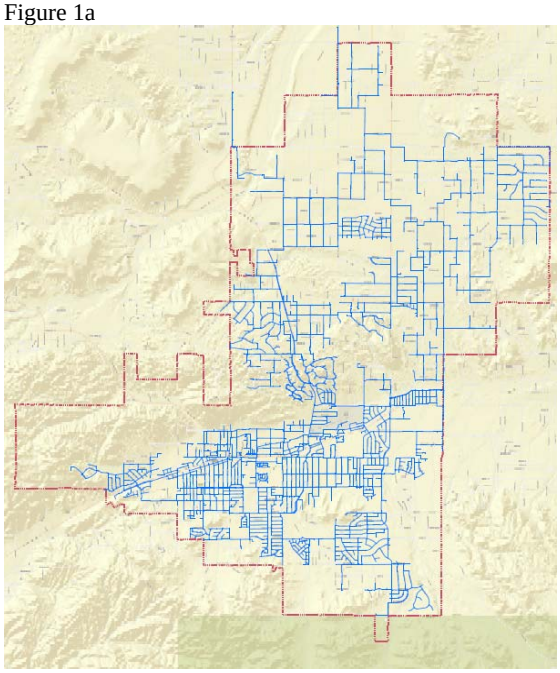
Agency **Date**

If you would like to receive this questionnaire in MS Word format, please email Ryan Potter at rpotter@planningcenter.com.

1. Please confirm that the Hi-Desert Water District (HDWD) provides water service to most (but not all) of areas within the Town of Yucca Valley (for boundaries, see Figure 1, *Townwide Aerial*).

   Hi-Desert Water District is in fact the sole public water system serving the Town of Yucca Valley. Figure 1a below reflects the Districts current service area.

Figure 1a



2. Please confirm that HDWD currently provides water to consumers using supply from the following four sources. Please identify any sources of water not listed.

   - Warren Valley Groundwater Basin
   - Ames/Means/Reche Valley Groundwater Basin
   - Septic system and irrigation return flows to groundwater (880 AFPY Warren Sub-Basin)
   - State Water Project/Mojave Water Agency (water used to recharge the Warren Valley Groundwater Basin)

   The above list of water supply sources provides an accurate and complete source inventory.

3. Please summarize any additional facilities or infrastructure needed to provide water service to future development under the General Plan Update.

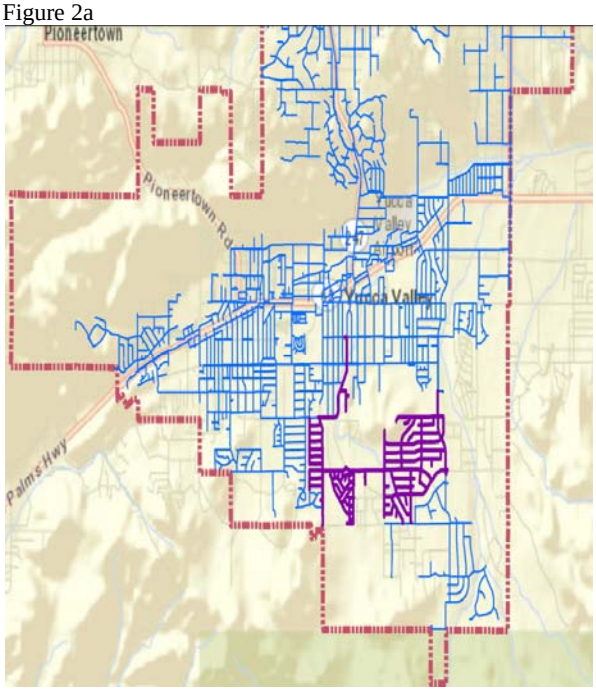
Pressure Zone 3797

Several water system improvements were identified through the District's most recent Water System Master Plan (WSMP) to facilitate growth within Yucca Valley. An update

of this WSMP is scheduled to take place beginning in July of 2013 and will depict more accurate findings based upon actual growth and current projections.

Under existing system operation, the need for an additional .25+ MG of water storage capacity within the District's 3797 pressure zone is apparent within the very near future. Figure 2a outlines pressure zone 3797 pipes in purple.

Figure 2a



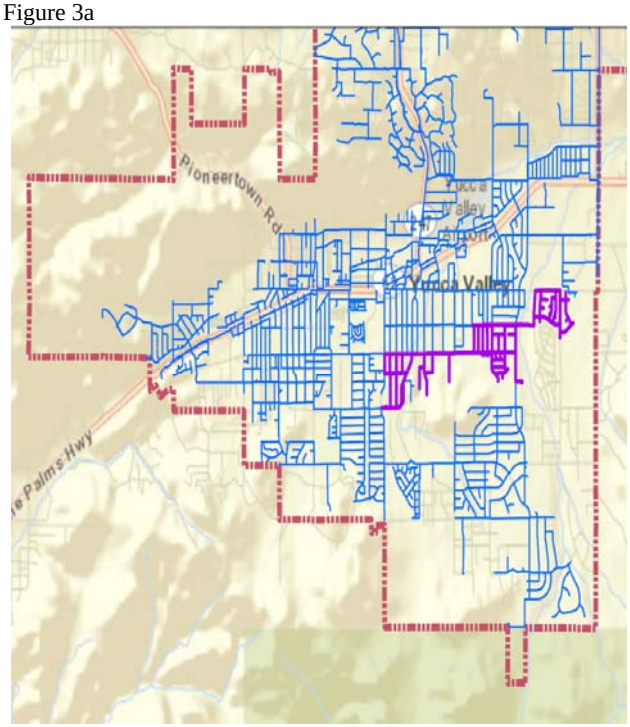
Negligible growth within this area would require the additional storage capacity such as the Town of Yucca Valley's phase II Southside Park improvements, or the development of an approved tract map that is believed to be constructing over 100 dwellings in the near future known as Copper Hills Homes #3.

Pressure Zone 3589

During the time the WSMP was completed, a proposed development known as Century Homes was anticipated to add 1,420 dwelling units by the year 2015. Due to this, the WSMP planned accordingly to ensure water system improvements were carried out by the respective date. This project was not built, however the number of dwellings adds some point of reference for water system impacts due to growth occurring within the District's 3589 pressure zone.

Pressure zone 3589 does not contain a water storage reservoir to provide an emergency water supply during electrical outages or fire suppression efforts. The pressure zone is controlled utilizing stored water from pressure zone 3797 which is reduced through the use of pressure reducing valves located on Joshua Lane crossing Onaga Trail and Palomar crossing Onaga Trail. Increased residential growth within this area, much like that of the Century Homes project listed above would require the construction of an additional water storage reservoir (1.25 MG) and booster station capable of delivering 600 gpm of "firm" capacity. Pressure zone 3589 is outlined within Figure 3a below.

Figure 3a



Source of Supply

Additional information provided within the District's most recent WSMP should be considered for source of supply during different stages of development. The District is currently capable of supplying approximately 7.9 million gallons per day (MGD). The latest WSMP outlines the maximum daily demands needed to meet the Town's stages of development based upon a 33, 66, and 100% build out condition. Table 1a outlines the maximum daily demand (MDD) needed to supply water at these stages of development.

Table 1a

Development	**33%**	**66%**	**100%**
Current Supplies	7.90	7.90	7.90
MDD	5.93	12.06	18.01
Surplus/(Deficit)	1.27	(4.86)	(10.81)

*The District must develop additional well supplies prior to the Town reaching the 33% development level in order to provide sufficient "*firm" well capacity.*

At 100% development, the District will have needed to increase its supply by an additional 5,500 AFPY. This would require negotiating an increase in allotment of SWP water through MWA or others; or finding additional sources of water outside of the District's boundaries. Conjunctive Use Agreements, water exchanges, and conservation efforts may also be applied to augment the needed amount of water.

*"firm" well capacity defined as available capacity with largest producing facility out of service

4. HDWD's 2010 Urban Water Management Plan (UWMP) discusses the Ames/Reche Recharge Project and plans for a centralized wastewater treatment and collection system. Please describe the current status of these proposed facilities.

Ames/Reche Recharge Project

Bighorn Desert View Water Agency, the projects lead, has closed escrow on its mitigation lands and the project's construction has been put out to bid by Mojave Water Agency (MWA). It is expected that a MWA Board Meeting in April of 2013 will host the contract award and construction will begin shortly thereafter. The improvements are minimal so availability to recharge at this location should be available by the end of 2013.

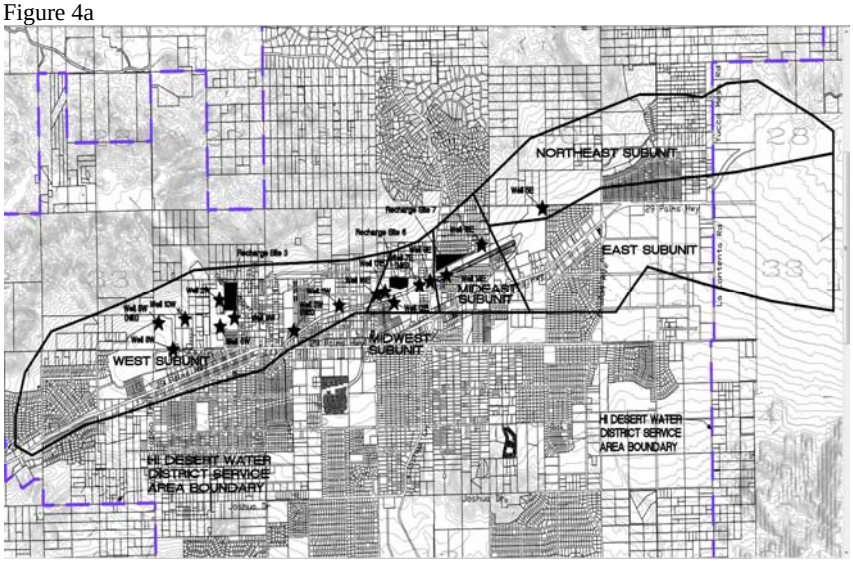
Wastewater Treatment and Water Reclamation Project

In September of 2012, the District hired Atkins North America to design the collection system for the WRF project. A draft Preliminary Design Report (PDR) which included an Engineer's Opinion of Probable Cost to deliver the project was accompanied by 30% design submittals in March of 2013. Currently, District staff is reviewing the material and conferring with Atkins regarding its contents. The 30% design submittal and PDR will be available to other agencies and project stakeholders shortly.

District staff and consultants are working with the Regional Board and California Department of Public Health (CDPH) to complete a Report of Waste Discharge (ROWD) for the treatment facility which includes the submission of an engineering report that must meet both agencies requirements. The information gained as a result of this exercise will determine the level of treatment that must be provided. It is the intent of the project to deliver high quality treated effluent to the Warren Subbasin via groundwater recharge. Spreading ponds will be constructed allowing the discharge to percolate into the East Hydrogeologic Subunit. Figure 4a displays the boundaries of the effective water bearing portion of the Warren Subbasin and its HGU's.

Albert Webb and Associates, the District's assessment district (AD) engineer is currently updating the District's AD Engineering Report which will provide the methodology behind the assessed value of each property based upon benefit and assigned Equivalent Dwelling Unit's (EDU).

Figure 4a



6. Please confirm that HDWD uses water consumption rates to predict wastewater flows for purposes of planning wastewater infrastructure. Please confirm that for purposes of sizing the planned wastewater treatment facility, HDWD assumes a per-capita wastewater flow rate of 83 gallons/person/day (Water Reclamation Facility Preliminary Design Report, HDWD, 2009).

   For new sanitary sewer collection systems, flow projections are typically estimated based on average water use and an estimated return to sewer rate. The District's Sewer System Master Plan (SSMP) used 80 gallons per capita per day (gpcd). Atkins obtained 2011 water use data from the District, which revealed that average Phase I and II water use was 78 gpcd (based on an average household size of 2.55 people) and average Phase III water use was 88 gpcd. Some water usage is not returned as wastewater, which for a desert community is approximately 10% of the total water usage. This means that wastewater generation rates would be between 70.2 and 79.2 gpcd. However, as the system ages, there is a potential for inflow and infiltration (I/I) from storm events. Because of this, the conservative number of 80 gpcd was adopted by the Board to provide a cushion for potential future I/I that may increase projected flows. Exceeding this number, or overestimating wastewater generation factors can result in pipelines that are too large for actual system flows, which means lower velocities, more solids, deposition, and ultimately more required maintenance and odor problems.

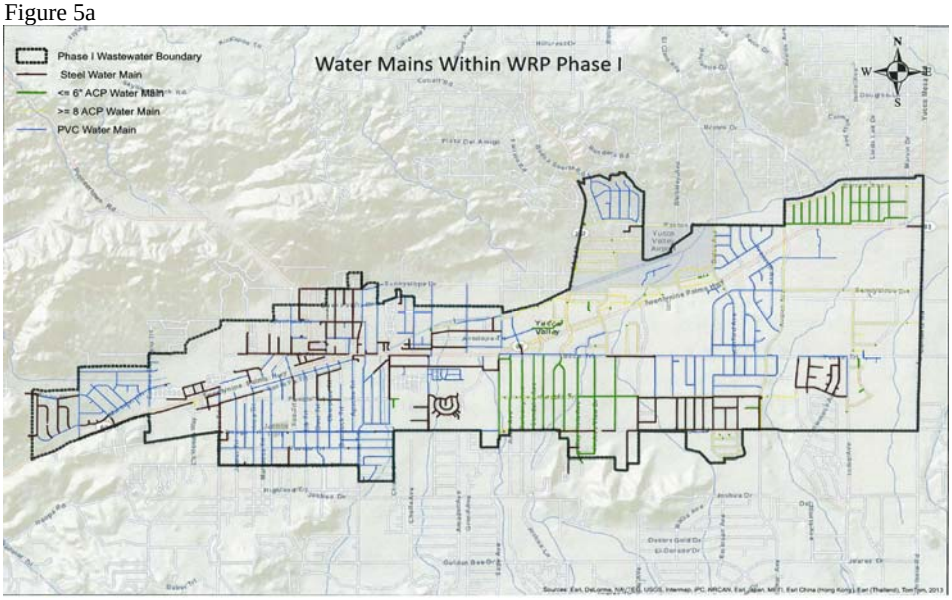
7. Please also describe any additional plans to expand water supply services and wastewater services and/or facilities that would serve the Town of Yucca Valley. Please identify how those services and/or facilities would be funded.

   In addition to the Phase I area of the WRF Project, two subsequent phases, Phase II and III are currently scheduled to be completed by 2019 and 2022. These Phases will require an additional AD formation to finance the project(s).

The District actively replaces watermains within its service boundaries at a rate of 25 – 40,000 l.f. per year. The program is intended to mainly replace aging steel watermain infrastructure that is undersized and failing however, additional infrastructure not comprised of steel but insufficient in capacity is also scheduled for replacement. As a result, some of the proposed changes listed within the General Plan Update may be met with inadequate capacity for fire flow/high demand conditions and should be considered as development occurs. Figure 5a displays areas that still require replacement under the District's Capital Watermain Replacement Program within the "downtown corridor".

These improvements are generally covered by District rates and fees; however in the event development occurs prior to District replacement, the developer may be required to replace watermains or other infrastructure.

Figure 5a



8. Please provide any additional comments and/or information regarding water supply service for Yucca Valley under the proposed General Plan Update (attach additional pages as necessary).

HDWD will utilize the General Plan update (as completed or approved portions) as a consideration for its upcoming Water System Master Plan Update. The document will be shared with Town staff in its draft form and as technical bulletins are released to allow for proper comment periods and future update considerations.

Response Prepared By:

Mark Ban	Assistant General Manager, Water Resources and Operations
Name	**Title**
Hi-Desert Water District	2/28/2013
Agency	**Date**

If you would like to receive this questionnaire in MS Word format, please email Ryan Potter at rpotter@planningcenter.com.

1. Please identify confirm that landfills owned and/or operated by San Bernardino County receive solid waste generated by land uses in the Town of Yucca Valley.

   The Landers Sanitary Landfill (LSL) is owned and operated by the County of San Bernardino, Solid Waste Management Division (SWMD). The LSL provides refuse disposal services for the Town of Yucca Valley.

2. Please confirm or correct the following information we obtained from the California Department of Resources Recovery and Recycling (CalRecycle) website:

   a. In 2011 approximately 97 percent of solid waste disposed from the Town of Yucca Valley was disposed at one landfill: the Landers Sanitary Landfill in the unincorporated community of Landers, approximately 10 miles north of Yucca Valley. This landfill is owned and operated by the County of San Bernardino, Solid Waste Management Division.

      The SWMD is not responsible nor can we verify the accuracy of the above data.

   b. Please confirm, correct, and/or supplement the information in the following table.

Facility	Maximum Permitted Throughput, Tons per Day	Average Disposal, tons per day[1]	Remaining Capacity, cubic yards	Estimated Closure Year
Landers Sanitary Landfill	1,200	150	550,017	2018
Other landfills: (provide information if relevant)				

[1] Based on 6 days/week operation. Landers Sanitary Landfill is open Monday-Saturday each week.

Source: CalRecycle 2012

3. Please confirm or correct the following data on solid waste diversion rates for the Town of Yucca Valley we obtained from CalRecycle's website:

Year	Diversion Rate, Percent
2001	64
2002	65
2003	59
2004	62
2005	60
2006	62

Source: CalRecycle 2012

Year*	Population Disposal, Percent		Employment Disposal, Percent	
	Target	Actual	Target	Actual
2007	9.2	5.7	42.3	24.5
2008	9.2	4.7	42.3	20.5
2009	9.2	4.5	42.3	21.0
2010	9.2	4.4	42.3	22.0
2011	9.2	4.6	42.3	22.5
Source: CalRecycle 2012				

* From 2007 onward, diversion rates are reported as actual disposal rates compared to target disposal rates. Actual disposal rates at or below target rates are one of several measures of compliance with the diversion requirement in AB 939.

The SWMD is not responsible nor can we verify the accuracy of the above data.

4. Please describe any existing plans to expand solid waste facilities that would serve the Town of Yucca Valley. Please also describe the **anticipated funding sources** for such improvements.

In order to provide long term refuse disposal capacity within the Eastern High Desert area, SWMD is in the process of preparing an Environmental Impact Report for the lateral expansion of the LSL. The project consists to expanding the existing 44-acre permitted footprint to 92-acres footprint which will increase the total landfill capacity by 10.8mcy. SWMD establishes fees that are charged to the public and other agencies for utilization of the County landfills. Funding for the cost of this project is included in the SWMD Capital Improvement Projects Ten-Year Rolling Plan

5. If not addressed in the previous question, please summarize any additional facilities or infrastructure needed to serve future development under the General Plan Update.

Environmental monitoring and control systems at the landfill will be added/extended as part of the proposed expansion project.

6. Could solid waste disposal be provided to serve future growth in accordance with buildout of the General Plan Update without significantly impacting existing solid waste services?

Per the current Solid Waste Facility Permit, the landfill has capacity until approximately August 2018. The lateral expansion project will provide additional refuse capacity to approximately 2072.

7. What impact will the General Plan Update, in combination with all the other development projects in the area, have on solid waste providers' ability to provide disposal services?

As mentioned above, SWMD is in the process of expanding the landfill. The expansion project will provide ability for disposal services until year 2072. With the expansion project, SWMD will be able to provide refuse disposal services to the Town of Yucca Valley and other areas within the Eastern High Desert to approximately 2072.

8. Please add any additional comments you may wish to make regarding the Yucca Valley General Plan Update and its impact on the provision of solid waste pickup and disposal.

SWMD has no additional comments.

Response Prepared By:

Johnny Gayman — Public Works Engineer III

Name — **Title**

DPW - Solid Waste Management Division — 3/13/13

Agency — **Date**

Appendix H

Noise Measurements and Calculations Outputs

Appendices

This page intentionally left blank.

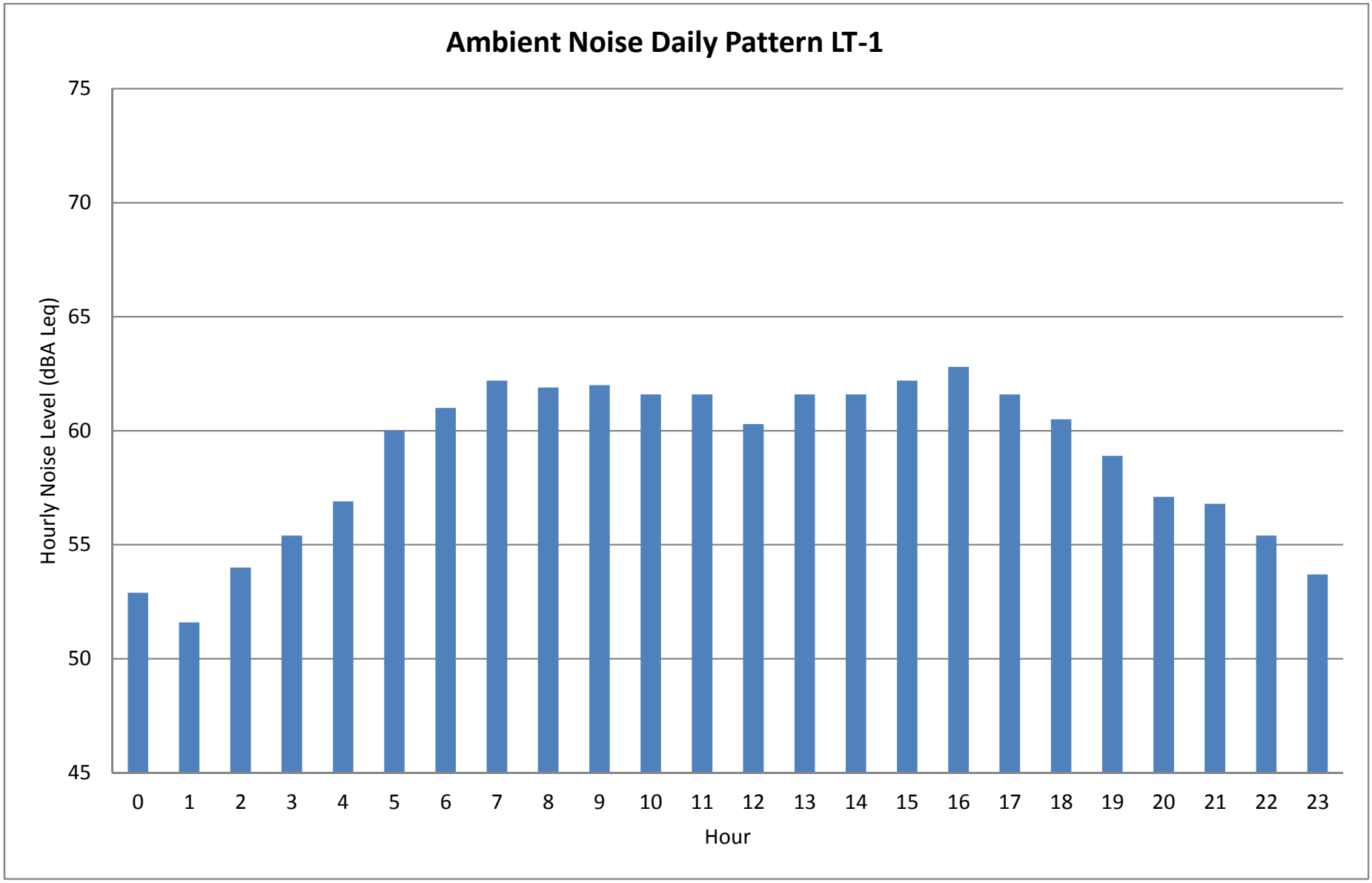
Number	Min	Date	Time	Duration	Leq	Lmax	Lmin	L(2)	L(8)	L(16)	L(25)	L(50)	L(90)
ST-2	1	16-Jan	11:38:44	15.3	53.0	59.5	46.5	56.8	55.1	54.3	53.7	52.5	50.3
ST-2	2	16-Jan	11:39:00	60	51.9	63.0	41.1	61.6	55.9	52.8	50.3	48.0	43.7
ST-2	3	16-Jan	11:40:00	60	61.1	73.6	39.6	72.2	66.1	59.8	57.4	50.5	43.6
ST-2	4	16-Jan	11:41:00	60	69.0	82.8	40.8	80.7	73.4	70.4	65.8	58.6	48.5
ST-2	5	16-Jan	11:42:00	60	56.2	67.4	42.2	64.9	59.9	58.1	56.7	52.9	44.2
ST-2	6	16-Jan	11:43:00	60	67.1	79.6	41.2	77.8	73.0	68.7	61.3	51.4	43.3
ST-2	7	16-Jan	11:44:00	60	66.9	75.6	50.9	75.0	72.5	70.1	68.3	60.1	52.7
ST-2	8	16-Jan	11:45:00	60	67.5	81.6	46.3	79.0	72.2	67.3	63.6	59.5	50.3
ST-2	9	16-Jan	11:46:00	60	67.7	82.2	40.1	74.8	73.6	71.6	69.1	54.5	43.4
ST-2	10	16-Jan	11:47:00	60	61.2	76.8	46.1	71.7	64.1	62.2	60.3	57.1	49.3
ST-2	11	16-Jan	11:48:00	60	69.9	81.2	50.1	80.0	75.7	70.8	67.3	61.0	54.6
ST-2	12	16-Jan	11:49:00	60	67.7	84.2	43.3	79.1	67.2	63.7	62.1	59.6	52.0
ST-2	13	16-Jan	11:50:00	60	58.4	73.9	35.9	70.9	58.4	49.5	47.7	45.0	37.1
ST-2	14	16-Jan	11:51:00	60	69.5	83.4	43.4	79.8	73.0	70.5	68.4	61.3	47.4
ST-2	15	16-Jan	11:52:00	60	54.0	68.2	36.3	63.0	59.9	56.6	52.9	44.9	38.1
ST-2	16	16-Jan	11:53:00	60	72.8	82.2	55.8	80.3	78.2	75.5	72.9	68.7	61.6
ST-2	17	16-Jan	11:54:00	60	62.2	74.7	34.2	73.4	68.5	61.0	55.2	48.4	35.5
ST-2	18	16-Jan	11:55:00	4.9	51.2	59.6	43.7	59.0	55.0	53.3	51.7	49.3	45.1
					66.4	**84.2**	**34.2**						
ST-9	1	16-Jan	12:09:16	43.1	70.6	80.5	43.4	79.3	77.5	73.6	70.6	56.3	46.8
ST-9	2	16-Jan	12:10:00	60	60.7	82.6	37.7	71.1	62.9	57.6	51.5	43.5	39.0
ST-9	3	16-Jan	12:11:00	60	67.6	82.0	46.0	78.6	71.8	68.1	64.6	57.0	48.4
ST-9	4	16-Jan	12:12:00	60	65.3	82.2	38.0	76.3	68.2	62.3	57.9	48.3	39.0
ST-9	5	16-Jan	12:13:00	60	65.0	81.1	39.7	74.0	70.1	64.8	62.0	53.7	46.0
ST-9	6	16-Jan	12:14:00	60	64.8	76.9	39.4	74.4	71.1	66.2	62.9	56.0	41.3
ST-9	7	16-Jan	12:15:00	60	62.9	73.3	45.0	72.0	68.8	66.1	62.6	53.5	46.8
ST-9	8	16-Jan	12:16:00	60	61.9	76.2	37.8	71.6	67.4	63.1	57.9	52.3	39.7
ST-9	9	16-Jan	12:17:00	60	67.1	80.3	45.1	76.9	72.3	68.2	64.7	58.3	47.3
ST-9	10	16-Jan	12:18:00	60	62.2	80.5	36.7	72.7	61.1	52.1	44.7	39.4	37.6
ST-9	11	16-Jan	12:19:00	60	66.1	75.8	43.0	73.9	72.1	69.7	67.1	58.5	45.9
ST-9	12	16-Jan	12:20:00	60	69.8	83.0	48.3	79.0	74.9	70.9	68.8	62.7	52.0
ST-9	13	16-Jan	12:21:00	60	68.4	79.6	45.8	78.2	74.9	69.6	66.2	59.8	49.8
ST-9	14	16-Jan	12:22:00	60	61.8	75.5	36.3	73.5	65.7	61.5	56.3	50.1	38.6
ST-9	15	16-Jan	12:23:00	7.4	55.0	62.1	48.2	61.4	60.4	58.8	54.5	51.1	49.0
					66.1	**83.0**	**36.3**						

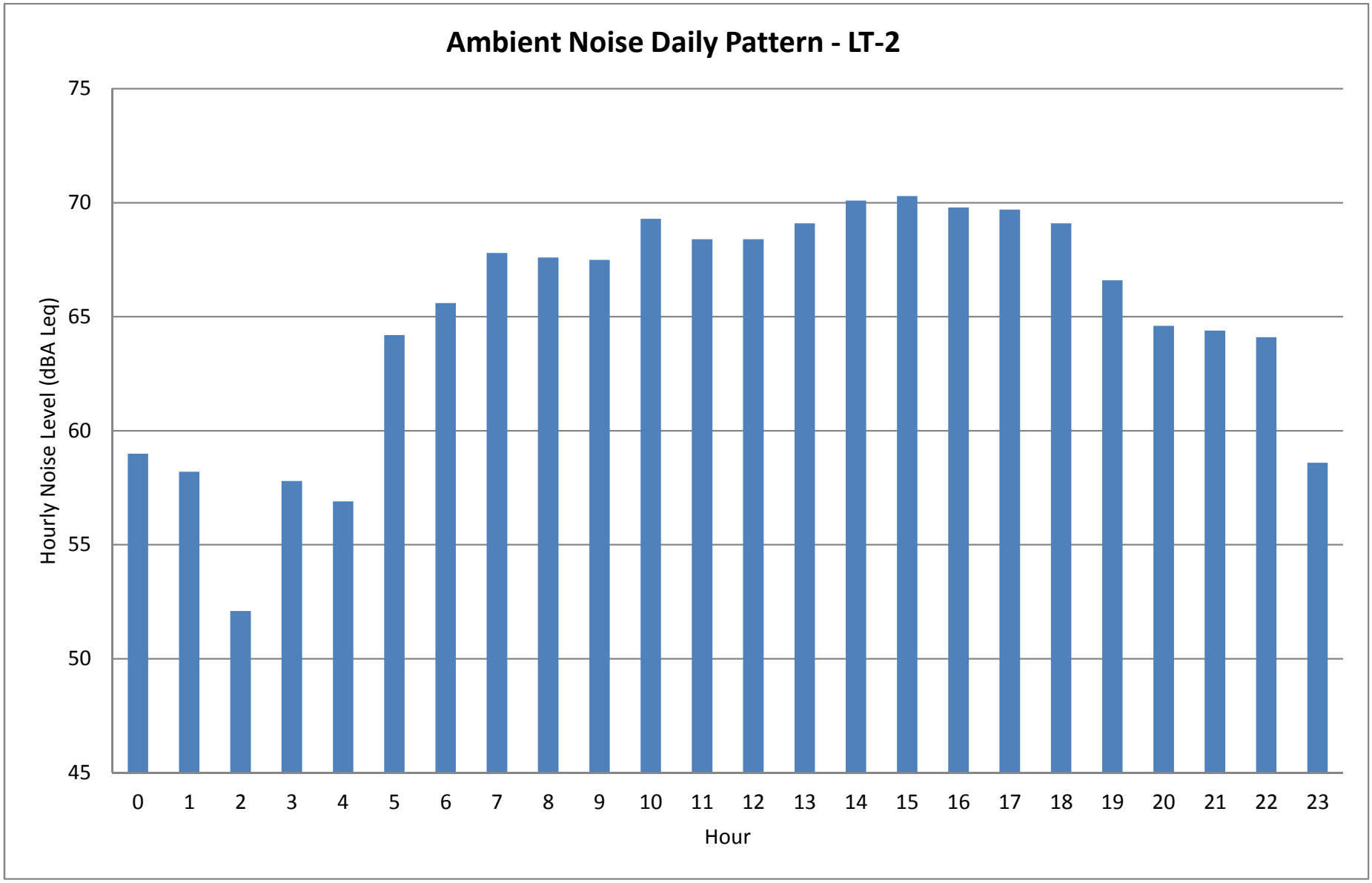
Number	Min	Date	Time	Duration	Leq	Lmax	Lmin	L(2)	L(8)	L(16)	L(25)	L(50)	L(90)
ST-7	1	16-Jan	12:28:32	27.6	47.7	55.1	42.1	52.1	49.8	49.0	48.4	47.2	44.4
ST-7	2	16-Jan	12:29:00	60	60.6	72.1	44.6	69.2	66.5	61.8	59.3	54.8	46.4
ST-7	3	16-Jan	12:30:00	60	58.1	72.1	46.2	68.5	62.1	59.3	55.8	50.5	47.8
ST-7	4	16-Jan	12:31:00	60	57.3	68.2	44.2	67.0	64.2	55.8	53.4	50.5	45.4
ST-7	5	16-Jan	12:32:00	60	56.7	67.7	44.2	66.4	63.2	57.4	53.1	50.3	45.7
ST-7	6	16-Jan	12:33:00	60	59.0	69.9	46.2	68.6	65.2	60.9	57.0	51.3	47.7
ST-7	7	16-Jan	12:34:00	60	50.4	56.8	45.1	54.2	52.7	51.8	51.2	50.1	47.0
ST-7	8	16-Jan	12:35:00	60	53.4	67.8	44.5	65.1	54.4	52.2	50.7	48.6	45.7
ST-7	9	16-Jan	12:36:00	60	60.7	73.7	45.0	71.2	66.9	60.9	57.2	50.5	46.8
ST-7	10	16-Jan	12:37:00	60	56.2	69.1	45.5	67.1	60.6	54.8	52.8	51.1	48.0
ST-7	11	16-Jan	12:38:00	60	56.5	66.6	45.5	65.5	62.2	59.1	55.6	50.6	47.6
ST-7	12	16-Jan	12:39:00	60	66.2	82.6	44.1	78.9	65.8	61.9	54.8	50.4	46.0
ST-7	13	16-Jan	12:40:00	60	55.4	66.5	44.1	65.6	61.2	55.5	52.2	49.0	45.8
ST-7	14	16-Jan	12:41:00	60	60.6	73.7	43.4	71.3	66.2	62.9	57.0	50.1	45.4
ST-7	15	16-Jan	12:42:00	60	60.6	72.7	44.4	70.9	66.1	62.4	59.3	52.5	46.1
ST-7	16	16-Jan	12:43:00	60	56.2	69.6	45.1	67.6	60.2	54.4	52.1	48.6	46.3
ST-7	17	16-Jan	12:44:00	36.6	63.3	73.0	46.3	71.8	69.5	66.9	62.3	55.6	47.7
					59.6	**82.6**	**42.1**						
ST-1	1	16-Jan	14:15:23	36.1	47.2	55.5	42.0	52.0	50.2	48.7	47.9	46.6	43.3
ST-1	2	16-Jan	14:16:00	60	47.0	63.0	39.5	54.2	51.0	48.4	46.7	43.6	40.9
ST-1	3	16-Jan	14:17:00	60	51.3	62.1	39.9	58.9	55.3	53.6	52.4	48.1	41.8
ST-1	4	16-Jan	14:18:00	60	41.3	49.6	37.4	46.8	43.6	42.4	41.8	40.3	38.1
ST-1	5	16-Jan	14:19:00	60	42.7	53.0	37.9	48.8	45.4	43.9	42.8	41.3	39.0
ST-1	6	16-Jan	14:20:00	60	42.0	58.6	35.6	46.8	44.3	43.3	42.4	39.5	37.0
ST-1	7	16-Jan	14:21:00	60	44.6	64.9	36.5	53.0	44.7	41.6	40.3	39.0	37.4
ST-1	8	16-Jan	14:22:00	60	47.1	70.2	38.4	49.7	44.9	42.8	41.7	40.5	39.2
ST-1	9	16-Jan	14:23:00	60	42.3	52.1	38.2	47.9	45.5	43.9	42.6	40.6	39.2
ST-1	10	16-Jan	14:24:00	60	45.0	55.1	38.6	51.5	48.2	46.4	45.3	43.6	40.6
ST-1	11	16-Jan	14:25:00	60	47.7	57.2	41.5	54.7	50.9	49.2	48.3	45.8	43.2
ST-1	12	16-Jan	14:26:00	60	44.4	57.6	38.5	53.4	47.2	44.7	43.6	41.8	39.8
ST-1	13	16-Jan	14:27:00	60	45.8	52.1	41.4	48.7	47.7	47.0	46.5	45.5	44.0
ST-1	14	16-Jan	14:28:00	60	49.0	67.6	41.8	54.2	51.6	49.9	48.8	46.7	43.2
ST-1	15	16-Jan	14:29:00	12.3	44.6	48.3	42.7	47.7	46.6	45.8	45.3	44.3	43.1
					46.3	**70.2**	**35.6**						

Number	Min	Date	Time	Duration	Leq	Lmax	Lmin	L(2)	L(8)	L(16)	L(25)	L(50)	L(90)
ST-3	1	16-Jan	14:42:50	9.7	55.8	61.5	45.2	60.7	59.8	59.3	58.7	50.9	46.7
ST-3	2	16-Jan	14:43:00	60	52.6	62.0	43.0	59.9	58.0	55.6	52.3	48.5	44.9
ST-3	3	16-Jan	14:44:00	60	54.7	65.7	43.9	64.0	59.9	56.7	54.3	49.5	45.5
ST-3	4	16-Jan	14:45:00	60	52.1	62.5	42.5	61.5	56.8	53.6	50.9	47.5	44.3
ST-3	5	16-Jan	14:46:00	60	51.1	61.4	43.4	59.8	55.8	52.4	49.7	47.7	45.5
ST-3	6	16-Jan	14:47:00	60	47.1	56.6	43.1	51.7	49.7	48.4	47.6	46.3	44.7
ST-3	7	16-Jan	14:48:00	60	56.2	67.1	43.4	65.6	61.1	58.5	55.2	47.8	44.8
ST-3	8	16-Jan	14:49:00	60	53.0	64.1	43.6	61.5	58.0	54.8	52.5	48.5	45.2
ST-3	9	16-Jan	14:50:00	60	54.5	63.3	41.7	62.3	59.4	57.1	55.1	51.1	45.1
ST-3	10	16-Jan	14:51:00	60	51.4	64.1	41.1	59.0	56.7	54.8	50.5	46.1	42.6
ST-3	11	16-Jan	14:52:00	60	53.4	63.5	43.7	62.5	58.8	56.4	51.1	48.3	45.4
ST-3	12	16-Jan	14:53:00	60	50.0	63.4	42.7	57.7	55.0	52.7	49.3	45.2	43.4
ST-3	13	16-Jan	14:54:00	60	55.8	72.7	43.7	66.6	57.7	53.3	51.5	48.2	45.8
ST-3	14	16-Jan	14:55:00	60	55.5	76.7	43.9	61.5	58.0	56.0	53.4	49.0	45.1
ST-3	15	16-Jan	14:56:00	60	54.7	76.2	43.8	60.4	57.1	55.2	52.5	49.7	45.6
ST-3	16	16-Jan	14:57:00	9.8	52.0	62.4	44.2	61.5	56.9	53.7	51.3	47.1	44.8
					53.7	**76.7**	**41.1**						
ST-8	1	16-Jan	15:09:26	33.5	62.5	72.4	45.2	70.9	68.7	65.5	61.8	56.2	48.4
ST-8	2	16-Jan	15:10:00	60	61.6	70.7	45.0	70.0	68.1	65.0	61.0	53.0	47.7
ST-8	3	16-Jan	15:11:00	60	58.5	66.9	42.5	65.3	63.7	61.6	60.4	55.3	45.4
ST-8	4	16-Jan	15:12:00	60	57.9	69.6	41.7	67.5	63.5	60.6	56.8	50.2	43.8
ST-8	5	16-Jan	15:13:00	60	60.8	70.0	41.5	68.8	66.8	63.9	61.6	55.3	45.6
ST-8	6	16-Jan	15:14:00	60	60.4	69.5	50.5	67.7	65.8	63.0	59.7	57.2	53.4
ST-8	7	16-Jan	15:15:00	60	64.4	71.1	44.6	69.9	68.8	67.6	66.7	61.9	52.0
ST-8	8	16-Jan	15:16:00	60	61.1	71.6	44.4	70.6	67.1	61.7	59.7	56.5	47.8
ST-8	9	16-Jan	15:17:00	60	66.4	75.9	44.6	75.2	71.8	68.5	66.7	62.6	47.2
ST-8	10	16-Jan	15:18:00	60	56.7	68.4	39.0	67.4	63.1	54.7	49.0	43.7	40.5
ST-8	11	16-Jan	15:19:00	60	67.6	80.8	42.4	79.5	71.7	66.5	64.5	59.8	52.5
ST-8	12	16-Jan	15:20:00	60	64.4	73.9	43.5	71.4	68.9	67.9	66.4	60.5	45.7
ST-8	13	16-Jan	15:21:00	60	66.5	73.4	47.8	72.4	70.2	69.4	68.3	65.4	53.6
ST-8	14	16-Jan	15:22:00	60	59.3	70.1	40.7	69.1	65.3	62.4	56.8	49.7	44.0
ST-8	15	16-Jan	15:23:00	60	60.0	69.5	39.0	68.6	65.9	63.8	61.0	50.2	40.8
ST-8	16	16-Jan	15:24:00	60	60.9	71.7	42.0	70.0	65.8	63.1	60.5	56.4	48.1
ST-8	17	16-Jan	15:25:00	4.2	50.9	58.4	43.2	58.4	57.5	55.0	49.0	45.8	43.6
					62.7	**80.8**	**39.0**						

Number	Min	Date	Time	Duration	Leq	Lmax	Lmin	L(2)	L(8)	L(16)	L(25)	L(50)	L(90)
ST-4	1	16-Jan	15:31:38	22	64.2	71.0	53.5	70.6	69.2	67.2	66.0	60.9	55.1
ST-4	2	16-Jan	15:32:00	60	60.8	72.6	42.4	70.1	68.0	63.3	56.6	48.4	44.7
ST-4	3	16-Jan	15:33:00	60	62.8	72.8	43.8	71.3	68.7	66.6	63.5	54.8	45.5
ST-4	4	16-Jan	15:34:00	60	61.2	72.5	44.0	70.7	67.1	63.2	60.1	53.9	47.0
ST-4	5	16-Jan	15:35:00	60	66.6	73.5	52.1	72.2	71.2	70.1	68.7	63.7	56.2
ST-4	6	16-Jan	15:36:00	60	64.6	73.3	50.6	71.6	69.4	67.9	65.8	61.3	53.1
ST-4	7	16-Jan	15:37:00	60	66.1	77.2	47.3	75.4	71.6	68.4	66.3	59.4	52.7
ST-4	8	16-Jan	15:38:00	60	68.4	77.1	46.3	76.1	73.2	71.6	70.3	62.0	48.1
ST-4	9	16-Jan	15:39:00	60	64.2	75.2	46.6	73.2	70.4	67.1	63.6	55.1	48.7
ST-4	10	16-Jan	15:40:00	60	66.7	74.4	51.5	73.0	71.5	70.1	68.8	63.3	53.9
ST-4	11	16-Jan	15:41:00	60	66.7	76.2	48.2	75.2	71.8	70.3	67.7	59.0	50.8
ST-4	12	16-Jan	15:42:00	60	62.0	71.0	49.1	69.3	67.6	65.8	62.7	56.7	50.9
ST-4	13	16-Jan	15:43:00	60	66.9	77.6	47.3	75.7	72.8	69.6	66.8	58.7	50.1
ST-4	14	16-Jan	15:44:00	60	62.5	73.2	46.8	70.6	68.7	65.7	62.0	55.9	50.0
ST-4	15	16-Jan	15:45:00	60	64.0	71.8	44.6	70.6	68.7	67.4	66.0	60.6	50.6
ST-4	16	16-Jan	15:46:00	60	59.1	73.0	43.8	71.4	60.3	54.8	53.3	50.0	45.2
ST-4	17	16-Jan	15:47:00	56.9	62.7	73.2	42.4	71.4	68.8	66.6	63.4	51.5	44.0
					64.8	**77.6**	**42.4**						
ST-5	1	16-Jan	15:58:59	1	76.2	77.4	73.5	77.4	77.4	77.4	77.0	76.4	74.5
ST-5	2	16-Jan	15:59:00	60	69.2	79.5	52.4	78.0	73.9	72.2	70.2	64.5	55.6
ST-5	3	16-Jan	16:00:00	60	67.5	77.8	51.3	75.6	73.3	70.7	67.8	61.5	54.0
ST-5	4	16-Jan	16:01:00	60	67.8	77.4	51.0	75.5	72.7	71.0	69.7	63.3	53.7
ST-5	5	16-Jan	16:02:00	60	66.3	78.7	48.3	76.5	71.8	67.2	64.8	57.8	51.3
ST-5	6	16-Jan	16:03:00	60	66.8	77.3	50.2	74.1	71.6	70.1	68.1	63.1	54.0
ST-5	7	16-Jan	16:04:00	60	68.6	77.2	52.6	75.5	73.7	71.5	69.9	65.6	57.1
ST-5	8	16-Jan	16:05:00	60	67.8	79.6	51.9	76.4	73.1	70.4	67.8	62.6	54.6
ST-5	9	16-Jan	16:06:00	60	68.3	79.0	52.5	76.2	73.4	70.9	69.6	64.0	55.8
ST-5	10	16-Jan	16:07:00	60	69.9	78.4	54.8	76.9	74.8	73.2	71.8	65.4	56.3
ST-5	11	16-Jan	16:08:00	60	65.8	75.4	48.5	74.2	71.7	68.9	65.4	60.2	50.8
ST-5	12	16-Jan	16:09:00	60	70.4	83.2	48.8	80.4	74.2	73.0	71.4	63.6	55.3
ST-5	13	16-Jan	16:10:00	60	67.5	78.6	50.5	77.3	72.6	70.1	66.9	61.4	53.1
ST-5	14	16-Jan	16:11:00	60	66.0	75.1	50.3	73.3	71.0	69.6	68.1	60.4	54.3
ST-5	15	16-Jan	16:12:00	39.8	66.5	77.1	48.1	75.2	70.5	68.5	66.7	63.9	56.3
					69.4	**83.2**	**48.1**						

Number	Min	Date	Time	Duration	Leq	Lmax	Lmin	L(2)	L(8)	L(16)	L(25)	L(50)	L(90)
ST-10	1	16-Jan	16:17:26	34	53.6	64.1	46.6	58.9	56.9	55.5	54.4	52.5	47.7
ST-10	2	16-Jan	16:18:00	60	53.8	61.7	46.8	61.0	58.7	54.2	53.0	51.7	49.1
ST-10	3	16-Jan	16:19:00	60	60.3	81.0	51.4	65.3	62.0	60.0	58.9	56.9	52.6
ST-10	4	16-Jan	16:20:00	60	61.1	72.5	52.2	70.5	64.5	62.1	60.2	57.8	54.7
ST-10	5	16-Jan	16:21:00	60	55.3	59.7	52.1	58.6	57.1	56.4	55.8	55.0	53.3
ST-10	6	16-Jan	16:22:00	60	54.1	59.5	49.3	58.8	57.7	55.6	54.5	52.9	50.8
ST-10	7	16-Jan	16:23:00	60	56.6	60.6	53.1	59.8	58.8	58.0	57.5	56.3	53.8
ST-10	8	16-Jan	16:24:00	60	57.8	71.7	50.3	64.5	62.0	58.9	57.6	55.6	53.2
ST-10	9	16-Jan	16:25:00	60	55.8	74.8	48.9	59.1	57.4	55.9	55.4	54.1	51.7
ST-10	10	16-Jan	16:26:00	60	55.7	62.6	48.6	60.9	59.2	58.5	57.6	54.1	49.6
ST-10	11	16-Jan	16:27:00	60	55.3	70.8	49.1	59.6	58.3	57.0	56.3	54.2	50.3
ST-10	12	16-Jan	16:28:00	60	55.6	63.4	49.7	59.9	58.6	57.7	56.9	54.9	51.4
ST-10	13	16-Jan	16:29:00	60	55.5	61.5	49.5	60.5	58.7	57.5	56.5	54.7	51.0
ST-10	14	16-Jan	16:30:00	60	54.7	59.9	46.8	59.3	58.2	56.9	56.0	54.2	48.6
ST-10	15	16-Jan	16:31:00	60	54.3	60.5	47.3	59.8	58.1	56.5	55.7	53.1	48.8
ST-10	16	16-Jan	16:32:00	60	53.8	58.6	49.5	57.8	56.7	55.5	54.5	53.1	51.1
ST-10	17	16-Jan	16:33:00	60	55.4	58.9	51.0	58.5	57.7	57.0	56.5	54.9	52.6
ST-10	18	16-Jan	16:34:00	33.8	55.5	59.1	51.1	58.6	57.8	57.3	56.8	55.6	51.8
					56.4	**81.0**	**46.6**						
ST-6	1	16-Jan	16:38:14	45.6	44.0	61.1	37.4	51.0	46.5	44.4	43.2	40.9	38.7
ST-6	2	16-Jan	16:39:00	60	56.0	68.9	38.5	67.3	61.8	55.0	47.3	42.6	40.1
ST-6	3	16-Jan	16:40:00	60	40.6	45.4	38.1	42.9	41.8	41.5	41.1	40.4	39.2
ST-6	4	16-Jan	16:41:00	60	41.4	44.8	37.9	44.0	43.3	42.8	42.3	41.2	39.3
ST-6	5	16-Jan	16:42:00	60	40.6	48.6	37.0	45.7	43.0	41.8	41.1	39.9	38.1
ST-6	6	16-Jan	16:43:00	60	41.8	49.8	38.3	45.6	43.9	43.0	42.5	41.3	39.4
ST-6	7	16-Jan	16:44:00	60	43.0	47.1	38.2	45.9	44.9	44.4	43.9	42.8	40.3
ST-6	8	16-Jan	16:45:00	60	41.5	46.4	38.1	44.6	43.5	42.8	42.3	41.3	39.4
ST-6	9	16-Jan	16:46:00	60	40.4	46.3	36.8	44.3	42.6	41.7	41.1	39.9	38.1
ST-6	10	16-Jan	16:47:00	60	40.8	46.3	37.1	43.9	42.8	42.0	41.5	40.5	39.0
ST-6	11	16-Jan	16:48:00	60	42.9	50.5	37.8	47.3	45.7	44.7	43.9	42.1	39.6
ST-6	12	16-Jan	16:49:00	60	42.4	55.1	37.2	46.7	44.4	43.5	42.9	41.8	39.2
ST-6	13	16-Jan	16:50:00	60	40.8	46.4	38.1	44.6	42.4	41.7	41.2	40.5	39.2
ST-6	14	16-Jan	16:51:00	60	52.1	73.0	37.6	61.0	51.0	45.6	43.4	41.4	39.5
ST-6	15	16-Jan	16:52:00	60	53.2	73.9	34.4	63.1	53.5	49.4	46.6	42.7	39.1
ST-6	16	16-Jan	16:53:00	21.6	55.6	71.4	38.4	70.0	45.8	42.8	41.7	40.6	39.3
					49.1	**73.9**	**34.4**						


Ambient Noise Daily Pattern LT-1
Hourly Noise Level (dBA Leq)
75
70
65
60
55
50
45
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour


Ambient Noise Daily Pattern - LT-2
Hourly Noise Level (dBA Leq)
75
70
65
60
55
50
45
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Acoma Trail	Analyst	FJS
Segment:	S/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,430
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	114	4	9	50	2	4	74	2	6
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-10.8	-25.5	-21.8	-14.4	-29.1	-25.5	-12.6	-27.4	-23.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	52.0	46.2	54.7	48.4	42.6	51.1	50.1	44.3	52.8
VEHICULAR NOISE	DAY=	56.9	Leq	EVENING=	53.3	Leq	NIGHT=	55.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**61.7**
			CNEL=	**61.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**28**	**60**	**130**
	CNEL:	**29**	**62**	**134**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Acoma Trail	Analyst	FJS
Segment:	N/ Mountain View	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,357
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	111	4	9	48	2	4	72	2	6
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-10.9	-25.7	-22.0	-14.5	-29.3	-25.6	-12.7	-27.5	-23.8
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	51.9	46.0	54.6	48.2	42.4	51.0	50.0	44.2	52.7
VEHICULAR NOISE	DAY=	56.8	Leq	EVENING=	53.2	Leq	NIGHT=	55.0	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**61.6**
			CNEL=	**61.8**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**27**	**59**	**128**
	CNEL:	**28**	**61**	**131**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Acoma Trail	Analyst	FJS
Segment:	S/ Joshua Drive	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	713
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	33	1	3	15	0	1	22	1	2
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-16.1	-30.9	-27.2	-19.7	-34.5	-30.8	-17.9	-32.7	-29.0
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	46.7	40.9	49.4	43.1	37.2	45.8	44.8	39.0	47.5
VEHICULAR NOISE	DAY=	51.6	Leq	EVENING=	48.0	Leq	NIGHT=	49.8	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**56.4**
			CNEL=	**56.6**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**12**	**27**	**57**
	CNEL:	**13**	**27**	**59**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Airway Avenue	Analyst	FJS
Segment:	N/ Yucca Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	1,638
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	77	3	6	33	1	3	50	2	4
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-12.5	-27.2	-23.6	-16.1	-30.9	-27.2	-14.3	-29.1	-25.4
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	50.3	44.5	53.0	46.7	40.8	49.4	48.4	42.6	51.1
VEHICULAR NOISE	DAY=	55.2	Leq	EVENING=	51.6	Leq	NIGHT=	53.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**60.0**
			CNEL=	**60.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**22**	**46**	**100**
	CNEL:	**22**	**48**	**103**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Airway Avenue	Analyst	FJS
Segment:	S/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,026
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	95	3	7	41	1	3	62	2	5
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-11.5	-26.3	-22.6	-15.2	-29.9	-26.3	-13.4	-28.2	-24.5
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	51.2	45.4	53.9	47.6	41.8	50.3	49.3	43.5	52.1
VEHICULAR NOISE	DAY=	56.2	Leq	EVENING=	52.5	Leq	NIGHT=	54.3	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**60.9**
			CNEL=	**61.1**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**25**	**54**	**115**
	CNEL:	**25**	**55**	**118**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Airway Avenue	Analyst	FJS
Segment:	N/ Outer Highway	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	893
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	42	1	3	18	1	1	27	1	2
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-15.1	-29.9	-26.2	-18.7	-33.5	-29.8	-17.0	-31.7	-28.1
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	47.6	41.8	50.4	44.0	38.2	46.7	45.8	40.0	48.5
VEHICULAR NOISE	DAY=	52.6	Leq	EVENING=	49.0	Leq	NIGHT=	50.7	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**57.4**
			CNEL=	**57.5**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**14**	**31**	**67**
	CNEL:	**15**	**32**	**69**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Avalon Avenue	Analyst	FJS
Segment:	N/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	1,374
SPEED (mph)	45
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	65	2	5	28	1	2	42	1	3
Speed in MPH	45	45	45	45	45	45	45	45	45
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	69.3	77.6	82.1	69.3	77.6	82.1	69.3	77.6	82.1
ADJUSTMENTS									
Flow	-13.7	-28.5	-24.8	-17.4	-32.1	-28.5	-15.6	-30.4	-26.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	51.0	44.5	52.7	47.4	40.9	49.1	49.1	42.6	50.8
VEHICULAR NOISE	DAY=	55.3	Leq	EVENING=	51.7	Leq	NIGHT=	53.5	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**60.1**
			CNEL=	**60.3**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**22**	**47**	**101**
	CNEL:	**22**	**48**	**104**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Avalon Avenue	Analyst	FJS
Segment:	N/ Sunnyslope Drive	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,707
SPEED (mph)	45
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	127	4	10	55	2	4	83	3	6
Speed in MPH	45	45	45	45	45	45	45	45	45
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	69.3	77.6	82.1	69.3	77.6	82.1	69.3	77.6	82.1
ADJUSTMENTS									
Flow	-10.8	-25.6	-21.9	-14.4	-29.2	-25.5	-12.7	-27.4	-23.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	53.9	47.4	55.6	50.3	43.8	52.0	52.1	45.6	53.8
VEHICULAR NOISE	DAY=	58.3	Leq	EVENING=	54.6	Leq	NIGHT=	56.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.0**
			CNEL=	**63.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**34**	**74**	**159**
	CNEL:	**35**	**76**	**163**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Balsa Avenue	Analyst	FJS
Segment:	N/ Outer Highway	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	6,121
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	287	10	22	125	4	10	187	6	15
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-6.7	-21.5	-17.8	-10.4	-25.1	-21.5	-8.6	-23.4	-19.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	56.0	50.2	58.7	52.4	46.6	55.1	54.2	48.3	56.9
VEHICULAR NOISE	DAY=	61.0	Leq	EVENING=	57.3	Leq	NIGHT=	59.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**65.7**
			CNEL=	**65.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**52**	**112**	**241**
	CNEL:	**53**	**115**	**247**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Balsa Avenue	Analyst	FJS
Segment:	S/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	5,973
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	280	9	22	122	4	9	183	6	14
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-6.8	-21.6	-17.9	-10.5	-25.2	-21.6	-8.7	-23.5	-19.8
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	55.9	50.1	58.6	52.3	46.5	55.0	54.0	48.2	56.8
VEHICULAR NOISE	DAY=	60.9	Leq	EVENING=	57.2	Leq	NIGHT=	59.0	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**65.6**
			CNEL=	**65.8**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**51**	**110**	**237**
	CNEL:	**52**	**113**	**243**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Buena Vista Drive	Analyst	FJS
Segment:	B/ Newton Lane - Rowell Road	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	3,643
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	171	6	13	74	2	6	111	4	9
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-9.0	-23.8	-20.1	-12.6	-27.4	-23.7	-10.9	-25.6	-21.9
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	53.8	47.9	56.5	50.1	44.3	52.8	51.9	46.1	54.6
VEHICULAR NOISE	DAY=	58.7	Leq	EVENING=	55.1	Leq	NIGHT=	56.8	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.5**
			CNEL=	**63.6**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**37**	**79**	**171**
	CNEL:	**38**	**81**	**175**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Buena Vista Drive	Analyst	FJS
Segment:	E/ Balsa Avenue	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	3,469
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	163	5	13	71	2	6	106	4	8
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-9.2	-24.0	-20.3	-12.8	-27.6	-23.9	-11.1	-25.8	-22.2
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	53.5	47.7	56.3	49.9	44.1	52.6	51.7	45.9	54.4
VEHICULAR NOISE	DAY=	58.5	Leq	EVENING=	54.9	Leq	NIGHT=	56.6	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.3**
			CNEL=	**63.4**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**36**	**77**	**165**
	CNEL:	**36**	**79**	**169**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Buena Vista Drive	Analyst	FJS
Segment:	W/ Yucca Mesa	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,332
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	109	4	9	48	2	4	71	2	6
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-10.9	-25.7	-22.0	-14.6	-29.3	-25.6	-12.8	-27.6	-23.9
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	51.8	46.0	54.5	48.2	42.4	50.9	50.0	44.1	52.7
VEHICULAR NOISE	DAY=	56.8	Leq	EVENING=	53.2	Leq	NIGHT=	54.9	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**61.5**
			CNEL=	**61.7**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**27**	**59**	**127**
	CNEL:	**28**	**60**	**130**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Buena Vista Drive	Analyst	FJS
Segment:	B/ Roberts Road - Faith Lane	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	3,638
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	171	6	13	74	2	6	111	4	9
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-9.0	-23.8	-20.1	-12.6	-27.4	-23.7	-10.9	-25.6	-22.0
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	53.7	47.9	56.5	50.1	44.3	52.8	51.9	46.1	54.6
VEHICULAR NOISE	DAY=	58.7	Leq	EVENING=	55.1	Leq	NIGHT=	56.8	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.5**
			CNEL=	**63.6**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**37**	**79**	**170**
	CNEL:	**38**	**81**	**175**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Camino del Cielo Trai	Analyst	FJS
Segment:	N/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	1,552
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	73	2	6	32	1	2	47	2	4
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-12.7	-27.5	-23.8	-16.3	-31.1	-27.4	-14.6	-29.3	-25.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	50.0	44.2	52.8	46.4	40.6	49.1	48.2	42.4	50.9
VEHICULAR NOISE	DAY=	55.0	Leq	EVENING=	51.4	Leq	NIGHT=	53.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**59.8**
			CNEL=	**59.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**21**	**45**	**97**
	CNEL:	**21**	**46**	**99**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	El Cortez Road	Analyst	FJS
Segment:	W/ State Route 247	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	483
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	23	1	2	10	0	1	15	0	1
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-17.8	-32.5	-28.9	-21.4	-36.2	-32.5	-19.6	-34.4	-30.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	45.0	39.2	47.7	41.4	35.5	44.1	43.1	37.3	45.8
VEHICULAR NOISE	DAY=	49.9	Leq	EVENING=	46.3	Leq	NIGHT=	48.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**54.7**
			CNEL=	**54.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**10**	**21**	**44**
	CNEL:	**10**	**21**	**45**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Fairview Drive	Analyst	FJS
Segment:	N/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	305
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	14	0	1	6	0	0	9	0	1
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-19.8	-34.5	-30.9	-23.4	-38.2	-34.5	-21.6	-36.4	-32.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	43.0	37.2	45.7	39.4	33.5	42.1	41.1	35.3	43.8
VEHICULAR NOISE	DAY=	47.9	Leq	EVENING=	44.3	Leq	NIGHT=	46.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**52.7**
			CNEL=	**52.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**7**	**15**	**33**
	CNEL:	**7**	**16**	**33**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Hilton Avenue	Analyst	FJS
Segment:	N/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	5,407
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	254	8	20	110	4	9	165	6	13
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-7.3	-22.1	-18.4	-10.9	-25.7	-22.0	-9.1	-23.9	-20.2
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	55.5	49.7	58.2	51.9	46.0	54.6	53.6	47.8	56.3
VEHICULAR NOISE	DAY=	60.4	Leq	EVENING=	56.8	Leq	NIGHT=	58.6	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**65.2**
			CNEL=	**65.4**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**48**	**103**	**222**
	CNEL:	**49**	**106**	**228**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Hopi Trail	Analyst	FJS
Segment:	S/ Santa Fe Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	681
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	32	1	2	14	0	1	21	1	2
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-16.3	-31.0	-27.4	-19.9	-34.7	-31.0	-18.1	-32.9	-29.2
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	46.5	40.7	49.2	42.9	37.0	45.6	44.6	38.8	47.3
VEHICULAR NOISE	DAY=	51.4	Leq	EVENING=	47.8	Leq	NIGHT=	49.6	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**56.2**
			CNEL=	**56.4**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**12**	**26**	**56**
	CNEL:	**12**	**27**	**57**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	N/ Onaga Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	4,953
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	233	8	18	101	3	8	152	5	12
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-8.6	-23.4	-19.7	-12.3	-27.0	-23.3	-10.5	-25.3	-21.6
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	57.9	50.8	58.7	54.3	47.2	55.1	56.0	48.9	56.8
VEHICULAR NOISE	DAY=	61.7	Leq	EVENING=	58.1	Leq	NIGHT=	59.8	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.5**
			CNEL=	**66.6**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**58**	**125**	**269**
	CNEL:	**60**	**128**	**276**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	N/ Pueblo Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	5,090
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	239	8	19	104	3	8	156	5	12
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-8.5	-23.3	-19.6	-12.1	-26.9	-23.2	-10.4	-25.1	-21.5
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	58.0	50.9	58.8	54.4	47.3	55.2	56.1	49.0	56.9
VEHICULAR NOISE	DAY=	61.8	Leq	EVENING=	58.2	Leq	NIGHT=	59.9	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.6**
			CNEL=	**66.7**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**59**	**127**	**274**
	CNEL:	**61**	**131**	**281**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	S/ Joshua Drive	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	4,311
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	202	7	16	88	3	7	132	4	10
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-9.2	-24.0	-20.3	-12.9	-27.6	-23.9	-11.1	-25.9	-22.2
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	57.3	50.2	58.1	53.7	46.6	54.5	55.4	48.3	56.2
VEHICULAR NOISE	DAY=	61.1	Leq	EVENING=	57.5	Leq	NIGHT=	59.2	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**65.8**
			CNEL=	**66.0**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**53**	**114**	**245**
	CNEL:	**54**	**117**	**252**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	E/ Emerson Avenue	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	1,164
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	55	2	4	24	1	2	36	1	3
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-14.9	-29.7	-26.0	-18.5	-33.3	-29.6	-16.8	-31.6	-27.9
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	51.6	44.5	52.4	48.0	40.9	48.8	49.7	42.6	50.5
VEHICULAR NOISE	DAY=	55.4	Leq	EVENING=	51.8	Leq	NIGHT=	53.5	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**60.2**
			CNEL=	**60.3**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**22**	**48**	**103**
	CNEL:	**23**	**49**	**105**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	E/ Acoma Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	1,810
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	85	3	7	37	1	3	55	2	4
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-13.0	-27.8	-24.1	-16.6	-31.4	-27.7	-14.9	-29.6	-26.0
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	53.5	46.4	54.3	49.9	42.8	50.7	51.6	44.6	52.5
VEHICULAR NOISE	DAY=	57.3	Leq	EVENING=	53.7	Leq	NIGHT=	55.5	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**62.1**
			CNEL=	**62.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**30**	**64**	**138**
	CNEL:	**30**	**66**	**141**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	W/ Barberry Avenue	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,277
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	107	4	8	46	2	4	70	2	5
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-12.0	-26.8	-23.1	-15.6	-30.4	-26.7	-13.9	-28.6	-25.0
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	54.5	47.4	55.3	50.9	43.8	51.7	52.6	45.5	53.5
VEHICULAR NOISE	DAY=	58.3	Leq	EVENING=	54.7	Leq	NIGHT=	56.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.1**
			CNEL=	**63.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**35**	**74**	**160**
	CNEL:	**35**	**76**	**165**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	B/ Yucca Trail - State Route 62 Ou	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	7,022
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	330	11	26	143	5	11	215	7	17
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-7.1	-21.9	-18.2	-10.7	-25.5	-21.8	-9.0	-23.7	-20.1
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	59.4	52.3	60.2	55.8	48.7	56.6	57.5	50.4	58.3
VEHICULAR NOISE	DAY=	63.2	Leq	EVENING=	59.6	Leq	NIGHT=	61.3	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**68.0**
			CNEL=	**68.1**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**73**	**158**	**340**
	CNEL:	**75**	**162**	**349**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Kickapoo Trail	Analyst	FJS
Segment:	S/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,790
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	131	4	10	57	2	4	85	3	7
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-10.2	-24.9	-21.2	-13.8	-28.5	-24.9	-12.0	-26.8	-23.1
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	52.6	46.8	55.3	49.0	43.2	51.7	50.7	44.9	53.4
VEHICULAR NOISE	DAY=	57.5	Leq	EVENING=	53.9	Leq	NIGHT=	55.7	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**62.3**
			CNEL=	**62.5**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**31**	**66**	**143**
	CNEL:	**32**	**68**	**146**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	La Contenta Road	Analyst	FJS
Segment:	N/ Yucca Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,170
SPEED (mph)	55
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	102	3	8	44	1	3	66	2	5
Speed in MPH	55	55	55	55	55	55	55	55	55
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	72.7	79.9	83.8	72.7	79.9	83.8	72.7	79.9	83.8
ADJUSTMENTS									
Flow	-12.6	-27.4	-23.7	-16.2	-31.0	-27.3	-14.5	-29.3	-25.6
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	55.5	47.8	55.5	51.9	44.2	51.9	53.6	46.0	53.6
VEHICULAR NOISE	DAY=	58.9	Leq	EVENING=	55.2	Leq	NIGHT=	57.0	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.6**
			CNEL=	**63.8**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**38**	**81**	**174**
	CNEL:	**39**	**83**	**179**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	La Contenta Road	Analyst	FJS
Segment:	S/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,230
SPEED (mph)	55
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	105	3	8	45	2	4	68	2	5
Speed in MPH	55	55	55	55	55	55	55	55	55
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	72.7	79.9	83.8	72.7	79.9	83.8	72.7	79.9	83.8
ADJUSTMENTS									
Flow	-12.5	-27.3	-23.6	-16.1	-30.9	-27.2	-14.4	-29.1	-25.5
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	55.6	48.0	55.6	52.0	44.3	52.0	53.7	46.1	53.7
VEHICULAR NOISE	DAY=	59.0	Leq	EVENING=	55.4	Leq	NIGHT=	57.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.7**
			CNEL=	**63.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**38**	**82**	**178**
	CNEL:	**39**	**85**	**182**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	E/ Elata Avenue	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,966
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	139	5	11	61	2	5	91	3	7
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-9.9	-24.7	-21.0	-13.5	-28.3	-24.6	-11.7	-26.5	-22.8
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	52.9	47.0	55.6	49.2	43.4	52.0	51.0	45.2	53.7
VEHICULAR NOISE	DAY=	57.8	Leq	EVENING=	54.2	Leq	NIGHT=	56.0	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**62.6**
			CNEL=	**62.8**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**32**	**69**	**149**
	CNEL:	**33**	**71**	**153**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	E/ Acoma Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	3,544
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	166	6	13	72	2	6	108	4	8
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-9.1	-23.9	-20.2	-12.7	-27.5	-23.8	-11.0	-25.7	-22.1
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	53.6	47.8	56.3	50.0	44.2	52.7	51.8	46.0	54.5
VEHICULAR NOISE	DAY=	58.6	Leq	EVENING=	55.0	Leq	NIGHT=	56.7	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.4**
			CNEL=	**63.5**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**36**	**78**	**167**
	CNEL:	**37**	**80**	**172**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	W/ Jemez Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	1,620
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	76	3	6	33	1	3	50	2	4
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-12.5	-27.3	-23.6	-16.1	-30.9	-27.2	-14.4	-29.1	-25.5
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	50.2	44.4	52.9	46.6	40.8	49.3	48.4	42.6	51.1
VEHICULAR NOISE	DAY=	55.2	Leq	EVENING=	51.6	Leq	NIGHT=	53.3	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**60.0**
			CNEL=	**60.1**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**21**	**46**	**99**
	CNEL:	**22**	**47**	**102**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	E/ Alaba Avenue	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	1,782
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	84	3	7	36	1	3	55	2	4
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-12.1	-26.9	-23.2	-15.7	-30.5	-26.8	-14.0	-28.7	-25.1
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	50.7	44.8	53.4	47.0	41.2	49.7	48.8	43.0	51.5
VEHICULAR NOISE	DAY=	55.6	Leq	EVENING=	52.0	Leq	NIGHT=	53.7	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**60.4**
			CNEL=	**60.5**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**23**	**49**	**106**
	CNEL:	**23**	**50**	**109**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	E/ Elk Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	3,017
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	142	5	11	62	2	5	92	3	7
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-9.8	-24.6	-20.9	-13.4	-28.2	-24.5	-11.7	-26.4	-22.8
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	52.9	47.1	55.6	49.3	43.5	52.0	51.1	45.3	53.8
VEHICULAR NOISE	DAY=	57.9	Leq	EVENING=	54.3	Leq	NIGHT=	56.0	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**62.7**
			CNEL=	**62.8**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**32**	**70**	**150**
	CNEL:	**33**	**72**	**154**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	W/ Joshua Lane	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	3,734
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	175	6	14	76	3	6	114	4	9
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-8.9	-23.7	-20.0	-12.5	-27.3	-23.6	-10.7	-25.5	-21.8
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	53.9	48.0	56.6	50.2	44.4	53.0	52.0	46.2	54.7
VEHICULAR NOISE	DAY=	58.8	Leq	EVENING=	55.2	Leq	NIGHT=	57.0	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.6**
			CNEL=	**63.8**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**37**	**80**	**173**
	CNEL:	**38**	**83**	**178**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	W/ Sage Avenue	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	4,765
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	224	7	17	97	3	8	146	5	11
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-7.8	-22.6	-18.9	-11.4	-26.2	-22.5	-9.7	-24.5	-20.8
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	54.9	49.1	57.6	51.3	45.5	54.0	53.1	47.2	55.8
VEHICULAR NOISE	DAY=	59.9	Leq	EVENING=	56.3	Leq	NIGHT=	58.0	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**64.6**
			CNEL=	**64.8**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**44**	**95**	**204**
	CNEL:	**45**	**97**	**209**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Palm Drive	Analyst	FJS
Segment:	N/ Pueblo Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	1,207
SPEED (mph)	45
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	57	2	4	25	1	2	37	1	3
Speed in MPH	45	45	45	45	45	45	45	45	45
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	69.3	77.6	82.1	69.3	77.6	82.1	69.3	77.6	82.1
ADJUSTMENTS									
Flow	-14.3	-29.1	-25.4	-17.9	-32.7	-29.0	-16.2	-30.9	-27.3
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	50.4	43.9	52.1	46.8	40.3	48.5	48.6	42.1	50.3
VEHICULAR NOISE	DAY=	54.8	Leq	EVENING=	51.1	Leq	NIGHT=	52.9	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**59.5**
			CNEL=	**59.7**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**20**	**43**	**93**
	CNEL:	**21**	**44**	**95**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Palomar Avenue	Analyst	FJS
Segment:	S/ Yucca Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	4,423
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	208	7	16	90	3	7	135	5	11
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-9.1	-23.9	-20.2	-12.7	-27.5	-23.8	-11.0	-25.8	-22.1
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	57.4	50.3	58.2	53.8	46.7	54.6	55.5	48.4	56.3
VEHICULAR NOISE	DAY=	61.2	Leq	EVENING=	57.6	Leq	NIGHT=	59.3	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.0**
			CNEL=	**66.1**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**54**	**116**	**250**
	CNEL:	**55**	**119**	**256**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Palomar Avenue	Analyst	FJS
Segment:	N/ Joshua Lane	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	836
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	39	1	3	17	1	1	26	1	2
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-16.4	-31.1	-27.4	-20.0	-34.7	-31.1	-18.2	-33.0	-29.3
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	50.2	43.1	51.0	46.5	39.4	47.3	48.3	41.2	49.1
VEHICULAR NOISE	DAY=	54.0	Leq	EVENING=	50.3	Leq	NIGHT=	52.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**58.7**
			CNEL=	**58.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**18**	**38**	**82**
	CNEL:	**18**	**39**	**84**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Paxton Drive	Analyst	FJS
Segment:	E/ State Route 247	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	1,522
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	71	2	6	31	1	2	47	2	4
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-12.8	-27.6	-23.9	-16.4	-31.2	-27.5	-14.6	-29.4	-25.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	50.0	44.1	52.7	46.3	40.5	49.1	48.1	42.3	50.8
VEHICULAR NOISE	DAY=	54.9	Leq	EVENING=	51.3	Leq	NIGHT=	53.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**59.7**
			CNEL=	**59.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**21**	**44**	**95**
	CNEL:	**21**	**45**	**98**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Pinon Drive	Analyst	FJS
Segment:	N/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	293
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	14	0	1	6	0	0	9	0	1
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-19.9	-34.7	-31.0	-23.6	-38.3	-34.7	-21.8	-36.6	-32.9
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	42.8	37.0	45.5	39.2	33.4	41.9	41.0	35.1	43.7
VEHICULAR NOISE	DAY=	47.8	Leq	EVENING=	44.1	Leq	NIGHT=	45.9	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**52.5**
			CNEL=	**52.7**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**7**	**15**	**32**
	CNEL:	**7**	**15**	**33**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Pioneertown Road	Analyst	FJS
Segment:	N/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,238
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	105	4	8	46	2	4	68	2	5
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-12.1	-26.9	-23.2	-15.7	-30.5	-26.8	-13.9	-28.7	-25.0
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	54.4	47.3	55.2	50.8	43.7	51.6	52.6	45.5	53.4
VEHICULAR NOISE	DAY=	58.2	Leq	EVENING=	54.6	Leq	NIGHT=	56.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.0**
			CNEL=	**63.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**34**	**74**	**159**
	CNEL:	**35**	**75**	**163**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Pioneertown Road	Analyst	FJS
Segment:	S/ Town Limits	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	981
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	46	2	4	20	1	2	30	1	2
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-15.7	-30.4	-26.8	-19.3	-34.1	-30.4	-17.5	-32.3	-28.6
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	50.8	43.8	51.7	47.2	40.1	48.0	49.0	41.9	49.8
VEHICULAR NOISE	DAY=	54.7	Leq	EVENING=	51.0	Leq	NIGHT=	52.8	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**59.4**
			CNEL=	**59.6**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**20**	**42**	**91**
	CNEL:	**20**	**44**	**94**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Pueblo Trail	Analyst	FJS
Segment:	W/ Hanford Avenue	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	291
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	14	0	1	6	0	0	9	0	1
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-20.0	-34.7	-31.1	-23.6	-38.4	-34.7	-21.8	-36.6	-32.9
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	42.8	37.0	45.5	39.2	33.3	41.9	40.9	35.1	43.6
VEHICULAR NOISE	DAY=	47.7	Leq	EVENING=	44.1	Leq	NIGHT=	45.9	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**52.5**
			CNEL=	**52.7**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**7**	**15**	**32**
	CNEL:	**7**	**15**	**32**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Sage Avenue	Analyst	FJS
Segment:	W/ Yucca Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	4,341
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	204	7	16	89	3	7	133	4	10
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-8.2	-23.0	-19.3	-11.9	-26.6	-22.9	-10.1	-24.9	-21.2
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	54.5	48.7	57.2	50.9	45.1	53.6	52.7	46.8	55.4
VEHICULAR NOISE	DAY=	59.5	Leq	EVENING=	55.8	Leq	NIGHT=	57.6	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**64.2**
			CNEL=	**64.4**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**41**	**89**	**192**
	CNEL:	**42**	**91**	**197**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Sage Avenue	Analyst	FJS
Segment:	N/ Onaga Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	4,122
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	194	6	15	84	3	7	126	4	10
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-8.5	-23.2	-19.6	-12.1	-26.9	-23.2	-10.3	-25.1	-21.4
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	54.3	48.5	57.0	50.7	44.9	53.4	52.4	46.6	55.1
VEHICULAR NOISE	DAY=	59.2	Leq	EVENING=	55.6	Leq	NIGHT=	57.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**64.0**
			CNEL=	**64.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**40**	**86**	**185**
	CNEL:	**41**	**88**	**190**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Sage Avenue	Analyst	FJS
Segment:	N/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,142
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	101	3	8	44	1	3	66	2	5
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-11.3	-26.1	-22.4	-14.9	-29.7	-26.0	-13.2	-27.9	-24.3
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	51.4	45.6	54.2	47.8	42.0	50.5	49.6	43.8	52.3
VEHICULAR NOISE	DAY=	56.4	Leq	EVENING=	52.8	Leq	NIGHT=	54.5	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**61.2**
			CNEL=	**61.3**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**26**	**56**	**120**
	CNEL:	**26**	**57**	**123**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Santa Fe Trail	Analyst	FJS
Segment:	W/ Cherokee Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	730
SPEED (mph)	35
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	34	1	3	15	0	1	22	1	2
Speed in MPH	35	35	35	35	35	35	35	35	35
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	65.1	74.8	80.0	65.1	74.8	80.0	65.1	74.8	80.0
ADJUSTMENTS									
Flow	-15.4	-30.2	-26.5	-19.0	-33.8	-30.1	-17.3	-32.0	-28.3
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	45.1	40.1	48.9	41.5	36.4	45.3	43.2	38.2	47.1
VEHICULAR NOISE	DAY=	50.8	Leq	EVENING=	47.2	Leq	NIGHT=	49.0	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**55.6**
			CNEL=	**55.8**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**11**	**24**	**51**
	CNEL:	**11**	**24**	**52**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Santa Fe Trail	Analyst	FJS
Segment:	E/ Kickapoo Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	505
SPEED (mph)	35
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	24	1	2	10	0	1	15	1	1
Speed in MPH	35	35	35	35	35	35	35	35	35
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	65.1	74.8	80.0	65.1	74.8	80.0	65.1	74.8	80.0
ADJUSTMENTS									
Flow	-17.0	-31.8	-28.1	-20.6	-35.4	-31.7	-18.9	-33.6	-29.9
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	43.5	38.5	47.3	39.9	34.8	43.7	41.6	36.6	45.5
VEHICULAR NOISE	DAY=	49.2	Leq	EVENING=	45.6	Leq	NIGHT=	47.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**54.0**
			CNEL=	**54.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**9**	**18**	**40**
	CNEL:	**9**	**19**	**41**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	Existing Count	Project:	Yucca Valley
Roadway:	Skyline Ranch Road	Analyst	FJS
Segment:	W/ State Route 247	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	833
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	39	1	3	17	1	1	25	1	2
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-15.4	-30.2	-26.5	-19.0	-33.8	-30.1	-17.3	-32.0	-28.4
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	47.3	41.5	50.1	43.7	37.9	46.4	45.5	39.7	48.2
VEHICULAR NOISE	DAY=	52.3	Leq	EVENING=	48.7	Leq	NIGHT=	50.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**57.1**
			CNEL=	**57.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**14**	**30**	**64**
	CNEL:	**14**	**30**	**65**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Acoma Trail	Analyst	FJS
Segment:	S/R 62 to Onaga Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	3,530
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	166	6	13	72	2	6	108	4	8
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-9.1	-23.9	-20.2	-12.8	-27.5	-23.8	-11.0	-25.8	-22.1
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	53.6	47.8	56.3	50.0	44.2	52.7	51.8	45.9	54.5
VEHICULAR NOISE	DAY=	58.6	Leq	EVENING=	55.0	Leq	NIGHT=	56.7	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.3**
			CNEL=	**63.5**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**36**	**78**	**167**
	CNEL:	**37**	**80**	**171**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Acoma Trail	Analyst	FJS
Segment:	Mountain View Trail to Onaga Trai	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	10,570
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	496	17	39	216	7	17	323	11	25
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-4.4	-19.1	-15.5	-8.0	-22.8	-19.1	-6.2	-21.0	-17.3
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	58.4	52.6	61.1	54.8	48.9	57.5	56.5	50.7	59.2
VEHICULAR NOISE	DAY=	63.3	Leq	EVENING=	59.7	Leq	NIGHT=	61.5	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**68.1**
			CNEL=	**68.3**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**75**	**161**	**347**
	CNEL:	**77**	**165**	**356**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Acoma Trail	Analyst	FJS
Segment:	Joshua Drive to Golden Bee Dr	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	3,300
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	155	5	12	67	2	5	101	3	8
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-9.4	-24.2	-20.5	-13.0	-27.8	-24.1	-11.3	-26.1	-22.4
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	53.3	47.5	56.0	49.7	43.9	52.4	51.5	45.6	54.2
VEHICULAR NOISE	DAY=	58.3	Leq	EVENING=	54.7	Leq	NIGHT=	56.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.0**
			CNEL=	**63.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**34**	**74**	**160**
	CNEL:	**35**	**76**	**164**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Airway Avenue	Analyst	FJS
Segment:	Yucca Trail to Primrose Dr	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	4,850
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	228	8	18	99	3	8	148	5	12
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-7.8	-22.5	-18.8	-11.4	-26.1	-22.5	-9.6	-24.4	-20.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	55.0	49.2	57.7	51.4	45.6	54.1	53.1	47.3	55.8
VEHICULAR NOISE	DAY=	60.0	Leq	EVENING=	56.3	Leq	NIGHT=	58.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**64.7**
			CNEL=	**64.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**44**	**96**	**206**
	CNEL:	**46**	**98**	**212**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Airway Avenue	Analyst	FJS
Segment:	Primrose Dr to S/R 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	3,590
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	169	6	13	73	2	6	110	4	9
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-9.1	-23.8	-20.2	-12.7	-27.5	-23.8	-10.9	-25.7	-22.0
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	53.7	47.9	56.4	50.1	44.3	52.8	51.8	46.0	54.5
VEHICULAR NOISE	DAY=	58.6	Leq	EVENING=	55.0	Leq	NIGHT=	56.8	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.4**
			CNEL=	**63.6**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**36**	**78**	**169**
	CNEL:	**37**	**80**	**173**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Airway Avenue	Analyst	FJS
Segment:	S/R 62 to Aviation Dr	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	7,110
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	334	11	26	145	5	11	218	7	17
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-6.1	-20.9	-17.2	-9.7	-24.5	-20.8	-8.0	-22.7	-19.0
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	56.7	50.8	59.4	53.0	47.2	55.7	54.8	49.0	57.5
VEHICULAR NOISE	DAY=	61.6	Leq	EVENING=	58.0	Leq	NIGHT=	59.8	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.4**
			CNEL=	**66.5**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**57**	**124**	**266**
	CNEL:	**59**	**127**	**273**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Avalon Avenue	Analyst	FJS
Segment:	State Route 62 to Paxton Rd	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	5,870
SPEED (mph)	45
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	276	9	21	120	4	9	180	6	14
Speed in MPH	45	45	45	45	45	45	45	45	45
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	69.3	77.6	82.1	69.3	77.6	82.1	69.3	77.6	82.1
ADJUSTMENTS									
Flow	-7.4	-22.2	-18.5	-11.1	-25.8	-22.1	-9.3	-24.1	-20.4
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	57.3	50.8	59.0	53.7	47.2	55.4	55.4	48.9	57.1
VEHICULAR NOISE	DAY=	61.6	Leq	EVENING=	58.0	Leq	NIGHT=	59.8	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.4**
			CNEL=	**66.6**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**57**	**124**	**267**
	CNEL:	**59**	**127**	**274**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Avalon Avenue	Analyst	FJS
Segment:	Sunnyslope Drive to S/R 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	10,970
SPEED (mph)	45
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	515	17	40	224	7	17	336	11	26
Speed in MPH	45	45	45	45	45	45	45	45	45
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	69.3	77.6	82.1	69.3	77.6	82.1	69.3	77.6	82.1
ADJUSTMENTS									
Flow	-4.7	-19.5	-15.8	-8.3	-23.1	-19.4	-6.6	-21.3	-17.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	60.0	53.5	61.7	56.4	49.9	58.1	58.2	51.7	59.9
VEHICULAR NOISE	DAY=	64.3	Leq	EVENING=	60.7	Leq	NIGHT=	62.5	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**69.1**
			CNEL=	**69.3**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**87**	**188**	**405**
	CNEL:	**89**	**193**	**415**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Balsa Avenue	Analyst	FJS
Segment:	S/R 62 to Paxton Rd	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	11,640
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	546	18	43	237	8	18	356	12	28
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-4.0	-18.7	-15.0	-7.6	-22.3	-18.7	-5.8	-20.6	-16.9
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	58.8	53.0	61.5	55.2	49.4	57.9	56.9	51.1	59.6
VEHICULAR NOISE	DAY=	63.8	Leq	EVENING=	60.1	Leq	NIGHT=	61.9	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**68.5**
			CNEL=	**68.7**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**80**	**172**	**370**
	CNEL:	**82**	**176**	**380**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Balsa Avenue	Analyst	FJS
Segment:	State Route 62 to Sunnyslope Dr	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	23,400
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	1099	37	85	477	16	37	716	24	56
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-0.9	-15.7	-12.0	-4.5	-19.3	-15.6	-2.8	-17.5	-13.9
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	61.8	56.0	64.5	58.2	52.4	60.9	60.0	54.2	62.7
VEHICULAR NOISE	DAY=	66.8	Leq	EVENING=	63.2	Leq	NIGHT=	64.9	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**71.6**
			CNEL=	**71.7**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**127**	**273**	**589**
	CNEL:	**130**	**281**	**605**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Buena Vista Drive	Analyst	FJS
Segment:	Newton Lane - Rowell Road	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	13,520
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	635	21	49	276	9	21	414	14	32
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-3.3	-18.1	-14.4	-6.9	-21.7	-18.0	-5.2	-19.9	-16.3
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	59.5	53.6	62.2	55.8	50.0	58.5	57.6	51.8	60.3
VEHICULAR NOISE	DAY=	64.4	Leq	EVENING=	60.8	Leq	NIGHT=	62.5	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**69.2**
			CNEL=	**69.3**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**88**	**190**	**409**
	CNEL:	**90**	**195**	**419**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Buena Vista Drive	Analyst	FJS
Segment:	Balsa Avenue to Indio Ave	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	7,960
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	374	12	29	162	5	13	244	8	19
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-5.6	-20.4	-16.7	-9.2	-24.0	-20.3	-7.5	-22.2	-18.6
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	57.2	51.3	59.9	53.5	47.7	56.2	55.3	49.5	58.0
VEHICULAR NOISE	DAY=	62.1	Leq	EVENING=	58.5	Leq	NIGHT=	60.2	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.9**
			CNEL=	**67.0**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**62**	**133**	**287**
	CNEL:	**63**	**137**	**295**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Buena Vista Drive	Analyst	FJS
Segment:	Indio Ave to Yucca Mesa Road	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	7,240
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	340	11	26	148	5	11	222	7	17
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-6.0	-20.8	-17.1	-9.6	-24.4	-20.7	-7.9	-22.6	-19.0
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	56.7	50.9	59.4	53.1	47.3	55.8	54.9	49.1	57.6
VEHICULAR NOISE	DAY=	61.7	Leq	EVENING=	58.1	Leq	NIGHT=	59.8	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.5**
			CNEL=	**66.6**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**58**	**125**	**270**
	CNEL:	**60**	**128**	**277**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Buena Vista Drive	Analyst	FJS
Segment:	Roberts Road - Faith Lane	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	10,350
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	486	16	38	211	7	16	317	11	25
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-4.5	-19.2	-15.6	-8.1	-22.9	-19.2	-6.3	-21.1	-17.4
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	58.3	52.5	61.0	54.7	48.9	57.4	56.4	50.6	59.1
VEHICULAR NOISE	DAY=	63.2	Leq	EVENING=	59.6	Leq	NIGHT=	61.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**68.0**
			CNEL=	**68.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**74**	**159**	**342**
	CNEL:	**76**	**163**	**351**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Camino del Cielo Trai	Analyst	FJS
Segment:	State Route 62 to Yucca Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	6,870
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	323	11	25	140	5	11	210	7	16
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-6.2	-21.0	-17.3	-9.9	-24.6	-21.0	-8.1	-22.9	-19.2
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	56.5	50.7	59.2	52.9	47.1	55.6	54.7	48.8	57.4
VEHICULAR NOISE	DAY=	61.5	Leq	EVENING=	57.8	Leq	NIGHT=	59.6	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.2**
			CNEL=	**66.4**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**56**	**121**	**260**
	CNEL:	**58**	**124**	**267**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	El Cortez Road	Analyst	FJS
Segment:	Buena Suerte Road to State Route	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	1,140
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	54	2	4	23	1	2	35	1	3
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-14.0	-28.8	-25.1	-17.7	-32.4	-28.8	-15.9	-30.7	-27.0
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	48.7	42.9	51.4	45.1	39.3	47.8	46.9	41.0	49.6
VEHICULAR NOISE	DAY=	53.7	Leq	EVENING=	50.0	Leq	NIGHT=	51.8	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**58.4**
			CNEL=	**58.6**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**17**	**36**	**79**
	CNEL:	**17**	**37**	**81**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Fairview Drive	Analyst	FJS
Segment:	State Route 62 to Cardillo Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	780
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	37	1	3	16	1	1	24	1	2
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-15.7	-30.5	-26.8	-19.3	-34.1	-30.4	-17.5	-32.3	-28.6
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	47.1	41.2	49.8	43.4	37.6	46.2	45.2	39.4	47.9
VEHICULAR NOISE	DAY=	52.0	Leq	EVENING=	48.4	Leq	NIGHT=	50.2	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**56.8**
			CNEL=	**56.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**13**	**28**	**61**
	CNEL:	**13**	**29**	**63**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Hilton Avenue	Analyst	FJS
Segment:	N/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	7,000
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	329	11	26	143	5	11	214	7	17
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-6.2	-20.9	-17.3	-9.8	-24.6	-20.9	-8.0	-22.8	-19.1
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	56.6	50.8	59.3	53.0	47.2	55.7	54.7	48.9	57.4
VEHICULAR NOISE	DAY=	61.5	Leq	EVENING=	57.9	Leq	NIGHT=	59.7	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.3**
			CNEL=	**66.5**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**57**	**122**	**264**
	CNEL:	**58**	**126**	**270**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Hopi Trail	Analyst	FJS
Segment:	Santa Fe Trail to Onaga Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,600
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	122	4	9	53	2	4	80	3	6
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-10.5	-25.2	-21.6	-14.1	-28.9	-25.2	-12.3	-27.1	-23.4
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	52.3	46.5	55.0	48.7	42.9	51.4	50.4	44.6	53.1
VEHICULAR NOISE	DAY=	57.2	Leq	EVENING=	53.6	Leq	NIGHT=	55.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**62.0**
			CNEL=	**62.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**29**	**63**	**136**
	CNEL:	**30**	**65**	**140**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	Onaga Trail to Peublo Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	9,660
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	454	15	35	197	7	15	296	10	23
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-5.7	-20.5	-16.8	-9.3	-24.1	-20.4	-7.6	-22.4	-18.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	60.8	53.7	61.6	57.2	50.1	58.0	58.9	51.8	59.7
VEHICULAR NOISE	DAY=	64.6	Leq	EVENING=	61.0	Leq	NIGHT=	62.7	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**69.4**
			CNEL=	**69.5**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**91**	**195**	**420**
	CNEL:	**93**	**200**	**431**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	Pueblo Trail to Yucca Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	10,580
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	497	17	39	216	7	17	324	11	25
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-5.3	-20.1	-16.4	-9.0	-23.7	-20.0	-7.2	-22.0	-18.3
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	61.2	54.1	62.0	57.6	50.5	58.4	59.3	52.2	60.1
VEHICULAR NOISE	DAY=	65.0	Leq	EVENING=	61.4	Leq	NIGHT=	63.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**69.7**
			CNEL=	**69.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**96**	**207**	**447**
	CNEL:	**99**	**213**	**458**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	Joshua Drive to Golden Bee Dr	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	10,890
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	511	17	40	222	7	17	333	11	26
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-5.2	-20.0	-16.3	-8.8	-23.6	-19.9	-7.1	-21.8	-18.2
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	61.3	54.2	62.1	57.7	50.6	58.5	59.4	52.3	60.3
VEHICULAR NOISE	DAY=	65.1	Leq	EVENING=	61.5	Leq	NIGHT=	63.2	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**69.9**
			CNEL=	**70.0**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**98**	**211**	**455**
	CNEL:	**101**	**217**	**467**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	E/ Emerson Avenue	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,830
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	133	4	10	58	2	4	87	3	7
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-11.1	-25.8	-22.2	-14.7	-29.5	-25.8	-12.9	-27.7	-24.0
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	55.4	48.4	56.3	51.8	44.7	52.6	53.6	46.5	54.4
VEHICULAR NOISE	DAY=	59.3	Leq	EVENING=	55.6	Leq	NIGHT=	57.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**64.0**
			CNEL=	**64.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**40**	**86**	**185**
	CNEL:	**41**	**88**	**190**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	E/ Acoma Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	7,860
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	369	12	29	160	5	12	241	8	19
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-6.6	-21.4	-17.7	-10.2	-25.0	-21.3	-8.5	-23.3	-19.6
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	59.9	52.8	60.7	56.3	49.2	57.1	58.0	50.9	58.8
VEHICULAR NOISE	DAY=	63.7	Leq	EVENING=	60.1	Leq	NIGHT=	61.8	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**68.5**
			CNEL=	**68.6**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**79**	**170**	**366**
	CNEL:	**81**	**174**	**376**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	Barberry Avenue to Sage Ave	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	6,740
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	316	11	25	137	5	11	206	7	16
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-7.3	-22.1	-18.4	-10.9	-25.7	-22.0	-9.2	-23.9	-20.2
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	59.2	52.1	60.0	55.6	48.5	56.4	57.4	50.3	58.2
VEHICULAR NOISE	DAY=	63.0	Leq	EVENING=	59.4	Leq	NIGHT=	61.2	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**67.8**
			CNEL=	**68.0**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**71**	**153**	**331**
	CNEL:	**73**	**157**	**339**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Joshua Lane	Analyst	FJS
Segment:	Yucca Trail to State Route 62 Out	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	14,070
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	661	22	51	287	10	22	431	14	33
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-4.1	-18.9	-15.2	-7.7	-22.5	-18.8	-6.0	-20.7	-17.0
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	62.4	55.3	63.2	58.8	51.7	59.6	60.6	53.5	61.4
VEHICULAR NOISE	DAY=	66.2	Leq	EVENING=	62.6	Leq	NIGHT=	64.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**71.0**
			CNEL=	**71.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**116**	**251**	**540**
	CNEL:	**119**	**257**	**554**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Kickapoo Trail	Analyst	FJS
Segment:	State Route 62 to Onaga Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	6,620
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	311	10	24	135	5	11	203	7	16
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-6.4	-21.2	-17.5	-10.0	-24.8	-21.1	-8.3	-23.0	-19.4
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	56.3	50.5	59.1	52.7	46.9	55.4	54.5	48.7	57.2
VEHICULAR NOISE	DAY=	61.3	Leq	EVENING=	57.7	Leq	NIGHT=	59.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.1**
			CNEL=	**66.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**55**	**118**	**254**
	CNEL:	**56**	**121**	**261**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	La Contenta Road	Analyst	FJS
Segment:	Yucca Trail to Sunnyslope Dr	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	8,430
SPEED (mph)	55
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	396	13	31	172	6	13	258	9	20
Speed in MPH	55	55	55	55	55	55	55	55	55
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	72.7	79.9	83.8	72.7	79.9	83.8	72.7	79.9	83.8
ADJUSTMENTS									
Flow	-6.7	-21.5	-17.8	-10.4	-25.1	-21.4	-8.6	-23.4	-19.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	61.4	53.7	61.4	57.8	50.1	57.8	59.5	51.9	59.5
VEHICULAR NOISE	DAY=	64.7	Leq	EVENING=	61.1	Leq	NIGHT=	62.9	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**69.5**
			CNEL=	**69.7**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**93**	**200**	**431**
	CNEL:	**95**	**205**	**442**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	La Contenta Road	Analyst	FJS
Segment:	Sunnyslope Dr to State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	18,660
SPEED (mph)	55
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	876	29	68	381	13	30	571	19	44
Speed in MPH	55	55	55	55	55	55	55	55	55
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	72.7	79.9	83.8	72.7	79.9	83.8	72.7	79.9	83.8
ADJUSTMENTS									
Flow	-3.3	-18.1	-14.4	-6.9	-21.7	-18.0	-5.1	-19.9	-16.2
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	64.8	57.2	64.8	61.2	53.6	61.2	63.0	55.3	63.0
VEHICULAR NOISE	DAY=	68.2	Leq	EVENING=	64.6	Leq	NIGHT=	66.3	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**73.0**
			CNEL=	**73.1**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**158**	**340**	**732**
	CNEL:	**162**	**349**	**751**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	E/ Elata Avenue	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	6,290
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	295	10	23	128	4	10	192	6	15
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-6.6	-21.4	-17.7	-10.2	-25.0	-21.3	-8.5	-23.3	-19.6
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	56.1	50.3	58.8	52.5	46.7	55.2	54.3	48.5	57.0
VEHICULAR NOISE	DAY=	61.1	Leq	EVENING=	57.5	Leq	NIGHT=	59.2	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**65.8**
			CNEL=	**66.0**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**53**	**114**	**245**
	CNEL:	**54**	**117**	**252**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	Acoma Trail to Palm Ave	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	3,550
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	167	6	13	72	2	6	109	4	8
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-9.1	-23.9	-20.2	-12.7	-27.5	-23.8	-11.0	-25.7	-22.1
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	53.6	47.8	56.4	50.0	44.2	52.7	51.8	46.0	54.5
VEHICULAR NOISE	DAY=	58.6	Leq	EVENING=	55.0	Leq	NIGHT=	56.7	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.4**
			CNEL=	**63.5**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**36**	**78**	**168**
	CNEL:	**37**	**80**	**172**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	Jemez Trail to Kickapoo Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	4,370
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	205	7	16	89	3	7	134	4	10
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-8.2	-23.0	-19.3	-11.8	-26.6	-22.9	-10.1	-24.8	-21.2
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	54.5	48.7	57.3	50.9	45.1	53.6	52.7	46.9	55.4
VEHICULAR NOISE	DAY=	59.5	Leq	EVENING=	55.9	Leq	NIGHT=	57.6	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**64.3**
			CNEL=	**64.4**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**41**	**89**	**193**
	CNEL:	**43**	**92**	**198**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	E/ Alaba Avenue	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	3,860
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	181	6	14	79	3	6	118	4	9
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-8.7	-23.5	-19.8	-12.4	-27.1	-23.5	-10.6	-25.4	-21.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	54.0	48.2	56.7	50.4	44.6	53.1	52.1	46.3	54.9
VEHICULAR NOISE	DAY=	59.0	Leq	EVENING=	55.3	Leq	NIGHT=	57.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.7**
			CNEL=	**63.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**38**	**82**	**177**
	CNEL:	**39**	**84**	**182**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	Elk Trail to Acoma Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	5,080
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	239	8	19	104	3	8	155	5	12
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-7.6	-22.3	-18.6	-11.2	-25.9	-22.3	-9.4	-24.2	-20.5
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	55.2	49.4	57.9	51.6	45.8	54.3	53.3	47.5	56.0
VEHICULAR NOISE	DAY=	60.2	Leq	EVENING=	56.5	Leq	NIGHT=	58.3	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**64.9**
			CNEL=	**65.1**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**46**	**99**	**213**
	CNEL:	**47**	**101**	**218**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	Joshua Lane to Sage Ave	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	5,380
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	253	8	20	110	4	9	165	5	13
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-7.3	-22.1	-18.4	-10.9	-25.7	-22.0	-9.2	-23.9	-20.3
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	55.4	49.6	58.2	51.8	46.0	54.5	53.6	47.8	56.3
VEHICULAR NOISE	DAY=	60.4	Leq	EVENING=	56.8	Leq	NIGHT=	58.5	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**65.2**
			CNEL=	**65.3**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**48**	**103**	**221**
	CNEL:	**49**	**105**	**227**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Onaga Trail	Analyst	FJS
Segment:	Sage Avenue to Palm Ave	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	6,540
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	307	10	24	133	4	10	200	7	16
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-6.5	-21.2	-17.5	-10.1	-24.8	-21.2	-8.3	-23.1	-19.4
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	56.3	50.5	59.0	52.7	46.9	55.4	54.4	48.6	57.1
VEHICULAR NOISE	DAY=	61.2	Leq	EVENING=	57.6	Leq	NIGHT=	59.4	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.0**
			CNEL=	**66.2**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**54**	**117**	**252**
	CNEL:	**56**	**120**	**258**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Palm Ave	Analyst	FJS
Segment:	Pueblo Trail to Yucca Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	3,890
SPEED (mph)	45
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	183	6	14	79	3	6	119	4	9
Speed in MPH	45	45	45	45	45	45	45	45	45
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	69.3	77.6	82.1	69.3	77.6	82.1	69.3	77.6	82.1
ADJUSTMENTS									
Flow	-9.2	-24.0	-20.3	-12.8	-27.6	-23.9	-11.1	-25.9	-22.2
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	55.5	49.0	57.2	51.9	45.4	53.6	53.7	47.2	55.4
VEHICULAR NOISE	DAY=	59.8	Leq	EVENING=	56.2	Leq	NIGHT=	58.0	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**64.6**
			CNEL=	**64.8**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**44**	**94**	**203**
	CNEL:	**45**	**97**	**208**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Palomar Avenue	Analyst	FJS
Segment:	Yucca Trail to Joshua Dr	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	14,720
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	691	23	54	300	10	23	450	15	35
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-3.9	-18.7	-15.0	-7.5	-22.3	-18.6	-5.8	-20.5	-16.9
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	62.6	55.5	63.4	59.0	51.9	59.8	60.8	53.7	61.6
VEHICULAR NOISE	DAY=	66.4	Leq	EVENING=	62.8	Leq	NIGHT=	64.6	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**71.2**
			CNEL=	**71.3**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**120**	**258**	**556**
	CNEL:	**123**	**265**	**571**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Palomar Avenue	Analyst	FJS
Segment:	Joshua Lane to Joshua Dr	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	5,080
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	239	8	19	104	3	8	155	5	12
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-8.5	-23.3	-19.6	-12.1	-26.9	-23.2	-10.4	-25.2	-21.5
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	58.0	50.9	58.8	54.4	47.3	55.2	56.1	49.0	56.9
VEHICULAR NOISE	DAY=	61.8	Leq	EVENING=	58.2	Leq	NIGHT=	59.9	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.6**
			CNEL=	**66.7**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**59**	**127**	**274**
	CNEL:	**61**	**130**	**281**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Paxton Drive	Analyst	FJS
Segment:	State Route 247 to Balsa Ave	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	8,810
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	414	14	32	180	6	14	270	9	21
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-5.2	-19.9	-16.3	-8.8	-23.6	-19.9	-7.0	-21.8	-18.1
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	57.6	51.8	60.3	54.0	48.2	56.7	55.7	49.9	58.4
VEHICULAR NOISE	DAY=	62.5	Leq	EVENING=	58.9	Leq	NIGHT=	60.7	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**67.3**
			CNEL=	**67.5**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**66**	**143**	**307**
	CNEL:	**68**	**146**	**315**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Pinon Drive	Analyst	FJS
Segment:	State Route 62 to Canyon Dr	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,990
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	140	5	11	61	2	5	91	3	7
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-9.9	-24.6	-20.9	-13.5	-28.2	-24.6	-11.7	-26.5	-22.8
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	52.9	47.1	55.6	49.3	43.5	52.0	51.0	45.2	53.7
VEHICULAR NOISE	DAY=	57.8	Leq	EVENING=	54.2	Leq	NIGHT=	56.0	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**62.6**
			CNEL=	**62.8**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**32**	**69**	**149**
	CNEL:	**33**	**71**	**153**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Pioneertown Road	Analyst	FJS
Segment:	State Route 62 to Sunnyslope Dr	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	9,120
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	428	14	33	186	6	14	279	9	22
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-6.0	-20.8	-17.1	-9.6	-24.4	-20.7	-7.8	-22.6	-18.9
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	60.5	53.4	61.3	56.9	49.8	57.7	58.7	51.6	59.5
VEHICULAR NOISE	DAY=	64.3	Leq	EVENING=	60.7	Leq	NIGHT=	62.5	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**69.1**
			CNEL=	**69.3**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**87**	**188**	**404**
	CNEL:	**89**	**193**	**415**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Pioneertown Road	Analyst	FJS
Segment:	Sunnyslope Dr to Town Limits	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	2,670
SPEED (mph)	50
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	125	4	10	54	2	4	82	3	6
Speed in MPH	50	50	50	50	50	50	50	50	50
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	71.1	78.8	83.0	71.1	78.8	83.0	71.1	78.8	83.0
ADJUSTMENTS									
Flow	-11.3	-26.1	-22.4	-14.9	-29.7	-26.0	-13.2	-27.9	-24.3
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	55.2	48.1	56.0	51.6	44.5	52.4	53.3	46.2	54.1
VEHICULAR NOISE	DAY=	59.0	Leq	EVENING=	55.4	Leq	NIGHT=	57.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.8**
			CNEL=	**63.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**38**	**83**	**178**
	CNEL:	**39**	**85**	**183**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Pueblo Trail	Analyst	FJS
Segment:	Hanford Avenue to Balsa Ave	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	450
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	21	1	2	9	0	1	14	0	1
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-18.1	-32.8	-29.2	-21.7	-36.5	-32.8	-19.9	-34.7	-31.0
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	44.7	38.9	47.4	41.1	35.2	43.8	42.8	37.0	45.5
VEHICULAR NOISE	DAY=	49.6	Leq	EVENING=	46.0	Leq	NIGHT=	47.8	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**54.4**
			CNEL=	**54.6**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**9**	**20**	**42**
	CNEL:	**9**	**20**	**43**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Sage Avenue	Analyst	FJS
Segment:	W/ Yucca Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	7,480
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	351	12	27	153	5	12	229	8	18
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-5.9	-20.6	-17.0	-9.5	-24.3	-20.6	-7.7	-22.5	-18.8
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	56.9	51.1	59.6	53.3	47.4	56.0	55.0	49.2	57.7
VEHICULAR NOISE	DAY=	61.8	Leq	EVENING=	58.2	Leq	NIGHT=	60.0	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.6**
			CNEL=	**66.8**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**59**	**128**	**275**
	CNEL:	**61**	**131**	**283**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Sage Avenue	Analyst	FJS
Segment:	N/ Onaga Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	7,720
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	362	12	28	157	5	12	236	8	18
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-5.7	-20.5	-16.8	-9.4	-24.1	-20.4	-7.6	-22.4	-18.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	57.0	51.2	59.7	53.4	47.6	56.1	55.2	49.3	57.9
VEHICULAR NOISE	DAY=	62.0	Leq	EVENING=	58.3	Leq	NIGHT=	60.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**66.7**
			CNEL=	**66.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**61**	**131**	**281**
	CNEL:	**62**	**134**	**289**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Sage Avenue	Analyst	FJS
Segment:	N/ State Route 62	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	6,020
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	283	9	22	123	4	10	184	6	14
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-6.8	-21.6	-17.9	-10.4	-25.2	-21.5	-8.7	-23.4	-19.8
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	55.9	50.1	58.6	52.3	46.5	55.0	54.1	48.3	56.8
VEHICULAR NOISE	DAY=	60.9	Leq	EVENING=	57.3	Leq	NIGHT=	59.0	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**65.7**
			CNEL=	**65.8**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**51**	**111**	**238**
	CNEL:	**53**	**113**	**245**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Santa Fe Trail	Analyst	FJS
Segment:	Hopi Trail toCherokee Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	4,290
SPEED (mph)	35
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	201	7	16	88	3	7	131	4	10
Speed in MPH	35	35	35	35	35	35	35	35	35
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	65.1	74.8	80.0	65.1	74.8	80.0	65.1	74.8	80.0
ADJUSTMENTS									
Flow	-7.7	-22.5	-18.8	-11.3	-26.1	-22.4	-9.6	-24.3	-20.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	52.8	47.7	56.6	49.2	44.1	53.0	50.9	45.9	54.8
VEHICULAR NOISE	DAY=	58.5	Leq	EVENING=	54.9	Leq	NIGHT=	56.7	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.3**
			CNEL=	**63.5**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**36**	**77**	**166**
	CNEL:	**37**	**79**	**170**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Santa Fe Trail	Analyst	FJS
Segment:	Kickapoo Trail to Hopi Trail	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	1,660
SPEED (mph)	35
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	78	3	6	34	1	3	51	2	4
Speed in MPH	35	35	35	35	35	35	35	35	35
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	65.1	74.8	80.0	65.1	74.8	80.0	65.1	74.8	80.0
ADJUSTMENTS									
Flow	-11.8	-26.6	-22.9	-15.4	-30.2	-26.5	-13.7	-28.5	-24.8
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	48.7	43.6	52.5	45.1	40.0	48.9	46.8	41.8	50.7
VEHICULAR NOISE	DAY=	54.4	Leq	EVENING=	50.8	Leq	NIGHT=	52.5	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**59.2**
			CNEL=	**59.3**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**19**	**41**	**88**
	CNEL:	**19**	**42**	**90**

FHWA RD-77-108 NOISE PREDICTION MODEL

Scenario:	2035 Count	Project:	Yucca Valley
Roadway:	Skyline Ranch Road	Analyst	FJS
Segment:	Grand Ave to State Route 247	Date:	16-Jul-13

ROADWAY INPUTS	
ADT	3,880
SPEED (mph)	40
ROAD NEAR-FAR LN. DIST.	12
DISTANCE ROAD CL (ft)	100
SOFT/HARD CONDITIONS	Soft
GRADE (%)	0%
LEFT VIEW	-90
RIGHT VIEW	90

VEHICLE MIX INPUTS			
DAILY		HOURLY	
% A	90.0%	DAY	62.6%
% MT	3.0%	EVENING	6.8%
% HT	7.0%	NIGHT	30.6%

CALCULATION AREA									
	DAYTIME			EVENING			NIGHT		
	AUTOS	MT	HT	AUTOS	MT	HT	AUTOS	MT	HT
Vehicles per hour	182	6	14	79	3	6	119	4	9
Speed in MPH	40	40	40	40	40	40	40	40	40
Left angle	-90	-90	-90	-90	-90	-90	-90	-90	-90
Right angle	90	90	90	90	90	90	90	90	90
Reference levels (dBA)	67.4	76.3	81.2	67.4	76.3	81.2	67.4	76.3	81.2
ADJUSTMENTS									
Flow	-8.7	-23.5	-19.8	-12.3	-27.1	-23.4	-10.6	-25.4	-21.7
Distance	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6
Finite Roadway	0	0	0	0	0	0	0	0	0
Barrier	0	0	0	0	0	0	0	0	0
Grade	0	0	0	0	0	0	0	0	0
LEQ	54.0	48.2	56.7	50.4	44.6	53.1	52.2	46.4	54.9
VEHICULAR NOISE	DAY=	59.0	Leq	EVENING=	55.4	Leq	NIGHT=	57.1	Leq

RESULTS				
NOISE LEVELS AT 100 FEET FROM CENTERLINE (dBA):			**Ldn=**	**63.8**
			CNEL=	**63.9**
NOISE CONTOUR:		*70 dBA*	*65 dBA*	*60 dBA*
ROAD CENTERLINE DISTANCE TO NOISE CONTOUR (FEET):	**Ldn:**	**38**	**83**	**178**
	CNEL:	**39**	**85**	**182**

Appendix I

Traffic Impact Study

Appendices

This page intentionally left blank.

Town of Yucca Valley

Transportation Study:

Recommendations and Impact Assessment

Prepared for:
Town of Yucca Valley

June 18, 2013

OC11-0177

Prepared by:

FEHR PEERS

3850 Vine St, Suite 140
Riverside, CA 92507

Jason D. Pack, P.E.
Senior Associate

Paul Herrmann
Transportation Engineer

Table of Contents

I. Executive Summary 7

Key Recommendations 7

(1) Introduction 9

(2) Existing Conditions 10

Analysis Parameters 10

Project Study Area 10

Analysis Methodologies 15

Existing Facilities 17

Roadway Facilities 17

Bicycle Facilities 20

Pedestrian Facilities 20

Transit Facilities 20

Aviation Facilities 26

Freight System 26

Traffic Operations Assessment 26

Roadway Segment Operations 26

Existing Intersection Operations 33

(3) Travel Demand Model Devleopement 35

Background and Purpose 35

Overview of the Model 36

Base Year Sub-Area Model Development 36

Roadway Network 36

TAZ Structure and SED Data 37

Base Year Sub-Area Model Validation 42

Future Year Sub-Area Model Development 44

Roadway Network 44

TAZ Structure and SED Data 44

Forecasting Methodology 45

(4) Approach, Goals, and Policy Recommendations 46

Transportation Best Management Practices Overview 46

Regulatory Framework 46

Circulation Element Recommendations 58

Constraints Based Planning 58

Complete Streets 58

Pedestrian Network 67

Transit Network 69

Efficient Goods Services and movement 69

Traffic Management 72

Recommended Goals and Policies 73

Key Transportation Goal 73

Recommended Transportation Policies 73

(5) Impact Assessment 77

Regulatory Framework 77

Federal Regulations 77

State Regulations 77

Regional Regulations 79

Local Regulations and Plans 82

Future Year (Post-2035) Level of Service Conditons 83

Future Forecasting 83

Future Bicycle Network 85

Future Pedestrian Network 85

Roadway Segment Traffic Operations 85

General Plan (2035) Conditions Intersection Operations 89

Transportation Impacts 90

CEQA Transportation Impact Analysis 90

List of Figures

Figure 2-1 Yucca Valley Town Limits 11

Figure 2-2 Existing Paved and Unpaved Roads 12

Figure 2-3 Existing Bicycle Facilities 22

Figure 2-4 Existing Sidewalk Facilities 23

Figure 2-5 Existing Transit Network 25

Figure 2-6 Existing Truck Routes 27

Figure 2-7 Existing Roadway Segment ADT 28

Figure 2-8 Existing Condition Lane Geometry 29

Exhibit 3-1 Base Year Roadway Network 39

Exhibit 3-2 Base Year TAZ Structure 40

Figure 4-1 Proposed Roadway System 61

Figure 4-2 Proposed Bicycle Network 68

Figure 4-3 Proposed Pedestrian Network 70

Figure 4-4 Designated Truck Routes 71

Figure 5-1 Future Roadway Segment ADT 89

List of Tables

Table 2-1 Analyzed Roadway Segments 13

Table 2-2 Study Intersections 14

Table 2-3 Maximum Daily Roadway Capacities 16

Table 2-4 Intersection Level of Service Criteria for Signalized Intersections 17

Table 2-5 Existing Roadway Volume and LOS 30

Table 2-6 Existing Lane Configurations and Turning Movement Volumes 33

Table 2-7 Existing (2013) Conditions Intersection LOS Results 34

Table 3-1 Base Year Additional Roadway Network Added 38

Table 3-2 Base Year Demographic and Employment Assumptions 41

Table 3-3 Results of Yucca Valley Sub-Area Model Daily Volume Validation 43

Table 3-4 Future Year Roadway Network Improvements 44

Table 3-5 Future Year Demographic and Employment Assumptions 45

Table 4-1 Daily Roadway Segment Capacity 67

Table 5-1 Future Year (Post-2035) Roadway Volume and LOS 86

Table 5-2 Future Year (Post-2035) Roadway Volume and LOS 87

Table 5-3 Future Year (Post-2035) Roadway Volume and LOS 88

Table 5-4 Future Lane Configurations and Turning Movement Volume Forecasts 91

Table 5-5 General Plan (2035) Conditions Intersection LOS Results 92

Appendices

Appendix A Yucca Valley Model Validation Tables

Appendix B Existing Intersection Counts

Appendix C Existing (2013) Conditions LOS Results

Appendix D General Plan (2035) Conditions LOS Results

Appendix E Existing and Future Traffic Model ADT Volumes

I. EXECUTIVE SUMMARY

This report summarizes an extensive amount of technical analysis and policy recommendations associated with the Town of Yucca Valley General Plan Update. As such, it documents the following information associated with this effort:

- Existing Conditions
- Travel Demand Forecasting Model Development
- Approach, Goals, and Policy Recommendations
- Transportation Impacts

Key recommendations are summarized below.

KEY RECOMMENDATIONS

Key components and results are summarized below:

1) Yucca Valley's transportation system includes roadways, bicycle facilities, pedestrian facilities, transit service, an airport, and designated truck routes within the Town.
2) Most facilities are operating at LOS C or better. The only evaluated facility that operates below LOS C is the SR-62/SR-247 intersection, which operates at LOS D during the morning peak hour.
3) A sub-area travel demand forecasting model, which exceeds Caltrans and FHWA validation criteria, was developed to ensure the highest level of confidence in the forecasting results.
4) A review of the best management practices for transportation was performed and identified the following areas as key for consideration in the Circulation Element:
    a) Consistency with the goals of the Global Warming Solutions Act (or AB 32) that identifies California's commitment to reduce Greenhouse Gas emissions to 1990 levels by year 2020.
    b) Consistency with SCAG's Regional Transportation Plan and Sustainable Communities Strategy.
    c) Compliance with the California Complete Street Act through implementation of a layered network approach (e.g. identify recommended facilities for implementation to ensure a network of complete streets for all modes).
    d) Implementation of a constraints based planning effort which recognizes a series of constraints and provides policy flexibility in accounting for those constraints.
    e) Implementation of Transit Services and Facilities through coordination with MBTA.

f) Implementation of a comprehensive bicycle network consistent with the SANBAG non-motorized plan and the Town's trails master plan effort.

g) Implementation of a comprehensive and connected pedestrian and trail network.

h) Movement of goods utilizing designated truck routes and protection of the Yucca Airport.

i) Utilization of transportation demand management, signal timing and coordination, and traffic calming to enhance the circulation experience where appropriate.

5) Recommended roadway classifications, roadway network, bicycle network, pedestrian network, designated truck routes, aviation facilities, and traffic management were documented.

6) The key transportation goals and recommended policies were recommended for inclusion in the Circulation Element.

7) An impact assessment was completed to identify potential impacts to the circulation system in a post-2035 build out scenario.

   a) The only impact identified was an inconsistency with the CMP level of service requirement on CMP-designated facilities; the SR-62/SR-247 intersection is expected to operate at LOS D during the PM peak hour under future conditions with build out of the General Plan. However, it will operate below the "middle of LOS D" threshold set forth through the CMP guidelines. This inconsistency is identified as a significant and unavoidable impact based on the CEQA significance criteria identified.

(1) INTRODUCTION

Fehr & Peers has completed a transportation assessment to support the Town of Yucca Valley's General Plan Update. Yucca Valley's transportation network is multi-modal and consists of highways, streets, pedestrian paths, bicycle routes, and buses. The safe and efficient movement of goods and vehicles is a key element in Yucca Valley's future social and economic well-being.

The purpose of this study is twofold. First, it provides recommendations associated with maps and policies for the Circulation Element. Second, it provides an impact assessment for incorporation into the EIR prepared for the General Plan.

The remainder of this report is divided into the following key chapters:

- Chapter 2 – Existing Conditions
- Chapter 3 – Travel Demand Forecasting Model Development
- Chapter 4 – Approach, Goals, and Policy Recommendations
- Chapter 5 – Impact Assessment

(2) EXISTING CONDITIONS

This chapter describes the existing conditions associated with the Town of Yucca Valley. Please note that much of this information was developed and submitted in April of 2012 to assist in informing development of the General Plan.

ANALYSIS PARAMETERS

This section outlines the geographic scope of the traffic analysis, including the study intersections and roadways, and the analysis methodologies employed in this study.

PROJECT STUDY AREA

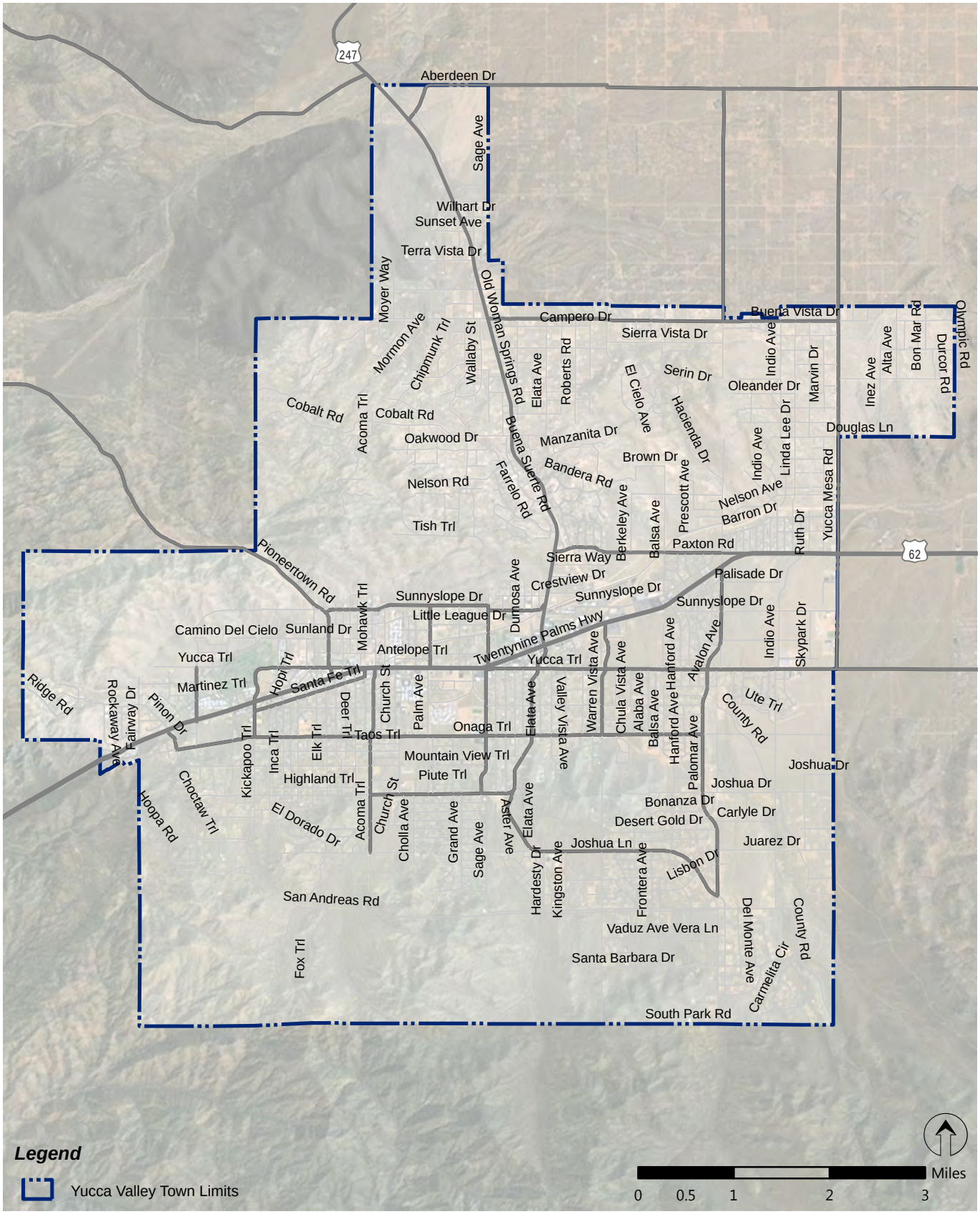
The Town of Yucca Valley is located in San Bernardino County, approximately 30 miles north of Palm Springs, in the Mojave Desert. The San Bernardino Mountains lie to the west, Joshua Tree National Park lies to the south, and the remainder of Yucca Valley is surrounded by unincorporated portions of San Bernardino County. State Route (SR) 62 and SR 247 are the primary roadway providing regional accessibility to Yucca Valley.

Figure 2-1 identifies the Town's boundaries and the general location of the Town.

The Town of Yucca Valley's roadway system includes a range of facilities including highways, arterials, collector streets, industrial streets and local streets. Two major functions of a roadway are to serve through traffic and provide access to adjacent property. Different facilities are intended to serve these purposes differently. For instance, arterials generally prioritize the movement of traffic over access to individual adjacent properties, while local streets prioritize access to private properties over through traffic.

Roadways are also intended to provide bicycle and pedestrian access and circulation and are the back bone of the bicycle and pedestrian network.

Yucca Valley has been developed in such a way that only roughly half of the roadways throughout the town are paved. Figure 2-2 illustrates the major routes in Yucca Valley's roadway system, and displays which roads throughout the Town are paved.



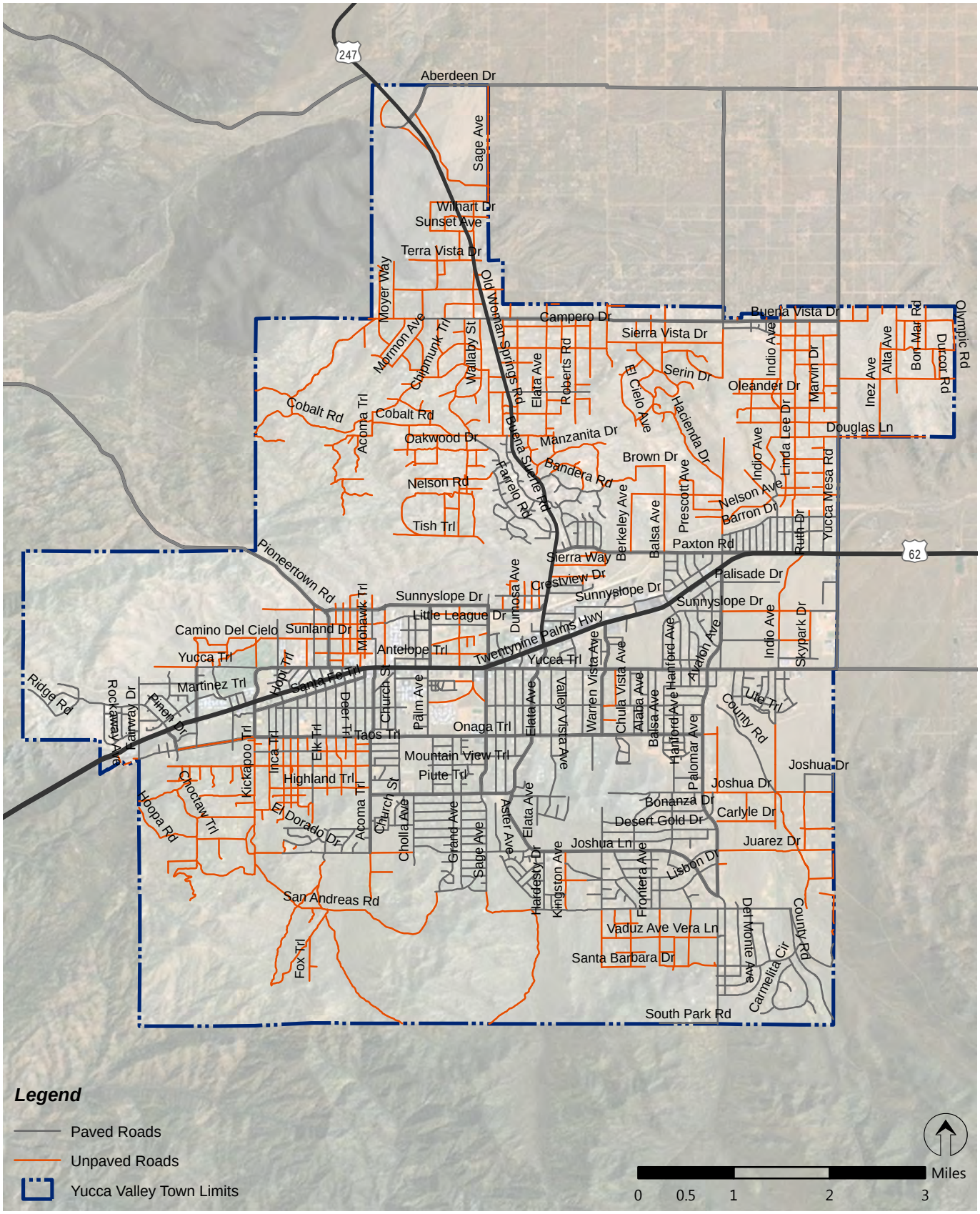
Yucca Valley Circulation Element - Transportation Impact Study

FEHR PEERS

Yucca Valley Town Limits

Path: W:\Orange County N Drive\PROJECTS\OC11\0177 - Yucca Valley General Plan\Graphics\GIS\MXD\TIS_Fig_2-1_City_Limits.mxd

Figure 2-1



Yucca Valley Circulation Element - Transportation Impact Study

FEHR PEERS

Existing Paved and Unpaved Roads

Path: W:\Orange County N Drive\PROJECTS\OC11\0177 - Yucca Valley General Plan\Graphics\GIS\MXD\TIS_Fig_2-2_Paved_Unpaved.mxd

Figure 2-2

STUDY ROADWAY SEGMENTS

Within the Town, 50 roadway segments and ten intersections were selected for analysis based on a review of the roadway network and circulation throughout Yucca Valley and are shown in Table 2-1 and Table 2-2, respectively.

TABLE 2-1
ANALYZED ROADWAY SEGMENTS

ROADWAY	SEGMENT
Acoma Trail	South of SR-62
	North of Mountain View
	South of Joshua Drive
Avalon Avenue/Palomar Avenue	South of SR-62
	North of SR-62
	South of Yucca Trail
	North of Joshua Lane
Balsa Avenue	North of Outer Highway
	South of SR-62
Buena Vista Drive	West of Yucca Mesa Road
	East of Balsa Avenue
	Between Roberts Road and Faith Lane
	Between Newton Lane and Rowell Road
Camino del Cielo Trail	North of SR-62
Joshua Drive	East of Acoma Trail
	West of Barberry Avenue
	East of Emerson Avenue
Joshua Lane	South of Joshua Drive
	North of Onaga Trail
	North of Pueblo Trail
	Between Yucca Trail and SR-62 Outer Highway
Kickapoo Trail	South of SR-62
La Contenta Road	South of SR-62
	North of Yucca Trail
Onaga Trail	East of Alaba Avenue
	East of Elata Avenue
	West of Joshua Lane
	West of Sage Avenue
	East of Acoma Trail
	East of Elk Trail
	West of Jemez Trail

TABLE 2-1
ANALYZED ROADWAY SEGMENTS

ROADWAY	SEGMENT
Palm Avenue	North of Pueblo Trail
Paxton Road	East of SR-247
Pioneertown Road/Deer Trail	North of SR-62
	South of Town Limits
Sage Avenue	North of SR-62
	South of SR-62
	North of Onaga Trail
Santa Fe Trail	West of Cherokee Trail
	East of Kickapoo Trail
Sunnyslope Avenue	West of SR-247
Warren Vista Avenue	South of SR-62
Yucca Trail	East of Cherokee Trail
	East of Miami Trail
	West of La Contenta Road
	East of Hanford Avenue
	West of Joshua View
	West of Condalia Avenue
Yucca Mesa Road	North of SR-62
	North of Buena Vista Drive

Notes:
Location naming convention consistent with count data received from Town staff.

TABLE 2-2
STUDY INTERSECTIONS

Twentynine Palms Highway (SR-62) at	Camino del Cielo
	Kickapoo Trail
	Pioneerrtown Road
	Acoma Trail
	Sage Avenue
	Old Woman Springs Road (SR-247)
	Airway Avenue
	Balsa Avenue
	Avalon Avenue
	Yucca Mesa Road

ANALYSIS METHODOLOGIES

Fehr & Peers analyzed the operation of the roadway system in the Town of Yucca Valley. Operations for these facilities are expressed in terms of level of service. Level of service is a general measure of traffic operating conditions whereby a letter grade, from Level of Service (LOS) A (no congestion) to F (high levels of congestion), is assigned. LOS E represents "at capacity" operations.

The flow of vehicles without significant impediments is considered "stable" whereas when traffic encounters interference that limits the capacity acutely, the flow becomes "unstable". These grades represent the perspective of drivers only and are an indication of the comfort and convenience associated with driving, as well as speed, travel time, traffic interruptions, and freedom to maneuver.

ROADWAY SEGMENT TRAFFIC OPERATIONS

A roadway operations analysis was performed at the study roadway segments to provide an evaluation of how the roadway network will perform. It also provides an idea of the amount of traffic that will utilize each roadway and if the existing or proposed lane configurations can adequately handle the volumes.

The level of service for roadway segments were calculated for key roadway segments in Yucca Valley's regional roadway system to evaluate existing traffic conditions. Daily capacity thresholds in accordance with the Town of Yucca Valley General Plan Circulation Element are shown in Table 2-3. This table establishes the maximum daily roadway capacities by street classifications.

INTERSECTION TRAFFIC OPERATIONS

Intersection operations are evaluated with the Synchro 6 level of service software, which is consistent with the methodologies identified in the *Highway Capacity Manual* (Transportation Research Board, 2000). Table 2-4 summarizes how the level of service corresponds to intersection delay at the signalized study intersections.

TABLE 2-3
MAXIMUM DAILY ROADWAY CAPACITIES

Classification	Typical Lane Configuration	Daily Volume Thresholds				
		LOS A	LOS B	LOS C	LOS D	LOS E
Unpaved Road	2 Lanes Undivided and Unpaved	-	-	-	500	-
Local Road	2 Lanes Undivided	-	-	-	1,500	2,000
Collector	2 Lanes Undivided	900	2,000	6,800	14,100	17,400
Industrial	2 Lanes Undivided	900	2,000	6,800	14,100	17,400
Arterial	2 Lanes Undivided	--	--	9,700	17,600	18,700
Arterial / Highway	4 Lanes Undivided	--	--	17,500	27,400	28,900
Arterial / Highway	4 Lanes Divided	--	--	19,200	35,400	37,400
Arterial / Highway	6 Lanes Divided	--	--	27,100	53,200	56,000

Source: Highway Capacity Manual (Transportation Research Board, 2000), FHWA Guidelines for Roadway Paving

TABLE 2-4
INTERSECTION LEVEL OF SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

Level of Service	Description	Signalized Intersection Delay (Seconds)
A	Operations with very low delay occurring with favorable progression and/or short cycle length.	≤ 10.0
B	Operations with low delay occurring with good progression and/or short cycle lengths.	>10.0 to 20.0
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	>20.0 to 35.0
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop and individual cycle failures are noticeable.	>35.0 to 55.0
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	>55.0 to 80.0
F	Operation with delays unacceptable to most drivers occurring due to over saturation, poor progression, or very long cycle lengths.	>80.0

Source:Highway Capacity Manual (Transportation Research Board, 2000).

EXISTING FACILITIES

ROADWAY FACILITIES

Major regional facilities within the Town include:

State Route 62 (SR-62), also known as Twentynine Palms Highway, provides primary regional access to the town and the rest of the Morongo Basin, including Joshua Tree National Park, the Marine Corps Air Ground Combat Center, the Colorado River, and the Mojave Desert. SR-62 is currently classified as a highway within Town limits and serves as the main roadway through the Town. It runs east/west through the center of the Town and has two lanes in each direction with a two-way left-turn lane.

State Route 247 (SR-247), also known as Old Woman Springs Road, is the second of two roadways providing regional access to Yucca Valley. Currrently classified as a highway within Town limits, SR-247 is a north/south undivided road with one to two travel lanes in each direction. SR-247 connects from the north to the center of town at SR-62, where it becomes Joshua Lane.

Major arterials within the Town include:

Joshua Lane is currently classified as an arterial roadway that extends north/south in the Town of Yucca Valley. It becomes SR-247 north of SR-62. Between SR-62 and Yucca Trail, Joshua Lane is a divided 4-lane roadway with a two-way left-turn lane. This section of roadway has some discontinuous sidewalks. Between Yucca Trail and Onaga Trail, Joshua Lane is an undivided two-lane roadway with some discontinuous sidewalks. Joshua Lane is also designated as a Class III bicycle route, as discussed later in this report, between Onaga Trail and Palomar Avenue. The posted speed limit on Joshua Lane is 40-45 miles per hour.

Onaga Trail between Kickapoo Trail and Palomar Avenue is an east/west roadway half a mile south of SR-62 and is currently classified as an arterial roadway. This roadway contains discontinuous sidewalks. A bike route is designated throughout the length of Onaga Trail. The most developed section of Onaga Trail lies west of Sage Avenue adjacent to Yucca Valley High School. The posted speed limit on Onaga Trail is 40-45 miles per hour.

Yucca Trail is currently classified as an arterial roadway that extends east/west between SR-62 eastbound to the eastern town limits, where it becomes Alta Loma Drive. This roadway contains discontinuous sidewalks. Yucca Trail is designated as a Class III bicycle route between Palomar Avenue and Yucca Mesa Road. The posted speed limit along Yucca Trail varies from 40 to 55 miles per hour.

Major collector roadways within the Town include:

Sage Avenue is currently as a collector roadway that extends from San Andreas Road north to Sunnyslope Drive. Sage Avenue is predominantly an undivided two-lane roadway with discontinuous sidewalks. The posted speed limit on Sage Avenue is 40 miles per hour.

Sunnyslope Drive is a collector roadway that extends from Shawnee Trail east to SR-247. Sunnyslope Drive is an undivided two-lane roadway with no pedestrian facilities. Sunnyslope Drive is a designated Class III bicycle route between Pioneertown Road and SR-247. The posted speed limit on Sage Avenue is 45 miles per hour.

Palomar Avenue/Avalon Avenue is currently classified as a collector roadway that extends from Joshua Lane north to Nelson Avenue, where it becomes Hacienda Drive. The roadway is named Palomar Avenue south of Lenox Avenue, and Avalon Avenue north of Lenox Avenue. South of Barron Drive, Palomar Avenue is a two-lane undivided roadway with no pedestrian facilities and a posted speed limit of 45 to 50 miles per hour. It is a designated Class III bicycle route between Joshua Lane and Yucca Trail.

Pioneertown Road is currently classified as a collector roadway that extends from SR-62 north to the unincorporated community of Pioneertown. Pioneertown Road is a two-lane undivided roadway with limited pedestrian facilities. Pioneertown Road is a Class III bicycle route from the Town limits to Sunnyslope Drive. The posted speed limit along Pioneertown Road is 40-50 miles per hour. South of SR-62 Pioneertown Road turns into Deer Trail.

Acoma Trail is currently classified as a collector roadway that extends from Golden Bee Drive north to SR-62. Acoma Trail is a two-lane undivided roadway with limited pedestrian facilities. It serves as a Class III bicycle route between Onaga Trail and SR-62. The posted speed limit along Acoma Trail is 40 miles per hour.

Santa Fe Trail is currently classified as a collector roadway that extends from Kickapoo Trail east to Apache Trail. It is a two-lane undivided roadway with a posted speed limit of 35 miles per hour. There are no pedestrian facilities along Santa Fe Trail.

Joshua Drive is currently classified as a collector roadway that extends from Acoma Trail east to Joshua Lane. It is a two-lane undivided roadway with a posted speed limit of 45-50 miles per hour. There are no pedestrian facilities along Joshua Drive. There are other un-connected sections of Joshua Drive, including one section running east/west from Palomar Avenue, one section west of La Contenta Road, and various small sections west of Acoma Trail.

Paxton Road is currently classified as a collector roadway that extends from SR-247 east to Avalon Avenue. Paxton Road is a two-lane undivided roadway with no pedestrian facilities. Paxton Road is a Class III Bicycle Route. The posted speed limit along Paxton Drive is 40 miles per hour.

Buena Vista Drive is currently classified as a collector roadway that extends from SR-247 east to Yucca Mesa Road. Buena Vista Drive is a two-lane undivided roadway without pedestrian facilities. The posted speed limit along Buena Vista Drive is 40-55 miles per hour.

Yucca Mesa Road is currently classified as a collector roadway that extends from SR-62 north to the Town's northern boundary. South of SR-62, Yucca Mesa Road is named La Contenta Road, which lies just east of the Town's eastern boundary. Yucca Mesa Road is a two-lane undivided roadway with no pedestrian facilities. It is classified as a Class III Bicycle Route from Yucca Trail to Buena Vista Drive. Yucca Mesa Road has a posted speed limit of 55 miles per hour.

Kickapoo Trail is currently classified as a collector roadway that extends from Hoopa Trail north to Yucca Trail. Kickapoo Trail, north of Navajo Trail, is a two-lane undivided roadway with discontinuous pedestrian facilities. Kickapoo Trail has a 40 mile per hour posted speed limit.

BICYCLE FACILITIES

Bicycle facilities are typically defined by the following classifications:

- **Class I**: Bike path providing a completely separated right-of-way designated for the exclusive use of bicycles and pedestrians with cross-flows by motorists minimized.
- **Class II:** Bikeway that provides a preferential right-of-way designated for the exclusive or semi-exclusive use of bicycles with through travel by motor vehicles or pedestrians prohibited, but with vehicle parking and cross flows by pedestrians and motorists minimized.
- **Class III:** Bikeways providing a route designation by signs or permanent pavement markings which are shared with either pedestrians or motorists.

The bicycle system in Yucca Valley includes on-street Class III bicycle routes that stretch along common arterials and collectors throughout the Town. The existing bicycle network allows for connectivity to and from the outskirts of the Town through mostly residential neighborhoods. However, Yucca Valley's central core around SR-62 has limited bicycle facilities to connect to main activity and business centers.

These facilities are along paved roads and designated by signage only. Many Class III routes available in Yucca Valley are shared with vehicles on a narrow roadway with a dirt shoulder.

Figure 2-3 identifies existing bicycle facilities within the Town.

PEDESTRIAN FACILITIES

Pedestrian facilities typically consist of sidewalks, pedestrian crossings (at intersections or mid-block), and off-street trails/paths. Currently, Yucca Valley's pedestrian system consists of limited pedestrian facilities including incomplete sidewalk facilities.

Figure 2-4 provides an overview of existing sidewalks in Yucca Valley.

TRANSIT FACILITIES

Providing public transit is beneficial to a town in a number of ways. It provides transportation for groups not having access to vehicles. Public transit also helps groups who choose not to drive and take non-automotive methods of travelling. Public transit also provides relief to a town's traffic network because people who are not driving their individual vehicles on the road are not contributing to traffic congestion.

Public transportation in Yucca Valley consists of the following services and facilities:

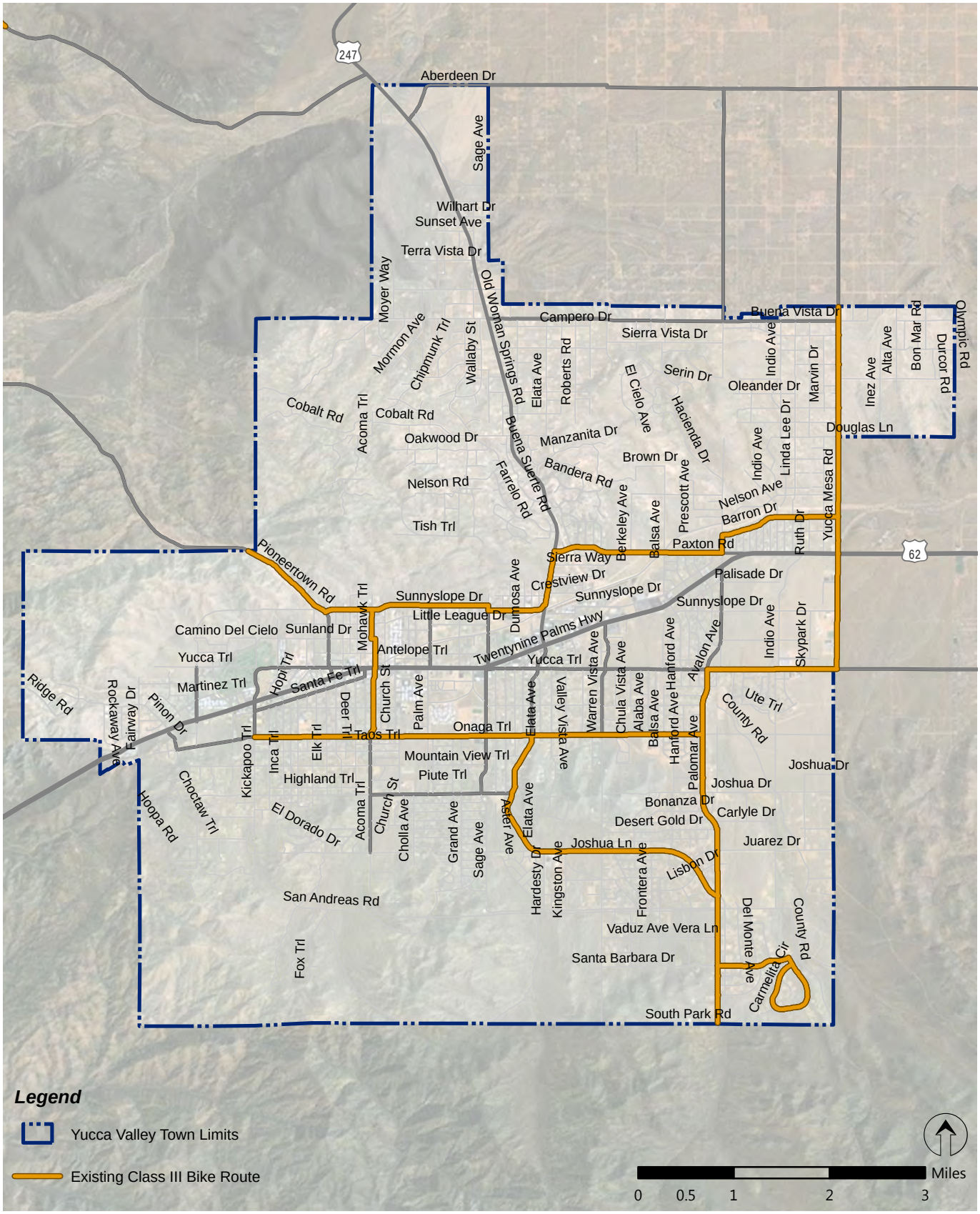
- Public bus
- Paratransit (Ready Ride)

Public Bus Service

Public transportation in Yucca Valley is operated by Morongo Basin Transit Authority (MBTA), which enables commuters to travel within the Town and adjacent cities with minimal transfers. All transit routes within Yucca Valley have a transfer point at the Yucca Valley Transit Center near the intersection of Yucca Trail & Valley Vista. Currently, MBTA operates buses on five routes, including Routes 1, 7A, 7B, 12/15 and 21.

Route 1 operates all Monday through Saturday and connects Yucca Valley to the cities of Joshua Tree and Twentynine Palms, with a terminus at the Twentynine Palms Marine Base. Route 1 primarily travels along SR-62 within the Town of Yucca Valley. On weekdays, Route 1 operates at approximately one-hour headways from 6:00 AM to 10:00 PM, with slightly longer headways after 6:00 PM. On Saturdays, Route 1 operates at one- to two-hour headways from approximately 7:00 AM to 10:00 PM. Weekday headways are approximately 60 minutes and Saturday headways are hourly.

Route 7A operates Monday through Friday and is predominantly a local collector route for Yucca Valley neighborhoods north of SR-62. Route 7A predominantly travels along Paxton Road, Sunnyslope Avenue, Pioneertown Road, Yucca Trail, and SR-62. Route 7A has hourly headways from 7:00 AM to 6:00 PM.



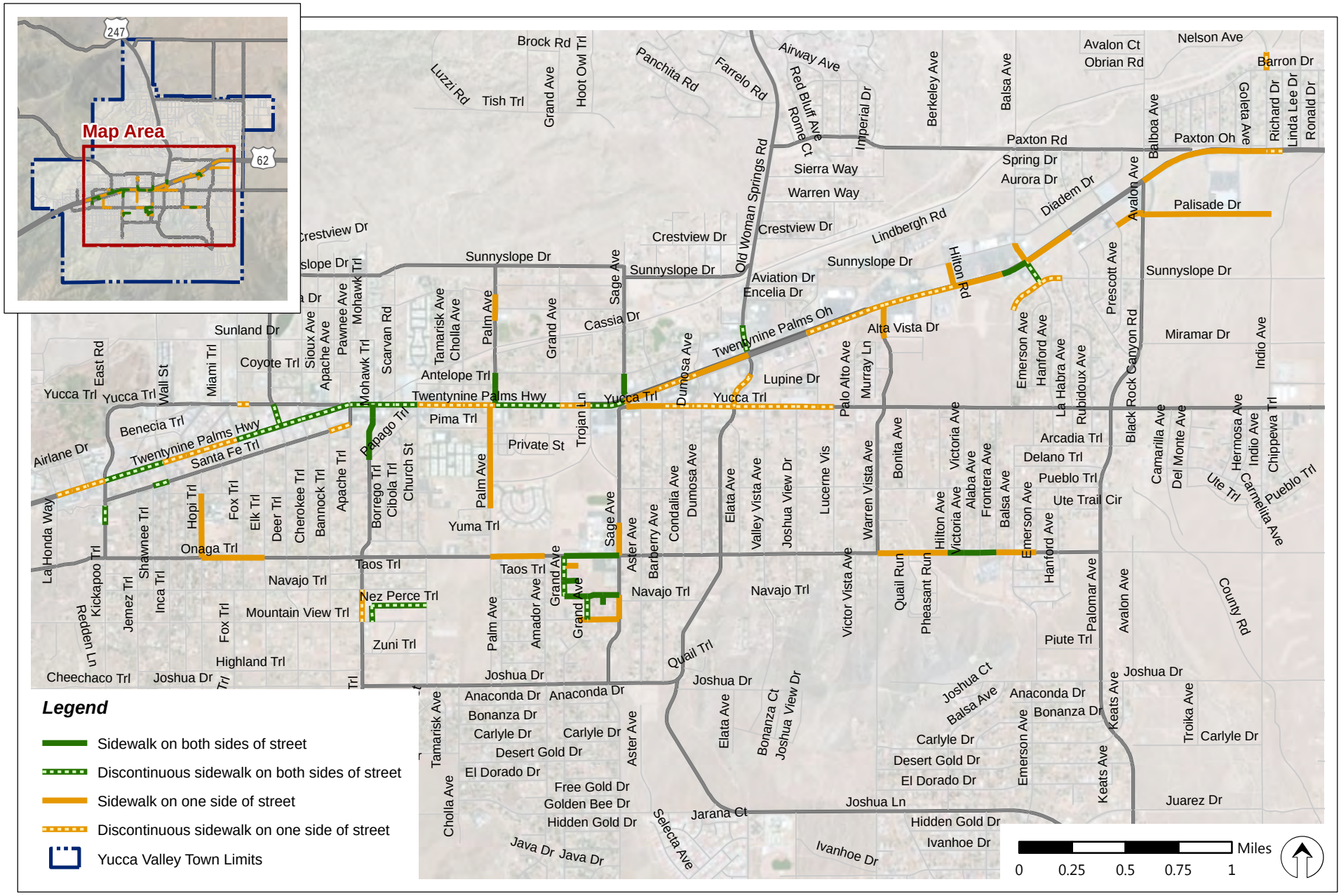
Yucca Valley Circulation Element - Transportation Impact Study

FEHR PEERS

Existing Bicycle Facilities

Path: W:\Orange County N Drive\PROJECTS\OC11\0177 - Yucca Valley General Plan\Graphics\GIS\MXD\TIS_Fig_2-3_Bicycle.mxd

Figure 2-3



Yucca Valley Circulation Element - Transportation Impact Study

FEHR PEERS

Path: W:\Orange County N Drive\PROJECTS\OC11\0177 - Yucca Valley General Plan\Graphics\GIS\MXD\TIS_Fig_2-4_Sidewalks.mxd

Existing Sidewalk Facilities

Figure 2-4

Route 7B operates Monday through Friday and is predominantly a local collector route for Yucca Valley neighborhoods south of SR-62. Route 7B predominantly travels along Onaga Trail, Palomar Road, Avalon Avenue, La Contenta Lane, and SR-62. Weekday frequency is 15 to 30 minutes, and weekend frequency is 30 minutes. Route 7B has hourly headways from 7:00 AM to 6:00 PM.

Route 12 operates Monday through Friday and connects Yucca Valley to the City of Palm Springs. Route 12 travels along SR-62 within the Town of Yucca Valley. Route 12 has three daily headways in each direction, departing Yucca Valley at 7:00 AM, 9:00 AM, and 4:00 PM, and departing Palm Springs at 7:50 AM, 10:10 AM, and 4:50 PM.

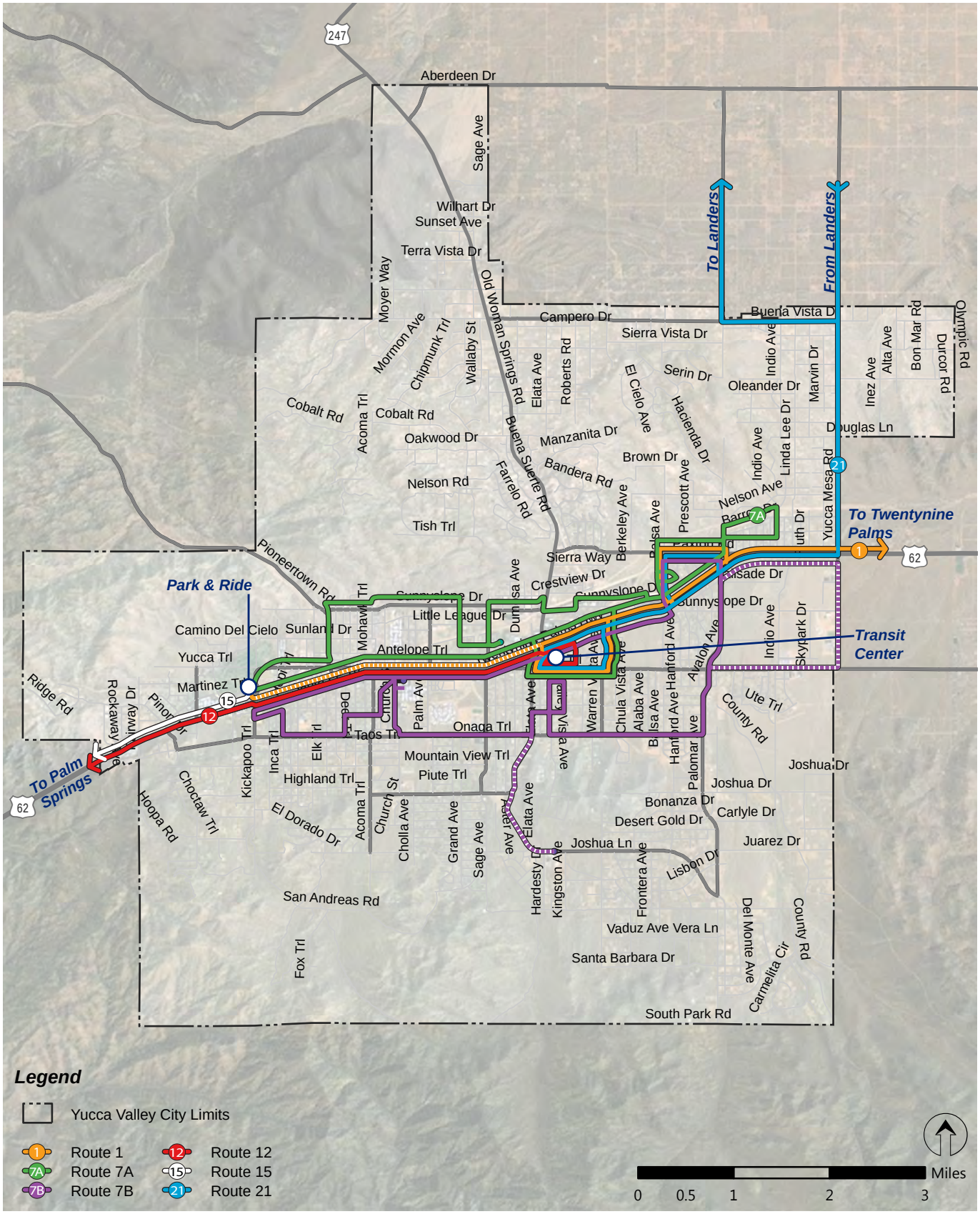
Route 15 operates on Fridays and weekends and connects Yucca Valley to the City of Palm Springs and the Twentynine Palms Marine Base. Route 15 travels along SR-62 within the Town of Yucca Valley. On Fridays, Route 15 makes one trip in each direction to and from Yucca Valley, with the bus leaving Yucca Valley at 6:10 PM en route to Palm Springs, and making a return trip from Palm Springs at 7:00 PM. On weekends, there are two daily trips along Route 15; buses depart Yucca Valley at 11:10 AM and 5:10 PM, and leave Palm Springs for Yucca Valley at 12:00 noon and 6:00 PM.

Route 21 operates Monday through Friday and connects Yucca Valley to the unincorporated community of Landers. Within Yucca Valley, Route 21 travels along SR-62, Yucca Mesa Road, and Buena Vista Drive. Route 21 operates on weekdays only with six headways between one and three hours apart between the hours of 6:45 AM and 5:55 PM.

Figure 2-5 identifies the existing transit network.

Paratransit

Paratransit is an alternative mode of flexible passenger transportation that does not follow fixed routes or schedules. Typically, vans or mini-buses are used to provide paratransit service, but share taxis and jitneys are also important providers. Paratransit services may vary considerably on the degree of flexibility they provide their customers. At their simplest, they may consist of a taxi or small bus that will run along a more or less defined route and then stop to pick up or discharge passengers on request. At the other end of the spectrum—fully demand-responsive transport—the most flexible paratransit systems offer on-demand call-up door-to-door service from any origin to any destination in a service area. Desert Communities Transportation Services currently provides private non-emergency paratransit services. Additionally, the Morongo Basin Transit Authority offers discounted transit aboard MBTA buses with proof of disability through the program "Ready Ride."



Yucca Valley Circulation Element - Transportation Impact Study

FEHR PEERS

Path: N:\Projects\Non_SanJose_Projects\OC Projects\OC11_0177_Yucca_Valley\Fig_2-3_Transit.ai

Existing Transit Network

Figure 2-5

AVIATION FACILITIES

Yucca Valley is home to Yucca Valley Airport, a privately-owned public use airport for private aircraft and aircraft maintenance and flight training. The closest airport offering commercial flights is the Palm Springs International Airport, approximately 30 miles south of Yucca Valley. This airport provides nonstop service primarily to the Western United States and Canada. MBTA routes 12 and 15 have a stop at the Palm Springs International Airport.

FREIGHT SYSTEM

The goods or freight movement system in Yucca Valley consists of designated truck routes. The Yucca Valley Municipal Code (Chapter 12, Section 30) contains language relating to truck routes. This chapter of the municipal code defines weight restrictions, specifies the ability of trucks to enter areas not designated as truck routes, and defines the truck routes within the town. Roadways in the system that are not designated truck routes are restricted to trucks under five tons only, with the exception of vehicles when making pickups or deliveries within the town limits.

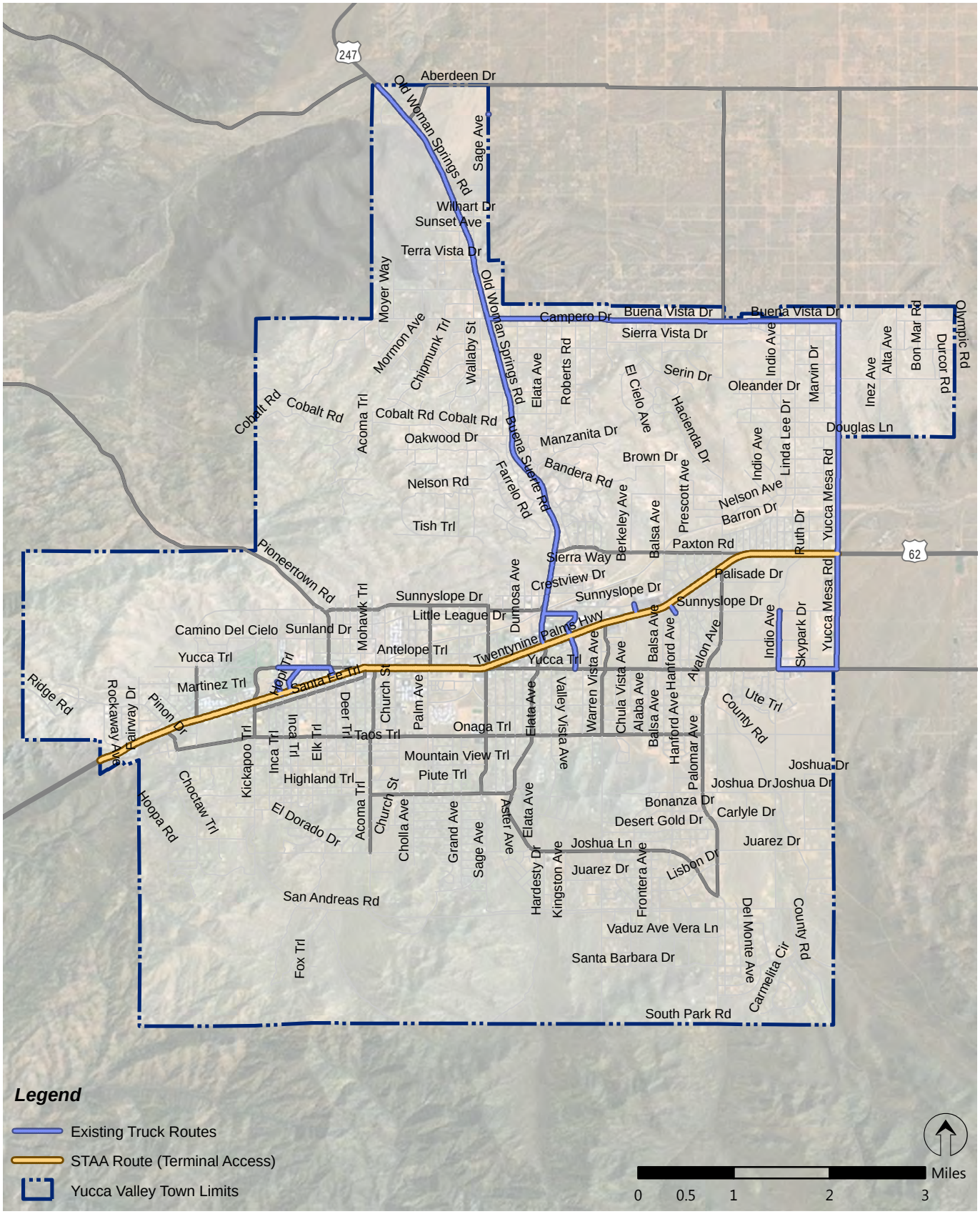
Figure 2-6 displays the designated truck routes in Yucca Valley.

TRAFFIC OPERATIONS ASSESSMENT

ROADWAY SEGMENT OPERATIONS

Table 2-5 presents the daily traffic volume and LOS operations on study roadway segments. As shown below, all of the existing roadway segments are currently operating at acceptable levels of service.

Figure 2-7 shows the average daily traffic of each roadway segment. Figure 2-8 shows the existing lane geometry on roadways throughout the Town.



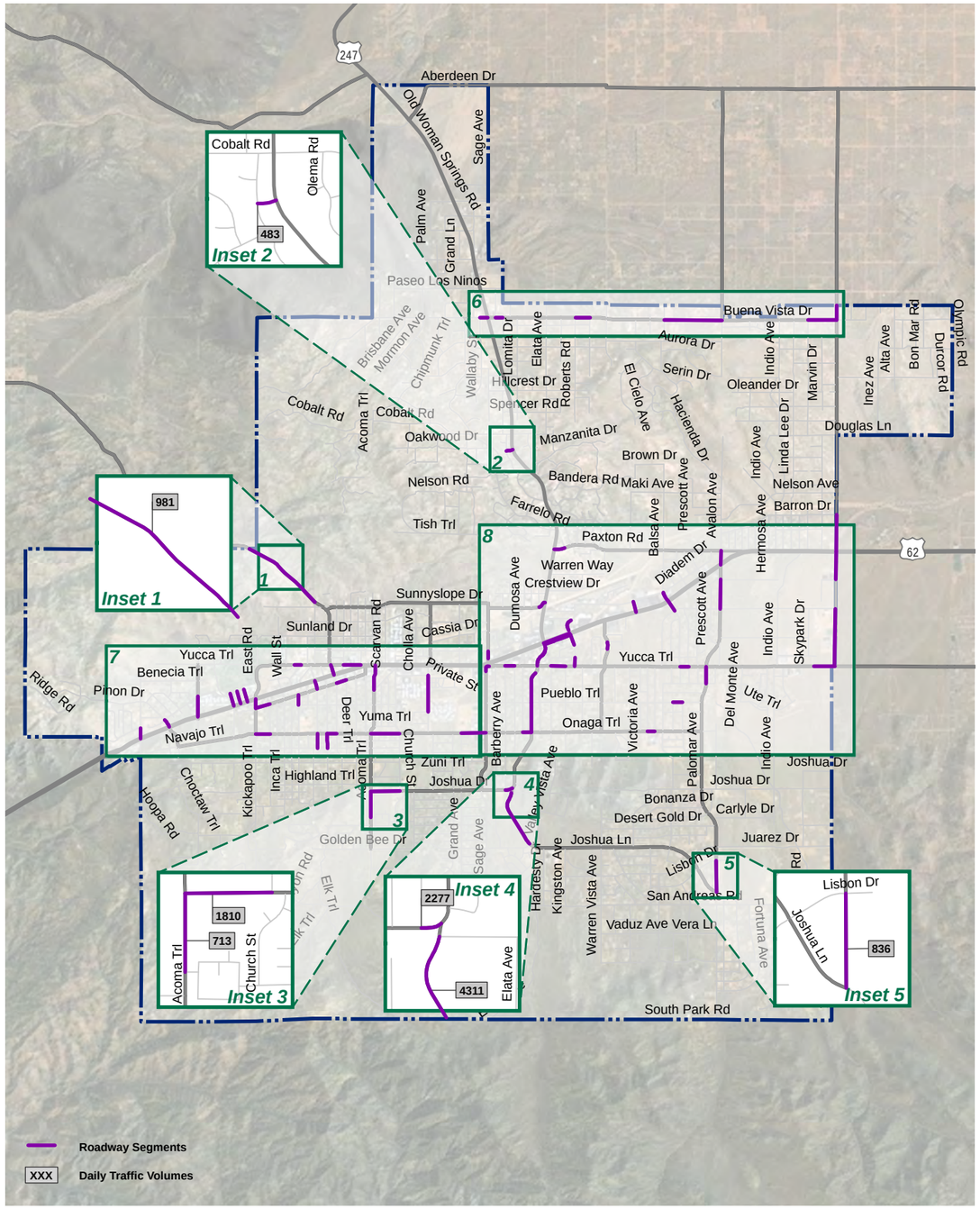
Yucca Valley Circulation Element - Transportation Impact Study

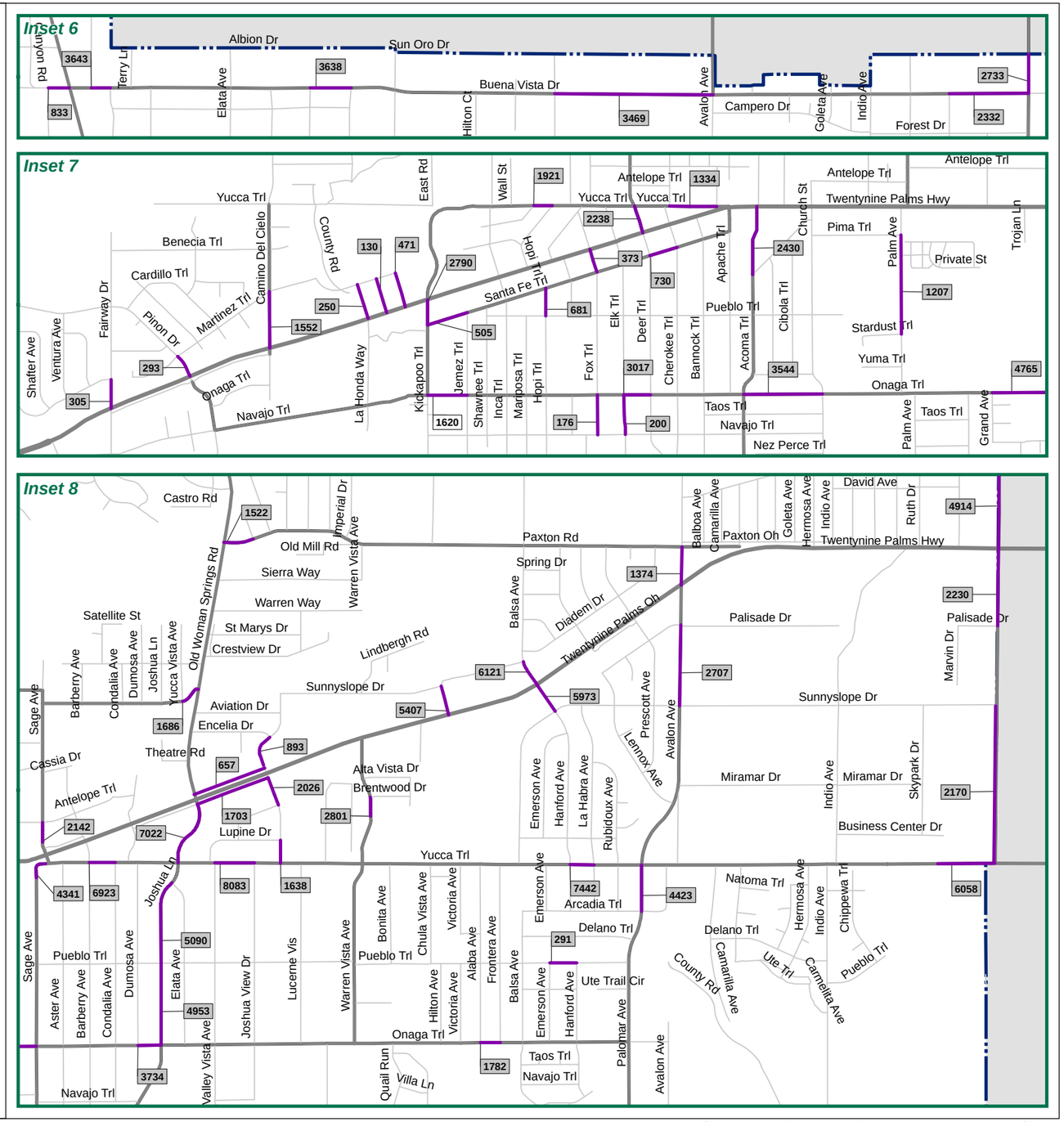
FEHR PEERS

Existing Truck Routes

Path: W:\Orange County N Drive\PROJECTS\OC11\0177 - Yucca Valley General Plan\Graphics\GIS\MXD\TIS_Fig_2-6_TruckRoutes.mxd

Figure 2-6





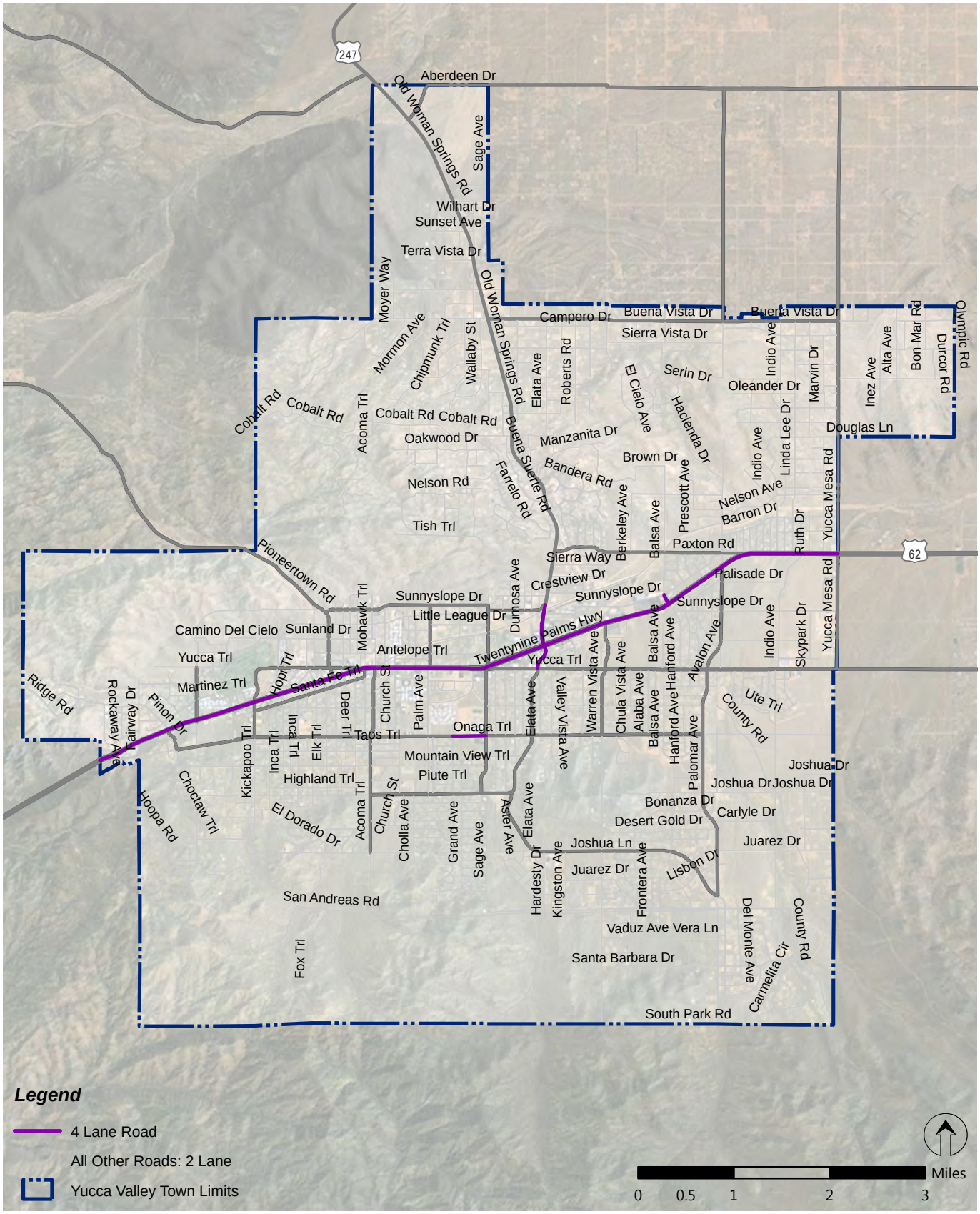
Yucca Valley Circulation Element - Transportation Impact Study

FEHR PEERS

Path: N:\Projects\Non_SanJose_Projects\OC Projects\OC11_0177_Yucca_Valley\Fig_2-5_ADT.ai

Existing Roadway Segment ADT

Figure 2-7



Yucca Valley Circulation Element - Transportation Impact Study

FEHR PEERS

Existing Condition Lane Geometry

Path: N:\Projects\Non_SanJose_Projects\OC Projects\OC11_0177_Yucca_Valley\TIS_Fig_2-8_Ex_Cond_Lane_Geometry.mxd

Figure 2-8

TABLE 2-5
EXISTING ROADWAY VOLUME AND LOS

Street Name and Segment	Current Classification	Traffic Volume	V/C	LOS
Acoma Trail				
South of SR-62	Collector	2,430	0.172	C or Better
North of Mountain View	Collector	2,357	0.167	C or Better
South of Joshua Drive	Collector	713	0.051	C or Better
Avalon Avenue				
North of Sunnyslope Drive	Collector	2,707	0.192	C or Better
North of SR-62	Collector	1,374	0.097	C or Better
Balsa Avenue				
North of Outer Highway	Collector	6,121	0.434	C or Better
South of SR-62	Collector	5,973	0.424	C or Better
Buena Vista Drive				
West of Yucca Mesa Road	Collector	2,332	0.165	C or Better
East of Balsa Avenue	Collector	3,469	0.246	C or Better
Between Roberts Road and Faith Lane	Collector	3,638	0.258	C or Better
Between Newton Lane and Rowell Road	Collector	3,643	0.258	C or Better
Camino del Cielo Trail				
North of SR-62	Collector	1,552	0.110	C or Better
Joshua Drive				
East of Acoma Trail	Collector	1,810	0.128	C or Better
West of Barberry Avenue	Collector	2,277	0.161	C or Better
East of Emerson Avenue	Collector	1,164	0.083	C or Better

TABLE 2-5
EXISTING ROADWAY VOLUME AND LOS

Street Name and Segment	Classification	Traffic Volume	V/C	LOS
Joshua Lane				
South of Joshua Drive	Collector	4,311	0.306	C or Better
North of Onaga Trail	2-Lane Arterial	4,953	0.281	C or Better
North of Pueblo Trail	2-Lane Arterial	5,090	0.289	C or Better
Between Yucca Trail and SR-62 Outer Highway	2-Lane Arterial	7,022	0.399	C or Better
Kickapoo Trail				
South of SR-62	Collector	2,790	0.198	C or Better
La Contenta Road				
South of SR-62	Collector	2,230	0.158	C or Better
North of Yucca Trail	Collector	2,170	0.154	C or Better
Onaga Trail				
East of Alaba Avenue	Collector	1,782	0.126	C or Better
East of Elata Avenue	Collector	2,966	0.210	C or Better
West of Joshua Lane	2-Lane Arterial	3,734	0.212	C or Better
West of Sage Avenue	2-Lane Arterial	4,765	0.271	C or Better
East of Acoma Trail	2-Lane Arterial	3,544	0.201	C or Better
East of Elk Trail	2-Lane Arterial	3,017	0.171	C or Better
West of Jemez Trail	2-Lane Arterial	1,620	0.092	C or Better
Palm Avenue				
North of Pueblo Trail	Collector	1,207	0.086	C or Better
Palomar Avenue				
South of Yucca Trail	Collector	4,423	0.314	C or Better
North of Joshua Lane	Collector	836	0.059	C or Better
Paxton Road				
East of SR-247	Collector	1,522	0.108	C or Better

TABLE 2-5
EXISTING ROADWAY VOLUME AND LOS

Street Name and Segment	Classification	Traffic Volume	V/C	LOS
Pioneertown Road				
North of SR-62	Collector	2,238	0.159	C or Better
South of Town Limits	Collector	981	0.070	C or Better
Sage Avenue				
North of SR-62	Collector	2,142	0.152	C or Better
South of SR-62	Collector	4,341	0.308	C or Better
North of Onaga Trail	Collector	4,122	0.292	C or Better
Santa Fe Trail				
West of Cherokee Trail	Collector	730	0.052	C or Better
East of Kickapoo Trail	Collector	505	0.036	C or Better
Sunnyslope Avenue				
West of SR-247	Collector	1,686	0.120	C or Better
Warren Vista Avenue				
South of SR-62	Collector	2,801	0.199	C or Better
Yucca Trail				
East of Cherokee Trail	Industrial	1,334	0.095	C or Better
East of Miami Trail	Industrial	1,921	0.136	C or Better
West of La Contenta Road	2-Lane Arterial	6,058	0.344	C or Better
East of Hanford Avenue	2-Lane Arterial	7,442	0.423	C or Better
West of Joshua View Drive	2-Lane Arterial	8,083	0.459	C or Better
West of Condalia Avenue	2-Lane Arterial	6,923	0.393	C or Better
Yucca Mesa Road				
North of SR-62	Collector	4,914	0.349	C or Better
North of Buena Vista Drive	Collector	2,733	0.194	C or Better

Notes:
1. LOS D Capacity for each roadway classification analyzed are as follows:
   - Collector – 14,100 vehicles per day (vpd)
   - Industrial – 14,100 vpd
   - 2-Lane Arterial – 17,600 vpd
2. V/C represents the volume to capacity ratio.

Source: Town of Yucca Valley Traffic Counts (2011), Caltrans Traffic Data (2010)

EXISTING INTERSECTION OPERATIONS

Table 2-6 presents the existing traffic volumes and lane configurations at the study intersections. Table 2-7 summarizes the exiting traffic operations at the ten study intersections during the morning (AM) and evening (PM) peak hours.

TABLE 2-6
EXISTING LANE CONFIGURATIONS AND TURNING MOVEMENT VOLUMES

Intersection		Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
1. SR-62 & Camino Del Cielo	Lanes	S	1	S	1+S	1	S	1	2	S	1	2	S
	AM Volume	3	0	3	75	0	5	2	592	0	4	633	18
	PM Volume	2	0	5	55	0	4	18	814	3	8	731	64
2. SR-62 & Kickapoo Trail	Lanes	1	1	1	1	1	S	1	2	S	1	2	S
	AM Volume	93	5	29	8	6	27	7	619	39	20	535	6
	PM Volume	63	4	36	10	6	20	17	769	89	39	789	9
3. SR-62 & Pioneertown Road/Deer Trail	Lanes	1	1	S	1	1	S	1	2	1	1	2	1
	AM Volume	13	13	24	67	13	20	14	712	8	10	627	12
	PM Volume	20	11	18	101	18	15	20	823	12	17	894	13
4. SR-62 & Acoma Trail	Lanes	1	1	1	1	1	1	1	2	S	1	2	1
	AM Volume	51	22	44	33	10	14	15	802	17	31	707	26
	PM Volume	62	7	39	54	11	19	17	953	33	44	981	25
5. SR-62 & Sage Avenue	Lanes	1	1	1	1	1	1	1	2	S	1	2	1
	AM Volume	186	18	17	39	31	36	16	733	113	32	682	13
	PM Volume	177	65	21	51	59	28	37	868	208	48	971	33
6. SR-62 & SR-247	Lanes	1	1	S	1	1	S	1	2	S	1	2	S
	AM Volume	69	86	53	111	96	226	121	603	18	39	504	61
	PM Volume	66	103	93	108	112	167	209	699	37	56	897	91
7. SR-62 & Airway Avenue	Lanes	1	1	S	1	1	S	1	2	S	1	2	S
	AM Volume	10	16	53	5	10	8	21	700	34	55	586	28
	PM Volume	14	16	82	39	21	41	46	830	29	69	999	42
8. SR-62 & Balsa Avenue	Lanes	1	2	S	1	1	1	1	2	S	1	2	S
	AM Volume	91	35	21	35	26	14	11	551	39	15	555	24
	PM Volume	122	64	29	161	114	26	18	645	96	41	844	54
9. SR-62 & Avalon Avenue	Lanes	2	1	1	1	1	1	1	2	S	1	2	S
	AM Volume	20	24	72	20	27	17	16	524	39	61	577	12
	PM Volume	58	33	50	13	13	23	24	726	39	66	933	25
10. SR-62 & Yucca Mesa Road/La Contenta Road	Lanes	1	1	S	1	1	S	1	2	S	1	2	S
	AM Volume	15	12	38	66	38	72	38	574	15	12	504	21
	PM Volume	16	38	6	35	29	60	121	620	23	28	893	77

Notes:
1. "S" represents a shared turn lane. "1+S" represents one turn lane with an additional shared turn lane.

TABLE 2-7
EXISTING (2013) CONDITIONS INTERSECTION LOS RESULTS

Intersection	Control	AM Peak		PM Peak	
		Delay	LOS	Delay	LOS
1. SR-62 & Camino Del Cielo	Signal	6.8	A	6.9	A
2. SR-62 & Kickapoo Trail	Signal	12.4	B	9.9	A
3. SR-62 & Pioneertown Road/Deer Trail	Signal	10.4	B	12.8	B
4. SR-62 & Acoma Trail	Signal	9.8	A	10	A
5. SR-62 & Sage Avenue	Signal	18.7	B	20.3	C
6. SR-62 & SR-247	Signal	35.2	D	33.6	C
7. SR-62 & Airway Avenue	Signal	11.3	B	17.4	B
8. SR-62 & Balsa Avenue	Signal	11.8	B	17	B
9. SR-62 & Avalon Avenue	Signal	16.9	B	15.6	B
10. SR-62 & Yucca Mesa Road/La Contenta Road	Signal	14.6	B	14.9	B

Notes:
1. Signalized intersection delay is reported as average delay.

Source: Fehr & Peers, April 2013

The results of the intersection assessment indicate that most of the study intersections are operating at LOS A or LOS B during one or both peak hours. Only the SR-62/SR-247 intersection operates below LOS C; operating at LOS D during the AM peak hour and LOS C during the PM peak hour.

(3) TRAVEL DEMAND MODEL DEVLEOPEMENT

One major component of this assessment was the development of a travel demand forecasting model. A travel demand forecasting model is a tool that incorporates land use and roadway network to "assign" traffic to the local roadway system. The model runs through numerous iterations during the traffic assignment procedure as the model also estimates traffic congestion on certain segments and reroutes traffic to other roadways that show a travel time savings for that trip.

As part of this General Plan Circulation Element, Fehr & Peers developed a sub-area Travel Demand Forecasting (TDF) model for the Town of Yucca Valley. This model was developed by modifying the 2008 San Bernardino County Transportation Analysis Model (SBTAM), which is a sub-regional model based on the Southern California Association of Governments (SCAG) TransCAD model. The SBTAM was built using the SCAG Sub regional Model Development Tool (SMDT) and validated against 2008 travel conditions. This chapter documents the development and validation of the sub-area travel demand model.

The remainder of this chapter summarizes key input data and modeling results associated with the Yucca Valley Transportation Analysis Model (YVTAM). Please note that the remainder of this chapter is intended to provide basic information to support the General Plan update process, but it also incorporates information that will be valuable to any travel demand forecasting expert utilizing the YVTAM model in the future.

BACKGROUND AND PURPOSE

The intent of developing a sub-area model for the Town of Yucca Valley was to create a travel demand model that can be used as a tool in the evaluation of land use scenarios and transportation system alternatives. The model provides the ability to evaluate the transportation system, use performance indicators for land use and transportation alternatives, provide information on regional pass through traffic versus locally generated trips and provide graphical displays of these results.

The SBTAM sub regional model provides a starting point for creating a locally valid sub-area model to which future roadway improvements and land use assumptions can be added. Starting with a regionally valid model ensures the sub-area model captures regional traffic flow patterns while the additional detail allows the sub-area model to capture local traffic patterns. The sub-area model can then be used to develop traffic volume forecasts to evaluate the transportation improvements needed to accommodate

the increase in land use associated with the Yucca Valley General Plan. Having a locally valid sub-area model is a critical step in ensuring a high level of confidence in these resulting traffic volume forecasts.

OVERVIEW OF THE MODEL

The sub-area model for Yucca Valley was developed using TransCAD Version 5.0 r4 Build 2025 modeling software. The model has been designed to produce AM, midday, PM, and nighttime vehicle flows within the town limits based on comprehensive land use and socioeconomic data (SED). The model utilizes a typical four-step process consisting of trip generation, trip distribution, modal split, and assignment. Detail regarding the 2008 SBTAM can be obtained in SBTAM Development and Validation Report and User's Guide (Parsons Brinckerhoff, May 2012). Information on the SMDT can be obtained in User's Guide for the SCAG Sub regional Planning Model in TransCAD 5.0 (Caliper Corporation, June 2010). The roadway network and traffic analysis zone (TAZ) structure were modified to ensure the model produced traffic forecasts that reasonably resemble observed traffic counts obtained within the Town of Yucca Valley in 2011.

Following validation of base year 2011 forecasts, the modifications to the base year SBTAM were applied to the future year 2035 SBTAM to produce forecasts of future vehicle flows within the town. These forecasts would then be used in the identification of system deficiencies and the development of transportation improvements needed to accommodate the increases in land use associated with the Yucca Valley General Plan.

BASE YEAR SUB-AREA MODEL DEVELOPMENT

To improve the model's forecasting ability and to incorporate the future land use data provided by The Planning Center, an increased level of detail was added to the SBTAM roadway network and TAZ structure. Substantial modifications were made within the Town of Yucca Valley that were necessary to validate the base year sub-area model to traffic counts collected in 2011.

ROADWAY NETWORK

The base year SBTAM roadway network was modified to include all arterials and collector roadways in order to facilitate the proper assignment of vehicles throughout the town. In addition, several unpaved roadways were included in the model to evaluate whether these facilities should be paved in the future. Finally, the roadway network was reviewed to ensure each roadway's facility type, free-flow speed, and

number of lanes matched data observed in aerial photography and field observations. A summary of the additional roadways coded into the model along with type (paved/unpaved) is summarized in Table 3-1. Exhibit 3-1 shows the existing SBTAM roadway network as well as the additional roadway segments that were added for the base year Yucca Valley sub-area model. SBTAM roadways are shown in green, additional paved roads are shown in red, and additional unpaved facilities are shown in blue.

TAZ STRUCTURE AND SED DATA

The SCAG regional and sub-regional models use a tiered TAZ structure to enhance the precision of the micro-level land use and smart growth analysis. The tiered zone structure consists of three levels, Tier 1 through Tier 3. The Tier 3 zone structure provides the highest precision and the most detailed zone information at the local level. The SBTAM adopts this tiered zone system so that a refined zone structure is used within the San Bernardino sub region while a much more aggregate zone structure is applied external to the sub region. TAZs within San Bernardino County are Tier 3 zones. The areas external to San Bernardino County and within an approximate five to ten mile buffer to the San Bernardino County border consist of Tier 2 zones. Beyond this Tier 2 buffer area is the Tier 1 area, with the farthest outlying areas aggregated to Combined Statistical Areas (CSAs).

The SBTAM divides the Town of Yucca Valley into 51 non-overlapping Tier 3 TAZs connected to the model roadway by centroid connectors. The existing TAZ structure was modified by moving 78 Tier 3 zones from outside the town into Yucca Valley. The new TAZ borders were drawn along major roadways and physical/man made boundaries. Exhibit 3-2 shows the SBTAM TAZ structure as well as the new TAZ structure for the Yucca Valley Sub-area Model. In total, the Town of Yucca Valley is divided into 129 TAZs in the new sub-area model, which increased the TAZ level of detail by 78 zones.

TABLE 3-1
BASE YEAR ADDITIONAL ROADWAY NETWORK ADDED

Roadway	Location	Type
Acoma Trail	between Golden Bee Drive and San Andreas Road	Unpaved
Acoma Trail	between Onaga Trail and Golden Bee Drive	Paved
Avalon Avenue	between Nelson Avenue and Barron Drive	Unpaved
Balsa Avenue	between Buena Vista Drive and Hilton Avenue	Unpaved
Balsa Avenue	between Hanford Avenue and Yucca Trail	Paved
Barron Drive	between Avalon Avenue and Yucca Mesa Road	Paved
Cactus Lane	between Carmelita Avenue and Linda Lee Drive	Unpaved
Church Street	between SR 62 and Onaga Trail	Paved
Cobalt Road	between Acoma Trail and SR 267	Unpaved
Golden Bee Drive	between Acoma Trail and Cholla Avenue	Unpaved
Golden Bee Drive	between Cholla Trail and Amador Avenue	Paved
Hacienda Drive	between Hilton Avenue and Nelson Avenue	Unpaved
Hilton Avenue	between Balsa Avenue and Hacienda Drive	Unpaved
Hilton Road	between Sunnyslope Drive and SR 62	Paved
Indio Avenue	between Barron Drive and SR 62	Paved
Indio Avenue	between Cactus Lane and Barron Drive	Unpaved
Indio Avenue	between Sunnyslope Drive and Yucca Trail	Unpaved
Joshua Drive	between Acoma Trail and Joshua Lane	Paved
Juarez Drive	between Joshua Lane Palomar Avenue and La Contenta Road	Unpaved
Kickapoo Trail	between Navajo Trail and San Andreas Road	Unpaved
Kickapoo Trail	between Onaga Trail and Navajo Trail	Paved
Kickapoo Trail	between Yucca Trail and SR 62	Paved
La Contenta Road	between SR 62 and Yucca Trail	Paved
La Contenta Road	between Yucca Trail and Juarez Drive	Unpaved
Linda Lee Drive	between Buena Vista Drive and Cactus Lane	Unpaved
Mohawk Trail	between Sunnyslope Drive and SR 62	Paved
Mountain View Trail	between Kickapoo Trail and Acoma Trail	Unpaved
Onaga Trail	between Pinon Drive and Kickapoo Trail	Unpaved
Palm Avenue	between Pima Trail and Onaga Trail	Paved
Sage Avenue	between Sunnyslope Drive and SR 62	Paved
San Andreas Road	between Kickapoo Trail and Acoma Trail	Unpaved
San Andreas Road	between Warren Vista Avenue and Joshua Lane	Paved
Santa Fe Trail	between Kickapoo Trail and Hopi Trail	Paved
Skyline Ranch Road	between Morman Avenue and SR 267	Paved
SR 62 Outer Highway N	between SR 267 and Airway Avenue	Paved
SR 62 Outer Highway S	between Joshua Lane and Airway Avenue	Paved
Sunnyslope Drive	between Avalon Avenue and La Contenta Road	Unpaved
Warren Vista Avenue	between Joshua Lane and San Andreas Road	Paved
Warren Vista Drive	between SR 62 and Yucca Trail	Paved
Yucca Trail	between Pioneertown Road and SR 62	Paved

Source: Fehr & Peers, 2012

Exhibit 3-1 Base Year Roadway Network

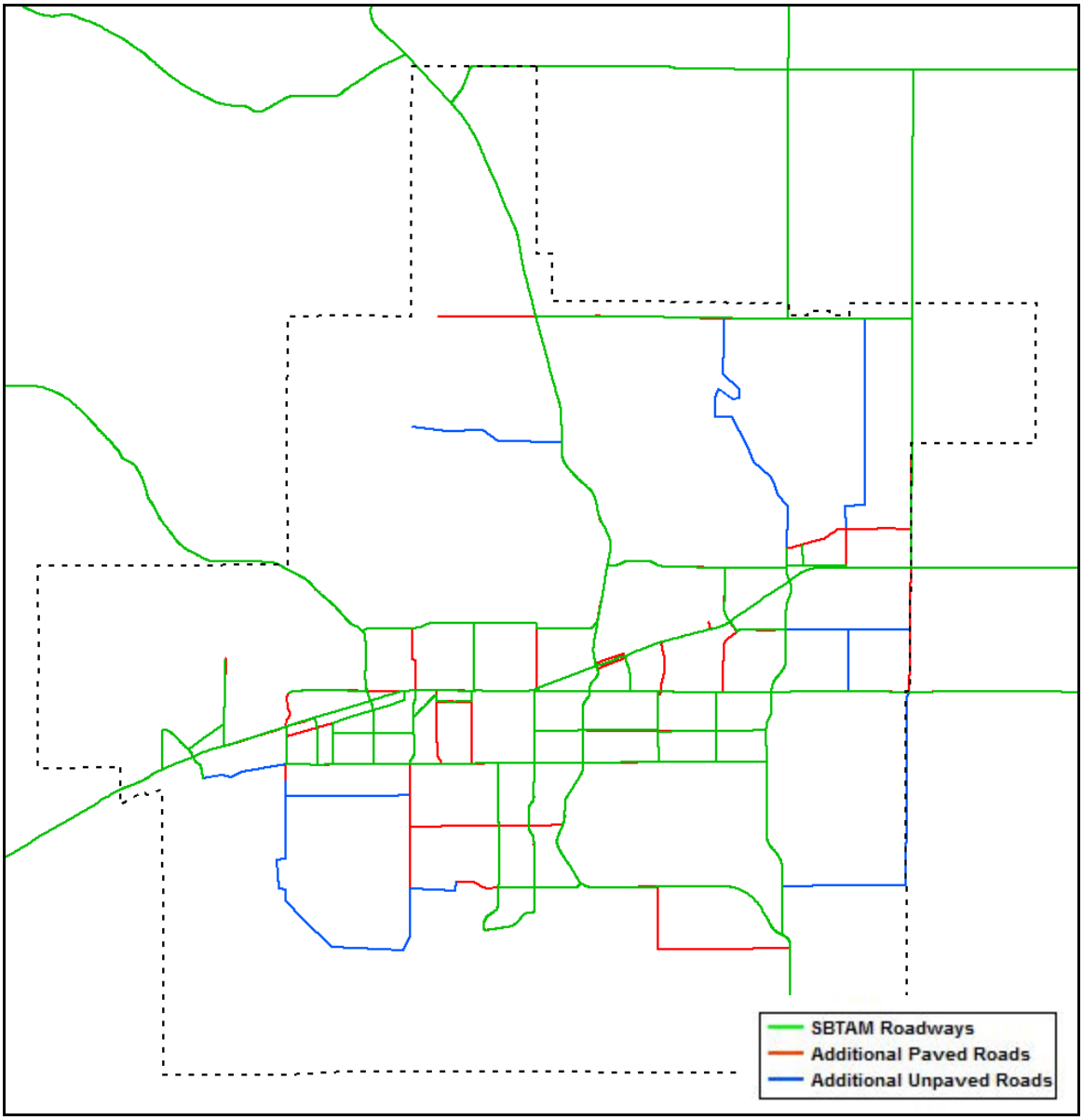
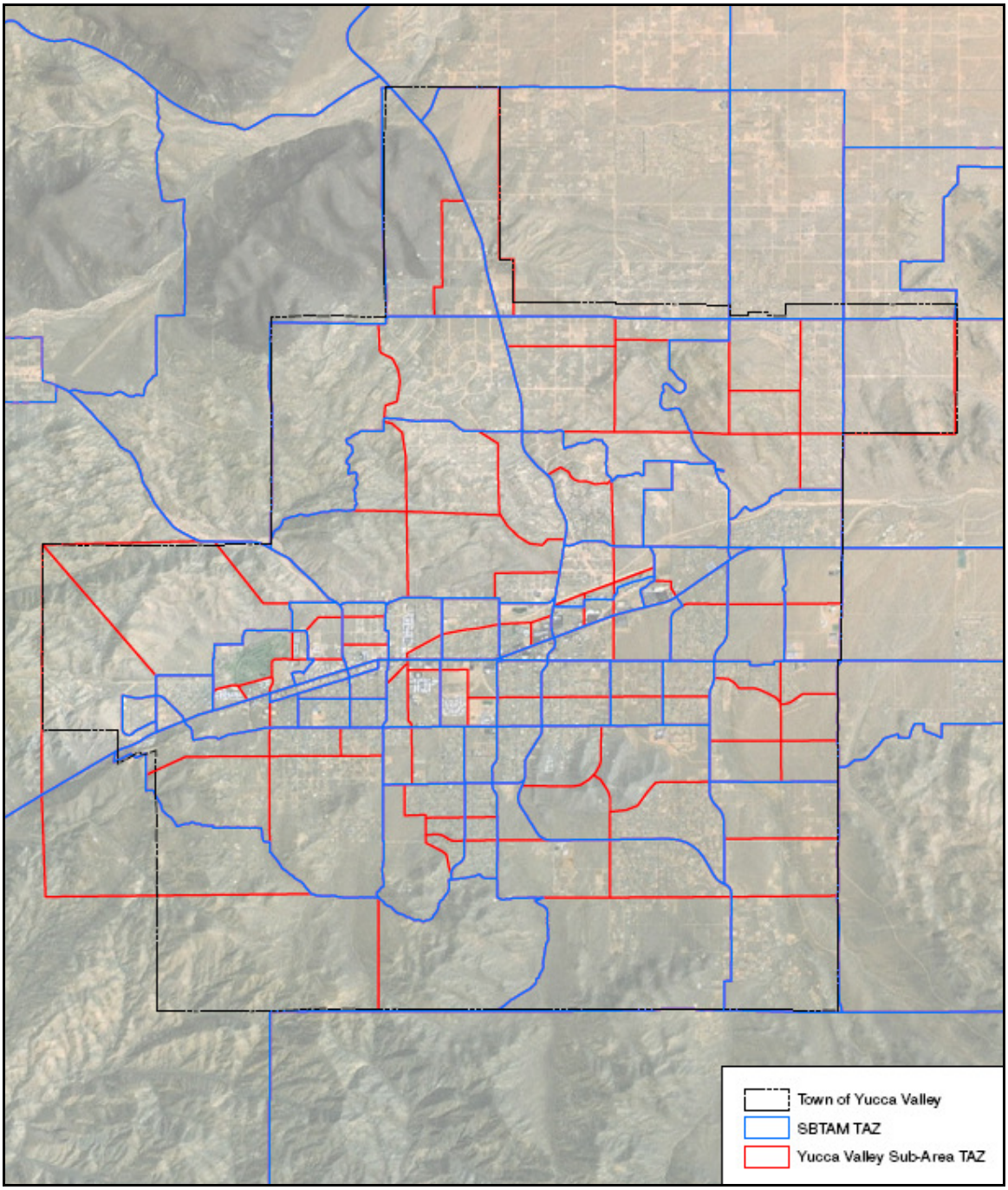


Exhibit 3-2 Base Year TAZ Structure



Since TAZs are used to tabulate demographic and employment data, the model SED files were then modified by reallocating demographic and employment assumptions from the original 51 TAZs to the new 129 TAZs. The data for each new Yucca Valley TAZ was allocated from its corresponding SBTAM TAZ based on aerial photography and field observations. The original socioeconomic data for TAZs that were moved into Yucca Valley were allocated to nearby TAZs so that the total land use was not affected.

The SBTAM allocates land using the following categories:

- Population
- Households
  - Single family
  - Multi-family
- Employment
  - Retail employment
  - Non-retail employment
- School Enrollment
  - K-12 enrollment
  - College/university enrollment

Base year demographic and employment assumptions within the Town of Yucca are summarized in Table 3-2. It should be noted that the model TAZ boundaries do not match the Town boundary, and therefore the demographic and employment associated with the Town was estimated for those TAZ not entirely within the Town limits, which may not match the values reported in the General Plan.

TABLE 3-2
BASE YEAR DEMOGRAPHIC AND EMPLOYMENT ASSUMPTIONS

Category	Quantity
Population	21,871
Households	8,952
Employment	4,699

Source: 2008 SBTAM

Using this basic Tier 3 level data, SBTAM further stratifies the data using Tier 2 socioeconomic data and allocation percentages uniquely defined for each Tier 3 TAZ within a Tier 2 TAZ. The following SED is automatically calculated each time the model is run.

- Population
  - By age
- Households
  - By size
  - By head of household age
  - By number of workers
  - By income
- Workers
  - By income level (low, medium, and high)
- Total employment
  - By income level (low, medium, and high)
  - By type (agriculture, construction, manufacturing, wholesale, retail, transportation, information services, financial/real estate, professional, educational, arts/entertainment, other services, and public administration)

The allocation percentages and Tier 2 reference TAZs were updated for each Tier 3 TAZ that was moved into Yucca Valley as well those that were disaggregated within the town.

The final step in modifying the SED for the Yucca Valley sub-area model was adjusting cross-classification tables based on income, earnings, number of workers, number of children, number of college students, head of household age, and household size. Except for one table, which is based on Tier 3 data, the tables only include information at the Tier 2 level. For this reason, only groups of Tier 3 TAZs that corresponded to a single Tier 2 TAZ were moved into Yucca Valley. These new TAZs were used to split a single existing Tier 2 TAZ in Yucca Valley. The cross-classification data for the Yucca Valley Tier 2 TAZ then replaced the data for the Tier 2 TAZ that was moved. The final step was scaling the data based on the new total number of households.

SBTAM contains other land use data but this was determined to have a limited effect on the model.

BASE YEAR SUB-AREA MODEL VALIDATION

The most critical measurement of the accuracy of any travel model is the degree to which it can approximate actual traffic counts in the base year. For a model to be considered accurate and appropriate for use in traffic forecasting, it must replicate actual conditions to within a certain level of accuracy. Traffic

forecasting models are typically calibrated by adjusting model parameters until they are validated by applying a set of criteria that compare model link volumes to actual counts.

For the Yucca Valley sub-area model, land use and roadway network modifications such as adjusting roadway speeds and capacities were made to the model and the resulting roadway link volumes were compared to 64 segment volumes collected during November and December 2011.

The California Transportation Commission has established guidelines for determining whether a model is valid and acceptable for forecasting future year traffic volumes. The sub-area validation results were compared to the following validation thresholds discussed in *2010 California Regional Transportation Plan Guidelines* (California Transportation Commission, April, 2010):

- The two-way sum of the volumes on all roadway links for which counts are available should be within 10 percent of the counts.
- At least 75 percent of the roadway links for which counts are available should be within the maximum desirable deviation, which ranges from approximately fifteen to sixty percent depending on total volume (for larger volumes, less deviation is permitted).
- The correlation coefficient between the actual ground counts and the estimated traffic volumes should be greater than 88 percent.
- The percent root mean square error (RMSE) should not exceed 40 percent.

The results for daily traffic volumes are summarized in Table 3-3 below, while the detailed spreadsheets are presented in the appendix.

TABLE 3-3
RESULTS OF YUCCA VALLEY SUB-AREA MODEL DAILY VOLUME VALIDATION

Validation Statistic	Criterion for Acceptance	Model Results
% of Links within Caltrans Standard Deviation	75% or greater	88%
2-way Sum of All Links Counted	10% or less	10%
Correlation Coefficient	88% or greater	98%
RMSE	40% or less	34%

Source: Fehr & Peers, 2012

As shown in Table 3-3, the Yucca Valley sub-area model meets or exceeds the guidelines for model accuracy for daily traffic volumes. Therefore, the base year model is considered to be valid to 2011 counts and appropriate for use in traffic forecasting.

FUTURE YEAR SUB-AREA MODEL DEVELOPMENT

The 2035 SBTAM was used to development future traffic land forecasts within the Town of Yucca Valley. The future land use information for TAZs within the Town of Yucca Valley was provided by The Planning Center. After the initial forecast was completed, suggested roadway improvements were incorporated into the network and final future year forecasts were generated.

ROADWAY NETWORK

The 2035 SBTAM roadway network includes all of the improvement assumed by SBTAM in their version of the model. These improvements include, but are not limited to, additional transit routes and facilities, new roadways, and added lanes.

Table 3-4 provides a list of roadway modifications that were included in the future year model within the Town of Yucca Valley. These improvements add capacity on roadways which are near capacity in the future. Also, unpaved roadway facilities that experienced a significant increase in traffic were assumed to be paved in the future.

TABLE 3-4
FUTURE YEAR ROADWAY NETWORK IMPROVEMENTS

Roadway	Location	Original	Change
Balsa Avenue	between SR 62 and Sunnyslope Drive	2 lanes	4 lanes
Indio Avenue	between Sunnyslope Drive and Yucca Trail	Unpaved	Paved
Indio Avenue	between south of SR-62	n/a	Paved
Onaga Trail	between Joshua Lane and Palomar Avenue	2 lanes	4 lanes
Onaga Trail	between Pinon Drive and Kickapoo Trail	2 lanes	4 lanes
SR 247	within Town of Yucca Valley Limits	2 lanes	4 lanes
SR 62	within Town of Yucca Valley Limits	4 lanes	6 lanes
Yucca Trail	between Indio Avenue and La Contenta Road	2 lanes	4 lanes

Source: Fehr & Peers, 2012

TAZ STRUCTURE AND SED DATA

The TAZ structure was not modified from the base year model. However, The Planning Center provided updated land use for the Town of Yucca Valley, and the Population value is a combination of SCAG data,

SBTAM data, census data, and data provide by The Planning Center. Table 3-5 summarizes the future land use within the town limits. As with the Base Year data, it should be noted that the model TAZ boundaries do not match the Town boundary, and therefore the demographic and employment associated with the Town was estimated for those TAZ not entirely within the Town limits, which may not match the values reported in the General Plan.

TABLE 3-5
FUTURE YEAR DEMOGRAPHIC AND EMPLOYMENT ASSUMPTIONS

Category	Quantity	Change
Population	63,839	41,968
Households	26,733	17,781
Employment	34,951	30,252

Source: Fehr & Peers, 2012

FORECASTING METHODOLOGY

Future volumes were developed by adding the difference between future year and base year traffic forecasts to the existing traffic count. This Difference Method is consistent with methodologies delineated in the National Cooperative Highway Research Program (NCHRP) 255 published by the Transportation Research Board (TRB). The resulting forecasts were then balanced where appropriate for use in the Circulation Element and for use in the General Plan EIR assessment.

(4) APPROACH, GOALS, AND POLICY RECOMMENDATIONS

In March of 2012, Fehr & Peers prepared a technical memorandum for the Town that summarized the Transportation Best Management Practices. Fehr & Peers then met with Town staff to go through the Best Management Practices and develop a list of items that were most appropriate for the goals and vision for the Town of Yucca Valley.

Fehr & Peers then utilized those best practices and the results of the travel demand forecasting effort described in Chapter 3 to develop the recommended goals and policy recommendations for the Circulation Element. This chapter summarizes the Transportation Best Management Practices that are appropriate for the Town of Yucca Valley, identifies the key circulation goal for the Town, and recommends policies that should be included in the Circulation Element.

TRANSPORTATION BEST MANAGEMENT PRACTICES OVERVIEW

The following practices are recommended for the Town of Yucca Valley and are recommended to be incorporated into the Circulation Element accordingly.

REGULATORY FRAMEWORK

The regulatory framework is used to inform decision makers about the regulatory agencies and policies that affect transportation in the Town. This enables them to make informed decisions about planning improvements to transportation systems in the Town.

Global Warming Solutions Act

The Global Warming Solutions Act (AB32) of 2006 was signed into law on September 27, 2006. AB32 established a comprehensive program to reduce greenhouse gas emissions to combat climate change. This bill requires the California Air Resources Board (CARB) to develop regulations to reduce greenhouse gas emissions to 1990 levels by 2020. January 1, 2012 the greenhouse gas rules and market mechanisms adopted by CARB take effect and are legally enforceable.

Source: NASA

The reduction goal for 2020 is to reduce greenhouse gas emissions by 25% of the current rate in order to meet 1990's level, and a reduction of 80% of current rates by 2050. The AB32 Scoping Plan contains the main strategies California will use to reduce the greenhouse gases. The scoping plan has a range of greenhouse gas reduction actions which include direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, market-based mechanisms such as a cap-and-trade system, and an AB32 program implementation regulation to fund the program.

The Town of Yucca Valley should strive to comply with AB32 and implement greenhouse gas reduction strategies.

Sustainable Communities and Climate Protection Act

The Sustainable Communities and Climate Protection Act (SB375) of 2008, also known as the California Anti-Sprawl Bill, was signed into law on September 30, 2008. The SB375 regulation provides incentives for cities and developers to bring housing and jobs closer together and to improve public transit. The goal behind SB375 is to reduce automobile commuting trips and thus help meet the statewide targets for reducing greenhouse gas emissions set by AB32. SB375 requires each Metropolitan Planning Organization to add a broader vision for growth, called a "Sustainable Communities Strategy" (SCS), to its transportation plan. The SCS must lay out a plan to meet the region's transportation, housing, economic, and environmental needs in a way that enables the area to lower greenhouse gas emissions. SCAG adopted the RTP and SCS in 2012 and the appropriate infrastructure and other recommendations in the document should be incorporated into the Circulation Element.

The Town of Yucca Valley should strive to comply with SB375 by incorporating the SCAG SCS into its transportation plan. Applicable components of SCAG's SCS include:

- *Encourage the implementation of a Complete Streets policy that meets the needs of all users of the streets, roads and highways – including bicyclists, children, persons with disabilities, motorists, neighborhood electric vehicle (NEVs) users, movers of commercial goods, pedestrians, users of public transportation and seniors – for safe and convenient travel in a manner that is suitable to the suburban and urban contexts within the region*
- *Support projects, programs, and policies that support active and healthy community environments that encourage safe walking, bicycling, and physical activity by children, including, but not limited to development of complete streets, school siting policies, joint use agreements, and bicycle and pedestrian safety education*
- *Update local zoning codes, General Plans, and other regulatory policies to promote a more balanced mix of residential, commercial, industrial, recreational and institutional uses located to provide options and to contribute to the resiliency and vitality of neighborhoods and districts*
- *Support projects, programs, policies and regulations that encourage the development of complete communities, which includes a diversity of housing choices and educational opportunities, jobs for a variety of skills and education, recreation and culture, and a full-range of shopping, entertainment and services all within a relatively short distance*
- *Expand the use of transit modes in our sub regions such as bus rapid transit or vanpooling*
- *Explore and implement innovative strategies and projects that enhance mobility and air quality, including those that increase the walkability of communities and accessibility to transit via non-auto modes, including walking, bicycling, and neighborhood electric vehicles (NEVs) or other alternative fueled vehicles*
- *Develop first-mile/last-mile strategies on a local level to provide an incentive for making trips by transit, bicycling, walking, or neighborhood electric vehicle or other zero-emission vehicle options*

California Complete Streets Act

The California Complete Streets Act (AB 1358) of 2008 was signed into law on September 30, 2008. Beginning January 1, 2011, AB 1358 requires circulations elements to address the transportation system from a multi-modal perspective. The bill states that streets, roads, and highways must "meet the needs of all users in a manner suitable to the rural, suburban, or urban context of the general plan." Essentially, this

bill requires a circulation element to plan for all modes of transportation where appropriate, including walking, biking, car travel, and transit.

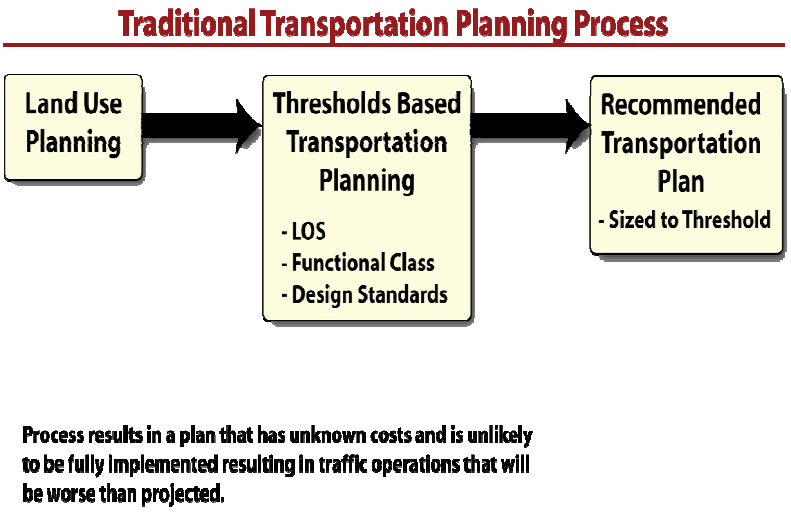
The Complete Streets Act also requires circulation elements to consider the multiple users of the transportation system, including children, adults, seniors, and the disabled. For further clarity, AB 1358 tasks the Governor's Office of Planning and Research to release guidelines for compliance with this legislation by January 1, 2014.

The Town of Yucca Valley should strive to comply with AB 1358 by addressing the transportation system from a multi-modal and multiple user perspective in its circulation element. For Yucca Valley, that should include:

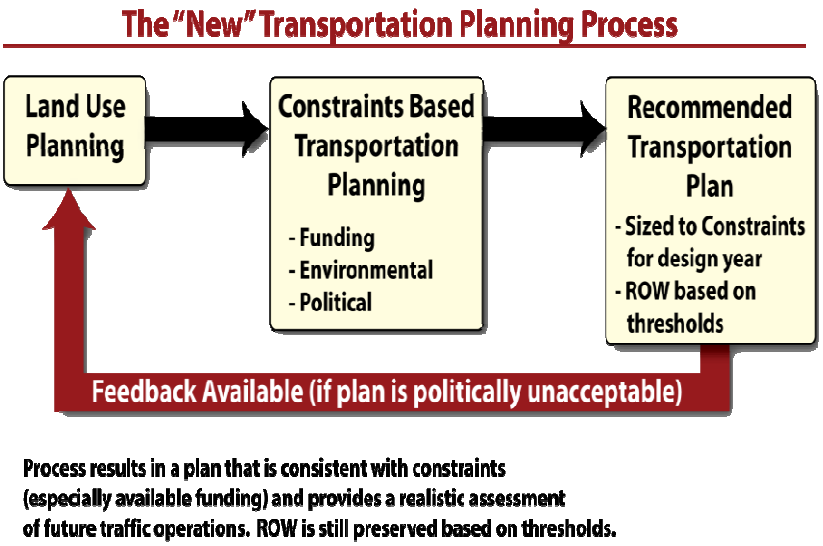
- *Developing a layered-networks approach to complete streets – this essentially identifies the network for all modes of travel and recommends appropriate implementation of those networks.*
- *Ensure that the complete streets network is feasible (fiscally and environmentally)*
- *Work to better integrate roadway network along SR-62 with the adjacent land uses*

Constraints Based Planning

In the past, planners would use threshold based policies to size town infrastructure. This process would result in a plan that has unknown costs and it would be unlikely that the plan could be fully implemented, resulting in worse traffic operations than projected. Planners could instead create policies that set realistic standards and that meet the unique needs of individual towns.



Constraints based planning considers funding, environmental and political constraints in order to recommend a transportation plan. Certain choices must be made that balance these constraints and community values of the Town. Constraints based planning will allow Yucca Valley to plan for realistic and feasible infrastructure that can be implemented and maintained in the future.



In Yucca Valley, Constraints Based Planning would result in a circulation element with realistic expectations that are feasible to implement. This strategy is recommended for incorporation into the process. It would effectively take the form in policy language that would allow flexibility in service standards to reflect the Town's ability to implement additional infrastructure.

Transit Services and Facilities

Public transportation provides mobility options for many residents that would otherwise struggle to get around the Town while also combining multiple trips. Mass transit options for Yucca Valley could promote less vehicle use and more shared trips. The progression of figures below shows how much space and energy can be saved by choosing the public transit alternative.

While Yucca Valley already utilizes Public Bus and Ready Ride, public transportation options for the Town could also include an express bus service or vanpooling. These four services are described in detail below:

- *Public Bus* – Morongo Basin Transit Authority (MBTA) currently offers nine deviated-fixed routes throughout the week. These routes have set schedules offering limited service throughout the day to multiple communities. Existing bus routes serving Yucca Valley are Route 1 (serving trips between Yucca Valley and 29 Palms), Route 7A (serving North Yucca Valley), Route 7B (serving South Yucca Valley), Route 12 (serving trips between Yucca Valley and Palm Springs), and Route 21 (serving trips between Landers and Yucca Valley). The Circulation element should consider enhancing this service to provide better mobility for the Town's residences.

- *Ready Ride* – An existing door-to-door service available primarily for Senior and Disabled passengers at a discounted rate, but is available for all passengers at a premium rate.

- *Express Bus Service* – Bus service that is intended to run faster than normal bus services between the same two commuter points. Express buses operate on a faster schedule by not making as many stops as normal bus services and often taking quicker routes, such as along freeways. Given the number of residences that commute far distances to employment centers outside of the town, this may be a transit option worth considering in the future.

- *Vanpooling* – Larger scale carpooling with concurrent savings in fuel and vehicle operating costs. Vehicles may be provided by individuals, by various public and private support programs, by an element of government, or a by an employer. The key concept is that people share the ride from home or one or more common meeting locations and travel together to a common destination or work center.

While Yucca Valley already utilizes public bus and MBTA's Ready Ride, additional transit facilities could be incorporated into the Town's transportation system, such as express bus service or vanpooling.

Bikeways

Bicycling is considered an environmentally friendly mode of transportation that enhances both personal and social wellbeing. In addition to transportation, this mode of travel provides many public access, health and economic benefits. Bicycling could be recognized as an integral component of Yucca Valley's transportation

Source: About Mountain Biking

system, currently and in the future. Safe, convenient, attractive, and well-designed bicycle facilities are essential if this mode is to be properly accommodated and encouraged. This mode could be integrated throughout the Town's Complete Streets vision, and a network of bicycle facilities linking all areas of the Town could be accommodated.

The existing bicycle system in Yucca Valley consists of on-street, shared roadways that create a loop around the Town. This system has many opportunities for improvement in the quality of bicycle facilities and the connectivity to main town areas. A major improvement to the bikeway system could be considered to connect people to key destinations in the town, especially employment centers, residential areas, and high use activity centers. This complete system could emphasize the following key components:

- Local and regional continuity and connectivity
- Increasing safety by focusing on visibility for cyclists
- Educating both cyclists and drivers to coexist with an awareness of each other
- Utilizing environmentally sensitive routing to minimize environmental impacts whenever possible
- Continued consideration of methods to promote the benefits of cycling

Yucca Valley's bicycle network could be expanded and improved to offer safer and more convenient routes that would increase connectivity and promote alternative modes of travel.

Pedestrian and Trails Facilities

Walking is another environmentally friendly mode of transportation that enhances both personal and social wellbeing. In addition to transportation, this mode of travel provides many public access, health and economic benefits. Well-designed pedestrian facilities are safe, attractive, convenient, and easy to use. Inadequate facilities discourage users and unnecessary facilities waste money and resources.

Pedestrian paths are primarily developed as part of the roadway and trail systems of a town and reflect the interconnected nature of circulation and transportation systems as a whole. Currently most major routes through the Town provide discontinuous or no sidewalks. Many opportunities exist to provide connectivity for pedestrians throughout the Town.

Source: National Recreational Trails

Even though bikeway master plans specifically address bicycle facilities on paved road-ways, community's trails are relevant and are critical to connecting people to places within the Town. This is especially true wherever connections can be made that enhance intra-community connectivity by linking the two systems. Therefore, these two non-motorized systems can be regarded as complementary extensions of each other.

The Town of Yucca Valley could implement a unique trail system that provides recreational access and alternative circulation for non-motorized users through an interlinked town-wide system of trails connecting neighborhoods to local parks and schools.

Goods Movement Facilities

The goods or freight movement system in Yucca Valley is crucial to the well-being of the residents of the Town. Identifying and prioritizing facilities for goods movement is a vital portion of effective planning.

Facilities that prioritize goods movement over other modes must be integrated into the transportation system. The Surface Transportation Assistance Act (STAA) of 1982 defines state truck routes and key freight corridors. Regional access to Yucca Valley is accommodated by STAA designated State Routes 62 and 247. In a reciprocal fashion, other modes of travel must not impede with the goods movement, either, to ensure efficient delivery.

In Yucca Valley, managing the goods movement demands along roadway corridors that provide economic and cultural services for the Town will be a critical component of this transportation element. Options, such as the Twentynine Palms Highway bypass, could be considered to increase the connectivity and ease of access to provide for crucial goods movement.

Aviation Facilities

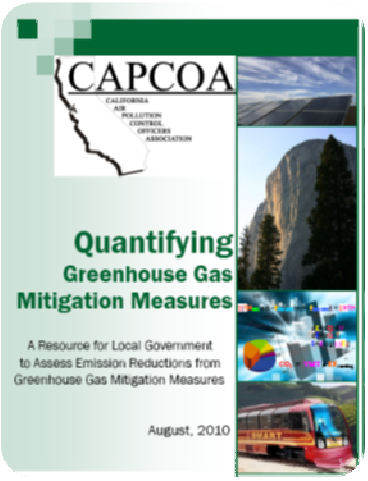
Aviation facilities can provide regional access that far outweighs the constraints of conventional roadways. Providing transportation of both goods and people, effective aviation planning can provide Yucca Valley opportunities that surrounding Town's will lack. Integrating the airport with the surrounding land uses will be an item the Land Use Plan should consider.

Source: Airplanepicture.org

The Yucca Valley Airport is a small facility that does not offer commercial flight services. Primary regional access by aviation is required through the Palm Springs International Airport, located approximately 30 miles south of Yucca Valley.

Appropriate land use and transportation planning should be considered in areas surrounding the Yucca Valley Airport in order to expand or maintain the existing aviation facilities.

Transportation Demand Management



As identified in the Ds of smart growth, one component of reducing the reliance of the single occupant vehicle is to implement a comprehensive Transportation Demand Management (TDM) program. TDM consists of measures and policies to promote alternative modes of travel. Standard measures that have been implemented statewide include employers providing commuter checks to employees, developers providing secure bicycle parking and showers at key employment centers, preferred parking for carpools, or reduced parking supply to encourage alternative travel modes.

Since a large percentage of Yucca Valley Residents commute long distances in order to get to work, focused transportation demand management incentives could help decrease the amount of commuting vehicles.

Potential TDM strategies that could be considered for Yucca Valley include carpooling, ride sharing and park and ride lots.

Signal Timing and Coordination

Signal timing refers to the phasing plans of signalized intersections that define when and how much green time is allowed for each direction. Signal coordination refers to groups of two or more signalized intersections with strategically planned signal timing to move vehicles efficiently with as few stops as possible. Benefits of effective signal coordination include shorter travel times, reduced stops and delay, reduced idling, reduced congestion and collisions, increased response time for emergency vehicles, and a reduction in fuel consumption and greenhouse gas emissions.

Similar signal coordination systems have been implemented throughout the state. A recent signal coordination study completed in the Coachella Valley found that the project resulted in a 25% decrease in travel times during peak periods, fuel consumption and greenhouse gas emissions reduction of approximately 5%, and improved pedestrian crossing times at intersections was provided.

Other traffic management strategies include speed management techniques, Intelligent Transportation Systems (ITS), and traffic management centers (TMC's). Speed management techniques reduce the existing speed limit to control traffic in a desired manner. ITS can provide real-time information regarding road conditions and directions and can be utilized by drivers to avoid congestion and reduce travel time. TMC's can remotely control the traffic signals and provide real-time video feeds from traffic cameras strategically located at the Town's busiest intersections. Traffic engineers staffing the TMC can check signal operations, adjust signal synchronization timing and monitor traffic progression throughout the Town. TMC's are a critical part of an advanced traffic management system that manages traffic flow in a town.

The Town is currently in the process of installing signal timing/synchronization between Camino del Cielo and Acoma Trail through the application of regional air quality grants.

Properly implemented traffic management strategies can maximize the efficiency of Yucca Valley's transportation system.

Traffic Calming

Traffic calming is a series of methods to reduce vehicle speeds, improve safety, and enhance quality of life. Although traffic calming includes traffic education, enforcement, and engineering (the three E's), most traffic calming applications focus on engineering measures to change driver behavior (such as encouraging vehicles to travel at a lower rate of speed).

Specific engineering applications of traffic calming include:

- Horizontal deflection of the roadway, such as bulbouts, chicanes, or roadway narrowing
- Vertical deflection of the roadway, including raised crosswalks, raised or textured intersections, or speed tables
- Traffic control devices, such as roundabouts or traffic circles

Traffic calming could be encouraged within Yucca Valley on neighborhood streets and other areas where high levels of pedestrian activity and use of alternative modes of travel are envisioned.

CIRCULATION ELEMENT RECOMMENDATIONS

The information presented above and in Chapter 3 was utilized to develop a series of recommendations for incorporation into the Town of Yucca Valley's Circulation Element as part of the General Plan effort. These recommendations are summarized below:

CONSTRAINTS BASED PLANNING

This will be a key approach for the Town, as the Town does not have significant funding to implement extensive infrastructure in the future. As such, this will provide the Town flexibility in identifying desired service levels, but provide "protection" for locations that may not be able to maintain acceptable service levels until appropriate funding is available. Additionally, it will allow for flexible service level standards when there is limited right of way, where a local plan may have more pressing needs, where there are environmental constraints, or when other factors make implementing infrastructure infeasible or undesirable. It is recommended that the Circulation Element incorporate policies and standards that support constraints based planning efforts.

COMPLETE STREETS

Based on state law, the Town is required to implement complete streets as part of the general plan update. It is recommended that the Town implement complete streets through a layered networks approach. Layered networks identify where infrastructure should go to serve the needs of the community. As such, not every street serves every mode; rather each mode has a network of connectivity that serves the users of the system.

Using the layered network approach, the General Plan should identify roadway infrastructure, the bicycle infrastructure, the pedestrian infrastructure, and the transit infrastructure to facilitate those primary users. These are described below:

Roadway Classifications

The following roadway classifications were developed for the Town of Yucca Valley. It is recommended that the roadway infrastructure be implemented using these roadway classifications, as shown in Figure 4-1a. Recommended roadway cross-sections are shown in Figure 4-1b through Figure 4-1d.

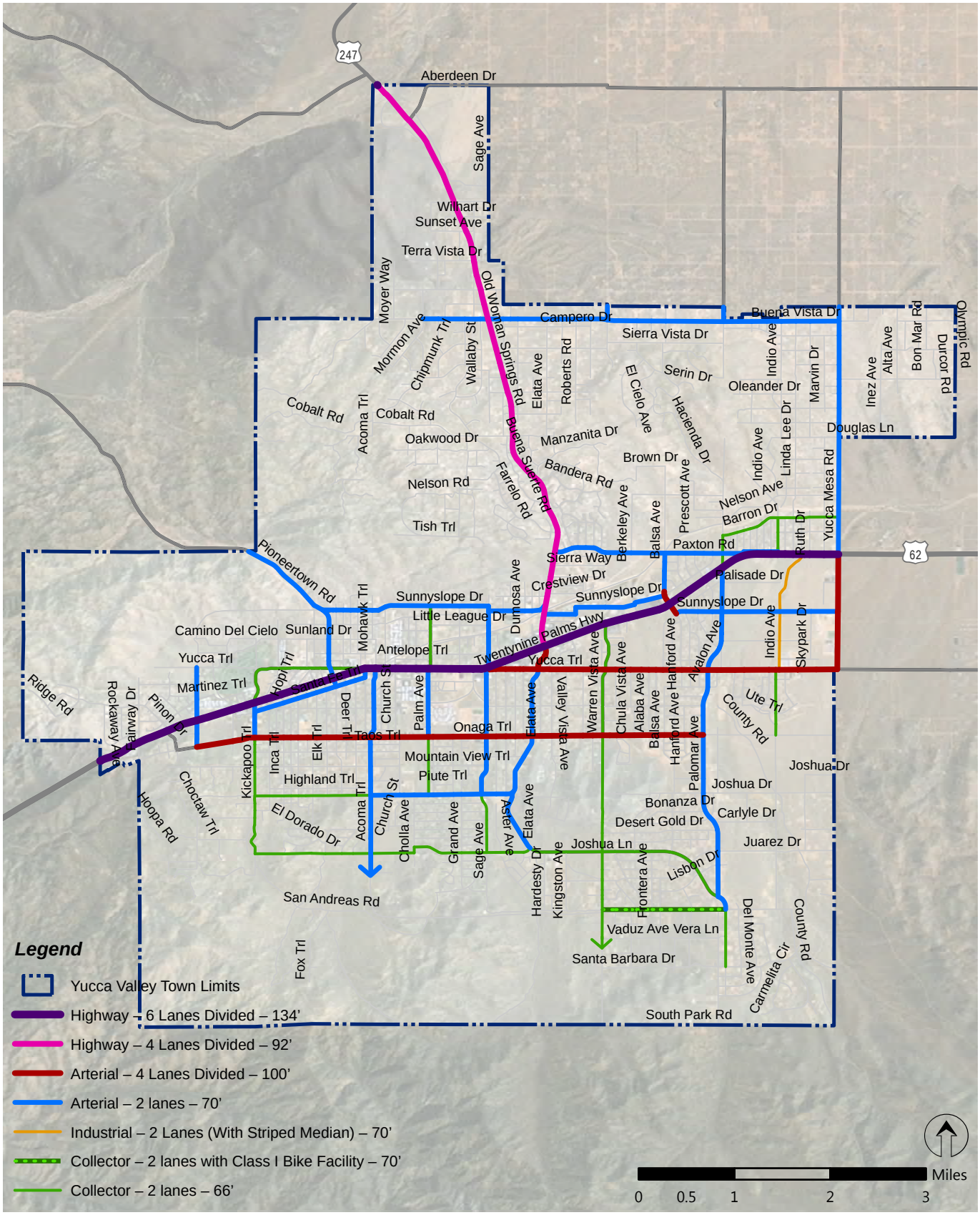
Please note that the roadway cross-sections identified on Figure 4-1a were developed as part of an iterative approach. First, the future year YVTAM model was reviewed to identify where traffic volumes increased such that they would warrant widening based on the volume thresholds for that facility. Then, the intersection assessment along SR-62 was reviewed to identify intersection needs along that facility. Finally, potential new connections were tested in the model to ensure that the facility was sized appropriately.

Figure 4-1b through Figure 4.1d show the recommended Town cross-sections. Although these are not recommended to be included in the General Plan Circulation Element, they are presented as recommendations to the Town specifically to reflect the State's complete streets requirement. Specifically, Fehr & Peers recommended several new cross-sections that would provide a median refuge for pedestrians or sections that provide a Class I bicycle pathway adjacent to the travel way.

Comparisons of the previous General Plan roadway network to the proposed network are summarized in Table 4-1 below.

TABLE 4-1
ROADWAY CLASSIFICATION CHANGES COMPARED TO THE EXISTING GENERAL PLAN

Facility/Segment	Existing General Plan	Proposed General Plan	Justification
SR-247, between SR-62 and Buena Vista Drive	6-Lane Highway	4-Lane Highway	Volumes do not warrant a 6-lane facility
Buena Vista Drive	4-Lane Collector	2-Lane Arterial	Volumes do not warrant a 4-lane facility
Yucca Mesa Road	4-Lane Collector	2-Lane Arterial	Volumes do not warrant a 4-lane facility
Paxton Road	4-Lane Collector	2-Lane Arterial	Volumes do not warrant a 4-lane facility
Sunnyslope Drive	4-Lane Collector	2-Lane Arterial (except adjacent to SR-62, where it is a 4-Lane Arterial)	Except adjacent to SR-62, volumes do not warrant a 4-lane facility
Pioneer Town Road	4-Lane Collector	2-Lane Arterial	Volumes do not warrant a 4-lane facility
Camino del Cielo	4-Lane Collector	2-Lane Arterial	Volumes do not warrant a 4-lane facility
Kickapoo Trail	4-Lane Collector	2-Lane Arterial or Collector	Volumes do not warrant a 4-lane facility
Acoma Trail	4-Lane Collector	2-Lane Arterial	Volumes do not warrant a 4-lane facility
Palm Avenue	2-Lane Collector	2-Lane Arterial or Collector	Additional capacity needed near SR-62
Sage Avenue	4-Lane Collector	2-Lane Arterial or Collector	Volumes do not warrant a 4-lane facility
Joshua Lane	4-Lane Arterial	4-Lane Arterial or 2-Lane Arterial	Volumes do not warrant a 4-lane facility south of Yucca Trail
Avalon Avenue/ Palomar Avenue	4-Lane Collector	2-Lane Arterial	Volumes do not warrant a 4-lane facility
La Contenta Road	4-Lane Collector	4-Lane Arterial	Volumes warrant additional capacity
Santa Fe Trail	4-Lane Collector	2-Lane Arterial	Volumes do not warrant a 4-lane facility
Yucca Trail, west of SR-62	2-Lane Industrial	4-Lane Arterial	Volumes warranted a 4-lane facility
Yucca Trail, east of Indio Avenue	4-Lane Collector	4-Lane Arterial	Volumes warranted additional capacity
Connectivity to Sections 13 and 15	2-Lane Collector	N/A	Connectivity addressed in the policy section of the element



Yucca Valley Circulation Element - Transportation Impact Study

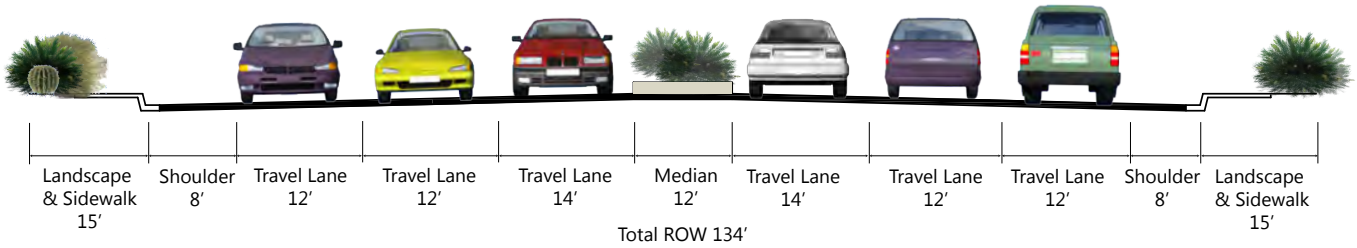
FEHR PEERS

Proposed Roadway System

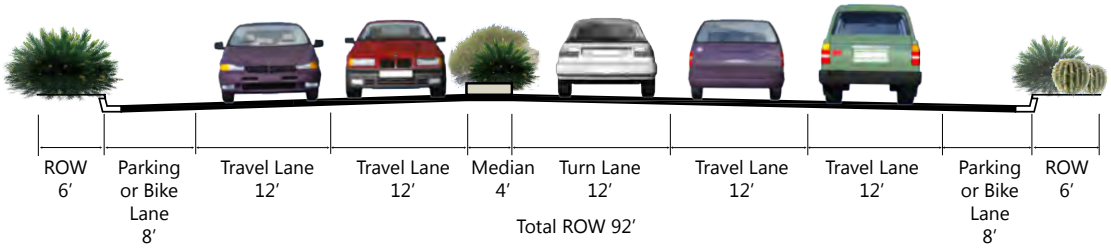
Path: W:\Orange County N Drive\PROJECTS\OC11\0177 - Yucca Valley General Plan\Graphics\GIS\MXD\TIS_Fig_4-1_RoadwayClassification.mxd

Figure 4-1

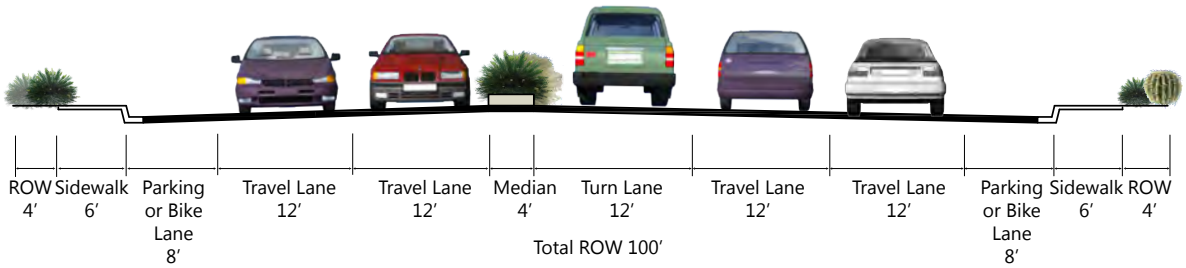
HIGHWAY - 6 LANES DIVIDED



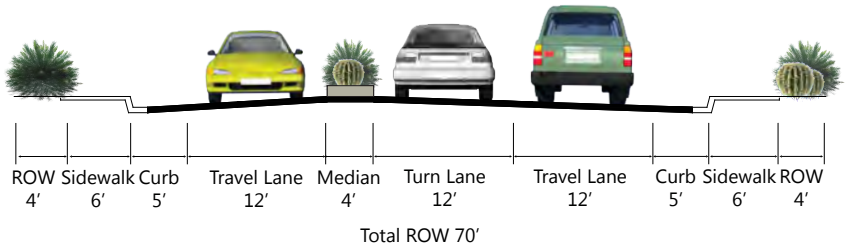
HIGHWAY - 4 LANES DIVIDED



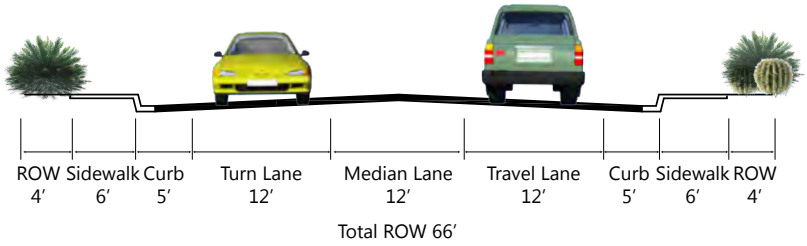
ARTERIAL- 4 LANES DIVIDED



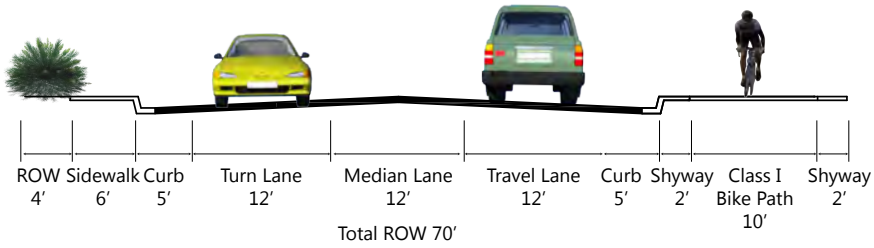
ARTERIAL - 2 LANES DIVIDED



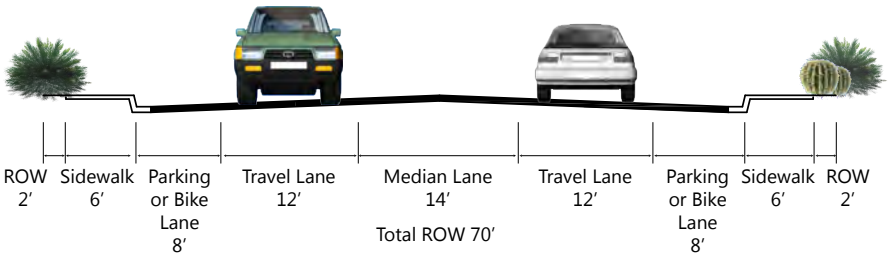
COLLECTOR - 2 LANES (WITH OPTIONAL STRIPED MEDIAN LANE)



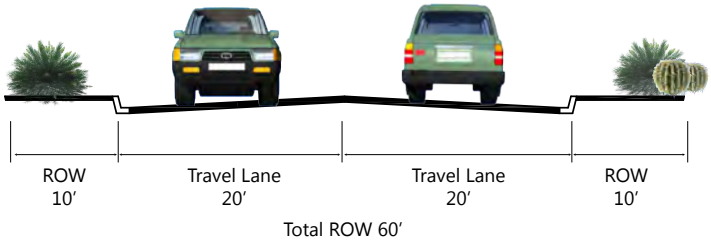
COLLECTOR WITH CLASS I BIKE PATH - 2 LANES (WITH OPTIONAL STRIPED MEDIAN LANE)



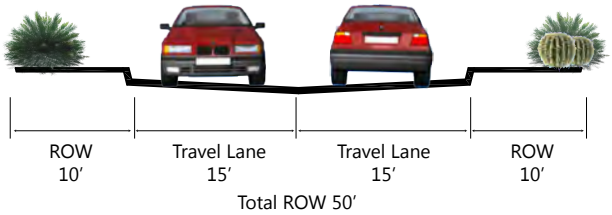
INDUSTRIAL - 2 LANES (WITH STRIPED MEDIAN LANE)



LOCAL



RURAL LOCAL



Arterial Roadways / Highways (Two, Four, or Six Lanes)

Paved roadways that are designed to move large volumes of traffic and provide a high level of mobility between major residential, employment, and activity centers. These facilities also provide regional mobility, connecting different portions of the region to each other through the Town of Yucca Valley. These roadways may or may not include a Class II bicycle lanes.

Collector Roadways (Two Lanes)

Paved roadways intended to "collect" traffic and people from local roadways and carry them to arterial roadways and highways. These roadways may or may not include a Class II bicycle lanes.

Collector Roadways With Class I Bicycle Lane (Two Lanes)

Paved roadways intended to "collect" traffic and people from local roadways and carry them to arterial roadways and highways. This Roadway classification also includes a Class I bicycle facility along the route.

Industrial Roadways

Function similarly to Collector Roadways, but they serve industrial areas. As such, they need to be paved and designed to accommodate larger vehicles and larger vehicle turning radii.

Local Streets

Serve predominantly residential adjacent properties and should enhance community livability. Speeds should be low and these facilities should discourage through traffic use. Local streets can be either paved or unpaved, depending on the type of development they serve, the amount of development they serve, and the total traffic volumes expected on these facilities.

Unpaved (Rural Local) Roadways

Low volume roadways that serve limited development in low density areas of the Town.

The above roadways should be evaluated using state-of-the-practice techniques to evaluate the capacity of each facility. The actual operations of these facilities are identified using the terminology "Level of Service."

Level of service is a general measure of traffic operating conditions whereby a letter grade, from Level of Service (LOS) A (no congestion) to F (high levels of congestion), is assigned. LOS E represents "at capacity" operations.

These grades represent the perspective of drivers and are an indication of the comfort and convenience associated with driving as well as speed, travel time, traffic interruptions, and freedom to maneuver. The level of service grades are generally defined as follows:

- LOS A represents free flow travel for vehicles. Individual users are virtually unaffected by others in the traffic stream.

- LOS B represents stable flow, but the presence of other users in the traffic stream begins to be noticeable.

- LOS C represents a range in which the influence of traffic density on operations becomes noticeable. The ability to maneuver within the traffic stream and to select an operating speed is now clearly affected by the presence of other vehicles.

- LOS D borders on unstable flow. Speeds and ability to maneuver are severely restricted because of traffic congestion.

- LOS E represents unstable operating conditions at or near the capacity level where maneuverability is severely limited.

- LOS F is used to define forced or a breakdown traffic flow where unsignalized and signalized intersections exceed 50 and 80 seconds of delay, respectively.

Table 4-2 identifies the LOS thresholds for each roadway classification for the Town of Yucca Valley. The capacities in the table are consistent with the *Highway Capacity Manual* (Transportation Research Board, 2000) and are considered state of the practice for identifying capacity of facilities. It should be noted the threshold for identifying the capacity of an unpaved road is based on the Federal Highway Aministration's recommendations for when facilities should be paved.

Bicycle Network

Bicycle facilities consist of Class I, Class II, and Class III facilities. Currently, the Town only has Class III facilities as summarized in the *Existing Conditions Report - Yucca Valley General Plan Update (*April 2012, Fehr & Peers).

Recommended bicycle facilities are shown on Figure 4-2. Please note that bicycle routes should be updated as part of a master plan effort and the proposed network may change with future master plans.

Class I

Bike path providing completely separated right-of-way designated to the exclusive use of bicycles and pedestrians.

In Yucca Valley, Class I facilities will primarily be implemented through the Parks and Recreation Master Plan (2008). Future bicycle facilities have also been identified through SANBAG's Non-Motorized Transportation Plan (2011).

Class II

Bikeway that provides designated lanes for the use of bicycles through the use of striping on the roadway and signage designations for the facility.

In Yucca Valley, this General Plan and the San Bernardino County Non-Motorized Transportation Plan envision a system of bicycle lanes on roadways that will connect the activity centers of the Town to the Town's residents as shown on Figure 4-2.

TABLE 4-2
DAILY ROADWAY SEGMENT CAPACITY

Facility Type	LOS A	LOS B	LOS C	LOS D	LOS E
Unpaved Road	-	-	-	500	-
Local Road	-	-	-	1,500	2,000
Collector	900	2,000	6,800	14,100	17,400
Industrial	900	2,000	6,800	14,100	17,400
Arterial (2-lanes, undivided)	-	-	9,700	17,600	18,700
Arterial / Highway (4-lanes, undivided)	-	-	17,500	27,400	28,900
Arterial / Highway (4-lanes, divided)	-	-	19,200	35,400	37,400
Arterial / Highway (6-lanes, divided)	-	-	27,100	53,200	56,000

Source: 2000 Highway Capacity Manual, FHWA Guidelines for Roadway Paving.

Class III

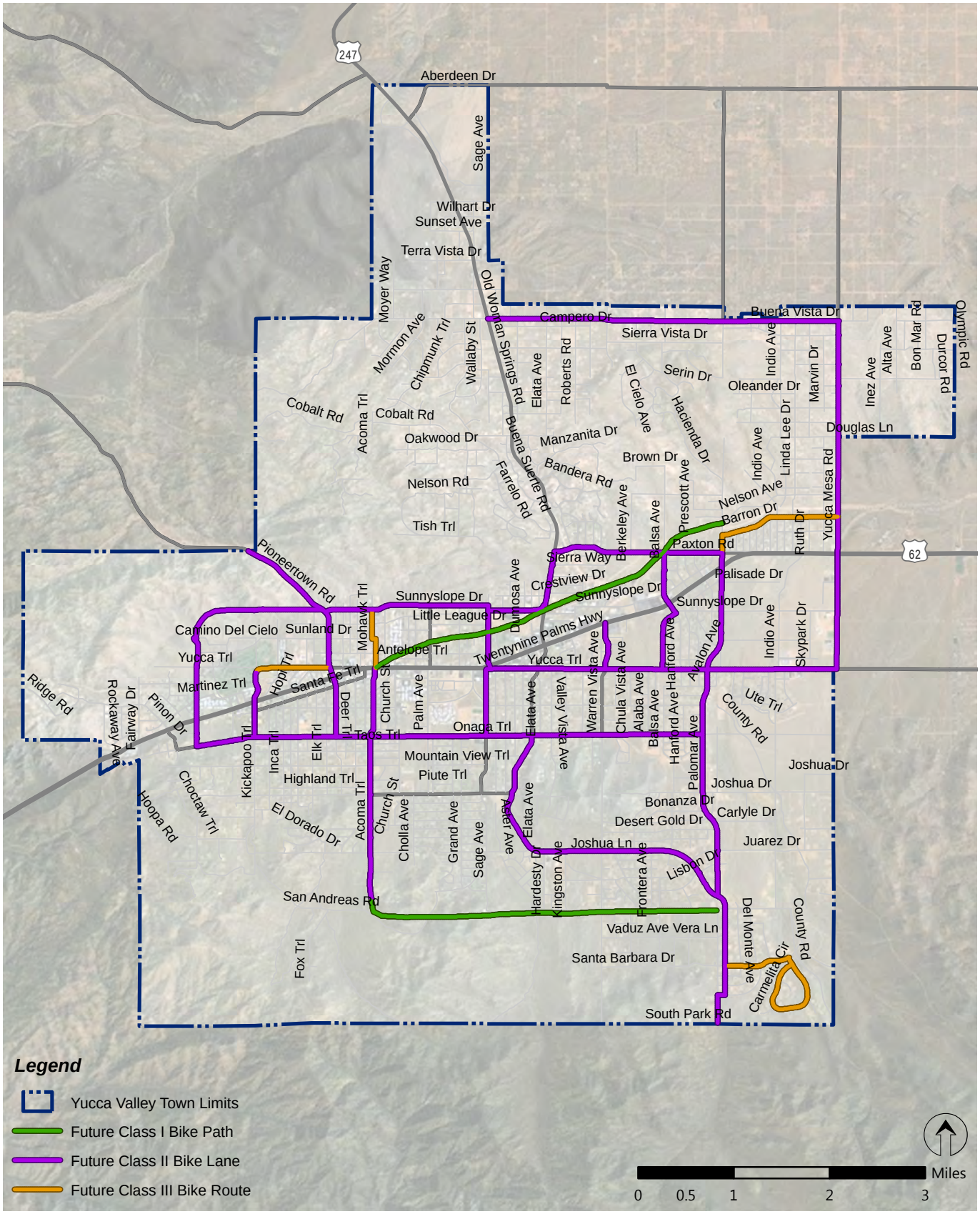
Bikeway providing route designation by signage. Roadways are shared between the bicycle and the motorists.

In Yucca Valley, Class III facilities are envisioned to be implemented on small segments of roadway that bridge gaps in the Class II and Class I roadway network. This includes Class III facilities on Yucca Trail, Baron Drive, and several other roadways as shown on Figure 4-2

PEDESTRIAN NETWORK

The pedestrian network is primarily developed as part of the roadway and trail systems of a town and reflects the interconnected nature of circulation and transportation systems as a whole. Constructing big, wide streets increases the distance a pedestrian must travel to cross a street, thereby making it inconvenient for public use. This inhibits pedestrian circulation in the Town. Currently, limited continuous sidewalks are provided along major routes in the Town. Sections of discontinuous sidewalks exist, but most roads throughout Yucca Valley lack sidewalks.

The Parks and Recreation Master Plan (2008) identified future recreational and bike trails within the Town that would not only provide recreation opportunities but could also be used to connect the pedestrian network throughout Town. In addition to connecting available pedestrian resources the Town should also prioritize the completion of sidewalks along retail land uses to better provide accessibility for pedestrians.



Yucca Valley Circulation Element - Transportation Impact Study

FEHR PEERS

Proposed Bicycle Network

Path: W:\Orange County N Drive\PROJECTS\OC11\0177 - Yucca Valley General Plan\Graphics\GIS\MXD\TIS_Fig_4-2_Future_Bicycle.mxd

Figure 4-2

Enhanced pedestrian crossings and sidewalks should also be considered in areas where high pedestrian demand occurs (such as schools) and pedestrians should be prioritized in the Old Town Specific Plan Area.

Multi-use trails are primarily identified in the Town's Trails Master Plan. Multi-use trails are facilities that can be used by bicycles, pedestrians, equestrians, and other recreational users within the Town.

Figure 4-3 identifies recommended improvements to the pedestrian system in the Town. Please note that, if the Town ever completes a pedestrian master plan, that effort would supercede the improvement noted on Figure 4-3.

TRANSIT NETWORK

As described above, the Town's transit network is primarily serviced by MBTA. It is recommended that the Circulation Element identify policies that are consistent with MBTA direction and that the Town support MBTA's transit projects in the future.

EFFICIENT GOODS SERVICES AND MOVEMENT

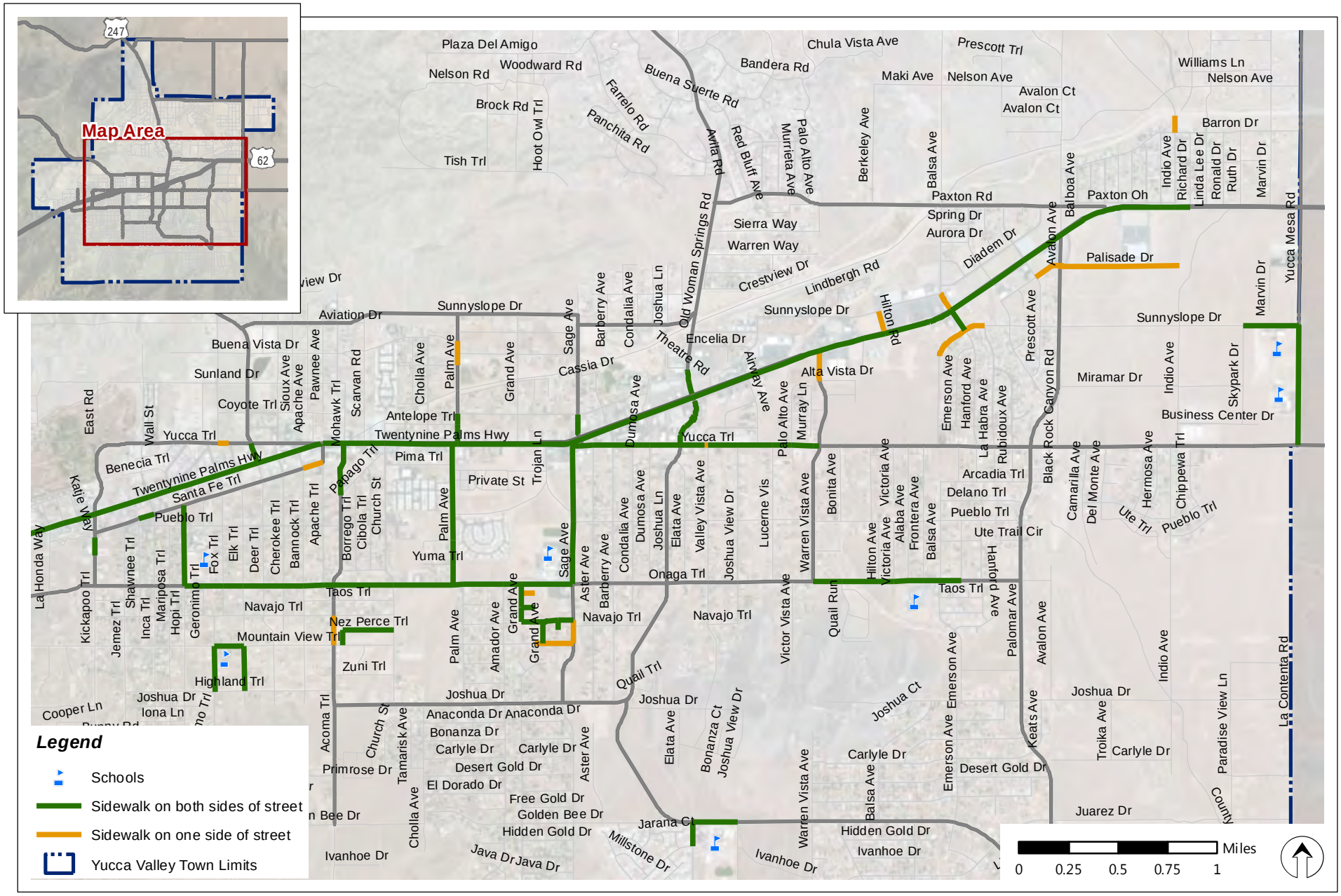
The goods or freight movement system in Yucca Valley consists of designated truck routes. Additionally, the local airport provides opportunities for additional services to be accommodated. Each system is discussed below as it relates to the operation and service of these facilities.

Please note that the movement of goods and services is also addressed in some of the discussions above. For example, specific roadway classifications have been developed for areas served by truck traffic. Additionally, when considering complete streets, truck traffic should also be considered along key corridors where truck traffic is expected.

Additionally, the Town is located near a Marine Base located just north of Twentynine Palms. As such, many of the state routes serve for the movement of military goods through the town.

Truck Routes

The Yucca Valley Municipal Code (Chapter 12, Section 30) regulates truck routes within the Town. The Municipal Code defines truck routes within the Town, weight restrictions, and specifies the ability of trucks to enter areas not designated as truck routes. Roadways in the system that are not designated truck routes are restricted to trucks under five tons only, with the exception of vehicles when making pickups or deliveries within the Town limits. Truck route, primarily on SR-62 and SR-247, in Town are shown on Figure 4-4.



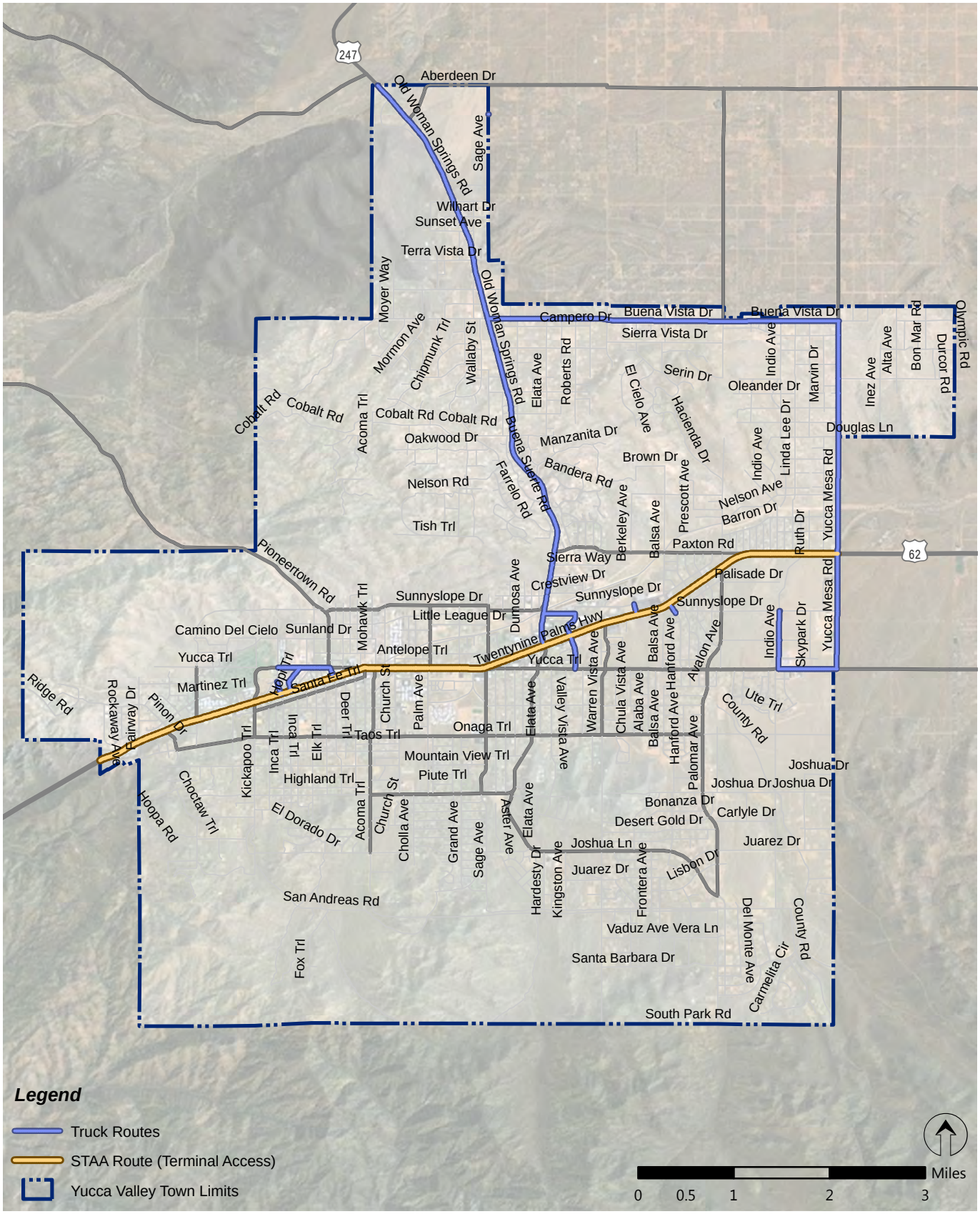
Yucca Valley Circulation Element - TIA

FEHR PEERS

Future Sidewalk Facilities

Path: \\fpainc.local\Dfs-ent-data\Orange County N Drive\PROJECTS\OC11\0177 - Yucca Valley General Plan\Graphics\Circ Elem\1.22.13\Fig_2B_SidewalksFU.mxd

Figure 4-3



Yucca Valley Circulation Element - Transportation Impact Study

FEHR PEERS

Designated Truck Routes

Path: W:\Orange County N Drive\PROJECTS\OC11\0177 - Yucca Valley General Plan\Graphics\GIS\MXD\TIS_Fig_2-6_TruckRoutes.mxd

Figure 4-4

Aviation Facilities

Yucca Valley is home to Yucca Valley Airport, a privately-owned airport available to the public for private aircraft and aircraft maintenance and flight training. The closest airport offering commercial flights is the Palm Springs International Airport, approximately 30 miles south of Yucca Valley. This airport provides nonstop service primarily to the Western United States and Canada. MBTA routes 12 and 15 have a stop at the Palm Springs International Airport.

It is recommended that various elements in the General Plan reflect the continued use of the airport and that planning does not conflict with future uses at the airport.

TRAFFIC MANAGEMENT

There are three common ways for cities and towns to better manage traffic:

- Traffic Calming on Neighborhood Streets;
- Traffic Signal Coordination; and
- Paving Non-Paved Roadways.

Currently, the Town has implemented signal timing improvements to improve the efficiency of their system. Effectively, signal timing improvements consists of retiming the traffic signals to improve vehicle progression through the Town (e.g. drivers will encounter few stops and will experience a more consistent speed). However, the Town has limited traffic calming applications on public streets, and the Town has a significant amount of unpaved roadways that will require paving if future development is to occur.

Traffic Calming

Traffic calming includes traffic education, enforcement, and engineering (the three E's), in an effort to reduce vehicle speeds, improve safety, and enhance quality of life. Although traffic calming does include education and enforcement, most traffic calming applications focus on engineering measures to change driver behavior (such as encouraging vehicles to travel at a lower rate of speed).

Applications of traffic calming include:

- Improvements to the roadway, such as curb extensions (e.g. extending the curb at intersections to reduce the pedestrian crossing distance and narrow the roadway), chicanes (mid-block curb extensions to narrow the roadway), raised crosswalks, raised or textured intersections, or speed humps; and
- Modifying appropriate intersections to remove traffic signals or stop signs and construct roundabouts or traffic circles.

Traffic calming should be encouraged within the Town on local and paved neighborhood streets and other areas where high levels of pedestrian activity take place (such as the Civic Center, schools, parks, and Old Town). This will assist the Town on improving the quality of life for its residents by managing the speed of traffic in appropriate areas.

Traffic Signal Coordination

One of the most cost-effective means to enhance traffic flow, improve safety, improve air quality, and manage traffic speeds is through signal coordination. This approach develops specific signal timings and implements appropriate signal control infrastructure to reduce the number of stops and improve vehicle progression through a corridor.

Paving Non-Paved Roadways

Using the capacities identified in Table 4-2, the Town should work with future development to identify appropriate roadways that should be paved. Paving roadways will reduce air-particulates, reduce noise, and improve mobility for the Town.

RECOMMENDED GOALS AND POLICIES

The following goals and policies are recommended for the Town of Yucca Valley. They reflect the information described above and the information described in previous chapters. The implementation of these goals and policies will provide direction and form the key implementation approach for implementing the Circulation Element within the Town.

Please note that one item identified during the modeling for this effort was the increase in traffic, both local and regional in nature, on SR-62. Although not identified in the Circulation element or the policies below, the Town may want to consider future investigationof a Town bypass to remove regional traffic from the local transportation system.

KEY TRANSPORTATION GOAL

Balance the needs for goods movement, non-automotive use, and complete streets to implement a constraints-based circulation system.

RECOMMENDED TRANSPORTATION POLICIES

Policy C 1-1 Utilize constraints based process to evaluate future transportation improvements.

Policy C1-2 Update the transportation impact mitigation fee program to assist in implementing the transportation system for expanding its roadway capacity, pedestrian sidewalk facilities, bicycle facilities, and trail facilities as appropriate.

Policy C 1-3 Strive to maintain vehicle level of service (LOS) D on all roadways within the Town. The Town will utilize the roadway capacities, as identified in Table 4-2, to evaluate roadway operations.

Policy C 1-4 Develop and maintain a list of protected intersections and roadways, adopted by Town Council, where the Town will not implement vehicle capacity to maintain the service goal outlined in Table 4-2 in support of Policy C 1-1.

Policy C 1-5 Coordinate with regional agencies to pursue additional funding to improve the Town's circulation infrastructure.

Policy C 1-6 Prioritize low-cost transportation enhancements, such as signal timing improvements, to maximize the Town's return on infrastructure investment related to the efficiency of the transportation system.

Policy C 1-7 Protect right of ways for SR-62 and SR-247, major arterials, collectors, residential streets, and for all other planned infrastructure as shown on the figures above.

Policy C 1-8 The Town shall implement a layered network of complete streets by working with adjacent land owners, regional agencies, and the public to implement the following:

- The Town Trails Master Plan
- Pedestrian network gap closures
- Bicycle infrastructure
- Or as updated by future Planning Documents related to pedestrians or bicycles

Policy C 1-9 Pursue outside funding opportunities to improve pedestrian facilities near schools (such as Safe-Routes-To-School (SR2S) funding).

Policy C 1-10 Encourage MBTA to provide enhanced bus service to employment areas outside of the Town, such as the Coachella Valley or the rest of the Inland Empire.

Policy C 1-11 Coordinate with MBTA and area religious facilities to consider opportunities for implementing park-and-ride facilities.

Policy C 1-12 Encourage MBTA to implement regional transportation solutions that will reduce vehicle miles traveled and greenhouse gas emissions.

Policy C 1-13 Work with new development to implement MBTA's *Transit Guidelines in Project Development* (MBTA, 2005) as appropriate.

Policy C 1-14 Encourage development designs that integrate multiple modes of access including pedestrian, cyclist, and public transportation.

Policy C 1-15 Encourage employers to support Transportation Demand Management techniques, such as bus transit passes or other measures that reduce the reliance of the single occupant vehicle.

Policy C 1-16 Maintain truck route designations to support heavy vehicle use to and from the Yucca Valley Airport.

Policy C 1-17 Design designated truck routes such that the pavement, roadway width, and curb return radii support anticipated heavy vehicle use.

Policy C 1-18 Coordinate with the Yucca Valley Airport District to provide appropriate level of supporting transportation infrastructure connecting to the Yucca Valley Airport.

Policy C 1-19 Support and work with Caltrans to coordinate signals along SR-62 and SR-247 in Town.

Policy C 1-20 Pursue funding to implement and maintain signal coordination through SANBAG, the Air Quality Management District, or other potential funding sources.

Policy C 1-21 Consider traffic calming techniques in residential neighborhoods and in the Old Town Specific Plan Area to slow and manage traffic volumes and speeds as deemed appropriate by the Town Engineer.

Policy C 1-22 Require future development to pave roadways that will serve 500 or more daily trips as noted in Table 4-2 unless paving of that facility is infeasible, there is no funding for the improvement, or when the majority of the residents on that facility desire it to be unpaved.

Policy C 1-23 Pursue funding to pave un-paved roadways where the traffic volume exceeds 500 daily trips unless paving of that facility is infeasible or when the majority of the residents on that facility desire it to be unpaved.

Policy C 1-24 Maintain truck route designations to support heavy vehicle use as noted on Figure 4-4.

Policy C 1-25 Work with future development and increased traffic in Sections 5, 13, and 15 of the Town to implement appropriate roadway, bicycle, and pedestrian connectivity to these areas based on the proposed land uses.

Policy C 1-26 Implent sidewalks concurrent with new development where commercial uses are planned, school uses are planned, where residential densities exceed two units per acre, or where required by the Town engineer.

Policy C 1-27 Investigate utilization of a non-toxic soil stabilizer on unpaved facilities to minimize dust emissions.

(5) IMPACT ASSESSMENT

This chapter is intended to document the results of the environmental impacts associated with the General Plan on the circulation system. It builds off of the existing conditions described earlier in this report, but also includes a regulatory framework, future conditions operations assessment, identified environmental impacts, and mitigation measures recommended for the project.

REGULATORY FRAMEWORK

The regulatory framework is used to inform decision makers about the regulatory agencies/policies that affect transportation in the Town. This enables them to make informed decisions about planning improvements to transportation systems in the Town. This document includes a discussion of funding as well as regulation. Major policy documents impacting the transportation system in the Town of Yucca Valley include laws at the federal and state level, and planning documents at a regional level.

FEDERAL REGULATIONS

In 1982, the federal government passed the Surface Transportation Assistance Act (STAA). This act requires states to allow larger trucks on the "National Network", which is comprised of the Interstate System plus the non-Interstate Federal-Aid Primary System. "Larger trucks" include (1) doubles with 28.5 foot trailers, (2) singles with 48-foot semi-trailers and unlimited kingpin-to-rear axle (KPRA) distance, (3) unlimited length for both vehicle combinations, and (4) widths up to 102 inches. State Route 62 and State Route 247 in the Town of Yucca valley are defined as STAA routes.

STATE REGULATIONS

AB 1358 – Complete Streets Act

The California Complete Streets Act of 2008 was signed into law on September 30, 2008. Beginning January 1, 2011, AB 1358 required circulation elements to address the transportation system from a multi-modal perspective. The bill states that streets, roads, and highways must "meet the needs of all users…in a manner suitable to the rural, suburban, or urban context of the general plan." Essentially, this bill requires a circulation element to plan for all modes of transportation where appropriate – including walking, biking, car travel, and transit.

The Complete Streets Act also requires circulation elements to consider the multiple users of the transportation system, including children, adults, seniors, and the disabled. For further clarity, AB 1358 tasks the Governor's Office of Planning and Research to release guidelines for compliance with this legislation by January 1, 2014.

AB 32 – Global Warming Solutions Act

With the passage of the Global Warming Solutions Act of 2006, the State of California committed itself to reducing greenhouse gas (GHG) emissions to 1990 levels by 2020. The California Air Resource Board (ARB), which is coordinating the response to comply with AB 32, is currently on schedule to meet this deadline.

In 2007, ARB adopted a list of early action programs that could be put in place by January 1, 2010. In 2008, ARB defined its 1990 baseline level of emissions, and by 2011 it completed its major rule making for reducing GHG emissions. Rules on emissions, as well as market-based mechanisms like the proposed cap and trade program, came into effect January 1, 2012. The cap and trade program controls pollution by a governing agency selling permits on the amount of pollutants a firm can emit. A firm's pollutants cannot exceed the limit. Firms requiring the need to increase their emissions must purchase permits from other firms requiring fewer permits.

SB 375

On December 11, 2008, the ARB adopted its Proposed Scoping Plan for AB 32. This scoping plan included the approval of SB 375 as the means for achieving regional transportation-related GHG targets. SB 375 provides guidance on how curbing emissions from cars and light trucks can help the state comply with AB 32.

There are five major components to SB 375. First, SB 375 will address regional GHG emission targets. ARB's Regional Targets Advisory Committee will guide the adoption of targets to be met by 2020 and 2035 for each Metropolitan Planning Organization (MPO) in the State. These targets, which MPOs may propose themselves, will be updated every eight years in conjunction with the revision schedule of housing and transportation elements.

Second, MPOs will be required to create a Sustainable Communities Strategy (SCS) that provides a plan for meeting regional targets. The SCS and the Regional Transportation Plan (RTP) must be consistent with each other, including action items and financing decisions. If the SCS does not meet the regional target, the MPO must produce an Alternative Planning Strategy that details an alternative plan to meet the target.

Third, SB 375 requires that regional housing elements and transportation plans be synchronized on eight-year schedules. In addition, Regional Housing Needs Assessment (RHNA) allocation numbers must conform to the SCS. If local jurisdictions are required to rezone land as a result of changes in the housing element, rezoning must take place within three years.

Fourth, SB 375 provides CEQA streamlining incentives for preferred development types. Residential or mixed-use projects qualify if they conform to the SCS. Transit oriented developments (TODs) also qualify if they 1) are at least 50% residential, 2) meet density requirements, and 3) are within one-half mile of a transit stop. The degree of CEQA streamlining is based on the degree of compliance with these development preferences.

Finally, MPOs must use transportation and air emission modeling techniques consistent with guidelines prepared by the California Transportation Commission (CTC). Regional Transportation Planning Agencies, cities, and counties are encouraged, but not required, to use travel demand models consistent with the CTC guidelines.

REGIONAL REGULATIONS

Southern California Association of Governments Regional Transportation Plan/Sustainable Communities Strategy

The Southern California Association of Governments (SCAG) Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) provides a regional transportation plan for five counties in Southern California: San Bernardino, Riverside, Los Angeles, Ventura and Imperial. The primary goal of the RTP is to increase mobility for the region. With recent legislation, this plan also encompasses sustainability as a key principle in future development.

San Bernardino Congestion Management Program

The Congestion Management Program (CMP) defines a network of state highways and arterials, level of service standards and related procedures, and provides technical justification for the approach. The CMP for San Bernardino County was originally adopted in 1992 and updated most recently in 2007.

For consistency with the CMP, CMP designated roadways in the Town (SR-62 and SR-247) should operate at "the middle of LOS D or better". Additionally, during the CMP monitoring process, if any CMP facility is identified as operating at a deficient level, a deficiency plan would be required to restore operations back to an acceptable level.

Traffic Impact Analysis Requirements

A key element of the current Land Use/Transportation Analysis Program of the CMP is the Traffic Impact Analysis Report (TIA Report), to be prepared by local jurisdictions. The TIA Reports are designed to provide an improved basis for assessing the impacts of land use decisions on the regional transportation system, both within and outside the permitting jurisdictions, by providing a consistent format to identify impacts and mitigations, and to evaluate mitigation costs. All TIA Reports prepared by local jurisdictions shall be copied to the CMA. TIA reports shall be prepared for projects when required by local thresholds and criteria, but must be prepared for land use decisions that are equal to or greater than half the thresholds for regional review defined by the California Environmental Quality Act (CEQA). If it is determined that a CMP TIA Report is required, the entity with local land use authority shall prepare or cause to be prepared a Traffic Impact Analysis Report consistent with the procedure and methodology specified in Appendix C of CMP and the local jurisdiction's Land Use/Transportation Analysis Program.

If it is determined that a project qualified for the preparation of a TIA Report but no report was prepared, adjacent potentially impacted jurisdictions, SANBAG, or Caltrans may request that such a report be prepared, even though it may be after-the-fact. The permitting jurisdiction shall prepare, or cause to be prepared, a TIA Report in order to determine appropriate mitigation measures and financial responsibilities for resolution of the ongoing CMP system impacts and for developing appropriate mitigations for future development projects.

In Yucca Valley, two roadways are designated by CMP as part of regional transportation system. These include:

- SR-62
- SR-247

San Bernardino County Non-Motorized Transportation Plan

SANBAG developed the Non-Motorized Transportation Plan (NMTP) in 2001, with the latest update in 2011. The plan is intended to be cohesive and integrated, with a comprehensive pedestrian and bicycle system. The 2011 update is also a response to California Senate Bill 375 (SB 375). The NMTP identifies the following future facilities in Yucca Valley:

- Class I Bicycle Trails
    - San Andreas Trail
    - Yucca Wash Trail

- Class II Bicycle Lanes
    - Acoma Trail, south of SR-62
    - Avalon Avenue
    - Balsa Avenue
    - Black Rock Canyon Road
    - Buena Vista Drive
    - Camino Del Cielo Trail
    - Joshua Lane
    - Kickapoo Trail
    - Onaga Trail
    - Palomar Avenue
    - Paxton Road
    - Pioneertown Road
    - Sage Avenue
    - San Marino Drive
    - SR-247
    - Sunnyslope Drive, west of Avalon Avenue
    - Warren Vista Avenue
    - Yucca Mesa Road
    - Yucca Trail, east of SR-62
- Class III Bicycle Routes
    - Sunnyslope Drive, east of Avalon Avenue
    - Acoma Trail, north of SR-62
    - Yucca Trail, west of SR-62
    - Carmelita Circle

The proposed bicycle network would have connections to the Yucca Valley Bus Transfer Center, Park & Ride Facility, and town-wide bus stops.

Measure I

Measure I is a 30-year program that provides funding for roadway resurfacing, rehabilitation and widening projects, as well as providing funds for elderly and handicap transit services. The original source of funding was a countywide half-cent sales tax that was passed by the voters in November 1989. In November 2004, the voters of San Bernardino County approved the extension of this program for 30 years starting in 2010 and extending until 2040 (www.sbcounty.gov). The new measure is referred to as Measure I 2010-2040 to distinguish it from the first Measure I.

The Measure I program also provides a framework for funding various roadway and transit improvement projects that are listed under the Nexus Study and Capital Improvement Program.

LOCAL REGULATIONS AND PLANS

Old Town Yucca Valley Specific Plan

The Town of Yucca Valley approved the Old Town Yucca Valley Specific Plan in December 2007. With this Specific Plan, the Town of Yucca Valley intends to improve the economic vitality and livability of the Old Town area by establishing comprehensive strategy to attract and expand economic activity and commerce. The purpose of the Old Town Yucca Valley Specific Plan is to identify key opportunities to enhance the Town's overall economic base and the historic Old Town area.

This plan outlines a new alignment of SR-62 to create a downtown along the existing alignment of SR-62. The proposed new street, Main Street, would replace the existing alignment of SR-62 between Yucca Trail and Kickapoo Trail, in which the proposed SR-62 alignment would follow. The improvements to the 250 acre plan area include the mentioned road improvements as well as providing a diversity of housing opportunities, high-quality architectural design of surrounding buildings, and a pedestrian focused environment along Main Street.

Please note that, given the desire to implement only feasible infrastructure, implementation of the SR-62 realignment is not included in this Circulation Element given the extensive cost of this infrastructure and the limited funding to implement the infrastructure.

Parks and Recreation Master Plan Update

The Town of Yucca Valley adopted a Parks and Recreation Master Plan Update in October 2008. While this plan predominantly focuses on parks and other recreational facilities, it also includes a trails plan for bicyclists and pedestrians, which are generally consistent with the SANBAG NMTP. In Yucca Valley, the following trails and bicycle facilities are proposed:

- Class I Equestrian Trails and Multi-Use Trails
    - Skyline Ranch Trail
    - Chipmunk Trail
    - Hacienda Trail
    - Yucca Wash Trail
    - Marvin Trail
    - Covington Wash Trail
    - Carmelita Wash Trail
    - Black Rock Wash Trial
    - San Andreas Trail
    - Kickapoo Trail
    - Hoopa Trail
    - Royal Springs Wash Trial
    - Little Morongo Canyon Trail
    - East Burnt Mountain Wash Trail

- Class I Bicycle and Pedestrian Trails
    - Yucca Wash Trail
- Class II Bicycle Lanes
    - Acoma Trail
    - Avalon Avenue
    - Balsa Avenue
    - Black Rock Canyon Road
    - Buena Vista Drive
    - Camino Del Cielo Trail
    - Joshua Lane
    - Kickapoo Trail
    - Onaga Trail
    - Palomar Avenue
    - Paxton Road
    - Pioneertown Road
    - Sage Avenue
    - San Marino Drive
    - SR-247
    - Sunnyslope Drive
    - Warren Vista Avenue
    - Yucca Mesa Road
    - Yucca Trail
- Class III Bicycle Routes
    - Avalon Avenue
    - Barron Drive
    - Carmelita Circle
    - Mohawk Trail
    - Santa Barbara Drive
    - Yucca Trail

As previously discussed, the Trails Master Plan (and other Master Planning efforts) occur more frequently than General Plan updates and, if revised, would provide more recent information than what is summarized above.

FUTURE YEAR (POST-2035) LEVEL OF SERVICE CONDITONS

This section outlines the geographic scope of the traffic impact analysis, including the study roadways, and the analysis methodologies employed in this study.

FUTURE FORECASTING

A detailed travel demand model was used to evaluate growth within the Town of Yucca Valley and the region. The San Bernardino Traffic Analysis Model (SBTAM) utilizes inputs such as land use, travel

behavior, and roadway network characteristics (number of lanes, speed, etc.) to estimate traffic demand on area roadways. The model is calibrated specifically to evaluate San Bernardino County and meets state and federal guidelines for model calibration. The Yucca Valley Traffic Analysis Model (YVTAM) was developed by modifying the 2008 SBTAM, which is a sub-regional model based on the Southern California Association of Governments (SCAG) TransCAD model.

The intent of developing a sub-area model for the Town of Yucca Valley was to create a travel demand model that can be used as a tool in the evaluation of land use scenarios and transportation system alternatives. The model provides the ability to evaluate the transportation system, use performance indicators for land use and transportation alternatives, provide information on regional pass through traffic versus locally generated trips and provide graphical displays of these results.

The SBTAM sub regional model provided a starting point for creating a locally valid sub-area model to which future roadway improvements and land use assumptions can be added. Starting with a regionally valid model ensures the sub-area YVTAM model captures regional traffic flow patterns while the additional detail allows the sub-area model to capture local traffic patterns. YVTAM can then be used to develop traffic volume forecasts to evaluate the transportation improvements needed to accommodate the increase in land use associated with the Yucca Valley General Plan. Having a locally valid sub-area model is a critical step in ensuring a high level of confidence in these resulting traffic volume forecasts.

Future Roadway Network

The future network assumptions incorporated into the travel demand model are consistent with the SCAG RTP funded roadway projects list, the needs identified by comparing the model results to the capacity tables referenced above, and the roadway network identified in the figures above.

As shown, SR-62 is planned to operate as a six lane facility. Other major roads are assumed to be improved and/or paved to provide more connectivity and capacity throughout the network, as shown on the Roadway Classifications map from the proposed General Plan Circulation Element.

Specific roadway improvements that were assumed include:

- SR-62: 6 Lanes though the Town Limits
- SR-247: 4 Lanes north of SR-62 to the Town Limits
- Onaga Trail: 4 lanes from Camino del Cielo to Palomar Avenue
- Yucca Trail: 4 lanes from Sage Avenue to La Contenta Road/Yucca Mesa Road
- Balsa Avenue: 4 lanes from SR-62 to Sunnyslope Drive
- Indio Avenue: Extended from Sunnyslope Drive to Yucca Trail

FUTURE BICYCLE NETWORK

Future bike routes and bike lanes are proposed on major arterials and collectors throughout Yucca Valley according to the *San Bernardino County Non-Motorized Transportation Plan* and the *Yucca Valley Parks and Recreation Master Plan Update*. These plans identify current bicycle facilities throughout the Town and provide policy and implementation strategies for enhancing the networks. The plans are intended to be cohesive and integrated, with a comprehensive pedestrian and bicycle system.

The Town proposes to enhance the bicycle network by upgrading nine existing bike routes to bike lanes and by implementing two new bike paths, nine new segments of bike lanes, and five bike routes to provide connectivity between key uses and destinations. The proposed bicycle network would have connections to the Yucca Valley Bus Transfer Center, Park & Ride Facility, and town-wide bus stops.

FUTURE PEDESTRIAN NETWORK

The *San Bernardino County Non-Motorized Transportation Plan* and the *Yucca Valley Parks and Recreation Master Plan Update* outline several trails available and proposed to the Yucca Valley community. Currently, limited continuous sidewalks are provided along major routes in the Town. Sections of discontinuous sidewalks exist, but most roads throughout Yucca Valley lack sidewalks. It is recommended in the Town General Plan Circulation Element to improve the sidewalk network by providing more connectivity through new sidewalk routes and by making the existing sidewalk network smooth and continuous.

ROADWAY SEGMENT TRAFFIC OPERATIONS

The level of service was calculated for key roadway segments in Yucca Valley's regional roadway system to evaluate General Plan traffic conditions. Daily capacity thresholds in accordance with those described in this document.

According to the Town's recommended circulation policies, LOS "D" is the minimum acceptable level of congestion that should be maintained on a daily basis for any classified roadway within Yucca Valley.

Figure 5-1 shows the forecasted ADT volumes on the Yucca Valley future roadway network. Table 5-1 shows the forecasted traffic volumes, proposed general plan roadway classifications and respective level of service.

TABLE 5-1
FUTURE YEAR (POST-2035) ROADWAY VOLUME AND LOS

Street Name and Segment	Classification	Traffic Volume	V/C	LOS
Acoma Trail				
South of SR-62	2-Lane Arterial	3,530	0.201	C or Better
North of Mountain View	2-Lane Arterial	10,570	0.601	D
South of Joshua Drive	2-Lane Arterial	3,300	0.188	C or Better
Avalon Avenue				
North of Sunnyslope Drive	2-Lane Arterial	5,870	0.334	C or Better
North of SR-62	Collector	10,970	0.778	D
Balsa Avenue				
North of Outer Highway	4-Lane Arterial	11,640	0.329	C or Better
South of SR-62	4-Lane Arterial	23,400	0.661	C or Better
Buena Vista Drive				
West of Yucca Mesa Road	2-Lane Arterial	7,240	0.411	C or Better
East of Balsa Avenue	2-Lane Arterial	7,960	0.452	C or Better
Between Roberts Road and Faith Lane	2-Lane Arterial	10,350	0.588	D
Between Newton Lane and Rowell Road	2-Lane Arterial	13,520	0.768	D
Camino del Cielo Trail				
North of SR-62	2-Lane Arterial	6,870	0.390	C or Better
Joshua Drive				
East of Acoma Trail	2-Lane Arterial	7,860	0.447	C or Better
West of Barberry Avenue	2-Lane Arterial	6,740	0.383	C or Better
East of Emerson Avenue	2-Lane Arterial	2,830	0.161	C or Better
Joshua Lane				
South of Joshua Drive	2-Lane Arterial	10,890	0.619	D
North of Onaga Trail	2-Lane Arterial	9,660	0.549	C or Better
North of Pueblo Trail	2-Lane Arterial	10,580	0.601	D
Between Yucca Trail and SR-62 Outer Highway	2-Lane Arterial	14,070	0.799	D
Kickapoo Trail				
South of SR-62	2-Lane Arterial	6,620	0.376	C or Better

TABLE 5-2
FUTURE YEAR (POST-2035) ROADWAY VOLUME AND LOS

Street Name and Segment	Classification	Traffic Volume	V/C	LOS
La Contenta Road				
South of SR-62	4-Lane Arterial	18,660	0.527	D
North of Yucca Trail	4-Lane Arterial	8,430	0.238	C or Better
Main Street (Proposed)				
East of Cherokee Trail	Collector	7,290	0.517	D
Onaga Trail				
East of Alaba Avenue	4-Lane Arterial, Divided	3,860	0.109	C or Better
East of Elata Avenue	4-Lane Arterial, Divided	6,290	0.178	C or Better
West of Joshua Lane	4-Lane Arterial, Divided	5,380	0.152	C or Better
West of Sage Avenue	4-Lane Arterial, Divided	6,540	0.185	C or Better
East of Acoma Trail	4-Lane Arterial, Divided	3,550	0.100	C or Better
East of Elk Trail	4-Lane Arterial, Divided	5,080	0.144	C or Better
West of Jemez Trail	4-Lane Arterial, Divided	4,370	0.123	C or Better
Palm Avenue				
North of Pueblo Trail	2-Lane Arterial	3,890	0.221	C or Better
Palomar Avenue				
South of Yucca Trail	2-Lane Arterial	14,720	0.836	D
North of Joshua Lane	2-Lane Arterial	5,080	0.289	C or Better
Paxton Road				
East of SR-247	2-Lane Arterial	8,810	0.501	C or Better
Pioneertown Road				
North of SR-62	2-Lane Arterial	9,120	0.518	C or Better
South of the Northern Town Limit	2-Lane Arterial	2,670	0.152	C or Better
Sage Avenue				
North of SR-62	2-Lane Arterial	6,020	0.342	C or Better
South of SR-62	2-Lane Arterial	7,480	0.425	C or Better
North of Onaga Trail	2-Lane Arterial	7,720	0.439	C or Better
Santa Fe Trail				
West of Cherokee Trail	2-Lane Arterial	4,290	0.244	C or Better
East of Kickapoo Trail	2-Lane Arterial	1,660	0.094	C or Better

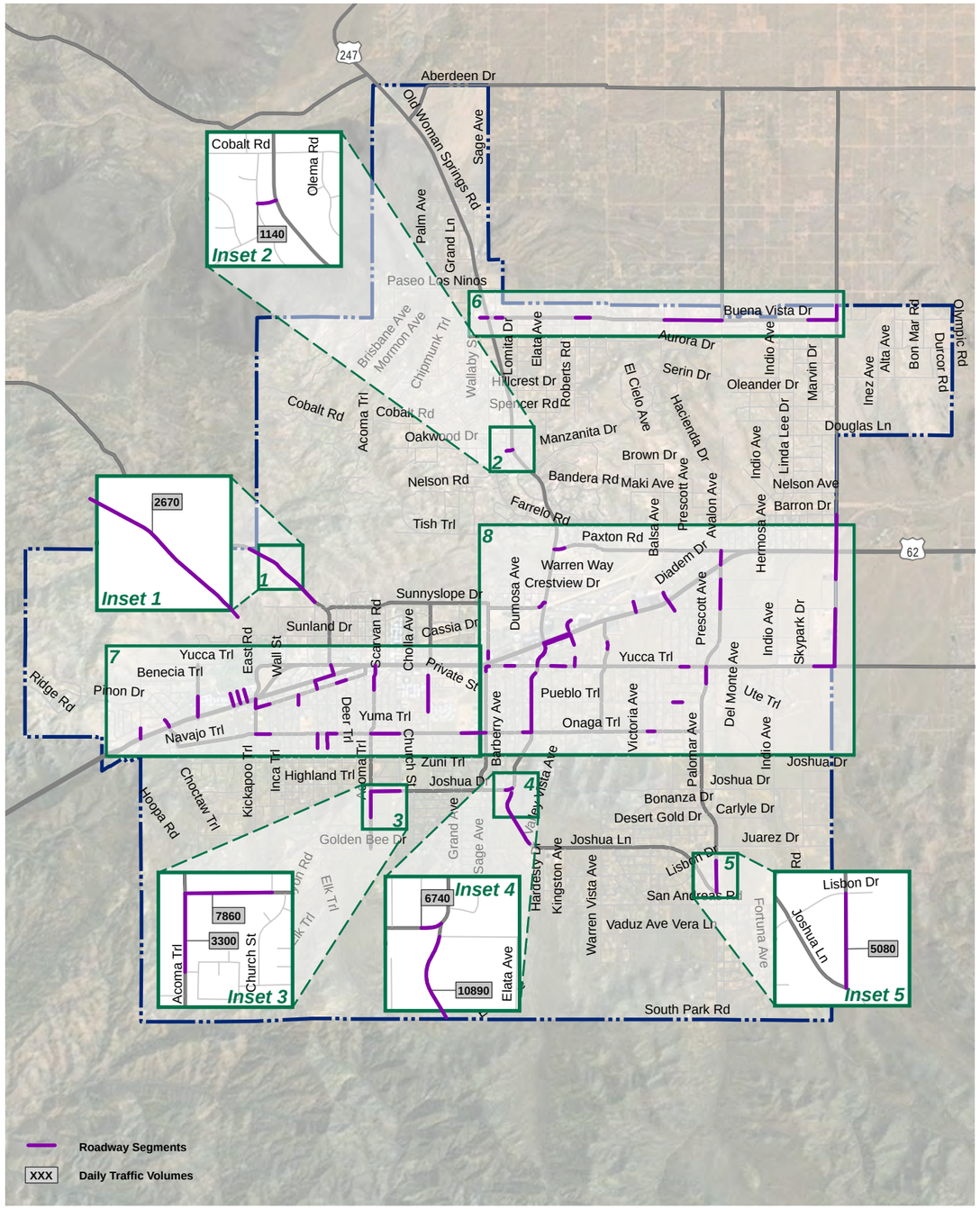
TABLE 5-3
FUTURE YEAR (POST-2035) ROADWAY VOLUME AND LOS

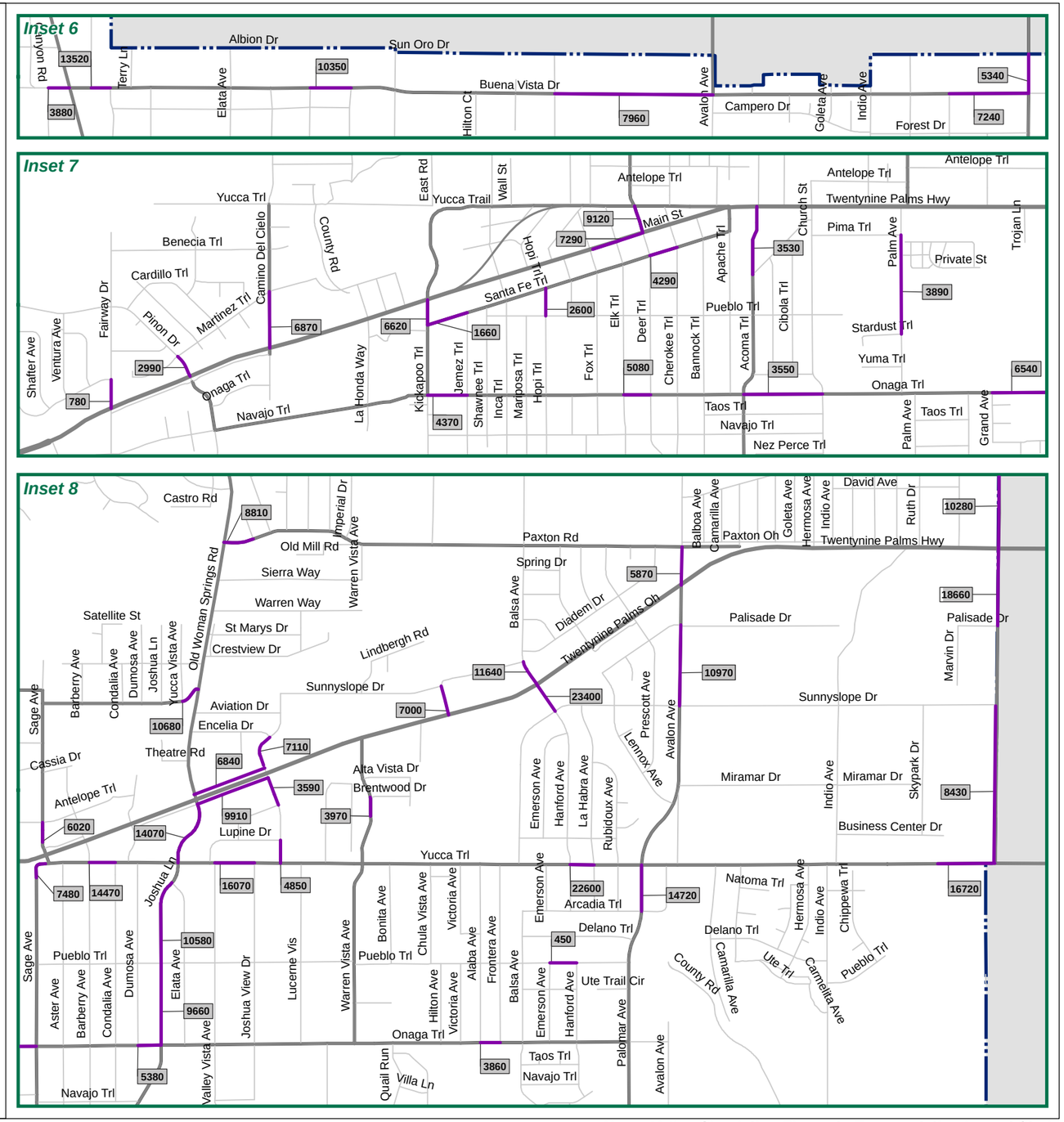
Street Name and Segment	Classification	Traffic Volume	V/C	LOS
Sunnyslope Avenue				
West of SR-247	2-Lane Arterial	10,680	0.607	C or Better
Warren Vista Avenue				
South of SR-62	Collector	3,970	0.282	C or Better
Yucca Trail				
West of La Contenta Road	4-Lane Arterial, Divided	16,720	0.472	C or Better
East of Hanford Avenue	4-Lane Arterial, Divided	22,600	0.638	D
West of Joshua View Drive	4-Lane Arterial, Divided	16,070	0.454	C or Better
West of Condalia Avenue	4-Lane Arterial, Divided	14,470	0.409	C or Better
Yucca Mesa Road				
North of SR-62	2-Lane Arterial	10,280	0.584	C or Better
North of Buena Vista Drive	2-Lane Arterial	5,340	0.303	C or Better

Notes:
1. LOS D Capacity for each roadway classification analyzed are as follows:
   - Collector – 14,100 vehicles per day (vpd)
   - Industrial – 14,100 vpd
   - 2-Lane Arterial – 17,600 vpd
   - 4-Lane Arterial – 35,400 vpd
2. V/C represents the volume to capacity ratio.

Source: Fehr & Peers, 2013.

As shown in Table 5-1, all of the roadways within the Town of Yucca Valley are forecasted to operate at LOS D or better.





Yucca Valley Circulation Element - Transportation Impact Study

FEHR PEERS

Path: N:\Projects\Non_SanJose_Projects\OC Projects\OC11_0177_Yucca_Valley\Fig_2-5_ADT.ai

Future Roadway Segment ADT

Figure 5-1

GENERAL PLAN (2035) CONDITIONS INTERSECTION OPERATIONS

The level of service was calculated for the study intersections to evaluate General Plan traffic conditions. As previously described, LOS D is the maximum acceptable level of congestion that should be maintained at any intersection in Yucca Valley – this is the Town's level of service standards. However, as previously described, the San Bernardino County CMP has its own level of service standards on CMP-designated facilities, which include SR-62 and SR-247. Since CEQA requires consistency with adopted plans and policies (e.g. the Town's proposed policies) and adopted CMP thresholds (e.g. the CMP threshold), but need to be evaluated. Please note that that the CMP threshold in San Bernardino County has been identified as "the middle of LOS D", or 45 seconds of delay. Therefore, intersection on SR-62 mush be consistent with the adopted CMP threshold, which is more stringent that the adopted Town threshold.

Table 5-4 summarizes the lane configurations and traffic volume projections at the study intersections. Table 5-5 summarizes the LOS results at the study intersections.

The results of the intersection assessment indicate that all of the study intersections operate at the Town's LOS D target or better. However, SR-62/SR-247 is projected to operate in excess of 45 seconds of delay in the PM peak hour, which is inconsistent with the CMP guidance for that facility.

The proposed intersection improvements required to meet acceptable level of service standards may be difficult to achieve due to right-of-way acquisitions at the intersections of SR-62 and SR-247.

TRANSPORTATION IMPACTS

This section discusses relevant General Plan Circulation Element Policies and their relation to the resulting Future Year (Post-2035) Conditions transportation impacts.

CEQA TRANSPORTATION IMPACT ANALYSIS

To determine significant impacts, the CEQA guidelines were combined with the CMP impact criteria. This information and the resulting impacts are described below.

First, the CEQA guidelines question for identifying impacts is identified. Then, the threshold of significance is defined for identifying a significant impact. Finally, an impact determination is made and mitigation is recommended, where required.

TABLE 5-4
FUTURE LANE CONFIGURATIONS AND TURNING MOVEMENT VOLUME FORECASTS

Intersection		Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
1. SR-62 & Camino Del Cielo	Lanes	S	1	S	1+S	1	S	1	3	S	1	3	S
	AM Volume	10	0	10	230	0	20	10	2460	10	10	920	40
	PM Volume	20	0	10	240	0	40	70	1170	10	20	2620	250
2. SR-62 & Kickapoo Trail	Lanes	1	1	1	1	1	1	1	3	S	1	3	S
	AM Volume	50	40	80	20	20	40	30	2380	100	60	990	20
	PM Volume	250	20	60	130	40	260	200	1450	300	70	2600	30
3. SR-62 & Pioneertown Road/Deer Trail	Lanes	1	1	S	1	1	S	1	3	S	1	3	S
	AM Volume	40	40	60	190	50	70	120	2140	40	20	1050	50
	PM Volume	40	50	50	200	90	90	160	1650	60	40	2610	90
4. SR-62 & Acoma Trail	Lanes	1	1	1	1	1	1	1	3	S	1	3	S
	AM Volume	100	40	40	120	50	100	60	2300	60	30	1060	60
	PM Volume	100	20	80	160	30	110	60	2190	60	70	3120	80
5. SR-62 & Sage Avenue	Lanes	1	1	1	1	1	1	1	3	S	1	3	S
	AM Volume	250	40	50	70	60	50	40	2460	300	80	1200	30
	PM Volume	240	90	40	120	70	40	60	2240	250	80	3070	130
6. SR-62 & SR-247	Lanes	1	2	1	1	2	2+O	2	3	1	1	3	1
	AM Volume	120	320	110	300	130	460	530	1760	30	60	850	230
	PM Volume	190	180	130	140	330	670	670	1370	170	100	2240	120
7. SR-62 & Airway Avenue	Lanes	1	1	S	1	1	S	1	3	S	1	3	S
	AM Volume	40	40	140	130	50	70	60	2080	80	80	1030	130
	PM Volume	30	40	140	330	50	70	60	1510	50	80	2040	60
8. SR-62 & Balsa Avenue	Lanes	1	2	S	1	1	1	1	3	S	1	3	S
	AM Volume	140	160	210	90	110	50	50	1420	120	160	760	100
	PM Volume	150	100	180	290	90	50	50	1110	150	160	1860	190
9. SR-62 & Avalon Avenue	Lanes	2	1	1	1	1	1	1	3	S	1	3	S
	AM Volume	60	80	110	60	90	60	90	1440	100	100	880	40
	PM Volume	320	70	120	40	70	100	60	1290	120	110	1690	50
10. SR-62 & Yucca Mesa Road/La Contenta Road	Lanes	2	1	S	1	1	S	1	3	1	1	3	1
	AM Volume	120	50	90	40	300	100	80	1080	340	110	880	50
	PM Volume	410	370	90	70	90	100	160	1140	280	120	1310	110

Notes:
1. "S" represents a shared turn lane. "1+S" represents one turn lane with an additional shared turn lane. "2+O" represents two turn lanes with a permissive overlap phase.
2. Shaded cells identify lane configurations that have changed from existing.

TABLE 5-5
GENERAL PLAN (2035) CONDITIONS INTERSECTION LOS RESULTS

Intersection	Control	AM Peak		PM Peak	
		Delay	LOS	Delay	LOS
1. SR-62 & Camino Del Cielo	Signal	13.8	B	23.8	C
2. SR-62 & Kickapoo Trail	Signal	10.1	B	34.9	C
3. SR-62 & Pioneertown Road/Deer Trail	Signal	16.4	B	34.2	C
4. SR-62 & Acoma Trail	Signal	12.3	B	22.6	C
5. SR-62 & Sage Avenue	Signal	26.1	C	38.3	D
6. SR-62 & SR-247	Signal	25.7	C	51.7	D
7. SR-62 & Airway Avenue	Signal	14.8	B	28	C
8. SR-62 & Balsa Avenue	Signal	15.4	B	27.6	C
9. SR-62 & Avalon Avenue	Signal	19.4	B	29.6	C
10. SR-62 & Yucca Mesa Road/La Contenta Road	Signal	24.8	C	36.9	D

Notes:
1. Signalized intersection delay is reported as average delay.
2. Shaded cells represent intersections operating in excess of "middle of LOS D" or in excess of 45 seconds.

Source: Fehr & Peers, April 2013

a) Does the proposed project conflict with an applicable plan, ordinance or policy?

Threshold: Would the project conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?

For the purposes of this project, the following traffic components would result in a traffic impact based on Policies C 1-3, C 1-4, and C 1-5:

- Degradation from and acceptable LOS D or better on collectors and local streets (that are not considered protected) to an unacceptable LOS E or F.

The results of the analysis indicate that implementation of the General Plan and expected increases in regional traffic would result in a ***less-than-significant impact*** to the study roadway segments and intersections. As such, no mitigation is necessary.

b) Would the project conflict with an applicable congestion management program (CMP), including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?

Threshold: For the purposes of this project, the following traffic components would result in a traffic impact based on the San Bernardino CMP significance criteria:

- Implementation of the plan degrades operations for CMP facilities from an acceptable LOS E or better to LOS F, or
- Implementation of the plan degrades operations on Caltrans' facilities below the "middle of LOS D." "Middle of LOS D" is defined to be 45 seconds of delay at the study intersections.

The results of the assessment indicate that plans would result in a ***significant impact*** at the following location due to growth identified in the General Plan and regional growth predicted in the SBTAM model:

- SR-62/SR-247 Intersection

Please note that, although this intersection would operate acceptably based on the Town's policy requirements, it will operate below the "middle of LOS D" as defined in the CMP requirements. Additionally approximately 20% of the total volume is anticipated to be regional in nature based on model runs completed as part of this project - these trips are outside of the Town's land use control. Finally, it should be noted that the growth projection assumed in the model will take many years to achieve, and the intersection will likely satisfy the CMP operating requirements well beyond Year 2035, depending on the ultimate absorption of the land use plan. However, since this is identified as a significant impact, it is subject to mitigation.

Mitigation:

There are no additional physical improvements that are feasible at this location. Even with dual left-turn lanes, three through lanes, and a dedicated right turn lane on the eastbound and westbound approaches; and with dual left-turn lanes, two through lanes, and dedicated right-turn lanes with overlap phasing; the intersection will operate at LOS D with more than 45 seconds of delay. Without a grade separation (which is fiscally infeasible) or additional widening for through traffic on SR-62 (which is also infeasible due to

limited right-of-way), the intersection would operate with more than 45 seconds of delay. As such, this impact is considered ***significant and unavoidable.***

c) Would the project result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?

Policy C 3-3 identifies that the Town shall coordinate with the Yucca Valley Airport District. Additionally, the General Plan does not identify any modification to existing operations at the airport. As such, this impact is considered ***less-than-significant.***

d) Would the project substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

The plan will not increase these hazards since this is a planning document and no civil engineering designs are being proposed. All future roadways would be designed by a professional civil engineer, would be required to satisfy current roadway design requirements (national, regional, and/or local). These design plans are where any hazards would be addressed. As such, this impact is considered ***less-than-significant.***

e) Would the project result in inadequate emergency access?

The General Plan is a planning document and does not inherently represent project-specific components. As such, the plans do not result in inadequate emergency access. However, any development or improvement processed under this plan should be reviewed by the Town Emergency Services Departments to ensure adequate emergency access. As such, this impact is considered ***less-than-significant.***

f) Would the project conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?

The Circulation Element policies support public transit, bicycle improvements, and improvements to the pedestrian facilities by closing gaps in the network, expanding the network, and coordinating with regional agencies (such as MBTA). They are also consistent with regional plans, such as the SANBAG Non-Motorized Plan and goals identified by MBTA. Additionally, these policies support implementation of Complete Streets, through a layered network approach, consistent with the State's Complete Streets Act. As such, they are consistent with the existing adopted policies, plans and programs regarding public transit, bicycle, or pedestrian facilities. Therefore, this impact is considered ***less-than-significant.***

APPENDIX A
YUCCA VALLEY MODEL VALIDATION TABLES

SBTAM Yucca Valley Link Volume Validation (ADT)										
Sheet Link	**Map #**	**SBTAM**	**Roadway**	**Segment**	**Count**	**Model**	**Dev**	**Max**	**Result**	**Diff^2**
YCV001	1	2661560	Acoma Trail	S/ State Route 62	2,430	776	-68%	63%	FAIL	2,736,722
YCV002	2	2743189	Acoma Trail	N/ Mountain View	2,357	2,265	-4%	63%	PASS	8,480
YCV003	3	2743304	Acoma Trail	S/ Joshua Drive	713	1,037	45%	68%	PASS	105,128
YCV004	4	2743339	Airway Avenue	N/ Outer Highway	893	966	8%	68%	PASS	5,330
YCV005	5	2743216	Airway Avenue	S/ State Route 62	2,026	2,306	14%	63%	PASS	78,309
YCV006	6	152781	Airway Avenue	N/ Yucca Trail	1,638	1,882	15%	63%	PASS	59,438
YCV007	7	123065	Avalon Avenue	N/ Sunnyslope Drive	2,707	1,904	-30%	58%	PASS	645,202
YCV066	66	123062	Avalon Avenue	N/ State Route 62	1,374	2,196	60%	63%	PASS	676,020
YCV008	8		Balsa Avenue	N/ Outer Highway	6,121					
YCV009	9		Balsa Avenue	S/ State Route 62	5,973					
YCV010	10	2743167	Buena Vista Drive	W/ Yucca Mesa	2,332	3,145	35%	63%	PASS	660,235
YCV011	11	2743160	Buena Vista Drive	E/ Balsa Avenue	3,469	4,135	19%	58%	PASS	443,570
YCV012	12	2743202	Buena Vista Drive	B/ Roberts Road - Faith Lane	3,638	5,206	43%	58%	PASS	2,458,001
YCV013	13	2743158	Buena Vista Drive	B/ Newton Lane - Rowell Road	3,643	5,335	46%	58%	PASS	2,864,336
YCV014	14	123051	Camino del Cielo Trail	N/ State Route 62	1,552	1,403	-10%	63%	PASS	22,156
YCV015	15		Chemehuevi Trail	N/ State Route 62	130					
YCV016	16	2743259	El Cortez Road	W/ State Route 247	483	1,193	147%	68%	FAIL	503,929
YCV061	61		Elk Trail	S/ Onaga Trail	200					
YCV017	17	133012	Fairview Drive	N/ State Route 62	305	772	153%	68%	FAIL	218,542
YCV018	18		Fox Trail	S/ State Route 62	373					
YCV060	60		Fox Trail	S/ Onaga Trail	176					
YCV019	19		Hilton Avenue	N/ State Route 62	5,407					
YCV020	20	2743196	Hopi Trail	S/ Santa Fe Trail	681	3,078	352%	68%	FAIL	5,745,882
YCV021	21	2743139	Joshua Lane	E/ Acoma Trail	1,810	1,182	-35%	63%	PASS	394,566
YCV022	22	2743229	Joshua Lane	W/ Barberry Avenue	2,277	3,293	45%	63%	PASS	1,032,625
YCV023	23	2740637	Joshua Lane	E/ Emerson Avenue	1,164	692	-41%	68%	PASS	223,013
YCV024	24	122981	Joshua Lane	S/ Joshua Drive	4,311	3,133	-27%	52%	PASS	1,387,165
YCV025	25	122972	Joshua Lane	N/ Onaga Trail	4,953	3,710	-25%	52%	PASS	1,545,018
YCV026	26	122978	Joshua Lane	N/ Pueblo Trail	5,090	4,131	-19%	48%	PASS	918,895
YCV063	63	2743336	Joshua Lane	B/ Yucca Trail - State Route 62 Outer Highway	7,022	4,930	-30%	44%	PASS	4,376,949
YCV027	27		Katje Way	N/ State Route 62	471					
YCV028	28	2743201	Kickapoo Trail	S/ State Route 62	2,790	3,115	12%	58%	PASS	105,671
YCV029	29	2743210	La Contenta Road	S/ State Route 62	2,230	1,041	-53%	63%	PASS	1,413,314
YCV065	65	2743156	La Contenta Road	N/ Yucca Trail	2,170	951	-56%	63%	PASS	1,485,132
YCV030	30		La Honda Way	N/ State Route 62	250					
YCV031	31	2701736	Onaga Trail	E/ Alaba Avenue	1,782	2,157	21%	63%	PASS	140,904
YCV032	32	122979	Onaga Trail	E/ Elata Avenue	2,966	3,048	3%	58%	PASS	6,741
YCV033	33	2740670	Onaga Trail	W/ Joshua Lane	3,734	3,059	-18%	58%	PASS	455,299
YCV034	34	2743276	Onaga Trail	W/ Sage Avenue	4,765	3,318	-30%	52%	PASS	2,095,103
YCV035	35	123002	Onaga Trail	E/ Acoma Trail	3,544	4,859	37%	58%	PASS	1,729,107
YCV036	36	2740545	Onaga Trail	E/ Elk Trail	3,017	2,834	-6%	58%	PASS	33,409
YCV037	37	144946	Onaga Trail	W/ Jemez Trail	1,620	2,261	40%	63%	PASS	410,760
YCV038	38	2743273	Palm Drive	N/ Pueblo Trail	1,207	1,576	31%	68%	PASS	136,434
YCV039	39	123043	Palomar Avenue	S/ Yucca Trail	4,423	4,150	-6%	52%	PASS	74,753
YCV040	40	123057	Palomar Avenue	N/ Joshua Lane	836	1,319	58%	68%	PASS	233,382
YCV041	41	122966	Paxton Drive	E/ State Route 247	1,522	2,092	37%	63%	PASS	325,344
YCV042	42	123054	Pinon Drive	N/ State Route 62	293	502	71%	68%	FAIL	43,726
YCV043	43	123030	Pioneertown Road	N/ State Route 62	2,238	1,389	-38%	63%	PASS	720,309
YCV044	44	2743069	Pioneertown Road	S/ Town Limits	981	784	-20%	68%	PASS	38,951
YCV045	45	123010	Pueblo Trail	W/ Hanford Avenue	291	633	118%	68%	FAIL	117,076
YCV046	46	2743147	Sage Avenue	N/ State Route 62	2,142	1,274	-41%	63%	PASS	753,400
YCV047	47	122993	Sage Avenue	W/ Yucca Trail	4,341	1,374	-68%	52%	FAIL	8,800,715
YCV062	62	122994	Sage Avenue	N/ Onaga Trail	4,122	1,532	-63%	52%	FAIL	6,708,601
YCV048	48	133016	Santa Fe Trail	W/ Cherokee Trail	730	429	-41%	68%	PASS	90,851
YCV049	49	2743199	Santa Fe Trail	E/ Kickapoo Trail	505	232	-54%	68%	PASS	74,552
YCV050	50	2743258	Skyline Ranch Road	W/ State Route 247	833	679	-19%	68%	PASS	23,843
YCV067	67	2743334	State Route 62 Outer Highway	B/ Joshua Lane - Airway Avenue	1,703	1,457	-14%	63%	PASS	60,630
YCV068	68	2743333	State Route 62 Outer Highway	B/ State Route 247 - Airway Avenue	657	728	11%	68%	PASS	4,974
YCV064	64	2743218	Sunnyslope Avenue	W/ State Route 247	1,686	1,595	-5%	63%	PASS	8,333
YCV051	51	2743192	Warren Vista Avenue	1000' S/ State Route 62	2,801	622	-78%	58%	FAIL	4,745,935
YCV058	58	100761	Yucca Mesa Road	N/ State Route 62	4,914	3,640	-26%	52%	PASS	1,622,249
YCV059	59	100762	Yucca Mesa Road	N/ Buena Vista Drive	2,733	2,782	2%	58%	PASS	2,396
YCV052	52	2743148	Yucca Trail	E/ Cherokee Trail	1,334	1,833	37%	63%	PASS	249,405
YCV053	53	2740565	Yucca Trail	E/ Miami Trail	1,921	1,786	-7%	63%	PASS	18,205
YCV054	54	2743023	Yucca Trail	W/ La Contenta Road	6,058	4,604	-24%	48%	PASS	2,112,947
YCV055	55	2743131	Yucca Trail	E/ Hanford Avenue	7,442	6,380	-14%	44%	PASS	1,127,327
YCV056	56	122976	Yucca Trail	W/ Joshua View Drive	8,083	5,029	-38%	41%	PASS	9,325,848
YCV057	57	2701724	Yucca Trail	W/ Condalia Avenue	6,923	5,030	-27%	44%	PASS	3,584,447
1	-	123050	State Route 62	W/ Camino del Cielo	25,500	32,023	26%	26%	FAIL	42,545,924
2	-	2701712	State Route 62	W/ Pioneertown Road	28,500	26,449	-7%	25%	PASS	4,204,997
3	-	2740593	State Route 62	W/ Joshua Lane	28,500	25,348	-11%	25%	PASS	9,934,701
4	-	144950	State Route 62	W/ Yucca Mesa Road	21,000	19,509	-7%	28%	PASS	2,221,733
5	-	122967	State Route 247	N/ Twentynine Palms Highway	12,000	10,282	-14%	34%	PASS	2,950,717
TOTAL LINKS		**64**		**SUM OF LINK VOLUMES**	**271,705**	**252,378**			**SUM OF DIFF^2**	**137,847,658**
				TOTAL LINK VOLUME DEVIATION			**-7%**	**+/- 10%**		**PASS**
				PERCENT WITHIN MAXIMUM DEVIATION			**84%**	**> 75%**		**PASS**
				PERCENT ROOT MEAN SQUARE ERROR (RMSE)			**35%**	**< 40%**		**PASS**
				CORRELATION COEFFICIENT			**0.97**	**0.88**		**PASS**

APPENDIX B
EXISTING INTERSECTION COUNTS

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_001 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

AM

NS/EW Streets:	Camino del Cielo			Camino del Cielo			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	1.3	.3	.3	1	2	0	1	2	0	
7:00 AM	1	0	1	11		2	2	105	0	0	219	3	344
7:15 AM	0	0	0	16		2	1	88	0	1	173	3	284
7:30 AM	0	0	0	21		2	0	139	0	0	142	5	309
7:45 AM	0	0	0	22		1	0	156	0	1	141	5	326
8:00 AM	1	0	2	11		1	1	126	0	0	160	1	303
8:15 AM	0	0	1	22		1	1	136	0	1	163	6	331
8:30 AM	2	0	0	20		2	0	174	0	2	169	6	375
8:45 AM	0	1	1	17		1	1	154	1	1	133	5	315
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	4	1	5	140	0	12	6	1078	1	6	1300	34	2587
APPROACH %'s :	40.00%	10.00%	50.00%	92.11%	0.00%	7.89%	0.55%	99.35%	0.09%	0.45%	97.01%	2.54%	
PEAK HR START TIME :	745 AM												TOTAL
PEAK HR VOL :	3	0	3	75	0	5	2	592	0	4	633	18	1335
PEAK HR FACTOR :		0.500			0.870			0.853			0.925		0.890

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_001 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

PM

NS/EW Streets:	Camino del Cielo			Camino del Cielo			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	1.3	.3	.3	1	2	0	1	2	0	
4:00 PM	0		2	11	2	4	7	207	0	2	171	12	418
4:15 PM	0		1	13	1	0	4	184	0	3	183	13	402
4:30 PM	0		0	14	1	1	4	193	0	3	163	14	393
4:45 PM	1		1	12	0	0	4	206	0	1	198	13	436
5:00 PM	0		1	13	0	3	11	180	0	2	206	18	434
5:15 PM	1		1	13	0	1	2	199	1	3	176	18	415
5:30 PM	0		2	17	0	0	1	229	2	2	151	15	419
5:45 PM	0		1	17	0	1	7	216	0	4	147	16	409
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	2	0	9	110	4	10	40	1614	3	20	1395	119	3326
APPROACH %'s :	18.18%	0.00%	81.82%	88.71%	3.23%	8.06%	2.41%	97.40%	0.18%	1.30%	90.94%	7.76%	
PEAK HR START TIME :	445 PM												TOTAL
PEAK HR VOL :	2	0	5	55	0	4	18	814	3	8	731	64	1704
PEAK HR FACTOR :		0.875			0.868			0.900			0.888		0.977

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_002 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

AM

NS/EW Streets:	Kickapoo Trail			Kickapoo Trail			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	1	1	1	1	1	2	0	1	2	0	
7:00 AM	43	2	4	0	1	12	2	111	4	0	175	5	359
7:15 AM	30	0	7	1	2	8	1	107	5	2	149	1	313
7:30 AM	31	1	7	1	1	10	1	142	7	6	118	0	325
7:45 AM	31	1	6	1	0	7	3	169	4	5	115	1	343
8:00 AM	22	2	7	4	0	4	3	128	10	5	151	1	337
8:15 AM	27	2	6	1	2	8	1	143	7	5	129	1	332
8:30 AM	20	1	3	2	2	8	1	181	10	3	144	3	378
8:45 AM	24	0	13	1	2	7	2	167	12	7	111	1	347
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	228	9	53	11	10	64	14	1148	59	33	1092	13	2734
APPROACH %'s :	78.62%	3.10%	18.28%	12.94%	11.76%	75.29%	1.15%	94.02%	4.83%	2.90%	95.96%	1.14%	
PEAK HR START TIME :	800 AM												TOTAL
PEAK HR VOL :	93	5	29	8	6	27	7	619	39	20	535	6	1394
PEAK HR FACTOR :		0.858			0.854			0.866			0.893		0.922

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_002 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

PM

NS/EW Streets:	Kickapoo Trail			Kickapoo Trail			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	1	1	1	1	1	2	0	1	2	0	
4:00 PM	18	3	7	4	3	6	11	207	21	8	173	1	462
4:15 PM	23	2	9	6	4	6	5	171	19	10	170	6	431
4:30 PM	15	1	8	0	0	8	5	189	23	6	184	1	440
4:45 PM	12	0	8	4	2	3	3	207	22	10	195	4	470
5:00 PM	21	2	7	2	1	4	1	183	23	13	218	1	476
5:15 PM	15	1	13	4	3	5	8	190	21	10	192	3	465
5:30 PM	17	1	6	6	1	1	9	207	28	4	153	0	433
5:45 PM	5	2	12	3	3	6	6	214	25	2	159	2	439
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	126	12	70	29	17	39	48	1568	182	63	1444	18	3616
APPROACH %'s :	60.58%	5.77%	33.65%	34.12%	20.00%	45.88%	2.67%	87.21%	10.12%	4.13%	94.69%	1.18%	
PEAK HR START TIME :	430 PM												TOTAL
PEAK HR VOL :	63	4	36	10	6	20	17	769	89	39	789	9	1851
PEAK HR FACTOR :		0.858			0.750			0.943			0.902		0.972

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_003 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

AM

NS/EW Streets:	Pioneertown Rd			Pioneertown Rd			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	0	1	1	0	1	2	1	1	2	1	
7:00 AM	6	4	4	5	1	4	1	113	1	3	173	0	315
7:15 AM	3	2	4	9	0	4	0	116	2	4	160	1	305
7:30 AM	5	5	3	14	0	3	0	155	3	0	122	2	312
7:45 AM	9	5	4	8	3	5	1	173	1	2	154	2	367
8:00 AM	4	5	5	15	0	5	1	164	0	0	160	7	366
8:15 AM	3	3	7	12	4	7	3	165	2	1	156	0	363
8:30 AM	2	3	7	20	2	5	3	194	2	4	160	2	404
8:45 AM	4	2	5	20	7	3	7	189	4	5	151	3	400
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	36	29	39	103	17	36	16	1269	15	19	1236	17	2832
APPROACH %'s :	34.62%	27.88%	37.50%	66.03%	10.90%	23.08%	1.23%	97.62%	1.15%	1.49%	97.17%	1.34%	
PEAK HR START TIME :	800 AM												TOTAL
PEAK HR VOL :	13	13	24	67	13	20	14	712	8	10	627	12	1533
PEAK HR FACTOR :		0.893			0.833			0.918			0.972		0.949

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_003 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

PM

NS/EW Streets:	Pioneertown Rd			Pioneertown Rd			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	0	1	1	0	1	2	1	1	2	1	
4:00 PM	4	2	5	31	4	5	1	231	3	8	216	1	511
4:15 PM	2	4	4	23	3	5	8	197	4	4	203	1	458
4:30 PM	8	5	3	33	3	0	3	199	3	7	208	3	475
4:45 PM	7	1	7	26	4	3	5	214	3	2	221	4	497
5:00 PM	3	1	4	19	8	7	4	213	2	4	262	5	532
5:15 PM	5	3	11	18	5	4	1	203	3	2	184	4	443
5:30 PM	5	7	3	22	6	6	4	230	6	0	181	3	473
5:45 PM	2	4	2	18	5	4	2	231	3	0	160	1	432
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	36	27	39	190	38	34	28	1718	27	27	1635	22	3821
APPROACH %'s :	35.29%	26.47%	38.24%	72.52%	14.50%	12.98%	1.58%	96.90%	1.52%	1.60%	97.09%	1.31%	
PEAK HR START TIME :	415 PM												TOTAL
PEAK HR VOL :	20	11	18	101	18	15	20	823	12	17	894	13	1962
PEAK HR FACTOR :		0.766			0.931			0.963			0.852		0.922

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_004 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

AM

NS/EW Streets:	Acoma Trail			Acoma Trail			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	1	1	1	1	1	2	0	1	2	1	
7:00 AM	13	2	8	4	0	1	0	120	4	4	192	1	349
7:15 AM	15	3	5	4	0	0	0	133	0	3	164	3	330
7:30 AM	9	0	6	6	0	1	3	169	4	3	132	3	336
7:45 AM	12	2	8	8	0	1	2	195	1	5	188	15	437
8:00 AM	12	6	13	6	2	1	1	185	6	9	184	6	431
8:15 AM	12	6	11	7	3	4	3	192	4	8	171	9	430
8:30 AM	12	8	10	6	2	6	3	199	2	6	172	3	429
8:45 AM	15	2	10	14	3	3	8	226	5	8	180	8	482
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	100	29	71	55	10	17	20	1419	26	46	1383	48	3224
APPROACH %'s :	50.00%	14.50%	35.50%	67.07%	12.20%	20.73%	1.37%	96.86%	1.77%	3.11%	93.64%	3.25%	
PEAK HR START TIME :	800 AM												TOTAL
PEAK HR VOL :	51	22	44	33	10	14	15	802	17	31	707	26	1772
PEAK HR FACTOR :		0.944			0.713			0.872			0.960		0.919

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_004 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

PM

NS/EW Streets:	Acoma Trail			Acoma Trail			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	1	1	1	1	1	2	0	1	2	1	
4:00 PM	9	8	12	12	2	6	6	265	11	13	237	8	589
4:15 PM	16	1	8	14	2	4	3	234	5	6	228	7	528
4:30 PM	14	1	9	15	2	3	3	227	11	7	233	5	530
4:45 PM	12	1	11	14	3	8	7	247	12	12	253	7	587
5:00 PM	20	4	11	11	4	4	4	245	5	19	267	6	600
5:15 PM	10	1	7	8	4	7	0	230	6	7	229	7	516
5:30 PM	9	2	11	9	2	1	1	257	4	8	190	6	500
5:45 PM	3	2	6	3	1	2	1	253	7	11	206	9	504
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	93	20	75	86	20	35	25	1958	61	83	1843	55	4354
APPROACH %'s :	49.47%	10.64%	39.89%	60.99%	14.18%	24.82%	1.22%	95.79%	2.98%	4.19%	93.03%	2.78%	
PEAK HR START TIME :	415 PM												TOTAL
PEAK HR VOL :	62	7	39	54	11	19	17	953	33	44	981	25	2245
PEAK HR FACTOR :		0.771			0.840			0.943			0.899		0.935

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_005 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

AM

NS/EW Streets:	Sage Ave			Sage Ave			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	.5	.5	1	1	0	1	2	0	1	2	0	
7:00 AM	53	2	3	6	3	2	2	109	20	14	171	3	388
7:15 AM	47	3	3	7	1	3	0	125	18	5	127	2	341
7:30 AM	45	2	2	7	5	5	5	143	28	5	145	4	396
7:45 AM	64	0	1	5	6	8	6	159	34	5	184	0	472
8:00 AM	39	10	6	8	3	9	3	172	26	6	179	2	463
8:15 AM	41	0	3	4	11	7	0	180	25	7	170	2	450
8:30 AM	55	7	0	10	4	12	5	192	30	3	163	4	485
8:45 AM	51	1	8	17	13	8	8	189	32	16	170	5	518
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	395	25	26	64	46	54	29	1269	213	61	1309	22	3513
APPROACH %'s :	88.57%	5.61%	5.83%	39.02%	28.05%	32.93%	1.92%	83.98%	14.10%	4.38%	94.04%	1.58%	
PEAK HR START TIME :	800 AM												TOTAL
PEAK HR VOL :	186	18	17	39	31	36	16	733	113	32	682	13	1916
PEAK HR FACTOR :		0.891			0.697			0.941			0.952		0.925

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_005 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

PM

NS/EW Streets:	Sage Ave			Sage Ave			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	.5	.5	1	1	0	1	2	0	1	2	0	
4:00 PM	45	4	8	11	19	3	8	244	53	7	231	10	643
4:15 PM	39	13	2	13	15	8	13	221	44	10	236	2	616
4:30 PM	46	11	2	13	19	5	10	206	54	15	223	9	613
4:45 PM	46	23	8	8	15	6	3	226	53	12	257	8	665
5:00 PM	46	18	9	17	10	9	11	215	57	11	255	14	672
5:15 PM	42	19	6	18	9	5	11	209	33	7	220	12	591
5:30 PM	38	20	10	5	19	2	11	248	63	5	202	11	634
5:45 PM	31	15	8	16	24	6	8	220	42	9	197	7	583
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	333	123	53	101	130	44	75	1789	399	76	1821	73	5017
APPROACH %'s :	65.42%	24.17%	10.41%	36.73%	47.27%	16.00%	3.31%	79.05%	17.63%	3.86%	92.44%	3.71%	
PEAK HR START TIME :	415 PM												TOTAL
PEAK HR VOL :	177	65	21	51	59	28	37	868	208	48	971	33	2566
PEAK HR FACTOR :		0.854			0.932			0.983			0.939		0.955

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_006 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

AM

NS/EW Streets:	Old Woman Springs Rd			Old Woman Springs Rd			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	2	0	1	2	0	1	2	0	1	2	0	
7:00 AM	14	24	17	31	14	56	25	102	1	6	110	8	408
7:15 AM	4	12	6	10	12	58	10	114	5	5	87	7	330
7:30 AM	14	19	11	25	24	38	17	115	5	9	100	17	394
7:45 AM	17	24	19	26	27	63	21	136	5	9	109	17	473
8:00 AM	14	17	14	31	14	70	28	160	5	7	116	12	488
8:15 AM	13	23	12	24	26	54	27	137	3	9	127	12	467
8:30 AM	18	20	12	23	27	56	30	156	4	8	124	16	494
8:45 AM	24	26	15	33	29	46	36	150	6	15	137	21	538
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	118	165	106	203	173	441	194	1070	34	68	910	110	3592
APPROACH %'s :	30.33%	42.42%	27.25%	24.85%	21.18%	53.98%	14.95%	82.43%	2.62%	6.25%	83.64%	10.11%	

PEAK HR START TIME :	800 AM												TOTAL
PEAK HR VOL :	69	86	53	111	96	226	121	603	18	39	504	61	1987
PEAK HR FACTOR :		0.800			0.941			0.961			0.873		0.923

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_006 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

PM

NS/EW Streets:	Old Woman Springs Rd			Old Woman Springs Rd			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	2	0	1	2	0	1	2	0	1	2	0	
4:00 PM	12	23	26	37	35	47	59	181	13	26	202	19	680
4:15 PM	19	18	18	24	24	51	57	176	11	4	219	23	644
4:30 PM	20	35	23	27	31	33	47	174	6	9	229	21	655
4:45 PM	15	27	26	20	22	36	46	168	7	17	247	28	659
5:00 PM	21	31	15	34	35	41	62	150	9	24	235	12	669
5:15 PM	18	19	22	38	18	37	59	156	4	25	206	19	621
5:30 PM	14	18	23	34	27	23	60	186	7	11	189	16	608
5:45 PM	25	19	10	34	17	25	63	151	5	17	178	22	566
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	144	190	163	248	209	293	453	1342	62	133	1705	160	5102
APPROACH %'s :	28.97%	38.23%	32.80%	33.07%	27.87%	39.07%	24.39%	72.27%	3.34%	6.66%	85.34%	8.01%	

PEAK HR START TIME :	400 PM												TOTAL
PEAK HR VOL :	66	103	93	108	112	167	209	699	37	56	897	91	2638
PEAK HR FACTOR :		0.840			0.813			0.934			0.894		0.970

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_007 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

AM

NS/EW Streets:	Airway Ave			Airway Ave			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	0	1	1	0	1	2	0	1	2	0	
7:00 AM	1	2	7	1	3	3	2	153	1	4	118	2	297
7:15 AM	0	1	5	1	1	2	0	122	2	5	95	1	235
7:30 AM	3	3	5	1	0	7	5	139	9	5	108	3	288
7:45 AM	0	1	8	1	1	4	4	168	7	6	124	3	327
8:00 AM	3	4	12	0	0	2	5	194	14	15	130	7	386
8:15 AM	3	3	13	2	1	1	3	155	8	9	144	4	346
8:30 AM	2	6	14	1	2	3	9	168	8	20	149	11	393
8:45 AM	2	3	14	2	7	2	4	183	4	11	163	6	401
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	14	23	78	9	15	24	32	1282	53	75	1031	37	2673
APPROACH %'s :	12.17%	20.00%	67.83%	18.75%	31.25%	50.00%	2.34%	93.78%	3.88%	6.56%	90.20%	3.24%	
PEAK HR START TIME :	800 AM												TOTAL
PEAK HR VOL :	10	16	53	5	10	8	21	700	34	55	586	28	1526
PEAK HR FACTOR :		0.898			0.523			0.886			0.929		0.951

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_007 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

PM

NS/EW Streets:	Airway Ave			Airway Ave			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	0	1	1	0	1	2	0	1	2	0	
4:00 PM	1	5	23	8	4	8	11	229	9	19	240	8	565
4:15 PM	5	3	21	7	2	11	10	198	5	20	229	12	523
4:30 PM	5	4	18	12	4	11	15	206	8	19	245	11	558
4:45 PM	3	4	20	12	11	11	10	197	7	11	285	11	582
5:00 PM	4	5	30	6	9	8	9	177	14	15	252	11	540
5:15 PM	6	1	16	4	2	4	6	199	5	8	244	7	502
5:30 PM	3	4	12	8	8	13	10	219	8	14	196	8	503
5:45 PM	2	1	13	3	4	9	6	189	4	14	209	9	463
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	29	27	153	60	44	75	77	1614	60	120	1900	77	4236
APPROACH %'s :	13.88%	12.92%	73.21%	33.52%	24.58%	41.90%	4.40%	92.18%	3.43%	5.72%	90.61%	3.67%	
PEAK HR START TIME :	400 PM												TOTAL
PEAK HR VOL :	14	16	82	39	21	41	46	830	29	69	999	42	2228
PEAK HR FACTOR :		0.966			0.743			0.909			0.904		0.957

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_008 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

AM

NS/EW Streets:	Balsa Ave			Balsa Ave			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	2	0	1	1	1	1	2	0	1	2	0	
7:00 AM	21	5	4	5	2	5	2	144	5	4	106	6	309
7:15 AM	12	4	3	11	2	2	0	106	7	3	82	6	238
7:30 AM	16	4	2	9	6	2	3	127	4	5	105	5	288
7:45 AM	19	2	1	12	5	1	1	136	7	6	138	3	331
8:00 AM	19	8	3	3	3	3	4	145	11	5	126	4	334
8:15 AM	19	2	5	12	8	2	0	137	5	3	122	2	317
8:30 AM	27	13	9	11	7	5	3	127	16	2	143	11	374
8:45 AM	26	12	4	9	8	4	4	142	7	5	164	7	392
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	159	50	31	72	41	24	17	1064	62	33	986	44	2583
APPROACH %'s :	66.25%	20.83%	12.92%	52.55%	29.93%	17.52%	1.49%	93.09%	5.42%	3.10%	92.76%	4.14%	
PEAK HR START TIME :	800 AM												TOTAL
PEAK HR VOL :	91	35	21	35	26	14	11	551	39	15	555	24	1417
PEAK HR FACTOR :		0.750			0.815			0.939			0.844		0.904

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_008 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

PM

NS/EW Streets:	Balsa Ave			Balsa Ave			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	2	0	1	1	1	1	2	0	1	2	0	
4:00 PM	32	19	7	46	28	6	5	168	26	10	184	20	551
4:15 PM	21	14	10	48	23	6	9	166	32	9	190	10	538
4:30 PM	38	9	7	31	30	13	1	168	23	11	239	14	584
4:45 PM	31	22	5	36	33	1	3	143	15	11	231	10	541
5:00 PM	33	16	8	29	30	9	4	149	22	17	210	17	544
5:15 PM	34	17	6	28	36	7	6	151	17	10	200	21	533
5:30 PM	24	8	3	29	28	8	4	147	24	6	182	10	473
5:45 PM	33	20	5	27	28	6	7	152	15	8	152	8	461
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	246	125	51	274	236	56	39	1244	174	82	1588	110	4225
APPROACH %'s :	58.29%	29.62%	12.09%	48.41%	41.70%	9.89%	2.68%	85.38%	11.94%	4.61%	89.21%	6.18%	
PEAK HR START TIME :	400 PM												TOTAL
PEAK HR VOL :	122	64	29	161	114	26	18	645	96	41	844	54	2214
PEAK HR FACTOR :		0.927			0.941			0.917			0.889		0.948

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_009 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

AM

NS/EW Streets:	Avalon Ave			Avalon Ave			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	2	1	1	1	1	1	1	2	0	1	2	0	
7:00 AM	7	4	25	3	2	1	0	142	7	11	105	1	308
7:15 AM	4	1	15	5	1	5	0	118	12	8	90	1	260
7:30 AM	2	0	14	4	1	6	1	114	13	10	107	2	274
7:45 AM	4	0	13	6	3	12	5	140	12	11	138	2	346
8:00 AM	8	4	17	4	4	3	5	121	10	14	128	1	319
8:15 AM	4	3	21	4	14	5	5	139	10	16	129	3	353
8:30 AM	3	9	25	8	7	5	1	138	9	18	154	4	381
8:45 AM	5	8	9	4	2	4	5	126	10	13	166	4	356
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	37	29	139	38	34	41	22	1038	83	101	1017	18	2597
APPROACH %'s :	18.05%	14.15%	67.80%	33.63%	30.09%	36.28%	1.92%	90.81%	7.26%	8.89%	89.52%	1.58%	
PEAK HR START TIME :	800 AM												TOTAL
PEAK HR VOL :	20	24	72	20	27	17	16	524	39	61	577	12	1409
PEAK HR FACTOR :		0.784			0.696			0.940			0.888		0.925

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_009 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

PM

NS/EW Streets:	Avalon Ave			Avalon Ave			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	2	1	1	1	1	1	1	2	0	1	2	0	
4:00 PM	14	5	9	4	3	6	10	193	16	11	185	5	461
4:15 PM	18	4	17	2	3	10	6	184	11	14	202	7	478
4:30 PM	22	12	12	2	3	6	9	199	11	18	247	6	547
4:45 PM	11	4	6	5	1	6	3	174	11	16	248	7	492
5:00 PM	7	13	15	4	6	1	6	169	6	18	236	5	486
5:15 PM	10	2	6	0	1	6	11	179	5	21	217	11	469
5:30 PM	6	3	12	4	4	5	6	176	4	10	180	9	419
5:45 PM	6	4	8	2	2	6	7	171	6	14	169	4	399
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	94	47	85	23	23	46	58	1445	70	122	1684	54	3751
APPROACH %'s :	41.59%	20.80%	37.61%	25.00%	25.00%	50.00%	3.69%	91.86%	4.45%	6.56%	90.54%	2.90%	
PEAK HR START TIME :	415 PM												TOTAL
PEAK HR VOL :	58	33	50	13	13	23	24	726	39	66	933	25	2003
PEAK HR FACTOR :		0.766			0.817			0.901			0.945		0.915

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_010 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

AM

NS/EW Streets:	Yucca Mesa Rd			Yucca Mesa Rd			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	0	1	1	0	1	2	0	1	2	0	
7:00 AM	18	10	11	17	18	17	10	143	17	5	77	6	349
7:15 AM	6	0	3	12	4	12	4	143	8	4	80	7	283
7:30 AM	8	0	6	20	4	12	7	119	6	9	115	0	306
7:45 AM	5	6	0	21	7	12	13	101	7	4	113	5	294
8:00 AM	4	3	8	15	7	17	8	150	4	1	111	5	333
8:15 AM	2	5	7	10	9	13	7	140	6	0	110	4	313
8:30 AM	4	2	11	19	11	22	7	152	5	6	140	5	384
8:45 AM	5	2	12	22	11	20	16	132	0	5	143	7	375
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	52	28	58	136	71	125	72	1080	53	34	889	39	2637
APPROACH %'s :	37.68%	20.29%	42.03%	40.96%	21.39%	37.65%	5.98%	89.63%	4.40%	3.53%	92.41%	4.05%	
PEAK HR START TIME :	800 AM												TOTAL
PEAK HR VOL :	15	12	38	66	38	72	38	574	15	12	504	21	1405
PEAK HR FACTOR :		0.855			0.830			0.956			0.866		0.915

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: CA13_6076_010 **Day:** TUESDAY

City: City of Yucca Valley **Date:** 4/16/2013

PM

NS/EW Streets:	Yucca Mesa Rd			Yucca Mesa Rd			Twentynine Palms Hwy			Twentynine Palms Hwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	1	0	1	1	0	1	2	0	1	2	0	
4:00 PM	7	7	1	16	1	10	20	149	7	4	170	17	409
4:15 PM	5	8	0	10	10	14	35	168	4	2	191	21	468
4:30 PM	3	6	1	9	6	19	25	147	8	7	232	23	486
4:45 PM	5	12	4	4	11	12	42	136	7	12	241	19	505
5:00 PM	3	12	1	12	2	15	19	169	4	7	229	14	487
5:15 PM	5	7	2	8	5	11	28	129	6	4	213	15	433
5:30 PM	1	9	3	11	6	13	32	157	5	8	172	21	438
5:45 PM	4	4	1	7	7	13	26	144	7	5	168	14	400
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	33	65	13	77	48	107	227	1199	48	49	1616	144	3626
APPROACH %'s :	29.73%	58.56%	11.71%	33.19%	20.69%	46.12%	15.40%	81.34%	3.26%	2.71%	89.33%	7.96%	
PEAK HR START TIME :	415 PM												TOTAL
PEAK HR VOL :	16	38	6	35	29	60	121	620	23	28	893	77	1946
PEAK HR FACTOR :		0.714			0.912			0.923			0.917		0.963

CONTROL : Signalized

APPENDIX C
EXISTING (2013) CONDITIONS LOS RESULTS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	592	0	4	633	18	3	0	3	75	0	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00		0.95	0.95	
Frt	1.00	1.00		1.00	1.00			0.93		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.98		0.95	0.96	
Satd. Flow (prot)	1770	3539		1770	3525			1695		1681	1662	
Flt Permitted	0.95	1.00		0.95	1.00			0.98		0.95	0.96	
Satd. Flow (perm)	1770	3539		1770	3525			1695		1681	1662	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	2	665	0	4	711	20	3	0	3	84	0	6
RTOR Reduction (vph)	0	0	0	0	1	0	0	3	0	0	6	0
Lane Group Flow (vph)	2	665	0	4	730	0	0	3	0	45	39	0
Turn Type	Prot			Prot			Split			Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases												
Actuated Green, G (s)	1.2	90.3		1.3	90.4			1.4		7.5	7.5	
Effective Green, g (s)	1.7	92.3		1.8	92.4			1.9		8.0	8.0	
Actuated g/C Ratio	0.01	0.77		0.02	0.77			0.02		0.07	0.07	
Clearance Time (s)	4.5	6.0		4.5	6.0			4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	25	2722		27	2714			27		112	111	
v/s Ratio Prot	0.00	0.19		c0.00	c0.21			c0.00		c0.03	0.02	
v/s Ratio Perm												
v/c Ratio	0.08	0.24		0.15	0.27			0.11		0.40	0.35	
Uniform Delay, d1	58.4	3.9		58.3	4.0			58.2		53.7	53.5	
Progression Factor	1.00	1.00		1.12	0.51			1.00		1.00	1.00	
Incremental Delay, d2	1.4	0.2		2.5	0.2			1.9		2.4	2.0	
Delay (s)	59.8	4.2		67.7	2.3			60.1		56.1	55.5	
Level of Service	E	A		E	A			E		E	E	
Approach Delay (s)		4.3			2.7			60.1			55.8	
Approach LOS		A			A			E			E	

Intersection Summary			
HCM Average Control Delay	6.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	30.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	7	619	39	20	535	6	93	5	29	8	6	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3508		1770	3533		1770	1863	1583	1770	1638	
Flt Permitted	0.95	1.00		0.95	1.00		0.73	1.00	1.00	0.75	1.00	
Satd. Flow (perm)	1770	3508		1770	3533		1367	1863	1583	1405	1638	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	8	673	42	22	582	7	101	5	32	9	7	29
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	28	0	25	0
Lane Group Flow (vph)	8	713	0	22	589	0	101	5	4	9	11	0
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2		2	6		
Actuated Green, G (s)	1.5	86.5		4.8	89.8		14.2	14.2	14.2	14.2	14.2	
Effective Green, g (s)	2.0	87.5		5.3	90.8		15.2	15.2	15.2	15.2	15.2	
Actuated g/C Ratio	0.02	0.73		0.04	0.76		0.13	0.13	0.13	0.13	0.13	
Clearance Time (s)	4.5	5.0		4.5	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	30	2558		78	2673		173	236	201	178	207	
v/s Ratio Prot	0.00	c0.20		c0.01	c0.17			0.00			0.01	
v/s Ratio Perm							c0.07		0.00	0.01		
v/c Ratio	0.27	0.28		0.28	0.22		0.58	0.02	0.02	0.05	0.05	
Uniform Delay, d1	58.3	5.5		55.5	4.3		49.4	45.9	45.9	46.1	46.1	
Progression Factor	0.96	0.86		0.81	1.72		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.7	0.3		2.0	0.2		4.9	0.0	0.0	0.1	0.1	
Delay (s)	60.7	5.0		46.7	7.5		54.4	45.9	45.9	46.2	46.2	
Level of Service	E	A		D	A		D	D	D	D	D	
Approach Delay (s)		5.6			8.9			52.1			46.2	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	36.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	14	712	8	10	627	12	13	13	24	67	13	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1684		1770	1695	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.73	1.00		0.73	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1368	1684		1363	1695	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	15	749	8	11	660	13	14	14	25	71	14	21
RTOR Reduction (vph)	0	0	2	0	0	3	0	23	0	0	19	0
Lane Group Flow (vph)	15	749	6	11	660	10	14	16	0	71	16	0
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2			6		
Actuated Green, G (s)	3.1	95.2	95.2	1.5	93.6	93.6	10.3	10.3		10.3	10.3	
Effective Green, g (s)	3.1	96.2	96.2	1.5	94.6	94.6	10.3	10.3		10.3	10.3	
Actuated g/C Ratio	0.03	0.80	0.80	0.01	0.79	0.79	0.09	0.09		0.09	0.09	
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	46	2837	1269	22	2790	1248	117	145		117	145	
v/s Ratio Prot	c0.01	c0.21		0.01	0.19			0.01			0.01	
v/s Ratio Perm			0.00			0.01	0.01			c0.05		
v/c Ratio	0.33	0.26	0.01	0.50	0.24	0.01	0.12	0.11		0.61	0.11	
Uniform Delay, d1	57.4	3.0	2.4	58.9	3.3	2.7	50.7	50.6		52.9	50.6	
Progression Factor	0.89	1.83	2.33	0.90	0.82	0.90	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.0	0.2	0.0	16.5	0.2	0.0	0.5	0.3		8.6	0.3	
Delay (s)	55.3	5.7	5.5	69.2	2.9	2.4	51.1	51.0		61.5	50.9	
Level of Service	E	A	A	E	A	A	D	D		E	D	
Approach Delay (s)		6.7			4.0			51.0			58.0	
Approach LOS		A			A			D			E	

Intersection Summary			
HCM Average Control Delay	10.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	802	17	31	707	26	51	22	44	33	10	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3528		1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.75	1.00	1.00	0.74	1.00	1.00
Satd. Flow (perm)	1770	3528		1770	3539	1583	1398	1863	1583	1381	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	872	18	34	768	28	55	24	48	36	11	15
RTOR Reduction (vph)	0	0	0	0	0	6	0	0	44	0	0	14
Lane Group Flow (vph)	16	890	0	34	768	22	55	24	4	36	11	1
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2		2	6		6
Actuated Green, G (s)	3.1	92.1		5.4	94.9	94.9	9.0	9.0	9.0	9.0	9.0	9.0
Effective Green, g (s)	2.6	93.1		5.4	95.9	95.9	9.5	9.5	9.5	9.5	9.5	9.5
Actuated g/C Ratio	0.02	0.78		0.05	0.80	0.80	0.08	0.08	0.08	0.08	0.08	0.08
Clearance Time (s)	3.5	5.0		4.0	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	38	2737		80	2828	1265	111	147	125	109	147	125
v/s Ratio Prot	0.01	c0.25		c0.02	c0.22			0.01			0.01	
v/s Ratio Perm						0.01	c0.04		0.00	0.03		0.00
v/c Ratio	0.42	0.33		0.42	0.27	0.02	0.50	0.16	0.03	0.33	0.07	0.01
Uniform Delay, d1	58.0	4.0		55.8	3.1	2.5	53.0	51.5	51.0	52.2	51.2	50.9
Progression Factor	1.22	0.77		1.20	0.82	0.44	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.3	0.3		3.5	0.2	0.0	3.5	0.5	0.1	1.8	0.2	0.0
Delay (s)	78.2	3.4		70.5	2.8	1.1	56.4	52.1	51.1	54.0	51.4	50.9
Level of Service	E	A		E	A	A	E	D	D	D	D	D
Approach Delay (s)		4.7			5.5			53.6			52.8	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	9.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	16	733	113	32	682	13	186	18	17	39	31	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3468		1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.74	1.00	1.00	0.75	1.00	1.00
Satd. Flow (perm)	1770	3468		1770	3539	1583	1370	1863	1583	1388	1863	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	17	788	122	34	733	14	200	19	18	42	33	39
RTOR Reduction (vph)	0	7	0	0	0	5	0	0	14	0	0	31
Lane Group Flow (vph)	17	903	0	34	733	9	200	19	4	42	33	8
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2		2	6		6
Actuated Green, G (s)	3.2	77.9		5.4	80.1	80.1	23.2	23.2	23.2	23.2	23.2	23.2
Effective Green, g (s)	3.2	78.9		5.4	81.1	81.1	23.7	23.7	23.7	23.7	23.7	23.7
Actuated g/C Ratio	0.03	0.66		0.05	0.68	0.68	0.20	0.20	0.20	0.20	0.20	0.20
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	47	2280		80	2392	1070	271	368	313	274	368	313
v/s Ratio Prot	0.01	c0.26		c0.02	0.21			0.01			0.02	
v/s Ratio Perm						0.01	c0.15		0.00	0.03		0.00
v/c Ratio	0.36	0.40		0.42	0.31	0.01	0.74	0.05	0.01	0.15	0.09	0.02
Uniform Delay, d1	57.4	9.5		55.8	8.0	6.3	45.2	39.0	38.7	39.8	39.3	38.8
Progression Factor	0.81	1.38		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.6	0.5		3.6	0.3	0.0	10.0	0.1	0.0	0.3	0.1	0.0
Delay (s)	51.3	13.6		59.4	8.3	6.4	55.3	39.1	38.7	40.1	39.4	38.9
Level of Service	D	B		E	A	A	E	D	D	D	D	D
Approach Delay (s)		14.3			10.5			52.7			39.5	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	18.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	121	603	18	39	504	61	69	86	53	111	96	226
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00		1.00	0.98		1.00	1.00	0.85	1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3523		1770	3482		1770	3539	1583	1770	3166	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3523		1770	3482		1770	3539	1583	1770	3166	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	132	655	20	42	548	66	75	93	58	121	104	246
RTOR Reduction (vph)	0	1	0	0	4	0	0	0	54	0	225	0
Lane Group Flow (vph)	132	674	0	42	610	0	75	93	4	121	125	0
Turn Type	Prot			Prot			Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	16.5	95.7		9.1	88.3		13.1	9.3	9.3	15.9	12.1	
Effective Green, g (s)	17.0	97.7		9.6	90.3		13.6	10.3	10.3	16.4	13.1	
Actuated g/C Ratio	0.11	0.65		0.06	0.60		0.09	0.07	0.07	0.11	0.09	
Clearance Time (s)	4.5	6.0		4.5	6.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	201	2295		113	2096		160	243	109	194	276	
v/s Ratio Prot	c0.07	c0.19		0.02	0.18		0.04	0.03		c0.07	c0.04	
v/s Ratio Perm									0.00			
v/c Ratio	0.66	0.29		0.37	0.29		0.47	0.38	0.04	0.62	0.45	
Uniform Delay, d1	63.7	11.3		67.3	14.4		64.8	66.8	65.2	63.9	65.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	7.5	0.3		2.1	0.4		2.2	1.0	0.1	6.1	1.2	
Delay (s)	71.2	11.6		69.4	14.8		66.9	67.8	65.4	70.0	66.2	
Level of Service	E	B		E	B		E	E	E	E	E	
Approach Delay (s)		21.4			18.3			66.9			67.2	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM Average Control Delay	35.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	21	700	34	55	586	28	10	16	53	5	10	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.88		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3514		1770	3515		1770	1648		1770	1745	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3514		1770	3515		1770	1648		1770	1745	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	22	737	36	58	617	29	11	17	56	5	11	8
RTOR Reduction (vph)	0	2	0	0	2	0	0	52	0	0	7	0
Lane Group Flow (vph)	22	771	0	58	644	0	11	21	0	5	12	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	4.8	83.8		8.1	87.1		1.5	8.2		1.4	8.1	
Effective Green, g (s)	5.3	84.8		8.6	88.1		2.0	8.7		1.9	8.6	
Actuated g/C Ratio	0.04	0.71		0.07	0.73		0.02	0.07		0.02	0.07	
Clearance Time (s)	4.5	5.0		4.5	5.0		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	78	2483		127	2581		30	119		28	125	
v/s Ratio Prot	0.01	c0.22		c0.03	c0.18		c0.01	c0.01		0.00	0.01	
v/s Ratio Perm												
v/c Ratio	0.28	0.31		0.46	0.25		0.37	0.18		0.18	0.09	
Uniform Delay, d1	55.5	6.6		53.5	5.2		58.4	52.3		58.3	52.1	
Progression Factor	1.00	1.00		0.95	0.70		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.0	0.3		2.5	0.2		7.4	0.7		3.0	0.3	
Delay (s)	57.5	6.9		53.3	3.9		65.8	53.0		61.3	52.4	
Level of Service	E	A		D	A		E	D		E	D	
Approach Delay (s)		8.3			7.9			54.7			54.2	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	48.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	11	551	39	15	555	24	91	35	21	35	26	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3504		1770	3517		1770	3342		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.74	1.00		0.71	1.00	1.00
Satd. Flow (perm)	1770	3504		1770	3517		1375	3342		1331	1863	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	12	612	43	17	617	27	101	39	23	39	29	16
RTOR Reduction (vph)	0	2	0	0	1	0	0	20	0	0	0	14
Lane Group Flow (vph)	12	653	0	17	643	0	101	42	0	39	29	2
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	2.9	87.8		3.2	88.1		14.5	14.5		14.5	14.5	14.5
Effective Green, g (s)	3.4	89.8		3.7	90.1		14.5	14.5		14.5	14.5	14.5
Actuated g/C Ratio	0.03	0.75		0.03	0.75		0.12	0.12		0.12	0.12	0.12
Clearance Time (s)	4.5	6.0		4.5	6.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	50	2622		55	2641		166	404		161	225	191
v/s Ratio Prot	0.01	c0.19		c0.01	0.18			0.01			0.02	
v/s Ratio Perm							c0.07			0.03		0.00
v/c Ratio	0.24	0.25		0.31	0.24		0.61	0.10		0.24	0.13	0.01
Uniform Delay, d1	57.0	4.7		56.9	4.6		50.1	47.0		47.8	47.1	46.4
Progression Factor	1.04	0.74		1.23	0.49		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.4	0.2		3.1	0.2		6.2	0.1		0.8	0.3	0.0
Delay (s)	62.0	3.7		73.4	2.5		56.2	47.1		48.6	47.4	46.5
Level of Service	E	A		E	A		E	D		D	D	D
Approach Delay (s)		4.7			4.3			52.8			47.7	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	11.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	43.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	16	524	39	61	577	12	20	24	72	20	27	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3502		1770	3528		3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3502		1770	3528		3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	17	563	42	66	620	13	22	26	77	22	29	18
RTOR Reduction (vph)	0	3	0	0	1	0	0	0	71	0	0	17
Lane Group Flow (vph)	17	602	0	66	632	0	22	26	6	22	29	1
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	3.2	78.0		8.6	83.4		4.0	8.1	8.1	4.8	8.9	8.9
Effective Green, g (s)	4.2	80.0		9.6	85.4		4.5	9.1	9.1	5.3	9.9	9.9
Actuated g/C Ratio	0.04	0.67		0.08	0.71		0.04	0.08	0.08	0.04	0.08	0.08
Clearance Time (s)	5.0	6.0		5.0	6.0		4.5	5.0	5.0	4.5	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	62	2335		142	2511		129	141	120	78	154	131
v/s Ratio Prot	0.01	0.17		c0.04	c0.18		0.01	0.01		c0.01	c0.02	
v/s Ratio Perm									0.00			0.00
v/c Ratio	0.27	0.26		0.46	0.25		0.17	0.18	0.05	0.28	0.19	0.01
Uniform Delay, d1	56.4	8.1		52.7	6.1		55.9	52.0	51.4	55.5	51.3	50.6
Progression Factor	0.80	1.69		0.89	0.72		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.4	0.3		2.4	0.2		0.6	0.6	0.2	2.0	0.6	0.0
Delay (s)	47.3	13.9		49.4	4.6		56.6	52.6	51.6	57.5	51.9	50.6
Level of Service	D	B		D	A		E	D	D	E	D	D
Approach Delay (s)		14.8			8.9			52.7			53.3	
Approach LOS		B			A			D			D	

Intersection Summary			
HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	38	574	15	12	504	21	15	12	38	66	38	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.99		1.00	0.89		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3526		1770	3518		1770	1651		1770	1680	
Flt Permitted	0.95	1.00		0.95	1.00		0.50	1.00		0.72	1.00	
Satd. Flow (perm)	1770	3526		1770	3518		938	1651		1345	1680	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	624	16	13	548	23	16	13	41	72	41	78
RTOR Reduction (vph)	0	1	0	0	1	0	0	36	0	0	68	0
Lane Group Flow (vph)	41	639	0	13	570	0	16	18	0	72	51	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	7.1	88.9		3.0	84.8		12.6	12.6		12.6	12.6	
Effective Green, g (s)	7.6	90.9		3.5	86.8		13.6	13.6		13.6	13.6	
Actuated g/C Ratio	0.06	0.76		0.03	0.72		0.11	0.11		0.11	0.11	
Clearance Time (s)	4.5	6.0		4.5	6.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	112	2671		52	2545		106	187		152	190	
v/s Ratio Prot	c0.02	c0.18		0.01	0.16			0.01			0.03	
v/s Ratio Perm							0.02			c0.05		
v/c Ratio	0.37	0.24		0.25	0.22		0.15	0.09		0.47	0.27	
Uniform Delay, d1	53.9	4.3		57.0	5.5		48.0	47.7		49.8	48.6	
Progression Factor	1.01	1.04		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.0	0.2		2.5	0.2		0.7	0.2		2.3	0.8	
Delay (s)	56.6	4.7		59.5	5.7		48.7	47.9		52.2	49.4	
Level of Service	E	A		E	A		D	D		D	D	
Approach Delay (s)		7.8			6.9			48.1			50.4	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	14.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	814	3	8	731	64	2	0	5	55	0	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00		0.95	0.95	
Frt	1.00	1.00		1.00	0.99			0.90		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	0.96	
Satd. Flow (prot)	1770	3537		1770	3497			1659		1681	1662	
Flt Permitted	0.95	1.00		0.95	1.00			0.99		0.95	0.96	
Satd. Flow (perm)	1770	3537		1770	3497			1659		1681	1662	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	18	831	3	8	746	65	2	0	5	56	0	4
RTOR Reduction (vph)	0	0	0	0	2	0	0	5	0	0	4	0
Lane Group Flow (vph)	18	834	0	8	809	0	0	2	0	30	26	0
Turn Type	Prot			Prot			Split			Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases												
Actuated Green, G (s)	3.2	90.9		1.5	89.2			1.4		6.7	6.7	
Effective Green, g (s)	3.7	92.9		2.0	91.2			1.9		7.2	7.2	
Actuated g/C Ratio	0.03	0.77		0.02	0.76			0.02		0.06	0.06	
Clearance Time (s)	4.5	6.0		4.5	6.0			4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	55	2738		30	2658			26		101	100	
v/s Ratio Prot	c0.01	c0.24		0.00	0.23			c0.00		c0.02	0.02	
v/s Ratio Perm												
v/c Ratio	0.33	0.30		0.27	0.30			0.08		0.30	0.26	
Uniform Delay, d1	56.9	4.0		58.3	4.5			58.2		54.0	53.9	
Progression Factor	1.00	1.00		0.95	0.79			1.00		1.00	1.00	
Incremental Delay, d2	3.5	0.3		4.6	0.3			1.3		1.6	1.4	
Delay (s)	60.4	4.3		59.9	3.8			59.5		55.6	55.3	
Level of Service	E	A		E	A			E		E	E	
Approach Delay (s)		5.5			4.4			59.5			55.4	
Approach LOS		A			A			E			E	

Intersection Summary			
HCM Average Control Delay	6.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	35.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	17	769	89	39	789	9	63	4	36	10	6	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	1.00		1.00	1.00	0.85	1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3484		1770	3533		1770	1863	1583	1770	1645	
Flt Permitted	0.95	1.00		0.95	1.00		0.74	1.00	1.00	0.76	1.00	
Satd. Flow (perm)	1770	3484		1770	3533		1378	1863	1583	1407	1645	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	18	793	92	40	813	9	65	4	37	10	6	21
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	34	0	19	0
Lane Group Flow (vph)	18	882	0	40	822	0	65	4	3	10	8	0
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2		2	6		
Actuated Green, G (s)	3.2	88.6		7.1	92.5		9.8	9.8	9.8	9.8	9.8	
Effective Green, g (s)	3.7	89.6		7.6	93.5		10.8	10.8	10.8	10.8	10.8	
Actuated g/C Ratio	0.03	0.75		0.06	0.78		0.09	0.09	0.09	0.09	0.09	
Clearance Time (s)	4.5	5.0		4.5	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	55	2601		112	2753		124	168	142	127	148	
v/s Ratio Prot	0.01	c0.25		c0.02	c0.23			0.00			0.00	
v/s Ratio Perm							c0.05		0.00	0.01		
v/c Ratio	0.33	0.34		0.36	0.30		0.52	0.02	0.02	0.08	0.05	
Uniform Delay, d1	56.9	5.2		53.9	3.8		52.1	49.8	49.8	50.0	49.9	
Progression Factor	0.94	0.90		0.77	1.28		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.4	0.3		1.9	0.3		4.0	0.1	0.1	0.3	0.2	
Delay (s)	56.8	5.0		43.3	5.2		56.1	49.9	49.9	50.3	50.1	
Level of Service	E	A		D	A		E	D	D	D	D	
Approach Delay (s)		6.0			6.9			53.7			50.1	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	9.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	823	12	17	894	13	20	11	18	101	18	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1688		1770	1739	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.73	1.00		0.74	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1367	1688		1372	1739	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	895	13	18	972	14	22	12	20	110	20	16
RTOR Reduction (vph)	0	0	3	0	0	4	0	18	0	0	14	0
Lane Group Flow (vph)	22	895	10	18	972	10	22	15	0	110	22	0
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2			6		
Actuated Green, G (s)	3.4	88.7	88.7	3.3	88.6	88.6	15.0	15.0		15.0	15.0	
Effective Green, g (s)	3.4	89.7	89.7	3.3	89.6	89.6	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.03	0.75	0.75	0.03	0.75	0.75	0.12	0.12		0.12	0.12	
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	50	2645	1183	49	2642	1182	171	211		172	217	
v/s Ratio Prot	c0.01	0.25		0.01	c0.27			0.01			0.01	
v/s Ratio Perm			0.01			0.01	0.02			c0.08		
v/c Ratio	0.44	0.34	0.01	0.37	0.37	0.01	0.13	0.07		0.64	0.10	
Uniform Delay, d1	57.4	5.1	3.8	57.3	5.3	3.9	46.7	46.3		49.9	46.5	
Progression Factor	1.01	1.62	2.04	0.84	1.18	1.69	1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.9	0.3	0.0	4.4	0.4	0.0	0.3	0.1		7.6	0.2	
Delay (s)	63.7	8.6	7.9	52.5	6.6	6.6	47.0	46.5		57.5	46.7	
Level of Service	E	A	A	D	A	A	D	D		E	D	
Approach Delay (s)		9.9			7.5			46.7			54.9	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	43.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	17	953	33	44	981	25	62	7	39	54	11	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3522		1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.75	1.00	1.00	0.75	1.00	1.00
Satd. Flow (perm)	1770	3522		1770	3539	1583	1397	1863	1583	1403	1863	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	18	1014	35	47	1044	27	66	7	41	57	12	20
RTOR Reduction (vph)	0	1	0	0	0	6	0	0	37	0	0	18
Lane Group Flow (vph)	18	1048	0	47	1044	21	66	7	4	57	12	2
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2		2	6		6
Actuated Green, G (s)	3.2	89.2		7.5	94.0	94.0	9.8	9.8	9.8	9.8	9.8	9.8
Effective Green, g (s)	2.7	90.2		7.5	95.0	95.0	10.3	10.3	10.3	10.3	10.3	10.3
Actuated g/C Ratio	0.02	0.75		0.06	0.79	0.79	0.09	0.09	0.09	0.09	0.09	0.09
Clearance Time (s)	3.5	5.0		4.0	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	40	2647		111	2802	1253	120	160	136	120	160	136
v/s Ratio Prot	0.01	c0.30		c0.03	0.29			0.00			0.01	
v/s Ratio Perm						0.01	c0.05		0.00	0.04		0.00
v/c Ratio	0.45	0.40		0.42	0.37	0.02	0.55	0.04	0.03	0.48	0.08	0.01
Uniform Delay, d1	57.9	5.3		54.2	3.7	2.6	52.6	50.3	50.3	52.3	50.5	50.2
Progression Factor	1.10	0.97		1.31	0.48	0.23	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.6	0.4		2.4	0.4	0.0	5.4	0.1	0.1	2.9	0.2	0.0
Delay (s)	71.2	5.6		73.2	2.1	0.6	58.0	50.4	50.3	55.2	50.7	50.2
Level of Service	E	A		E	A	A	E	D	D	E	D	D
Approach Delay (s)		6.7			5.1			54.8			53.5	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	10.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	37	868	208	48	971	33	177	65	21	51	59	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3436		1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.72	1.00	1.00	0.71	1.00	1.00
Satd. Flow (perm)	1770	3436		1770	3539	1583	1336	1863	1583	1328	1863	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	39	904	217	50	1011	34	184	68	22	53	61	29
RTOR Reduction (vph)	0	12	0	0	0	11	0	0	18	0	0	24
Lane Group Flow (vph)	39	1109	0	50	1011	23	184	68	4	53	61	5
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2		2	6		6
Actuated Green, G (s)	5.6	76.8		7.7	78.9	78.9	22.0	22.0	22.0	22.0	22.0	22.0
Effective Green, g (s)	5.6	77.8		7.7	79.9	79.9	22.5	22.5	22.5	22.5	22.5	22.5
Actuated g/C Ratio	0.05	0.65		0.06	0.67	0.67	0.19	0.19	0.19	0.19	0.19	0.19
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	83	2228		114	2356	1054	251	349	297	249	349	297
v/s Ratio Prot	0.02	c0.32		c0.03	0.29			0.04			0.03	
v/s Ratio Perm						0.01	c0.14		0.00	0.04		0.00
v/c Ratio	0.47	0.50		0.44	0.43	0.02	0.73	0.19	0.01	0.21	0.17	0.02
Uniform Delay, d1	55.8	11.0		54.1	9.4	6.8	45.9	41.1	39.7	41.3	41.0	39.7
Progression Factor	0.94	1.47		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.0	0.8		2.7	0.6	0.0	10.5	0.3	0.0	0.4	0.2	0.0
Delay (s)	56.5	16.9		56.8	10.0	6.8	56.5	41.4	39.7	41.7	41.2	39.8
Level of Service	E	B		E	A	A	E	D	D	D	D	D
Approach Delay (s)		18.2			12.0			51.4			41.1	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	209	699	37	56	897	91	66	103	93	108	112	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3513		1770	3490		1770	3539	1583	1770	3221	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3513		1770	3490		1770	3539	1583	1770	3221	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	215	721	38	58	925	94	68	106	96	111	115	172
RTOR Reduction (vph)	0	2	0	0	4	0	0	0	88	0	153	0
Lane Group Flow (vph)	215	757	0	58	1015	0	68	106	8	111	134	0
Turn Type	Prot			Prot			Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	22.7	85.4		9.5	72.2		10.3	11.1	11.1	14.0	14.8	
Effective Green, g (s)	23.2	87.4		10.0	74.2		10.8	12.1	12.1	14.5	15.8	
Actuated g/C Ratio	0.17	0.62		0.07	0.53		0.08	0.09	0.09	0.10	0.11	
Clearance Time (s)	4.5	6.0		4.5	6.0		4.5	5.0	5.0	4.5	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	293	2193		126	1850		137	306	137	183	364	
v/s Ratio Prot	c0.12	0.22		0.03	c0.29		0.04	0.03		c0.06	c0.04	
v/s Ratio Perm									0.01			
v/c Ratio	0.73	0.35		0.46	0.55		0.50	0.35	0.06	0.61	0.37	
Uniform Delay, d1	55.5	12.6		62.4	21.8		62.0	60.2	58.7	60.0	57.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	9.2	0.4		2.7	1.2		2.8	0.7	0.2	5.6	0.6	
Delay (s)	64.6	13.0		65.1	23.0		64.8	60.9	58.9	65.6	58.1	
Level of Service	E	B		E	C		E	E	E	E	E	
Approach Delay (s)		24.4			25.2			61.2			60.2	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	33.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	64.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	46	830	29	69	999	42	14	16	82	39	21	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.88		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3521		1770	3518		1770	1630		1770	1678	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3521		1770	3518		1770	1630		1770	1678	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	48	865	30	72	1041	44	15	17	85	41	22	43
RTOR Reduction (vph)	0	2	0	0	2	0	0	76	0	0	37	0
Lane Group Flow (vph)	48	893	0	72	1083	0	15	26	0	41	28	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	7.5	73.2		8.9	74.6		3.1	12.3		7.1	16.3	
Effective Green, g (s)	8.0	74.2		9.4	75.6		3.6	12.8		7.6	16.8	
Actuated g/C Ratio	0.07	0.62		0.08	0.63		0.03	0.11		0.06	0.14	
Clearance Time (s)	4.5	5.0		4.5	5.0		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	118	2177		139	2216		53	174		112	235	
v/s Ratio Prot	0.03	0.25		c0.04	c0.31		0.01	c0.02		c0.02	c0.02	
v/s Ratio Perm												
v/c Ratio	0.41	0.41		0.52	0.49		0.28	0.15		0.37	0.12	
Uniform Delay, d1	53.7	11.7		53.1	11.9		56.9	48.7		53.9	45.1	
Progression Factor	1.00	1.00		0.94	0.86		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.3	0.6		3.1	0.7		2.9	0.4		2.0	0.2	
Delay (s)	56.0	12.3		52.9	10.9		59.9	49.1		55.9	45.4	
Level of Service	E	B		D	B		E	D		E	D	
Approach Delay (s)		14.5			13.5			50.4			49.4	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	645	96	41	844	54	122	64	29	161	114	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.99		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3470		1770	3507		1770	3371		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.58	1.00		0.69	1.00	1.00
Satd. Flow (perm)	1770	3470		1770	3507		1083	3371		1286	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	19	679	101	43	888	57	128	67	31	169	120	27
RTOR Reduction (vph)	0	7	0	0	2	0	0	26	0	0	0	22
Lane Group Flow (vph)	19	773	0	43	943	0	128	72	0	169	120	5
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	3.3	77.2		7.2	81.1		21.1	21.1		21.1	21.1	21.1
Effective Green, g (s)	3.8	79.2		7.7	83.1		21.1	21.1		21.1	21.1	21.1
Actuated g/C Ratio	0.03	0.66		0.06	0.69		0.18	0.18		0.18	0.18	0.18
Clearance Time (s)	4.5	6.0		4.5	6.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	56	2290		114	2429		190	593		226	328	278
v/s Ratio Prot	0.01	0.22		c0.02	c0.27			0.02			0.06	
v/s Ratio Perm							0.12			c0.13		0.00
v/c Ratio	0.34	0.34		0.38	0.39		0.67	0.12		0.75	0.37	0.02
Uniform Delay, d1	56.9	8.9		53.9	7.8		46.2	41.6		46.9	43.6	40.9
Progression Factor	1.07	0.62		1.42	0.32		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.4	0.4		2.0	0.4		9.1	0.1		12.7	0.7	0.0
Delay (s)	64.0	5.9		78.3	2.9		55.3	41.7		59.6	44.3	40.9
Level of Service	E	A		E	A		E	D		E	D	D
Approach Delay (s)		7.3			6.2			49.4			52.2	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	17.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	24	726	39	66	933	25	58	33	50	13	13	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3512		1770	3525		3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3512		1770	3525		3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	789	42	72	1014	27	63	36	54	14	14	25
RTOR Reduction (vph)	0	2	0	0	1	0	0	0	49	0	0	23
Lane Group Flow (vph)	26	829	0	72	1040	0	63	36	5	14	14	2
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	5.0	76.5		9.0	80.5		7.2	11.0	11.0	3.0	6.8	6.8
Effective Green, g (s)	6.0	78.5		10.0	82.5		7.7	12.0	12.0	3.5	7.8	7.8
Actuated g/C Ratio	0.05	0.65		0.08	0.69		0.06	0.10	0.10	0.03	0.06	0.06
Clearance Time (s)	5.0	6.0		5.0	6.0		4.5	5.0	5.0	4.5	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	89	2297		148	2423		220	186	158	52	121	103
v/s Ratio Prot	0.01	0.24		c0.04	c0.30		c0.02	c0.02		0.01	0.01	
v/s Ratio Perm									0.00			0.00
v/c Ratio	0.29	0.36		0.49	0.43		0.29	0.19	0.03	0.27	0.12	0.02
Uniform Delay, d1	55.0	9.4		52.5	8.3		53.5	49.6	48.8	57.0	52.9	52.5
Progression Factor	0.89	1.41		1.21	0.60		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7	0.4		2.4	0.5		0.7	0.5	0.1	2.8	0.4	0.1
Delay (s)	50.4	13.6		65.7	5.5		54.3	50.1	48.9	59.8	53.3	52.6
Level of Service	D	B		E	A		D	D	D	E	D	D
Approach Delay (s)		14.7			9.4			51.4			54.7	
Approach LOS		B			A			D			D	

Intersection Summary			
HCM Average Control Delay	15.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	121	620	23	28	893	77	16	38	6	35	29	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.98		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3520		1770	3497		1770	1826		1770	1674	
Flt Permitted	0.95	1.00		0.95	1.00		0.59	1.00		0.73	1.00	
Satd. Flow (perm)	1770	3520		1770	3497		1091	1826		1354	1674	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	126	646	24	29	930	80	17	40	6	36	30	62
RTOR Reduction (vph)	0	1	0	0	3	0	0	5	0	0	56	0
Lane Group Flow (vph)	126	669	0	29	1007	0	17	41	0	36	36	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	13.8	88.9		5.1	80.2		10.5	10.5		10.5	10.5	
Effective Green, g (s)	14.3	90.9		5.6	82.2		11.5	11.5		11.5	11.5	
Actuated g/C Ratio	0.12	0.76		0.05	0.68		0.10	0.10		0.10	0.10	
Clearance Time (s)	4.5	6.0		4.5	6.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	211	2666		83	2395		105	175		130	160	
v/s Ratio Prot	c0.07	0.19		0.02	c0.29			0.02			0.02	
v/s Ratio Perm							0.02			c0.03		
v/c Ratio	0.60	0.25		0.35	0.42		0.16	0.23		0.28	0.22	
Uniform Delay, d1	50.1	4.4		55.4	8.4		49.8	50.2		50.4	50.1	
Progression Factor	1.04	0.88		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.3	0.2		2.5	0.5		0.7	0.7		1.2	0.7	
Delay (s)	56.6	4.1		58.0	8.9		50.6	50.8		51.6	50.8	
Level of Service	E	A		E	A		D	D		D	D	
Approach Delay (s)		12.4			10.3			50.8			51.0	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	52.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX D

GENERAL PLAN (2035) CONDITIONS LOS RESULTS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	2160	40	10	2450	10	10	10	10	230	10	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00		0.95	0.95	
Frt	1.00	1.00		1.00	1.00			0.96		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.98		0.95	0.96	
Satd. Flow (prot)	1770	5071		1770	5082			1750		1681	1665	
Flt Permitted	0.95	1.00		0.95	1.00			0.98		0.95	0.96	
Satd. Flow (perm)	1770	5071		1770	5082			1750		1681	1665	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	11	2427	45	11	2753	11	11	11	11	258	11	22
RTOR Reduction (vph)	0	1	0	0	0	0	0	10	0	0	4	0
Lane Group Flow (vph)	11	2471	0	11	2764	0	0	23	0	147	140	0
Turn Type	Prot			Prot			Split			Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases												
Actuated Green, G (s)	0.7	69.9		0.7	69.9			4.6		13.6	13.6	
Effective Green, g (s)	1.2	71.9		1.2	71.9			5.1		14.1	14.1	
Actuated g/C Ratio	0.01	0.66		0.01	0.66			0.05		0.13	0.13	
Clearance Time (s)	4.5	6.0		4.5	6.0			4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	20	3367		20	3374			82		219	217	
v/s Ratio Prot	c0.01	0.49		0.01	c0.54			c0.01		c0.09	0.08	
v/s Ratio Perm												
v/c Ratio	0.55	0.73		0.55	0.82			0.27		0.67	0.64	
Uniform Delay, d1	53.3	11.9		53.3	13.4			49.8		44.9	44.7	
Progression Factor	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Incremental Delay, d2	28.9	0.9		28.9	1.6			1.8		7.8	6.4	
Delay (s)	82.2	12.8		82.2	15.1			51.6		52.7	51.1	
Level of Service	F	B		F	B			D		D	D	
Approach Delay (s)		13.1			15.3			51.6			51.9	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	16.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	108.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	2380	100	60	2300	20	50	30	70	20	20	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5054		1770	5079		1770	1863	1583	1770	1678	
Flt Permitted	0.95	1.00		0.95	1.00		0.71	1.00	1.00	0.74	1.00	
Satd. Flow (perm)	1770	5054		1770	5079		1331	1863	1583	1370	1678	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	2587	109	65	2500	22	54	33	76	22	22	43
RTOR Reduction (vph)	0	6	0	0	1	0	0	0	69	0	39	0
Lane Group Flow (vph)	33	2690	0	65	2521	0	54	33	7	22	26	0
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2		2	6		
Actuated Green, G (s)	2.6	41.3		4.0	42.7		5.3	5.3	5.3	5.3	5.3	
Effective Green, g (s)	3.1	42.3		4.5	43.7		6.3	6.3	6.3	6.3	6.3	
Actuated g/C Ratio	0.05	0.65		0.07	0.67		0.10	0.10	0.10	0.10	0.10	
Clearance Time (s)	4.5	5.0		4.5	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	84	3284		122	3409		129	180	153	133	162	
v/s Ratio Prot	0.02	c0.53		c0.04	0.50			0.02			0.02	
v/s Ratio Perm							c0.04		0.00	0.02		
v/c Ratio	0.39	0.82		0.53	0.74		0.42	0.18	0.05	0.17	0.16	
Uniform Delay, d1	30.1	8.5		29.3	7.0		27.7	27.0	26.7	27.0	27.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.0	1.7		4.4	0.9		2.2	0.5	0.1	0.6	0.5	
Delay (s)	33.1	10.2		33.7	7.9		29.9	27.5	26.8	27.6	27.4	
Level of Service	C	B		C	A		C	C	C	C	C	
Approach Delay (s)		10.5			8.5			28.0			27.5	
Approach LOS		B			A			C			C	

Intersection Summary			
HCM Average Control Delay	10.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	65.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	2300	40	110	2130	30	40	40	60	180	50	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583	1770	1695		1770	1711	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.67	1.00		0.69	1.00	
Satd. Flow (perm)	1770	5085	1583	1770	5085	1583	1246	1695		1284	1711	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	2421	42	116	2242	32	42	42	63	189	53	63
RTOR Reduction (vph)	0	0	17	0	0	12	0	50	0	0	50	0
Lane Group Flow (vph)	21	2421	25	116	2242	20	42	55	0	189	66	0
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2			6		
Actuated Green, G (s)	1.9	43.8	43.8	6.0	47.9	47.9	16.5	16.5		16.5	16.5	
Effective Green, g (s)	1.9	44.8	44.8	6.0	48.9	48.9	16.5	16.5		16.5	16.5	
Actuated g/C Ratio	0.02	0.56	0.56	0.08	0.62	0.62	0.21	0.21		0.21	0.21	
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	42	2873	894	134	3136	976	259	353		267	356	
v/s Ratio Prot	0.01	c0.48		0.07	c0.44			0.03			0.04	
v/s Ratio Perm			0.02			0.01	0.03			c0.15		
v/c Ratio	0.50	0.84	0.03	0.87	0.71	0.02	0.16	0.16		0.71	0.19	
Uniform Delay, d1	38.2	14.3	7.6	36.3	10.4	5.9	25.7	25.7		29.2	25.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.1	2.4	0.0	40.3	0.8	0.0	0.3	0.2		8.3	0.3	
Delay (s)	47.3	16.7	7.6	76.6	11.2	5.9	26.0	25.9		37.5	26.1	
Level of Service	D	B	A	E	B	A	C	C		D	C	
Approach Delay (s)		16.8			14.3			25.9			33.1	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	79.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	2400	40	60	2130	30	40	40	60	180	50	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5073		1770	5085	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.72	1.00	1.00	0.73	1.00	1.00
Satd. Flow (perm)	1770	5073		1770	5085	1583	1345	1863	1583	1358	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	2609	43	65	2315	33	43	43	65	196	54	65
RTOR Reduction (vph)	0	2	0	0	0	12	0	0	52	0	0	52
Lane Group Flow (vph)	22	2650	0	65	2315	21	43	43	13	196	54	13
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2		2	6		6
Actuated Green, G (s)	1.8	52.1		5.1	55.9	55.9	17.7	17.7	17.7	17.7	17.7	17.7
Effective Green, g (s)	1.3	53.1		5.1	56.9	56.9	18.2	18.2	18.2	18.2	18.2	18.2
Actuated g/C Ratio	0.01	0.60		0.06	0.64	0.64	0.21	0.21	0.21	0.21	0.21	0.21
Clearance Time (s)	3.5	5.0		4.0	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	26	3047		102	3273	1019	277	384	326	280	384	326
v/s Ratio Prot	0.01	c0.52		c0.04	0.46			0.02			0.03	
v/s Ratio Perm						0.01	0.03		0.01	c0.14		0.01
v/c Ratio	0.85	0.87		0.64	0.71	0.02	0.16	0.11	0.04	0.70	0.14	0.04
Uniform Delay, d1	43.5	14.8		40.7	10.3	5.7	28.8	28.5	28.1	32.6	28.7	28.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	109.6	2.9		12.3	0.7	0.0	0.3	0.1	0.1	7.7	0.2	0.1
Delay (s)	153.1	17.7		53.1	11.0	5.7	29.1	28.7	28.2	40.2	28.9	28.2
Level of Service	F	B		D	B	A	C	C	C	D	C	C
Approach Delay (s)		18.8			12.1			28.6			35.8	
Approach LOS		B			B			C			D	

Intersection Summary			
HCM Average Control Delay	17.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	88.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	1100	20	40	2060	300	250	30	40	70	60	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5071		1770	5085	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.71	1.00	1.00	0.74	1.00	1.00
Satd. Flow (perm)	1770	5071		1770	5085	1583	1331	1863	1583	1372	1863	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	86	1183	22	43	2215	323	269	32	43	75	65	54
RTOR Reduction (vph)	0	2	0	0	0	159	0	0	31	0	0	39
Lane Group Flow (vph)	86	1203	0	43	2215	164	269	32	12	75	65	15
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2		2	6		6
Actuated Green, G (s)	4.9	38.9		3.5	37.5	37.5	19.9	19.9	19.9	19.9	19.9	19.9
Effective Green, g (s)	4.9	39.9		3.5	38.5	38.5	20.4	20.4	20.4	20.4	20.4	20.4
Actuated g/C Ratio	0.06	0.53		0.05	0.51	0.51	0.27	0.27	0.27	0.27	0.27	0.27
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	114	2669		82	2583	804	358	501	426	369	501	426
v/s Ratio Prot	c0.05	0.24		0.02	c0.44			0.02			0.03	
v/s Ratio Perm						0.10	c0.20		0.01	0.05		0.01
v/c Ratio	0.75	0.45		0.52	0.86	0.20	0.75	0.06	0.03	0.20	0.13	0.03
Uniform Delay, d1	34.9	11.1		35.3	16.3	10.2	25.4	20.6	20.4	21.4	21.0	20.4
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	24.3	0.1		5.9	3.0	0.1	8.6	0.1	0.0	0.3	0.1	0.0
Delay (s)	59.1	11.3		41.3	19.3	10.4	34.0	20.7	20.4	21.7	21.1	20.5
Level of Service	E	B		D	B	B	C	C	C	C	C	C
Approach Delay (s)		14.5			18.5			31.0			21.2	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	18.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	75.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	750	230	530	1760	30	120	320	110	300	120	460
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5085	1583	3433	5072		1770	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5085	1583	3433	5072		1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	815	250	576	1913	33	130	348	120	326	130	500
RTOR Reduction (vph)	0	0	185	0	1	0	0	0	101	0	0	197
Lane Group Flow (vph)	65	815	65	576	1945	0	130	348	19	326	130	303
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			6
Actuated Green, G (s)	8.8	29.0	29.0	30.2	50.4		13.9	17.6	17.6	23.2	26.9	26.9
Effective Green, g (s)	9.3	31.0	31.0	30.7	52.4		14.4	18.6	18.6	23.7	27.9	27.9
Actuated g/C Ratio	0.08	0.26	0.26	0.26	0.44		0.12	0.16	0.16	0.20	0.23	0.23
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0		4.5	5.0	5.0	4.5	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	137	1314	409	878	2215		212	549	245	350	823	368
v/s Ratio Prot	0.04	c0.16		0.17	c0.38		0.07	0.10		c0.18	0.04	
v/s Ratio Perm			0.04						0.01			c0.19
v/c Ratio	0.47	0.62	0.16	0.66	0.88		0.61	0.63	0.08	0.93	0.16	0.82
Uniform Delay, d1	53.0	39.3	34.4	39.9	30.9		50.2	47.5	43.4	47.4	36.7	43.7
Progression Factor	1.00	1.00	1.00	0.56	0.43		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.6	2.2	0.8	1.3	4.0		5.2	2.4	0.1	31.0	0.1	13.8
Delay (s)	55.6	41.5	35.2	23.7	17.3		55.3	49.9	43.5	78.3	36.8	57.5
Level of Service	E	D	D	C	B		E	D	D	E	D	E
Approach Delay (s)		40.9			18.8			49.8			61.8	
Approach LOS		D			B			D			E	

Intersection Summary			
HCM Average Control Delay	35.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	930	130	50	2070	80	40	30	140	130	50	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.88		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4992		1770	5057		1770	1633		1770	1700	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4992		1770	5057		1770	1633		1770	1700	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	74	979	137	53	2179	84	42	32	147	137	53	74
RTOR Reduction (vph)	0	14	0	0	3	0	0	133	0	0	43	0
Lane Group Flow (vph)	74	1102	0	53	2260	0	42	46	0	137	84	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	6.8	69.6		6.2	69.0		5.6	11.3		14.4	20.1	
Effective Green, g (s)	7.3	70.6		6.7	70.0		6.1	11.8		14.9	20.6	
Actuated g/C Ratio	0.06	0.59		0.06	0.58		0.05	0.10		0.12	0.17	
Clearance Time (s)	4.5	5.0		4.5	5.0		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	108	2937		99	2950		90	161		220	292	
v/s Ratio Prot	c0.04	0.22		0.03	c0.45		c0.02	c0.03		c0.08	0.05	
v/s Ratio Perm												
v/c Ratio	0.69	0.38		0.54	0.77		0.47	0.29		0.62	0.29	
Uniform Delay, d1	55.2	13.0		55.1	18.8		55.4	50.2		49.9	43.3	
Progression Factor	0.67	0.32		0.89	0.62		1.00	1.00		1.00	1.00	
Incremental Delay, d2	13.2	0.3		2.6	0.9		3.8	1.0		5.4	0.5	
Delay (s)	50.3	4.4		51.5	12.6		59.2	51.2		55.3	43.9	
Level of Service	D	A		D	B		E	D		E	D	
Approach Delay (s)		7.3			13.5			52.7			49.8	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM Average Control Delay	16.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	870	90	40	2000	110	130	160	200	80	100	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	0.92		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5014		1770	5046		1770	3245		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.69	1.00		0.40	1.00	1.00
Satd. Flow (perm)	1770	5014		1770	5046		1277	3245		745	1863	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	178	967	100	44	2222	122	144	178	222	89	111	44
RTOR Reduction (vph)	0	18	0	0	11	0	0	185	0	0	0	37
Lane Group Flow (vph)	178	1049	0	44	2333	0	144	215	0	89	111	7
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	9.2	33.4		2.1	26.3		10.0	10.0		10.0	10.0	10.0
Effective Green, g (s)	9.7	35.4		2.6	28.3		10.0	10.0		10.0	10.0	10.0
Actuated g/C Ratio	0.16	0.59		0.04	0.47		0.17	0.17		0.17	0.17	0.17
Clearance Time (s)	4.5	6.0		4.5	6.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	286	2958		77	2380		213	541		124	311	264
v/s Ratio Prot	c0.10	0.21		0.02	c0.46			0.07			0.06	
v/s Ratio Perm							0.11			c0.12		0.00
v/c Ratio	0.62	0.35		0.57	0.98		0.68	0.40		0.72	0.36	0.03
Uniform Delay, d1	23.4	6.4		28.2	15.6		23.5	22.3		23.7	22.2	20.9
Progression Factor	1.36	0.93		1.04	1.07		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.9	0.3		7.1	11.5		8.2	0.5		17.9	0.7	0.0
Delay (s)	35.7	6.2		36.2	28.3		31.7	22.8		41.6	22.9	21.0
Level of Service	D	A		D	C		C	C		D	C	C
Approach Delay (s)		10.4			28.4			25.1			29.3	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM Average Control Delay	23.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	970	30	90	2030	100	60	70	100	50	90	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91		0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5063		1770	5049		3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5063		1770	5049		3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	108	1043	32	97	2183	108	65	75	108	54	97	65
RTOR Reduction (vph)	0	2	0	0	4	0	0	0	97	0	0	57
Lane Group Flow (vph)	108	1073	0	97	2287	0	65	75	11	54	97	8
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	11.4	71.1		10.7	70.4		4.5	10.9	10.9	6.8	13.2	13.2
Effective Green, g (s)	12.4	73.1		11.7	72.4		5.0	11.9	11.9	7.3	14.2	14.2
Actuated g/C Ratio	0.10	0.61		0.10	0.60		0.04	0.10	0.10	0.06	0.12	0.12
Clearance Time (s)	5.0	6.0		5.0	6.0		4.5	5.0	5.0	4.5	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	183	3084		173	3046		143	185	157	108	220	187
v/s Ratio Prot	c0.06	0.21		0.05	c0.45		0.02	0.04		c0.03	c0.05	
v/s Ratio Perm									0.01			0.00
v/c Ratio	0.59	0.35		0.56	0.75		0.45	0.41	0.07	0.50	0.44	0.04
Uniform Delay, d1	51.4	11.6		51.7	17.3		56.2	50.7	49.0	54.6	49.2	46.9
Progression Factor	0.91	0.62		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.7	0.3		4.1	1.8		2.3	1.5	0.2	3.6	1.4	0.1
Delay (s)	51.2	7.5		55.8	19.0		58.5	52.2	49.2	58.2	50.6	47.0
Level of Service	D	A		E	B		E	D	D	E	D	D
Approach Delay (s)		11.5			20.5			52.5			51.4	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM Average Control Delay	21.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	780	40	80	1980	340	120	50	90	40	290	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	0.97	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583	3433	1683		1770	1791	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.19	1.00		0.61	1.00	
Satd. Flow (perm)	1770	5085	1583	1770	5085	1583	690	1683		1142	1791	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	848	43	87	2152	370	130	54	98	43	315	109
RTOR Reduction (vph)	0	0	22	0	0	189	0	71	0	0	14	0
Lane Group Flow (vph)	120	848	21	87	2152	181	130	81	0	43	410	0
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2			6		
Actuated Green, G (s)	7.5	40.7	40.7	7.0	40.2	40.2	23.1	23.1		23.1	23.1	
Effective Green, g (s)	8.0	42.7	42.7	7.5	42.2	42.2	24.1	24.1		24.1	24.1	
Actuated g/C Ratio	0.09	0.49	0.49	0.09	0.49	0.49	0.28	0.28		0.28	0.28	
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	164	2516	783	154	2487	774	193	470		319	500	
v/s Ratio Prot	c0.07	0.17		0.05	c0.42			0.05			c0.23	
v/s Ratio Perm			0.01			0.11	0.19			0.04		
v/c Ratio	0.73	0.34	0.03	0.56	0.87	0.23	0.67	0.17		0.13	0.82	
Uniform Delay, d1	38.1	13.2	11.2	37.8	19.5	12.7	27.6	23.6		23.3	29.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	15.4	0.1	0.0	4.7	3.4	0.2	8.9	0.2		0.2	10.1	
Delay (s)	53.6	13.3	11.2	42.5	22.9	12.9	36.5	23.7		23.5	39.2	
Level of Service	D	B	B	D	C	B	D	C		C	D	
Approach Delay (s)		18.0			22.2			29.6			37.7	
Approach LOS		B			C			C			D	

Intersection Summary			
HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	86.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	2230	250	60	2070	10	10	10	10	240	10	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00		0.95	0.95	
Frt	1.00	0.98		1.00	1.00			0.96		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00			0.98		0.95	0.97	
Satd. Flow (prot)	1770	5008		1770	5082			1750		1681	1642	
Flt Permitted	0.95	1.00		0.95	1.00			0.98		0.95	0.97	
Satd. Flow (perm)	1770	5008		1770	5082			1750		1681	1642	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	20	2276	255	61	2112	10	10	10	10	245	10	41
RTOR Reduction (vph)	0	8	0	0	0	0	0	10	0	0	11	0
Lane Group Flow (vph)	20	2523	0	61	2122	0	0	20	0	149	136	0
Turn Type	Prot			Prot			Split			Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases												
Actuated Green, G (s)	3.3	73.0		6.7	76.4			4.9		15.9	15.9	
Effective Green, g (s)	3.8	75.0		7.2	78.4			5.4		16.4	16.4	
Actuated g/C Ratio	0.03	0.62		0.06	0.65			0.05		0.14	0.14	
Clearance Time (s)	4.5	6.0		4.5	6.0			4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	56	3130		106	3320			79		230	224	
v/s Ratio Prot	0.01	c0.50		0.03	c0.42			c0.01		c0.09	0.08	
v/s Ratio Perm												
v/c Ratio	0.36	0.81		0.58	0.64			0.26		0.65	0.61	
Uniform Delay, d1	56.9	17.0		54.9	12.4			55.4		49.1	48.8	
Progression Factor	1.00	1.00		0.87	0.66			1.00		1.00	1.00	
Incremental Delay, d2	3.9	2.3		5.9	0.8			1.7		6.2	4.6	
Delay (s)	60.8	19.3		53.4	8.9			57.1		55.2	53.3	
Level of Service	E	B		D	A			E		E	D	
Approach Delay (s)		19.7			10.1			57.1			54.3	
Approach LOS		B			B			E			D	

Intersection Summary			
HCM Average Control Delay	17.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	2300	60	90	2110	70	20	20	70	130	20	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00		1.00	1.00	0.85	1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5066		1770	5061		1770	1863	1583	1770	1664	
Flt Permitted	0.95	1.00		0.95	1.00		0.71	1.00	1.00	0.74	1.00	
Satd. Flow (perm)	1770	5066		1770	5061		1322	1863	1583	1385	1664	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	41	2371	62	93	2175	72	21	21	72	134	21	52
RTOR Reduction (vph)	0	4	0	0	5	0	0	0	64	0	46	0
Lane Group Flow (vph)	41	2429	0	93	2242	0	21	21	8	134	27	0
Turn Type	Prot			Prot			Perm		Perm	Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2		2	6		
Actuated Green, G (s)	2.8	32.5		7.4	37.1		5.6	5.6	5.6	5.6	5.6	
Effective Green, g (s)	3.3	33.5		7.9	38.1		6.6	6.6	6.6	6.6	6.6	
Actuated g/C Ratio	0.06	0.56		0.13	0.64		0.11	0.11	0.11	0.11	0.11	
Clearance Time (s)	4.5	5.0		4.5	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	97	2829		233	3214		145	205	174	152	183	
v/s Ratio Prot	0.02	c0.48		c0.05	c0.44			0.01			0.02	
v/s Ratio Perm							0.02		0.01	c0.10		
v/c Ratio	0.42	0.86		0.40	0.70		0.14	0.10	0.05	0.88	0.15	
Uniform Delay, d1	27.4	11.2		23.9	7.2		24.1	24.0	23.9	26.3	24.2	
Progression Factor	1.00	1.52		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.9	2.4		1.1	1.3		0.5	0.2	0.1	40.5	0.4	
Delay (s)	29.3	19.5		25.0	8.5		24.6	24.3	24.0	66.8	24.5	
Level of Service	C	B		C	A		C	C	C	E	C	
Approach Delay (s)		19.6			9.1			24.2			51.9	
Approach LOS		B			A			C			D	

Intersection Summary			
HCM Average Control Delay	16.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	2450	90	160	2140	60	40	50	40	200	90	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583	1770	1739		1770	1723	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.46	1.00		0.67	1.00	
Satd. Flow (perm)	1770	5085	1583	1770	5085	1583	861	1739		1254	1723	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	2663	98	174	2326	65	43	54	43	217	98	98
RTOR Reduction (vph)	0	0	33	0	0	22	0	28	0	0	35	0
Lane Group Flow (vph)	43	2663	65	174	2326	43	43	69	0	217	161	0
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases			4			8	2			6		
Actuated Green, G (s)	4.6	57.9	57.9	11.0	64.3	64.3	22.1	22.1		22.1	22.1	
Effective Green, g (s)	4.6	58.9	58.9	11.0	65.3	65.3	22.1	22.1		22.1	22.1	
Actuated g/C Ratio	0.04	0.57	0.57	0.11	0.63	0.63	0.21	0.21		0.21	0.21	
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	78	2880	897	187	3193	994	183	370		266	366	
v/s Ratio Prot	0.02	c0.52		c0.10	0.46			0.04			0.09	
v/s Ratio Perm			0.04			0.03	0.05			c0.17		
v/c Ratio	0.55	0.92	0.07	0.93	0.73	0.04	0.23	0.19		0.82	0.44	
Uniform Delay, d1	48.7	20.5	10.2	46.1	13.3	7.4	33.9	33.6		39.0	35.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.2	5.7	0.0	46.2	0.9	0.0	0.7	0.2		17.3	0.8	
Delay (s)	56.9	26.3	10.2	92.3	14.1	7.4	34.6	33.8		56.3	36.4	
Level of Service	E	C	B	F	B	A	C	C		E	D	
Approach Delay (s)		26.2			19.3			34.1			46.8	
Approach LOS		C			B			C			D	

Intersection Summary			
HCM Average Control Delay	24.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	104.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	2440	80	60	2180	50	100	10	80	160	30	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5061		1770	5085	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.74	1.00	1.00	0.75	1.00	1.00
Satd. Flow (perm)	1770	5061		1770	5085	1583	1372	1863	1583	1398	1863	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	74	2596	85	64	2319	53	106	11	85	170	32	106
RTOR Reduction (vph)	0	4	0	0	0	20	0	0	73	0	0	91
Lane Group Flow (vph)	74	2677	0	64	2319	33	106	11	12	170	32	15
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2		2	6		6
Actuated Green, G (s)	5.6	44.1		4.2	43.2	43.2	9.5	9.5	9.5	9.5	9.5	9.5
Effective Green, g (s)	5.1	45.1		4.2	44.2	44.2	10.0	10.0	10.0	10.0	10.0	10.0
Actuated g/C Ratio	0.07	0.63		0.06	0.62	0.62	0.14	0.14	0.14	0.14	0.14	0.14
Clearance Time (s)	3.5	5.0		4.0	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	127	3201		104	3152	981	192	261	222	196	261	222
v/s Ratio Prot	c0.04	c0.53		0.04	0.46			0.01			0.02	
v/s Ratio Perm						0.02	0.08		0.01	c0.12		0.01
v/c Ratio	0.58	0.84		0.62	0.74	0.03	0.55	0.04	0.05	0.87	0.12	0.07
Uniform Delay, d1	32.1	10.2		32.8	9.5	5.3	28.6	26.5	26.6	30.0	26.8	26.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.7	2.0		10.3	0.9	0.0	3.4	0.1	0.1	30.8	0.2	0.1
Delay (s)	38.7	12.3		43.1	10.4	5.3	32.0	26.6	26.7	60.8	27.0	26.7
Level of Service	D	B		D	B	A	C	C	C	E	C	C
Approach Delay (s)		13.0			11.1			29.4			45.5	
Approach LOS		B			B			C			D	

Intersection Summary			
HCM Average Control Delay	14.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	71.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	2370	120	60	1930	250	240	80	30	110	60	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5049		1770	5085	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.72	1.00	1.00	0.70	1.00	1.00
Satd. Flow (perm)	1770	5049		1770	5085	1583	1335	1863	1583	1310	1863	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	83	2469	125	62	2010	260	250	83	31	115	62	42
RTOR Reduction (vph)	0	6	0	0	0	116	0	0	23	0	0	32
Lane Group Flow (vph)	83	2588	0	62	2010	144	250	83	8	115	62	10
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2		2	6		6
Actuated Green, G (s)	4.7	47.0		3.9	46.2	46.2	20.6	20.6	20.6	20.6	20.6	20.6
Effective Green, g (s)	4.7	48.0		3.9	47.2	47.2	21.1	21.1	21.1	21.1	21.1	21.1
Actuated g/C Ratio	0.06	0.56		0.05	0.56	0.56	0.25	0.25	0.25	0.25	0.25	0.25
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	98	2851		81	2824	879	331	462	393	325	462	393
v/s Ratio Prot	c0.05	c0.51		0.04	0.40			0.04			0.03	
v/s Ratio Perm						0.09	c0.19		0.00	0.09		0.01
v/c Ratio	0.85	0.91		0.77	0.71	0.16	0.76	0.18	0.02	0.35	0.13	0.03
Uniform Delay, d1	39.8	16.5		40.1	13.9	9.2	29.6	25.1	24.1	26.3	24.8	24.2
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	45.5	4.7		34.2	0.9	0.1	9.4	0.2	0.0	0.7	0.1	0.0
Delay (s)	85.3	21.2		74.3	14.8	9.3	39.0	25.3	24.2	27.0	25.0	24.2
Level of Service	F	C		E	B	A	D	C	C	C	C	C
Approach Delay (s)		23.2			15.7			34.6			25.9	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM Average Control Delay	20.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	2240	120	660	1370	160	190	170	130	140	320	670
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5085	1583	3433	5005		1770	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5085	1583	3433	5005		1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	103	2309	124	680	1412	165	196	175	134	144	330	691
RTOR Reduction (vph)	0	0	46	0	12	0	0	0	120	0	0	15
Lane Group Flow (vph)	103	2309	78	680	1565	0	196	175	14	144	330	676
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4						2			6
Actuated Green, G (s)	31.6	51.1	51.1	20.5	40.0		12.0	11.3	11.3	17.1	16.4	48.0
Effective Green, g (s)	32.1	53.1	53.1	21.0	42.0		12.5	12.3	12.3	17.6	17.4	49.0
Actuated g/C Ratio	0.27	0.44	0.44	0.18	0.35		0.10	0.10	0.10	0.15	0.14	0.41
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0		4.5	5.0	5.0	4.5	5.0	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	473	2250	700	601	1752		184	363	162	260	513	646
v/s Ratio Prot	0.06	c0.45		c0.20	0.31		c0.11	0.05		0.08	0.09	c0.28
v/s Ratio Perm			0.05						0.01			0.15
v/c Ratio	0.22	1.03	0.11	1.13	0.89		1.07	0.48	0.08	0.55	0.64	1.05
Uniform Delay, d1	34.2	33.4	19.6	49.5	36.9		53.8	50.8	48.8	47.6	48.4	35.5
Progression Factor	1.00	1.00	1.00	0.55	0.38		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	26.0	0.3	74.1	5.6		84.7	1.0	0.2	2.5	2.8	48.0
Delay (s)	34.4	59.5	19.9	101.2	19.7		138.5	51.9	49.0	50.1	51.1	83.5
Level of Service	C	E	B	F	B		F	D	D	D	D	F
Approach Delay (s)		56.5			44.3			84.7			70.2	
Approach LOS		E			D			F			E	

Intersection Summary			
HCM Average Control Delay	56.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	94.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	2300	60	70	2050	40	20	20	120	90	40	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	1.00		1.00	0.87		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5066		1770	5071		1770	1624		1770	1708	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5066		1770	5071		1770	1624		1770	1708	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	83	2396	62	73	2135	42	21	21	125	94	42	52
RTOR Reduction (vph)	0	2	0	0	2	0	0	114	0	0	36	0
Lane Group Flow (vph)	83	2456	0	73	2175	0	21	32	0	94	58	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	10.1	70.3		7.6	67.8		4.2	10.3		13.3	19.4	
Effective Green, g (s)	10.6	71.3		8.1	68.8		4.7	10.8		13.8	19.9	
Actuated g/C Ratio	0.09	0.59		0.07	0.57		0.04	0.09		0.12	0.17	
Clearance Time (s)	4.5	5.0		4.5	5.0		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	156	3010		119	2907		69	146		204	283	
v/s Ratio Prot	0.05	c0.48		0.04	c0.43		0.01	0.02		c0.05	c0.03	
v/s Ratio Perm												
v/c Ratio	0.53	0.82		0.61	0.75		0.30	0.22		0.46	0.21	
Uniform Delay, d1	52.3	19.2		54.4	19.1		56.1	50.7		49.6	43.2	
Progression Factor	0.57	0.20		1.10	0.52		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.0	0.8		4.3	0.8		2.5	0.8		1.6	0.4	
Delay (s)	30.6	4.6		64.4	10.8		58.6	51.5		51.3	43.6	
Level of Service	C	A		E	B		E	D		D	D	
Approach Delay (s)		5.4			12.5			52.4			47.4	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	2160	190	40	1970	140	140	90	180	290	80	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5024		1770	5035		1770	3186		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.70	1.00		0.53	1.00	1.00
Satd. Flow (perm)	1770	5024		1770	5035		1308	3186		980	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	168	2274	200	42	2074	147	147	95	189	305	84	53
RTOR Reduction (vph)	0	8	0	0	6	0	0	45	0	0	0	36
Lane Group Flow (vph)	168	2466	0	42	2215	0	147	239	0	305	84	17
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	12.5	63.3		4.0	54.8		38.2	38.2		38.2	38.2	38.2
Effective Green, g (s)	13.0	65.3		4.5	56.8		38.2	38.2		38.2	38.2	38.2
Actuated g/C Ratio	0.11	0.54		0.04	0.47		0.32	0.32		0.32	0.32	0.32
Clearance Time (s)	4.5	6.0		4.5	6.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	192	2734		66	2383		416	1014		312	593	504
v/s Ratio Prot	0.09	c0.49		0.02	c0.44			0.08			0.05	
v/s Ratio Perm							0.11			c0.31		0.01
v/c Ratio	0.88	0.90		0.64	0.93		0.35	0.24		0.98	0.14	0.03
Uniform Delay, d1	52.7	24.5		56.9	29.7		31.4	30.1		40.5	29.2	28.2
Progression Factor	1.23	0.33		0.84	0.65		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	23.5	3.6		12.4	5.5		0.5	0.1		44.4	0.1	0.0
Delay (s)	88.5	11.7		60.5	24.9		31.9	30.3		84.8	29.3	28.2
Level of Service	F	B		E	C		C	C		F	C	C
Approach Delay (s)		16.6			25.6			30.8			67.5	
Approach LOS		B			C			C			E	

Intersection Summary			
HCM Average Control Delay	25.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	2400	40	50	1730	120	320	70	120	30	70	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91		0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5073		1770	5036		3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5073		1770	5036		3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	2609	43	54	1880	130	348	76	130	33	76	109
RTOR Reduction (vph)	0	1	0	0	7	0	0	0	99	0	0	96
Lane Group Flow (vph)	109	2651	0	54	2003	0	348	76	31	33	76	13
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	13.7	66.2		6.7	59.2		13.6	22.9	22.9	3.7	13.0	13.0
Effective Green, g (s)	14.7	68.2		7.7	61.2		14.1	23.9	23.9	4.2	14.0	14.0
Actuated g/C Ratio	0.12	0.57		0.06	0.51		0.12	0.20	0.20	0.04	0.12	0.12
Clearance Time (s)	5.0	6.0		5.0	6.0		4.5	5.0	5.0	4.5	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	217	2883		114	2568		403	371	315	62	217	185
v/s Ratio Prot	0.06	c0.52		0.03	c0.40		c0.10	0.04		0.02	c0.04	
v/s Ratio Perm									0.02			0.01
v/c Ratio	0.50	0.92		0.47	0.78		0.86	0.20	0.10	0.53	0.35	0.07
Uniform Delay, d1	49.2	23.4		54.2	23.9		52.0	40.1	39.3	56.9	48.8	47.2
Progression Factor	0.84	0.70		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	3.2		3.1	2.4		17.1	0.3	0.1	8.5	1.0	0.2
Delay (s)	42.1	19.5		57.3	26.3		69.1	40.4	39.4	65.4	49.8	47.4
Level of Service	D	B		E	C		E	D	D	E	D	D
Approach Delay (s)		20.4			27.2			58.2			50.9	
Approach LOS		C			C			E			D	

Intersection Summary			
HCM Average Control Delay	27.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	2300	100	150	1400	280	400	360	80	70	90	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	0.97	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583	3433	1812		1770	1716	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	1770	5085	1583	3433	1812		1770	1716	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	125	2396	104	156	1458	292	417	375	83	73	94	104
RTOR Reduction (vph)	0	0	35	0	0	108	0	6	0	0	30	0
Lane Group Flow (vph)	125	2396	69	156	1458	184	417	452	0	73	168	0
Turn Type	Prot		Perm	Prot		pm+ov	Prot			Prot		
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	14.1	62.6	62.6	11.9	60.4	66.4	16.0	34.3		6.0	24.3	
Effective Green, g (s)	14.6	64.6	64.6	12.4	62.4	66.4	16.0	35.3		6.0	25.3	
Actuated g/C Ratio	0.11	0.48	0.48	0.09	0.46	0.49	0.12	0.26		0.04	0.19	
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	4.0	4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	192	2446	761	163	2363	783	409	476		79	323	
v/s Ratio Prot	0.07	c0.47		c0.09	0.29	0.01	c0.12	c0.25		0.04	0.10	
v/s Ratio Perm			0.04			0.11						
v/c Ratio	0.65	0.98	0.09	0.96	0.62	0.23	1.02	0.95		0.92	0.52	
Uniform Delay, d1	57.4	34.2	18.9	60.7	27.0	19.4	59.2	48.6		63.9	49.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	7.7	13.6	0.1	57.2	0.5	0.2	49.6	28.6		75.4	1.5	
Delay (s)	65.1	47.8	19.0	117.9	27.5	19.6	108.7	77.2		139.3	50.5	
Level of Service	E	D	B	F	C	B	F	E		F	D	
Approach Delay (s)		47.5			33.7			92.2			74.5	
Approach LOS		D			C			F			E	

Intersection Summary			
HCM Average Control Delay	51.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	134.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	93.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX E

EXISTING AND FUTURE TRAFFIC MODEL ADT VOLUMES

EXISTING ROADWAY VOLUME		
Street Name and Segment	**Classification**	**Traffic Volume**
Acoma Trail		
South of SR-62	Collector	2,430
North of Mountain View	Collector	2,357
South of Joshua Drive	Collector	713
Avalon Avenue		
North of Sunnyslope Drive	Collector	2,707
North of SR-62	Collector	1,374
Balsa Avenue		
North of Outer Highway	Collector	6,121
South of SR-62	Collector	5,973
Buena Vista Drive		
West of Yucca Mesa Road	Collector	2,332
East of Balsa Avenue	Collector	3,469
Between Roberts Road and Faith Lane	Collector	3,638
Between Newton Lane and Rowell Road	Collector	3,643
Camino del Cielo Trail		
North of SR-62	Collector	1,552
Joshua Drive		
East of Acoma Trail	Collector	1,810
West of Barberry Avenue	Collector	2,277
East of Emerson Avenue	Collector	1,164

EXISTING ROADWAY VOLUME		
Street Name and Segment	**Classification**	**Traffic Volume**
Joshua Lane		
South of Joshua Drive	Collector	4,311
North of Onaga Trail	2-Lane Arterial	4,953
North of Pueblo Trail	2-Lane Arterial	5,090
Between Yucca Trail and Outer Highway	2-Lane Arterial	7,022
Kickapoo Trail		
South of SR-62	Collector	2,790
La Contenta Road		
South of SR-62	Collector	2,230
North of Yucca Trail	Collector	2,170
Onaga Trail		
East of Alaba Avenue	Collector	1,782
East of Elata Avenue	Collector	2,966
West of Joshua Lane	2-Lane Arterial	3,734
West of Sage Avenue	2-Lane Arterial	4,765
East of Acoma Trail	2-Lane Arterial	3,544
East of Elk Trail	2-Lane Arterial	3,017
West of Jemez Trail	2-Lane Arterial	1,620
Palm Avenue		
North of Pueblo Trail	Collector	1,207
Palomar Avenue		
South of Yucca Trail	Collector	4,423
North of Joshua Lane	Collector	836
Paxton Road		
East of SR-247	Collector	1,522
Pioneertown Road		
North of SR-62	Collector	2,238
South of Town Limits	Collector	981

EXISTING ROADWAY VOLUME		
Street Name and Segment	**Classification**	**Traffic Volume**
Sage Avenue		
North of SR-62	Collector	2,142
West of Yucca Trail	Collector	4,341
North of Onaga Trail	Collector	4,122
Santa Fe Trail		
West of Cherokee Trail	Collector	730
East of Kickapoo Trail	Collector	505
SR-62/Twentynine Palms Road		
West of Camino Del Cielo	4-Lane Arterial, Divided	25,500
West of Pioneertown Road	4-Lane Arterial, Divided	28,500
West of SR-247	4-Lane Arterial, Divided	28,500
West of Yucca Mesa Road	4-Lane Arterial, Divided	21,000
SR-247/Old Woman Springs Rd		
North of SR-62	2-Lane Arterial	12,000
Sunnyslope Avenue		
West of SR-247	Collector	1,686
Warren Vista Avenue		
South of SR-62	Collector	2,801
Yucca Trail		
East of Cherokee Trail	Industrial	1,334
East of Miami Trail	Industrial	1,921
West of La Contenta Road	2-Lane Arterial	6,058
East of Hanford Avenue	2-Lane Arterial	7,442
West of Joshua View Drive	2-Lane Arterial	8,083
West of Condalia Avenue	2-Lane Arterial	6,923
Yucca Mesa Road		
North of SR-62	Collector	4,914
North of Buena Vista Drive	Collector	2,733

Source: Town of Yucca Valley Traffic Counts (2011), Caltrans Traffic Data (2010)

FUTURE YEAR (2035) ROADWAY VOLUME		
Street Name and Segment	**Classification**	**Traffic Volume**
Acoma Trail		
South of SR-62	2-Lane Arterial	3,530
North of Mountain View	2-Lane Arterial	10,570
South of Joshua Drive	2-Lane Arterial	3,300
Avalon Avenue		
North of Sunnyslope Drive	2-Lane Arterial	5,870
North of SR-62	Collector	10,970
Balsa Avenue		
North of Outer Highway	4-Lane Arterial	11,640
South of SR-62	4-Lane Arterial	23,400
Buena Vista Drive		
West of Yucca Mesa Road	2-Lane Arterial	7,240
East of Balsa Avenue	2-Lane Arterial	7,960
Between Roberts Road and Faith Lane	2-Lane Arterial	10,350
Between Newton Lane and Rowell Road	2-Lane Arterial	13,520
Camino del Cielo Trail		
North of SR-62	2-Lane Arterial	6,870
Joshua Drive		
East of Acoma Trail	2-Lane Arterial	7,860
West of Barberry Avenue	2-Lane Arterial	6,740
East of Emerson Avenue	2-Lane Arterial	2,830
Joshua Lane		
South of Joshua Drive	2-Lane Arterial	10,890
North of Onaga Trail	2-Lane Arterial	9,660
North of Pueblo Trail	2-Lane Arterial	10,580
Between Yucca Trail and Outer Highway	2-Lane Arterial	14,070
Kickapoo Trail		
South of SR-62	2-Lane Arterial	6,620

FUTURE YEAR (2035) ROADWAY VOLUME		
Street Name and Segment	**Classification**	**Traffic Volume**
La Contenta Road		
South of SR-62	4-Lane Arterial	18,660
North of Yucca Trail	4-Lane Arterial	8,430
Main Street (Proposed)		
East of Cherokee Trail	Collector	7,290
Onaga Trail		
East of Alaba Avenue	4-Lane Arterial, Divided	3,860
East of Elata Avenue	4-Lane Arterial, Divided	6,290
West of Joshua Lane	4-Lane Arterial, Divided	5,380
West of Sage Avenue	4-Lane Arterial, Divided	6,540
East of Acoma Trail	4-Lane Arterial, Divided	3,550
East of Elk Trail	4-Lane Arterial, Divided	5,080
West of Jemez Trail	4-Lane Arterial, Divided	4,370
Palm Avenue		
North of Pueblo Trail	2-Lane Arterial	3,890
Palomar Avenue		
South of Yucca Trail	2-Lane Arterial	14,720
North of Joshua Lane	2-Lane Arterial	5,080
Paxton Road		
East of SR-247	2-Lane Arterial	8,810
Pioneertown Road		
North of SR-62	2-Lane Arterial	9,120
South of Town Limits	2-Lane Arterial	2,670
Sage Avenue		
North of SR-62	2-Lane Arterial	6,020
West of Yucca Trail	2-Lane Arterial	7,480
North of Onaga Trail	2-Lane Arterial	7,720
Santa Fe Trail		
West of Cherokee Trail	2-Lane Arterial	4,290
East of Kickapoo Trail	2-Lane Arterial	1,660
SR-62/Twentynine Palms Road		

FUTURE YEAR (2035) ROADWAY VOLUME		
Street Name and Segment	**Classification**	**Traffic Volume**
West of Camino Del Cielo	6-Lane Arterial, Divided	53,330
West of Pioneertown Road (Proposed)	6-Lane Arterial, Divided	65,610
West of SR-247	6-Lane Arterial, Divided	70,440
West of Yucca Mesa Road	6-Lane Arterial, Divided	40,580
SR-247/Old Woman Springs Rd		
North of SR-62	4-Lane Highway	31,.230
Sunnyslope Avenue		
West of SR-247	2-Lane Arterial	10,680
Warren Vista Avenue		
South of SR-62	Collector	3,970
Yucca Trail		
West of La Contenta Road	4-Lane Arterial, Divided	16,720
East of Hanford Avenue	4-Lane Arterial, Divided	22,600
West of Joshua View Drive	4-Lane Arterial, Divided	16,070
West of Condalia Avenue	4-Lane Arterial, Divided	14,470
Yucca Mesa Road		
North of SR-62	2-Lane Arterial	10,280
North of Buena Vista Drive	2-Lane Arterial	5,340

Source: Fehr & Peers, 2013.

Appendix J

General Plan Buildout Assumptions and Methodology

Appendices

This page intentionally left blank.

YUCCA VALLEY
GENERAL PLAN

General Plan Buildout Assumptions and Methodology

Memorandum

Date June 8, 2012

To Shane Stueckle, Town of Yucca Valley

From Wendy Grant, The Planning Center|DC&E

The following paper provides a description of the assumptions and methods used to determine housing, population, and building square footage for the land uses illustrated in the Yucca Valley General Plan. The projections themselves will be presented on the Future Buildout Projections Summary under separate cover.

Background and Baseline Assumptions

The General Plan Future Buildout Summary represents an estimate of the dwelling units, population, and non-residential building square footage associated with the future buildout of the proposed Land Use Plan. A key assumption in understanding these projections is that they reflect a theoretical buildout of the entire Town, rather than what is likely to appear on the ground over the next 20 years. The Proposed Land Use Plan serves as the basis for these projections.

There are no specific industry standards for population density or building intensity that are required to be used in the Yucca Valley General Plan. As a result, data from the Development Code update, SCAG, California Department of Finance (2010), and contemporary planning experience have been used to define the factors below to estimate Yucca Valley's future buildout projections.

Gross Acres: Gross acreage refers to the total number of acres of an area including all roads, railroads, and flood control facilities.

Square Feet: To convert adjusted gross acres to adjusted gross square feet, adjusted gross acres are multiplied by 43,560 (the number of square feet in an acre).

Adjusted Gross Acres: Gross acreage minus the acreage used for major public roads (classified as collector roads and above), railroads, and flood control facilities. Dwelling units and square footages in the General Plan Buildout Summary are calculated using adjusted gross acres.

Assumed Density/Intensity: It is assumed that not all uses in the Town will be implemented at either the high or low end of the permitted densities and intensities in each land use category. Historically, local buildout levels have not achieved the maximum allowable density (residential uses) or intensity (non-residential uses) on every parcel and are, on average, lower than allowed by the General Plan because the development of individual parcels or groups of

parcels must account for factors such as physical site constraints, zoning requirements that further limit development potential, and other regulatory constraints. As a result, the assumptions used to calculate buildout represent an average level of density/intensity that will likely be achieved at buildout of each land use category.

Residential Assumptions: Population and Dwelling Units

Estimations for the buildout of residential land use designations were calculated used the following assumptions and methods:

Occupied Dwelling Units: Based on 2010 California Department of Finance figures, the Town of Yucca Valley experienced a vacancy rate of 12.62%, which is the same as saying the Town had an occupancy rate of 87.38%. This occupancy rate is low due to unusual market constraints. Over time it is expected to improve so the buildout will assume a 95% occupancy rate. The total number of occupied units is estimated by multiplying the total number of dwelling units by the occupancy rate. The number of occupied units is then multiplied by the appropriate persons per household figure to arrive at a more refined population estimate.

Persons per Household (PPH): This factor is used to estimate population at buildout. The latest data from the California Department of Finance shows an average household size of 2.496 persons (2012). The buildout will assume a 2.5 persons per household factor.

Population: Population is determined by multiplying the projected number of occupied dwelling units in the Town by an average persons per household factor.

Dwelling Units: Dwelling unit projections are estimated by multiplying the adjusted gross acres of each residential land use designation by the corresponding assumed density factor. For example, 100 acres of Medium Density Residential with an assumed density of 8.0 du/ac would result in 800 dwelling units.

Residential Density (du/ac): Each of the residential land use designations includes a range of allowable densities. The lower threshold figure for each category represents a minimum amount of development anticipated, provided that all other required conditions can be met, and the higher figure represents a potential maximum that could be located in each area.

It should be noted that a variety of lot sizes and residential product types may be used in a land use category, as long as the maximum number of dwelling units allowed by the designation is not exceeded (not all lots must be exactly the same size unless zoning dictates it). Areas designated for specific plans have unique assumptions that are addressed separately in the Future Buildout Summary table and later in this paper.

Assumed Residential Density: To determine future buildout projections an assumed residential density is identified for each designation. The assumed density represents the number of units per acre that will likely be achieved at buildout within each land use designation's specified density range. Buildout, in most cases, does not always occur at the maximum density; therefore, the assumed buildout density used in the buildout projections for each residential land use category is assumed at a midpoint and is specified in the following table:

GP Land Use Designation	DENSITY	
	Assumed DU/AC	Maximum DU/AC
Hillside Residential (HR)	1 DU/20 AC	1 DU/20 AC
Rural Living (RL-10)	1 DU/10 AC	1 DU/10 AC
Rural Living (RL-5)	1 DU/5 AC	1 DU/5 AC
Rural Residential (RR-2.5)	1 DU/2.5 AC	1 DU/2.5 AC
Rural Residential (RR-1)	1 DU/AC	1 DU/AC
Rural Residential (RR-0.5)	2 DU/AC	2 DU/AC
Low Density Residential (LDR)	3.5 DU/AC	5 DU/AC
Medium Density Residential (MDR)	6 DU/AC	8 DU/AC
Medium High Density Residential (MHDR)	10 DU/AC	14 DU/AC

Non-Residential Assumptions

Estimations for the buildout of non-residential land use designations such as commercial, office, and industrial uses were calculated used the following assumptions and methods:

Floor Area Ratio (FAR): Building intensities for nonresidential uses are measured by floor area ratio (FAR). FAR is the ratio of the total net floor area of a building on a parcel to the total adjusted gross square footage of that parcel. FAR calculations do not include floor areas for parking structures or outdoor open storage.

Building Square Footage: Building square footage for non-residential land uses are calculated by multiplying the adjusted gross square feet of each land use designation by the corresponding FAR. For instance, 20,000 square feet of Commercial with an assumed FAR of 0.35 would yield 7,000 square feet of building space. In the case of Public Facilities such as schools, the General Plan assumptions are not focused on square footage, instead they are based on the number of employees typically generated by each use.

Assumed Intensities: Non-residential designations identify a range of FAR's that can be achieved in each land use, with the high end of the range serving as the maximum allowable FAR permitted in each land use designation. To determine future non-residential buildout projections for the Town, an assumed FAR is identified for each non-residential designation. The assumed FARs represent the anticipated intensity for each different land use designation, which typically is lower than the maximum allowable buildout. The adjustment provides a more realistic expectation of the square footage that is anticipated to be constructed on each site. The assumed and maximum intensities for non-residential land use categories are provided below.

Proposed GP Land Use Designation	INTENSITY	
	Assumed FAR	Maximum FAR
Commercial (C)	0.35	0.50
Mixed Use (MU-TC)	0.50 (20% residential at 18 DU/AC and 80% retail)	1.0 (25 DU/AC max density)
Mixed Use (MU-CC)	0.50 (20% residential at 18 DU/AC, 2% office, and 60% retail)	1.0 (25 DU/AC max density)
Industrial	0.25	1.0

Specific Plan Assumptions

Specific Plans provide comprehensive development plans for designated areas of the Town. Since the preparation, adoption, and implementation of Specific Plans typically demands significant investments of time and resources by property owners, staff and decision makers, the land use plans approved with each Specific Plan (i.e. Old Town, Home Depot and Senior Affordable Housing Specific Plans) have been incorporated into the General Plan. As such, the assumptions made for each Specific Plan project area for units and non-residential square footage are consistent with the Land Use Plans that were adopted with each document.

Special Policy Areas

Several new Special Policy Areas are recommended in the Proposed General Plan land use map. These areas will have customized policy direction to address the unique circumstances facing each area.

Employment Assumptions

Estimates for the number of jobs accommodated in areas designated for commercial and industrial land uses are based on the following assumptions and methods:

Number of Jobs: The number of jobs is a count of the total jobs, both full- and part-time and is not a full-time equivalent measure. Almost all publically available economic data provides total job counts and not full-time equivalents.

Employment Density: Employment density is the number of employees per adjusted gross acre. Multiplying the adjusted gross acreage of each land use designation by the employment density determines the estimated number of jobs at buildout. The following table provides the assumed employment density for commercial and industrial land uses.

Land Use Designation	Employment Density (employees per acre)
Commercial Office	45
Commercial Retail	20
Industrial	15.5
Public/Quasi-Public	Custom (input data from schools, utilities, etc.)

DRAFT

YUCCA VALLEY GENERAL PLAN UPDATE ENVIRONMENTAL IMPACT REPORT

SCH NO. 2012111021

VOLUME II OF II

APPENDICES

prepared for:

TOWN OF YUCCA VALLEY

57090 29 Palms Highway
Yucca Valley, CA 92284
Tel: 760.369.6575

Contact:
Shane Stueckle
Deputy Town Manager

prepared by:

THE PLANNING CENTER|DC&E

3 MacArthur Place, Suite 1100
Santa Ana, CA 92707
Tel: 714.966.9220 • Fax: 714.966.9221
E-mail: information@planningcenter.com
Website: www.planningcenter.com

Contact:
Associate Principal

TYV-01.0L

AUGUST 2013

VOLUME II – APPENDICES

A Initial Study/Notice of Preparation

B Initial Study/Notice of Preparation Comments

C Air Quality and Greenhouse Gas Emissions Modeling

D Biological Resources Technical Report

E Paleontological and Cultural Resources Assessment

F Technical Background Report to the Safety Element

G Agency and Service Letter Responses

H Noise Measurements and Calculations Outputs

I Traffic Impact Study

J General Plan Buildout Assumptions and Methodology

This page intentionally left blank.