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GEOTECHNICAL

August 22, 2022

Project No. 22289

Mr. Daniel Patneaude
**DRP Enterprises, LLC**
PO Box 4428
Palm Springs, CA 92263

Subject: Preliminary Geotechnical Investigation Report
Proposed Commercial Building
56695 Twentynine Palms Highway, Yucca Valley, California

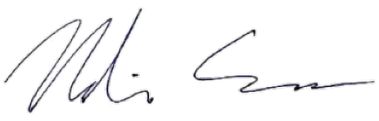
Dear Mr. Patneaude:

In accordance with your request and authorization, we are presenting the results of our geotechnical investigation for the proposed commercial building to be constructed at 56695 Twentynine Palms Highway, in the City of Yucca Valley, California. The purpose of this investigation has been to evaluate the subsurface conditions at the site and to provide geotechnical engineering recommendations for the proposed construction.

Based on our findings, the proposed project is geotechnically feasible, provided that the recommendations in this report are incorporated into the design and are implemented during construction of the project. This report was prepared in accordance with the requirements of the 2019 California Building Code and the Town of Yucca Valley requirements.

We appreciate the opportunity to be of service on this project. Should you have any questions regarding this report or if we can be of further service, please do not hesitate to contact the undersigned at (657) 888-4608 or info@ntsgeo.com.

Respectfully submitted,
**NTS GEOTECHNICAL, INC.**



Nadim Sunna, M.Sc., Q.S.P, P.E., G.E. 3172
Principal Engineer

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Plate 1 – Location Map
Plate 2 – Geotechnical Map

Appendix A – Field Exploration
Appendix B – Geotechnical Laboratory Test Result

## INTRODUCTION

This report presents the results of our geotechnical engineering evaluation performed for the proposed commercial building to be located at 56695 Twentynine Palms Highway, in the Town of Yucca Valley, California. See (Plate 1, Location Map). The purpose of this study has been to evaluate the subsurface conditions at the site and to provide geotechnical recommendations related to the design and construction of the proposed building foundation.

## SITE AND PROJECT DESCRIPTION

The project site is located at 56695 Twentynine Palms Highway, in City of Yucca Valley, California, and it is bound by commercial structures on the east and west, by Desert Sky Drive on the south and Twentynine Palms Highway on the north.

It is our understanding that the proposed project consists of construction of new 1-story, commercial building with associated site improvements such as a new pavement and trash enclosure. Detailed plans were not available during the preparation of this report and thus this report is subject to change based on final plans.

## SCOPE OF WORK

As part of the preparation of this report, we have performed the following tasks:

### Background Review

We reviewed readily available background data including geologic maps, topographic maps, and aerial photographs relevant to the subject site in preparation of this report.

### Field Exploration

The subsurface conditions were evaluated on June 11, 2022 by advancing two (2) hand auger borings to maximum depth of 15 feet below the existing grade. The approximate location of the boring is shown on Plate 2 – Geotechnical Map. Detailed exploration information of soils boring is presented in Appendix A, Field Exploration.

### Geotechnical Laboratory Testing

Laboratory tests were performed on selected samples obtained from the boring in order to aid in the soil classification and to evaluate the engineering properties of the foundation soils. The following tests were performed in general accordance with ASTM standards:

- In-situ moisture;
- #200 Wash;
- Direct shear;
- Consolidation; and
- Corrosivity.

Laboratory results are presented in Appendix B of this report.

## GEOLOGIC FINDINGS

### Subsurface Materials

Earth materials encountered during our subsurface investigation consist of alluvium (Qa) to the total depth of the exploration. The alluvium consists brown, brown, damp to dry, loose to medium dense, silty sands. The upper 4 feet of the site soils are loose and will require remedial grading to densify the soils for support of new foundation and slab-on-grade.

### Groundwater

Groundwater was not observed during our exploration to a maximum depth of 15 feet below the existing grade. Groundwater conditions may vary across the site due to stratigraphic and hydrologic conditions and may change over time as a consequence of seasonal and meteorological fluctuations, or activities by humans at this site and nearby sites. However, based on the above findings, groundwater is unlikely to impact the proposed development.

## GEOLOGIC HAZARDS

### Faulting and Seismicity

The site is not located within an Alquist-Priolo Earthquake Fault Zone, and no known active faults are shown on the reviewed geologic maps crossing the site, however, the site is located in the seismically active region of Southern California. The nearest known active fault is the Pinto Mountain fault, which is located approximately 0.5 miles from the subject site and capable of generating a maximum earthquake magnitude (Mw) of 7.30.

### Liquefaction and Seismic Settlement

Liquefaction occurs when the pore pressures generated within a soil mass approach the effective overburden pressure. Liquefaction of soils may be caused

by cyclic loading such as that imposed by ground shaking during earthquakes. The increase in pore pressure results in a loss of strength, and the soil then can undergo both horizontal and vertical movements, depending on the site conditions. Other phenomena associated with soil liquefaction include sand boils, ground oscillation, and loss of foundation bearing capacity. Liquefaction is generally known to occur in loose, saturated, relatively clean, fine-grained cohesionless soils at depths shallower than approximately 50 feet. Factors to consider in the evaluation of soil liquefaction potential include groundwater conditions, soil type, grain size distribution, relative density, degree of saturation, and both the intensity and duration of ground motion.

Based on our review of the County of San Bernardino County Land Use plan, Geologic Hazard Overlays, the site is not situated within an area identified to having susceptibility to liquefaction. Additionally, based on the lack of shallow groundwater, and uniform soil stratum, it is our professional opinion that potential for liquefaction and associated seismic settlement to impact the proposed improvement is considered low.

**Landslides**

Based on our review of the referenced geologic maps, literature, topographic maps, aerial photographs, and our subsurface evaluation, no landslides or related features underlie or are adjacent to the subject site. Due to the relatively level nature of the site and surrounding areas, the potential for landslides at the project site is considered low.

**Flooding**

The Federal Emergency Management Agency (FEMA) has prepared flood insurance rate maps (FIRMs) for use in administering the National Flood Insurance Program. Based on our review of the FEMA flood map, the site is located in an area of Special Flood Hazard Areas (Zone A), Without Base Flood Elevation (BFE). The potential for flooding to impact the proposed development should be evaluated by the project designer.

**Tsunami and Seiches**

Tsunamis are waves generated by massive landslides near or under sea water. The site is not located on any State of California Tsunami Inundation Map for Emergency Planning. The potential for the site to be adversely impacted by earthquake-induced tsunamis is considered to be negligible because the site is located several miles inland from the Pacific Ocean shore, at an elevation exceeding the maximum height of potential tsunami inundation.

Seiches are standing wave oscillations of an enclosed water body after the original driving force has dissipated. The potential for the site to be adversely

impacted by earthquake-induced seiches is considered to be negligible due to the lack of any significant enclosed bodies of water located in the vicinity of the site.

## GEOTECHNICAL ENGINEERING FINDINGS

### Expansive Soil

Based on our evaluation, laboratory testing and experience with similar material types, the soils encountered near the ground surface at the site exhibit a very low expansion potential.

### Hydroconsolidation

Based on our laboratory testing result and experience with nearby sites, the potential for hydrocollapse settlement to affect the proposed structures should be considered low to moderate.

### Soil Corrosion

The potential for the on-site materials to corrode buried steel and concrete improvements was evaluated. Laboratory testing was performed on representative soil samples to evaluate pH, minimum resistivity, and soluble chloride and sulfate contents. The results of our corrosivity testing is presented within Appendix B of this report. General recommendations to address the corrosion potential of the on-site soils are provided below. Imported fill materials, if used, should be tested to evaluate whether their corrosion potential is more severe than those assumed.

Structural Concrete

Laboratory tests indicate that the potential of sulfate attack on concrete in contact with the on-site soils is “negligible” or “S0” exposure in accordance with ACI 318, Table 19.3.1.1. Therefore, restriction on the type of cement, water to cement ratio, and compressive strength is not required.

The aforementioned recommendations in regards to concrete are made from a soils perspective only. Final concrete mix design is beyond our purview. All applicable codes, ordinances, regulations, and guidelines should be followed in regard to the designing a durable concrete with respect to the potential for sulfate exposure from the on-site soils and/or changes in the environment.

Ferrous Metal

The results of the laboratory chemical tests performed on a sample of soil collected within the site indicate that the on-site soils are mildy corrosive to ferrous metals. Consequently, metal structures which will be in direct contact with the soil (i.e., underground metal conduits, pipelines, metal sign posts, etc.) and/or in close proximity to the soil (wrought iron fencing, etc.) may be subject to corrosion. The use of special coatings or cathodic protection around buried metal structures has been shown to be beneficial in reducing corrosion potential. Additional provisions will be required to address high chloride contents of the soil per the 2019 CBC to protect the concrete reinforcement. The laboratory testing program performed for this project does not address the potential for corrosion to copper piping. In this regard, a corrosion engineer should be consulted to perform more detailed testing and develop appropriate mitigation measures (if necessary).

The above discussion is provided for general guidance in regards to the corrosiveness of the on-site soils to typical metal structures used for construction. Detailed corrosion testing and recommendations for protecting buried ferrous metal and/or copper elements are beyond our purview. If detailed testing is required, a corrosion engineer should be consulted to perform the testing and develop appropriate mitigation measures.

### Excavation Characteristics

The majority of the soil materials underlying the site can be excavated with excavators and other conventional grading equipment.

## GEOTECHNICAL ENGINEERING CONLUSIONS AND RECOMMENDATIONS

### Conclusions

Based on the results of our field exploration and engineering analyses, it is our opinion that the proposed development is feasible from a geotechnical standpoint, provided that the recommendations in this report are incorporated into the design plans and are implemented during construction.

The proposed home may be supported on shallow foundation embedded a minimum of 18 inches into competent engineered fill soils. Due to the compressible near-surface material encountered during our subsurface investigation, the potential for soil subsidence in the upper 4 feet, and potential disturbance of subsurface soils during grading, we recommend that the building pad be excavated to a depth of 2 feet below the footing or 4 feet from existing grade, whichever is deeper, and recompacted to create a uniform blanket of engineered fill.

Our geotechnical engineering analyses performed for this report were based on the earth materials encountered during the subsurface exploration for the site. If the design substantially changes, then our geotechnical engineering recommendations would be subject to revision based on our evaluation of the changes. The following sections present our conclusions and recommendations pertaining to the engineering design for this project.

**Site Preparation**

Site preparation should begin with the removal of utility lines, asphalt, concrete, vegetation, and other deleterious debris from areas to be graded. Tree stumps and roots should be removed to such a depth that organic material is generally not present. Clearing and grubbing should extend to the outside edges of the proposed excavation and fill areas. We recommend that unsuitable materials such as organic matter or oversized material be selectively removed and disposed offsite. The debris and unsuitable material generated during clearing and grubbing should be removed from areas to be graded and disposed at a legal dump site away from the project area.

**Corrective Grading**

Corrective grading will serve to create a firm and workable platform for construction of the proposed development. The fill material encountered during our subsurface investigation will require some corrective grading in order to densify any disturbed soil and undocumented artificial fill that may be encountered during the grading operation.

It should be noted that the recommendations provided herein are based on our subsurface exploration and knowledge of the on-site geology. Actual removals may vary in configuration and volume based on observations of geologic materials and conditions encountered during grading. The bottom of all corrective grading removals should be observed by a representative of NTS to verify the suitability of in-place soil prior to performing scarification and recompaction. Corrective grading recommendations are outlined below.

<u>Building Pad</u>

In order to create a firm and stable platform on which to construct the new building foundation and slab-on-grade, we recommend the following:

- Building pad should be excavated to a depth of at least 2 feet below the bottom of the footing or 4 feet from existing grade, whichever is deeper.
- The excavation should extend laterally a minimum of 3 feet from edge of future footings.

- The bottom of the over excavation should then be scarified to a depth of at least 6 inches, moisture conditioned to near optimum moisture content and recompacted to at least 90 percent relative compaction as determined in accordance with ASTM D1557.
- Following the approval of the over-excavation bottom by a representative of NTS, the onsite material may be used as fill material to achieve the planned footing elevation.
- The fill material should then be placed in 6- to- 8-inch-thick lifts, moisture conditioned to near optimum moisture content and compacted to achieve 90 percent relative compaction.

If the existing loose fill materials are found to be disturbed to depths greater than the proposed remedial grading, then the depth of over-excavation and re-compaction should be increased accordingly in local areas as recommended by a representative of NTS.

**Materials for Fill**

On-site soils with an organic content of less than 3 percent by volume (or 1 percent by weight) are suitable for use as fill. Soil material to be used as fill should not contain contaminated materials, rocks, or lumps over 6 inches in largest dimension, and not more than 40 percent larger than ¾ inch. Utility trench backfill material should not contain rocks or lumps over 3 inches in largest dimension. Larger chunks, if generated during excavation, may be broken into acceptably sized pieces or may be disposed offsite.

Any imported fill material should consist of granular soil having a “very low” expansion potential (that is, expansion index of 20 or less). Import material should also have low corrosion potential (that is, chloride content less than 500 parts per million [ppm], soluble sulfate content of less than 0.1 percent, and pH of 5.5 or higher). Materials to be used as fill should be evaluated by a representative of NTS prior to importing or filling.

**Compacted Fill**

Prior to placement of compacted fill, the contractor should request an evaluation of the exposed excavation bottom by NTS. Unless otherwise recommended, the exposed ground surface should then be scarified to a depth of at least 6 inches and watered or dried, as needed, to achieve generally consistent moisture contents approximately near optimum moisture content. The scarified materials should then be compacted to 90 percent relative compaction in accordance with the latest version of ASTM Test Method D1557.

Compacted fill should be placed in horizontal lifts of approximately 6 to 8 inches in loose thickness. Prior to compaction, each lift should be watered or dried as needed to achieve near optimum moisture condition, mixed, and then compacted

to a relative compaction of 90 percent as evaluated by ASTM D1557. Successive lifts should be treated in a like manner until the desired finished grades are achieved.

Personnel from NTS should observe the excavations so that any necessary modifications based on variations in the encountered soil conditions can be made. All applicable safety requirements and regulations, including CalOSHA requirements, should be met.

**Temporary Excavations**

Temporary excavations for the demolishing, earthwork, footing and utility trench are expected. We anticipate that unsurcharged excavations with vertical side slopes less than 3 feet high will generally be stable; however, sloughing of cohesionless sandy materials encountered at the site should be expected.

Where the space is available, temporary, unsurcharged excavation sides over 3 feet in height should be sloped no steeper than an inclination of 1.5H:1V (horizontal:vertical). Where sloped excavations are created, the tops of the slopes should be barricaded so that vehicles and storage loads do not encroach within 10 feet of the top of the excavated slopes. A greater setback may be necessary when considering heavy vehicles, such as concrete trucks and cranes. NTS should be advised of such heavy vehicle loadings so that specific setback requirements can be established. If the temporary construction slopes are to be maintained during the rainy season, berms are recommended to be graded along the tops of the slopes in order to prevent runoff water from entering the excavation and eroding the slope faces. Where space for sloped excavations is not available, temporary shoring may be utilized.

Personnel from NTS should observe the excavation so that any necessary modifications based on variations in the encountered soil conditions can be made. All applicable safety requirements and regulations, including CalOSHA requirements, should be met.

Excavations shall not undermine the existing adjacent building footings. Where space for sloped excavations is not available, temporary shoring or A-B-C slot cuts may be utilized.

**Seismic Design**

Our recommendations for seismic design parameters have been developed in accordance with 2019 CBC and ASCE 7-16 (ASCE, 2016) standards. The applicable site class is D (“default”) based on the results of our field investigation. The table presents the seismic design parameters for the site that are obtained from USGS Design Ground Motions website and are based on the ASCE 7-16

and 2019 California Building Code, and the site coordinates of N34.1202893° and W116.4271033°.

| Design Parameters | Value |
|---|---|
| Mapped Spectral Acceleration Parameter at Period of 0.2-Second, $S_S$ | 2.268 |
| Mapped Spectral Acceleration Parameter at Period 1-Second, $S_1$ | 0.809 |
| Site Coefficient, $F_a$ | 1.2 |
| Site Coefficient, $F_v$ | 1.7 |
| Adjusted MCER1 Spectral Response Acceleration Parameter at Short Period, $S_{MS}$ | 2.721 |
| 1-Second Period Adjusted MCER1 Spectral Response Acceleration Parameter, $S_{M1}$ | 1.375 |
| Short Period Design Spectral Response Acceleration Parameter, $S_{DS}$ | 1.814 |
| 1-Second Period Design Spectral Response Acceleration Parameter, $S_{D1}$ | 0.917 |
| Peak Ground Acceleration, $PGA_M$ * | 1.143 |
| *Risk-targeted maximum considered earthquake | |

Since the Site Class is designated as D and the S1 value is greater than or equal to 0.2, the 2019 CBC requires either a site-specific seismic hazard analysis per Section 21.2 of ASCE 7-16 or the application of Exception 2 of Section 11.4.8 of ASCE 7-16. The project structural engineer should apply all requirements of Section 11.4.8 of ASCE 7-16 in their structural design.

It should be recognized that much of southern California is subject to some level of damaging ground shaking as a result of movement along the major active (and potentially active) fault zones that characterize this region. Design utilizing the 2019 CBC is not meant to completely protect against damage or loss of function. Therefore, the preceding parameters should be considered as minimum design criteria.

**Building Foundation Design and Construction**

A shallow foundation system may be used for support of the proposed building, provided that all the footings are embedded into competent engineered fill as described in the **Corrective Grading** section of this report. Our geotechnical foundation design parameters are presented in the table below:

| | |
|---|---|
| **Bearing Material** | ▪ Competent engineered fill<br>▪ 2 feet below bottom of footings |
| **Minimum Footing Size** | ▪ Width: 12 inches<br>▪ Depth: 18 inches below the lowest adjacent soil grade |
| **Minimum Footing Reinforcement** | ▪ Footings reinforcement should consist of at least four No. 4 bars (two on top and two on bottom). |
| **Allowable Bearing Capacity** | ▪ 2,000 psf for the minimum footing size given above.<br>▪ The above value may be increased by 1/3 for temporary loads such as wind or earthquake. |
| **Static Settlement** | ▪ Total static settlement of 1 inch with differential settlement estimated to be approximately ½ inch over a span of 20 feet. |
| **Allowable Lateral Passive Resistance** | • 300 pcf (equivalent fluid pressure) |
| **Allowable Coefficient of Friction** | • 0.35 |

**Slab-On-Grade Design and Construction**

The slab-on-grade should be designed and constructed with the minimum recommendations presented below, however, final design of the slab should be determined by the project structural engineer.

Minimum Thickness: The minimum slab thickness should be 5 inches.

Minimum Slab Reinforcement: Minimum slab reinforcement shall not be less than No. 4 bars placed at 18 inches on center. Welded wire mesh is not recommended. Care should be taken to position the reinforcement bars in the center of the slab.

Slab Subgrade:

- The upper 24 inches of the slab subgrade should be moisture conditioned to near optimum moisture content and compacted to a minimum relative compaction of compacted to 90 percent relative compaction in accordance with the latest version of ASTM D1557.

- A moisture vapor retarder should be placed in accordance with the "Moisture Vapor Retarder" section below.

**Moisture Vapor Retarder**

A vapor retarder, such as a 10--mil-thick moisture vapor retarder that meets the requirements of ASTM E1745 Class C (Stego Wrap or equivalent) should be placed directly over the prepared soil subgrade to provide protection against vapor transmission through concrete floor slabs that are anticipated to receive carpet, tile or other moisture sensitive coverings. The use of moisture vapor retarder should be determined by the project architect. At minimum, the vapor retarder should be installed as follows:

- Per the manufacture's specifications as well as with the applicable recognized installation procedures such as ASTM E1643;
- Joints between the sheets and the openings for utility piping should be lapped and taped. If the barrier is not continuously placed across footings/ribs, the barrier should at minimum be lapped into the side of the footing/rib trenches down to the bottom of the trench; and,
- Punctures in the vapor retarder should be repaired prior to concrete placement.

It should be noted that the moisture retarder is intended only to reduce moisture vapor transmissions from the soil beneath the concrete and is consistent with the current standard of the industry in the building construction in Southern California. It is not intended to provide a "waterproof" or "vapor proof" barrier or reduce vapor transmission from sources above the retarder (i.e., concrete). The evaluation of water vapor from any source and its effect on any aspect of the proposed building space above the slab (i.e., floor covering applicability, mold growth, etc.) is beyond our purview and the scope of this report.

**Drainage Control**

The control of surface water is essential to the satisfactory performance of the building and site improvements. Surface water should be controlled so that conditions of uniform moisture are maintained beneath the improvements, even during periods of heavy rainfall. The following recommendations are considered minimal:

- Ponding and areas of low flow gradients should be avoided.
- If bare soil within 5 feet of the structure is not avoidable, then a gradient of 5 percent or more should be provided sloping away from the improvement. Corresponding paved surfaces should be provided with a gradient of at least 2 percent.
- The remainder of the unpaved areas should be provided with a drainage gradient of at least 2 percent.

- Positive drainage devices, such as graded swales, paved ditches, and/or catch basins should be employed to accumulate and to convey water to appropriate discharge points.
- Concrete walks and flatwork should not obstruct the free flow of surface water.
- Brick flatwork should be sealed by mortar or be placed over an impermeable membrane.
- Area drains should be recessed below grade to allow free flow of water into the basin.
- Enclosed raised planters should be sealed at the bottom and provided with an ample flow gradient to a drainage device. Recessed planters and landscaped areas should be provided with area inlet and subsurface drain pipes.
- Planters should not be located adjacent to the structures wherever possible. If planters are to be located adjacent to the structures, the planters should be positively sealed, should incorporate a subdrain, and should be provided with free discharge capacity to a drainage device.
- Planting areas at grade should be provided with positive drainage. Wherever possible, the grade of exposed soil areas should be established above adjacent paved grades. Drainage devices and curbing should be provided to prevent runoff from adjacent pavement or walks into planted areas.
- Gutter and downspout systems should be provided to capture discharge from roof areas. The accumulated roof water should be conveyed to off-site disposal areas by a pipe or concrete swale system.
- Landscape watering should be performed judiciously to preclude either soaking or desiccation of soils. The watering should be such that it just sustains plant growth without excessive watering. Sprinkler systems should be checked.

**Plans and Specifications Review**

The recommendations presented in this report are contingent upon review of final plans and specifications for the project by NTS. NTS Geotechnical, Inc. should review and verify in writing the compliance of the final grading plan and the final foundation plans with the recommendations presented in this report.

**Construction Observation and Testing**

It is recommended that NTS be retained to provide Geotechnical Consulting services during the earthwork operations and foundation installation process. This is to observe compliance with the design concepts, specifications and recommendations and to allow for design changes in the event that subsurface conditions differ from those anticipated during our subsurface investigation.

It is the responsibility of the owner and their representative to bring any deviations or unexpected conditions observed during construction to the attention of NTS Geotechnical, in order for supplemental recommendations can be made with a minimum delay to the project. Construction should be observed and/or testing at the following stages by NTS Geotechnical, Inc.:

- During all phases of precise grading, including over-excavation, temporary excavations, removals, scarification, ground preparation, moisture condition, proof-rolling, and placement and compaction of all fill material.
- All foundation excavation prior to placement of steel
- When unusual conditions are encountered.

If any of these inspections to verify site geotechnical conditions are not performed by NTS Geotechnical, liability for the safety and stability of the project is limited only to the actual portions of the project that is observed and approved by NTS Geotechnical.

## LIMITATIONS

All parties reviewing or utilizing this report should recognize that the findings, conclusions, and recommendations presented represent the results of our professional geological and geotechnical engineering efforts and judgments. Due to the inexact nature of the state of the art of these professions and the possible occurrence of undetected variables in subsurface conditions, we cannot guarantee that the conditions actually encountered during grading and site construction will be identical to those observed, sampled, and interpreted during our study, or that there are no unknown subsurface conditions which could have an adverse effect on the use of the property. We have exercised a degree of care comparable to the standard of practice presently maintained by other professionals in the fields of geotechnical engineering and engineering geology, and believe that our findings present a reasonably representative description of geotechnical conditions and their probable influence on the grading and use of the property.

Our conclusions and recommendations are based on the assumption that our firm will act as the geotechnical engineer of record during construction and grading of the project to observe the actual conditions exposed, to verify our design concepts and the grading contractor's general compliance with the project geotechnical specifications, and to provide our revised conclusions and recommendations should subsurface conditions differ significantly from those used as the basis for our conclusions and recommendations presented in this report. Since our conclusions and recommendations are based on a limited amount of current and previous geotechnical exploration and analysis, all parties should recognize the need for possible revisions to our conclusions and recommendations during grading of the project.

It should be further noted that the recommendations presented herein are intended solely to minimize the effects of post-construction soil movements. Consequently, minor cracking and/or distortion of all on-site improvements should be anticipated.

This report has not been prepared for the use by other parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

## REFERENCES

Coduto, Donald P., 1994, Foundation Design: Principles and Practices: Prentice-Hall, Inc, Englewood Cliffs, New Jersey.

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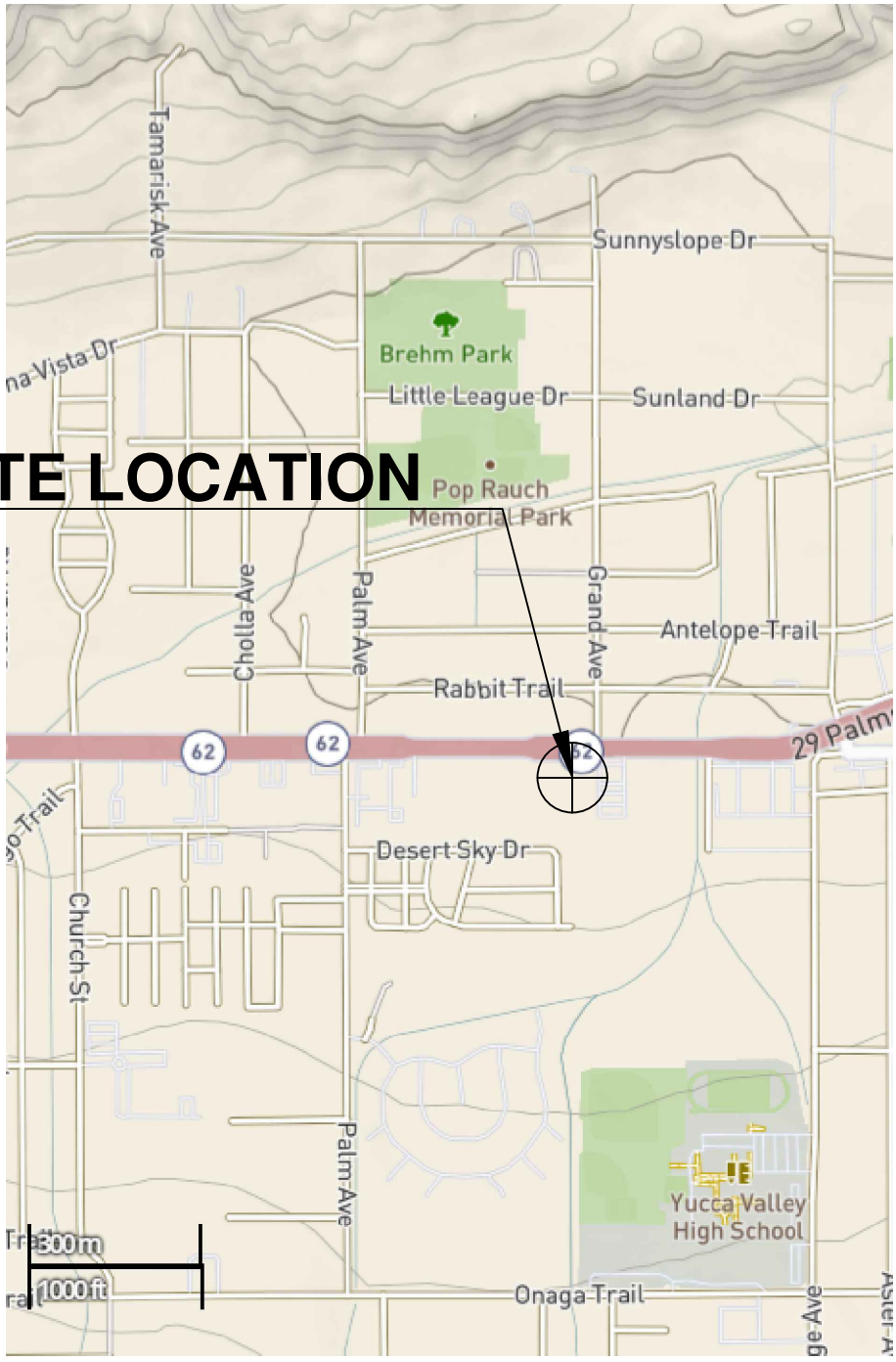
Naval Facilities Engineering Command, 1986, NAVFAC Design Manual.

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# LOCATION MAP

| | | |
|---|---|---|
| NTS GEOTECHNICAL | Date: August 19, 2022 | Plate 1 |
| | Project No.: 22289 | |


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0 30'

**GEOTECHNICAL LEGEND**

**B-1** ● APPROXIMATE LOCATION OF BORING

# GEOTECHNICAL MAP

| Date: 08/19/2022 | Project No.: 22289 | Plate: 2 |
|---|---|---|

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# APPENDIX A

Field Investigation

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# Appendix A
# Field Exploration

The subsurface exploration program for the proposed project consisted of advancing two (2) 3-inch-diameter hand tool borings. The borings were advanced to depths ranging from 10 to 15 feet below the existing grade.

The Boring Logs are presented as Figures A-2 to A-3. The Boring Logs describe the earth materials encountered, samples obtained, and show the field and laboratory tests performed. The log also shows the boring number, drilling date, and the name of the logger and drilling subcontractor. The borings were logged by an engineer using the Unified Soil Classification System. The boundaries between soil types shown on the logs are approximate because the transition between different soil layers may be gradual. Drive samples of representative earth materials were obtained from the borings.

A California modified sampler was used to obtain drive samples of the soil encountered. This sampler consists of a 3-inch outside diameter (O.D.), 2.4-inch inside diameter (I.D.) split barrel shaft that was driven a total of 6-inches into the soil at the bottom of the boring by a safety hammer. The soil was retained in brass rings for laboratory testing. Additional soil from each drive remaining in the cutting shoe was usually discarded after visually classifying the soil.

Upon completion of the borings, the borings were backfilled with soil from the cuttings.

| Project: 56695 Twentynine Palms Hwy<br>Project Location: 56695 Twentynine Palms Hwy, Yucca Valley<br>Project Number: 22289 | NTS GEOTECHNICAL | Key to Log of Boring<br>**Sheet 1 of 1** |
|---|---|---|

| Depth (feet) | Sample Type | Sampling Resistance, blows/ft | Material Type | Graphic Log | MATERIAL DESCRIPTION | Water Content, % | Dry Unit Weight, pcf | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

## COLUMN DESCRIPTIONS

1. Depth (feet): Depth in feet below the ground surface.
2. Sample Type: Type of soil sample collected at the depth interval shown.
3. Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
4. Material Type: Type of material encountered.
5. Graphic Log: Graphic depiction of the subsurface material encountered.
6. MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
7. Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.
8. Dry Unit Weight, pcf: Dry weight per unit volume of soil sample measured in laboratory, in pounds per cubic foot.
9. REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.

## FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

## MATERIAL GRAPHIC SYMBOLS

Silty SAND (SM)

## TYPICAL SAMPLER GRAPHIC SYMBOLS

- Auger sampler
- Bulk Sample
- 3-inch-OD California w/ brass rings
- CME Sampler
- Grab Sample
- 2.5-inch-OD Modified California w/ brass liners
- Pitcher Sample
- 2-inch-OD unlined split spoon (SPT)
- Shelby Tube (Thin-walled, fixed head)

## OTHER GRAPHIC SYMBOLS

- Water level (at time of drilling, ATD)
- Water level (after waiting, AW)
- Minor change in material properties within a stratum
- Inferred/gradational contact between strata
- Queried contact between strata

## GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

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**Figure A-1**

| Project: 56695 Twentynine Palms Hwy<br>Project Location: 56695 Twentynine Palms Hwy, Yucca Valley<br>Project Number: 22289 | NTS GEOTECHNICAL | Log of Boring B-1<br>**Sheet 1 of 1** |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **6/11/2022** | Logged By **LB** | Checked By **NS** |
| Drilling Method **Hand Tools** | Drill Bit Size/Type **3"** | Total Depth of Borehole **15 feet** |
| Drill Rig Type **Hand Tools** | Drilling Contractor **Juan Garcia** | Approximate Surface Elevation **N/A** |
| Groundwater Level and Date Measured **Not Encountered** | Sampling Method(s) **Modified California** | Hammer Data **N/A** |
| Borehole Backfill **Native** | Location **56695 Twentynine Palms Hwy, Yucca Valley** | |

| Depth (feet) | Sample Type | Sampling Resistance, blows/ft | Material Type | Graphic Log | MATERIAL DESCRIPTION | Water Content, % | Dry Unit Weight, pcf | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|
| 0 | | | SM | | ALLUVIUM (Qa):<br>SILTY SAND, some gravel, damp to moist, medium dense, brown | | | |
| | | | SM | | damp to moist | 5.3 | 111.1 | |
| 5 | | | SM | | damp to moist | 5.6 | 109.4 | |
| | | | SM | | some gravel, dry, loose | | | |
| 10 | | | SM | | dry | 1.5 | 102.6 | |
| 15 | | | SM | | dry | 1.2 | | |
| | | | | | Total Depth = 15 feet<br>Groundwater not encountered<br>Backfilled with native | | | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |
| 30 | | | | | | | | |

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**Figure A-2**

| Project: 56695 Twentynine Palms Hwy<br>Project Location: 56695 Twentynine Palms Hwy, Yucca Valley<br>Project Number: 22289 | NTS GEOTECHNICAL | Log of Boring B-2<br>**Sheet 1 of 1** |
|---|---|---|

| | | |
|---|---|---|
| Date(s) Drilled **6/11/2022** | Logged By **LB** | Checked By **NS** |
| Drilling Method **Hand Tools** | Drill Bit Size/Type **3"** | Total Depth of Borehole **10 feet** |
| Drill Rig Type **Hand Tools** | Drilling Contractor **Juan Garcia** | Approximate Surface Elevation **N/A** |
| Groundwater Level and Date Measured **Not Encountered** | Sampling Method(s) **Modified California** | Hammer Data **N/A** |
| Borehole Backfill **Native** | Location **56695 Twentynine Palms Hwy, Yucca Valley** | |

| Depth (feet) | Sample Type | Sampling Resistance, blows/ft | Material Type | Graphic Log | MATERIAL DESCRIPTION | Water Content, % | Dry Unit Weight, pcf | REMARKS AND OTHER TESTS |
|---|---|---|---|---|---|---|---|---|
| 0 | | | SM | | ALLUVIUM (Qa): | | | |
| | | | SM | | SILTY SAND, dry, loose, brown | | | |
| | | | SM | | some gravel, moist, medium dense, brown | 4.7 | 109.6 | |
| | | | | | damp | | | |
| 5 | | | SM | | damp | 4.9 | 109.9 | |
| | | | SM | | some gravel, dry, loose, brown | | | |
| 10 | | | SM | | dry | 2.4 | 104.0 | |
| | | | | | Total Depth = 10 feet | | | |
| | | | | | Groundwater not encountered | | | |
| | | | | | Backfilled with native | | | |
| 15 | | | | | | | | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |
| 30 | | | | | | | | |

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**Figure A-3**

NTS GEOTECHNICAL

# APPENDIX B

## Geotechnical Laboratory Testing

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# Appendix B
# Geotechnical Laboratory Testing

## Laboratory Moisture Content and Density Tests

The moisture content and dry densities of selected driven samples obtained from the exploratory boring was evaluated in general accordance with the latest version of ASTM D 2937. The test results are presented on the log of the exploratory boring in Appendix A.

## Wash Sieve

The amount of fines passing the No. 200 sieve was evaluated by the wash sieve. The test procedure was in general accordance with ASTM D 1140. The results are attached below.

| Boring No. | Depth | Passing No. 200, % |
|---|---|---|
| B-1 | 2’ | 13.8 |
| B-1 | 5’ | 20.9 |
| B-1 | 10’ | 16.3 |
| B-1 | 15’ | 24.0 |
| B-2 | 2’ | 15.9 |
| B-2 | 5’ | 19.4 |
| B-2 | 10’ | 22.7 |

## Direct Shear Tests

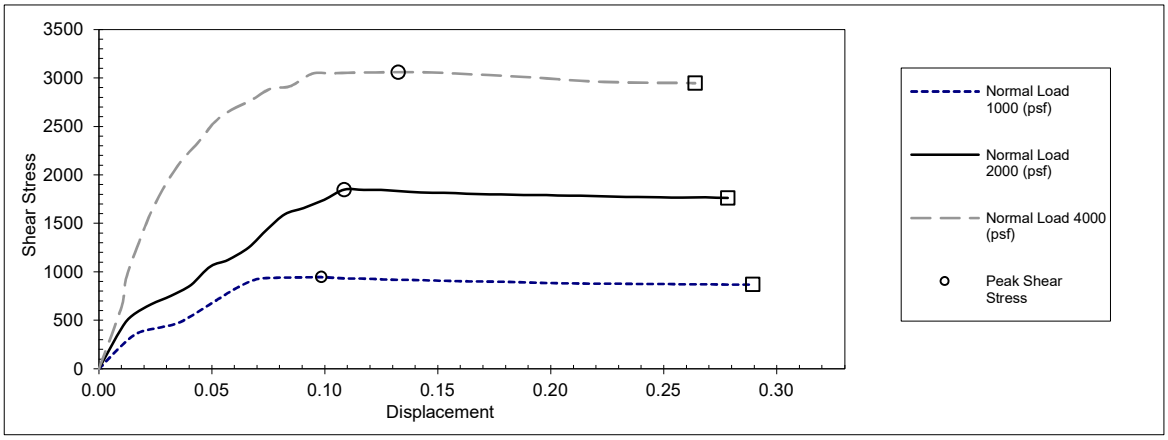
Direct shear tests were performed on selected remolded and relatively undisturbed soil samples in general accordance with ASTM D 3080 to evaluate the shear strength characteristics of the materials. The samples were inundated during shearing to represent adverse field conditions. Direct shear test results are attached to this Appendix B.

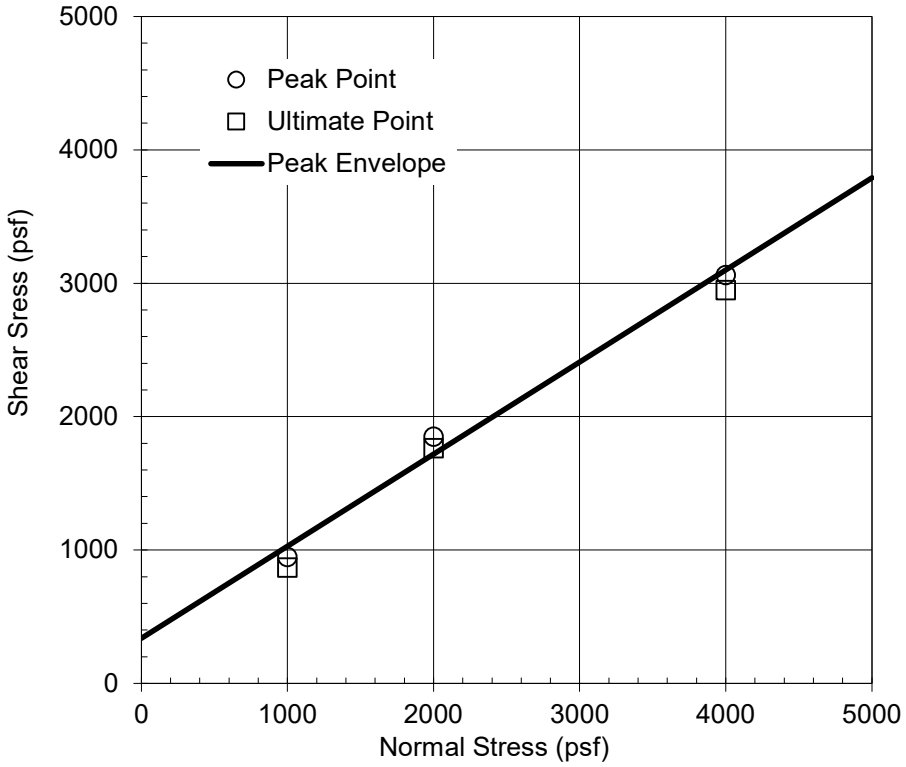
## Consolidation Test

Consolidation tests was performed on a selected driven soil sample in general accordance with the latest version of ASTM D2435. The sample was inundated during testing to represent adverse field conditions. The percent consolidation for each load cycle was recorded as a ratio of the amount of vertical compression to the original height of the sample. Consolidation testing results are attached to this Appendix B.

**Corrosion Suite**

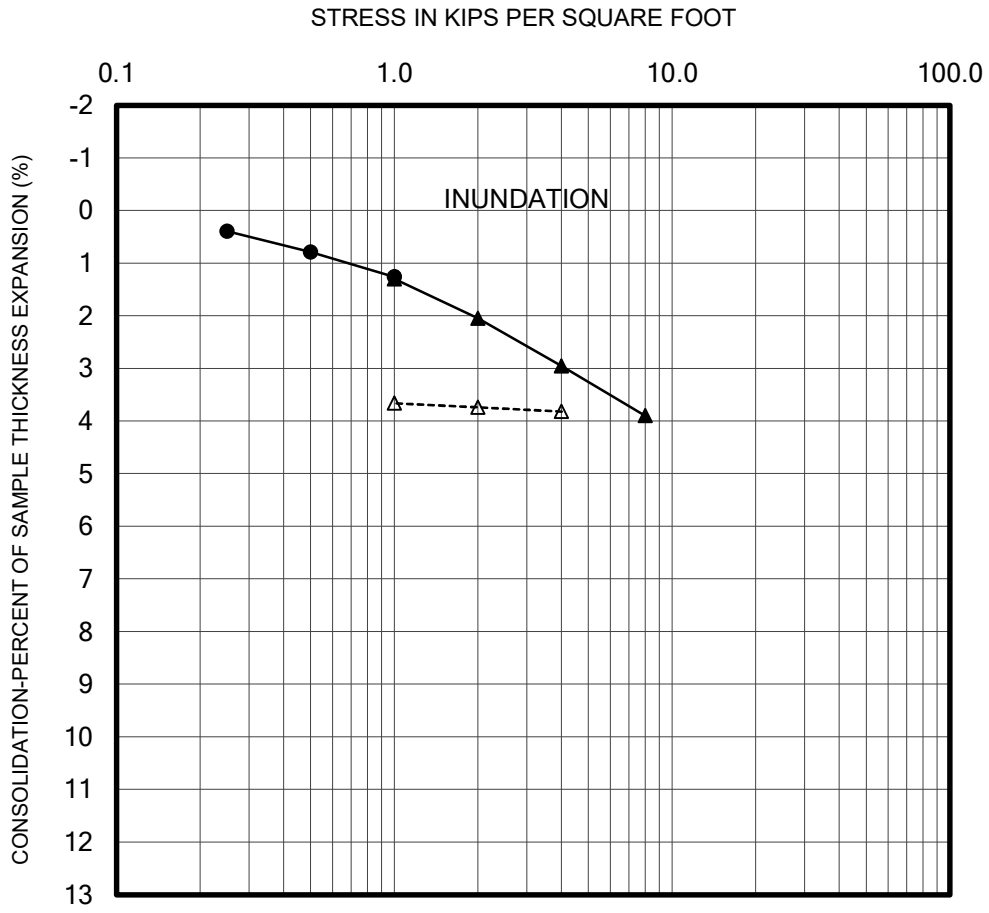
The corrosion potential of typical on-site materials under long-term contact with both metal and concrete was determined by chemical and electrical resistance tests. The soluble sulfate test for potential concrete corrosion was performed in general accordance with ASTM D4327, the minimum resistivity test for potential metal corrosion was performed in general accordance with ASTM G187, and the concentration of soluble chlorides was determined in general accordance with ASTM D4327. The test results are attached to this Appendix B.




| Strain Rate = 0.0118 inch/min | | | | Interpreted Shear Strength | | | |
|---|---|---|---|---|---|---|---|
| Date Tested: 6/26/2022 | | | | Peak | | Ultimate | |
| Boring No. | Sample No. | Depth | UCSC | Cohesion (psf) | Friction Angle (deg) | Cohesion (psf) | Friction Angle (deg) |
| B-1 | 1 | 2 | SM | 340 | 34.6 | 277 | 34.1 |
| Sample description: | Brown Silty Sand | | | | | | |

| | | | |
|---|---|---|---|
| NTS GEOTECHNICAL | | Direct Shear Test Results | Figure |
| Tech: | LB | 50095 29 Palms Hwy | B-1 |
| Project # | 22289 | | |




Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

Date Tested: 26-Jun

| | |
|---|---|
| **Boring No.** | **B-1** |
| **Sample No.** | **2** |
| **Depth, ft.** | **5** |
| **Sample Description** | **Brown Silty Sand w/ Gravel** |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

NTS GEOTECHNICAL

| | |
|---|---|
| Tech: | LB |
| Project # | 22289 |

**CONSOLIDATION TEST**

**50095 29 Palms Hwy**

**FIGURE**

**B-2**

# Soil Analysis Lab Results

Client: NTS Geotechnical
Job Name: 50095 29 Palms Hwy, Yucca Valley
Client Job Number: X
Project X Job Number: S220613D
June 13, 2022

| | Method | ASTM D4327 | | ASTM D4327 | | ASTM G187 | | ASTM G51 |
|---|---|---|---|---|---|---|---|---|
| **Bore# / Description** | **Depth** | **Sulfates** $SO_4^{2-}$ | | **Chlorides** $Cl^-$ | | **Resistivity** As Rec'd \| Minimum | | **pH** |
| | (ft) | (mg/kg) | (wt%) | (mg/kg) | (wt%) | (Ohm-cm) | (Ohm-cm) | |
| B-1 Brown Silty Sand | 2 | 4.3 | 0.0004 | 7.1 | 0.0007 | 201,000 | 28,140 | 8.3 |

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract
PPM = mg/kg (soil) = mg/L (Liquid)