

IV. PREPARATION OF COST ESTIMATES

A. Basis of Cost Estimates

The conceptual design of the regional, secondary and local drainage facilities developed for both the non-detained and detained drainage scenarios was the basis for preparation of the cost estimates. The conceptual design of facilities for both drainage scenarios is summarized on the related tables and plan and profile exhibits.

B. Criteria

The cost estimates include quantities of major cost items, the unit cost for each item, and the total estimated cost for each drainage facility. Unit costs used in the cost estimates were determined based on actual costs experienced on similar drainage Master Plan projects, production rates, and current labor, equipment and material costs. In addition, the total project cost estimates include separate costs for engineering and design, construction, supervision, and administration. The construction cost estimate includes 30 percent for contingencies.

C. Development of Unit Costs

The unit costs utilized for construction items such as installation of fence and gates, earthwork excavation and embankment backfill, concrete lining for construction of channel structures, spillways, energy dissipators, and inlet channels were based on bid prices developed for a recent flood control project in the Yucca Valley area (Long Canyon Channel and Yucca Creek).

The unit cost for disposal of excess materials was developed based on the assumption that the disposal can be done at nearby dump sites with minimal haul distance.

The unit cost for reinforced concrete structures such as box conduits and culverts was developed based on recent cost experience for reinforced concrete structures from similar flood control projects.

The unit cost for reinforced concrete pipe was based on the 1997 unit prices published in *National Construction Estimator* by Craftsman. Using the 20-city average Engineering News Record Construction Cost Index for January 1997 (5765) and January 1999 (6000), a reasonable cost adjustment factor to apply to the 1997 costs to estimate 1999 costs is 1.04.

The unit cost for items such as riprap and rock lining were obtained through communications with a number of contractors in nearby town of Apple Valley. Due to the economy of scale, rock used for lining channels would cost a little less, on a per unit basis, than rock used for lining limited reaches upstream and downstream of concrete channels or downstream of detention basin outlets.

To develop the costs for land acquisition, consultation with the Town of Yucca Valley yielded three tiers of right-of-way (R/W) costs, depending on the location of the land. Land acquisition costs vary from the most expensive easements located in commercial/industrial areas along the highway, to less expensive easements located further away from the highway. Land costs in high-density areas are more costly than low-density areas. The cost of land acquisition also includes a cost for purchase of residences to obtain right-of-way areas for construction of regional facilities.

The unit cost for purchase of residences was estimated based on the average selling price of lots with homes that have recently changed ownership, ranging from \$70,000 to \$80,000 (the latter price was used for the unit cost for purchase of residences in the cost estimate calculation tables).

A lump sum cost equal to 30 percent of the RCP and RCB construction cost, not including excavation and backfill, was considered for removal and replacement of street pavement for installation of RCPs and RCBs. The cost of miscellaneous facilities related to detention basins such as access roads, local drainage facilities, erosion control facilities, etc., was assumed to be 10 percent of the construction cost of all other line items. Engineering, design, construction supervision, and administration were assumed to be 25 percent of the total construction costs. Detailed descriptions of the methodology and assumptions used for each cost item are tabulated below.

Description of Unit Costs

Item Description	Unit Cost	Assumptions
CHANNEL, BOX CONDUIT, AND PIPE IMPROVEMENTS:		
Excavation	\$2.50/CY	<p>The same unit cost applied for excavation of sandy material was also used for rock material. Rock material could be a source of riprap therefore, no additional cost for excavating hard material was considered.</p> <p>For soft-bottom channels with rock-revetted side slopes, the excavation depths include the depth required to accommodate rock thickness.</p> <p>For open channel excavation, \$1.00/CY was added to reflect the cost of disposal of excess material.</p>
Backfill	\$3.50/CY	Unit cost assumption was based on contractors' average bid prices for backfill for the Long Canyon project.
Rock-revetted Side Slopes	\$50.00/CY	Assumed 3' thickness for riprap. Assumed riprap cut-off depth of 2 feet for 20-foot-wide channels or less, 3 feet for 30-foot-wide channels, 4 feet for 40-foot-wide channels, and 5 feet for 50-foot-wide channels or more.
Rock Lining	\$70.00/CY	<p>This unit cost was applied to rock lining of 25 feet U/S and D/S of concrete channels and to the erosion control areas at detention basins.</p> <p>Unit cost assumption was based on contractors' bid for rock slope protection for the Long Canyon project.</p>
Concrete Lining	\$225.00/CY	Assumed concrete-lined channels are 8" thick; unit cost assumption was based on contractors' average bid price for concrete plus reinforcing steel bar for the Long Canyon project.
RCB	\$425.00/CY	Assumed 12" thick invert slab walls and deck; unit cost assumption was based on recent cost experience of reinforced concrete structures for similar flood control projects.
RCP	Unit Cost/LF	Based on 1997 <i>National Construction Estimator</i> + 30% for trenching and dewatering + \$40 -\$50 for backfill.

Item Description	Unit Cost	Assumptions
Culvert	\$425.00/CY	Culverts were sized assuming an opening area equivalent to the cross-sectional area of the delivery channel; culvert height assumed to be the same as channel height; assumed 12" thick invert slab walls and deck; a maximum barrel width of 14.5 feet, and 2 feet of freeboard to roadway deck. Length of culverts in feet are as indicated in parenthesis.
Fence & Gates	\$11.00/LF	Unit cost based on contractors' average bid of \$8.00/LF for 6' high chain link fence for Long Canyon project + additional \$3.00/LF for gates at every street crossing.
Right-of-Way	\$3,000/AC	Unit cost for obtaining easements in residential areas and some commercial/industrial areas outside of designated boundary (low-density).
	\$15,000/AC	Unit cost for obtaining easements in residential areas and some commercial/industrial areas outside of designated boundary (high density).
	\$60,000/AC	Unit cost for obtaining easements in commercial/industrial areas along the highway.
Purchase of Residences (CORRECTED)	\$80,000/EA	Cost represents acquisition of houses to obtain additional R/W for constructing regional facilities.
Bottom Control Structures	\$90.00/CY	Stabilizers were assumed to be placed normal to the channel centerline and extend across the channel invert into the channel banks. The stabilizers consist of grouted rock. Unit cost assumed to be \$650 per linear foot of channel width (or \$90/cy) and was based on a crest width of 20' with 2:1 sloping U/S and D/S cut-off walls. U/S and D/S sloping cut-off walls assumed to extend to 10 feet below grade. Rock thickness assumed to be 3'.
Side-slopes protection at Bottom Control Structures	\$90.00/CY	Applicable to soft-bottom channels only to protect slopes from high flow velocities. At the location of a bottom control structure, a strip of the channel bank (20' wide by length of bank) on each side of the banks will be lined with grouted rock.
Street Pavement (Remove & Replace)	30%	Lump sum assumed to be 30% of cost for RCP or for RCB; includes the cost of street closure and traffic control.

Item Description	Unit Cost	Assumptions
DETENTION BASINS:		
Concrete Spillway, Energy Dissipator & Inlet Channel	\$225.00/CY	Assumed unit cost is the same as for concrete lining. Spillway sized to convey 3 times the 100-year peak discharge with 10' high walls. Freeboard is 2'. Length of spillway channel is equivalent to length of D/S embankment slope. Length of entrance channel is the length of the slope into basin plus 10' U/S and 10' D/S; Entrance channel is 50' W x 10' H with 1:1 side slopes.
Basin Excavation & Dam Embankment Foundation Removals	\$2.50/CY	Same unit cost as for excavation for channel construction; since basin excavation can penetrate deep into rock material, the rock material can be a source for riprap. Basin excavation volume estimated using an average area and average basin depth from stage-storage data used for basin flood routing; Foundation removal volume assumed equal to dam embankment volume.
Levee Embankment	\$3.50/CY	Unit cost based upon contractor's average bid for earth (Long Canyon project). Volume of earthfill was calculated by taking an average cross-sectional area of the embankment multiplied by the length of the embankment.
RCB	\$425.00/CY	Assume 12" thick slab walls and deck; unit cost assumption based on recent cost experience on reinforced concrete structures.
RCP	Unit Cost/LF	Based on 1997 <i>National Construction Estimator</i> +30% for trenching and dewatering + \$40-\$50 for backfill.

Item Description	Unit Cost	Assumptions
Right-of-Way		Right-of-way determined from basin approximate footprint.
	\$3,000/AC	Unit cost for obtaining easements in residential areas and some commercial/industrial areas outside of designated boundary (low density).
	\$15,000/AC	Unit cost for obtaining easements in residential areas and some commercial/industrial areas outside of designated boundary (high density).
	\$60,000/AC	Unit cost for obtaining easements in commercial/industrial areas along the highway.
Riprap	\$70.00/CY	Assume riprap area is 50' L x 20' W by 3' thick (placed at the D/S end of the inlet channel).
Disposal of Excess Earth Materials	\$1.00/CY	Assume excess earth materials can be disposed of at nearby dump sites with minimal haul distance.
Miscellaneous Facilities	10%	Assume that miscellaneous facilities such as access road and ramp paving, security fencing, local drainage facilities, trash racks, operating valves, miscellaneous erosive protection, etc. are funded at 10% of the total of all other line items.
OTHER COSTS:		
Contingencies	30%	Assume contingencies are funded at 30% of the total cost for each proposed facility.
Engineering & Design	10%	Assume engineering and design costs are funded at 10% of total construction cost.
Construction, Supervision & Administration	15%	Assume supervision and administration costs are funded at 15% of total construction cost.

D. Results of Cost Estimate Study

The results of the cost estimate study for both the non-detained and detained systems is summarized on Table 6. Tables 7, 8, and 9 provide the basis for the

non-detained conveyance system, the detained conveyance system, and the detention basin costs, respectively.

The least cost drainage scenario is the detained system. This system is, therefore, the recommended Flood Control Plan for the Town of Yucca Valley.