

City of Riverside

**WASTEWATER COLLECTION AND TREATMENT
FACILITIES INTEGRATED MASTER PLAN**

**VOLUME 2: BASIS OF PLANNING
CHAPTER 4: BASIS OF COST ESTIMATES**

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BASIS OF COST ESTIMATES

4.1 PURPOSE

The purpose of this chapter is to summarize the procedures and guidelines for estimating Operations and Maintenance (O&M) and capital costs for the Integrated Master Plan. In addition, procedures for applying the O&M and capital costs in a life-cycle cost analysis to compare alternatives are summarized.

4.2 BACKGROUND

The Riverside Regional Water Quality Control Plant (RWQCP) Integrated Master Plan, when completed, will present a plan that will meet the expansion and replacement needs of the RWQCP's facilities through 2025. In order to complete this plan, consistent assumptions and criteria for development of O&M and capital costs and life-cycle cost analyses are necessary.

4.3 LEVEL OF ACCURACY

The expected level of accuracy for the cost estimates for the Integrated Master Plan is Class 4, as classified by the Association for the Advancement of Cost Engineering International (AACEI, 1999). The expected accuracy range of a Class-4 estimate is within 30 percent over the estimate to 15 percent under the estimate. In order to reduce the risk of the impact of underestimation, for capital costs, a contingency as described below is applied to the developed estimates.

4.4 OPERATIONS AND MAINTENANCE COSTS

O&M costs include the labor, supplies and utility costs for operations, preventive and corrective maintenance, inspections, and repair and replacement of parts. O&M costs are based on the information provided by the following:

- Historical costs from recent Carollo Engineers (Carollo) projects.
- Vendor supplied costs.
- Costs supplied by RWQCP staff (i.e., power, labor, chemicals, and natural gas).
- Calculations as necessary to supplement other sources.

The cost estimates are generally based on applying the above information to flow diagrams for main process systems, plant schematic layouts, and equipment lists that will be

developed for the Integrated Master Plan. O&M costs are escalated for inflation as described in the capital cost section that follows.

4.5 CAPITAL COSTS

Capital costs consist of all the items that will be constructed/purchased for the projects that are being evaluated for the Integrated Master Plan. The direct cost of each equipment item or process area will be based on the following:

- Vendor-quoted information.
- Cost curves based on historical costs from other Carollo Projects or scale-up or scale-down of similar sized projects.
- Scale-up of costs to account for inflation, using a base ENR value of 8,570 (Los Angeles, August 2006).
- Quantity take-off and unit prices when applicable information is necessary and available.

For most projects, depending on applicability, general factors will be added to the direct costs derived from the information listed above. These factors include the following:

- The costs of Site Work and Electrical and Instrumentation are estimated as percentages of the subtotal direct cost. Typical percentages are 10 percent and 15 percent, respectively.
- The contingency is an amount added to the construction cost estimate to provide for undefined project elements and to reduce the risk for underestimation. The contingency usually ranges from 0 to 30 percent. The contingency is estimated as 30 percent of the total direct cost in the Integrated Master Plan.
- The added amount for General Conditions include the costs of mobilization/demobilization, bonds and insurance, contractor temporary project facilities and supervisory personnel, testing, start-up, and other constraints. A General Conditions of 10 percent of the total direct cost plus contingency is added.
- General Contractor Overhead and Profit refers to the general contractor's home office overhead and profit. It is estimated to be 15 percent of the subtotal of the above costs.
- The cost of the project at approximate midpoint of construction is predicted by escalating August 2006 costs. The escalation rate is assumed to be 6 percent for years 1 through 5 of the life-cycle period and 4 percent thereafter.
- Sales Tax is estimated at 7.75 percent on materials, based on material cost equaling 50 percent of the total direct cost and contingency.

- Bid Market Allowance is included in the total construction cost due to the volatile nature of the current bidding market throughout the United States and especially California. It is estimated to be 15 percent of the subtotal cost of all above items.
- Engineering, Management, and Legal are also included to determine the total project cost. This covers Engineering, Planning, design and construction oversight costs, legal fees, as well as City administration expenses to oversee the project from planning through construction. For this project, a factor of 30 percent of the total construction cost is used, including all above items.

4.6 LIFE-CYCLE COSTS

In order to evaluate different alternatives for upgrading or replacement of the RWQCP facilities, life-cycle cost analyses will be performed to distinguish which alternative is the best from an economic standpoint. Life-cycle cost analyses determine the present worth of both capital costs and annual O&M costs for each alternative. Factors considered in the life-cycle costs include the escalation rate, cost of capital (discount rate), and the life-cycle period. These values are as follows:

- Escalation rate of 6 percent for years 1 through 5 of the life-cycle period and 4 percent thereafter.
- Discount rate of 6 percent for computing present worth values.
- Life-cycle period of 19 years from 2006 till the end of 2025.