

## CHAPTER 6. BASIS OF PLANNING

Criteria to be used for planning are established in this chapter. Economic evaluation factors, including provisions for non-construction costs, contingencies, and for cost indexing are defined herein. Non-economic evaluation criteria for alternatives and equipment selection are also included.

A 20-year planning horizon is used for this project. Growth has been projected through buildout conditions which have been defined in the comprehensive plan as year 2023. After build out, no additional growth is projected through 2029. A discount rate of 3 percent is used for consistency with other City planning efforts.

Alternatives will be compared on a present worth basis. The present worth cost of the alternatives will include:

- Capital costs
- Operation and maintenance costs including labor, materials, chemicals and power

Alternatives will also be compared on a non-economic basis. Non-economic criteria are described below.

### FACTORS FOR CONDUCTING ECONOMIC EVALUATION

#### Capital Cost Estimates

All cost estimates are order-of-magnitude estimates as defined by the American Association of Cost Engineers (AACE). An order of magnitude estimate is one that is made without detailed engineering data and uses techniques such as cost curves and scaling factors applied to estimates developed for similar projects. The overall expected level of accuracy of the cost estimates presented is -30 percent to +50 percent. This means that bids can be expected to fall within a range of 30 percent under to 50 percent over the estimate for each project. This is consistent with the guidelines established by the AACE for planning level studies.

The economic evaluation was based on capital cost estimates. The capital cost estimates were prepared using the current 20-Cities Engineering News Record (ENR) Construction Cost Index average of 8089. The estimates reflect a professional opinion of costs at this time and are subject to change as the design of each project component develops. The markups that were applied are summarized in Table 6-1.

**Table 6-1. Mark Up Factors Used in Developing Preliminary Construction Cost Estimates**

Item	Markup
Contractor General Conditions	10%
Contractor Overhead and Profit	15%

The preliminary construction cost estimates do not include the following:

- Potential cost increases due to unknown historical or cultural impacts to construction
- Potential costs associated with identification and mitigation of hazardous waste
- Easement or land acquisition
- Contingencies
- Engineering, legal and administrative (ELA) costs

Total project capital costs for planning alternatives will be calculated by multiplying the sum of the estimated construction costs (with general conditions and overhead and profit) by factors to account for contingencies, and engineering, legal and administrative costs as shown in Table 6-2.

**Table 6-2. Mark Up Factors Used in Developing Project Capital Cost Estimates**

Item	Markup
Contingencies	30%
Engineering, Legal and Administration	25%

The engineering, legal and administrative cost factors will be applied to the construction cost following the application of the contingencies factor.

**Operation and Maintenance (O&M) Costs**

Operation and maintenance costs will be based on annual average flow and load conditions. Unit costs for labor, materials and power were developed based on current City costs and will be used to develop operation and maintenance costs. O&M unit costs are summarized in Table 6-3.

**Table 6-3. Operation and Maintenance Unit Costs**

Item	Unit Cost
O&M Labor (including benefits), \$/hour	50.00
Electrical Power, \$/kwh	0.06
Natural gas, \$/therm	1.14
Hydrated Lime (Ca(OH) <sub>2</sub> ) \$/delivered ton	180.00
Liquid Alum (Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> ), \$/CDT	16.92

## CRITERIA FOR NON-ECONOMIC EVALUATIONS

Non-economic evaluations will be conducted on two levels. Plant-wide or overall process strategies will be evaluated using criteria that will define the workability and appropriateness of the alternatives being considered. These criteria include:

- *Performance.* The alternative should be able to consistently meet treatment requirements.
- *Expandability.* The alternative should be expandable in the future should solids production increase beyond buildout quantities due to annexation or regional treatment agreements, neither of which are currently anticipated.
- *Ease of Operation.* The alternative should be straightforward in its operation, requiring a reasonable amount of operator attention. Further, the alternative should not create uncomfortable or unsafe working conditions for operators.
- *Reliability.* The alternative should provide consistent results with a reasonable amount of maintenance. The alternative should provide redundant equipment or operation.
- *Constructability.* The alternative should be realistically constructible with minimal disruption to treatment plant operation.

Detailed unit process alternatives will be evaluated using criteria that allow judgments to be made regarding suitability of specific equipment for a particular application. The criteria may include any or all of the following:

- *O&M considerations.* This criterion includes considerations such as the amount of equipment that must be operated and maintained, and the ability to handle upset conditions.
- *Reliability.* Alternatives that are less reliant on mechanical equipment, and have inherent redundancy, are deemed more reliable.
- *Odor.* Alternatives that contain or do not produce odors are considered more favorable.
- *Flexibility.* This criterion considers the operational options that would be available to WRF personnel.
- *Complexity.* Systems that require extensive use of equipment and sophisticated controls are considered to be more complex.
- *Energy use.* Systems that are energy efficient, or use less energy, are considered more favorable.