

APPENDIX T

Cost Estimating Assumptions

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OVERVIEW

This appendix provides the assumptions used by West Yost to estimate the probable construction costs for the planning and design of recommended water system facilities for the City's water system. Unit construction costs were developed in the *City of Modesto's 2010 Engineer's Report Options A and B, Attachment A*. The unit costs were based on a combination of data supplied by manufacturers, published industry standard cost data and curves, and construction costs for similar facilities built by the City and/or other public agencies with similar construction cost indexes. All construction costs have been adjusted to reflect March 2017 costs at an Engineering News Record (ENR) construction cost index of 11,609.44 for San Francisco. These costs are to be used for conceptual cost estimates only, and should be updated regularly.

Additionally, the unit costs presented in this appendix are for construction only and do not include estimating uncertainties or unexpected construction costs (e.g., variations in final quantities) or cost estimates for land acquisition, engineering, legal costs, environmental review, soils investigation, surveying, construction management, and inspections and/or contract administration. Some of these additional cost items are referred to as contingency costs and are further described in the last section of this appendix.

Construction costs presented in this appendix are not intended to represent the lowest prices in the industry for each type of construction; rather they are representative of average or typical construction costs. These planning level construction cost estimates have been prepared for guidance in evaluating various facility improvement options, and are intended for budgetary purposes only, within the context of this master planning effort.

The following sections of this appendix describe the assumptions used to estimate the probable construction costs for the planning and design of recommended water system facilities for the City's potable water system:

- Water System Construction Costs
- Contingency Costs

WATER SYSTEM CONSTRUCTION COSTS

The following sections present the construction cost estimates used to project probable construction costs for recommended water system facilities in the City's water system and are categorized by improvement project type, including the following:

- Pipelines,
- Treated water storage tanks,
- Treated water booster pump stations,
- Municipal groundwater production wells, and
- Backup power generators.

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Pipelines

Unit construction costs for water pipelines 6- through 36-inches in diameter are provided in Table 1. These costs are to be used for typical pipeline construction in urban areas (urban) and construction across open fields or areas that are not yet developed (rural). These costs generally include pipe materials, trenching, placing and jointing pipe, valves, fittings, hydrants, service connections, placing imported pipe bedding, native backfill material, and asphalt pavement replacement, if required.

Pipeline Diameter, inches	Unit Construction Cost, \$/linear foot	
	Rural	Urban
6	73	91
8	80	121
10	97	147
12	113	162
14	130	178
16	146	195
18	162	212
20	169	235
24	200	260
30	282	326
36	375	422

(a) Based on March 2017 ENR CCI of 11,609.44 (San Francisco).

The construction costs summarized in Table 1 do not include the cost of boring and jacking pipe or other trenchless methods. Trenchless unit construction costs for water pipelines for water pipelines 12- through 24-inches in diameter are provided in Table 2. These costs are used in areas where typical open-cut methods are not appropriate and trenchless crossings are required. Unit construction costs are provided for both jack and boring and horizontal directional drilling (HDD). Jack and bore construction costs are used in areas requiring typical trenchless installations, such as freeway crossings. HDD construction costs are used in areas requiring a more elaborate trenchless installation, such as crossing the Tuolumne River. These costs include the jacking and receiving pits and casing/carrier pipes.

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Pipeline Diameter, inches	Unit Construction Cost, \$/linear foot	
	Jack and Bore	HDD
12 (24-inch Casing)	840	1,080
16 (30-inch Casing)	1,050	1,350
18 (32-inch Casing)	1,120	1,440
24 (36-inch Casing)	1,260	1,620

(a) Based on March 2017 ENR CCI of 11,609.44 (San Francisco).

Treated Water Storage Tanks

Table 3 summarizes the estimated construction costs for water storage tanks between the size range of 1.0 to 6.0 million gallons (MG). Because these costs represent budgetary numbers for planning purposes, West Yost based them on partially buried pre-stressed concrete tanks rather than above ground steel tanks which provides the City with a more conservative planning budget. It should be noted that these costs are representative of construction conducted under normal excavation and foundation conditions, and would be significantly higher for special or difficult foundation requirements.

Capacity, MG	Estimated Construction Cost Pre-Stressed Concrete Storage Tank, \$ ^(b)
1.0	1,630,000
2.0	3,290,000
3.0	4,930,000
4.0	6,580,000
5.0	8,210,000
6.0	9,870,000

(a) Based on March 2017 ENR CCI of 11,609.44 (San Francisco).
 (b) Rounded to the nearest \$10,000.

Treated Water Booster Pump Stations

Estimated average construction costs for distribution pumping stations, as shown in Table 4, are based on enclosed stations with architectural and landscaping treatment suitable for residential areas. Pump station cost estimates include the installation of backup/standby generators and SCADA.

It should be noted that booster pump station costs can vary considerably, depending on factors such as architectural design, pumping head, and pumping capacity. Therefore, these costs presented below are representative of construction conducted under common or normal conditions, and would be significantly higher for special or difficult conditions.

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Pumping Capacity, horsepower	Estimated Construction Cost, \$ ^(b)
50	950,000
75	1,100,000
100	1,220,000
125	1,320,000
150	1,430,000
175	1,540,000
200	1,630,000
250	1,870,000
300	1,990,000
350	2,150,000
400	2,320,000

(a) Based on March 2017 ENR CCI of 11,609.44 (San Francisco).
 (a) Rounded to the nearest \$10,000.

Municipal Groundwater Production Wells

Well construction consists of pilot hole drilling, water quality/soil sampling, pilot hole reaming, well construction, well development and providing the necessary housing, pump, motor, automatic control equipment, discharge piping, SCADA, and disinfection equipment. Costs also assume a backup power generator will be installed.

The estimated construction cost of a new 1,500 to 2,000-gpm well, approximately 400 to 500 feet deep, based on March 2017 ENR CCI of 11,609.44 for San Francisco would be approximately \$2,300,000 per well¹. These costs are representative of construction conducted under normal drilling conditions, and would be significantly higher for special or difficult locations. With markups for soft costs (see Contingency Costs below), the total capital cost for production wells is estimated to be approximately \$3.5M per well.

Backup Power Generators

On-site backup power generators are recommended at key locations to provide power to pumps so that water can be pumped into the distribution system in the event of a power outage. These generators should be sized to meet the power demands of the pumps. The total construction cost for a new on-site backup power generator is estimated to be approximately \$238,000 (includes contingencies). Therefore, the unit cost of a new backup power generator is approximately \$159,000. This cost is representative of construction conducted under normal conditions, and would be significantly higher for special or difficult conditions.

¹ Costs are based on the City’s new Grogan Park Well, which include a well construction cost of approximately \$500,000 and an estimated well equipping cost of \$1,800,000.

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CONTINGENCY COSTS

Contingency costs or mark-ups must be reviewed on a case-by-case basis because they will vary considerably with each construction project. However, to assist City staff with budgeting for these recommended water system facility improvements, the following percentages were developed.

- Construction Contingencies: 20 percent
The construction costs presented above are representative of the construction of water system facilities under normal construction conditions and schedules; consequently, it is appropriate to allow for estimating and construction uncertainties unavoidably associated with the conceptual planning of projects. Factors such as unexpected construction conditions, the need for unforeseen mechanical items, and variations in final quantities are only a few of the items that can increase project costs. For this study, construction contingencies are assumed to be 10 percent of the base construction cost estimate.
- Other Project Fees: 30 percent
Other project fees have been divided into three 3 subcategories, totaling 30 percent: 10 percent engineering, 10 percent construction management, and 10 percent program implementation.
 - Engineering services associated with new facilities include preliminary investigations and reports, right-of-way acquisition, foundation explorations, preparation of drawings and specifications during construction, surveying and staking, sampling of testing material, and start-up services. For this study, engineering costs are assumed to be 10 percent of the base construction cost estimate.
 - Construction management covers such items as contract management and inspection during construction. The cost of these items can also vary, but for the purpose of this study, it is assumed that construction management charges will equal approximately 10 percent of the base construction cost estimate.
 - Finally, there are program implementation costs, which cover items such as legal fees, environmental/CEQA compliance requirements, financing expenses, administrative costs, and interest during construction. The cost of these items can also vary, but for the purpose of this study, it is assumed that program implementation costs will equal approximately 10 percent of the base construction cost estimate.

Construction Contingencies:	20 percent
Engineering Costs:	10 percent
Construction Management:	10 percent
Program Implementation:	10 percent
Total:	<u>50 percent</u>

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The contingency costs total 50 percent of the estimated base construction cost. An example application of these standard mark-ups to a project with an assumed base construction cost of \$1.0M is shown in Table 5.

Table 5. Example Application of Mark-ups		
Cost Component	Percent	Cost
Estimated Base Construction Cost ^(a)	--	\$1,000,000
Contingencies:		
Construction Contingencies	20%	\$200,000
Estimated Project Cost after Construction Contingencies		\$1,200,000
Other Project Fees:		
Engineering Costs	10%	\$100,000
Construction Management	10%	\$100,000
Program Implementation	10%	\$100,000
Estimated Professional Services Total		\$300,000
Estimated Total Project Cost		\$1,500,000
(a) Assumed cost of an example project.		