APPENDIX W

Cost Estimate Methodology

Updated Project Cost Estimates for CIP

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Purpose

This memo summarizes proposed unit costs and methods for estimating capital improvements identified in the Sammamish Plateau Water and Sewer District Water Comprehensive Plan. Construction costs are presented below, generally as unit costs, and are given in August 1999 dollars (Seattle ENR CCI 6928). These costs have been developed from CH2M HILL experience, using information from projects in the area when possible.

Contingency, Sales Tax, Engineering, and Administrative Costs

Project costs will be estimated by multiplying construction costs by 1.8, a factor which allows for 30 percent construction contingency and mitigation expenses, 8.6 percent sales tax, and 31 percent for permit applications, engineering, and financial/administrative costs. Right-of way acquisition costs are not included.

Final costs of the projects will depend on actual labor and material costs, actual site conditions, final project scope, final project schedule, and other variables. As a result, final project costs may vary from the estimates presented herein. Because of these factors, funding needs must be carefully reviewed before making specific financial decisions or establishing final budgets.

Pipelines

The following project costs include:

- Ductile iron pipe with push-on joints suitable for 150 psi service
- Trench excavation and backfill for 4 feet cover (native BF in unimproved areas, imported BF in improved areas), thrust blocks, and dewatering for water table 6 feet below ground level
- Buried valves (at 1000 feet intervals for 16-inch and smaller pipelines and 2000 feet intervals for 20-inch and larger pipelines
- Waterless hydrants at 1000 foot intervals on 12-inch and smaller pipelines

- Air valves and blowoffs each at 2000 foot intervals on 16-inch and larger pipelines
- Surface restoration of 4-inch AC, 12 feet wide for trenches under or crossing streets for improved areas, and hydroseeding over native topsoil replacement for unimproved areas. Full width overlays are not included. Traffic control in improved areas is included.
- No service connections
- Sumps and pumps which are considered adequate for trench dewatering
- Minimal cathodic protection as required

Diameter	Unimproved Area Cost per Foot	Improved Street Area Cost per Foot
6	56	108
8	65	120
10	75	134
12	87	150
16	120	191
20	166	236
24	198	275
30	284	374
36	365	467

Backup for development of the above costs is included in the attached worksheets.

Bored / jacked crossings estimated separately at 3 times unit cost above.

Microtunneled crossings estimated separately at 8 times unit cost above.

Pump Stations

No costs have been estimated for rehabilitation / expansion of existing booster pump stations.

Where (if) additional pumping capacity is needed, it is assumed to be provided by a new booster pump station. Pump station construction costs will be based on the following assumptions:

- Pressure boost of 75 psi
- Above-ground structure, concrete block with wood frame roof
- Minimum three pumps, including one as standby
- No standby power (emergency generator)

Estimated project costs will be as follows:

Capacity	Cost ($1000)
1 MGD	675
2 MGD	845

3 MGD	1015
5 MGD	1260
8 MGD	1575
10 MGD	1800

These figures are based on the *Standardized Costs for Water Supply Distribution Systems*, prepared for the Environmental Protection Agency, January 1992. For pump stations sized different from those listed above, the costs were plotted against the pump station capacity to develop the following linear relationship: Capital Cost = (121830 x Capacity in MGD) + 606154.

Reservoirs

Reservoir project costs will be estimated at $0.53/gallon for reservoirs 1 to 3 MG, and $0.43/gallon for reservoirs larger than 3 MG. Standpipe project costs are estimated at $0.72/gallon. The initial buy-in cost for the Union Hill tank was estimated at $375,000. The costs are based on the following:

- On-grade steel tanks. Reservoirs larger than 3 MG may be more cost-effectively constructed of prestressed concrete.
- Moderate level of site preparation and yard piping, no rock excavation or extensive earthwork required, moderate surfacing and planting.
- Nominal length (200± feet) of connecting pipeline and overflow pipeline
- Sitework cost of $0.32/gallon

Reservoir costs are based on CH2M HILL's previous project experience and estimates from *Marshall Valuation Service*, published by Marshall and Swift.

Reservoir repainting costs will be estimated on the basis of $3.25/SF for interior surfaces (2-3 coats polyamid) and $3.00/SF for exterior surfaces (2-3 coats polyurethane). Costs are based on sandblast to white metal, with no lead-based paint to remove; lead-based paint removal will increase costs by a factor of three. For reservoirs of typical heights (32-40 feet), repainting costs for interior plus exterior total:

- 1-MG $ 90,000
- 2-MG $145,000
- 3-MG $185,000
- 4-MG $230,000
- 5-MG $275,000

Paint in relatively good condition requiring only spot blasting and touch-up prior to recoating is estimated to cost $2.00/SF and repainting costs will be reduced from those tabulated above.

Note that repainting costs are for standard painting schemes. Painted graphics/scenes on a reservoir would increase the repainting costs.

Wells

Estimated project well cost of $414,000 each is based on the following:

- 1,000 feet deep.
- 500 feet of 24-inch diameter upper casing; 500 feet of 20-inch diameter lower casing to accommodate 2,500-gpm pump.

Estimated project pump cost of $180,000 each is based on the following:

- 300 foot pump setting.
- 400 HP, 2,500 gpm.

Estimated project pump station (well building) cost of $540,000 each is based on the following:

- Concrete block building, wood frame roof.
- Power available within 300 feet; transformer by power company.
- Nominal site improvements, fence, grading, surfacing.
- Nominal (100±feet) connecting pipeline.
- No standby power (engine generator set).

Well costs are based on CH2M HILL experience with 8-10 test and production wells constructed for Seattle Public Utilities' Highline Wellfield project in the 1980s. These figures are supplemented with additional well costs from projects completed for the City of Renton and updated in 1997 for estimating Snoqualmie Aquifer transmission costs.

Treatment Costs

Each well was evaluated separately in terms of its instantaneous flow rate, average flow rate, and treatment requirements based on its water quality. Costs for each alternative were developed based on the function of each well in the alternative. The following costs include equipment, delivery and training cost. In addition, they include a 10% Contractor mark-up, 30% installation costs, 25% electrical and I&C costs, and the 1.8 factor described previously to account for construction contingency and mitigation expenses, sales tax, and permit applications, engineering, and financial/administrative costs. The cost per alternative assumes that the treatment systems are constructed under one contract. Project phasing and multiple contracts will result in higher capital costs, and these circumstances are not reflected in this estimate. The estimated costs were based on the following:

- Chlorine disinfection project costs were obtained from Clor-tec on-site generation equipment. This consideration is not provided as an equipment recommendation. On-site sodium hypochlorite generation was used in this case due to its conservative capital costs, though there are other viable disinfection alternatives. Additional costs were included for miscellaneous items such as injectors, static mixers, and transfer pumps.
  - 1 mg/L dose, 2 lbs/day $40,095

- 1 mg/L dose, 6 lbs/day $86,130
- 1 mg/L dose, 12 lbs/day $100,980
- 1 mg/L dose, 24 lbs/day $124,740

- Fluoridation project costs were obtained from Acrison dry-sodium fluoride feed system. It includes a feeder/hopper, single door loader, 50 gallon dissolver w/ mixer, level probes and valving, and a control panel. It does not include a dust collection system. This consideration is not provided as an equipment recommendation. A dry sodium fluoride feeder system was used in this case due to its reliability and conservative capital costs, though there are other viable fluoridation alternatives. Additional costs were included for miscellaneous items such as day tank, injector, and transfer pumps.
  - 0-2000 gpm @ 1 mg/L dose $74,250
- Manganese Sequestering project costs were obtained from SeaQuest equipment. This consideration is not provided as an equipment recommendation. This system was used in this case due to its conservative capital costs, though there are other viable manganese sequestering alternatives. The system costs included here include some automation including level sensors, which may be tied to the SCADA system. Less expensive systems could be implemented with out automation.
  - 0-2000 gpm, treat max 0.046 mg/L Mn conc. with 0.65 ppm dose $29,700
- Manganese Removal project costs were obtained from Culligan Greensand Filters. This consideration is not provided as an equipment recommendation. Green sand filtration was used in this case due to its conservative capital costs. Costs were also added to include backwash tank and pump, additional chlorine facilities for manganese oxidation, miscellaneous piping, blower, and startup services.
  - 0-2000 gpm, treat max 0.135 mg/L Mn concentration $335,000
- Membrane treatment (Alt 3.02) plant cost were based on CH2M HILL experience with similar sized membrane plants. $1/gallon treated was used with the 1.8 factor for the capital cost of a 7 MGD membrane plant.
- The treatment plants for Alts 2.01 and 6.01 for reuse were obtained from the Dames and Moore estimate used the original alternative analysis preformed for the Draft Water Plan. $3,000,000 per plant was used.

Backup for development of the above costs is included in the attached worksheets.

Operation and Maintenance Costs

O&M costs were derived for each costing category. These are annual costs, assuming operation for 365 day/year, unless otherwise indicated.

- Conveyance system or pipeline maintenance costs were assumed to be 0.50% of capital costs/year.
- Pump station maintenance costs were assumed to be 1.00% of capital costs/year.

- Well / ASR maintenance costs were assumed to be based on the volume of water pumped each year: $0.35 per hundred cubic feet.
- Treatment O&M costs were evaluated separately for each well. They were based on chemical requirements (based on flow and dose) and labor hours required for system maintenance (cleaning, refilling, testing, etc.). Chemical costs were obtained from chemical suppliers, labor costs were assumed to be $50 / hour and include materials, tools and transportation.
  - O&M cost for the membrane filtration plant (Alt 3.02) were generated from previous CH2M HILL projects, which estimated the cost per gallon of a 2 MGD plant operating 3 months a year ($0.64 / thousand gallons).
  - The O&M costs for treatment plants for Alts 2.01 and 6.01 for reuse were obtained from the Dames and Moore estimate used the original alternative analysis preformed for the Draft Water Plan. The plants operate 3 months / year at $1.80 / ccf.
- Reservoir maintenance costs were assumed to be 1.00% of capital costs / year. The reservoir O&M costs for the Union Hill Tank were estimated to be 1.00% of the capital cost for a new 2MG tank.

Backup for development of the above costs is included in the attached worksheets.

Miscellaneous Costs

Some alternatives included specialty items that were included as separate line items.

- Alternative 3.02 required a 100 MG surface water impoundment and a 10 MGD treatment plant.
  - The surface water impoundment was estimated at $ 4.32 million. The following assumptions were made: 1) all materials were available on site, 2) the cut and fill volumes were balanced, 3) a single membrane liner was used, 4) 12-inches of cushion materials was provided for the liner, 5) clearing, stripping and grubbing was moderately difficult, 6) the site was fenced, and 7) no extraordinary measures are required for its construction. The 1.8 factor described previously to account for construction contingency and mitigation expenses, sales tax, and permit applications, engineering, and financial / administrative costs was applied. This cost does not included land acquisition of a 40-acre site.
  - $100,000 was assumed as the cost of a complete pilot plant study for the membrane plant.
- The South Connection with the Issaquah Pipeline via I-90 was assumed to be a 24-inch pipe located along the I-90 corridor, from the East Gate Reservoir to Well 9.
  - 33,900 feet was the estimated length and the pipeline costs used in the 'Pipelines' section of this tech memo was used to determine the total cost of the pipe. The District's share of the pipe was determined based on it's required ADD (5500 gpm) as a percentage of the maximum flow through the 24-inch pipe at 7 fps (approx 10,000 gpm).

- The South Connection with the Issaquah Pipeline via Issaquah Highlands was assumed to be a new 12-inch line from Issaquah Highlands to the 'Y' and an upgraded pipe from the Holly and Phase II pump stations to Issaquah Highlands.
  - The estimate described above for the south connection of the Issaquah pipeline via I-90 was used for the main transmission line. The same pipe length was used for this estimate since changes in the pipe routing from the East Gate Reservoir to Issaquah Highlands would most likely result in a similar length (33,900 feet of 24-inch pipe).
  - 9,200 feet was estimated as new 24" or 30" pipes (unplanned for Issaquah Highlands) from the Issaquah Highlands. Pipeline costs used in the 'Pipelines' section of this tech memo was used to determine the cost of this section of pipe.
  - 2,800 feet was estimated as upgraded pipe from the Holly and Phase II pump stations to Issaquah Highlands (16" planned for Issaquah Highlands, but 24" or 30" required for this connection). The difference between these pipeline costs was used as the linear foot costs for the Districts share of the pipeline costs.
  - Also, the Holly and Phase II pump stations would have to be upgraded to account for the additional 5500 flow to the Plateau. The difference between the planned flow (2241 gpm) and the required flow (2241+5500=7741 gpm) was used to determine the cost for the pump station upgrade. This cost was obtained from the 'Pump Station' section of this memo.