

**ON-CALL ENGINEERING SERVICES**  
**QUARTERMASTER HARBOR COMMUNITIES**  
**WASTEWATER MANAGEMENT OPTIONS**

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**COST ANALYSIS**

This chapter consolidates the cost information presented in the previous chapters and presents a life cycle cost analysis.

## 6.1 BASIS OF COST

The factors and assumptions used to develop capital costs are listed below.

- Number of parcels served: 433.
- Costs for all elements of the vacuum system and pump station costs were based on the Bunker Trail Collection System Bid Tabs. Costs were adjusted for contractor overhead and profit and inflated to 2007 dollars based on the ENR CCI for Seattle between 1999 and 2007.
- 6-inch Force Main - Conventional cut and cover construction, trench depth 5 feet, vertical sidewalls
- 6-inch Force Main - Good soil conditions, Imported material for pipe bedding and initial backfill, native material for subsequent backfill, Waste native material is hauled for disposal
- No groundwater, rock, hazardous materials or archaeological finds
- Land Value - \$24,000/acre, which is the average taxable land value for all potential treatment/drainfield sites in Figure 4.13.
- Administration, Engineering Design, and Permitting Fees: Not included.
- Contingency range of 0 percent to 100 percent reflecting the level of detail known about the study area.
- 5 percent Mobilization/Demobilization.
- 10 percent General Conditions.
- 10 percent Contractor Overhead, Profit, and Risk.

The factors and assumptions used to develop operations and maintenance costs are listed below.

- Power (2012): \$0.067 kilowatt hour (kW-hr)<sup>56</sup>.
- Labor rate (2012): \$51.94/hr<sup>57</sup>.
- FTE: 2080 hours/yr.

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<sup>56</sup> 2007 King County WTD Life-Cycle Cost Spreadsheet.

<sup>57</sup> Ibid.

- Electrical operating cost for vacuum stations are based on Carnation's 2004 Facilities Plan<sup>58</sup>.
- Centralized treatment option includes Vashon WWTP treatment costs at projected 2012 rates of \$52.05 per month capacity charge (for 15 years) and a \$38.88 per month sewer rate for each ERU in the study area<sup>59</sup>. This equals a \$472,000 per year treatment cost for the study area for the first 15 years.
- MBR and SBR treatment facilities solids disposal cost based on an assumed 6,000 gallon hauling truck, carrying a 5,000 load, at \$420 / haul and an incurred treatment cost at the South Plant of \$0.09 / gal<sup>60</sup>.
- Grit disposal: \$80/ton.
- Membrane replacement: \$3.02/sf.
- Citric acid: \$0.05/lb.

## 6.2 COST SUMMARY

Capital cost and O&M annual cost for each option is summarized in Table 6.1.

## 6.3 LIFE CYCLE ANALYSIS

Life cycle costs were calculated using the King County Wastewater Treatment Division Life Cycle Cost Template.

The following factors were used:

- Facilities construction: 2011
- First year of O&M Costs: 2012
- 20-year Life Cycle
- General Inflation: 3%
- Wastewater Treatment Division Borrowing Rate: 5.25%
- Wastewater Treatment Division Discount Rate (real): 2.2%
- Office of Management and Budget (OMB) Discount Rate (real): 7%
- Debt Issuance Cost: 2%

Life cycle costs shown in Table 6.1 are based on the average of the high and low capital costs and the Wastewater Treatment Division Discount rate. The difference between the

<sup>58</sup> City of Carnation, August 2004, *2004 Sewer Facilities Plan*. Prepared by Roth Hill Engineering Partners, LLC.

<sup>59</sup> Personal communication, Tom Lienesch, King County, July 2008.

<sup>60</sup> Personal communication, Mark Lucas and Carol Nelson, King County, June 2008.

present value of cost of the centralized treatment option, the SBR/percolation pond option, and the MBR/percolation pond option is insignificant for this planning level study. The option with the highest present value of cost is the recirculating filter/SDS. This option is more than 50% greater than the present value of the centralized treatment option. While the septic tank/community drainfield option is only 12% greater than the centralized treatment option, acquisition of 45 acres of drainfield land may be difficult. Based on economics, the options that should be considered for further evaluation are centralized treatment or decentralized treatment with a SBR or MBR system to produce reclaimed water quality effluent and discharge to a percolation pond.

<b>Table 6.1 Wastewater Management Options Cost Summary/Life Cycle Cost Analysis            Quartermaster Harbor Communities Wastewater Management Options            King County Department of Natural Resources and Parks</b>					
	Centralized Treatment	Septic Tank/ Conventional Drainfield	Recirculating Gravel Filter/Subsurface Drip System	SBR/Percolation Pond	MBR/Percolation Pond
Land Required (Acre)	n/a	56	28	7	7
Number of Systems Required	1	14	11	1	1
ERUs Served	433	433	433	433	433
System Capital Cost -Low Est	\$10,384,000	\$16,411,000	\$23,954,000	\$13,950,000	\$13,921,000
System Capital Cost -High Est	\$20,765,000	\$32,823,000	\$47,909,000	\$27,901,000	\$27,842,000
Cost per ERU <sup>(1,2)</sup>	\$48,000	\$75,800	\$110,600	\$64,000	\$64,000
Annual O&M Cost	\$720,000	\$317,000	\$300,000	\$319,000	\$341,000
Annual Cost per ERU <sup>(3)</sup>	\$1,663 <sup>(4)</sup>	\$732	\$693	\$736	\$788
Present Value of Costs <sup>(5)</sup>	\$25,139,000	\$27,602,000	\$37,707,000	\$24,185,000	\$24,464,000
Net Equivalent Annual Cost	\$1,565,000	\$1,718,000	\$2,347,000	\$1,506,000	\$1,523,000
<b>Notes:</b> (1) Based on High Estimate. (2) Simple calculation for comparison purposes and does not include considerations for financing or outside funding sources. (3) Annual O&M Cost divided by 433 ERUs. VSD management fees not included. (4) Includes conveyance/collection operating cost and King County treatment cost - capacity charge (15 years) and sewer rate for 433 ERUs. (5) Assumes average capital cost between high estimate and low estimate, annual cost per ERU as shown, 20-year period, KC WTD discount rate 2.2% = KC borrowing rate 5.25% - general inflation 3%.					