Appendix J: Conceptual Cost Calculator (3C) Model and User Guide

SEATTLE PUBLIC UTILITIES
LONG-TERM CONTROL PLAN

USER'S GUIDE FOR THE

LONG-TERM CONTROL PLAN-CONCEPTUAL COST CALCULATOR (LTCP-3C) V 3.0

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INTRODUCTION

A cost estimating tool was originally developed by CH2M HILL in September 2011 to support both the SPU CSO reduction alternative study and the project's environmental impact assessment. The initial tool contained cost tools for open cut conveyance, trenchless technology, pipe & tank storage and pump stations. Storage ponds, water quality vaults, and green storm water sheets were later added to the tool in September 2012. Finally the tool was updated to April 2013 dollars and pricing was modified based on actual bid costs and data from the Windermere and Genesee CSO tanks projects.

This document provides a simple guide and description of the tool functions to the user.

The tool is created in Microsoft Excel. The workbook consists of a number of excel sheets serving one of the three functions: model input, cost estimate or schedule estimate. Formula cross referencing between sheets is avoided in order to lower the risk of bad links. Table 1 lists all sheets in their functional categories. More detailed descriptions of each sheet can be found in later sections of this document.

- Sheets in the model input category are used to clarify and record the assumptions used for the cost estimates. In cases in which not all of the sheets in this group are applicable to every project, the unused sheets can be ignored or deleted from the workbook for clarity.
- The cost estimate sheets are set up to measure all major costs in construction. Special Items not accounted for elsewhere in this category can be added in as user defined items. Storage estimates and pump station estimates require one sheet for each tank or pump station. If multiple storage tanks or pump stations are used in the project, the cost estimate sheet should be copied, and included in the total cost calculation. If no storage tank or pump station is included in project, the unused sheets can be deleted from the workbook for clarity.
- The schedule estimate sheets use information, such as the construction quantities or costs, in the cost estimate category as basis for calculation. Use only those sheets applicable to the project.

Table 1 Model Configuration and Categories

Functional	Sheets	Note
Model input	Open Cut Pipe input	Apply for open cut construction only
	Trench	Apply for open cut construction only
	Tunnel	When storage tunnel is required
	Micro-tunneling	When micro-tunneling construction is used
	Bore & Jack	When bore and jack construction is used
	Pond Input	Apply for storage ponds construction
	Water Quality Vaults	Used for when water quality vaults are constructed
	Storage Input	Used for storage tank and pipe construction
	PS Input	Used for pump station construction
Cost estimate	Open Cut Pipe	Apply for open cut construction only

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	Trenchless Estimate	Used for tunneling, micro-tunneling, and bore and jack constriction.
	Pond Estimate	Used for storage pond construction
	Water Quality Vaults	Used for when water quality vaults are constructed
	Storage Estimate	Make a copy of this sheet if multiple storage tanks are used
	Pump Station (PS)	Make a copy of this sheet if multiple PSs used
	Total Costs	Summary of the costs from individual cost sheets and application of the project costs
Schedule Estimate	Pipe Schedule	Apply for open cut construction only
	Storage Schedule	
	Trenchless Schedule	Apply for tunnel, micro-tunnel and bore & jack
	Pond Schedule	
	Water Quality Vaults	
	PS Schedule	

LTCP 3C v3.0 UPDATE SUMMARY

Summary of April 2013 Updates

Below is a summary of the updates made from the previous version to the current LTCP-3C v3.0 cost tool.

- The previous LTCP v1.0 and v2.1 had unit prices benchmarked to September 2011 dollars (ENR Seattle CCI 9056), this version updates these unit costs to April 2013 dollars. A variety of sources were used when updating the unit costs. Some of these sources were but are not limited to the following:
  - ENR's Seattle Construction Cost Index (CCI) to bring costs from previous year up to April 2013 (ENR Seattle CCI 9431)
  - Hoffman's 90% MACC estimate for the Genesee Storage Tanks
  - The Engineer's Estimate for the 90% MACC estimate for the Genesee Storage Tanks
  - CDM's Final MACC estimate for the Windermere Storage Tank
  - The Engineer's Estimate for the 90% MACC estimate for the Windermere Storage Tank
  - RS Means 2013 Building Construction Cost Data
  - CH2M HILL's 2012 Timberline unit pricing database
  - Cost developed for the December 2011 Tunnel Workshop that were then validated by independent tunneling experts
  - SPU's 2010 Unit Cost Report escalated to 2013 using the Seattle ENR CCI Index

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    - Update in Prevailing Wages for King County to April 2013
    - Other SPU Bid Tab information from previous projects
- When actual SPU bid tab information was available this information was given priority over other cost sources.
- For the Storage Tanks the plumbing, HVAC, electrical, and I&C costs are all priced as a percent of the Total Costs. These percentages were determined by looking at the actual percent of totals used on the Windermere and Genesee Tank projects.
- The Tank Cleaning Equipment costs were determined by looking at the costs used on the two Genesee tanks, 0.12 MG & 0.48 MG, and the Windermere tank, 2.05 MG. This information was then used to create a cost formula with a linear relationship to the tank size. This value is $ = $282,000 * MG + $69,000. Since this cost is based on a small data sample in the future as SPU completes more CSO projects this cost should be re-examined.
- The Tank Odor Control costs were determined by looking at the costs used on the two Genesee tanks and the Windermere tank. This information was then used to create a cost formula with a linear relationship to the tank size. This value is $ = $59,500 * MG + $45,000. Since this cost is based on a small data sample in the future as SPU completes more CSO projects this cost should be re-examined.
- The previous Tank excavation Dewatering costs were based off the Tabula Dewatering curve. The costs used in this curve were re-examined based on the actual dewatering costs incurred on both Genesee and Windermere. This Dewatering curve was these adjusted to better fit these actual costs. The final value used for major dewatering was $ = $1,425*(MG^2) + $102,500*MG + $350,000. The final value used for minor dewatering was $ = $1,110*(MG^2) + $52,800*MG + $190,000.
- Other cost items that were adjusted based on the Windermere and Genesee MACC costs are, but are not solely limited to, the following items:
    - Shoring: Soldier Pile shoring and sheet pile shoring. A new line item for Secant pile shoring was added to the Tank estimate pricing.
    - Tank excavation and earthwork.
    - Tank concrete pricing for slabs, walls, and elevated structures.
    - Manhole and catch basins.
    - HMA pavement costs.
    - Concrete pavement costs.
- Based on Windermere and Genesee the earthwork and shoring calculation was changed to allow for the structure to be built up against the shoring.
- As requested by SPU for the integrated plan storage pond, water quality vaults and the green stormwater construction cost functions were added since the version 1.0.

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- The storage pond cost information was based on the SPU Norfolk Bid Tabs and other projects.
- The water quality vault cost is based on a quote from Contech that SPU obtained back in April 2012 for the South Park Project.
- The green stormwater cost per sf comes from the SPU GSI report for the LTCP written in May 2011.

MODEL INPUT

Open Cut Pipe Inputs

This sheet applies to open cut trench pipe projects only and is not applicable to micro-tunneling, tunnel or bore & jack projects. Some special notes to the users are listed below.

- Different types of pipes (gravity or force main) and pipes with different diameters should be put in separate columns. Users need to make copies of the sample column and fill in the values as described in the following bullets.
- Basic information including pipe diameter, length, cover depth, trench width for each segment of pipe should be based on the alternative design.
- The cover depth in the “Trench details” section refers to the average cover depth of the pipe segment. Bottom of Trench Width (In inches) is calculated as 1.5 times the pipe diameter plus 18 inches. Top of Trench Width (In inches) can be found in the “Trench” sheet. Trench Width in the “Pavement” section is calculated as top of trench width plus 8 feet.
- “Trench Quantities” and “Trench Safety” sections should be filled in using the calculation results from the “Trench” sheet.
- Diversion structures are normally structures with weirs and flap gates to divert flow into storages or CSO outfalls. User needs to specify the flow diversion structures in each segment of pipe.
- Selection of the dewatering method will depend on the location as well as the geotechnical report of the construction site.
- The inputs for other required fields such as surface restoration, traffic control, pavements, etc. should be consistent with the inputs in the “Open Cut Pipe Estimates” sheet.

Trench Inputs

This sheet applies to open cut trench projects only and is not applicable to trenchless projects. Calculation for in this sheet includes greater detail than the contents in typical SPU contracts. Normally SPU estimates trench costs based on linear footage of pipe without specifying pipe diameter, trench slope, or backfill material. In order to support the environmental impact

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assessment for the LTCP, the cost estimate for trenching in this sheet has been broken down into more detailed items such as excavation, backfill and shoring.

- The required inputs are:
    - Depth of cover to top of the pipe, which should be the average cover for the pipe segment
    - Pipe diameter in inches
    - Base depth, which should be at least 6 inches
    - Zone depth, which should be at least one pipe diameter plus 12 inches.
    - Trench with, which should be at least 1.5 times of pipe diameter plus 18 inches.
    - Width extension of the surface restoration needed over the top width of the trench.
    - The trench slope vertical run is set 1 so the user needs to input the corresponding horizontal run. If special shoring or sheet pile shoring are used set the horizontal run to 0. If standard shoring (trench box) is used set the horizontal slope to 0.25.
- A trench cross section is vertically divided into 3 sections: bed, zone and above zone area. Each section may require a different type of backfill. The quantities of excavation and backfill for each section are automatically calculated based on the user pipe input which should match the information in open cut input sheets.
- The shoring requirement is calculated as the product of the pipe length and trench depth.
- User needs to make a copy of the sample trench calculation section and develop similar calculations for all the pipe diameters in the project.

Trenchless Inputs (Tunnel, Micro-tunneling, Bore & Jack)

There are three types of widely used trenchless technologies that can be applied in pipe line construction for the CSO reduction alternatives. Tunneling is only required when a storage tunnel is designed for the project. Tunnel diameters vary from 8' to 24'. Micro-tunneling and bore & jack are suitable for constructing pipe lines from 12" to 120" in diameter.

Compared with open trench construction, trenchless technology requires less surface demolition and restoration. In addition, the construction costs caused by utility conflicts are usually much lower.

Special notes for the input sheets include:

- Each type of trenchless technology requires a separate input sheet (set up as default in the tool).
- Tunnels/pipes with different diameters should have separate input columns.
- The required inputs for earthwork calculation are tunnel/pipe diameter, tunnel/pipe length, launch shaft depth and retrieving shaft depth.

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- Sizes of the launch and retrieving shaft are calculated based on the size of the tunnel/pipe. Refer to the “comments” column for calculation formulas. Whether to include manhole in the shafts and the manhole sizes is dependent on the alternative design. Use imported backfill if not specified otherwise.
- Earthwork calculations are shown at the bottom of the sheet.
- Use the entire parcel area as the footprint for launch and retrieving shafts. Use GIS data to calculate the parcel area.
- Use GIS data as basics to fill the “additional costs” and “building demo” sections if no other data resource available. The sidewalks can be assumed as 6 feet wide.

Storage Pond Inputs

This input sheet is use to calculate the earthwork requirements for storage ponds. Special notifications to the user include:

- Cells requiring user input or information are in yellow. Calculated outputs are in the white cells.
- The storage pond calculation currently only works for rectangular pond shapes.
- The user will need to know the ponds bottom length and width (in feet), the vertical run for the side slope if the horizontal is set to 1, and the vertical storage and freeboard.
- The Input sheet will calculate the pond excavation volume and the basin storage.
- If a separation berm is included the user will need to know the berms top width and the side slope.

Water Quality Vault Facility Inputs

This input sheet is use to assist the user in calculating the number and size of the vaults needed and the earthwork requirements for the vaults. Special notifications to the user include:

- Cells requiring user input or information are in yellow. Calculated outputs are in the white cells.
- The user should know the total gallons per minute (gpm) of water to be treated. They can then enter in how many vaults of each size they wish to use. The input sheet will then calculate the volume of water treated by the users input and compare that to the total desired amount or water to be treated.
- Once the number and size of vaults is determined the input sheet will then calculate the total earthwork required to install the water quantity vaults.

Storage Inputs

This input sheet is for storage tanks and pipes only, and not applicable to storage tunnel. Special notifications to the user include:

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- Storage tanks spanning more than 20 feet normally require internal support walls and are divided into cells to facilitate operation and maintenance. The length of the internal support wall length should be provided by the alternative design.
- The storage tanks can be either circular or rectangular. User needs to select the type and fill in the dimensions accordingly.
- Storage pipe diameters range from 6′ to 12′ ID and are reinforced concrete pipe.
- "Shore and pile" requirements and "dewatering" requirements should be based on the location of the tank and the geotechnical report.
- Odor control system is required unless otherwise specified.
- Earthwork and concrete work calculations are shown at the bottom of the sheet.
- Use the entire parcel area for tank footprint. Use GIS data to calculate the parcel area.
- Use GIS data as basics to fill the "additional costs" and "building demo" sections if no other data resource available. The sidewalks can be assumed as 6 feet wide.
- The inputs for other required fields such as surface restoration, traffic control, pavements, etc. should be consistent with the inputs in the "Storage Estimates" sheet.
- The mechanical, HVAC, electrical, and instrumentation and control for the tanks and storage pipes are calculated as a percent of the other costs. These percentages were determined from the costs on the SPU Windermere and Genesee Tank projects. For tanks the mechanical allowance is 6%, the HVAC allowance is 1%, the electrical allowance is 10%, and the I&C is 6%. These allowances are lower for for storage pipes the mechanical allowance is 2%, the HVAC allowance is 0%, the electrical allowance is 5%, and the I&C is 3%.

Pump Station Inputs

This input sheet is required when pump stations are included in the alternative design. Special notifications to the user include:

- Use wet well when pumping capacity is greater than 2MGD; use caisson when pumping capacity is equal to or less than 2MGD. Caisson size can be selected from the manufacturer's packages according to pumping capacity.
- Wet well wall and slab thickness are based on the alternative design. If no design data are available, conservative values should be used.
- For comparison purpose, both open cut and shored excavation are calculated. Selection should be made for cost estimate based on the location of the tank and the geotechnical report.
- Pumping capacity and total dynamic head (TDH) are decided based on engineer's calculation.
- Backup generators are required for all pump stations.

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- Use the entire parcel area for PS footprint. Use GIS data to calculate the parcel area.
- Use GIS data as basics to fill the "additional costs" and "building demo" sections if no other data resource available. The sidewalks can be assumed as 6 feet wide.
- The inputs for other required fields such as surface restoration, traffic control, pavements etc. should be consistent with the inputs in the "PS Estimates" sheet.
- For pump stations placed inside of tunnel shafts delete the associated earthwork and shoring as this will be covered in the tunnel shaft construction.
- The pump station sheet also contains a formula for odor control if placed in a tunnel shaft.

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COST ESTIMATE

Open Cut Pipe Estimate

SECTION 1-09 MEASUREMENT AND PAYMENT

The mobilization cost is assumed to be 8% of the total construction cost.

SECTION 1-10 TEMPORARY TRAFFIC CONTROL

The maintenance and traffic control cost is assumed to be 3% of the total construction cost for project with light traffic control needs such as pipes constructed in parks or outside of the street right of way. For projects with moderate traffic control needs such as those within the street right of way but located on smaller arterial streets use 5%. For projects on busy streets which require heavy traffic control use 8% for this cost item.

SECTION 2-01 CLEARING, GRUBBING AND ROADSIDE CLEANUP

Refer to SPU spec section 2-01 for the definition of Clearing, Grubbing and Roadside cleanup. The Clearing & Grubbing area requirements should be minor in the CSO projects. Roadside cleanup may be required after surface restoration.

SECTION 2-02 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

The quantity of sidewalks, pavements, manholes, catch basins and buildings to be removed can be decided based on GIS data and site visits. The city's GIS data provides information about sidewalk locations, and whether sidewalks are on both sides of the road. The sidewalk width is normally 6 feet.

SECTION 2-04 STRUCTURE EXCAVATION

Applicable only when removal or installation of an underground flow diversion structure or vault is required, not applicable to trench excavation. Trench excavation for pipes is located in pipe cost section. Special shoring may be requirements according to site location and geotechnical report.

SECTION 2-15 CONSTRUCTION GEOTEXTILE

Applicable only when large quantities of geotextile are required for construction.

SECTION 4-01 MINERAL AGGREGATES

Assume the mineral aggregates used to form asphalt concrete or cement concrete pavements penetrate through the entire depth of the pavement. Thus the quantity of aggregate should be equal to the total pavement area times the depth of the pavement.

SECTION 5-04 ASPHALT CONCRETE PAVEMENT

The square footage of the pavement is calculated from the surface restoration in the "open cut pipe input" sheet and the percentage of the surface restoration area requiring ACP pavements. A site visits may be required to decide the locations of ACP required. Assume 4" thickness for parking lots or site surfacing and 6" thickness for roadway. A 2" thick pavement overlay over the entire roadway may be required on certain roadways by SDOT.

SECTION 5-05 CEMENT CONCRETE PAVEMENT

The square footage of the pavement is calculated from the surface restoration in the "open cut pipe input" sheet and the percentage of the surface restoration area requiring cement pavements. A site visit(s) may be required to decide the locations of ACP required. Assume 8" thickness for concrete pavement.

SECTION 7-17 STORM DRAINS AND SANITARY SEWERS

- The total amount of earth work for trench excavation is a summary of all the trench excavation defined in the "open cut pipe inputs" and "trench" sheet.
- It is assumed that all the excavation will be hauled and wasted.
- Quantity of pipe bedding is a summary of all pipe bedding requirements defined in the "pipe inputs" and "trench" tab.
- It is assumed that all of the backfill above bed and zone will be imported material. No native material is to be used.
- "Pump in the trench" dewatering methods will apply to minimal dewatering situations.
- Well/well point dewatering will apply to significant dewatering requirements.
- Controlled density fill (CDF) is low strength concrete that is sometimes used as backfill or bed and zone. Instead of being 4000 psi it is around 250 to 300 psi. Refer to the alternative design for areas requiring controlled density fill.
- Extra excavation may occur in an area where the soil material is extremely poor. The quantity can be estimated according to the geotechnical report during the design phase. Field inspectors will direct where it is necessary during construction.
- Select the utility conflicts to be either average or significant based on utility maps.
- The linear footage of each type of pipe need to be filled in this section. Make sure the inputs are consistent with the inputs in the "pipe inputs" sheet.
- Safety system for trench excavation including trench box, sheets and jacks or sheet piles would be a summary of each type of safety system as defined in the "pipe inputs" and "trench" sheet.

SECTION 8-01 EROSION CONTROL

If no specific information is available use 1% of the total construction cost.

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Trenchless Estimate

Refer to the description in the "open cut pipe estimate" sheet for the following sections.

SECTION 1-09 MEASUREMENT AND PAYMENT

SECTION 2-01 CLEARING, GRUBBING AND ROADSIDE CLEANUP
SECTION 2-02 REMOVAL OF STRUCTURES AND OBSTRUCTIONS
SECTION 2-04 STRUCTURE EXCAVATION
SECTION 2-15 CONSTRUCTION GEOTEXTILE
SECTION 4-01 MINERAL AGGREGATES
SECTION 5-04 ASPHALT CONCRETE PAVEMENT
SECTION 5-05 CEMENT CONCRETE PAVEMENT
SECTION 7-05 MANHOLES, CATCH BASINS AND INLETS
SECTION 7-16 DIVERSION STRUCTURES
SECTION 8-01 EROSION CONTROL

SECTION 1-10 TEMPORARY TRAFFIC CONTROL

The maintenance and traffic control cost is assumed to be 3% of the total construction cost with the construction/shafts take place outside of the street right of way. If the shafts are constructed inside of the street right of way then use 5% of the total costs.

SECTION 6-02 CONCRETE STRUCTURES (TUNNEL SHAFTS, ETC)

In some cases a permanent drop structure for the tunnel may be constructed in the launching or retrieval shaft. If a permanent drop structure is required this section estimates the cost of concrete required to build the launch and receiving shafts drop structure. Quantities of concrete including forms and rebar are calculated separately for footings, columns and slabs & beams. It may be necessary to seek help from a structural engineer when completing this section.

SECTION 7-17 STORM DRAINS AND SANITARY SEWERS

- The amount of excavation and backfill for all shafts are calculated in the input sheets for tunnel, micro-tunneling and bore & jack respectively.
- It is assumed that all the excavation will be hauled and wasted.
- Under normal circumstances, the shaft dewatering should be minimal. Use "significant" if the shaft is close to a water body or suggested by the geotechnical report.
- Soldier pile shoring is selected as default for shaft construction. If the shaft depth exceeds 70 ft then use the higher price for soldier shoring to reflect the great complexity and cost associated with deep shoring projects.

Storm Pond Estimate

Refer to the description in the "open cut pipe estimate" sheet for the following sections.

SECTION 1-09 MEASUREMENT AND PAYMENT

SECTION 1-09 TEMPORARY TRAFFIC CONTROL
SECTION 2-01 CLEARING, GRUBBING AND ROADSIDE CLEANUP

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SECTION 2-02 REMOVAL OF STRUCTURES AND OBSTRUCTIONS
SECTION 2-04 STRUCTURE EXCAVATION
SECTION 2-15 CONSTRUCTION GEOTEXTILE
SECTION 4-01 MINERAL AGGREGATES
SECTION 5-04 ASPHALT CONCRETE PAVEMENT
SECTION 5-05 CEMENT CONCRETE PAVEMENT
SECTION 7-16 DIVERSION & OVERFLOW STRUCTURES

SECTION 8-01 EROSION CONTROL

For temporary erosion and sediment control use 3% of the total construction cost based on the Norfolk Storm Pond bid tabs.

Water Quality Estimate

Refer to the description in the "open cut pipe estimate" sheet for the following sections.

SECTION 1-09 MEASUREMENT AND PAYMENT

SECTION 1-09 TEMPORARY TRAFFIC CONTROL
SECTION 2-01 CLEARING, GRUBBING AND ROADSIDE CLEANUP
SECTION 2-02 REMOVAL OF STRUCTURES AND OBSTRUCTIONS
SECTION 2-04 STRUCTURE EXCAVATION
SECTION 2-15 CONSTRUCTION GEOTEXTILE
SECTION 4-01 MINERAL AGGREGATES
SECTION 5-04 ASPHALT CONCRETE PAVEMENT
SECTION 5-05 CEMENT CONCRETE PAVEMENT

SPECIAL SECTION WATER QUALITY STRUCTURES

Based on the Water Quality input sheet the user will select the number and types of water quality structures need for the project. The pricing for these structures is based on a quote from Contech that SPU obtained back in April 2012 for the South Park Project.

Storage Estimate

DIVISION 2 - EXISTING CONDITIONS

The existing conditions should be determined from the city's GIS data, as built drawings and site investigation.

DIVISION 3 – CONCRETE

The amount of concrete required in slabs, walls and suspended slabs and beams is calculated in the "storage inputs" sheet. Concrete unit costs are based on actual costs from the Windermere and Genesee projects.

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DIVISION 22 - PLUMBING

Use 6% of the total construction cost of the storage tank as default if not otherwise specified. This percentage is based off of the Windermere and Genesee Storage Tank project. For Pipe Storage use 2% of construction cost.

DIVISION 23 - HEATING, VENTILATING, AIR-CONDITIONING (HVAC)

Use 1% of the total construction cost of the storage tank as default if not otherwise specified. This percentage is based off of the Windermere and Genesee Storage Tank project. For Pipe Storage use 0% of construction cost.

DIVISION 26 - ELECTRICAL

Use 10% of the total construction cost of the storage tank for electrical allowance, general electrical conditions. This percentage is based off of the Windermere and Genesee Storage Tank project and does not include an emergency generator. The generator cost is based on the generator size. For Pipe Storage use 5% of construction cost.

DIVISION 31 – EARTHWORK

- The amount of excavation, fill (with native or imported material), waste of excess native material, and bedding are calculated in the “storage inputs” sheet, under the assumption that no imported backfill will be used.
- If imported backfill is used, the native backfill should be the total amount of backfill less the imported amount.
- Whether or not imported backfill is used, the waste of excess native materials equals the amount of excavation less fill.
- Dewatering Water Treatment System is priced as lump sum based on the tank storage volume. Different formulas are provided for minor dewatering and significant dewatering based on Tabula Dewatering Cost Curve which has been modified to more accurately reflect actual costs incurred on the Windermere and Genesee project.
- Drilled steel solder pipes and lagging, walers, and tiebacks as shoring when bad soil conditions or high groundwater is encountered. Use sheet piles in other conditions. Secant pile shoring has been added to the estimate and should only be used when indicated by a geotechnical engineer based on high water tables and poor soil conditions. The square footage of shoring is calculated in the “storage inputs” sheet.

DIVISION 32 - EXTERIOR IMPROVEMENTS

This section calculates the cost of surface restoration for buried tanks. Mineral Aggregate used in ACP or CCP is assumed to be distributed in the full depth of the pavement.

DIVISION 40 - PROCESS INTEGRATION

The cost of Storage Facility I&C is estimated to be 6% of the total construction cost. This percentage is based off of the Windermere and Genesee Storage Tank project. For Pipe Storage use 3% of construction cost.

DIVISION 44 - POLLUTION CONTROL EQUIPMENT

The unit price for odor control systems is given. The total cost of odor control equipments is proportional to the tank storage volume and is based on the actual costs from the Windermere and Genesee projects.

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DIVISION 46 - WATER AND WASTEWATER EQUIPMENT

The unit price for a tank cleaning system is given. The cost of tank cleaning equipment is proportional to the tank storage volume and is based on the actual costs from the Windermere and Genesee projects.

Pump Station (PS) Estimate

DIVISION 2 - EXISTING CONDITIONS

The existing conditions should be decided from the City's GIS data, as built drawings and site investigations.

DIVISION 3 – CONCRETE

The amount of concrete required in slabs, walls and suspended slabs and beams is calculated in the "PS inputs" sheet.

DIVISION 11 - EQUIPMENT

- If the total pumping capacity is less than 2MGD, the mechanical and equipment cost estimate is based on quotes from Pump Tech NW for duplex Submersible Pump System Packages.
- If the total pumping capacity is greater than 2MGD, the mechanical and equipment cost estimate is based on Tabula Mechanical and Equipment Cost Curve. The base estimated cost will then be adjusted by the total dynamic head for the pump station. For pump stations with a low TDH the base cost will be reduced and for those with a high TDH of greater than 300 feet the base pump costs cost will be increased.

DIVISION 22 - PLUMBING

The plumbing costs are included under the equipment and mechanical cost curve or pump station packages.

DIVISION 23 - HEATING, VENTILATING, AIR-CONDITIONING (HVAC)

These costs are included under the equipment and mechanical cost curve or pump station packages.

DIVISION 26 – ELECTRICAL

- Pump station electrical and I&C costs are calculated as a lump sum. The cost is proportional to the total pump station horsepower.
- Backup generators are sized based on engineer's calculation to match pump station horsepower.

DIVISION 31 - EARTHWORK

- The amount of excavation, fill (with native or imported material), waste of excess native material, and bedding are calculated in the "PS inputs" sheet, under the assumption that no imported backfill will be used.
- If imported backfill is used, the native backfill should be the total amount of backfill less the imported amount.
- Even if imported backfill is used, the waste of excess native materials equals the amount of excavation less fill.

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- Dewatering Water Treatment System is priced as lump sum based on the excavation volume. Different formulas are used for minor dewatering and significant dewatering. See comments on this item for details.
- Use Drilled steel solder pipes and lagging, walers, and tiebacks as shoring approach when bad soil condition or high groundwater is encountered. Use otherwise sheet piles. The square footage of shoring is calculated in the "PS inputs" sheet.

DIVISION 32 - EXTERIOR IMPROVEMENTS

This section calculates the cost of surface restoration for buried tanks. Mineral Aggregate used in ACP or CCP is assumed to be distributed over the full depth of the pavement.

GSI Estimate

DIVISION 32 – EXTERIOR IMPROVEMENTS

Green Stormwater mitigation costs are based on the May 2011 GSI report prepared by SPU for the LTCP program.

Total Costs

The total cost estimate for the project is the summary of costs estimated for open cut pipe, trenchless technology, storage ponds, water quality vaults, storage tanks, pump stations and GSI cost with Sales tax, Allied costs and Construction contingency applied. If multiple estimate sheets are used for storage tanks or pump stations make sure to update the formula to include the summary costs for these sheets.

Below is Table 2 which lists the cost elements currently in the Total Cost Estimate.

Table 2 Elements in Total Cost Calculation

	Cost Element Description	Costs
A	Facility Cost Estimate	$ -
B	**Subtotal**	**$ -**
C	Retrofit Costs	$ -
D	Permit Fees (Use 1% based on Windermere)	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ -
F	Construction Line Item Pricing (See above for ENR Index Date)	$ -
G	Adjustment for Market Conditions	$ -
H	**Construction Bid Amount**	**$ -**
I	Sales Tax	$ -
J	**Construction Contract Amount**	**$ -**
K	Crew Construction Cost	$ -
L	Miscellaneous Hard Costs	$ -
M	**Hard Cost Total**	**$ -**
N	Soft Cost %	

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O	Soft Cost Amount	$ -
P	Property Cost (Per SPU Real Estate)	$ -
Q	**Base Cost**	**$ -**
R	Construction Contingency 20% (Base Cost)	
S	Construction Contingency Amount	$ -
T	Management Reserve 15% (Base Cost)	
U	Management Reserve Amount	$ -
V	Allowance for Indeterminates 25% (Construction Bid Amount)	
W	Allowance for Indeterminates Amount	$ -
X	GC/CM Allowance 10% (Construction Contract Amount)	
Y	GC/CM Allowance Amount	$ -
Z	**Total Costs, 2013 Dollars**	**$ -**

The following Table 3 lists the cost elements currently in the Total Cost Estimate and presents the formulas used to calculate the individual cost elements (if applicable)

Table 3 Elements for Total Cost Calculation

Item #	Cost Element	Formula	Basis
A	Facility Cost Estimate	TBD	Developed based on estimate sheets for open cut pipe, trenchless methods, ponds, water quality vaults, storage tank and pump stations.
B	Subtotal	A	Subtotal of various Facility Cost Estimates.
C	Retrofit Costs	TBD	To be provided by SPU if needed.
D	Permit Fees	1% x B	Includes all permit fees including Street Use Permit Fee. Based on actual costs from Windermere Project.
E	Construction Line Item Pricing in Sept 2011 dollars	B+C+D	
F	Construction Line Item Pricing in Current dollars	E x ENR Index Adjustment	Use the ENR CCI Index to adjust cost from April 2013 dollars to current dollars.
G	Adjustment for Market Conditions	% x F	This adjustment is currently set to 0% but can be adjusted as needed. SPU Finance office will provide this adjustment.
H	Construction Bid Amount	F + G	
I	Sales Tax	9.5% x H	9.5% of Construction Cost (Item D). State of Washington Sales Tax for Seattle WA in April 2013.
J	Construction Contract Amount	H + I	

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K	Crew Construction Cost	TBD	Additional SPU Crew Construction Costs for Project
L	Miscellaneous Hard Costs	TBD	Other miscellaneous hard costs determined to be in the estimate
M	Hard Cost Total	J + K + L	
N	Soft Cost %	49%	Soft cost % is based on SPU guidelines for large drainage or wastewater projects (TCP > $5M)
O	Soft Cost Amount	M x N	
P	Property Costs	TBD	Property cost to be determined by SPU Real Estate.
Q	Base Cost	M + O + P	
R	Construction Contingency %	20%	Based on SPU guidelines for SPU Options analysis which ranges from 15% to 25%.
S	Construction Contingency Amount	Q x R	Calculated off of Base Cost.
T	Management Reserve %	15%	Based on SPU guidelines for SPU Options analysis which ranges from 10% to 20%.
U	Management Reserve Amount	Q x T	Calculated off of Base Cost.
V	Allowance for Indeterminates %	25%	Based on SPU CSO Program Director instruction from 2/26/13 meeting.
W	Allowance for Indeterminates Amount	H x V	Calculated off of Construction Bid Amount.
X	GC/CM Allowance %	10%	Based off of GC/CM guidance memorandum published on 1/9/13. Only used on Tank projects with Construction Contract Amount (Item J) exceeding $10 million.
Y	GC/CM Allowance Amount	J x X	Calculated off of Construction Contract Amount.
Z	Total Cost	Q + S + U + W +Y	

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CONSTRUCTION SCHEDULE

Open Cut Pipe Schedule

The schedule estimate for open cut pipe construction can be grouped into 9 categories as listed in Table 4. Detailed calculation inputs for each category are itemized in the schedule inputs column. The production rates for the schedule items to determine the baseline duration was reviewed by SPU's construction management.

Baseline schedule values assume standard production with no difficulties. Medium schedule assumes the task takes 30% longer due to site restrictions such as access, traffic control, ground conditions or other issues. Hard schedule assume the task takes 50% longer due to site restrictions such as access, traffic control, ground conditions or other issues. SPU's construction management group will determine which category to use based on the project description provided by the engineer.

The appropriate schedule category durations (baseline, medium, hard) will then be copied into a pre-prepared Microsoft Project schedule to determine the project schedule to the open cut pipeline.

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Table 4 Open Cut Pipeline Schedule Estimate Items

Schedule Category	Schedule Inputs
Mobilization	Mobilization
Site demo/prep	Site Demolition $ value
	Demo Waste
Trench, Shore and Install Pipe	Trench Excavation
	Trench Waste (add 20% for swell)
	Import Backfill & Bedding
	Special Shoring (Slide Rails/Sheet & Jacking)
	Special Shoring (Sheet Piles)
	Pipe 6" to 12" dia
	Pipe 15" to 24" dia
	Pipe 30" to 42" dia
	Pipe 48" to 60" dia
Concrete Structures	Concrete Structures
Control Structures & Manholes	Manhole/Catch Basin 48" to 60"
	Manholes 72" to 84"
	Manholes 96" to 120"
	Manholes 144"
	Flow Control/Diversion Structure 48" to 60"
	Flow Control/Diversion Structure 72" to 84"
	Flow Control/Diversion Structure 96" to 120"
	Flow Control/Diversion Structure 144"
	Control Structure Fixed Gate
	Control Structure Automatic Gate
Commissioning	Commissioning
Pavement Restoration	Concrete Pavement

	HMA Pavement
Site restoration	Site Restoration $ value
Demobilization	De-mobilization and punch list

Note: refer to the "Open cut pipe estimate" sheet for the quantity of work required.

Man Hour Calculations

- To calculate the total number of man hours for each item a representative crew was determined for each item.
- Total man hours are calculated based on 8 hour work days for each member of the crew and added up for the entire project duration.
- To calculate the average number of personnel onsite each day during the project the total project man hours is divided by the baseline duration. This number is then increased by 100% to account for site foremen, superintendents, and miscellaneous other small site item not accounted for elsewhere.

Truck Trips

- .
- Assume one truck trip can transfer 16 cubic yards of demolition waste, trench waste or trench backfill material.
- Truck trip requirement for each linear foot of pipe line installation will depends on pipe diameter and trench configuration.
- Truck trips requirement for construction of each Manhole/Diversion Structure vary per size of the structure.
- The total number of truck trips calculated is then increased by 50% to account for small items, miscellaneous unaccounted for work, and equipment coming and going from site during the project.

Equipment Hours

- The total equipment hours are divided among 3 types of equipment: Pile driving/Shoring Equipment, Earthwork Equipment, and Lifting/Pumping Equipment.
- Equipment hour/ Crew hour ratio varies for projects.
- Site demolition, trench excavation, trench bedding and backfill, special shoring, pipe installation and manhole construction require earthwork equipment.
- Special shoring work only requires Pile driving/Shoring Equipment.
- Lifting/Pumping Equipment is required by special shoring (sheet piles) work.

Trenchless Schedule

This schedule estimate sheet applies to all types of trenchless construction, including tunneling, micro-tunneling, and boring & jacking. The schedule estimate can be grouped into 13 categories as listed in Table 5. Detailed calculation inputs for each category are itemized in the schedule inputs column. The production rates for the schedule items to determine the baseline duration was reviewed by SPU's construction management.

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Baseline schedule values assume standard production with no difficulties. Medium schedule assumes the task takes 30% longer due to site restrictions such as access, traffic control, ground conditions or other issues. Hard schedule assume the task takes 50% longer due to site restrictions such as access, traffic control, ground conditions or other issues. SPU’s construction management group will determine which category to use based on the project description provided by the engineer.

The appropriate schedule category durations (baseline, medium, hard) will then be copied into a pre-prepared Microsoft Project schedule to determine the project schedule to the open cut pipeline.

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Table 5 Trenchless Pipeline Schedule Estimate Items

Schedule Category	Schedule Inputs
TBM Procurement	TBM Procurement
Mobilization	Mobilization
Site demo/prep	Site Demolition $ value
Shaft Excavation	Shaft Excavation
	Spoils Waste (Add 20% for Swell)
	Amount of import backfill
	Shaft Shoring (Sheet Piles)
	Shaft Shoring (Soldier Piles)
Shaft Backfill	Shaft Backfill
Mob/Assemble Equip to Site	Mobilization for Microtunnel/B&J
	Mobilization/Assemble TBM
Disassemble/Remove Equip to Site	Disassemble/Remove Microtunneling Equip
	Disassemble/Remove TBM
Tunneling	Microtunnel/Bore & Jack 12" to 36"
	Microtunnel/Bore & Jack 42" to 60"
	Microtunnel/Bore & Jack 66" to 120"
	Tunneling 8' to 10'
	Tunneling 11' to 15'
	Tunneling 16' to 24'
Concrete Structures	Concrete Structures
Control Structures & Manholes	Manhole/Catch Basin 48" to 60"
	Manholes 72" to 84"
	Manholes 96" to 120"
	Manholes 144"
	Flow Control/Diversion Structure 48" to 60"
	Flow Control/Diversion Structure 72" to 84"
	Flow Control/Diversion Structure 96" to 120"
	Flow Control/Diversion Structure 144"
	Control Structure Fixed Gate

	Control Structure Automatic Gate
Commissioning	Commissioning
Site restoration	Site Restoration $ value
Demobilization	De-mobilization and punch list

Note: refer to the "Trenchless estimate" sheet for the quantity of work required.

Man Hour Calculations

- To calculate the total number of man hours for each item a representative crew was determined for each item.
- Total man hours are calculated based on 8 hour work days for each member of the crew and added up for the entire project duration.
- To calculate the average number of personnel onsite each day during the project the total project man hours is divided by the baseline duration. This number is then increased by 100% to account for site foremen, superintendents, and miscellaneous other small site item not accounted for elsewhere.

Truck Trips

- Project mobilization requires 10 truck trips.
- Assume one truck trip can transfer 16 cubic yard of demolition waste, trench waste or trench backfill material.
- Truck trips required for to bring in precast panels for tunneling are calculated as 4 trips per truck per day for tunnels up to 10 feet diameter, 5 truck trips per day for tunnels up to 15 feet diameter, and 6 truck trips per day for tunnels up to 20 feet in diameter. The increase in the number and size of panels needed per linear foot is partially offset by the reduced productivity for the large tunnels. These panels are assumed to be cast offsite and brought to the project as needed.
- Truck trips requirement for construction of each Manhole/Diversion Structure vary per size of the structure.
- Mobilization and removal of the tunneling (microtunneling) machine require 10 truck trips each.
- The total number of truck trips calculated is then increased by 50% to account for small items, miscellaneous unaccounted for work, and equipment coming and going from site during the project.

Equipment Hours

- The total equipment hours are divided among 3 types of equipments: Pile driving/Shoring Equipment, Earthwork Equipment, and Lifting/Pumping Equipment.
- Site demolition, shaft excavation, special shoring and shaft backfill require earthwork equipment.
- Special shoring work only requires Pile driving/Shoring Equipment.
- Mobilization & removal of the tunneling (micro-tunneling) machine, special shoring of sheet piles and tunneling work requires Lifting/Pumping Equipment.

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Storage Pond Schedule

The schedule estimate for the storage pond construction can seen in Table 6. Detailed calculation inputs for each category are itemized in the schedule inputs column. The production rates for the schedule items to determine the baseline duration was reviewed by SPU’s construction management.

Baseline schedule values assume standard production with no difficulties. Medium schedule assumes the task takes 30% longer due to site restrictions such as access, traffic control, ground conditions or other issues. Hard schedule assume the task takes 50% longer due to site restrictions such as access, traffic control, ground conditions or other issues. SPU’s construction management group will determine which category to use based on the project description provided by the engineer.

The appropriate schedule category durations (baseline, medium, hard) will then be copied into a pre-prepared Microsoft Project schedule to determine the project schedule to the open cut pipeline.

Table 6 Storage Pond Schedule Estimate Items

Schedule Category	Schedule Inputs
Mobilization	Mobilization
Site demo/prep	Site Demolition $ value
	Demo Waste
Pond Excavation & Backfill	Pond Excavation
	Spoils Waste (add 20% for swell)
	Import Backfill & Bedding
Control Structures & Manholes	Special Structures
Commissioning	Commissioning
Pavement Restoration	Concrete Pavement
	HMA Pavement
Site restoration	Site Restoration $ value
Demobilization	De-mobilization and punch list

Note: refer to the “Open cut pipe estimate” sheet for the quantity of work required.

Man Hour Calculations

- To calculate the total number of man hours for each item a representative crew was determined for each item.
- Total man hours are calculated based on 8 hour work days for each member of the crew and added up for the entire project duration.
- To calculate the average number of personnel onsite each day during the project the total project man hours is divided by the baseline duration. This number is then increased by 100% to account for site foremen, superintendents, and miscellaneous other small site item not accounted for elsewhere.

Truck Trips

- Assume one truck trip can transfer 16 cubic yards of demolition waste, trench waste or trench backfill material.

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- Truck trip requirement for each linear foot of pipe line installation will depends on pipe diameter and trench configuration.
- Truck trips requirement for construction of each Manhole/Diversion Structure vary per size of the structure.
- The total number of truck trips calculated is then increased by 50% to account for small items, miscellaneous unaccounted for work, and equipment coming and going from site during the project.

Equipment Hours

- The total equipment hours are divided among 3 types of equipment: Pile driving/Shoring Equipment, Earthwork Equipment, and Lifting/Pumping Equipment.
- Equipment hour/ Crew hour ratio varies for projects.
- Site demolition, trench excavation, trench bedding and backfill, special shoring, pipe installation and manhole construction require earthwork equipment.
- Special shoring work only requires Pile driving/Shoring Equipment.
- Lifting/Pumping Equipment is required by special shoring (sheet piles) work.

Water Quality Vaults Schedule

The schedule estimate for the water quality vault construction can seen in Table 7. Detailed calculation inputs for each category are itemized in the schedule inputs column. The production rates for the schedule items to determine the baseline duration was reviewed by SPU's construction management.

Baseline schedule values assume standard production with no difficulties. Medium schedule assumes the task takes 30% longer due to site restrictions such as access, traffic control, ground conditions or other issues. Hard schedule assume the task takes 50% longer due to site restrictions such as access, traffic control, ground conditions or other issues. SPU's construction management group will determine which category to use based on the project description provided by the engineer.

The appropriate schedule category durations (baseline, medium, hard) will then be copied into a pre-prepared Microsoft Project schedule to determine the project schedule to the open cut pipeline.

Table 7 Water Qualtity Schedule Estimate Items

Schedule Category	Schedule Inputs
Mobilization	Mobilization
Site demo/prep	Site Demolition $ value
	Demo Waste
Excavation & Backfill	Structure Excavation
	Spoils Waste (add 20% for swell)
	Import Backfill & Bedding
	Special Shoring

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Concrete Structures	Concrete Structures
Control Structures & Manholes	WQ Structures
	Swirl Concentrator
Commissioning	Commissioning
Pavement Restoration	Concrete Pavement
	HMA Pavement
Site restoration	Site Restoration $ value
Demobilization	De-mobilization and punch list

Note: refer to the "Open cut pipe estimate" sheet for the quantity of work required.

Man Hour Calculations

- To calculate the total number of man hours for each item a representative crew was determined for each item.
- Total man hours are calculated based on 8 hour work days for each member of the crew and added up for the entire project duration.
- To calculate the average number of personnel onsite each day during the project the total project man hours is divided by the baseline duration. This number is then increased by 100% to account for site foremen, superintendents, and miscellaneous other small site item not accounted for elsewhere.

Truck Trips

- Assume one truck trip can transfer 16 cubic yards of demolition waste, trench waste or trench backfill material.
- Truck trip requirement for each linear foot of pipe line installation will depends on pipe diameter and trench configuration.
- Truck trips requirement for construction of each Manhole/Diversion Structure vary per size of the structure.
- The total number of truck trips calculated is then increased by 50% to account for small items, miscellaneous unaccounted for work, and equipment coming and going from site during the project.

Equipment Hours

- Equipment hour/ Crew hour ratio varies for projects.
- Site demolition, trench excavation, trench bedding and backfill, special shoring, pipe installation and manhole construction require earthwork equipment.

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Storage Schedule

The storage tank construction schedule estimate can be grouped into 12 categories as listed in Table 8. Detailed calculation inputs for each category are itemized in the schedule inputs column. The production rates for the schedule items to determine the baseline duration was reviewed by SPU's construction management.

Baseline schedule values assume standard production with no difficulties. Medium schedule assumes the task takes 30% longer due to site restrictions such as access, traffic control, ground conditions or other issues. Hard schedule assume the task takes 50% longer due to site restrictions such as access, traffic control, ground conditions or other issues. SPU's construction management group will determine which category to use based on the project description provided by the engineer.

The appropriate schedule category durations (baseline, medium, hard) will then be copied into a pre-prepared Microsoft Project schedule to determine the project schedule to the open cut pipeline.

Table 8 Storage Construction Schedule Estimate Items

Schedule Category	Schedule Inputs
Mobilization	Mobilization
Site demo/prep	Site Demolition $ value
Shoring & Excavation	Shoring Sheet Pile
	Shoring Soldier Piles
	Excavation
	Waste
Concrete Work	Concrete
Backfill	Backfill & Bedding
	Imported Material
Mechanical Work	Mechanical & HVAC
Odor Control Equip	Odor Control
Tank Cleaning Equip	Tank Cleaning Equipment
Electrical Work	Electrical
Commissioning	Commissioning
Site restoration	Site Restoration $ value
Demobilization	De-mobilization and punch list

Note: refer to the "Storage estimate" sheet for the quantity of work required.

Man Hour Calculations

- To calculate the total number of man hours for each item a representative crew was determined for each item.
- Total man hours are calculated based on 8 hour work days for each member of the crew and added up for the entire project duration.
- To calculate the average number of personnel onsite each day during the project the total project man hours is divided by the baseline duration. This number is then increased by 100% to account for site foremen, superintendents, and miscellaneous other small site item not accounted for elsewhere.

Truck Trips

- Assume one truck trip can transfer 16 cubic yard of excavation waste or backfill material.

- Assume one truck trip can transfer 8 cubic yard of concrete.

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- The total number of truck trips calculated is then increased by 50% to account for small items, miscellaneous unaccounted for work, and equipment coming and going from site during the project.

Equipment Hours

- The total equipment hours are divided among 3 types of equipment: Pile driving/Shoring Equipment, Earthwork Equipment, and Lifting/Pumping Equipment.
- Shoring, excavation, and backfill & bedding and site restoration require earthwork equipment.
- Shoring work only requires Pile driving/Shoring Equipment.
- Shoring soldier piles, concrete work, mechanical & HVAC work, odor control system construction, tank cleaning equipment installation require Lifting/Pumping Equipment.
- It is assumed that the equipment is used for 8 hours per day.
- Equipment hour/ Crew hour ratio varies for projects.

Pump Station (PS) Schedule

The estimate of pump station construction schedule can be grouped into 10 categories as listed in Table 9. Detailed calculation inputs for each category are itemized in the schedule inputs column. The production rates for the schedule items to determine the baseline duration was reviewed by SPU's construction management.

Baseline schedule values assume standard production with no difficulties. Medium schedule assumes the task takes 30% longer due to site restrictions such as access, traffic control, ground conditions or other issues. Hard schedule assume the task takes 50% longer due to site restrictions such as access, traffic control, ground conditions or other issues. SPU's construction management group will determine which category to use based on the project description provided by the engineer.

The appropriate schedule category durations (baseline, medium, hard) will then be copied into a pre-prepared Microsoft Project schedule to determine the project schedule to the open cut pipeline.

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Table 9 Pump Station (PS) Construction Schedule Estimate Items

Schedule Category	Schedule Inputs
Mobilization	Mobilization
Site demo/prep	Site Demolition $ value
Shoring & Excavation	Shoring Sheet Pile
	Shoring Soldier Piles
	Excavation
	Waste
Concrete/Caisson Work	Caisson Construction, 8' dia, up to 20 ft
	Caisson Excavation
	Caisson Concrete

	Caisson Construction, 10' dia, up to 20 ft
	Caisson Excavation
	Caisson Concrete
	Caisson Construction, 12' dia, up to 20 ft
	Caisson Excavation
	Caisson Concrete
	Concrete
Backfill	Backfill & Bedding
	Imported Materials
Mechanical Work	Mechanical & Equipment
Electrical Work	Electrical
Commissioning	Commissioning
Site restoration	Site Restoration $ value
Demobilization	De-mobilization and punch list

Note: refer to the "PS estimate" sheet for the quantity of work required.

Man Hour Calculations

- To calculate the total number of man hours for each item a representative crew was determined for each item.
- Total man hours are calculated based on 8 hour work days for each member of the crew and added up for the entire project duration.
- To calculate the average number of personnel onsite each day during the project the total project man hours is divided by the baseline duration. This number is then increased by 100% to account for site foremen, superintendents, and miscellaneous other small site item not accounted for elsewhere.

Truck Trips

- Assume one truck trip can transfer 16 cubic yard of excavation waste or backfill material.
- Assume one truck trip can transfer 8 cubic yard of concrete.
- The total number of truck trips calculated is then increased by 50% to account for small items, miscellaneous unaccounted for work, and equipment coming and going from site during the project.

Equipment Hours

- The total equipment hours are divided among 3 types of equipment: Pile driving/Shoring Equipment, Earthwork Equipment, and Lifting/Pumping Equipment.
- Site demolition, shoring sheet piles, excavation, and backfill & bedding and site restoration require earthwork equipment.
- Pile driving/Shoring Equipment is required by shoring work only.
- Lifting/Pumping Equipment is required for concrete work and mechanical equipment installation.
- It is assumed that the equipment is used for 8 hours per day.
- Equipment hour/ Crew hour ratio varies for projects.

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LTCP 3C v3.0 VALIDATION

Once the unit costs were adjusted for the LTCP-3C v3.0 cost tool the tool was then compared to the Windermere and Genesee by using these two projects to create sample estimates for comparison as shown in the summary table below. See cost backup for details.

Table 10 Comparison of Windermere and Genesee MACC to LTCP 3C Output

Windermere Totals	Original MACC Contract	LTCP 3C	Notes
MACC Subcontractors	$ 24,380,921.00	$ 21,743,000	Construction Bid Amount
Negotiated Support Services	$ 4,660,300.00	$ 4,965,000	Allowance for Indeterminates (25%)
Subtotal	$ 29,041,221.00		
MACC Contingency (2.5%)	$ 726,030.53	$ 6,479,000	Construction Contingency (20%)
Subtotal	$ 29,767,251.53		
GCCM Fee (6.1%)	$ 1,815,802.34	$ 2,175,000	GCCM Allowance Amount
GC/CM Specified General Conditions (Lump Sum)	$ 2,825,000.00		
	$ 34,408,053.87	$ 35,362,000	
		2.8%	Percent Difference from Original MACC Bid

Genesee Totals	Original MACC Contract	LTCP 3C	Notes
Subcontractor Subtotal	$ 14,378,672	$ 12,255,000	Construction Bid Amount
Negotiated Support Services	$ 2,017,829	$ 2,798,000	Allowance for Indeterminates (25%)
Subtotal	$ 16,396,501		
Design Contingency	$ 245,598		
Subtotal	$ 16,642,099		
Escalation & Market Conditions	$ 242,017		
Subtotal	$ 16,884,116		
MACC Contingency (2.5%)	$ 422,103	$ 3,652,000	Contingency (20%)
Subtotal	$ 17,306,219		
GCCM Fee & Specified GCs	$ 1,919,743	$ 1,225,000	GCCM Allowance Amount
	$ 19,225,962	$ 19,930,000	
		3.7%	Percent Difference from Original MACC Bid

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In summary the LTCP 3C v3.0 cost tool is an acceptable cost estimating tool for the AACE class 4 estimates. The the level of accuracy per AACE for a Class 4 estimate per the December 5th, 2012, is a -20% to +30% range. This level of cost estimating is sufficient for the SPU project initiation phase.

Model Inputs

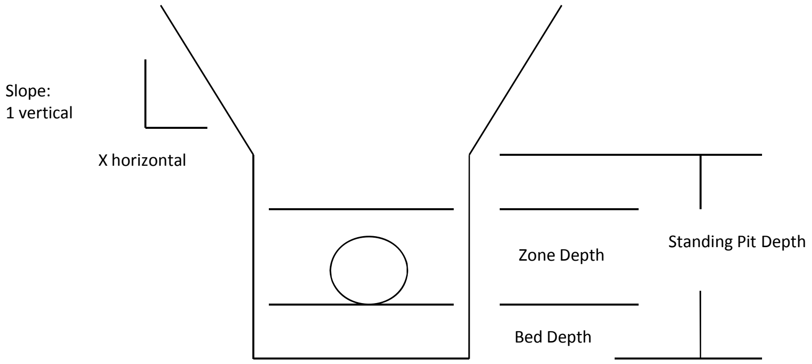
Project Type:
Open Cut Pipeline

Field	Entry	Comment	12" Effluent Line
Pipe Type			
	Pipe Types	Gravity Pipe: Reinforced Concrete Pipe (RCP) or Force Main: Cement Lined Ductile Iron (CLDI)	DI
Diameter			
	Pipe Diameter	RCP (8" to 144") CLDI Mechanical Joint (8" to 24")	12
Length			
	Pipeline Length		500
Trench Details			
	Cover Depth	From ground surface to top of pipe in feet	11
	Bottom of Trench Width (In inches)	The is the minimum width for the bottom of the trench in inches (see standard plan 284): For Pipes less than 18" use 3'-4" or 40" is the minimum For pipes 18" or larger use Pipe IDx1.5+18"	36
	Top of Trench Width (In inches)		115
	Bed and Zone Backfill Type	Always use Class B Bedding for all pipe types; Imported material, Type 9 Aggregate; see Standard Plan 285	Imported
	Trench Backfill Type above bed and zone	Imported material if under roadway or material is expected to be wet or of poor quantity	Imported
Trench Quantities			
	Trench Excavation	In cubic yards	1,495.0
	Bed and Zone Backfill	In cubic yards	168.7
	Native Backfill above Zone	In cubic yards (see description above)	
	Imported Backfill above Zone	In cubic yards (see description above)	1,311.7
	Waste Material	In cubic yards	1,495.0
Manhole Spacing			
	Number of Manholes	For gravity use 300' to 500' ft spacing or engineers best judgement.	0
	Manhole Diameter	Manhole Diameter from 48" to 144"	48
	Manhole Depth		
Diversion Structure with Gates			
	Number of Diversion Structures	Typically drilled caisson structure	0
	Structure Diameter	Diameter from 54" to 144"	72
	Structure Depth		16
	Controls	Weir or Manual Gate = M Automatic Gates = A	A
Trench Safety			
	Type of Trench Safety	Standard Trench Safety = ST (soil is good, no groundwater issues, trench depth is 12' or less) Moderate Shoring = MS (soil is poor or trench depth is up to 21' depth, minimal dewatering needs) Special Shoring = SS (Soil is poor, excavation is below 21' or significant groundwater issues)	ST
	Type of Trench Safety Quantity	Paid per SPU Section 2-07.4; Use vertical face along centerline of trench	6,250.00
Dewatering			
	Dewatering Needs	None = N Minimal = M (pumps in trench) Significant = S (wells & wellpoints)	M
Existing Utilities			
	Utility Conflicts	None = N (Field or park) Average = A (Private property or perpendicular to roadway) Complex = C (Trench down roadway up to 12' depth)	A

Model Inputs

Project Type:
Open Cut Pipeline

Field	Entry	Comment	12" Effluent Line
Traffic Control			
	Traffic Control	None = N (Not Used) Light = L (Work is in field or park, with construction vehicles entering and leaving site) Heavy = H (work in roadway or heavily congested area)	H
Pavement			
	Restoration Type	Hydroseed = H Gravel = G ACP Pavement = A Concrete Pavement = C	A
	Trench Width	This is the surface restoration calculated from above in feet + 4 ft on each side for damage and trim	11
	Pavement Depth	If no information is known: For ACP: 4" in parking lots or site surfacing 6" for roadway depth For Concrete: 8" for Concrete pavement	6"
	Restoration Width Override	To set the restoration width rather use the calculated width. Must be larger number then the trench width. For roadways use 12' for each lane of traffic.	
Landscaping			
	Landscaping General	If landscaping quantities are unknown then use following: Minimal Landscaping = M (mostly grass area with a few shrubs) Average Landscaping = A (Shrubs and groundcover with mulch) High End Landscaping = H (Many shrubs, groundcover and small dia trees with mulch) Quantity is Area in SF	
	Irrigation	Priced per SF of desired irrigation area	
Additional Costs			
	Sidewalk	Sidewalk width is minimum of 5' wide. When no information is know use 6' wide.	
	Curb and gutter	Default is curb & gutter Standard Plan 410B	
	Sidewalk Ramps	Price per EA	
	Precast Traffic Curb	Price per LF	
	Chain Link Fence	Price per LF	
	Chain Link Gate	Single 6' gate, or double 12' or 20' gates	
Other Items			



TYPE 1 TRENCHING

EXAMPLE

Proj No: 12" Effluent Pipe FM

Item: 12 " Pipe - DI

11 ft cover

Pipe Diameter, Nom 12.00 inches

Depth 12.5 feet

Length 500.0 feet

Slope: 1 Vert. to 0.25 Horiz.

- Calculated Volumes:

Trench Excavation = 1,494.98 cu yd |

Bed + Zone fill = 168.71 cu yd |

Zone Only Fill = 137.85 cu yd |

Bed Only Fill = 30.86 cu yd |

Backfill Above Zone = 1,311.73 cu yd |

Waste if Import Bed, Zone = 183.26 cu yd |

Waste if Native Bed, Zone = 14.54 cu yd |

Surface Restoration Area = 976.85 sq yd |

Shoring SF = 6,250.00 sq ft |

Pipe X-section = 0.785 sq. ft.

Base Width 3.33 ft.

Zone Depth = 2.00 ft.

Zone + Base Depth = 2.50 ft.

Top Width = 9.6

Restoration Width = 17.583

- Constants: -- ---

Base Depth = 6 in.

Zone Depth = D+ 12 in.

Min. Width = 40 in.

Width = D+ 24 in.

Pit Depth = 0 ft.

<= Wid+/Side 4 ft.

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)
Cost Estimate Elements:
Open Cut Pipes

Takeoff By:
Estimate By:
Date:
Rev:
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Rev:

Tool Revision: Ver 3, edited 4/18/13

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
MEASUREMENT AND PAYMENT							
1-09	109005	MOBILIZATION	8	%	$1,615,649.59	$129,251.97	Use 8% of total below
TEMPORARY TRAFFIC CONTROL							
1-10	110005	MAINTENANCE AND PROTECTION OF TRAFFIC CONTROL	8	%	$1,615,649.59	$129,251.97	Use Light traffic control (TC) use 3%, for Moderate TC use 5% and for Heavy TC use 8%, based on WSDOT project cost analysis for Columbia River Crossing.
CLEARING, GRUBBING AND ROADSIDE CLEANUP							
2-01	201005	CLEARING & GRUBBING		SF	$1.00	$0.00	
REMOVAL OF STRUCTURES AND OBSTRUCTIONS							
2-02	202035	REMOVE CEM CONC SIDEWALK { QTY >= 1000 }		SY	$15.00	$0.00	
2-02		1000 }		SY	$22.00	$0.00	
2-02	202045	REMOVE PAVEMENT { QTY >= 1000 }	4407	SY	$15.00	$66,106.67	
2-02		{ 200 <= QTY < 1000 }		SY	$20.00	$0.00	
2-02		{ QTY < 200 }		SY	$32.00	$0.00	
2-02	202055	REMOVE PAVEMENT, REINFORCED CONCRETE		SY	$40.00	$0.00	
2-02	202170	REMOVE FENCE, CHAIN LINK		LF	$8.00	$0.00	
2-02	202270	REMOVE CATCH BASIN		EA	$650.00	$0.00	
2-02	202805	ABANDON CATCH BASIN		EA	$315.00	$0.00	
2-02	202820	ABANDON MANHOLE		EA	$620.00	$0.00	
2-02	202850	ABANDON AND FILL PIPE		LF	$15.00	$0.00	
2-03	SPECIAL	BUILDING DEMOLITION		SF	$10.00	$0.00	Includes cost to demo and waste building. Include the SF from each floor for the total SF quantity.
STRUCTURAL EXCAVATION							
2-04	203005	COMMON EXCAVATION { QTY >= 500 }		CY	$35.00	$0.00	Do not use for trench excavation. Trench excavation for pipes is located in pipe cost section. Includes Haul and Waste.
2-04		{ QTY < 500 }			$45.00	$0.00	
2-04	203010	SOLID ROCK EXCAVATION		CY	$90.00	$0.00	Includes Haul and Waste.
2-04	203130	UNSUITABLE FOUNDATION EXCAVATION		CY	$40.00	$0.00	Includes Haul and Waste.
2-04	209005	STRUCTURE EXCAVATION		CY	$40.00	$0.00	Includes Haul and Waste.
2-07	SPECIAL	SHEET PILE SHORING FOR STRUCTURE		SF	$30.00	$0.00	Paid by the SF of exposed face to engineer, place and remove shoring.
2-07	SPECIAL	SOLDIER PILE SHORING WITH TIE-BACKS FOR STRUCTURE		SF	$80.00	$0.00	Paid by the SF of exposed face to engineer, place and remove shoring.
CONSTRUCTION GEOTEXTILE							
2-15	SPECIAL	CONSTRUCTION GEOTEXTILE		SY	$2.00	$0.00	All Geotextile types and applications except for silt fence which is covered by the TESC allowance

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
STRUCTURAL & ROADWAY MINERAL AGGREGATES							For trench backfill see section 7-17
4-01	401201	MINERAL AGGREGATE, TYPE 1		CY	$65.00	$0.00	Spec Sect 4-04; Crushed Surfacing
4-01	401202	MINERAL AGGREGATE, TYPE 2	984	CY	$65.00	$63,976.56	Spec Sect 4-04; Base Course
4-01	401217	MINERAL AGGREGATE, TYPE 17 { QTY >= 2000 }		CY	$34.00	$0.00	Spec Sect 4-04; Gravel Base
4-01		2000 }		CY	$40.00	$0.00	Spec Sect 4-04; Gravel Base
4-01		QTY < 200 }		CY	$46.00	$0.00	Spec Sect 4-04; Gravel Base
HOT MIX ASPHALT (HMA) PAVEMENT							
5-04	SPECIAL	PAVEMENT, HMA (CL 3/8 IN), 2" IN		SY	$14.00	$0.00	For placement of CL 3/8" HMA 2" depth. Includes all work related to HMA placement.
5-04	SPECIAL	PAVEMENT, HMA (CL 1/2 IN), 4" IN		SY	$26.00	$0.00	For placement of CL 1/2" HMA 4" depth. Includes all work related to HMA placement.
5-04	SPECIAL	PAVEMENT, HMA (CL 3/4 IN), 6" IN	4407	SY	$40.00	$176,284.44	For placement of CL 3/4" HMA 6" depth. Includes all work related to HMA placement.
CEMENT CONCRETE FOR ROADWAY							
5-05	505076	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 6 IN		SY	$78.00	$0.00	
5-05	505078	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 8 IN		SY	$82.00	$0.00	
5-05	505080	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 10 IN		SY	$90.00	$0.00	
5-05	505082	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 12 IN		SY	$105.00	$0.00	
CONCRETE STRUCTURES (TUNNEL SHAFTS, ETC)							
6-02	SPECIAL	CONCRETE FOR SLABS & FOOTINGS (INCL FORMS & REBAR)		CY	$500.00	$0.00	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
6-02	SPECIAL	CONCRETE WALLS & COULUMNS (INCL FORMS & REBAR)		CY	$1,050.00	$0.00	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
6-02	SPECIAL	CONCRETE ELEVATED SLABS & BEAMS (INCL FORMS & REBAR)		CY	$1,300.00	$0.00	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
MANHOLES, CATCH BASINS AND INLETS							
7-05	705200	MANHOLE, TYPE 200A (48" DIAMETER, W/ REDUCER TOP)		EA	$3,700.00	$0.00	Spec Sect 7-05; Up to 10' depth
7-05	705201	MANHOLE, TYPE 201A (54" DIAMETER, W/ REDUCER TOP)	4	EA	$4,000.00	$16,000.00	Spec Sect 7-05; Up to 10' depth
7-05	705202	MANHOLE, TYPE 202A (72" DIAMETER, W/ REDUCER TOP)		EA	$7,000.00	$0.00	Spec Sect 7-05; Up to 10' depth
7-05	705203	MANHOLE, TYPE 203A (84" DIAMETER, W/ REDUCER TOP)		EA	$10,800.00	$0.00	Spec Sect 7-05; Up to 10' depth
7-05	705204	MANHOLE, TYPE 204A (96" DIAMETER, W/ REDUCER TOP)		EA	$15,200.00	$0.00	Spec Sect 7-05; Up to 10' depth
7-05	705205	MANHOLE, TYPE 205A (120" DIAMETER, W/ REDUCER TOP)		EA	$23,900.00	$0.00	Spec Sect 7-05; Up to 10' depth
7-05	705206	MANHOLE, TYPE 206A (144" DIAMETER, W/ REDUCER TOP)		EA	$27,100.00	$0.00	Spec Sect 7-05; Up to 10' depth
7-05	705230	EXTRA DEPTH, TYPE 200A MANHOLE		VF	$270.00	$0.00	Spec Sect 7-05; Add for depth greater than 10'
7-05	705231	EXTRA DEPTH, TYPE 201A MANHOLE	20	VF	$290.00	$5,800.00	Spec Sect 7-05; Add for depth greater than 10'
7-05	705232	EXTRA DEPTH, TYPE 202A MANHOLE		VF	$330.00	$0.00	Spec Sect 7-05; Add for depth greater than 10'
7-05	705233	EXTRA DEPTH, TYPE 203A MANHOLE		VF	$490.00	$0.00	Spec Sect 7-05; Add for depth greater than 10'
7-05	705234	EXTRA DEPTH, TYPE 204A MANHOLE		VF	$600.00	$0.00	Spec Sect 7-05; Add for depth greater than 10'
7-05	705235	EXTRA DEPTH, TYPE 205A MANHOLE		VF	$920.00	$0.00	Spec Sect 7-05; Add for depth greater than 10'
7-05	705352	CATCH BASIN, TYPE 240A (48" DIAMETER, W/ REDUCER TOP)		EA	$2,800.00	$0.00	
7-05	705353	CATCH BASIN, TYPE 240B (48" DIAMETER, W/ SLAB TOP)		EA	$2,800.00	$0.00	

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
7-05	705354	CATCH BASIN, TYPE 241 (2.67' x 2.33' SECTION)		EA	$1,700.00	$0.00	
7-05	705355	CATCH BASIN, TYPE 242A (42" DIAMETER, W/ REDUCER TOP)		EA	$2,700.00	$0.00	
7-05	705356	CATCH BASIN, TYPE 242B (42" DIAMETER, W/ CURB CAST FLUSH)		EA	$2,700.00	$0.00	
7-05	705360	EXTRA DEPTH, CATCH BASIN		VF	$270.00	$0.00	
DIVERSION STRUCTURES							
SPECIAL	SPECIAL	SWIRL CONCETRATOR, VORTECH MDL 4000		EA	$45,000.00	$0.00	Payment includes all work require to install diversion structure, based on Midvale Bid Tab
SPECIAL	SPECIAL	WATER QUALITY TREATMENT (4'x4'), (FILTERRA)		EA	$15,000.00	$0.00	Payment includes all work require to install diversion structure, based on NPDES 95 Retrofit Bid Tab
SPECIAL	SPECIAL	WATER QUALITY TREATMENT (4'x8'), (FILTERRA)		EA	$18,000.00	$0.00	Payment includes all work require to install diversion structure, based on NPDES 95 Retrofit Bid Tab
SPECIAL	SPECIAL	DIVERSION STRUCTURE, 54 IN		EA	$29,000.00	$0.00	Payment includes all work require to install diversion structure, lining, and outlet/inlet connection piping.
SPECIAL	SPECIAL	DIVERSION STRUCTURE, 72 IN	1	EA	$36,000.00	$36,000.00	Payment includes all work require to install diversion structure, lining, and outlet/inlet connection piping.
SPECIAL	SPECIAL	DIVERSION STRUCTURE, 96 IN		EA	$55,000.00	$0.00	Payment includes all work require to install diversion structure, lining, and outlet/inlet connection piping.
SPECIAL	SPECIAL	DIVERSION STRUCTURE, 120 IN		EA	$92,000.00	$0.00	Payment includes all work require to install diversion structure, lining, and outlet/inlet connection piping.
SPECIAL	SPECIAL	DIVERSION STRUCTURE, 144 IN		EA	$110,000.00	$0.00	Payment includes all work require to install diversion structure, lining, and outlet/inlet connection piping.
SPECIAL	SPECIAL	FIXED GATE (WIER AND MANUAL CONTROL)		EA	$15,000.00	$0.00	Includes concrete allowance for fixed weir system in diversion structure
SPECIAL	SPECIAL	AUTOMATIC GATE & CONTROLS	1	EA	$35,000.00	$35,000.00	Includes slide gate, stem, guides, additional concrete, power, and controls.
STORM DRAINS AND SANITARY SEWERS							
7-17	SPECIAL	TRENCH EXCAVATION	7219	CY	$8.00	$57,749.04	As per payment outlined in spec section 7-17.5 but for excavation only. Required for EIS report needs.
2-06	SPECIAL	HAUL AND WASTE	7219	CY	$25.00	$180,465.74	As per payment outlined in spec section 7-17.5 but for haul and waste of spoils only. Required for EIS report needs.
7-17	SPECIAL	PIPE BEDDING	1176	CY	$50.00	$58,797.94	Payment by CY of bedding not LF. Bedding is Class B.
7-17	SPECIAL	NATIVE BACKFILL ABOVE BED AND ZONE		CY	$10.00	$0.00	As per payment outlined in spec section 7-17.5 but for native backfill only. Required for EIS report needs.
7-17	SPECIAL	IMPORTED BACKFILL ABOVE BED & ZONE	5817	CY	$45.00	$261,746.67	As per payment outlined in spec section 7-17.5 but for imported backfill only. Required for EIS report needs.
2-08	SPECIAL	DEWATERING (PUMPS IN TRENCH)	2144	LF	$20.00	$42,880.00	Allowance paid per linear foot of pipeline for dewatering in trench during pipeline installation.
2-08	SPECIAL	DEWATERING (WELL/WELLPOINTS)		LF	$130.00	$0.00	Allowance paid per linear foot of pipeline for dewatering in trench during pipeline installation.
7-17	717200	CONTROLLED DENSITY FILL		CY	$135.00	$0.00	
SPECIAL	SPECIAL	ADDER FOR AVERAGE UTILITY CONFLICTS		LF	$15.00	$0.00	Allowance paid per linear foot of pipeline for conflicts with existing utilities along pipeline route. Includes some relocations, utility support, replacement of bedding, etc.
SPECIAL	SPECIAL	ADDER FOR SIGNIFIGANT UTILITY CONFLICTS	2144	LF	$120.00	$257,280.00	Allowance paid per linear foot of pipeline for conflicts with existing utilities along pipeline route. Includes some relocations, utility support, replacement of bedding, etc.
7-17	717406	PIPE, PSD, CONC C14 CL 3, 6 IN		LF	$30.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717408	PIPE, PSD, CONC C14 CL 3, 8 IN		LF	$35.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717414	PIPE, PSD, CONC REINF C76 CL V, 12 IN		LF	$60.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717416	PIPE, PSD, CONC REINF C76 CL IV, 15 IN		LF	$65.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717417	PIPE, PSD, CONC REINF C76 CL V, 15 IN		LF	$65.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717418	PIPE, PSD, CONC REINF C76 CL III, 18 IN		LF	$75.00	$0.00	Pipe placement only; earthwork paid separately above

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7-17	717419	PIPE, PSD, CONC REINF C76 CL IV, 18 IN		LF	$80.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717420	PIPE, PSD, CONC REINF C76 CL V, 18 IN		LF	$85.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717421	PIPE, PSD, CONC REINF C76 CL III, 21 IN		LF	$90.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717422	PIPE, PSD, CONC REINF C76 CL IV, 21 IN		LF	$90.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717424	PIPE, PSD, CONC REINF C76 CL III, 24 IN		LF	$100.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717425	PIPE, PSD, CONC REINF C76 CL IV, 24 IN		LF	$110.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717430	PIPE, PSD, CONC REINF C76 CL III, 30 IN	1072	LF	$160.00	$171,520.00	Pipe placement only; earthwork paid separately above
7-17	717436	PIPE, PSD, CONC REINF C76 CL III, 36 IN		LF	$200.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717442	PIPE, PSD, CONC REINF C76 CL III, 42 IN		LF	$220.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717448	PIPE, PSD, CONC REINF C76 CL III, 48 IN		LF	$260.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717461	PIPE, PSD, CONC REINF C76 CL IV, 54 IN		LF	$330.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717461	PIPE, PSD, CONC REINF C76 CL IV, 60 IN		LF	$375.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717608	PIPE, PSD, D.I. CL 50, 6 IN		LF	$70.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717608	PIPE, PSD, D.I. CL 50, 8 IN		LF	$85.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717612	PIPE, PSD, D.I., CL 50, 12 IN	1072	LF	$120.00	$128,640.00	Pipe placement only; earthwork paid separately above
7-17	717616	PIPE, PSD, D.I., CL 50, 16 IN		LF	$180.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717618	PIPE, PSD, D.I., CL 50, 18 IN		LF	$190.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717620	PIPE, PSD, D.I., CL 50, 20 IN		LF	$235.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717624	PIPE, PSD, D.I., CL 50, 24 IN		LF	$285.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717630	PIPE, PSD, D.I., CL 50, 30 IN		LF	$330.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717636	PIPE, PSD, D.I., CL 50, 36 IN		LF	$395.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717642	PIPE, PSD, D.I., CL 50, 42 IN		LF	$485.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717648	PIPE, PSD, D.I., CL 50, 48 IN		LF	$535.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717461	PIPE, PSD, D.I., CL 50, 54 IN		LF	$610.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717656	PIPE, PSD, D.I., CL 52, 6 IN		LF	$73.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717658	PIPE, PSD, D.I., CL 52, 8 IN		LF	$92.00	$0.00	Pipe placement only; earthwork paid separately above
7-17	717662	PIPE, PSD, D.I., CL 52, 12 IN		LF	$129.00	$0.00	Pipe placement only; earthwork paid separately above
2-07	717900	SAFETY SYST. FOR TRENCH EXCAV, TRENCH BOX	26264	SF	$1.25	$32,830.00	Paid per Spec Sect 2-07
2-07	SPECIAL	SAFETY SYST. FOR TRENCH EXCAV, SLIDE RAIL/SHEETS & JACKING INCLUDES SHORING ON BOTH SIDES OF TRENCH		SF	$16.00	$0.00	Paid per Spec Sect 2-07; includes steel sheets with jacking on both sides of trench.
2-07	SPECIAL	SAFETY SYST. FOR TRENCH EXCAV, SHEET PILES INCLUDES SHORING ON BOTH SIDES OF TRENCH		SF	$60.00	$0.00	Paid per Spec Sect 2-07; includes sheet pile shoring on both sides, placement and removal of shoring.
7-17	717906	EXTRA EXCAVATION		CY	$52.00	$0.00	
7-17	717990	TELEVISION INSPECTION	2144	LF	$4.00	$8,576.00	

EROSION CONTROL

8-01	801005	TEMPORARY EROSION & SEDIMENT CONTROL	1	%	$1,599,653.05	$15,996.53	An allowance of TESC items for projects are calculated as 1% of other estimate pay items.

LANDSCAPE CONSTRUCTION

8-02	801160	TOPSOIL, TYPE A		CY	$50.00	$0.00	
8-02	801165	TOPSOIL, TYPE B		CY	$35.00	$0.00	
8-02	SPECIAL	LANDSCAPING - MINIMUM		SF	$1.00	$0.00	Allowance for hydroseeding with some minor planting beds with shrubs and bark mulch.
8-02	SPECIAL	LANDSCAPING - AVERAGE		SF	$5.00	$0.00	Planting allowance includes about 50% hydroseeding and 50% planting beds with shrubs and bark mulch.
8-02	SPECIAL	LANDSCAPING - HIGH END		SF	$10.00	$0.00	Planting allowance includes planting beds with shrubs, small trees and bark mulch.

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
IRRIGATION SYSTEM							
8-03	SPECIAL	IRRIGATION SYSTEM		SF	$2.00	$0.00	Irrigation system for plantings, includes piping, controls, and spray heads.
CEMENT CONCRETE CURB, CURB AND GUTTER							
8-04	804005	CURB, CEM CONC { QTY >= 1000 }		LF	$20.00	$0.00	
8-04		{ QTY < 1000 }			$30.00	$0.00	
8-04	804015	CURB AND GUTTER, CEM CONC		LF	$40.00	$0.00	
EXTRUDED CURB							
8-06	806005	CURB, EXTRUDED ASPHALT CONCRETE		LF	$15.00	$0.00	
8-06	806010	CURB, EXTRUDED CEMENT CONCRETE		LF	$13.00	$0.00	
PRECAST TRAFFIC CURB AND BLOCK TRAFFIC CURB							
8-07	807005	CURB, TRAFFIC, PRECAST		LF	$16.00	$0.00	
CHAIN LINK FENCE AND WIRE FENCE							
8-12		CHAIN LINK FENCE, TYPE 1		LF	$33.00	$0.00	Per Standard Plan 450a, Type 1
8-12	812012	CHAIN LINK GATE, DOUBLE 12 FT WIDE		EA	$1,300.00	$0.00	
8-12	812020	CHAIN LINK GATE, DOUBLE 20 FT WIDE		EA	$1,800.00	$0.00	
8-12	812026	CHAIN LINK GATE, SINGLE 6 FT WIDE		EA	$525.00	$0.00	
CEMENT CONCRETE SIDEWALKS							
8-14	814005	SIDEWALK, CEM CONC { QTY >= 500 }		SY	$45.00	$0.00	
8-14		{ QTY < 500 }			$65.00	$0.00	
8-14		CURB RAMP, TYPE 442a		EA	$1,500.00	$0.00	Per Standard Plan 422a
RIPRAP							
8-14	SPECIAL	QUARRY SPALLS / RIP RAP		CY	$70.00	$0.00	Machine place quarry spalls by CY not ton
CEMENT CONCRETE DRIVEWAY AND ALLEY RETURN							
8-19	819006	DRIVEWAY, CEM CONC, 6 IN		SY	$70.00	$0.00	
TRAFFIC SIGNAL SYSTEMS							
8-31	SPECIAL	TRAFFIC SIGNAL (4 WAY COMPLETE)		EA	$320,000.00	$0.00	For 4 way, 2 lanes each way intersection
8-31	SPECIAL	DETECTOR LOOP		EA	$1,000.00	$0.00	Complete cost to replace existing detector loop in roadway
SPECIAL ITEMS NOT ACCOUNTED FOR ELSEWHERE							Seek estimators help in pricing special line items
							For significant cost items not accounted for elsewhere.
		SUBTOTAL				**$1,874,154**	
		CONSTRUCTION SUBTOTAL (ROUNDED)				**$1,870,000**	

Pipeline Schedule Inputs	QTY	Unit	Baseline Schedule Days
Mobilization			10 days
Site Demolition $ value	66,107	$ value	14.0 days
Demo Waste	82	CY	
Trench Excavation	7,219	CY	37.0 days
Trench Waste (add 20% for swell)	8,662	CY	
Import Backfill & Bedding	6,993	CY	44.0 days
Special Shoring (Slide Rails/Sheet & Jacking)	0	SF	0.0 days
Special Shoring (Sheet Piles)	0	SF	0.0 days
Pipe 6" to 12" dia	1,072	LF	11.0 days
Pipe 15" to 24" dia	0	LF	0.0 days
Pipe 30" to 42" dia	1,072	LF	30.0 days
Pipe 48" to 60" dia	0	LF	0.0 days
Concrete Structures	0	CY	0.0 days
Manhole/Catch Basin 48" to 60"	4	EA	2.0 days
Manholes 72" to 84"	0	EA	0.0 days
Manholes 96" to 120"	0	EA	0.0 days
Manholes 144"	0	EA	0.0 days
Diversion Structure 48" to 60"	0	EA	0.0 days
Diversion Structure 72" to 84"	1	EA	2.0 days
Diversion Structure 96" to 120"	0	EA	0.0 days
Diversion Structure 144"	0	EA	0.0 days
Control Structure Fixed Gate	0	EA	0.0 days
Control Structure Automatic Gate	1	EA	4.0 days
Comissioning	5	%	7.0 days
Concrete Pavement Restoration	0	SY	0.0 days
HMA Pavement Restoration	4,407	SY	21.0 days
Site Restoration $ value	0	$ value	0.0 days
De-mobilization and punch list			15 days

Pipeline Schedule	Baseline	Medium	Hard	$ Value
Mobilization	10 days	10 days	10 days	$90,476
Site demo/prep	14 days	18 days	21 days	$72,109
Trench, Shore and Install Pipe	41 days	53 days	62 days	$1,300,135
Concrete Structures	0 days	0 days	0 days	$0
Control Structures & Manholes	8 days	10 days	12 days	$101,226
Commissioning/Testing/Disinfection	7 days	9 days	11 days	$9,355
Pavement Restoration	21 days	27 days	32 days	$262,077
Site restoration	0 days	0 days	0 days	$0
Demobilization	15 days	15 days	15 days	$38,776
				$1,874,154

Schedule Values	
Baseline	Baseline schedule values assumes standard production with no difficulties
Medium	Task takes 30% longer due to site restrictions such as access, traffic control, ground conditions
Hard	Task takes 50% longer due to site restrictions such as access, traffic control, ground conditions

Manhour Calculations		
Total Manhours for the schedule items	6,596	MHs
Add 100% for foreman, site supervision, misc other site items, cleanup, etc.	6596	MHs
Baseline Total Number of Man Hours	13192	
Medium Total Number of Man Hours	16148.83	
Hard Total Number of Man Hours	18537.03	

Truck Trips

Raw/Base Truck Trips over project life	1,080
Add 50% for pipes, shoring items, other items	540
Total Truck Trips during entire project	1,620

Equipment Hours

Piledriving/Shoring Equipment Hours	0
Add 50% total hours	0
Baseline Total Piledriving Equipment hours	0
Medium Total Piledriving Equipment hours	0
Hard Total Piledriving Equipment hours	0
Earthwork Equipment Hours (Excavator, dozer, loader, etc)	1,680
Add 50% total hours	840
Baseline Total Earthwork Equipment hours	2,520
Medium Total Earthwork Equipment hours	3,085
Hard Total Earthwork Equipment hours	3,541
Lifting/Pumping Equipment Hours (Cranes, concrete pump, forklift, etc)	240
Add 50% total hours	120
Baseline Total Lifting/Pumping Equipment hours	360
Medium Total Lifting/Pumping Equipment hours	441
Hard Total Lifting/Pumping Equipment hours	506

Model Inputs

Project Type:
Tunnel

Field	Entry	Comment	Sample
Diameter			
	Tunnel diameters vary from 8' to 24'	Use as sized by Engineer; For sizes outside this range use special input and consult with cost estimator.	16
Length			
	Input per drawing or engineer direction		2200

Launch Shaft/Retrieval Shaft			
Launch Shaft			
	Launch Shaft Depth	Per engineer in ft	70
	Launch Shaft Length	Minimum of 4 x tunnel dia	64
	Launch Shaft Width	Minimum of 3 x tunnel dia	48
	Manhole in Launch Shaft	Yes = Y No = N, if no launch shaft is entirely backfilled	Y
	Manhole Diameter	Manhole Diameter from 48" to 144"	120
	Shaft Backfill Material	Native Backfill = N, use if no dewatering issue and good ground conditions Import Backfill = I, use if there are groundwater issues or poor soils are expected	I
Retrieval Shaft			
	Retrieval Shaft Depth	Per engineer in ft	150
	Retrieval Shaft Length	Minimum of 3 x tunnel dia	48
	Retrieval Shaft Width	Minimum of 2 x tunnel dia	32
	Manhole in Launch Shaft	Yes = Y No = N, if no retrieval shaft is entirely backfilled	N
	Manhole Diameter	Manhole Diameter from 48" to 144"	0
	Shaft Backfill Material	Native Backfill = N, use if no dewatering issue and good ground conditions Import Backfill = I, use if there are groundwater issues or poor soils are expected	I
Existing Utilities			
	None	Not used unless directed by engineer for project specific requirements.	
	Average	Only use if project is in open park area where utilities are not expected by engineer.	
	Complex	Default; Due to the general urban environment of the Seattle area use for all projects unless directed by engineer for project specific requirements.	
Footprint			
	Footprint of Launch Shaft and Staging Area (SF)	Use parcel size. (The launch shaft location needs a minimum area of 120 ft + launch shaft length x 100 ft + launch shaft width. This is for the tunnel support equipment such as tanks, grout plant, tower crane, segment storage yard and other tunnel support items.)	39750
	Footprint of Retrieval Shaft and Staging Area (SF)	Use parcel size.	11700
Surface Restoration			
	Restoration Type	Hydroseed = H Gravel = G ACP Pavement = A Concrete Pavement = C	A
	Pavement Depth	If no information is known: For ACP: 4" in parking lots or site surfacing 6" for roadway depth For Concrete: 8" for Concrete pavement	4"

Model Inputs

Project Type:
Tunnel

Field	Entry	Comment	Sample
Dewatering			
	None	Not used unless directed by engineer for project specific requirements.	
	Minimal	Default; Use for all projects unless directed by engineer for project specific requirements.	
	Significant	Use is project is near body of water or at or below ground water level.	S
Landscaping			
	Landscaping General	If landscaping quantities are unknown then use following: Minimal Landscaping = M (mostly grass area with a few shrubs) Average Landscaping = A (Shrubs and groundcover with mulch) High End Landscaping = H (Many shrubs, groundcover and small dia trees with mulch) Quantity is Area in SF	
	Irrigation	Priced per SF of desired irrigation area	
Additional Costs			
	Sidewalk	Sidewalk width is minimum of 5' wide. When no information is know use 6' wide.	3360
	Curb and gutter	Default is curb & gutter Standard Plan 410B	560
	Sidewalk Ramps	Price per EA	4
	Precast Traffic Curb	Price per LF	
	Chain Link Fence	Price per LF	830
	Chain Link Gate	Single 6' gate, or double 12' or 20' gates	20'
Other Items			
	Building Demo	Priced by SF; Remember to count the SF on each floor	17600

Launch Shaft Earthwork

Launch Shaft Excavation	7964.4	cu yd
Launch Shaft Shoring	15680.0	sf
Launch Shaft Manhole Volume (if used)	203.6	cu yd
Launch Shaft Backfill	7760.8	cu yd

Retrieval Shaft Earthwork

Retrieval Shaft Excavation	8533.3	cu yd
Retrieval Shaft Shoring	24000.0	sf
Launch Shaft Manhole Volume (if used)	0.0	cu yd
Retrieval Shaft Backfill	8533.3	cu yd

Tunnel Earthwork

Outer diameter of Tunnel	18	ft
Tunnel Boring Spoils	20734.56	cu yd

Model Inputs

Project Type:
TRENCHLESS TECHNOLOGIES (JACK & BORE, MICROTUNNELS)

Field	Entry	Comment	Sample
Microtunnel or Bore & Jack			
	Microtunnel diameters vary from 12" to 120"	Can be used in significant groundwater conditions.	48
Length			
	Input per drawing or engineer direction		600
Launch Shaft/Retrieval Shaft			
Launch Shaft			
	Launch Shaft Depth	Per engineer in ft	20
	Launch Shaft Length	Minimum of 20 + Dia (FT)	24
	Launch Shaft Width	Minimum of 15 + Dia (FT)	19
	Manhole in Launch Shaft	Yes = Y No = N, if no launch shaft is entirely backfilled	Y
	Manhole Diameter	Manhole Diameter from 48" to 144"	54
Retrieval Shaft			
	Retrieval Shaft Depth	Per engineer in ft	20
	Retrieval Shaft Length	Minimum of 15 + Dia (FT)	19
	Retrieval Shaft Width	Minimum of 15 + Dia (FT)	19
	Manhole in Launch Shaft	Yes = Y No = N, if no retrieval shaft is entirely backfilled	Y
	Manhole Diameter	Manhole Diameter from 48" to 144"	48
Intermediate Shafts			
	Number of Intermediate shafts		2
	Intermediate Shaft Depth	Per engineer in ft	20
	Intermediate Shaft Length	Minimum of 15 + Dia (FT)	19
	Intermediate Shaft Width	Minimum of 15 + Dia (FT)	19
	Manhole in Launch Shaft	Yes = Y No = N, if no retrieval shaft is entirely backfilled	
	Manhole Diameter	Manhole Diameter from 48" to 144"	0
Existing Utilities			
	None	Not used unless directed by engineer for project specific requirements.	
	Average	Only use if project is in open park area where utilities are not expected by engineer.	
	Complex	Default; Due to the general urban environment of the Seattle area use for all projects unless directed by engineer for project specific requirements.	
Footprint			
	Footprint of Launch Shaft and Staging Area	Use parcel size. The launch shaft location needs a minimum area of 120 ft + launch shaft length x 100 ft + launch shaft width. This is for the tunnel support equipment such as tanks, grout plant, tower crane, segment storage yard and other tunnel support items.	
	Footprint of Retrieval Shaft and Staging Area	Use parcel size.	
Surface Restoration			
	Restoration Type	Hydroseed = H Gravel = G ACP Pavement = A Concrete Pavement = C	A
Dewatering			
	None	Not used unless directed by engineer for project specific requirements.	
	Minimal	Default; Use for all projects unless directed by engineer for project specific requirements.	
	Significant	Use is project is near body of water or at or below ground water level.	

Model Inputs

Project Type:
TRENCHLESS TECHNOLOGIES (JACK & BORE, MICROTUNNELS)

Field	Entry	Comment	Sample
Landscaping			
	Landscaping General	If landscaping quantities are unknown then use following: Minimal Landscaping = M (mostly grass area with a few shrubs) Average Landscaping = A (Shrubs and groundcover with mulch) High End Landscaping = H (Many shrubs, groundcover and small dia trees with mulch) Quantity is Area in SF	
	Irrigation	Priced per SF of desired irrigation area	
Additional Costs			
	Sidewalk	Sidewalk width is minimum of 5' wide. When no information is know use 6' wide.	
	Curb and gutter	Default is curb & gutter Standard Plan 410B	
	Sidewalk Ramps	Price per EA	
	Precast Traffic Curb	Price per LF	
	Chain Link Fence	Price per LF	
	Chain Link Gate	Single 6' gate, or double 12' or 20' gates	
Other Items			
	Building Demo	Priced by SF; Remember to count the SF on each floor	

Launch Shaft Earthwork

Launch Shaft Excavation	337.8	cu yd
Launch Shaft Shoring	1720.0	sf
Launch Shaft Manhole Volume (if used)	11.8	cu yd
Launch Shaft Backfill	326.0	cu yd

Retrieval Shaft Earthwork

Retrieval Shaft Excavation	267.4	cu yd
Retrieval Shaft Shoring	1520.0	sf
Retrieval Shaft Manhole Volume (if used)	9.3	cu yd
Retrieval Shaft Backfill	258.1	cu yd

Intermediate Shaft Earthwork

Intermediate Shaft Excavation	534.8	cu yd
Intermediate Shaft Shoring	3040.0	sf
Intermediate Shaft Manhole Volume (if used)	0.0	cu yd
Intermediate Shaft Backfill	534.8	cu yd

Microtunnel Earthwork

Outer diameter of Microtunnel	5	ft
Microtunnel Spoils	436.3	cu yd

Model Inputs

Project Type:
TRENCHLESS TECHNOLOGIES (JACK & BORE, MICROTUNNELS)

Field	Entry	Comment	Sample
Microtunnel or Bore & Jack			
	Bore & Jack diameters vary from 12" to 120"	Do Not use if any single reach is over 300 ft in length or if significant dewatering is expected.	48
Length			
	Input per drawing or engineer direction		200
Launch Shaft/Retrieval Shaft			
Launch Shaft			
	Launch Shaft Depth	Per engineer in ft	20
	Launch Shaft Length	Minimum of 20 + Dia (FT)	24
	Launch Shaft Width	Minimum of 15 + Dia (FT)	19
	Manhole in Launch Shaft	Yes = Y No = N, if no launch shaft is entirely backfilled	Y
	Manhole Diameter	Manhole Diameter from 48" to 144"	54
Retrieval Shaft			
	Retrieval Shaft Depth	Per engineer in ft	20
	Retrieval Shaft Length	Minimum of 15 + Dia (FT)	19
	Retrieval Shaft Width	Minimum of 15 + Dia (FT)	19
	Manhole in Launch Shaft	Yes = Y No = N, if no retrieval shaft is entirely backfilled	Y
	Manhole Diameter	Manhole Diameter from 48" to 144"	48
Existing Utilities			
	None	Not used unless directed by engineer for project specific requirements.	
	Average	Only use if project is in open park area where utilities are not expected by engineer.	
	Complex	Default; Due to the general urban environment of the Seattle area use for all projects unless directed by engineer for project specific requirements.	
Footprint			
	Footprint of Launch Shaft and Staging Area	Use parcel size. The launch shaft location needs a minimum area of 120 ft + launch shaft length x 100 ft + launch shaft width. This is for the tunnel support equipment such as tanks, grout plant, tower crane, segment storage yard and other tunnel support items.	
	Footprint of Retrieval Shaft and Staging Area	Use parcel size.	
Surface Restoration			
	Restoration Type	Hydroseed = H Gravel = G ACP Pavement = A Concrete Pavement = C	A
Dewatering			
	None	Not used unless directed by engineer for project specific requirements.	
	Minimal	Default; Use for all projects unless directed by engineer for project specific requirements.	
	Significant	Use is project is near body of water or at or below ground water level.	
Landscaping			
	Landscaping General	If landscaping quantities are unknown then use following: Minimal Landscaping = M (mostly grass area with a few shrubs) Average Landscaping = A (Shrubs and groundcover with mulch) High End Landscaping = H (Many shrubs, groundcover and small dia trees with mulch) Quantity is Area in SF	
	Irrigation	Priced per SF of desired irrigation area	

Model Inputs

Project Type:
TRENCHLESS TECHNOLOGIES (JACK & BORE, MICROTUNNELS)

Field	Entry	Comment	Sample
Additional Costs			
	Sidewalk	Sidewalk width is minimum of 5' wide. When no information is know use 6' wide.	
	Curb and gutter	Default is curb & gutter Standard Plan 410B	
	Sidewalk Ramps	Price per EA	
	Precast Traffic Curb	Price per LF	
	Chain Link Fence	Price per LF	
	Chain Link Gate	Single 6' gate, or double 12' or 20' gates	

Other Items			
	Building Demo	Priced by SF; Remember to count the SF on each floor	

Launch Shaft Earthwork		
Launch Shaft Excavation	cu yd	337.8
Launch Shaft Shoring	sf	1720.0
Launch Shaft Manhole Volume (if used)	cu yd	11.8
Launch Shaft Backfill	cu yd	326.0
Retrieval Shaft Earthwork		
Retrieval Shaft Excavation	cu yd	267.4
Retrieval Shaft Shoring	sf	1520.0
Retrieval Shaft Manhole Volume (if used)	cu yd	9.3
Retrieval Shaft Backfill	cu yd	258.1
Bore & Jack Earthwork		
Outer diameter of Microtunnel	ft	5
Microtunnel Spoils	cu yd	145.4

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)
Cost Estimate Elements:
Tunneling
Microtunnel
Bore & Jack
Tool Revision: Ver 3, edited 4/18/13

Takeoff By:
Estimate By:
Date:
Rev:
Rev:
Rev:

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
MEASUREMENT AND PAYMENT							
1-09	109005	MOBILIZATION	8	%	$1,998,697.34	$159,895.79	Use 8% of total below
TEMPORARY TRAFFIC CONTROL							
1-10	110005	MAINTENANCE AND PROTECTION OF TRAFFIC CONTROL	3	%	$1,998,697.34	$59,960.92	Use 3% for projects outside of street ROW or 5% for projects in the street ROW.
CLEARING, GRUBBING AND ROADSIDE CLEANUP							
2-01	201005	CLEARING & GRUBBING		SF	$1.00	$0.00	
REMOVAL OF STRUCTURES AND OBSTRUCTIONS							
2-02	202035	REMOVE CEM CONC SIDEWALK { QTY >= 1000 }		SY	$15.00	$0.00	
2-02		1000 }		SY	$22.00	$0.00	
2-02	202045	REMOVE PAVEMENT { QTY >= 1000 }		SY	$15.00	$0.00	
2-02		{ 200 <= QTY < 1000 }		SY	$20.00	$0.00	
2-02		{ QTY < 200 }		SY	$32.00	$0.00	
2-02	202055	REMOVE PAVEMENT, REINFORCED CONCRETE		SY	$40.00	$0.00	
2-02	202170	REMOVE FENCE, CHAIN LINK		LF	$8.00	$0.00	
2-02	202270	REMOVE CATCH BASIN		EA	$650.00	$0.00	
2-02	202805	ABANDON CATCH BASIN		EA	$315.00	$0.00	
2-02	202820	ABANDON MANHOLE		EA	$620.00	$0.00	
2-02	202850	ABANDON AND FILL PIPE		LF	$15.00	$0.00	
2-03	SPECIAL	BUILDING DEMOLTION (SF)		SF	$10.00	$0.00	Includes cost to demo and waste building. Include the SF from each floor for the total SF quantity.
STRUCTURAL EXCAVATION							
2-04	203005	COMMON EXCAVATION { QTY >= 500 }		CY	$35.00	$0.00	Do not use for trench or trenchless shaft excavation. Trench excavation for pipes is located in pipe cost section.
2-04		{ QTY < 500 }			$45.00	$0.00	
2-04	203010	SOLID ROCK EXCAVATION		CY	$90.00	$0.00	
2-04	203130	UNSUITABLE FOUNDATION EXCAVATION		CY	$40.00	$0.00	
2-04	209005	STRUCTURE EXCAVATION		CY	$40.00	$0.00	
2-07	SPECIAL	SHEET PILE SHORING FOR STRUCTURE		SF	$30.00	$0.00	Paid by the SF of exposed face to engineer, place and remove shoring.
2-07	SPECIAL	SOLDIER PILE SHORING WITH TIE-BACKS FOR STRUCTURE		SF	$80.00	$0.00	Paid by the SF of exposed face to engineer, place and remove shoring.

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
CONSTRUCTION GEOTEXTILE							
2-15	SPECIAL	CONSTRUCTION GEOTEXTILE		SY	$2.00	$0.00	All Geotextile types and applications except for silt fence which is covered by the TESC allowance
STRUCTURAL & ROADWAY MINERAL AGGREGATES							For trench backfill see section 7-17
4-01	401201	MINERAL AGGREGATE, TYPE 1		CY	$65.00	$0.00	Spec Sect 4-04; Crushed Surfacing
4-01	401202	MINERAL AGGREGATE, TYPE 2		CY	$65.00	$0.00	Spec Sect 4-04; Base Course
4-01	401217	MINERAL AGGREGATE, TYPE 17 { QTY >= 2000 }		CY	$34.00	$0.00	Spec Sect 4-04; Gravel Base
4-01		2000 }		CY	$40.00	$0.00	Spec Sect 4-04; Gravel Base
4-01		QTY < 200 }		CY	$46.00	$0.00	Spec Sect 4-04; Gravel Base
HOT MIX ASPHALT (HMA) PAVEMENT							
5-04	SPECIAL	PAVEMENT, HMA (CL 3/8 IN), 2" IN		SY	$14.00	$0.00	For placement of CL 3/8" HMA 2" depth. Includes all work related to HMA placement.
5-04	SPECIAL	PAVEMENT, HMA (CL 1/2 IN), 4" IN		SY	$26.00	$0.00	For placement of CL 1/2" HMA 4" depth. Includes all work related to HMA placement.
5-04	SPECIAL	PAVEMENT, HMA (CL 3/4 IN), 6" IN		SY	$40.00	$0.00	For placement of CL 3/4" HMA 6" depth. Includes all work related to HMA placement.
CEMENT CONCRETE FOR ROADWAY							
5-05	505076	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 6 IN		SY	$78.00	$0.00	
5-05	505078	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 8 IN		SY	$82.00	$0.00	
5-05	505080	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 10 IN		SY	$90.00	$0.00	
5-05	505082	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 12 IN		SY	$105.00	$0.00	
CONCRETE STRUCTURES (TUNNEL SHAFTS, ETC)							
6-02	SPECIAL	CONCRETE FOR SLABS & FOOTINGS (INCL FORMS & REBAR)		CY	$500.00	$0.00	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
6-02	SPECIAL	CONCRETE WALLS & COULUMNS (INCL FORMS & REBAR)		CY	$1,050.00	$0.00	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
6-02	SPECIAL	CONCRETE ELEVATED SLABS & BEAMS (INCL FORMS & REBAR)		CY	$1,300.00	$0.00	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
MANHOLES, CATCH BASINS AND INLETS							
7-05	705200	MANHOLE, TYPE 200A (48" DIAMETER, W/ REDUCER TOP)		EA	$3,700.00	$0.00	Spec Sect 7-05; Up to 10' depth
7-05	705201	MANHOLE, TYPE 201A (54" DIAMETER, W/ REDUCER TOP)		EA	$4,000.00	$0.00	Spec Sect 7-05; Up to 10' depth
7-05	705202	MANHOLE, TYPE 202A (72" DIAMETER, W/ REDUCER TOP)		EA	$7,000.00	$0.00	Spec Sect 7-05; Up to 10' depth
7-05	705203	MANHOLE, TYPE 203A (84" DIAMETER, W/ REDUCER TOP)		EA	$10,800.00	$0.00	Spec Sect 7-05; Up to 10' depth
7-05	705204	MANHOLE, TYPE 204A (96" DIAMETER, W/ REDUCER TOP)		EA	$15,200.00	$0.00	Spec Sect 7-05; Up to 10' depth
7-05	705205	MANHOLE, TYPE 205A (120" DIAMETER, W/ REDUCER TOP)		EA	$23,900.00	$0.00	Spec Sect 7-05; Up to 10' depth
7-05	705206	MANHOLE, TYPE 206A (144" DIAMETER, W/ REDUCER TOP)		EA	$27,100.00	$0.00	Spec Sect 7-05; Up to 10' depth
7-05	705230	EXTRA DEPTH, TYPE 200A MANHOLE		VLF	$270.00	$0.00	Spec Sect 7-05; Add for depth greater than 10'
7-05	705231	EXTRA DEPTH, TYPE 201A MANHOLE		VLF	$290.00	$0.00	Spec Sect 7-05; Add for depth greater than 10'

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
7-05	705232	EXTRA DEPTH, TYPE 202A MANHOLE		VLF	$330.00	$0.00	Spec Sect 7-05; Add for depth greater than 10'
7-05	705233	EXTRA DEPTH, TYPE 203A MANHOLE		VLF	$490.00	$0.00	Spec Sect 7-05; Add for depth greater than 10'
7-05	705234	EXTRA DEPTH, TYPE 204A MANHOLE		VLF	$600.00	$0.00	Spec Sect 7-05; Add for depth greater than 10'
7-05	705235	EXTRA DEPTH, TYPE 205A MANHOLE		VLF	$920.00	$0.00	Spec Sect 7-05; Add for depth greater than 10'
7-05	705352	CATCH BASIN, TYPE 240A (48" DIAMETER, W/ REDUCER TOP)		EA	$2,800.00	$0.00	Spec Sect 7-05
7-05	705353	CATCH BASIN, TYPE 240B (48" DIAMETER, W/ SLAB TOP)		EA	$2,800.00	$0.00	Spec Sect 7-05
7-05	705354	CATCH BASIN, TYPE 241 (2.67' x 2.33' SECTION)		EA	$1,700.00	$0.00	Spec Sect 7-05
7-05	705355	CATCH BASIN, TYPE 242A (42" DIAMETER, W/ REDUCER TOP)		EA	$2,700.00	$0.00	Spec Sect 7-05
7-05	705356	CATCH BASIN, TYPE 242B (42" DIAMETER, W/ CURB CAST FLUSH)		EA	$2,700.00	$0.00	Spec Sect 7-05
7-05	705360	EXTRA DEPTH, CATCH BASIN		VF	$270.00	$0.00	Spec Sect 7-05
DIVERSION STRUCTURES							
SPECIAL	SPECIAL	DIVERSION STRUCTURE, 54 IN		EA	$29,000.00	$0.00	Payment includes all work require to install diversion structure, lining, and outlet/inlet connection piping.
SPECIAL	SPECIAL	DIVERSION STRUCTURE, 72 IN		EA	$36,000.00	$0.00	Payment includes all work require to install diversion structure, lining, and outlet/inlet connection piping.
SPECIAL	SPECIAL	DIVERSION STRUCTURE, 96 IN		EA	$55,000.00	$0.00	Payment includes all work require to install diversion structure, lining, and outlet/inlet connection piping.
SPECIAL	SPECIAL	DIVERSION STRUCTURE, 120 IN		EA	$92,000.00	$0.00	Payment includes all work require to install diversion structure, lining, and outlet/inlet connection piping.
SPECIAL	SPECIAL	DIVERSION STRUCTURE, 144 IN		EA	$110,000.00	$0.00	Payment includes all work require to install diversion structure, lining, and outlet/inlet connection piping.
SPECIAL	SPECIAL	FIXED GATE (WIER AND MANUAL CONTROL)		EA	$15,000.00	$0.00	Includes concrete allowance for fixed weir system in diversion structure
SPECIAL	SPECIAL	AUTOMATIC GATE & CONTROLS		EA	$35,000.00	$0.00	Includes slide gate, stem, guides, additional concrete, power, and controls.
STORM DRAINS AND SANITARY SEWERS							
	MICROTUNNEL AND BORE & JACK						
7-17.3(J)	SPECIAL	SHAFT EXCAVATION	1630	CY	$24.00	$39,111.11	As per payment outlined in spec section 7-17.5 but for excavation only. Required for EIS report needs.
7-17.3(J)	SPECIAL	HAUL AND WASTE (SHAFT & TUNNEL SPOILS)	1630	CY	$25.00	$40,740.74	As per payment outlined in spec section 7-17.5 but for haul and waste of spoils only. Required for EIS report needs.
7-17.3(J)	SPECIAL	NATIVE BACKFILL IN SHAFT		CY	$10.00	$0.00	As per payment outlined in spec section 7-17.5 but for native backfill only. Required for EIS report needs.
7-17.3(J)	SPECIAL	IMPORTED BACKFILL IN SHAFT	1578	CY	$45.00	$71,016.40	As per payment outlined in spec section 7-17.5 but for imported backfill only. Required for EIS report needs.
7-17.3(J)	SPECIAL	DEWATERING PER SHAFT (MINIMAL)	2	EA	$20,000.00	$40,000.00	Dewatering allowance at each of the jacking and receiving shafts. Enter the total number of shafts used including any intermediate shafts.
7-17.3(J)	SPECIAL	DEWATERING PER SHAFT (SIGNIFIGANT)		EA	$30,000.00	$0.00	Dewatering allowance at each of the jacking and receiving shafts. Enter the total number of shafts used including any intermediate shafts. Bore and jacking operation will not work in areas with significant dewatering needs.
SPECIAL	SPECIAL	ADDER FOR AVERAGE UTILITY CONFLICTS AT SHAFTS	1000	SF	$10.00	$10,000.00	Allowance paid per square foot of shaft horizontal area for conflicts with existing utilities at excavation. Includes some relocations, utility support, replacement of bedding, etc.

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
SPECIAL	SPECIAL	ADDER FOR COMPLEX UTILITY CONFLICTS AT SHAFTS		SF	$20.00	$0.00	Allowance paid per square foot of shaft horizontal area for conflicts with existing utilities at excavation. Includes some relocations, utility support, replacement of bedding, etc.
2-07	SPECIAL	SHEET PILE SHORING FOR SHAFTS, UP TO 25 FT DEPTH	8400	SF	$30.00	$252,000.00	Paid by the SF of exposed face to engineer, place and remove shoring.
2-07	SPECIAL	SOLDIER PILE SHORING FOR SHAFTS, UP TO 50 FT DEPTH		SF	$80.00	$0.00	Paid by the SF of exposed face to engineer, place and remove shoring.
2-07	SPECIAL	SLURRY WALLS FOR SHAFTS, GREATER THAN 50 FT DEEP		SF	$225.00	$0.00	Paid by the SF of exposed face to engineer, place and remove shoring. If shoring depth exceeds 75 ft deep then include total shoring SF for that shaft here.
7-17.3(J)	SPECIAL	MTBM FIXED COST, 12 IN DIA		LS	$147,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST, 15 IN DIA		LS	$184,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST, 18 IN DIA		LS	$218,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST, 21 IN DIA		LS	$255,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST, 24 IN DIA		LS	$294,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST, 30 IN DIA		LS	$363,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST, 36 IN DIA		LS	$434,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST, 42 IN DIA		LS	$505,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST, 48 IN DIA		LS	$576,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST, 54 IN DIA		LS	$652,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST 60 IN DIA		LS	$721,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST 66 IN DIA		LS	$792,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST 72 IN DIA		LS	$868,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST 84 IN DIA		LS	$1,010,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MTBM FIXED COST 96 IN DIA		LS	$1,154,000.00	$0.00	Includes procurement, shipping to site, assembly, and additional part/refurbishment of MTBM caused by tunneling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 12 IN DIA		LF	$670.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 15 IN DIA		LF	$700.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 18 IN DIA		LF	$720.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 21 IN DIA		LF	$750.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 24 IN DIA		LF	$810.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 30 IN DIA		LF	$870.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 36 IN DIA		LF	$1,020.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 42 IN DIA		LF	$1,130.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 48 IN DIA		LF	$1,300.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 54 IN DIA		LF	$1,470.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 60 IN DIA		LF	$1,700.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 66 IN DIA		LF	$1,860.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 72 IN DIA		LF	$2,110.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 84 IN DIA		LF	$2,640.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	MICROTUNNELING COST, 96 IN DIA		LF	$3,240.00	$0.00	Includes all costs for the tunnel and casing placement operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 12 IN DIA		LF	$300.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 15 IN DIA		LF	$370.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 18 IN DIA		LF	$450.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 21 IN DIA		LF	$520.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 24 IN DIA		LF	$600.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 30 IN DIA		LF	$780.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 36 IN DIA		LF	$940.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 42 IN DIA		LF	$1,090.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 48 IN DIA		LF	$1,300.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 54 IN DIA		LF	$1,470.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 60 IN DIA	942	LF	$1,620.00	$1,526,040.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 66 IN DIA		LF	$1,860.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 72 IN DIA		LF	$2,030.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 84 IN DIA		LF	$2,470.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 96 IN DIA		LF	$2,910.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 108 IN DIA		LF	$3,400.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
7-17.3(J)	SPECIAL	BORE & JACK COST, 120 IN DIA		LF	$4,040.00	$0.00	Includes all costs for the bore and jacking operation with the exception of spoils hauling.
	TUNNEL						
7-17.3(J)	SPECIAL	SHAFT EXCAVATION		CY	$24.00	$0.00	As per payment outlined in spec section 7-17.5 but for excavation only. Required for EIS report needs.
7-17.3(J)	SPECIAL	HAUL AND WASTE (SHAFT & TUNNEL SPOILS)		CY	$25.00	$0.00	As per payment outlined in spec section 7-17.5 but for haul and waste of spoils only. Required for EIS report needs.
7-17.3(J)	SPECIAL	NATIVE BACKFILL IN SHAFT		CY	$10.00	$0.00	As per payment outlined in spec section 7-17.5 but for native backfill only. Required for EIS report needs.
7-17.3(J)	SPECIAL	IMPORTED BACKFILL IN SHAFT		CY	$45.00	$0.00	As per payment outlined in spec section 7-17.5 but for imported backfill only. Required for EIS report needs.

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
7-17.3(J)	SPECIAL	DEWATERING FOR TUNNELING FIXED COST (STANDARD) UP TO 1000 FT		LS	$35,000.00	$0.00	Dewatering allowance for the tunnel operation for the 1st 1000 ft of tunneling. Includes pumping and treatment.
7-17.3(J)	SPECIAL	DEWATERING FOR TUNNELING (STANDARD) FOR EACH FT PAST 1000 FT		LF	$10.00	$0.00	Dewatering allowance for the tunnel operation past the first 1000 ft of tunneling. Includes pumping and treatment.
7-17.3(J)	SPECIAL	DEWATERING FOR TUNNELING FIXED COST (SIGNIFIGANT) UP TO 1000 FT		LS	$65,000.00	$0.00	Dewatering allowance for the tunnel operation for the 1st 1000 ft of tunneling. Includes pumping and treatment.
7-17.3(J)	SPECIAL	DEWATERING FOR TUNNELING (SIGNIFIGANT) FOR EACH FT PAST 1000 FT		LF	$50.00	$0.00	Dewatering allowance for the tunnel operation past the first 1000 ft of tunneling. Includes pumping and treatment.
SPECIAL	SPECIAL	ADDER FOR AVERAGE UTILITY CONFLICTS AT SHAFTS		SF	$10.00	$0.00	Allowance per square foot of shaft horizontal area for conflicts w/ existing utilities. Includes some relocations, utility support, replacement of bedding, etc.
SPECIAL	SPECIAL	ADDER FOR COMPLEX UTILITY CONFLICTS AT SHAFTS		SF	$20.00	$0.00	Allowance per square foot of shaft horizontal area for conflicts w/ existing utilities. Includes some relocations, utility support, replacement of bedding, etc.
2-07	SPECIAL	SOLDIER PILE SHORING FOR SHAFTS, UP TO 50 FT DEPTH		SF	$80.00	$0.00	Paid by the SF of exposed face to engineer, place and remove shoring.
2-07	SPECIAL	SLURRY WALLS FOR SHAFTS, GREATER THAN 50 FT DEEP		SF	$225.00	$0.00	Paid by the SF of exposed face to engineer, place and remove shoring. If shoring depth exceeds 75 ft deep then include total shoring SF for that shaft here.
7-17.3(J)	SPECIAL	TBM FIXED COST, 8 FT DIA		LS	$5,440,000.00	$0.00	Includes procurement, shipping, assembly, & additional parts/refurbishment of TBM caused by tunneling.
7-17.3(J)	SPECIAL	TBM FIXED COST, 9 FT DIA		LS	$6,040,000.00	$0.00	Includes procurement, shipping, assembly, & additional parts/refurbishment of TBM caused by tunneling.
7-17.3(J)	SPECIAL	TBM FIXED COST, 10 FT DIA		LS	$6,560,000.00	$0.00	Includes procurement, shipping, assembly, & additional parts/refurbishment of TBM caused by tunneling.
7-17.3(J)	SPECIAL	TBM FIXED COST, 11 FT DIA		LS	$7,000,000.00	$0.00	Includes procurement, shipping, assembly, & additional parts/refurbishment of TBM caused by tunneling.
7-17.3(J)	SPECIAL	TBM FIXED COST, 12 FT DIA		LS	$7,370,000.00	$0.00	Includes procurement, shipping, assembly, & additional parts/refurbishment of TBM caused by tunneling.
7-17.3(J)	SPECIAL	TBM FIXED COST, 13 FT DIA		LS	$7,670,000.00	$0.00	Includes procurement, shipping, assembly, & additional parts/refurbishment of TBM caused by tunneling.
7-17.3(J)	SPECIAL	TBM FIXED COST, 14 FT DIA		LS	$7,920,000.00	$0.00	Includes procurement, shipping, assembly, & additional parts/refurbishment of TBM caused by tunneling.
7-17.3(J)	SPECIAL	TBM FIXED COST, 15 FT DIA		LS	$8,100,000.00	$0.00	Includes procurement, shipping, assembly, & additional parts/refurbishment of TBM caused by tunneling.
7-17.3(J)	SPECIAL	TBM FIXED COST, 16 FT DIA		LS	$8,400,000.00	$0.00	Includes procurement, shipping, assembly, & additional parts/refurbishment of TBM caused by tunneling.
7-17.3(J)	SPECIAL	TBM FIXED COST, 18 FT DIA		LS	$8,900,000.00	$0.00	Includes procurement, shipping, assembly, & additional parts/refurbishment of TBM caused by tunneling.
7-17.3(J)	SPECIAL	TBM FIXED COST, 20 FT DIA		LS	$9,500,000.00	$0.00	Includes procurement, shipping, assembly, & additional parts/refurbishment of TBM caused by tunneling.
7-17.3(J)	SPECIAL	TBM FIXED COST, 22 FT DIA		LS	$10,480,000.00	$0.00	Includes procurement, shipping, assembly, & additional parts/refurbishment of TBM caused by tunneling.
7-17.3(J)	SPECIAL	TBM FIXED COST, 24 FT DIA		LS	$11,430,000.00	$0.00	Includes procurement, shipping, assembly, & additional parts/refurbishment of TBM caused by tunneling.
7-17.3(J)	SPECIAL	TUNNELING COST, 8 FT DIA		LF	$2,760.00	$0.00	Includes all costs for the tunneling operation with the exception of off site spoils hauling.
7-17.3(J)	SPECIAL	TUNNELING COST, 9 FT DIA		LF	$2,790.00	$0.00	Includes all costs for the tunneling operation with the exception of off site spoils hauling.
7-17.3(J)	SPECIAL	TUNNELING COST, 10 FT DIA		LF	$2,840.00	$0.00	Includes all costs for the tunneling operation with the exception of off site spoils hauling.

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
7-17.3(J)	SPECIAL	TUNNELING COST, 11 FT DIA		LF	$2,940.00	$0.00	Includes all costs for the tunneling operation with the exception of off site spoils hauling.
7-17.3(J)	SPECIAL	TUNNELING COST, 12 FT DIA		LF	$3,050.00	$0.00	Includes all costs for the tunneling operation with the exception of off site spoils hauling.
7-17.3(J)	SPECIAL	TUNNELING COST, 13 FT DIA		LF	$3,200.00	$0.00	Includes all costs for the tunneling operation with the exception of off site spoils hauling.
7-17.3(J)	SPECIAL	TUNNELING COST, 14 FT DIA		LF	$3,350.00	$0.00	Includes all costs for the tunneling operation with the exception of off site spoils hauling.
7-17.3(J)	SPECIAL	TUNNELING COST, 15 FT DIA		LF	$3,700.00	$0.00	Includes all costs for the tunneling operation with the exception of off site spoils hauling.
7-17.3(J)	SPECIAL	TUNNELING COST, 16 FT DIA		LF	$3,900.00	$0.00	Includes all costs for the tunneling operation with the exception of off site spoils hauling.
7-17.3(J)	SPECIAL	TUNNELING COST, 18 FT DIA		LF	$4,100.00	$0.00	Includes all costs for the tunneling operation with the exception of off site spoils hauling.
7-17.3(J)	SPECIAL	TUNNELING COST, 20 FT DIA		LF	$4,400.00	$0.00	Includes all costs for the tunneling operation with the exception of off site spoils hauling.
7-17.3(J)	SPECIAL	TUNNELING COST, 22 FT DIA		LF	$5,020.00	$0.00	Includes all costs for the tunneling operation with the exception of off site spoils hauling.
7-17.3(J)	SPECIAL	TUNNELING COST, 24 FT DIA		LF	$5,480.00	$0.00	Includes all costs for the tunneling operation with the exception of off site spoils hauling.

EROSION CONTROL

8-01	801005	TEMPORARY EROSION & SEDIMENT CONTROL	1	%	$1,978,908.26	$19,789.08	An allowance of TESC items for projects are calculated as 1% of other estimate pay items.

LANDSCAPE CONSTRUCTION

8-02	801160	TOPSOIL, TYPE A		CY	$50.00	$0.00	
8-02	801165	TOPSOIL, TYPE B		CY	$35.00	$0.00	
8-02	SPECIAL	LANDSCAPING - MINIMUM		SF	$1.00	$0.00	Allowance for hydroseeding with some minor planting beds with shrubs and bark mulch.
8-02	SPECIAL	LANDSCAPING - AVERAGE		SF	$5.00	$0.00	Planting allowance includes about 50% hydroseeding and 50% planting beds with shrubs and bark mulch.
8-02	SPECIAL	LANDSCAPING - HIGH END		SF	$10.00	$0.00	Planting allowance includes planting beds with shrubs, small trees and bark mulch.

IRRIGATION SYSTEM

8-03	SPECIAL	IRRIGATION SYSTEM		SF	$2.00	$0.00	Irrigation system for plantings, includes piping, controls, and spray heads.

CEMENT CONCRETE CURB, CURB AND GUTTER

8-04	804005	CURB, CEM CONC { QTY >= 1000 }		LF	$20.00	$0.00
8-04		{ QTY < 1000 }			$30.00	$0.00
8-04	804015	CURB AND GUTTER, CEM CONC		LF	$40.00	$0.00

EXTRUDED CURB

8-06	806005	CURB, EXTRUDED ASPHALT CONCRETE		LF	$15.00	$0.00
8-06	806010	CURB, EXTRUDED CEMENT CONCRETE		LF	$13.00	$0.00

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
PRECAST TRAFFIC CURB AND BLOCK TRAFFIC CURB							
8-07	807005	CURB, TRAFFIC, PRECAST		LF	$16.00	$0.00	
CHAIN LINK FENCE AND WIRE FENCE							
8-12		CHAIN LINK FENCE, TYPE 1		LF	$33.00	$0.00	Per Standard Plan 450a, Type 1
8-12	812012	CHAIN LINK GATE, DOUBLE 12 FT WIDE		EA	$1,300.00	$0.00	
8-12	812020	CHAIN LINK GATE, DOUBLE 20 FT WIDE		EA	$1,800.00	$0.00	
8-12	812026	CHAIN LINK GATE, SINGLE 6 FT WIDE		EA	$525.00	$0.00	
CEMENT CONCRETE SIDEWALKS							
8-14	814005	SIDEWALK, CEM CONC { QTY >= 500 }		SY	$45.00	$0.00	
8-14		{ QTY < 500 }			$65.00	$0.00	
8-14		CURB RAMP		EA	$1,500.00	$0.00	Per Standard Plan 422a
RIPRAP							
8-14	SPECIAL	QUARRY SPALLS / RIP RAP		CY	$70.00	$0.00	Machine place quarry spalls by CY not ton
CEMENT CONCRETE DRIVEWAY AND ALLEY RETURN							
8-19	819006	DRIVEWAY, CEM CONC, 6 IN		SY	$70.00	$0.00	
TRAFFIC SIGNAL SYSTEMS							
8-31	SPECIAL	TRAFFIC SIGNAL (4 WAY COMPLETE)		EA	$320,000.00	$0.00	For 4 way, 2 lanes each way intersection
8-31	SPECIAL	DETECTOR LOOP		EA	$1,000.00	$0.00	Complete cost to replace existing detector loop in roadway
SPECIAL ITEMS NOT ACCOUNTED FOR ELSEWHERE							Seek estimators help in pricing special line items
							For significant cost items not accounted for elsewhere.
		SUBTOTAL				**$2,218,554**	
		CONSTRUCTION SUBTOTAL (ROUNDED)				**$2,220,000**	

Trenchless Schedule Inputs	**QTY**	**Unit**	**Baseline Schedule Days**
TBM Procurement	0		0 days
Mobilization			10 days
Site Demolition $ value	0	$ value	0.0 days
Shaft Excavation	1,630	CY	9.0 days
Spoils Waste (Add 20% for Swell)	1,956	CY	
Shaft Backfill	1,578	CY	10.0 days
Amount of import backfill	1,578	CY	
Shaft Shoring (Sheet Piles)	8,400	SF	9.0 days
Shaft Shoring (Soldier Piles)	8,400	SF	17.0 days
Mobilization for Microtunnel/B&J	0	EA	0.0 days
Disassemble/Remove Equip	0	EA	0.0 days
Microtunnel/Bore & Jack 12" to 36"	0	LF	0.0 days
Microtunnel/Bore & Jack 42" to 60"	942	LF	19.0 days
Microtunnel/Bore & Jack 66" to 120"	0	LF	0.0 days
Mobilization/Assemble TBM	0	EA	0.0 days
Disassemble/Remove TBM	0	EA	0.0 days
Tunneling 8' to 10'	0	LF	0.0 days
Tunneling 11' to 15'	0	LF	0.0 days
Tunneling 16' to 24'	0	LF	0.0 days
Concrete Structures	0	CY	0.0 days
Manhole/Catch Basin 48" to 60"	0	EA	0.0 days
Manholes 72" to 84"	0	EA	0.0 days
Manholes 96" to 120"	0	EA	0.0 days
Manholes 144"	0	EA	0.0 days
Diversion Structure 48" to 60"	0	EA	0.0 days
Diversion Structure 72" to 84"	0	EA	0.0 days
Diversion Structure 96" to 120"	0	EA	0.0 days
Diversion Structure 144"	0	EA	0.0 days
Control Structure Fixed Gate	0	EA	0.0 days
Control Structure Automatic Gate	0	EA	0.0 days
Comissioning	10	%	7.0 days
Site Restoration $ value	0	$ value	0.0 days
De-mobilization and punch list			15 days

Pipeline Schedule	**Baseline**	**Medium**	**Hard**	**$ Value**
TBM Procurement	0 days	0 days	0 days	$0
Mobilization	10 days	10 days	10 days	$111,927
Site demo/prep	0 days	0 days	0 days	$0
Shaft Excavation	26 days	34 days	39 days	$83,070
Mob/Assemble Equip to Site	0 days	0 days	0 days	$0
Tunneling	19 days	25 days	29 days	$1,901,710
Disassemble/Remove Equip to Site	0 days	0 days	0 days	$0
Shaft Backfill	10 days	13 days	15 days	$73,878
Concrete Structures	0 days	0 days	0 days	$0
Control Structures & Manholes	0 days	0 days	0 days	$0
Commissioning/Testing/Disinfection	7 days	9 days	11 days	
Site restoration	0 days	0 days	0 days	$0
Demobilization	15 days	15 days	15 days	$47,969
				$2,218,554

Schedule Values

Baseline	Baseline schedule values assumes standard production with no difficulties
Medium	Task takes 30% longer due to site restrictions such as access, traffic control, ground conditions
Hard	Task takes 50% longer due to site restrictions such as access, traffic control, ground conditions

Manhour Calculations

Total Manhours for the schedule items	3,800	MHs
Add 100% for foreman, site supervision, misc other site items, cleanup, etc.	3800	MHs
Baseline Total Number of Man Hours	7600	
Medium Total Number of Man Hours	9259.77	
Hard Total Number of Man Hours	10395.4	

Truck Trips

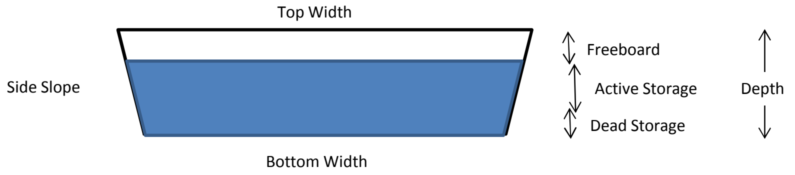
Raw/Base Truck Trips over project life	390
Add 50% for pipes, shoring items, other items	195
Total Truck Trips during entire project	585

Equipment Hours

Piledriving/Shoring Equipment Hours	360
Add 50% total hours	180
Baseline Total Piledriving Equipment hours	540
Medium Total Piledriving Equipment hours	658
Hard Total Piledriving Equipment hours	739
Earthwork Equipment Hours (Excavator, dozer, loader, etc)	440
Add 50% total hours	220
Baseline Total Earthwork Equipment hours	660
Medium Total Earthwork Equipment hours	804
Hard Total Earthwork Equipment hours	903
Lifting/Pumping Equipment Hours (Cranes, concrete pump, forklift, etc)	288
Add 50% total hours	144
Baseline Total Lifting/Pumping Equipment hours	432
Medium Total Lifting/Pumping Equipment hours	526
Hard Total Lifting/Pumping Equipment hours	591

Model Inputs

Project Type:
Open Pond Facility



Pond Inputs						
Bottom Length	320	ft				
Bottom Width	65	ft				
Freeboard	2	ft				
Dead Storage	4	ft				
Active Storage	4	ft				
Side Slope	0.5	:1 (V:H)				
Perimeter Rd width	12	ft				
Perimeter Fence Length	970	lf				
Pond Outputs						
Depth	10	ft				
Top Width	105	ft				
Top Length	360	ft				
Width at Active Storage Level	97	ft				
Length at Active Storage Level	352	ft				
Basin Excavation	288,800	Cu. Ft	Frustrum of Pyramid V=d/3*(A1+(A1xA2)^0.5+A2)	A1 = Area of Bottom Surface (Bottom Length x Bottom Width)	A2 = Area of Top Surface (Top Length x Top Width)	d = Distance between Surfaces (Depth)
Basin Storage	217,583	Cu. Ft				
Basin Storage	5.00	Acre-Ft				
Basin Storage	1,627,631	Gallons				
Surface Area	29,300	Sq. Ft	Includes Bottom			
Perimeter Road (SF)	9,240	Sq. Ft				
Seperation Berm			Berm top is even with top of active storage			
Berm Top width	6	ft	Based on Norfolk			
Side Slope	0.5	:1 (V:H)	Based on Norfolk			
Berm Bottom width	38	ft				
Berm Volume	11,336	Cu. Ft	Frustrum of Pyramid V=d/3*(A1+(A1xA2)^0.5+A2)	A1 = Area of Bottom Surface (Bottom Length x Bottom Width)	A2 = Area of Top Surface (Top Length x Top Width)	d = Distance between Surfaces (Depth)
Quarry Spall Slope Protection	1,878	Sq. Ft				

Landscaping				
Parcel Size		Sq. Ft	-	AC
Clear and Grub	130,680	Sq. Ft	3.00	AC
Topsoil Cover Area		Sq. Ft	0	CY
Topsoil Depth		Inches		
Landscaping - Mimimum	130,680	Sq. Ft	3.00	AC
Landscaping - Average	43,560	Sq. Ft	1.00	AC
Landscaping - High End		Sq. Ft	-	AC

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)
Cost Estimate Elements:
Pond Storage

Takeoff By:
Estimate By:
Date:
Rev:
Rev:
Rev:

Tool Revision: Ver 3, edited 4/18/13

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
MEASUREMENT AND PAYMENT							
1-09	109005	MOBILIZATION	8	%	$881,936.58	$70,554.93	Use 8% of total below
TEMPORARY TRAFFIC CONTROL							
1-10	110005	MAINTENANCE AND PROTECTION OF TRAFFIC CONTROL	3	%	$881,936.58	$26,458.10	Use Light traffic control (TC) use 3%, for Moderate TC use 5% and for Heavy TC use 8%, based on WSDOT project cost analysis for Columbia River Crossing.
CLEARING, GRUBBING AND ROADSIDE CLEANUP							
2-01	201005	CLEARING & GRUBBING	130680	SY	$0.25	$32,670.00	
REMOVAL OF STRUCTURES AND OBSTRUCTIONS							
2-02	202035	REMOVE CEM CONC SIDEWALK { QTY >= 1000 }		SY	$15.00	$0.00	
2-02		1000 }		SY	$22.00	$0.00	
2-02	202045	REMOVE PAVEMENT { QTY >= 1000 }		SY	$15.00	$0.00	
2-02		{ 200 <= QTY < 1000 }		SY	$20.00	$0.00	
2-02		{ QTY < 200 }		SY	$32.00	$0.00	
2-02	202055	REMOVE PAVEMENT, REINFORCED CONCRETE		SY	$40.00	$0.00	
2-02	202170	REMOVE FENCE, CHAIN LINK		LF	$8.00	$0.00	
2-02	202270	REMOVE CATCH BASIN		EA	$650.00	$0.00	
2-02	202805	ABANDON CATCH BASIN		EA	$315.00	$0.00	
2-02	202820	ABANDON MANHOLE		EA	$620.00	$0.00	
2-02	202850	ABANDON AND FILL PIPE		LF	$15.00	$0.00	
2-03	SPECIAL	BUILDING DEMOLITION		SF	$10.00	$0.00	Includes cost to demo and waste building. Include the SF from each floor for the total SF quantity.
STRUCTURAL EXCAVATION							
2-04	203005	COMMON EXCAVATION { QTY >= 500 }	10696	CY	$35.00	$374,370.25	Includes Haul & Waste; Do not use for trench excavation. Trench excavation for pipes is located in pipe cost section.
2-04		{ QTY < 500 }			$45.00	$0.00	
2-04	203010	SOLID ROCK EXCAVATION		CY	$90.00	$0.00	
2-04	203130	UNSUITABLE FOUNDATION EXCAVATION		CY	$40.00	$0.00	
2-04	209005	STRUCTURE EXCAVATION		CY	$40.00	$0.00	
2-07	SPECIAL	SHEET PILE SHORING FOR STRUCTURE		SF	$30.00	$0.00	Paid by the SF of exposed face to engineer, place and remove shoring.
2-07	SPECIAL	SOLDIER PILE SHORING WITH TIE-BACKS FOR STRUCTURE		SF	$80.00	$0.00	Paid by the SF of exposed face to engineer, place and remove shoring.
CONSTRUCTION GEOTEXTILE							
2-15	SPECIAL	CONSTRUCTION GEOTEXTILE	1878	SY	$2.00	$3,756.00	All Geotextile types and applications except for silt fence which is covered by the TESC allowance

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
STRUCTURAL & ROADWAY MINERAL AGGREGATES							For trench backfill see section 7-17
4-01	401201	MINERAL AGGREGATE, TYPE 1		CY	$65.00	$0.00	Spec Sect 4-04; Crushed Surfacing
4-01	401202	MINERAL AGGREGATE, TYPE 2		CY	$65.00	$0.00	Spec Sect 4-04; Base Course
4-01	401217	MINERAL AGGREGATE, TYPE 17 { QTY >= 2000 }		CY	$34.00	$0.00	Spec Sect 4-04; Gravel Base
4-01		{ 200 <= QTY < 2000 }	420	CY	$40.00	$16,793.97	Spec Sect 4-04; Gravel Base
4-01		{ QTY < 200 }		CY	$46.00	$0.00	Spec Sect 4-04; Gravel Base
HOT MIX ASPHALT (HMA) PAVEMENT							
5-04	SPECIAL	PAVEMENT, HMA (CL 3/8 IN), 2" IN		SY	$14.00	$0.00	For placement of CL 3/8" HMA 2" depth. Includes all work related to HMA placement.
5-04	SPECIAL	PAVEMENT, HMA (CL 1/2 IN), 4" IN	500	SY	$26.00	$13,000.00	For placement of CL 1/2" HMA 4" depth. Includes all work related to HMA placement.
5-04	SPECIAL	PAVEMENT, HMA (CL 3/4 IN), 6" IN		SY	$40.00	$0.00	For placement of CL 3/4" HMA 6" depth. Includes all work related to HMA placement.
CEMENT CONCRETE FOR ROADWAY							
5-05	505076	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 6 IN		SY	$78.00	$0.00	
5-05	505078	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 8 IN		SY	$82.00	$0.00	
5-05	505080	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 10 IN		SY	$90.00	$0.00	
5-05	505082	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 12 IN		SY	$105.00	$0.00	
MANHOLES, CATCH BASINS AND INLETS							
These items should appear on Pipe Estimate Cost Sheet							
OVERFLOW STRUCTURE							
SPECIAL	SPECIAL	SWIRL CONCETRATOR, VORTECH MDL 4000		EA	$45,000.00	$0.00	Payment includes all work require to install structure, lining, and outlet/inlet connection piping.
SPECIAL	SPECIAL	OVERFLOW STRUCTURE, 54 IN	1	EA	$29,000.00	$29,000.00	Payment includes all work require to install structure, lining, and outlet/inlet connection piping.
SPECIAL	SPECIAL	OVERFLOW STRUCTURE, 72 IN		EA	$36,000.00	$0.00	Payment includes all work require to install structure, lining, and outlet/inlet connection piping.
STORM DRAINS AND SANITARY SEWERS							
These items should appear on Pipe Estimate Cost Sheet							
EROSION CONTROL							
8-01	801005	TEMPORARY EROSION & SEDIMENT CONTROL	3	%	$856,249.11	$25,687.47	An allowance of TESC items for these types of project are calculated as 3% of other estimate pay items.
LANDSCAPE CONSTRUCTION							
8-02	801160	TOPSOIL, TYPE A		CY	$50.00	$0.00	
8-02	801165	TOPSOIL, TYPE B		CY	$35.00	$0.00	
8-02	SPECIAL	LANDSCAPING - MINIMUM	130680	SF	$1.00	$130,680.00	Allowance for hydroseeding with some minor planting beds with shrubs and bark mulch.
8-02	SPECIAL	LANDSCAPING - AVERAGE	43560	SF	$5.00	$217,800.00	Planting allowance includes about 50% hydroseeding and 50% planting beds with shrubs and bark mulch.
8-02	SPECIAL	LANDSCAPING - HIGH END	0	SF	$10.00	$0.00	Planting allowance includes planting beds with shrubs, small trees and bark mulch.

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
IRRIGATION SYSTEM							
8-03	SPECIAL	IRRIGATION SYSTEM		SF	$2.00	$0.00	Irrigation system for plantings, includes piping, controls, and spray heads.
CEMENT CONCRETE CURB, CURB AND GUTTER							
8-04	804005	CURB, CEM CONC { QTY >= 1000 }		LF	$20.00	$0.00	
8-04		{ QTY < 1000 }			$30.00	$0.00	
8-04	804015	CURB AND GUTTER, CEM CONC		LF	$40.00	$0.00	
EXTRUDED CURB							
8-06	806005	CURB, EXTRUDED ASPHALT CONCRETE		LF	$15.00	$0.00	
8-06	806010	CURB, EXTRUDED CEMENT CONCRETE		LF	$13.00	$0.00	
PRECAST TRAFFIC CURB AND BLOCK TRAFFIC CURB							
8-07	807005	CURB, TRAFFIC, PRECAST		LF	$16.00	$0.00	
CHAIN LINK FENCE AND WIRE FENCE							
8-12		CHAIN LINK FENCE, TYPE 1	970	LF	$33.00	$32,010.00	Per Standard Plan 450a, Type 1
8-12	812012	CHAIN LINK GATE, DOUBLE 12 FT WIDE	1	EA	$1,300.00	$1,300.00	
8-12	812020	CHAIN LINK GATE, DOUBLE 20 FT WIDE		EA	$1,800.00	$0.00	
8-12	812026	CHAIN LINK GATE, SINGLE 6 FT WIDE		EA	$525.00	$0.00	
CEMENT CONCRETE SIDEWALKS							
8-14	814005	SIDEWALK, CEM CONC { QTY >= 500 }		SY	$45.00	$0.00	
8-14		{ QTY < 500 }			$65.00	$0.00	
8-14		CURB RAMP, TYPE 442a		EA	$1,500.00	$0.00	Per Standard Plan 422a
RIPRAP							
8-14	SPECIAL	QUARRY SPALLS / RIP RAP	70	CY	$70.00	$4,868.89	Machine place quarry spalls by CY not ton
CEMENT CONCRETE DRIVEWAY AND ALLEY RETURN							
8-19	819006	DRIVEWAY, CEM CONC, 6 IN		SY	$70.00	$0.00	
TRAFFIC SIGNAL SYSTEMS							
8-31	SPECIAL	TRAFFIC SIGNAL (4 WAY COMPLETE)		EA	$320,000.00	$0.00	For 4 way, 2 lanes each way intersection
8-31	SPECIAL	DETECTOR LOOP		EA	$1,000.00	$0.00	Complete cost to replace existing detector loop in roadway
SPECIAL ITEMS NOT ACCOUNTED FOR ELSEWHERE							Seek estimators help in pricing special line items
							For significant cost items not accounted for elsewhere.
		SUBTOTAL				**$978,950**	
		CONSTRUCTION SUBTOTAL (ROUNDED)				**$980,000**	

Storage Pond Schedule Inputs	**QTY**	**Unit**	**Baseline Schedule Days**
Mobilization			10 days
Site Demolition $ value	0	$ value	0.0 days
Demo Waste	0	CY	
Pond Excavation	10,696	CY	27.0 days
Spoils Waste (add 20% for swell)	12,836	CY	
Import Backfill & Bedding	420	CY	3.0 days
Special Structures	1	EA	2.0 days
Comissioning	5	%	2.0 days
Concrete Pavement Restoration	0	SY	0.0 days
HMA Pavement Restoration	500	SY	2.0 days
Site Restoration $ value	38,179	$ value	4.0 days
De-mobilization and punch list			15 days

Storage Pond Schedule	**Baseline**	**Medium**	**Hard**	**$ Value**
Mobilization	10 days	10 days	10 days	$49,388
Site demo/prep	0 days	0 days	0 days	$34,660
Pond Excavation & Backfill	30 days	39 days	45 days	$418,971
Control Structures & Manholes	2 days	3 days	3 days	$30,766
Commissioning	2 days	3 days	3 days	
Pavement Restoration	2 days	3 days	3 days	$13,792
Site restoration	4 days	5 days	6 days	$410,206
Demobilization	15 days	15 days	15 days	$21,166
				$978,949

Schedule Values	
Baseline	Baseline schedule values assumes standard production with no difficulties
Medium	Task takes 30% longer due to site restrictions such as access, traffic control, ground conditions
Hard	Task takes 50% longer due to site restrictions such as access, traffic control, ground conditions

Manhour Calculations

Total Manhours for the schedule items	1,804	MHs
Add 100% for foreman, site supervision, misc other site items, cleanup, etc.	1804	MHs
Baseline Total Number of Man Hours	3608	
Medium Total Number of Man Hours	4329.6	
Hard Total Number of Man Hours	4718.154	

Truck Trips

Raw/Base Truck Trips over project life	854
Add 50% for pipes, shoring items, other items	427
Total Truck Trips during entire project	1,281

Equipment Hours

Piledriving/Shoring Equipment Hours	0
Add 50% total hours	0
Baseline Total Piledriving Equipment hours	0
Medium Total Piledriving Equipment hours	0
Hard Total Piledriving Equipment hours	0
Earthwork Equipment Hours (Excavator, dozer, loader, etc)	312
Add 50% total hours	156
Baseline Total Earthwork Equipment hours	468
Medium Total Earthwork Equipment hours	562
Hard Total Earthwork Equipment hours	612
Lifting/Pumping Equipment Hours (Cranes, concrete pump, forklift, etc)	0
Add 50% total hours	0
Baseline Total Lifting/Pumping Equipment hours	0
Medium Total Lifting/Pumping Equipment hours	0
Hard Total Lifting/Pumping Equipment hours	0

Model Inputs

Project Type:
Water Quality Vaults Facility

Water Quality Inputs		
Total Water for treatment	7,000	gpm

Vault Quantities	**# of vaults used**		**# of 18" dia cartridges**	**Water Volume treated by each Vault (gpm)**	**Total Volume (gpm)**	
6'x12' Vault	0	ea	11	82	0	
6'x16' Vault	0	ea	19	142	0	
8'x16' Vault	9	ea	39	292	2,628	
8'x18' Vault	4	ea	44	330	1,320	
8'x20' Vault	4	ea	51	382	1,528	
8'x24' Vault	5	ea	61	457	2,285	
					7,761	Total volume treated by all vaults
					-761	Remaining volume to be treated from user input, adjust vault quantities till value is zero or less

Vault Take offs	**# of vaults from above**	**Surface Area (SF)**	**Excavation (CY)**	**Waste (CY)**	**Imported Backfill (CY)**	**Shoring (SF)**	
6'x12' Vault	0	0	0	0	0	0	
6'x16' Vault	0	0	0	0	0	0	
8'x16' Vault	9	2,772	1,129	1,129	772	7,128	
8'x18' Vault	4	1,344	548	548	370	3,344	
8'x20' Vault	4	1,456	593	593	397	3,520	
8'x24' Vault	5	2,100	856	856	564	4,840	
		7,672	**3,126**	**3,126**	**2,104**	**18,832**	

Vault take off based on vertical shoring, 6' internal hgt, 12" base course under vault and 4' cover over top.

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)
Cost Estimate Elements:
Water Quality Vaults

Takeoff By:
Estimate By:
Date:
Rev:
Rev:
Rev:

Tool Revision: Ver 3, edited 4/18/13

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
MEASUREMENT AND PAYMENT							
1-09	109005	MOBILIZATION	8	%	$2,263,317.68	$181,065.41	Use 8% of total below
TEMPORARY TRAFFIC CONTROL							
1-10	110005	MAINTENANCE AND PROTECTION OF TRAFFIC CONTROL	5	%	$2,263,317.68	$113,165.88	Use Light traffic control (TC) use 3%, for Moderate TC use 5% and for Heavy TC use 8%, based on WSDOT project cost analysis for Columbia River Crossing.
CLEARING, GRUBBING AND ROADSIDE CLEANUP							
2-01	201005	CLEARING & GRUBBING		SF	$1.00	$0.00	
REMOVAL OF STRUCTURES AND OBSTRUCTIONS							
2-02	202035	REMOVE CEM CONC SIDEWALK { QTY >= 1000 }		SY	$15.00	$0.00	
2-02		1000 }		SY	$22.00	$0.00	
2-02	202045	REMOVE PAVEMENT { QTY >= 1000 }		SY	$15.00	$0.00	
2-02		{ 200 <= QTY < 1000 }		SY	$20.00	$0.00	
2-02		{ QTY < 200 }		SY	$32.00	$0.00	
2-02	202055	REMOVE PAVEMENT, REINFORCED CONCRETE		SY	$40.00	$0.00	
2-02	202170	REMOVE FENCE, CHAIN LINK		LF	$8.00	$0.00	
2-02	202270	REMOVE CATCH BASIN		EA	$650.00	$0.00	
2-02	202805	ABANDON CATCH BASIN		EA	$315.00	$0.00	
2-02	202820	ABANDON MANHOLE		EA	$620.00	$0.00	
2-02	202850	ABANDON AND FILL PIPE		LF	$15.00	$0.00	
2-03	SPECIAL	BUILDING DEMOLITION		SF	$10.00	$0.00	Includes cost to demo and waste building. Include the SF from each floor for the total SF quantity.
STRUCTURAL EXCAVATION							
2-04	203005	COMMON EXCAVATION { QTY >= 500 }		CY	$35.00	$0.00	Do not use for trench excavation. Trench excavation for pipes is located in pipe cost section. Includes Haul and Waste.
2-04		{ QTY < 500 }			$45.00	$0.00	
2-04	203010	SOLID ROCK EXCAVATION		CY	$90.00	$0.00	Includes Haul and Waste.
2-04	203130	UNSUITABLE FOUNDATION EXCAVATION		CY	$40.00	$0.00	Includes Haul and Waste.
2-04	209005	STRUCTURE EXCAVATION	3126	CY	$40.00	$125,025.19	Includes Haul and Waste.
2-07	SPECIAL	SHORING OTHER	18832	SF	$1.25	$23,540.00	
2-07	SPECIAL	SAFETY SYST. FOR TRENCH EXCAV, SLIDE RAIL/SHEETS & JACKING	18832	SF	$10.00	$188,320.00	Paid per Spec Sect 2-07; includes steel sheets with jacking on both sides of trench.
2-07	SPECIAL	SHEET PILE SHORING FOR STRUCTURE		SF	$30.00	$0.00	Paid by the SF of exposed face to engineer, place and remove shoring.
2-07	SPECIAL	SOLDIER PILE SHORING WITH TIE-BACKS FOR STRUCTURE		SF	$80.00	$0.00	Paid by the SF of exposed face to engineer, place and remove shoring.

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
CONSTRUCTION GEOTEXTILE							
2-15	SPECIAL	CONSTRUCTION GEOTEXTILE		SY	$2.00	$0.00	All Geotextile types and applications except for silt fence which is covered by the TESC allowance
STRUCTURAL & ROADWAY MINERAL AGGREGATES							For trench backfill see section 7-17
4-01	401201	MINERAL AGGREGATE, TYPE 1		CY	$65.00	$0.00	Spec Sect 4-04; Crushed Surfacing
4-01	401202	MINERAL AGGREGATE, TYPE 2		CY	$65.00	$0.00	Spec Sect 4-04; Base Course
4-01	401217	MINERAL AGGREGATE, TYPE 17 { QTY >= 2000 }	2104	CY	$34.00	$71,523.41	Spec Sect 4-04; Gravel Base
4-01		{ 200 <= QTY < 2000 }		CY	$40.00	$0.00	Spec Sect 4-04; Gravel Base
4-01		{ QTY < 200 }		CY	$46.00	$0.00	Spec Sect 4-04; Gravel Base
HOT MIX ASPHALT (HMA) PAVEMENT							
5-04	SPECIAL	PAVEMENT, HMA (CL 3/8 IN), 2" IN		SY	$14.00	$0.00	For placement of CL 3/8" HMA 2" depth. Includes all work related to HMA placement.
5-04	SPECIAL	PAVEMENT, HMA (CL 1/2 IN), 4" IN		SY	$26.00	$0.00	For placement of CL 1/2" HMA 4" depth. Includes all work related to HMA placement.
5-04	SPECIAL	PAVEMENT, HMA (CL 3/4 IN), 6" IN		SY	$40.00	$0.00	For placement of CL 3/4" HMA 6" depth. Includes all work related to HMA placement.
CEMENT CONCRETE FOR ROADWAY							
5-05	505076	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 6 IN		SY	$78.00	$0.00	
5-05	505078	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 8 IN		SY	$82.00	$0.00	
5-05	505080	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 10 IN		SY	$90.00	$0.00	
5-05	505082	PAVEMENT, CEM CONC CL 6.5 (1-1/2), 12 IN		SY	$105.00	$0.00	
CONCRETE STRUCTURES (ADDITION VAULT FOUNDATIONS, ETC)							
6-02	SPECIAL	CONCRETE FOR SLABS & FOOTINGS (INCL FORMS & REBAR)		CY	$500.00	$0.00	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
6-02	SPECIAL	CONCRETE WALLS & COULUMNS (INCL FORMS & REBAR)		CY	$1,050.00	$0.00	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
6-02	SPECIAL	CONCRETE ELEVATED SLABS & BEAMS (INCL FORMS & REBAR)		CY	$1,300.00	$0.00	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
MANHOLES, CATCH BASINS AND INLETS							
These items should appear on Pipe Estimate Cost Sheet							

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
WATER QUALITY STRUCTURE							
SPECIAL	SPECIAL	SWIRL CONCETRATOR, VORTECH MDL 4000		EA	$45,000.00	$0.00	Payment includes all work require to install structure, lining, and outlet/inlet connection piping.
SPECIAL	SPECIAL	6'x12' VAULT, (11) 18" DIA CARTRIDGES	0	EA	$22,000.00	$0.00	
SPECIAL	SPECIAL	6'x16' VAULT, (19) 18" DIA CARTRIDGES	0	EA	$36,000.00	$0.00	
SPECIAL	SPECIAL	8'x16' VAULT, (39) 18" DIA CARTRIDGES	9	EA	$69,500.00	$625,500.00	
SPECIAL	SPECIAL	8'x18' VAULT, (44) 18" DIA CARTRIDGES	4	EA	$78,000.00	$312,000.00	
SPECIAL	SPECIAL	8'x20' VAULT, (51) 18" DIA CARTRIDGES	4	EA	$90,000.00	$360,000.00	
SPECIAL	SPECIAL	8'x24' VAULT, (61) 18" DIA CARTRIDGES	5	EA	$107,000.00	$535,000.00	
STORM DRAINS AND SANITARY SEWERS							
These items should appear on Pipe Estimate Cost Sheet							
EROSION CONTROL							
8-01	801005	TEMPORARY EROSION & SEDIMENT CONTROL	1	%	$2,240,908.59	$22,409.09	An allowance of TESC items for these types of project are calculated as 3% of other estimate pay items.
LANDSCAPE CONSTRUCTION							
8-02	801160	TOPSOIL, TYPE A		CY	$50.00	$0.00	
8-02	801165	TOPSOIL, TYPE B		CY	$35.00	$0.00	
8-02	SPECIAL	LANDSCAPING - MINIMUM		SF	$1.00	$0.00	Allowance for hydroseeding with some minor planting beds with shrubs and bark mulch.
8-02	SPECIAL	LANDSCAPING - AVERAGE		SF	$5.00	$0.00	Planting allowance includes about 50% hydroseeding and 50% planting beds with shrubs and bark mulch.
8-02	SPECIAL	LANDSCAPING - HIGH END		SF	$10.00	$0.00	Planting allowance includes planting beds with shrubs, small trees and bark mulch.
IRRIGATION SYSTEM							
8-03	SPECIAL	IRRIGATION SYSTEM		SF	$2.00	$0.00	Irrigation system for plantings, includes piping, controls, and spray heads.
CEMENT CONCRETE CURB, CURB AND GUTTER							
8-04	804005	CURB, CEM CONC { QTY >= 1000 }		LF	$20.00	$0.00	
8-04		{ QTY < 1000 }			$30.00	$0.00	
8-04	804015	CURB AND GUTTER, CEM CONC		LF	$40.00	$0.00	
EXTRUDED CURB							
8-06	806005	CURB, EXTRUDED ASPHALT CONCRETE		LF	$15.00	$0.00	
8-06	806010	CURB, EXTRUDED CEMENT CONCRETE		LF	$13.00	$0.00	

SPU SPEC SECTION	OLD SPU BID ITEM #	BID ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	COST ITEM NOTES
PRECAST TRAFFIC CURB AND BLOCK TRAFFIC CURB							
8-07	807005	CURB, TRAFFIC, PRECAST		LF	$16.00	$0.00	
CHAIN LINK FENCE AND WIRE FENCE							
8-12		CHAIN LINK FENCE, TYPE 1		LF	$33.00	$0.00	Per Standard Plan 450a, Type 1
8-12	812012	CHAIN LINK GATE, DOUBLE 12 FT WIDE		EA	$1,300.00	$0.00	
8-12	812020	CHAIN LINK GATE, DOUBLE 20 FT WIDE		EA	$1,800.00	$0.00	
8-12	812026	CHAIN LINK GATE, SINGLE 6 FT WIDE		EA	$525.00	$0.00	
CEMENT CONCRETE SIDEWALKS							
8-14	814005	SIDEWALK, CEM CONC { QTY >= 500 }		SY	$45.00	$0.00	
8-14		{ QTY < 500 }			$65.00	$0.00	
8-14		CURB RAMP, TYPE 442a		EA		$0.00	Per Standard Plan 422a
RIPRAP							
8-14	SPECIAL	QUARRY SPALLS / RIP RAP		CY	$70.00	$0.00	Machine place quarry spalls by CY not ton
CEMENT CONCRETE DRIVEWAY AND ALLEY RETURN							
8-19	819006	DRIVEWAY, CEM CONC, 6 IN		SY	$70.00	$0.00	
TRAFFIC SIGNAL SYSTEMS							
8-31	SPECIAL	TRAFFIC SIGNAL (4 WAY COMPLETE)		EA	$320,000.00	$0.00	For 4 way, 2 lanes each way intersection
8-31	SPECIAL	DETECTOR LOOP		EA	$1,000.00	$0.00	Complete cost to replace existing detector loop in roadway
SPECIAL ITEMS NOT ACCOUNTED FOR ELSEWHERE							Seek estimators help in pricing special line items
							For significant cost items not accounted for elsewhere.
		SUBTOTAL				**$2,557,549**	
		CONSTRUCTION SUBTOTAL (ROUNDED)				**$2,560,000**	

Water Quality Vault Schedule Inputs	QTY	Unit	Baseline Schedule Days
Mobilization			10 days
Site Demolition $ value	0	$ value	0.0 days
Demo Waste	0	CY	
Structure Excavation	3,126	CY	16.0 days
Spoils Waste (add 20% for swell)	3,751	CY	
Import Backfill & Bedding	2,104	CY	14.0 days
Special Shoring (Slide Rails/Sheet & Jacking)	18,832	SF	5.0 days
Special Shoring (Sheet Piles)	0	SF	0.0 days
Shoring Soldier Piles	0	SF	0.0 days
Concrete Structures	0	CY	0.0 days
WQ Structure, 6x12 & 6x16	0	EA	0.0 days
WQ Structure, 8x16 & 8x18	13	EA	20.0 days
WQ Structure, 8x20 & 8x24	9	EA	18.0 days
Swirl Concentrator	0	EA	0.0 days
Comissioning	5	%	4.0 days
Concrete Pavement Restoration	0	SY	0.0 days
HMA Pavement Restoration	0	SY	0.0 days
Site Restoration $ value	0	$ value	0.0 days
De-mobilization and punch list			15 days

Water Quality Vault Schedule	Baseline	Medium	Hard	$ Value
Mobilization	10 days	10 days	10 days	$126,746
Site demo/prep	0 days	0 days	0 days	$0
Excavation & Backfill	35 days	46 days	53 days	$357,267
Concrete Structures	0 days	0 days	0 days	$0
Control Structures & Manholes	38 days	49 days	57 days	$1,943,366
Commissioning/Testing/Disinfection	4 days	5 days	6 days	
Pavement Restoration	0 days	0 days	0 days	$75,851
Site restoration	0 days	0 days	0 days	$0
Demobilization	15 days	15 days	15 days	$54,320
				$2,557,550

Schedule Values

Baseline	Baseline schedule values assumes standard production with no difficulties
Medium	Task takes 30% longer due to site restrictions such as access, traffic control, ground conditions
Hard	Task takes 50% longer due to site restrictions such as access, traffic control, ground conditions

Manhour Calculations

Total Manhours for the schedule items	3,884	MHs
Add 100% for foreman, site supervision, misc other site items, cleanup, etc.	3884	MHs
Baseline Total Number of Man Hours	7768	
Medium Total Number of Man Hours	9519.608	
Hard Total Number of Man Hours	10738.12	

Truck Trips

Raw/Base Truck Trips over project life	408
Add 50% for pipes, shoring items, other items	204
Total Truck Trips during entire project	612

Equipment Hours

Piledriving/Shoring Equipment Hours	40
Add 50% total hours	20
Baseline Total Piledriving Equipment hours	60
Medium Total Piledriving Equipment hours	74
Hard Total Piledriving Equipment hours	83
Earthwork Equipment Hours (Excavator, dozer, loader, etc)	696
Add 50% total hours	348
Baseline Total Earthwork Equipment hours	1,044
Medium Total Earthwork Equipment hours	1,279
Hard Total Earthwork Equipment hours	1,443
Lifting/Pumping Equipment Hours (Cranes, concrete pump, forklift, etc)	0
Add 50% total hours	0
Baseline Total Lifting/Pumping Equipment hours	0
Medium Total Lifting/Pumping Equipment hours	0
Hard Total Lifting/Pumping Equipment hours	0

Model Inputs

Project Type:
Storage Facility

Field	Entry	Comment	Sample
Storage Tank Size			
	Size	In Mgal	2.05
Type of Storage			
	Type of Tank	Rectangular = R Circular = C Storage Pipe = P	R
	Tank Diameter	Used if tank is circular. Give value in feet.	0
	Tank Length	Used if tank is rectangular. Give value in feet.	188
	Tank Width	Used if tank is rectangular. Give value in feet.	121
	Cover Depth over tank	Cover over the top of the storage tank in feet; Typically a minimum of 2 ft; Give cover in ft	2
	Bottom slab thickness	In inches; Typically between 24" and 48" thick	48
	Wall Height	Tank wall height in feet	24
	Exterior Wall Thickness	In inches; Typically between 12" and 36" thick	36
	Internal Support Wall Length	If needed for elevated slab support, normally used for spans of more than 20'	847
	Interior Wall Thickness	In inches; Typically between 12" and 36" thick	18
	Elevated Slab thickness	In inches; Typically between 12" and 24" thick	18
	Pipe Diameter	Used if storage is pipe. Give value in inches.	0
	Pipe Length	Used if storage is pipe. Give value in feet.	100
	Cover Depth over Pipe	Cover over the top of the storage tank in feet. Give cover in ft	6
	Bottom of Trench Width for Pipe Storage (In inches)	The is the minimum width for the bottom of the trench in inches (see standard plan 284): For pipes 18" or larger use Pipe IDx1.5+18"	18
	Bed and Zone Backfill Type	Always use Class B Bedding for all pipe types; Imported material, Type 9 Aggregate; see Standard Plan 285	Imported
	Trench Backfill Type above bed and zone	Imported material if under roadway or material is expected to be wet or of poor quantity	Imported
Shoring and Piles			
	Shoring or Open Cut	Open Cut = O (Not used) Shoring = S	S
	Type of Shoring	Standard Trench Safety = ST (sheet piles) (Used when excavation is no deeper than 20 ft and there are no ground water concerns) Special Shoring = SS (Solider piles shoring) (Used for depths below 20 ft or when there are ground water concerns)	SS
	Distance from Tank Walls to Shoring	If shoring is used for exterior wall form then use 0 ft. If walls are formed away from shoring use minimum of 8 ft.	0
	Piles	May be needed for poor ground conditions (Yes/No)	No
	Pile type	Concrete Filled Pipe Piles = P Drilled caissons = D	
	Pile Diameter	Pipe Piles range from 12" or 18" Drilled Caissons range 24", 36" or 48"	
	Number of Piles		
	Pile depth	In vertical linear feet (vlf)	
Odor Control			
	Yes	In Seattle Odor control is assumed to be needed on all	Yes
	No	Not used	
Parcel Footprint			
	Use the full footprint of the Parcel location used		43560
Surface Restoration			
	Restoration Type	Hydroseed = H Gravel = G ACP Pavement = A Concrete Pavement = C	A
Dewatering			
	Dewatering Needs	None = N Minimal = M Significant = S	S

Model Inputs

Project Type:
Storage Facility

Field	Entry	Comment	Sample
Landscaping			
	Landscaping General	If landscaping quantities are unknown then use following: Minimal Landscaping = M (mostly grass area with a few shrubs) Average Landscaping = A (Shrubs and groundcover with mulch) High End Landscaping = H (Many shrubs, groundcover and small dia trees with mulch) Quantity is Area in SF	
	Irrigation	Priced per SF of desired irrigation area	
Additional Costs			
	Sidewalk	Sidewalk width is minimum of 5' wide. When no information is know use 6' wide.	
	Curb and gutter	Default is curb & gutter Standard Plan 410B	
	Sidewalk Ramps	Price per EA	
	Precast Traffic Curb	Price per LF	
	Chain Link Fence	Price per LF	
	Chain Link Gate	Single 6' gate, or double 12' or 20' gates	
Other Items			
	Building Demo	Priced by SF; Remember to count the SF on each floor	
	Waterproofing Coating	Floor and Wall SF	37580

Circular tank dimensions

Slab Concrete	0	cu yd
Wall Concrete	0	cu yd
Elevated Slab	0	cu yd
Earthwork (Shored)		
Excavation	0	cu yd
Bedding	0	cu yd
Waste (Native Fill)	0	cu yd
Fill along sides	0	cu yd
Fill over top	0	cu yd
Circular Shoring	0	sf

Rectangular Tank Dimensions

Slab Concrete	3,370	cu yd
Wall Concrete	2,777	cu yd
Elevated Slab	1,264	cu yd
Earthwork (Shored)		
Excavation	27,382	cu yd
Bedding	843	cu yd
Waste (Native Fill)	25,697	cu yd
Fill along sides	0	cu yd
Fill over top	1,685	cu yd
Rect Shoring	22,557	sf

Pipe Storage Takeoff Information

Trench Excavation	36	cu yd
Bed and Zone Backfill	8	cu yd
Native Backfill above bed and Zone	28	cu yd
Imported Backfill above bed and Zone	28	cu yd
Waste Material if Native Backfill	8	cu yd
Waste Material if Imported Backfill	36	cu yd
Shoring (quantity includes both sides of trench)	1,300	sf

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST	COMMENTS
DIVISION 1 - GENERAL REQUIREMENTS					
Mobilization	1	LS	$ 947,731	$ 947,731.40	8% Allowance of Div 2 through 48
Temporary Traffic Control	1	LS	$ 355,399	$ 355,399.28	3% Allowance of Div 2 through 48
Temporary Erosion and Sediment Control	1	LS	$ 118,466	$ 118,466.43	1% Allowance of Div 2 through 48
Survey Controls	1	LS	$ 118,466	$ 118,466.43	1% Allowance of Div 2 through 48
DIVISION 2 - EXISTING CONDITIONS					
Remove CB/MH		EA	$620.00	$0.00	
Remove Existing Fence		LF	$5.00	$0.00	
Remove ACP Pavement		SY	$14.00	$0.00	
Remove PCC Pavement		SY	$40.00	$0.00	
Remove Sidewalk (incl curb ramp)		SY	$12.00	$0.00	
Building Demo	1,200	SF	$10.00	$12,000.00	Includes cost to demo and waste building. Include the SF from each floor for the total SF quantity.
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
DIVISION 3 - CONCRETE					
Cast in Place Reinforced Concrete - Slabs on Grade	3,370	CY	$500.00	$1,685,037.04	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
Cast in Place Reinforced Concrete - Walls and Columns	2,083	CY	$1,050.00	$2,187,150.00	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
Cast in Place Reinforced Concrete - Suspended Slabs and Beams	1,264	CY	$1,300.00	$1,642,911.11	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
DIVISION 4 - MASONRY					
DIVISION 5 - METALS					
Access Hatch	48	SF	$150.00	$7,200.00	Galvanized steel access hatch priced by the sf. Includes frame and hinges.
Railing, Galvanized Steel, 3 rail		LF	$110.00	$0.00	
Floor Plate Stairs, Galvanized Steel		VLF	$500.00	$0.00	Priced by vertical linear feet includes stairs, frame, and railing.
Ladder, Galvanized Steel with Cage	36	LF	$135.00	$4,860.00	
Landing, Galvanized Steel		SF	$100.00	$0.00	Includes galvanized bar decking and support frame in cost.
Minor Misc Items	25%	LS	$12,060.00	$3,015.00	% of Metals above
DIVISION 6 - WOOD, PLASTICS, & COMPOSITES					
DIVISION 7 - THERMAL AND MOISTURE PROTECTION					
Waterproofing System (Including surface prep)	33,872	SF	$8.00	$270,976.00	Use floor and wall square footage
DIVISION 8 - OPENINGS					

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST	COMMENTS
DIVISION 9 - FINISHES					
DIVISION 10 - SPECIALTIES					
DIVISION 11 - EQUIPMENT					
DIVISION 12 - FURNISHINGS					
DIVISION 13 - SPECIAL CONSTRUCTION					
Pre-Manufactured Metal Building (Conceptual SF Cost)		SF	$150.00	$0.00	Complete cost for pre-manufactured building including 8" concrete slab, metal frame, openings, insulation, roofing, building standard power and water.
CMU Above Grade Building (Conceptual SF Cost)		SF	$250.00	$0.00	Complete cost for CMU building including 8" concrete slab, metal frame, openings, insulation, roofing, building standard power and water.
Other Items					Change Description and enter unit cost if needed
DIVISION 14 - CONVEYING EQUIPMENT					
DIVISION 21 - FIRE SUPPRESSION					
DIVISION 22 - PLUMBING					Use 6% for Concrete Storage Tanks and 2% for Storage Pipes.
Mechanical Piping	6%	LS	$577,885.00	$577,885.00	Based on Windermere/Genesee costs.
DIVISION 23 - HEATING, VENTILATING, AIR-CONDITIONING (HVAC)					Use 1% for Concrete Storage Tanks and 0% for Storage Pipes.
HVAC	1%	LS	$96,314.17	$96,314.17	Based on Windermere/Genesee costs.
DIVISION 25 - INTEGRATED AUTOMATION					
DIVISION 26 - ELECTRICAL					Use 10% for Concrete Storage Tanks and 5% for Storage Pipes.
Electrical Allowance, General Electrical Conditions	10%	LS	$963,141.67	$963,141.67	Based on Windermere/Genesee costs.
30 kW Diesel Generator w/ day tank, muffler, ATS		EA	$25,000.00	$0.00	
50 kW Diesel Generator w/ day tank, muffler, ATS		EA	$30,000.00	$0.00	
75 kW Diesel Generator w/ day tank, muffler, ATS		EA	$39,000.00	$0.00	
100 kW Diesel Generator w/ day tank, muffler, ATS		EA	$43,000.00	$0.00	
125 kW Diesel Generator w/ day tank, muffler, ATS		EA	$46,000.00	$0.00	
150 kW Diesel Generator w/ day tank, muffler, ATS		EA	$52,000.00	$0.00	
200 kW Diesel Generator w/ day tank, muffler, ATS		EA	$59,000.00	$0.00	
250 kW Diesel Generator w/ day tank, muffler, ATS		EA	$68,000.00	$0.00	
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST	COMMENTS

DIVISION 27 - COMMUNICATIONS

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

DIVISION 31 - EARTHWORK

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST	COMMENTS
Excavation	23,169	CY	$10.00	$231,692.59	As per payment outlined in spec section 7-17.5 but for excavation only. Required for EIS report needs.
Native Backfill (Place and compaction)		CY	$10.00	$0.00	As per payment outlined in spec section 7-17.5 but for native backfill only. Required for EIS report needs.
Imported Backfill (Material cost, place and compact)	0	CY	$45.00	$0.00	As per payment outlined in spec section 7-17.5 but for imported backfill only. Required for EIS report needs.
Waste of Excess Native Materials	23,169	CY	$25.00	$579,231.48	As per payment outlined in spec section 7-17.5 but for haul and waste of spoils only. Required for EIS report needs.
Bedding	843	CY	$50.00	$42,125.93	Crushed surfacing base course bedding placed under structure. Normally 6" depth minimum.
Clearing and Grubbing	82,250	SF	$1.00	$82,250.00	
Dewatering Water Treatment System					
Storage Volume	**2.05**	**MG**			
Treatment System Operation and Maintenance - For major dewatering for concrete storage tank.	0	LS	$0.00	$0.00	Based on modified Tabula Dewatering Cost Curve adjusted to for Actual costs on Windermere & Genesee
Treatment System Operation and Maintenance - For minor dewatering for concrete storage tank.	1	LS	$302,904.78	$302,904.78	Based on modified Tabula Dewatering Cost Curve
Pipe Storage Dewatering (Pump in trench)		LF	$20.00	$0.00	Based on pipe construction dewatering cost
Pipe Storage Dewatering (Wells/Wellpoints)		LF	$130.00	$0.00	Based on pipe construction dewatering cost
Shoring					
Drilled steel solder pipes and lagging, walers, with tiebacks	19,467	SF	$80.00	$1,557,360.00	Paid by the SF of exposed face to engineer, place and remove shoring.
Sheet Piles		SF	$30.00	$0.00	Paid by the SF of exposed face to engineer, place and remove shoring.
Secant Pile Walls		SF	$150.00	$0.00	Paid by the SF of exposed face to engineer, left in place
Mechanical Trench Support (Slide Rails, Steel Sheets)		SF	$10.00	$0.00	Paid by the SF of exposed face.
Trench Box Shoring		LF	$10.00	$0.00	Trench Box
Piles					
Concrete filled Steel Pile Piles, 12" diameter		VLF	$54.00	$0.00	
Concrete filled Steel Pile Piles, 18" diameter		VLF	$87.00	$0.00	
Drilled caisson piles, 24" diameter		VLF	$71.00	$0.00	
Drilled caisson piles, 36" diameter		VLF	$149.00	$0.00	
Drilled caisson piles, 48" diameter		VLF	$245.00	$0.00	
Pipe Storage					
RCP Pipe, 6' diameter		LF	$500.00	$0.00	Pipe placement only; earthwork paid separately above
RCP Pipe, 7' diameter		LF	$640.00	$0.00	Pipe placement only; earthwork paid separately above
RCP Pipe, 8' diameter		LF	$850.00	$0.00	Pipe placement only; earthwork paid separately above
RCP Pipe, 9' diameter		LF	$1,100.00	$0.00	Pipe placement only; earthwork paid separately above
RCP Pipe, 10' diameter		LF	$1,290.00	$0.00	Pipe placement only; earthwork paid separately above
RCP Pipe, 11' diameter		LF	$1,610.00	$0.00	Pipe placement only; earthwork paid separately above
RCP Pipe, 12' diameter		LF	$1,820.00	$0.00	Pipe placement only; earthwork paid separately above

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST	COMMENTS
DIVISION 32 - EXTERIOR IMPROVEMENTS					
ACP Replacement					
Pavement, HMA (CL 1/2), Based on 4" Depth		SY	$26.00	$0.00	For placement of CL 1/2" HMA 4" depth. Includes all work related to HMA placement.
Mineral Aggregate, Type 2 (QTY(TN)<500), Based on 6" Depth		CY	$65.00	$0.00	
HMA (CL 1/2), Overlay, 2" depth		SY	$14.00	$0.00	
PCC Pavement Replacement					
Replace PCC Pavement, 8" depth		SY	$82.00	$0.00	
Replace PCC Pavement, 12" depth		SY	$105.00	$0.00	
Mineral Aggregate, Type 2 (QTY(TN)>500), Based on 6" Depth		CY	$65.00	$0.00	
Sidewalk/Crosswalk Landings		SY	$65.00	$0.00	
Curb and Gutter, Cement Concrete		LF	$40.00	$0.00	
Landscaping					
Topsoil, Type A, Based on 8" thickness	2,528	CY	$50.00	$126,377.78	
Landscaping - Minimum	82,250	SF	$1.00	$82,250.00	Allowance for hydroseeding with some minor planting beds with shrubs and bark mulch.
Landscaping - Average		SF	$5.00	$0.00	Planting allowance includes about 50% hydroseeding and 50% planting beds with shrubs and bark mulch.
Landscaping - High End		SF	$10.00	$0.00	Planting allowance includes planting beds with shrubs, small trees and bark mulch.
Irrigation		SF	$2.00	$0.00	Irrigation system for plantings, includes piping, controls, and spray heads.
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
DIVISION 33 - UTILITIES					
Manhole (48" diameter, 10' depth)		EA	$3,700.00	$0.00	
Manhole (48" diameter, additional depth)		VLF	$270.00	$0.00	
Manhole (72" diameter, 10' depth)		EA	$7,000.00	$0.00	
Manhole (72" diameter, additional depth)		VLF	$330.00	$0.00	
Manhole (120" diameter, 10' depth)		EA	$23,900.00	$0.00	
Manhole (120" diameter, additional depth)		VLF	$920.00	$0.00	
Catch Basin, Type 240A or 240B		EA	$2,800.00	$0.00	
Inlet, Type 250A		EA	$1,500.00	$0.00	
Connection to existing storm drainage system		LS	$5,000.00	$0.00	
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed

DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST	COMMENTS
DIVISION 40 - PROCESS INTEGRATION					Use 6% for Concrete Storage Tanks and 3% for Storage Pipes.
Storage Facility I&C	6%	LS	$577,885.00	$577,885.00	
DIVISION 41 - MATERIAL PROCESS AND HANDLING EQUIPMENT					
DIVISION 43 - PROCESS GAS AND LIQUID HANDLING					
DIVISION 44 - POLLUTION CONTROL EQUIPMENT					
Storage Odor Control	**2.05**	**MG**			
Odor Control Equipment	1	LS	$166,975.00	$166,975.00	Based on Windermere/Genesee costs.
DIVISION 46 - WATER AND WASTEWATER EQUIPMENT					
Tank Cleaning Equipment	**2.05**	**MG**			
Tank Cleaning Equipment	1	LS	$647,100.00	$647,100.00	Based on Windermere/Genesee costs.
SUBTOTAL				**$13,386,706**	
CONSTRUCTION SUBTOTAL (ROUNDED)				**$13,390,000**	

Storage Schedule Inputs			Baseline Schedule Days		N	Is Tank over 2.5 MG with adequate site access for concurrent work? (Y/N)
Mobilization			20.0	days		
Set up dewatering system			15.0	days		
Site Demolition $ value	12,000	LS	3.0	days		
Shoring Sheet Pile	0	SF	0.0	days		
Shoring Soldier Piles	19,467	SF	39.0	days		
Secant Pile Shoring	0	SF	0.0	days		
Excavation	23,169	CY	78.0	days		
Waste	23,169	CY				
Concrete SOG	3,370	CY	81.0	days		
Concrete Walls	2,083	CY	174.0	days		
Concrete Elev Slab	1,264	CY	71.0	days		
Pipe 72" to 84" dia	0	LF	0.0	days		
Pipe 92" to 108" dia	0	LF	0.0	days		
Pipe 120" to 144" dia	0	LF	0.0	days		
Backfill & Bedding	843	CY	6.0	days		
Imported Material	843	CY				
Mechanical & HVAC	674,199	LS	54.0	days		
Odor Control	166,975	LS	14.0	days		
Tank Cleaning Equipment	647,100	LS	52.0	days		
Electrical and I&C	1,541,027	LS	124.0	days		
Comissioning	1	LS	261.0	days		
Site Restoration $ value	208,628	LS	21.0	days		
De-mobilization and punch list			15.0	days		

Storage Schedule	Baseline		Medium		Hard		$ Value
Mobilization & Dewatering Setup	35	days	35	days	35	days	$663,412
Site demo/prep	3	days	4	days	5	days	$100,794
Shoring & Excavation	117	days	152	days	176	days	$2,694,683
Concrete/Pipe Work	326	days	424	days	489	days	$6,346,033
Backfill	6	days	8	days	9	days	$45,051
Mechanical Work	54	days	70	days	81	days	$674,199
Odor Control Equip	14	days	18	days	21	days	$166,975
Tank Cleaning Equip	52	days	68	days	78	days	$647,100
Electrical Work	124	days	161	days	186	days	$1,541,027
Comissioning	261	days	261	days	261	days	
Site restoration	21	days	27	days	32	days	$223,113
Demobilization	15	days	15	days	15	days	$284,319
							$13,386,706

Schedule Values

Baseline	Baseline schedule values assumes standard production with no difficulties
Medium	Task takes 30% longer due to site restrictions such as access, traffic control, ground conditions
Hard	Task takes 50% longer due to site restrictions such as access, traffic control, ground conditions

Manhour Calculations

Total Manhours for the schedule items	26,184	MHs
Add 100% for foreman, site supervision, misc other site items, cleanup, etc.	26184	MHs
Baseline Total Number of Man Hours	52368	
Medium Total Number of Man Hours	67047	
Hard Total Number of Man Hours	76948	

Truck Trips

Raw/Base Truck Trips over project life	2,360
Add 50% for pipes, shoring items, other items	1,180
Total Truck Trips during entire project	3,541

Equipment Hours

Piledriving/Shoring Equipment Hours	312
Add 50% total hours	156
Baseline Total Piledriving Equipment hours	468
Medium Total Piledriving Equipment hours	599
Hard Total Piledriving Equipment hours	688
Earthwork Equipment Hours (Excavator, dozer, loader, etc)	1,476
Add 50% total hours	738
Baseline Total Earthwork Equipment hours	2,214
Medium Total Earthwork Equipment hours	2,835
Hard Total Earthwork Equipment hours	3,253
Lifting/Pumping Equipment Hours (Cranes, concrete pump, forklift, etc)	1,444
Add 50% total hours	722
Baseline Total Lifting/Pumping Equipment hours	2,166
Medium Total Lifting/Pumping Equipment hours	2,773
Hard Total Lifting/Pumping Equipment hours	3,183

Model Inputs

Project Type:
Pump Station

Field	Entry	Comment	Sample
Type of Pump Station			
	Type of PS	Rectangular = R Caisson Style Manhole = C	R
If Pump Station Wet Well is Rectangular			
	Length	In feet	20
	Width	In feet	20
	Bottom slab thickness	In inches	36
	Wall Height	PS wall height in feet	18
	Exterior Wall Thickness	In inches; Typically between 24" and 48" thick	24
	Internal Support Wall Length	If needed for elevated slab support, normally used for spans of more than 20'	0
	Interior Wall Thickness	In inches; Typically between 12" and 36" thick	18
	Elevated Slab thickness	In inches	12
	Shoring or Open Cut	Open Cut = O (Not used) Shoring = S	S
If Pump Station Wet Well Caisson			
	Diameter	In feet: Estimate has cost for 8', 10' and 12' diameter	0
	Depth	In feet	0
Shoring and Piles			
	Type of Shoring	Standard Trench Safety = ST (sheet piles) (Used when excavation is no deeper than 20 ft and there are no ground water concerns) Special Shoring = SS (Solider piles shoring) (Used for depths below 20 ft or when there are ground water concerns)	ST
	Distance from Tank Walls to Shoring	If shoring is used for exterior wall form then use 0 ft. If walls are formed away from shoring use minimum of 8 ft.	0
	Piles	May be needed for poor ground conditions (Yes/No)	No
	Pile type	Concrete Filled Pipe Piles = P Drilled caissons = D	
	Pile Diameter	Pipe Piles range from 12" or 18" Drilled Caissons range 24", 36" or 48"	
	Number of Piles		
	Pile depth	In vertical linear feet (vlf)	
Pump Capacity			
	Pump Station Capacity MGD		0.6
	Total HP for Pump Station		20
	TDH for Pump Station		100
Generator			
	Standby Generator	Yes = Y No = N	Y
	Generator Size	If a generator is needed give the size in kW	125
	Separate Generator Bldg	Yes = Y No = N	Y
	Generator Bldg Size	If a separate generator bldg is needed give the size in square feet	300

Model Inputs

Project Type:
Pump Station

Field	Entry	Comment	Sample
Parcel Footprint			
	Use the full footprint of the Parcel location used		5000
Surface Restoration			
	Restoration Type	Hydroseed = H Gravel = G ACP Pavement = A Concrete Pavement = C	A
Dewatering			
	Dewatering Needs	None = N Minimal = M Significant = S	M
Landscaping			
	Landscaping General	If landscaping quantities are unknown then use following: Minimal Landscaping = M (mostly grass area with a few shrubs) Average Landscaping = A (Shrubs and groundcover with mulch) High End Landscaping = H (Many shrubs, groundcover and small dia trees with mulch) Quantity is Area in SF	
	Irrigation	Priced per SF of desired irrigation area	
Additional Costs			
	Sidewalk	Sidewalk width is minimum of 5' wide. When no information is know use 6' wide.	600
	Curb and gutter	Default is curb & gutter Standard Plan 410B	100
	Sidewalk Ramps	Price per EA	1
	Precast Traffic Curb	Price per LF	
	Chain Link Fence	Price per LF	
	Chain Link Gate	Single 6' gate, or double 12' or 20' gates	

Field	Entry	Comment	Sample
Other Items			
	Building Demo	Priced by SF; Remember to count the SF on each floor	

Rectangular Tank Dimensions		
Slab Concrete	44.4	cu yd
Wall Concrete	106.7	cu yd
Elevated Slab	14.8	cu yd
Earthwork (Shored)		
Excavation	340.7	cu yd
Bedding	14.8	cu yd
Waste (Native Fill)	340.7	cu yd
Fill	0.0	cu yd
Rect Shoring	2160.0	sf

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)
Cost Estimate Elements:
Pump Station

Takeoff By:
Estimate By:
Date:
Rev:
Rev:
Rev:

Tool Revision: Ver 3, edited 4/18/13

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST	COMMENTS
DIVISION 1 - GENERAL REQUIREMENTS					
Mobilization	1	LS	$ 124,279	$ 124,278.50	8% Allowance of Div 2 through 48
Temporary Traffic Control	1	LS	$ 46,604	$ 46,604.44	3% Allowance of Div 2 through 48
Temporary Erosion and Sediment Control	1	LS	$ 15,535	$ 15,534.81	1% Allowance of Div 2 through 48
Survey Controls	1	LS	$ 15,535	$ 15,534.81	1% Allowance of Div 2 through 48
DIVISION 2 - EXISTING CONDITIONS					
Remove CB/MH		EA	$620.00	$0.00	
Remove Existing Fence		LF	$5.00	$0.00	
Remove ACP Pavement		SY	$14.00	$0.00	
Remove PCC Pavement		SY	$40.00	$0.00	
Remove Sidewalk (incl curb ramp)		SY	$12.00	$0.00	
Building Demo		SF	$10.00	$0.00	Includes cost to demo and waste building. Include the SF from each floor for the total SF quantity.
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
DIVISION 3 - CONCRETE					
Cast in Place Reinforced Concrete - Slabs on Grade	293	CY	$500.00	$146,611.11	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
Cast in Place Reinforced Concrete - Walls and Columns	380	CY	$1,050.00	$398,533.33	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
Cast in Place Reinforced Concrete - Suspended Slabs and Beams	147	CY	$1,300.00	$190,594.44	Paid per CY in place Sect 6-02.4 with the inclusion of the rebar in the concrete payment
DIVISION 4 - MASONRY					
DIVISION 5 - METALS					
Access Hatch	72	SF	$150.00	$10,800.00	Galvanized steel access hatch priced by the sf. Includes frame and hinges.
Railing, Galvanized Steel, 3 rail		LF	$110.00	$0.00	
Floor Plate Stairs, Galvanized Steel	66	RISER	$500.00	$33,000.00	Priced by vertical linear feet includes stairs, frame, and railing.
Ladder, Galvanized Steel with Cage		LF	$135.00	$0.00	
Landing, Galvanized Steel		SF	$100.00	$0.00	Includes galvanized bar decking and support frame in cost.
Minor Misc Items	25%	LS	$43,800.00	$10,950.00	% of Metals above
DIVISION 6 - WOOD, PLASTICS, & COMPOSITES					
DIVISION 7 - THERMAL AND MOISTURE PROTECTION					
DIVISION 8 - OPENINGS					
DIVISION 9 - FINISHES					
DIVISION 10 - SPECIALTIES					
DIVISION 11 - EQUIPMENT					
Pump Station MGD	**2.05**	**MGD**			
Pump Station TDH	**83**	**TDH**			
PUMP STATION MECHANICAL & EQUIPMENT COST	2.05	MGD	$136,741.10	$280,319.25	Based on Tabula Mechanical and Equipment Cost Curve
MECHANICAL ADJUSTMENT FOR TDH < 300	2.05	MGD	-$22,816.67	-$46,774.17	Based on Tabula Mechanical and Equipment Cost Curve
MECHANICAL ADJUSTMENT FOR TDH > 300	0	MGD	$0.00	$0.00	Based on Tabula Mechanical and Equipment Cost Curve
If Pump capacity is less or equal than 2 MGD then use:					
Submersible Pump System, 0.5 MGD Package		LS	$60,000.00	$0.00	Based on quote per Pump Tech + OH&P and Labor
Submersible Pump System, 1.0 MGD Package		LS	$89,000.00	$0.00	Based on quote per Pump Tech + OH&P and Labor
Submersible Pump System, 1.5 MGD Package		LS	$105,000.00	$0.00	Based on quote per Pump Tech + OH&P and Labor
Submersible Pump System, 2 MGD Package		LS	$134,000.00	$0.00	Based on quote per Pump Tech + OH&P and Labor
DIVISION 12 - FURNISHINGS					
DIVISION 13 - SPECIAL CONSTRUCTION					
Pre-Manufactured Metal Building (Conceptual SF Cost)		SF	$150.00	$0.00	Complete cost for pre-manufactured building including 8" concrete slab, metal frame, openings, insulation, roofing, building standard power and water.
CMU Above Grade Building (Conceptual SF Cost)		SF	$250.00	$0.00	Complete cost for CMU building including 8" concrete slab, metal frame, openings, insulation, roofing, building standard power and water.
Other Items					Change Description and enter unit cost if needed
DIVISION 14 - CONVEYING EQUIPMENT					
DIVISION 21 - FIRE SUPPRESSION					
DIVISION 22 - PLUMBING					
Mechanical Piping (See above)					Cost included in Pump Station equipment and mechanical cost curve in Div 11

Seattle Public Utilities	Takeoff By:
LTCP Basin:	Estimate By:
Project Definition Cost Estimate (Class 4)	Date:
Cost Estimate Elements:	Rev:
Pump Station	Rev:
	Rev:

Tool Revision: Ver 3, edited 4/18/13

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST	COMMENTS
DIVISION 1 - GENERAL REQUIREMENTS					
DIVISION 23 - HEATING, VENTILATING, AIR-CONDITIONING (HVAC)					
HVAC (See Above)					Cost included in Pump Station equipment and mechanical cost curve in Div 11
DIVISION 25 - INTEGRATED AUTOMATION					
DIVISION 26 - ELECTRICAL					
Pump Station HP	**50**	**HP**			
PUMP STATION ELECTRICAL AND I&C COST	1	LS	$235,689.86	$235,689.86	Based on Tabula Mechanical and Equipment Cost Curve
If Pump capacity is less or equal than 2 MGD then use:					
Electrical and I&C are included in Pump Package Above					Electrical and I&C costs for pump packages are includes in the pump package cost in Div 11
30 kW Diesel Generator w/ day tank, muffler, ATS		EA	$25,000.00	$0.00	
50 kW Diesel Generator w/ day tank, muffler, ATS		EA	$30,000.00	$0.00	
75 kW Diesel Generator w/ day tank, muffler, ATS		EA	$39,000.00	$0.00	
100 kW Diesel Generator w/ day tank, muffler, ATS		EA	$43,000.00	$0.00	
125 kW Diesel Generator w/ day tank, muffler, ATS		EA	$46,000.00	$0.00	
150 kW Diesel Generator w/ day tank, muffler, ATS		EA	$52,000.00	$0.00	
200 kW Diesel Generator w/ day tank, muffler, ATS		EA	$59,000.00	$0.00	
250 kW Diesel Generator w/ day tank, muffler, ATS		EA	$68,000.00	$0.00	
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
DIVISION 27 - COMMUNICATIONS					
DIVISION 28 - ELECTRONIC SAFETY AND SECURITY					
DIVISION 31 - EARTHWORK					
Excavation	2,199	CY	$10.00	$21,991.67	As per payment outlined in spec section 7-17.5 but for excavation only. Required for EIS report needs.
Native Backfill (Place and compaction)		CY	$10.00	$0.00	As per payment outlined in spec section 7-17.5 but for native backfill only. Required for EIS report needs.
Imported Backfill (Material cost, place and compact)	0	CY	$45.00	$0.00	As per payment outlined in spec section 7-17.5 but for imported backfill only. Required for EIS report needs.
Waste of Excess Native Materials	2,199	CY	$25.00	$54,979.17	As per payment outlined in spec section 7-17.5 but for haul and waste of spoils only. Required for EIS report needs.
Bedding	98	CY	$50.00	$4,887.04	Crushed surfacing base course bedding placed under structure. Normally 6" depth minimum.
Clearing and Grubbing		SF	$1.00	$0.00	
Dewatering Water Treatment System					
Treatment System Operation and Maintenance - For major dewatering.		LS	$0.00	$0.00	Based on $2/gallon includes pumping and treatment/settling of groundwater
Treatment System Operation and Maintenance - For minor dewatering	1	LS	$21,099.58	$21,099.58	Based on intermittent pumping via sump in excavation and treatment/settling of groundwater
Shoring					
Drilled steel solder pipes and lagging, walers, with tiebacks		SF	$80.00	$0.00	
Sheet Piles	6,360	SF	$30.00	$190,800.00	
Mechanical Trench Support (Slide Rails, Steel Sheets)		SF	$10.00	$0.00	
Trench Box Shoring		LF	$10.00	$0.00	Trench Box
Piles					
Concrete filled Steel Pile Piles, 12" diameter		VLF	$54.00	$0.00	
Concrete filled Steel Pile Piles, 18" diameter		VLF	$87.00	$0.00	
Drilled caisson piles, 24" diameter		VLF	$71.00	$0.00	
Drilled caisson piles, 36" diameter		VLF	$149.00	$0.00	
Drilled caisson piles, 48" diameter		VLF	$245.00	$0.00	
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
DIVISION 32 - EXTERIOR IMPROVEMENTS					
ACP Replacement					
Pavement, HMA (CL 1/2), Based on 4" Depth		SY	$26.00	$0.00	For placement of CL 1/2" HMA 4" depth. Includes all work related to HMA placement.
Mineral Aggregate, Type 2 (QTY(TN)<500), Based on 6" Depth		CY	$65.00	$0.00	
HMA (CL 1/2), Overlay, 2" depth		TN	$14.00	$0.00	
PCC Pavement Replacement					
Replace PCC Pavement, 8" depth		SY	$82.00	$0.00	
Replace PCC Pavement, 12" depth		SY	$105.00	$0.00	
Mineral Aggregate, Type 2 (QTY(TN)>500), Based on 6" Depth		CY	$65.00	$0.00	
Sidewalk/Crosswalk Landings		SY	$65.00	$0.00	
Curb and Gutter, Cement Concrete		LF	$40.00	$0.00	
Landscaping					
Topsoil, Type A, Based on 8" thickness		CY	$50.00	$0.00	

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)
Cost Estimate Elements:
Pump Station

Takeoff By:
Estimate By:
Date:
Rev:
Rev:
Rev:

Tool Revision: Ver 3, edited 4/18/13

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST	COMMENTS
DIVISION 1 - GENERAL REQUIREMENTS					
Landscaping - Minimum		SF	$1.00	$0.00	Allowance for hydroseeding with some minor planting beds with shrubs and bark mulch.
Landscaping - Average		SF	$5.00	$0.00	Planting allowance includes about 50% hydroseeding and 50% planting beds with shrubs and bark mulch.
Landscaping - High End		SF	$10.00	$0.00	Planting allowance includes planting beds with shrubs, small trees and bark mulch.
Irrigation		SF	$2.00		Irrigation system for plantings, includes piping, controls, and spray heads.
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
DIVISION 33 - UTILITIES					
Caisson for Pump Station 8' dia, up to 20 ft depth		EA	$186,500.00	$0.00	Includes excavation, shoring & concrete
Addition Caisson depth, 8' dia		VLF	$5,550.00	$0.00	Includes excavation, shoring & concrete
Caisson for Pump Station 10' dia, up to 20 ft depth		EA	$232,000.00	$0.00	Includes excavation, shoring & concrete
Addition Caisson depth, 10' dia		VLF	$7,100.00	$0.00	Includes excavation, shoring & concrete
Caisson for Pump Station 12' dia, up to 20 ft depth		EA	$335,500.00	$0.00	Includes excavation, shoring & concrete
Addition Caisson depth, 12' dia		VLF	$9,350.00	$0.00	Includes excavation, shoring & concrete
Manhole (48" diameter, 10' depth)		EA	$3,700.00	$0.00	
Manhole (48" diameter, additional depth)		VLF	$270.00	$0.00	
Manhole (72" diameter, 10' depth)		EA	$7,000.00	$0.00	
Manhole (72" diameter, additional depth)		VLF	$330.00	$0.00	
Manhole (120" diameter, 10' depth)		EA	$23,900.00	$0.00	
Manhole (120" diameter, additional depth)		VLF	$920.00	$0.00	
Catch Basin, Type 240A or 240B		EA	$2,800.00	$0.00	
Inlet, Type 250A		EA	$1,500.00	$0.00	
Connection to existing storm drainage system		LS	$5,000.00	$0.00	
Other Items					Change Description and enter unit cost if needed
Other Items					Change Description and enter unit cost if needed
DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION					
DIVISION 40 - PROCESS INTEGRATION					
Storage Facility I&C (See Above)					Cost included in Pump Station electrical and I&C cost curve in Div 23
DIVISION 41 - MATERIAL PROCESS AND HANDLING EQUIPMENT					
DIVISION 43 - PROCESS GAS AND LIQUID HANDLING					
DIVISION 44 - POLLUTION CONTROL EQUIPMENT					
Storage Odor Control	**0**	**MG**			Only use for Effluent PS on a tunnel storage options. Tank storage costs should already include this cost item and standard PS do not need this item.
Odor Control Equipment	1	LS	$0.00	$0.00	Based on Windermere/Genesee costs; Used for PS on tunnels.
DIVISION 46 - WATER AND WASTEWATER EQUIPMENT					
DIVISION 48 - ELECTRIC POWER GENERATION					
SUBTOTAL				**$1,755,434**	
CONSTRUCTION SUBTOTAL (ROUNDED)				**$1,760,000**	

Storage Schedule Inputs			**Baseline Schedule Days**
Mobilization			10.0 days
Set up dewatering system			15.0 days
Site Demolition $ value	0	LS	0.0 days
Shoring Sheet Pile	6,360	SF	7.0 days
Shoring Soldier Piles	0	SF	0.0 days
Cassion Construction, 8' dia, up to 20 ft	0	EA	0.0 days
Cassion Excavation	0	CY	
Cassion Concrete	0	CY	
Cassion Construction, 10' dia, up to 20 ft	0	EA	0.0 days
Cassion Excavation	0	CY	
Cassion Concrete	0	CY	
Cassion Construction, 12' dia, up to 20 ft	0	EA	0.0 days
Cassion Excavation	0	CY	
Cassion Concrete	0	CY	
Excavation	2,199	CY	8.0 days
Waste	2,199		
Concrete SOG	293	CY	7.0 days
Concrete Walls	380		32.0 days
Concrete Elev Slab	147		9.0 days
Backfill & Bedding	98	CY	1.0 days
Imported Materials	98	CY	
Mechanical & Equipment	233,545	LS	24.0 days
Electrical	235,690	LS	24.0 days
Comissioning	10	%	5.0 days
Site Restoration $ value	0	LS	0.0 days
De-mobilization and punch list			15.0 days

Pump Station Schedule	**Baseline**	**Medium**	**Hard**	**$ Value**
Mobilization	10 days	10 days	10 days	$86,995
Site demo/prep	0 days	0 days	0 days	$0
Shoring & Excavation	15 days	20 days	23 days	$298,260
Concrete/Cassion Work	48 days	62 days	72 days	$858,424
Backfill	1 days	1 days	2 days	$5,237
Mechanical Work	24 days	31 days	36 days	$233,545
Electrical Work	24 days	31 days	36 days	$235,690
Comissioning	5 days	7 days	8 days	
Site restoration	0 days	0 days	0 days	$0
Demobilization	15 days	15 days	15 days	$37,284
				$1,755,434

Schedule Values	
Baseline	Baseline schedule values assumes standard production with no difficulties
Medium	Task takes 30% longer due to site restrictions such as access, traffic control, ground conditions
Hard	Task takes 50% longer due to site restrictions such as access, traffic control, ground conditions

Manhour Calculations

Total Manhours for the schedule items	5,360	MHs
Add 100% for foreman, site supervision, misc other site items, cleanup, etc.	5360	MHs
Baseline Total Number of Man Hours	10720	
Medium Total Number of Man Hours	13362.2535	
Hard Total Number of Man Hours	15250	

Truck Trips

Raw/Base Truck Trips over project life	286
Add 50% for pipes, shoring items, other items	143
Total Truck Trips during entire project	429

Equipment Hours

Piledriving/Shoring Equipment Hours	56
Add 50% total hours	28
Baseline Total Piledriving Equipment hours	84
Medium Total Piledriving Equipment hours	105
Hard Total Piledriving Equipment hours	119
Earthwork Equipment Hours (Excavator, dozer, loader, etc)	196
Add 50% total hours	98
Baseline Total Earthwork Equipment hours	294
Medium Total Earthwork Equipment hours	366
Hard Total Earthwork Equipment hours	418
Lifting/Pumping Equipment Hours (Cranes, concrete pump, forklift, etc)	192
Add 50% total hours	96
Baseline Total Lifting/Pumping Equipment hours	288
Medium Total Lifting/Pumping Equipment hours	359
Hard Total Lifting/Pumping Equipment hours	410

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)
Cost Estimate Elements:
Green Stormwater Infrastructure

Takeoff By:
Estimate By:
Date:
Rev:
Rev:
Rev:

Tool Revision: Ver 3, edited 9/25/12

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST	COMMENTS
GSI Construction Costs	0	SF	$3.50	$0.00	GSI costs per GSI report for LTCP, May 2011
SUBTOTAL				**$0**	
CONSTRUCTION SUBTOTAL (ROUNDED)				**$0**	

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)

Takeoff By:
Estimate By:
Date:
Rev:
Rev:

Tool Revision: Ver 3, edited 5/8/14

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), April 2013	9430.77
Unit Cost Adjustment	1.000
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 22,780,000	$ 1,870,000	$ 2,220,000	$ 980,000	$ 2,560,000	$ 13,390,000	$ 1,760,000	$ -
B	**Subtotal**	**$ 22,780,000**	**$ 1,870,000**	**$ 2,220,000**	**$ 980,000**	**$ 2,560,000**	**$ 13,390,000**	**$ 1,760,000**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 227,800	$ 18,700	$ 22,200	$ 9,800	$ 25,600	$ 133,900	$ 17,600	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 23,007,800	$ 1,888,700	$ 2,242,200	$ 989,800	$ 2,585,600	$ 13,523,900	$ 1,777,600	$ -
F	Construction Line Item Pricing (See above for ENR Index Date)	$ 23,008,000	$ 1,889,000	$ 2,242,000	$ 990,000	$ 2,586,000	$ 13,524,000	$ 1,778,000	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 3,451,350	$ 283,350	$ 336,300	$ 148,500	$ 387,900	$ 2,028,600	$ 266,700	$ -
I	**Construction Bid Amount**	**$ 26,461,000**	**$ 2,172,000**	**$ 2,578,000**	**$ 1,139,000**	**$ 2,974,000**	**$ 15,553,000**	**$ 2,045,000**	**$ -**
J	Sales Tax[2]	$ 2,513,795	$ 206,340	$ 244,910	$ 108,205	$ 282,530	$ 1,477,535	$ 194,275	$ -
K	**Construction Contract Amount**	**$ 28,975,000**	**$ 2,378,000**	**$ 2,823,000**	**$ 1,247,000**	**$ 3,257,000**	**$ 17,031,000**	**$ 2,239,000**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 28,975,000**	**$ 2,378,000**	**$ 2,823,000**	**$ 1,247,000**	**$ 3,257,000**	**$ 17,031,000**	**$ 2,239,000**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 14,197,000	$ 1,165,000	$ 1,383,000	$ 611,000	$ 1,596,000	$ 8,345,000	$ 1,097,000	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 43,172,000**	**$ 3,543,000**	**$ 4,206,000**	**$ 1,858,000**	**$ 4,853,000**	**$ 25,376,000**	**$ 3,336,000**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 8,635,000	$ 709,000	$ 841,000	$ 372,000	$ 971,000	$ 5,075,000	$ 667,000	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 6,475,000	$ 531,000	$ 631,000	$ 279,000	$ 728,000	$ 3,806,000	$ 500,000	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2013 Dollars[8]**	**$ 58,280,000**	**$ 4,780,000**	**$ 5,680,000**	**$ 2,510,000**	**$ 6,550,000**	**$ 34,260,000**	**$ 4,500,000**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

TRADES			T&I	OH&P	Downtown Factor	Total Burdened Rate
Carpenter	1	49.57	1.40	1.18	1.15	**$94.17**
Cement Mason	1	50.13	1.40	1.18	1.15	**$95.24**
Electrician	1	59.85	1.40	1.18	1.15	**$113.70**
Fence Laborer	1	15.18	1.40	1.18	1.15	**$28.84**
Flagger	1	34.61	1.40	1.18	1.15	**$65.75**
Ironworker	1	59.02	1.40	1.18	1.15	**$112.13**
Laborer	1	40.83	1.40	1.18	1.15	**$77.57**
Pipe Layer	1	41.59	1.40	1.18	1.15	**$79.01**
Millwright	1	50.67	1.40	1.18	1.15	**$96.26**
Painter	1	36.53	1.40	1.18	1.15	**$69.40**
Plumber	1	71.69	1.40	1.18	1.15	**$136.20**
Oper-Heavy	1	51.40	1.40	1.18	1.15	**$97.65**
Oiler/Mechanic	1	52.44	1.40	1.18	1.15	**$99.63**
Roofer	1	43.90	1.40	1.18	1.15	**$83.40**
Sheetmetal Worker	1	68.52	1.40	1.18	1.15	**$130.17**
Teamster	1	47.91	1.40	1.18	1.15	**$91.02**
Welder (Field)	1	59.02	1.40	1.18	1.15	**$112.13**

King County
Effective: 4/9/2013

1.038 Seattle Area Adj Factor 2013 RS Means

SEA ENR CCI Index	
Apr-13	9430.77
Dec-11	9059.55
Aug-10	8697.82

Escalation	1.041	Dec 2011 to April 2013
Escalation	1.084	Aug 2010 to April 2013

CREWS

1 Mobilization

Foreman	1	52.40	52.40	Pickup	10.00	
Oper-Heavy	0	51.40	0.00	Trench Box	0.00	
Oiler	1	52.44	52.44	Truck &Trailer	80.00	
Laborer	1	40.83	40.83			
Total MH/Crew HR	3		145.67		90.00	
	T&I		1.40			
	OH&P		1.18	OH&P	1.18	
	City of Seattle Factor		1.15	City of Seattle Factor	1.15	
			$276.74		**$122.13**	**$398.87**

2 Excavation

Foreman	1	52.40	52.40	Pickup	10.00	
Oper-Heavy	1	51.40	51.40	Trench Box	0.00	
Oiler	0.5	52.44	26.22	Excavator	80.00	
Laborer	1	40.83	40.83			
Total MH/Crew HR	3.5		170.85		90.00	
	T&I		1.40			
	OH&P		1.18	OH&P	1.18	
	City of Seattle Factor		1.15	City of Seattle Factor	1.15	
			$324.58		**$122.13**	**$446.71**

3 Additional Dozer to feed Excavator

Foreman	0	52.40	0.00	Pickup	0.00	
Oper-Heavy	1	51.40	51.40	Trench Box	0.00	
Oiler	0	52.44	0.00	Dozer	50.00	
Laborer	0	40.83	0.00			
Total MH/Crew HR	1		51.40		50.00	
	T&I		1.40			
	OH&P		1.18	OH&P	1.18	
	City of Seattle Factor		1.15	City of Seattle Factor	1.15	
			$97.65		**$67.85**	**$165.50**

4 Conveyor Loading System

Foreman	0	52.40	0.00	Pickup	0.00	
Oper-Heavy	1	51.40	51.40	Trench Box	0.00	
Oiler	1	52.44	52.44	Conveyor System	22.00	
Laborer	0	40.83	0.00			
Total MH/Crew HR	2		103.84		22.00	
	T&I		1.40			
	OH&P		1.18	OH&P	1.18	
	City of Seattle Factor		1.15	City of Seattle Factor	1.15	
			$197.28		**$29.85**	**$227.13**

5 Stockpile Handling

Foreman	0	52.40	0.00	Pickup	10.00	
Oper-Heavy	1	51.40	51.40	Trench Box	0.00	
Oiler	0.5	52.44	26.22	Dozer	50.00	
Laborer	0	40.83	0.00			
Total MH/Crew HR	1.5		77.62		60.00	
	T&I		1.40			
	OH&P		1.18	OH&P	1.18	
	City of Seattle Factor		1.15	City of Seattle Factor	1.15	
			$147.46		**$81.42**	**$228.88**

6 Grub and Clear

Foreman	1	52.40	52.40	Pickup	10.00	
Oper-Heavy	1	51.40	51.40	Trench Box	0.00	
Oiler	0.5	52.44	26.22	Dozer	50.00	
Laborer	0	40.83	0.00			
Total MH/Crew HR	2.5		130.02		60.00	
	T&I		1.40			
	OH&P		1.18	OH&P	1.18	
	City of Seattle Factor		1.15	City of Seattle Factor	1.15	
			$247.01		**$81.42**	**$ 328.43**

7 Hand Excavation

Foreman	1	52.40	52.40	Pickup	10.00	
Oper-Heavy	1	51.40	51.40	Trench Box	0.00	
Oiler	0	52.44	0.00	Tractor/Backhoe	25.00	
Laborer	3	40.83	122.49			
Total MH/Crew HR	5		226.29		35.00	
	T&I		1.40			
	OH&P		1.18	OH&P	1.18	
	City of Seattle Factor		1.15	City of Seattle Factor	1.15	
			$429.91		**$47.50**	**$ 477.40**

8 Demolition Crew

Foreman	1	52.40	52.40	Pickup	10	
Oper-Heavy	2	51.40	102.80	Excavator	80	
Oiler	0.5	52.44	26.22	Loader	50	
Laborer	1	40.83	40.83			
Total MH/Crew HR	4.5		222.25		140	
	T&I		1.40			
	OH&P		1.18	OH&P	1.18	
	City of Seattle Factor		1.15	City of Seattle Factor	1.15	
			$422.23		**$189.98**	**$ 612.21**

9 Pile Driver

Foreman	1	50.57	50.57	Pickup	10	
Operator	2	49.57	99.14	60 ton crane	70	
Oiler	1	52.44	52.44	Forklift	35	
Laborer	3	40.83	122.49	Compactor	0	
Total MH/Crew HR	7		324.64		115	
	T&I		1.40			
	OH&P		1.18	OH&P	1.18	
	City of Seattle Factor		1.15	City of Seattle Factor	1.15	
			$616.75		**$156.06**	**$ 772.81**

10 Bed & Zone

Foreman	1	50.57	50.57	Hand Compactor (2)	3	
Operator	1	49.57	49.57	Loader	80	
Laborer	3	40.83	122.49	Pickup	10	
Total MH/Crew HR	5		222.63		93	
	T&I		1.40			
	OH&P		1.18	OH&P	1.18	
	City of Seattle Factor		1.15	City of Seattle Factor	1.15	
			$422.95		**$126.20**	**$549.15**

11 Backfill

Foreman	1	50.57	50.57	Pickup	10	
Operator	2	49.57	99.14	Loader	80	
Laborer	1	40.83	40.83	Compactor	50	
Total MH/Crew HR	4		190.54		140	
	T&I		1.40			
	OH&P		1.18	OH&P	1.18	
	City of Seattle Factor		1.15	City of Seattle Factor	1.15	
			$361.99		**$189.98**	**$ 551.97**

12 Steel Pipe

Foreman	1	52.40	52.40	Pickup	10	
Welder	2	59.02	118.04			
Oper-Heavy	1	51.40	51.40	Welder	25	
Oiler	0.5	52.44	26.22	Crane	100	
Laborer	3	40.83	122.49			
Total MH/Crew HR	7.5		370.55		135	
	T&I		1.40			
	OH&P		1.18	OH&P	1.18	
	City of Seattle Factor		1.15	City of Seattle Factor	1.15	
			$703.97		**$183.20**	**$ 887.17**

13 Large DI Pipe

Foreman	1	52.40	52.40	Pickup	10	
Welder	0	59.02	0.00			
Oper-Heavy	1	51.40	51.40	Welder	0	
Oiler	0.5	52.44	26.22	Crane	100	
Laborer	4	40.83	163.32			
Total MH/Crew HR	6.5		293.34		110	
	T&I		1.40			
	OH&P		1.18	OH&P	1.18	
	City of Seattle Factor		1.15	City of Seattle Factor	1.15	
			$557.29		**$149.27**	**$ 706.56**

14 **PVC Pipe**

Foreman	1	52.40	52.40	Pickup	10		
Welder	0	59.02	0.00				
Oper-Heavy	1	51.40	51.40	Welder	0		
Oiler	0	52.44	0.00	Excavator	80		
Laborer	3	40.83	122.49				
Total MH/Crew HR	5		226.29		90		
		T&I	1.40				
		OH&P	1.18	OH&P	1.18		
		City of Seattle Factor	1.15	City of Seattle Factor	1.15		
			$429.91		**$122.13**	$	552.04

15 **Small PVC Pipe**

Foreman	1	52.40	52.40	Pickup	10		
Welder	0	59.02	0.00				
Oper-Heavy	0	51.40	0.00	Welder	0		
Oiler	0	52.44	0.00	Excavator	0		
Laborer	3	40.83	122.49				
Total MH/Crew HR	4		174.89		10		
		T&I	1.40				
		OH&P	1.18	OH&P	1.18		
		City of Seattle Factor	1.15	City of Seattle Factor	1.15		
			$332.26		**$13.57**	$	345.83

16 **Waste**

Teamster	1	47.91	47.91	Truck & Trailer	35		
Total MH/Crew HR	1		47.91		35		
		T&I	1.40				
		OH&P	1.18	OH&P	1.18		
		City of Seattle Factor	1.15	City of Seattle Factor	1.15		
			$91.02		**$47.50**	$	138.51

17 **Masonry**

Foreman	1	50.57	50.57				
Carpenter/Laborer	3	49.57	148.71	Misc	10		
Total MH/Crew HR	4		199.28		10		
		T&I	1.40				
		OH&P	1.18	OH&P	1.18		
		City of Seattle Factor	1.15	City of Seattle Factor	1.15		
			$378.59		**$13.57**	$	392.16

18 **Misc**

Foreman	1	50.57	50.57				
Carpenter/Laborer	2	49.57	99.14	Misc	5		
Total MH/Crew HR	3		149.71		5		
		T&I	1.40				
		OH&P	1.18	OH&P	1.18		
		City of Seattle Factor	1.15	City of Seattle Factor	1.15		
			$284.42		**$6.79**	$	291.20

19 **Fencing Crew**

Foreman/Operator	1	51.40	51.40	Crew Truck	10.00		
Fence Laborer	3	15.18	45.54	Tractor/Backhoe	25.00		
Total MH/Crew HR	4		96.94		35		
		T&I	1.40				
		OH&P	1.18	OH&P	1.18		
		City of Seattle Factor	1.15	City of Seattle Factor	1.15		
			$184.17		**$47.50**	$	231.66

20 **Metals**

Foreman	1	52.40	52.40	Pickup	10		
Ironworkers	2	59.02	118.04				
Oper-Heavy	1	51.40	51.40	Misc	10		
Oiler	0.5	52.44	26.22	Crane	100		
Laborer	2	40.83	81.66				
Total MH/Crew HR	6.5		329.72		120		
		T&I	1.40				
		OH&P	1.18	OH&P	1.18		
		City of Seattle Factor	1.15	City of Seattle Factor	1.15		
			$626.40		**$162.84**	$	789.24

21 **Formwork**

Foreman	1	50.57	50.57	1 Pickup	8		
Carpenter	1	49.57	49.57	1 Misc	10		
Laborer	1	40.83	40.83				
Total MH/Crew HR	3		140.97		18		
		T&I	1.40				
		OH&P	1.18	OH&P	1.18		
		City of Seattle Factor	1.15	City of Seattle Factor	1.15		
			$267.81		**$24.43**		$292.24

22 **Rebar**

Ironworker Foreman	1	60.02	60.02	1 Misc	10		
Ironworker	2	59.02	118.04	1 Forklift	25		
Total MH/Crew HR	3		178.06		35		
		T&I	1.40				
		OH&P	1.18	OH&P	1.18		
		City of Seattle Factor	1.15	City of Seattle Factor	1.15		
			$338.28		**$47.50**		$385.77

23 Placement & Finishing

Foreman	1	50.57	50.57	1	Pickup	8		
Carpenter	1	49.57	49.57					
Cement Finisher	1	41.59	41.59	1	Power Trowel	5		
Laborer	1	40.83	40.83	1	Vibrator & Misc	10		
Total MH/Crew HR	4		182.56			23		
		T&I	1.40					
		OH&P	1.18		OH&P	1.18		
		City of Seattle Factor	1.15		City of Seattle Factor	1.15		
			$346.83			**$31.21**		**$378.04**

24 Equipment

Foreman	1	52.40	52.40		Pickup	10		
Plumber/Elect	2	59.85	119.70					
Oper-Heavy	1	51.40	51.40		Misc	25		
Oiler	0.5	52.44	26.22		Crane	100		
Laborer	2	40.83	81.66					
Total MH/Crew HR	6.5		331.38			135		
		T&I	1.40					
		OH&P	1.18		OH&P	1.18		
		City of Seattle Factor	1.15		City of Seattle Factor	1.15		
			$629.56			**$183.20**	**$**	**812.75**

25 Plumbing

Foreman	1	72.69	72.69					
Plumbing	1	71.69	71.69		Misc	5		
Total MH/Crew HR	2		144.38			5		
		T&I	1.40					
		OH&P	1.18		OH&P	1.18		
		City of Seattle Factor	1.15		City of Seattle Factor	1.15		
			$274.29			**$6.79**	**$**	**281.08**

26 Electrical

Foreman	1	60.85	60.85					
Electrician	1	59.85	59.85		Misc	5		
Total MH/Crew HR	2		120.70			5		
		T&I	1.40					
		OH&P	1.18		OH&P	1.18		
		City of Seattle Factor	1.15		City of Seattle Factor	1.15		
			$229.31			**$6.79**	**$**	**236.09**

27 Ductwork & Fans

Foreman	1	52.40	52.40		Pickup	10		
Plumber/Elect	1	59.85	59.85					
Oper-Heavy	1	51.40	51.40		Misc	25		
Oiler	0.5	52.44	26.22		Lifting Equipment	50		
Sheetmetal	2	68.52	137.04					
Total MH/Crew HR	5.5		326.91			85		
		T&I	1.40					
		OH&P	1.18		OH&P	1.18		
		City of Seattle Factor	1.15		City of Seattle Factor	1.15		
			$621.06			**$115.35**	**$**	**736.41**

28 Roofing & Siding

Foreman	1	69.52	69.52		Pickup	10		
Laborer	2	40.83	81.66					
Oper-Heavy	0	51.40	0.00		Misc	25		
Oiler	0	52.44	0.00		Lifting Equipment	0 with decking crew		
Sheetmetal	2	68.52	137.04					
Total MH/Crew HR	5		288.22			35		
		T&I	1.40					
		OH&P	1.18		OH&P	1.18		
		City of Seattle Factor	1.15		City of Seattle Factor	1.15		
			$547.56			**$47.50**	**$**	**595.06**

29 Paving Crew

Foreman	1	1.00	1.00		Pickup	10		
Laborer	3	40.83	122.49		Tandum Roller	35		
Oper-Heavy	2	51.40	102.80		Paver	75		
Oiler	0	52.44	0.00					
Total MH/Crew HR	6		226.29			120		
		T&I	1.40					
		OH&P	1.18		OH&P	1.18		
		City of Seattle Factor	1.15		City of Seattle Factor	1.15		
			$429.91			**$162.84**	**$**	**592.75**

Appendix K: Operating Cost Model

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number **SAMPLE CALCULATION**
Alternative Description

5/8/2014

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/*	*Ann*	*Anticipated*	*Variability*	*High End*
					Base Cost	*Freq*	*Annual Cost*	*Multiplier*	*Annual Cost*
Conveyance Pipeline-	7	Typical	1	LF	$ 1.75	1	$ 2	1	$ 2
special cleaning		Arterial	1	LF	$ 2.00	1	$ 2	1	$ 2
		Lakeline	1	LF	$ 2.00	1	$ 2	1	$ 2
		Force Main	1	LF	$ 1.00	1	$ 1	1	$ 1
Diversion Structure									
		Type 1 - Basic	1	ea	$ 260	4	$ 1,040	1.5	$ 1,560
	8	Type 2 - Hydrobrake	1	ea	$ 260	12	$ 4,240	1.5	$ 6,360
		Type 3 - Motorized	1	ea	$ 1,000	4	$ 2,040	1.5	$ 3,060
Undercrossing									
			1	LF	$ 2	1	$ 2	1.5	$ 3
Wet weather Pump Station									
		Type 1 - < 50 HP	1	ea	$ 6,500	1	$ 6,500	1.25	$ 8,125
		Type 2 - 50 HP & up	1	ea	$ 11,600	1	$ 11,600	1.25	$ 14,500
	9	Demand charge	1	HP		1	$ 9	1	
		Odor Control	1	ea	$ 6,000		$ 6,000	1.25	$ 7,500
Effluent Pump Station									
		Type 1 - <50HP	1	ea	$ 5,000	1	$ 5,000	1.25	$ 6,250
		Type 2 - 50HP & up	1	ea	$ 9,600	1	$ 9,600	1.25	$ 12,000
		Continuous Operation	1	ea	$ 2,000	1	$ 2,000	1.25	$ 2,500
	9	Demand charge	1	HP		1	$ 9	1	$ 9
Storage Tanks	12								
		Type 1 - < 72-inch pipe	1	LF	$ 1.75	2	$ 1,044	1.25	$ 1,304
		Type 2 - < 1.5 MG	1	ea	$ 16,500	1	$ 16,500	1.25	$ 20,625
		Type 3 - > 1.5 MG	1	MG	$ 14,012	1	$ 14,012	1.5	$ 21,017
		Type 4 - Tunnel	1	MG	$ 14,012	1	$ 14,012	1.5	$ 21,017
Tank cleaning equipment									
		Motorized gate	1	ea	$ 1,040	1	$ 1,040	1.25	$ 1,300
	11	Tipping bucket	1	ea	$ 1,040	1	$ 1,040	1.5	$ 1,560
Odor Control									
			1	MG	$ 15,600	1	$ 15,600	1.25	$ 19,500
Landscape Maintenance	13		1	SF	$ 0.145	29	$ 0	1.2	$ 0
Generator Maintenance			1	ea	$ 2,040	6	$ 2,040	1.25	$ 2,550
NDS Maintenance			1				$ -	1	$ -
Water Quality Structures			1				$ -	1.5	$ -
Annual O&M							$ 113,334		$ 150,748

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟫	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Appendix L: LTCP CSO Control Measures Performance Modeling Report

Seattle Public Utilities

Protecting Seattle's Waterways

Long-Term Control Plan CSO Control Measures Performance Modeling Report

January 2015

Seattle Public Utilities
Long-Term Control Plan CSO Control Measure Modeling Report

January 2015

Prepared for:

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SPU CSO Project No. C-308039
SPU Consultant Contract No. C10-048

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List of Abbreviations

Term	**Definition**
ADS	ADS Environmental Services
BECV	best-estimate control volume
City	City of Seattle
CSO	combined sewer overflow
CSS	combined sewer system
EBI	Elliott Bay Interceptor
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
fps	foot/feet per second
ft/ft	foot/feet vertical per 1 foot horizontal
ft^2	square foot/feet
GIS	geographic information system
HLKK	Hanford-Lander-King Street-Kingdome
KC	King County
lf	linear foot/feet
LTCP	Long-Term Control Plan
LTS	long-term simulation
MG	million gallon(s)
mgd	million gallon(s) per day
MH	maintenance hole
NIRR	no-impact release rate
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
PS	pump station
RG	rain gauge
RTC	real-time control
SCADA	supervisory control and data acquisition
SPU	Seattle Public Utilities
SWMM5	EPA Storm Water Management Model, Version 5
WWTP	wastewater treatment plant

Executive Summary

The City of Seattle (City) owns and operates a combined sewer system (CSS) that overflows at designed relief points during heavy rainfall events. These relief points and the combined sewer overflows (CSOs) they produce help the City avoid more serious operational, environmental, and public-safety concerns, such as sewage flooding into the streets or backups into basements. Nevertheless, these CSOs discharge untreated wastewater and its inherent pollutants (e.g., bacteria, metals) to our local water bodies, potentially impacting their quality and beneficial uses. The City is working to reduce these discharges.

Seattle Public Utilities (SPU) is developing a Long-Term Control Plan (LTCP) that will guide the planning and implementation of the CSO control program beyond 2015 by addressing technical, environmental, financial, and regulatory elements of CSO control. The LTCP is being developed under a Consent Decree agreement with the U.S. Environmental Protection Agency (EPA) that describes LTCP requirements, CSO program milestone dates, and other required activities. To comply with the Consent Decree, the number of untreated CSO events at each outfall will be limited to a moving 20-year average of no more than 1.0 event per year.

This report strategically targets 11 uncontrolled CSO areas identified in SPU's 2015 Final LTCP Reduction Plan—Ballard, Central Waterfront (Vine Street), Delridge/Longfellow, Duwamish, East Waterway, Fremont/Wallingford, Leschi, Magnolia, Montlake, North Union Bay, and Portage Bay. For clarity, each of these basins has been assigned a name in this report and in SPU's modeling work that refers to the number of the authorized CSO outfall where the basin overflows. For example, the NPDES152 Basin refers to the portion of the Ballard CSO Area that overflows to the outfall designated in SPU's National Pollutant Discharge Elimination System (NPDES) permit as Outfall 152. Some NPDES basins have more than one overflow structure for each outfall. For example, eight overflow structures ultimately discharge flows into the Duwamish River through NPDES Outfall 111. For clarity, they are designated as NPDES111(A–H) in this report and in SPU's modeling work. Also for clarity, the areas discharging through NPDES111 and NPDES111(A–H) are designated as the NPDES111 and NPDES111(A–H) Basins in this report and in SPU's modeling work.

Purpose of Final LTCP CSO Control Measure Alternatives Performance Modeling Report

This report describes the hydraulic modeling of the Final Long-Term Control Plan (LTCP) CSO control measure alternatives. An overview of the LTCP basins is shown in Figure ES-1. The specific CSO control measures modeled are listed in Table ES-1, and the storage volumes provided and maximum rates of release of storage to King County are shown in Table ES-2.

Table ES-1. Final LTCP CSO Control Measure Alternatives

CSO control measure	CSO area	CSO outfalls
Ballard Neighborhood Storage	Ballard	NPDES150/151 and NPDES152
Central Waterfront (Vine Street) Neighborhood Storage	Central Waterfront	NPDES069
Delridge Neighborhood Storage	Delridge/Longfellow	NPDES099
Delridge Retrofits (two storage facilities if required)	Delridge/Longfellow	NPDES168 and NPDES169
Duwamish Neighborhood Storage	Duwamish	NPDES111: CSO Control Structure 111 B, 111C, and 111H
East Waterway Neighborhood Storage	East Waterway	NPDES107
Fremont/Wallingford Neighborhood Storage	Fremont-Wallingford	NPDES147[A], NPDES147[B], and NPDES174
Leschi: Neighborhood Storage (four storage facilities)	Leschi	NPDES028, NPDES029, NPDES031, NPDES032, and NPDES036
Magnolia Neighborhood Storage	Magnolia	NPDES060
Montlake Neighborhood Storage (three storage facilities)	Montlake	NPDES020, NPDES139, and NPDES140
North Union Bay Retrofit	North Union Bay	NPDES018[A] and NPDES018[B]
Portage Bay Neighborhood Storage	Portage Bay/Lake Union	NPDES138
Joint CSO control measure with King County. Shared West Ship Canal Tunnel will include storage for King County 3rd Ave. W and 11th Ave. NW CSO areas.	SPU CSO Areas: Ballard and Fremont-Wallingford King CSO Areas: 3rd Ave. W and 11th Ave. NW	Seattle Public Utilities Outfalls: NPDES147[A], NPDES147[B], NPDES150/151, NPDES152, NPDES174 King County outfalls: 3rd Ave. W (Outfall 008) and 11th Ave. NW (Outfall 004)

Table ES-2. Final LTCP CSO Control Measure Alternative Sizing

CSO control measure	Total storage volume (MG)	Total maximum storage release rate (mgd)[a]
Ballard Neighborhood Storage	6.0	12.0
Central Waterfront (Vine Street) Neighborhood Storage	0.13	0.26
Delridge Neighborhood Storage 099	0.17	0.34
Delridge Retrofits (two storage facilities if needed)[b]	0.5	1.0
Duwamish Neighborhood Storage	0.03	0.06
East Waterway Neighborhood Storage	0.5	1.0
Fremont/Wallingford Neighborhood Storage	3.3	6.6
Leschi: Neighborhood Storage (four storage facilities)	0.39	0.78
Magnolia Neighborhood Storage	0.11	0.22
Montlake Neighborhood Storage (three storage facilities)	0.22	0.44
North Union Bay Retrofit	NA	0 to 3 mgd potential[c]
Portage Bay Neighborhood Storage	0.12	0.24
Joint CSO control measure with King County. Shared West Ship Canal Tunnel will include storage for SPU Ballard and Fremont/Wallingford CSO Areas and the King County 3rd Ave. W and 11th Ave. NW CSO areas.	16	32

a. *Release rate of stored flow following storm subsidence or in accordance with the KC NIRR.*

b. *Post-construction monitoring of the Delridge retrofits will determine if the storage facilities are needed.*

c. *To be confirmed in final design.*

This report specifically evaluates the final LTCP CSO control measures against the CSO control performance standard given in the Consent Decree by predicting the CSO frequency for a moving 20-year average and evaluating the CSO control measure performance with and without climate change. The performance requirements in the Consent Decree are documented in Section 1.2 of this report.

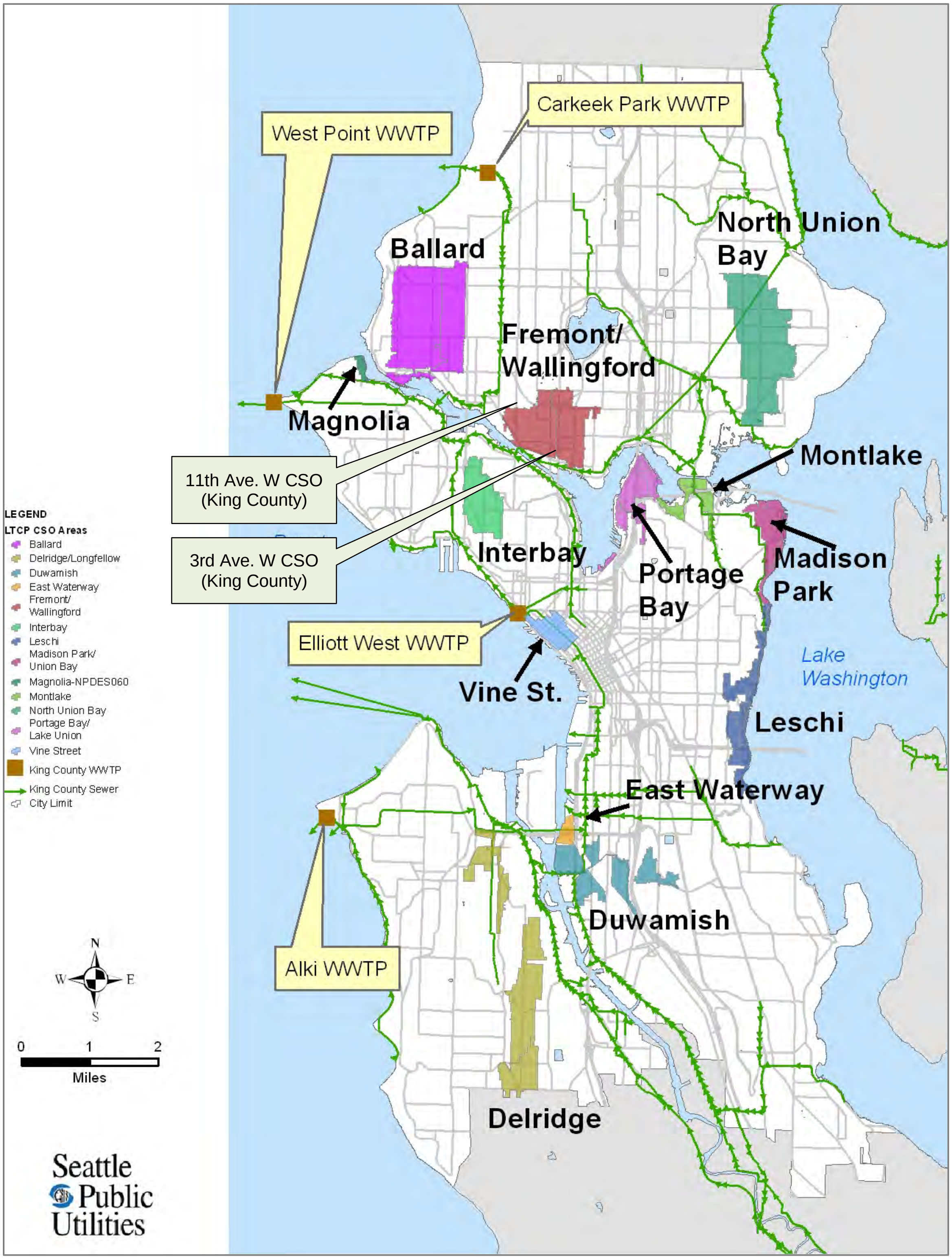


Figure ES-1. Location of LTCP CSO basins

Modeling Analysis

The models used for this analysis were based upon the calibrated Storm Water Management Model, Version 5 (SWMM5) v22 models that were documented in the LTCP modeling reports (CH2M Hill, 2012). The models were modified to incorporate the LTCP CSO control measure facilities and the model was analyzed to ensure compliance with the Consent Decree requirements. The SPU Consent Decree requires that performance be analyzed on a rolling 20-year average. Where possible, the analysis will use the period from 1993–2012 for the moving 20-year average to confirm CSO control compliance.

All SPU CSO basins eventually discharge to the King County (KC) interceptor system through various facilities. KC provided time series of flow rates for drainage of SPU storage CSO control measures at key locations in its interceptor system, in order to account for the conditions in the KC interceptor system. These time series of flow, called no-impact release rates (NIRR), provide times and maximum flow rates for release of stored flow from SPU CSO control facilities that would have minimal or no impact on the operation of KC's facilities. The NIRR time series are further described in Section 1.3 of this report.

The proposed LTCP CSO control measures were also evaluated using the KC NIRR to ensure that the proposed CSO control measures were still in compliance with the Consent Decree requirements. Where necessary, minor modifications were made to the LTCP CSO control measures to account for the KC NIRR, but the NIRR did not significantly impact any of the proposed CSO control measures. An example of the KC NIRR is shown in ES-2, which includes a portion of the NIRR time series for Fremont/Wallingford. As shown, the NIRR contains periods in which there is no allowable storage release from SPU facilities, followed by periods in which the NIRR exceeds the drainage rate from the proposed storages. The simulation results and boundary condition for a representative event for the Fremont/Wallingford Neighborhood Storage CSO control measure are also shown in Figure ES-2. The KC NIRR was available only for the period from 1978–2009 and thus all model analysis using the KC NIRR was restricted to this period.

The analysis of the North Union Bay NPDES018[B] and Delridge NPDES168 and NPDES169 retrofits did not include consideration of the respective KC NIRR for these locations. Downstream impacts on KC facilities may or may not be significant. The two agencies will jointly determine downstream impacts of these and other projects using post-construction monitoring and modeling. If downstream impacts are significant, the two agencies will jointly determine appropriate solutions.

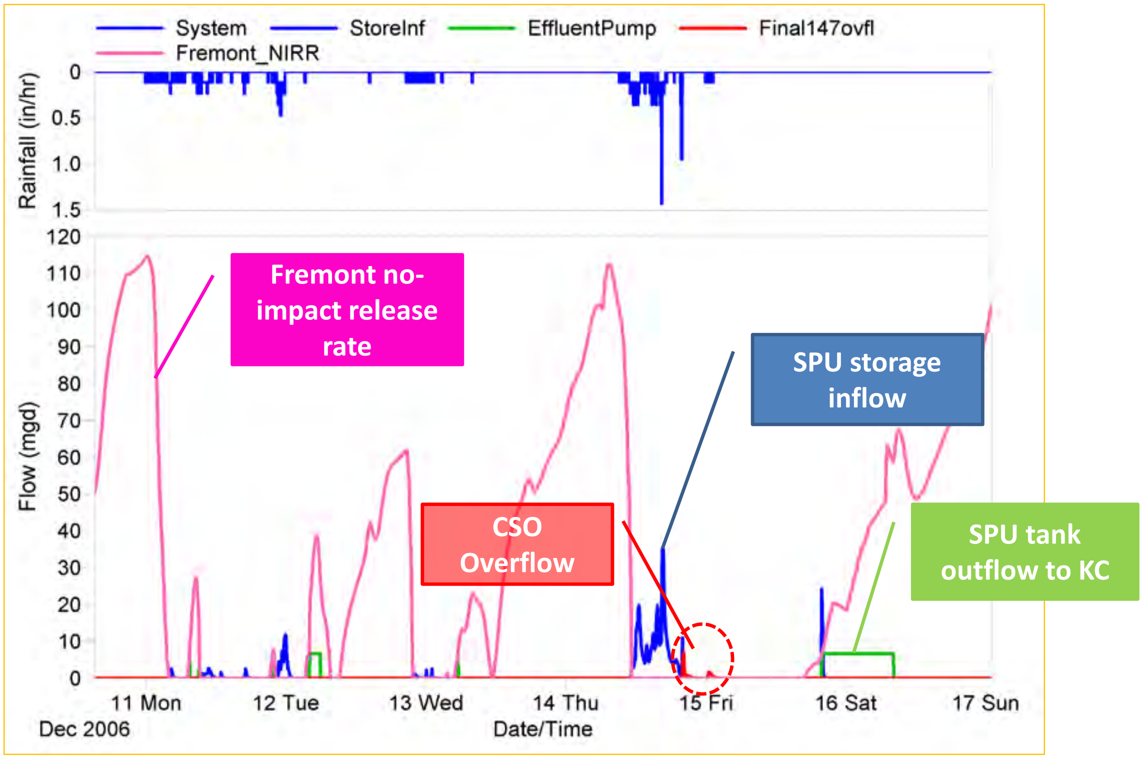


Figure ES-2. Simulation results for representative event with KC no-impact release rate: Fremont/Wallingford Neighborhood Storage CSO control measure example

CSO Performance Hydraulic Analysis

A summary of the simulation results for the LTCP CSO control measures is shown in Table ES-3. The LTCP CSO control measures provide an overflow frequency of less than 1.0 event per year over the last 20 years. Results are reported for the 20-year period from 1990–2009, which was necessary to conform to the available KC NIRR time series.

Table ES-3. LTCP CSO Control Measures
20-year (1990–2009) Moving Average Overflow Performance Results with KC No-Impact Release Rate Restrictions Imposed

CSO control measure	Outfall location	20-year overflow frequency without climate change (per year)[a]	20-year overflow frequency with climate change (per year)[a]
Ballard Neighborhood Storage	NPDES150/151	0.4	0.6
	NPDES152	0.5	0.7
Central Waterfront Neighborhood Storage	NPDES069	0.7	1.0
Delridge Neighborhood Storage	NPDES099	0.8	0.9

Table ES-3. LTCP CSO Control Measures
20-year (1990–2009) Moving Average Overflow Performance Results with KC No-Impact Release Rate Restrictions Imposed

CSO control measure	Outfall location	20-year overflow frequency without climate change (per year)[a]	20-year overflow frequency with climate change (per year)[a]
Delridge Retrofits[b]	NPDES168 NPDES169	1.0 0.5	1.0 0.9
Duwamish Neighborhood Storage	NPDES111	0.7	1.0
East Waterway Neighborhood Storage	NPDES107	0.7	0.8
Fremont/Wallingford Neighborhood Storage	NPDES147	0.5	0.7
	NPDES174	0.5	0.6
Leschi Neighborhood Storage	NPDES028	0.5	0.6
	NPDES029	0.5	0.5
	NPDES031	0.5	0.6
	NPDES032	0.4	0.5
	NPDES036	0.5	0.8
Magnolia Neighborhood Storage	NPDES060	0.5	0.9
Montlake Neighborhood Storage	NPDES020	0.6	0.8
	NPDES139	0.5	0.7
	NPDES140	0.4	0.7
North Union Bay Retrofit[b]	NPDES018	0.8	1.0
Portage Bay Neighborhood Storage	NPDES138	0.6	0.8
Shared West Ship Canal Tunnel Storage	NPDES147	0.5	0.6
	NPDES174	0.5	0.6
	NPDES152	0.5	0.7
	NPDES150/151	0.5	0.6
	KC 3rd Ave. W	0.5	0.6
	KC 11th Ave. NW	0.4	0.4

a. Results for the 20-year period of 1990–2009 except for Delridge retrofits 1993–2012.

b. Results projected for retrofits without addition of storage or use of the KC NIRR. Performance will be confirmed in post-construction monitoring/modeling and adjustments will be made for downstream impacts and performance upgrades if necessary.

SECTION 1

Introduction

1.1 Final CSO Control Measures

This report describes the hydraulic modeling of the Final LTCP CSO control measures for the remaining uncontrolled LTCP basins. The final CSO control measures are shown on Table 1-1 below.

Table 1-1. Final LTCP Alternative CSO Control Measures

CSO control measure	CSO area	CSO outfalls	Comments
Ballard Neighborhood Storage	Ballard	NPDES 150/151 and NPDES152	
Central Waterfront Neighborhood Storage	Central Waterfront	NPDES069	
Delridge Neighborhood Storage	Delridge/Longfellow	NPDES099	
Delridge Retrofits (two storage facilities)	Delridge/Longfellow	NPDES168 and NPDES169	Potential additional storage may be required after the 2015 Delridge Retrofit CSO control measure
Duwamish Neighborhood Storage	Duwamish	NPDES111 (CSO Control Structure 111B, 111C, and 111H)	
East Waterway Neighborhood Storage	East Waterway	NPDES107	
Fremont/Wallingford Neighborhood Storage	Fremont-Wallingford	NPDES147 (CSO Control Structures NPDES147[A], NPDES147[B]), and NPDES174	
Leschi: Neighborhood Storage (four storage facilities)	Leschi	NPDES028, NPDES029, NPDES031, NPDES032, and NPDES036)	
Magnolia Neighborhood Storage	Magnolia	NPDES060	

Table 1-1. Final LTCP Alternative CSO Control Measures

CSO control measure	CSO area	CSO outfalls	Comments
Montlake Neighborhood Storage (three storage facilities)	Montlake	NPDES020, NPDES139, and NPDES140	
North Union Bay Retrofit	North Union Bay	NPDES018 (CSO Control Structures NPDES018[A] and NPDES018[B])	SPU peak flows to King County may increase from NPDES018[B]
Portage Bay Neighborhood Storage	Portage Bay/Lake Union	NPDES138	
Shared West Ship Canal Tunnel Storage	SPU CSO Areas: Ballard and Fremont-Wallingford King CSO Areas: 3rd Ave. W and 11th Ave. NW	Seattle Public Utilities Outfalls: NPDES147, NPDES150/151, NPDES152, NPDES174 King County outfalls: 3rd Ave. W (Outfall 008) and 11th Ave. NW (Outfall 004)	Joint CSO control measure with King County. Tunnel will include storage for King County 3rd Ave. W and 11th Ave. NW CSO areas.

The following sections describe the combined sewer overflow (CSO) alternatives, analysis method, and modeling results.

1.2 Purpose of Hydraulic Analysis

The LTCP team has proposed independent Neighborhood Storage CSO control measures for the Ballard (NPDES150/151 and NPDES152), Central Waterfront (NPDES069), Delridge (NPDES099), Duwamish (NPDES111[B], 111[C], and 111[H]), East Waterway (NPDES107), Fremont/Wallingford (NPDES147[A], NPDES147[B], and NPDES174), Leschi (NPDES028, NPDES029, NPDES031, NPDES032, and NPDES036), Magnolia (NPDES060), Montlake (NPDES020, NPDES139, and NPDES140), and Portage Bay (NPDES138) CSO Areas. The LTCP team has also proposed a retrofit CSO control measure for the North Union Bay (NPDES018[B]) CSO Area and a retrofit CSO control measure for the Delridge NPDES168 and NPDES169 CSO areas. The LTCP is including small storage tanks for NPDES168 and NPDES169 to be constructed in the eventuality that the retrofit CSO control measures do not bring these outfalls into compliance. At NPDES018[B], the retrofit CSO control measure is assumed to bring that outfall into compliance.

In addition, a storage CSO control measure (West Ship Canal Tunnel) has been proposed for the Ballard and Fremont/Wallingford (NPDES147[A], NPDES147[B], NPDES150/151, NPDES152, and NPDES174) CSO Areas as well as nearby KC overflows. The Shared Westside Tunnel CSO control measure would replace the Ballard and Fremont/Wallingford

Neighborhood Storage CSO control measures, and also the KC Neighborhood Storage CSO control measures for 3rd Avenue W and 11th Avenue NW.

This report specifically evaluates the proposed LTCP CSO control measures against the CSO control performance standard given in the Consent Decree by predicting the CSO frequency for a moving 20-year average and to evaluate the CSO control measure performance associated with climate change. Hydraulic models reflecting the CSO control measure configurations in the Draft LTCP (May 2014) were constructed and used for these analyses. Some of the CSO control measures have been refined since the Draft LTCP was issued. Examination of these refinements indicates that they will provide equal or better performance compared to that reported in the following sections.

1.3 CSO Control Performance Requirements

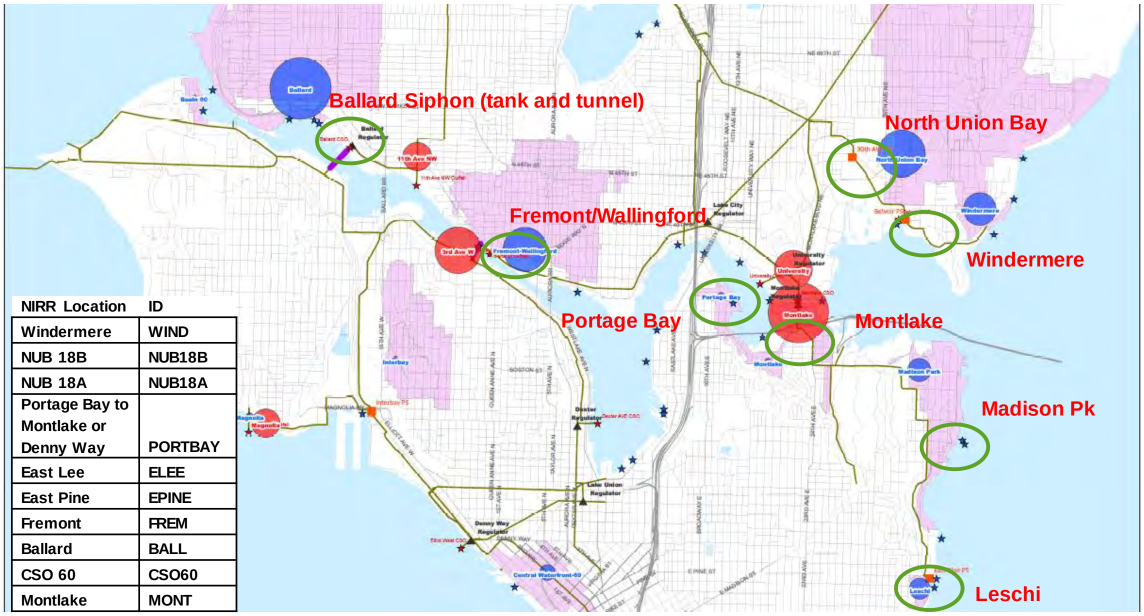
The CSO performance of the CSO Area outfalls is measured against the requirements defined under the Consent Decree entered on July 3, 2013, between the City of Seattle (City), Washington State Department of Ecology (Ecology), U.S. Environmental Protection Agency (EPA), and U.S. Department of Justice to address violations of the Clean Water Act caused by CSOs. The performance standard is defined under Section IV, paragraph 9 (ee) as follows:

> **Section IV, Paragraph 9 (ee).** *“Twenty Year Moving Average” shall mean the average number of untreated discharge events per CSO Outfall over a twenty year period for purposes of compliance with WAC 173- 245-020(22). For previously Controlled CSO Outfalls and where monitoring records exist for the past 20 consecutive years, the twenty year moving average shall mean the average number of untreated discharges per CSO Outfall over the 20 year record. On an annual basis, the twenty year moving average will be calculated and includes the current monitored year and each of the previous 19 years of monitored CSO data. For CSO reduction projects and Controlled CSO Outfalls where a complete twenty year record of monitored data does not exist, missing annual CSO frequency data will be generated based on the predicted CSO frequency for a given year as established in the approved engineering report or facility plan. For each CSO reduction project, the engineering report or facility plan shall predict the CSO frequency for each CSO Outfall (s) based on long-term simulation modeling using a 20-year period of historical rainfall data, the hydraulic model, the CSO control project design and assuming the CSO control project existed throughout the 20-year period. For CSO reduction projects, the level of control is the number of discharge events per CSO Outfall per year that are estimated to occur based on the designed CSO control project over a 20-year period. The level of control will be estimated for each year for a period of 20 years in the engineering report or facility plan.*

1.4 Impact of King County System Operation

All SPU CSO basins eventually discharge to the King County (KC) interceptor system through various facilities. In order to account for the conditions in the KC interceptor system, KC provided time series of estimated no-impact release rates (NIRR) for drainage of SPU storage CSO control measures at key locations in its interceptor system on July 11 and August 22, 2014. The NIRR time series provide times and maximum flow rates for release of stored flow from SPU CSO control facilities that would have minimal impact on the operation of KC's facilities. These NIRR were computed using KC's model results, and assume that KC has priority for drainage of storage in its system and that no storage release in either the KC or SPU system could occur until flows at the West Point Wastewater Treatment Plant (WWTP) had fallen below 250 million gallons per day (mgd) following storm events. The NIRR provided covers the period from January 1978–December 2009.

Each of the LTCP basin models discussed in this report were run with a downstream boundary condition representing the KC NIRR specific to the individual basin. If the overflow frequency increased to more than 1.0 event per year as a result of the KC NIRR, further model modifications were made to ensure compliance with the Consent Decree requirements. The areas covered by the NIRR are shown in Figure 1-1 and Figure 1-2.



NIRR Location	ID
Windermere	WIND
NUB 18B	NUB18B
NUB 18A	NUB18A
Portage Bay to Montlake or Denny Way	PORTBAY
East Lee	ELEE
East Pine	EPINE
Fremont	FREM
Ballard	BALL
CSO 60	CSO60
Montlake	MONT

Figure 1-1. King County North Interceptor no impact release rate area

NIRR Location	ID
Central Waterfront North	CWFN
Central Waterfront South to WP	CWFSWP
Central Waterfront South to HLKK	CWFSHLKK
Basin 107 to EBI	BSN107
Basin 107 to HLKK	HLKK_INTCAP
Basin 111	BSN111
Genesee	GENE
Delridge	DELR
8th Ave S	8THS
Basin 49	BSN49
Basin 49 Alt	BSN49ALT

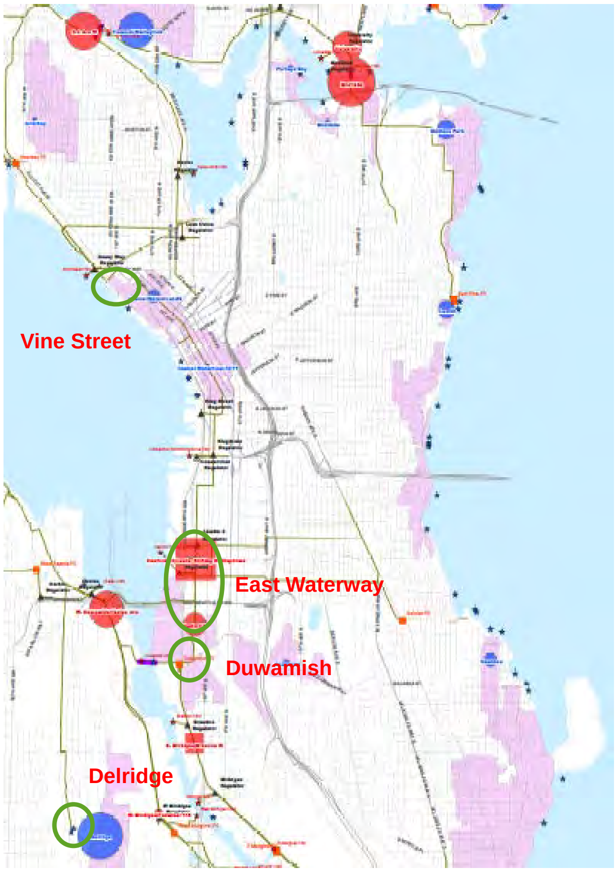


Figure 1-2. King County Elliott Bay Interceptor no-impact release rate areas

Examples of the KC NIRR are shown in Figure 1-3, which includes a portion of the NIRR time series for Fremont/Wallingford, Montlake, Leschi, and the Central Waterfront (NPDES069). As shown, the NIRR contains periods in which there is no allowable storage release from SPU facilities, followed by periods in which the NIRR exceeds the drainage rate from the proposed storages. The simulation results and boundary condition for a representative event for the Fremont/Wallingford Neighborhood Storage CSO control measure and Shared West Ship Canal Tunnel Storage CSO control measure are shown in Figure 1-4 and Figure 1-5.

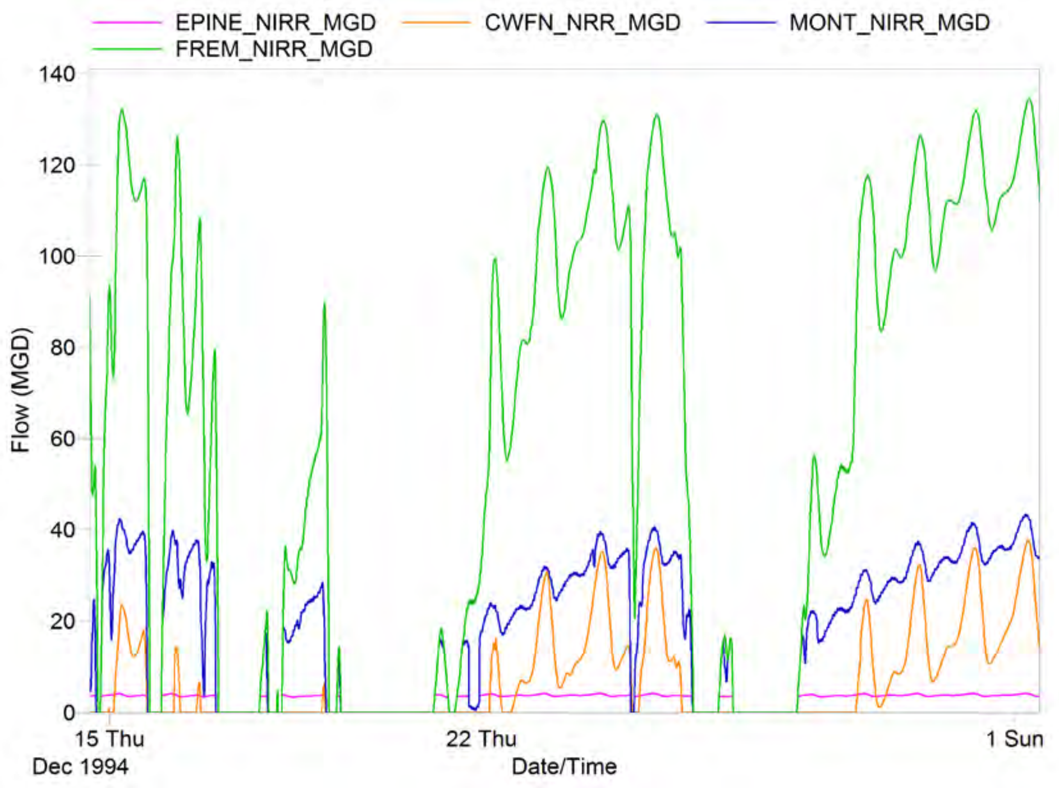


Figure 1-3. Portion of KC no-impact release rates

(red = E Pine PS-Leschi; green = Fremont/Wallingford; blue = Montlake; orange = Central Waterfront)

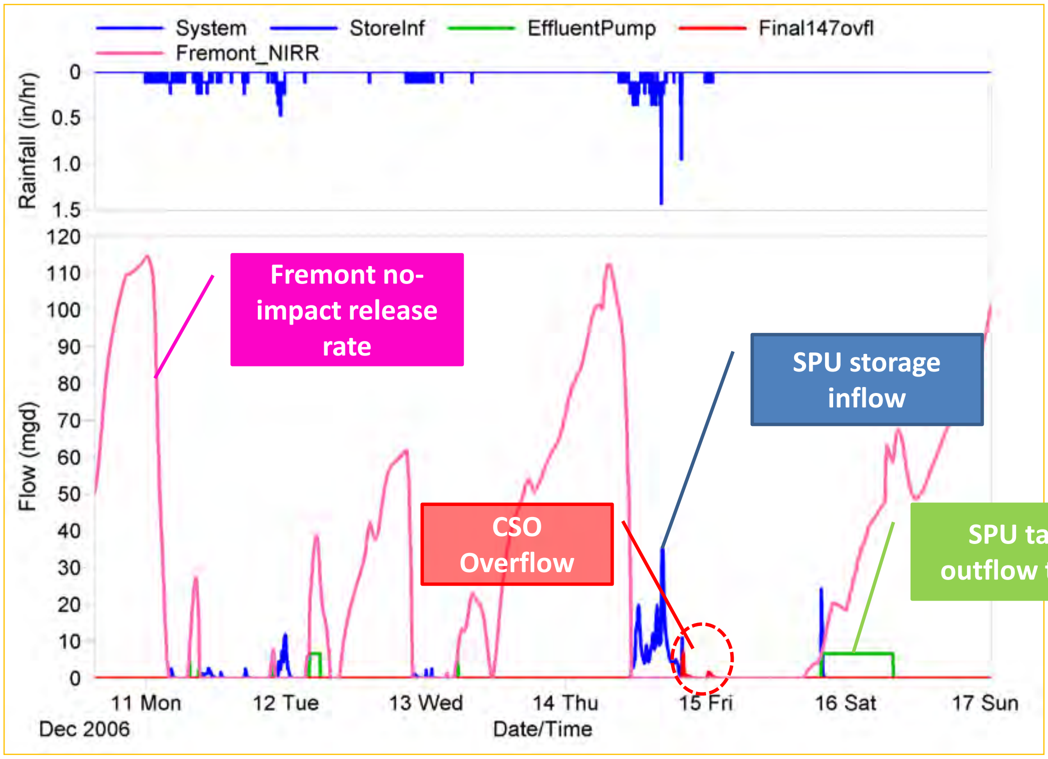


Figure 1-4. Simulation results for November 1983 event: Fremont/Wallingford Neighborhood Storage CSO control measure example

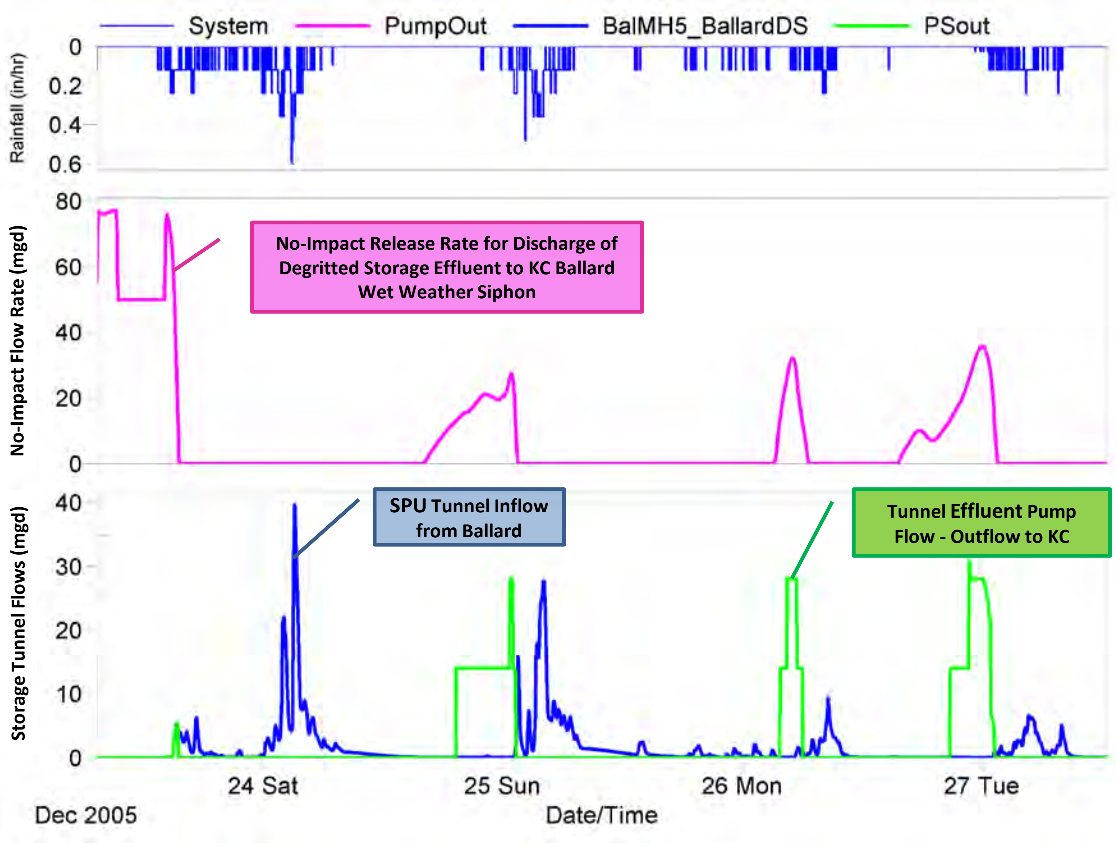


Figure 1-5. Simulation results for December 2005 event: Shared West Ship Canal Tunnel Storage CSO control measure example

Two types of model simulations were conducted. Where possible, release from storage was controlled using depth in a key structure (local control). When the depth in the key structure drops below a given set point, the effluent pumps or gate are allowed to operate. To simulate the impact of the KC NIRR, the appropriate NIRR time series was used to control storage release. Local control could be used for small neighborhood storage facilities for the Delridge NPDES099; Central Waterfront NPDES069; Portage Bay NPDES138; four Leschi storage facilities; and Montlake NPDES020, NPDES139, and NPDES140 sites. It was found in simulations that local control based on measurement of depth in a key structure could be found that would allow discharge at times approximating those allowed by the NIRR. Occasional violations of the NIRR were found to occur, however. These will need to be examined in the future to determine if local control of small-volume, low-release rate systems is acceptable, or if SPU and KC need to integrate supervisory control and data acquisition (SCADA) systems to provide a signal to SPU when storage release is allowed.

SECTION 2

Ballard Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

This section reviews the proposed Ballard Neighborhood Storage CSO control measure, describes how the LTCP model of the area was updated to represent the CSO control measure, and summarizes the simulated CSO control performance against the Consent Decree performance criteria with and without climate change considerations.

2.1 Proposed Storage CSO Control Measure

The Ballard Neighborhood Storage CSO control measure will control CSOs from the NPDES150/151 and NPDES152 Basins. The proposed storage CSO control measure includes the following major features:

- a new 6-million-gallon (MG) off-line underground storage tank
- an effluent pump station (PS) to drain the storage in at least 12 hours
- diversion structures to divert CSOs to the storage tank
- up to approximately 1,710 feet of 60-inch-diameter microtunneled gravity pipe, depending on the location selected for the off-line storage tank
- up to approximately 150 feet of 30-inch-diameter microtunneled force main, depending on the location selected for the off-line storage tank
- two new automated control gates at the NPDES150/151 CSO Outfall and the NPDES152 CSO Outfall

The Ballard CSO Area is shown in Figure 2-1. The proposed CSO control measure is shown in Figure 2-2. The entire basin drains to the KC Ballard Regulator Station.

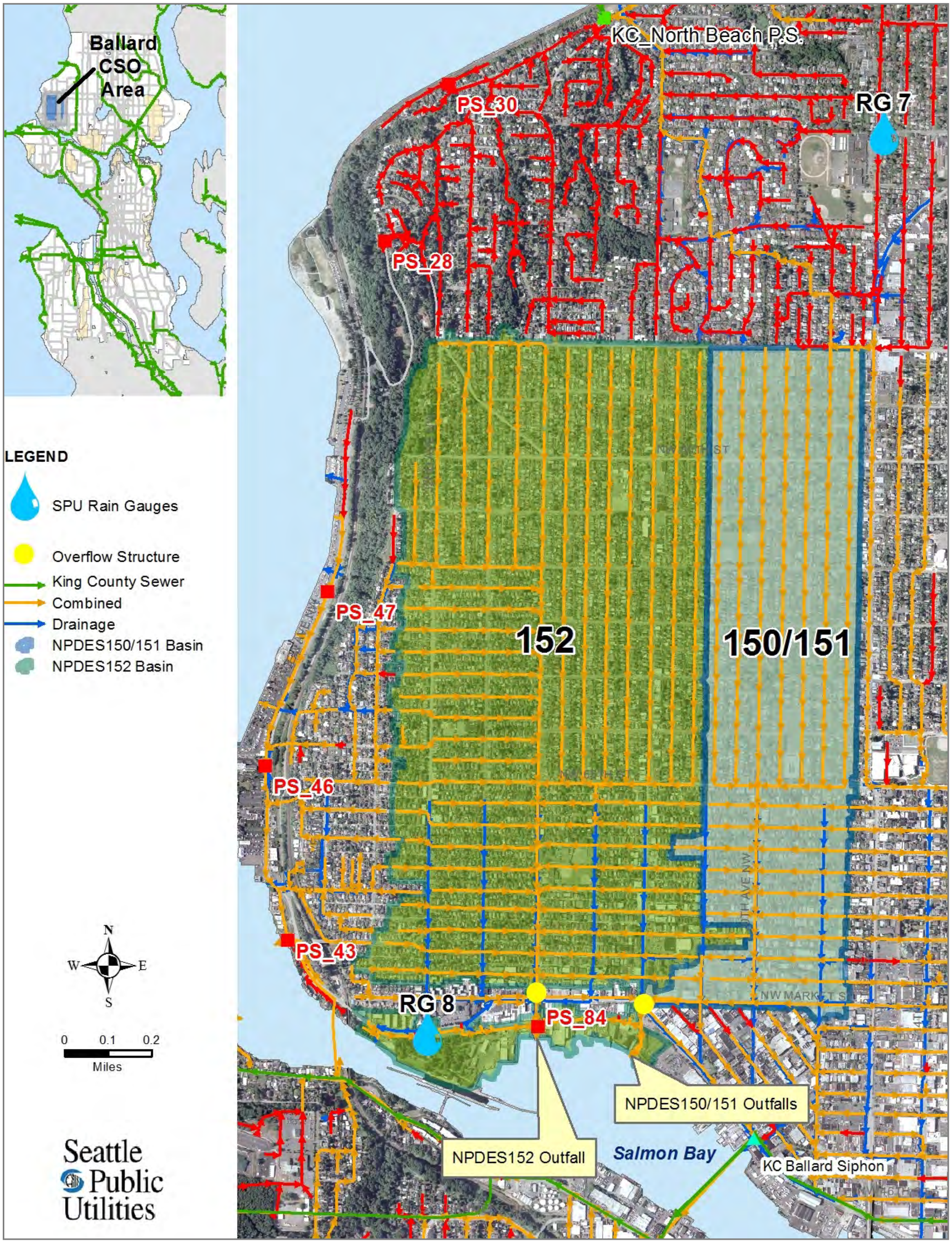


Figure 2-1. Ballard CSO Area

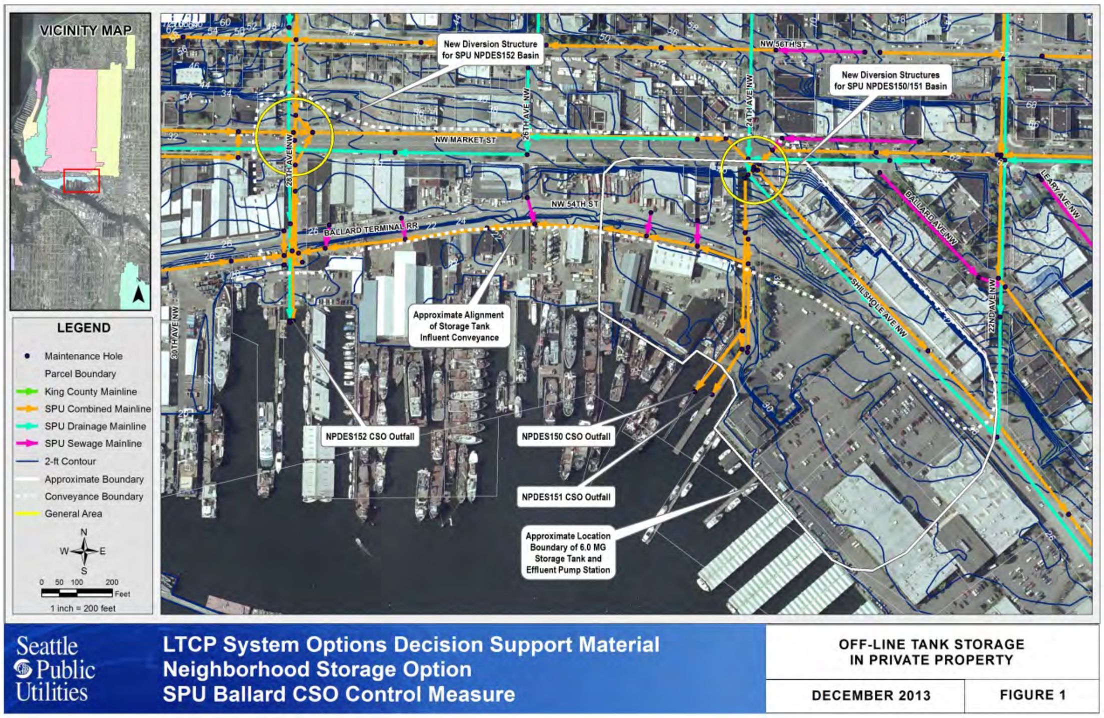


Figure 2-2. Ballard Neighborhood Storage CSO control measure

2.2 Model Revisions

The model used for this analysis was based upon the Storm Water Management Model, Version 5 (SWMM5) v22 model that was documented in the LTCP modeling report (CH2M HILL, 2012a). This model was modified to incorporate the proposed LTCP CSO control measure facilities. These modifications are described below.

2.2.1 NPDES152 Diversion Structure

A consolidation conduit, consisting of a 60-inch-diameter pipe running from the NPDES152 overflow structure to the NPDES150/151 overflow structure and thence to the storage tank, is required for the CSO control measure.

In order to not interfere with the existing performance of the overflow structure and to hydraulically accommodate the necessary transfer rates, the model was modified to insert a new structure in the existing outfall conduit immediately downstream of the existing overflow weir. This new structure would have an invert elevation approximately 6 feet below the existing conduit at elevation 16.28 feet. In this structure would be included a 4-by-4-foot motorized sluice gate to transfer flow to the consolidation conduit, and a new weir for final overflow at an elevation of 23.5 feet (just below the existing weir). The sluice gate is necessary to control flows to the storage tank to prevent it from overfilling, causing local flooding. This gate would be normally open and would close only when the downstream storage tank is filled.

Figure 2-3 shows a profile of the existing structure from ADS drawings with the location of the consolidation conduit. Figure 2-4 shows the plan view of the modeled connection. The diversion structure could be moved south of the assumed position to reduce construction difficulties in NW Market Street. This would require lowering the consolidation conduit.

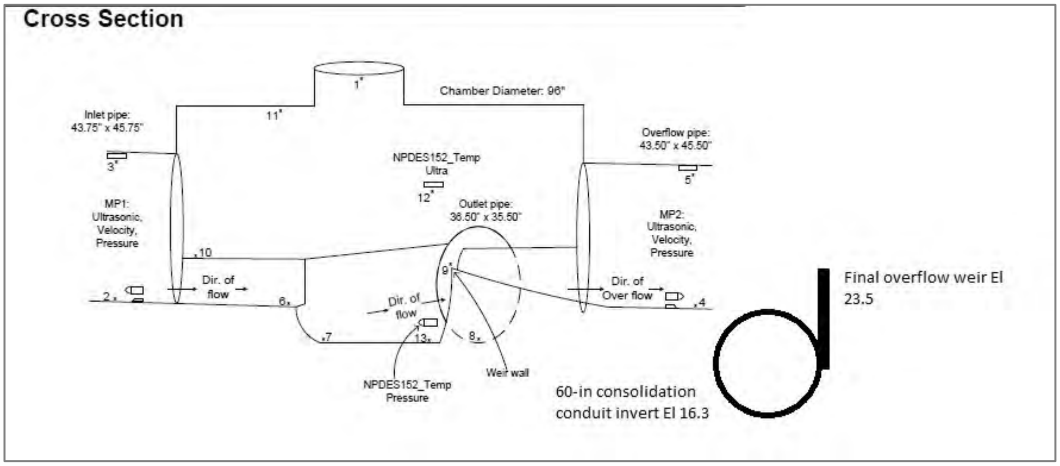


Figure 2-3. NPDES152 overflow structure

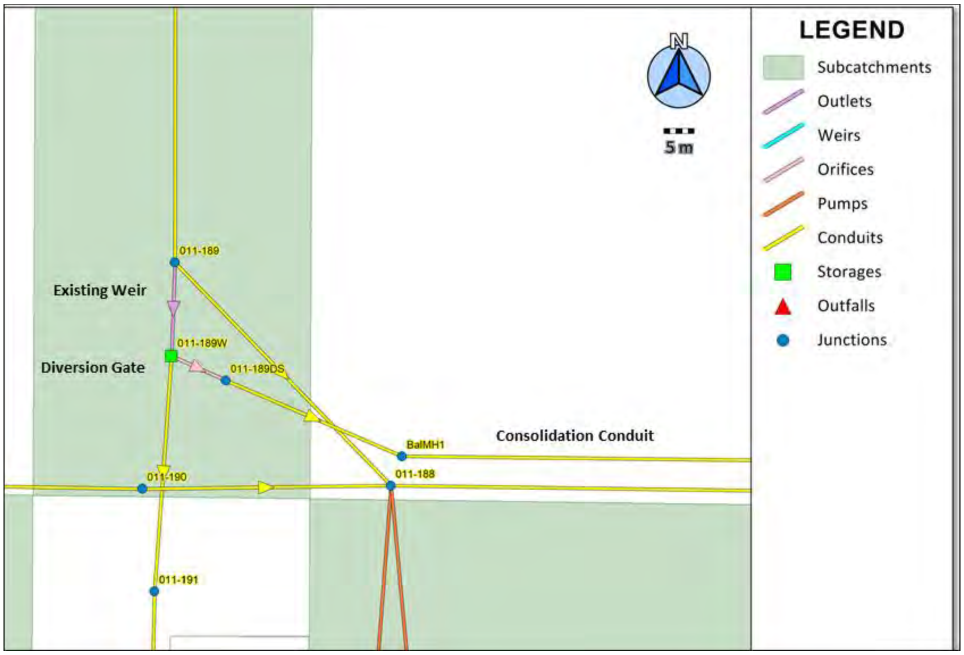


Figure 2-4. NPDES152 connections

2.2.2 NPDES150/151 Diversion Structure

The existing outfall from the NPDES150/151 overflow structure will pass over the consolidation conduit by at least 19 feet. To avoid interference with operation of the existing overflow structure and the passage of low flow to KC's sewer, a new structure was inserted downstream of the structure in the existing outfall line at maintenance hole (MH) 011-343. The new structure would have an invert elevation of 29 feet, approximately 4 feet below the invert of the outfall pipe leaving the MH. The structure would also include a 3.5-by-3.5-foot motorized sluice gate on the diversion to the consolidation conduit. The sluice gate is necessary to control flows to the storage tank to prevent it from overfilling, causing local flooding. Overflows in events exceeding the storage volume would pass out the existing overflow conduit 011-343_011-185. A new weir would not be required.

Figure 2-5 shows the plan view of the modeled connections. If necessary for construction purposes, the diversion structure could be located to the west at MH011-185.

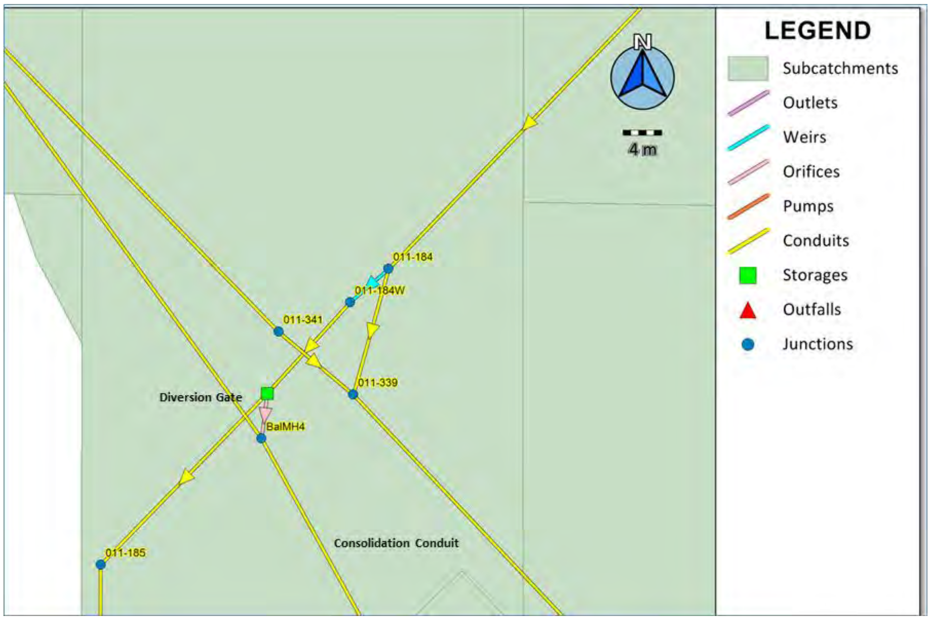


Figure 2-5. NPDES150/151 connections

2.2.3 Storage Tank

The storage tank as configured for the Ballard Neighborhood Storage CSO control measure has a fixed surface area of 50,175 square feet (ft^2) due to the constraints of potential sites. A water depth of 16 feet would be required to provide the 6 MG storage volume. In addition, cover, freeboard, and top slab dimensions might amount to a total of 6 feet.

It was found in the modeling that the maximum water surface elevation in the tank should not exceed elevation 21 feet in order to meet the identified performance requirement at NPDES152—higher maximum elevations interfere with the operation of the diversion structure at that location. This would require the bottom of the main storage tank to be at elevation 5 feet. Addition of a sump for the effluent PS could bring the final bottom elevation of excavation to zero feet or below. The effluent PS has an assumed maximum capacity of 12 mgd in the model in order to empty the storage tank in 12 hours. Two 6 mgd pumps are assumed in the model. The effluent PS is controlled based on boundary conditions, as described in Section 2.3.

An emergency overflow connection to the existing NPDES150/151 outfall should be considered in final design to guard against failure of the diversion gates. If such a weir could be added and it could hold the maximum water surface elevation in the tank to 21 feet, then it may be possible to eliminate the control gates at NPDES150/151 and NPDES152.

2.2.4 Consolidation Conduit

Modeling indicates that the 60-inch-diameter consolidation conduit will need to convey a maximum flow of about 100 mgd from NPDES152. The conduit will need to convey up to about 150 mgd downstream of the NPDES150/151 connection.

As described in Section 2.2.1, the upstream end of the conduit at NPDES152 was set at elevation 16.28 feet. In the model, the conduit has a slope of about 0.0042 foot vertical per 1 foot horizontal (ft/ft) from NPDES152 to the storage tank. Figure 2-6 shows the profile of the consolidation conduit from NPDES152 to the storage tank.

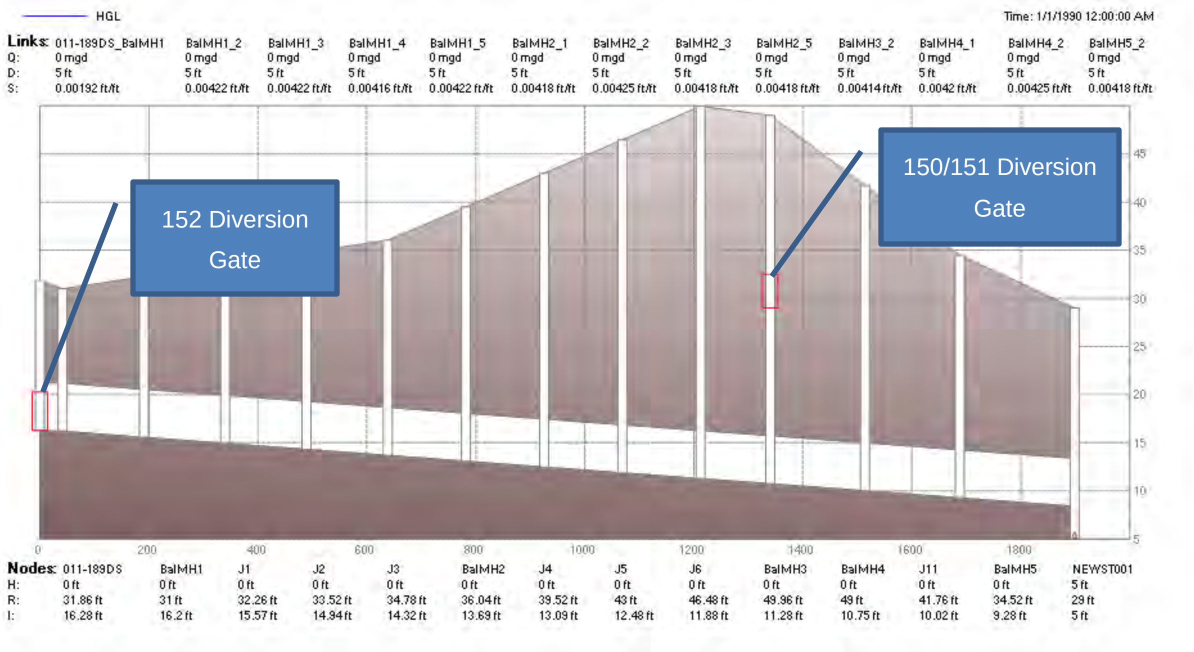


Figure 2-6. Profile of the consolidation conduit

2.3 CSO Performance Hydraulic Analysis

The SPU Consent Decree requires that performance be analyzed on a rolling 20-year average. Where possible, the analysis will use the period from 1993–2012 for the moving 20-year average to confirm CSO control compliance. The Ballard system is connected to the KC Ballard Regulator Station. Previous model development and long-term simulations (LTS) were performed using a time series of water surface elevation at the regulator station provided by KC from its model run, as described in the LTCP Modeling Report (CH2M HILL, 2012a). This time series covers the period from 1978–2009. Effluent discharge from the Ballard Neighborhood storage tank was governed by the NIRR for this basin.

The revised model was run with KC flow conditions represented by the NIRR for the Ballard area, as discussed below. Climate change and other uncertainties were included by scaling the rainfall by a factor of 1.0746 for the NPDES150/151 tributary area, and by 1.0749 for the NPDES152 tributary area.

KC provided three NIRR time series for discharge of stored flow to the KC Ballard Regulator. One of these was specific for discharge only to the dry weather siphon barrels of the recently modified Ballard siphon (BALL_NIRR_MGD). The dry weather flow barrels have a maximum capacity of about 12 mgd and the corresponding NIRR was computed by subtracting flows occurring in the rest of the basin from that value. The resulting NIRR time series varies from zero to about 8 mgd in a diurnal pattern, as shown in Figure 2-7. This time series was used in the model to directly control the effluent pump station for the storage tank. Model simulations for the 20-year period from 1990–2009 and the dry weather siphon

NIRR time series indicated that the Ballard Neighborhood storage tank would have to be increased in volume from 6 MG to 10 MG in order to meet the performance criteria. In addition, the restricted values of the dry weather siphon NIRR result in periods of up to 30 days during which the storage tank could not be emptied. Such events would present a significant odor control problem.

The dry weather siphon NIRR time series avoids use of the new Ballard wet weather siphon barrel for discharge from storage in the Ballard area. There is concern that velocities in the wet weather barrel would be too low to ensure that there would not be a significant buildup of sediment and debris if it were used for this purpose. Because of the impact of the dry weather siphon release rate, KC provided a new NIRR time series for discharge to the wet weather siphon (ball_ww_NIRR_2014). This new series is predicated on achieving a velocity in the 85.5-inch-diameter wet weather siphon barrel of at least 3 feet per second (fps). This would require effluent pumping at a rate of 77 mgd over the entire emptying cycle of the storage tank, as shown in Figure 2-7. This would present challenges for the effluent pump station design and cost.

KC subsequently provided a third NIRR time series for the Ballard area. This time series (ball_ww_clearwater_NIRR_2014), also shown in Figure 2-7, would allow discharge of stored flows to the Ballard wet weather siphon under the assumption that grit and settleable solids are removed sufficiently to prevent deposition in the siphon. Either this time series or that for a minimum velocity of 3 fps in the siphon would allow the 6 MG tank identified to meet the Consent Decree requirements.

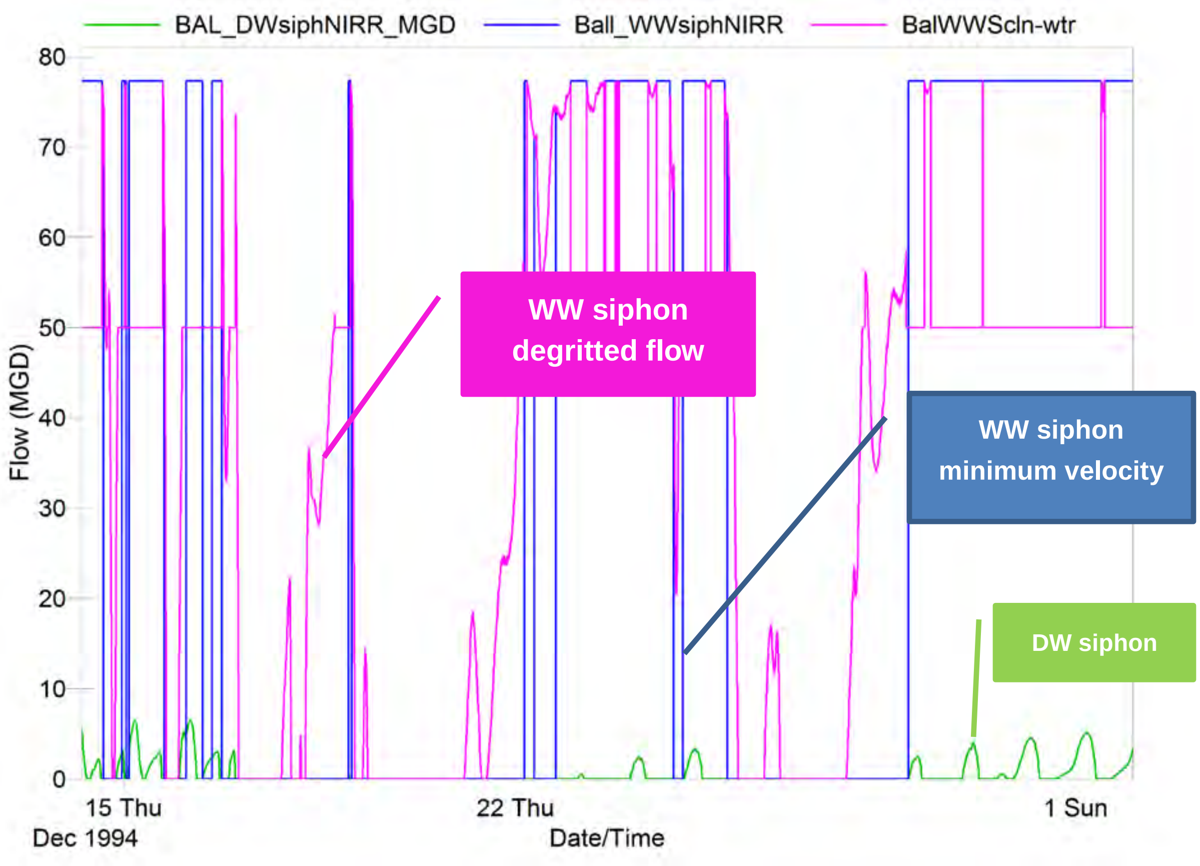


Figure 2-7. Alternative no-impact release rates for discharge to the Ballard siphon

WW = wet weather; DW = dry weather

Simulation results are reported in Table 2-1 for the 6 MG Ballard tank with discharge controlled by the time series assuming removal of grit and settleable solids, with and without climate change considered, for the 20-year period of 1990–2009. The results demonstrate conformance with the Consent Decree requirements. Appendix A presents a listing of the remaining overflow events.

Table 2-1. Ballard CSO Area Neighborhood Storage CSO Control Measure Overflow Results with KC No-Impact Release Rate

Location	Overflow frequency without climate change (per year)	Overflow frequency with climate change (per year)
	20-year (1990–2009)	20-year (1990–2009)
NPDES150/151	0.4	0.6
NPDES152	0.5	0.7

Table 2-2 presents the average annual volumes of flow delivered to KC in the existing condition and after the Neighborhood Storage CSO control measure is implemented. Climate change is not included in these volumes, and values are averages over the 1990–2009 period.

Table 2-2. Ballard CSO Area Flow Volumes without Climate Change

Location	20-year average of flow volume delivered to KC (MG/year)	
	Existing condition	With storage CSO control measure
Flow to Ballard Regulator Station	801	821

2.4 Summary of Ballard Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

The CSO performance hydraulic analyses described above indicated the following:

- Using the KC NIRR time series (1990–2009) for discharge only to the dry weather barrels of the Ballard siphon as a boundary condition to control the storage tank effluent pumps resulted in an increase in the storage tank volume required to achieve the performance criteria with climate change from 6 MG to 10 MG. In addition, this restriction resulted in periods during which sewage was retained in the storage tank of up to 30 days. This could have significant ramifications for odor control.
- Simulation of the system using the NIRR time series requiring a minimum flow rate of 77 mgd indicated that the original LTCP 6 MG storage tank would meet the performance requirement. Implementation of an effluent pump station to deliver 77 mgd throughout the emptying cycle would present cost and design challenges.
- Simulation of the system using the NIRR time series for discharge to the wet weather barrel of the Ballard siphon assuming removal of grit and settleable solids indicated that the original LTCP 6 MG storage tank will meet the performance requirement. For small events when only small volumes are in the storage tank and for removal of solids deposited in the tank, a second set of pumps for discharge to the dry weather siphon barrels may be necessary.
- In all cases, the storage CSO control measure as modified will meet the performance criterion of 1.0 overflow event per year in the 20-year period from 1990–2009.

SECTION 3

Central Waterfront Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

This section reviews the proposed Central Waterfront Neighborhood Storage CSO control measure for NPDES069, describes how the LTCP model of the area was updated to represent the CSO control measure, and summarizes the simulated CSO control performance against the Consent Decree performance criteria with and without climate change considerations.

3.1 Proposed Storage CSO Control Measure

The proposed Central Waterfront Neighborhood Storage CSO control measure will control CSOs from the NPDES069 Basin. It will be located adjacent to the existing overflow structure in the vicinity of the NPDES069 CSO Outfall. The proposed storage CSO control measure includes:

- a 600-foot long, 6-foot-diameter storage pipe providing 0.13 MG of storage to be located underground in the vicinity of the NPDES069 CSO Outfall
- up to 50 linear feet of 12-inch-diameter gravity pipe, depending on the location selected for the off-line storage pipe, to return stored flows to the downstream sewer
- diversion structure modifications to install a new weir in the existing CSO facility to divert excess flow to the storage pipe
- a new automated control gate and tie-in structure to allow gravity return of stored flows to the diversion structure when capacity is available
- two access and ventilation shafts

The Central Waterfront CSO Area is shown in Figure 3-1. Note that this report covers only NPDES069. The remaining NPDES outfalls shown on Figure 3-1 are not addressed in the LTCP. The proposed CSO control measure is shown in Figure 3-2.

Figure 3-1. Central Waterfront CSO Area

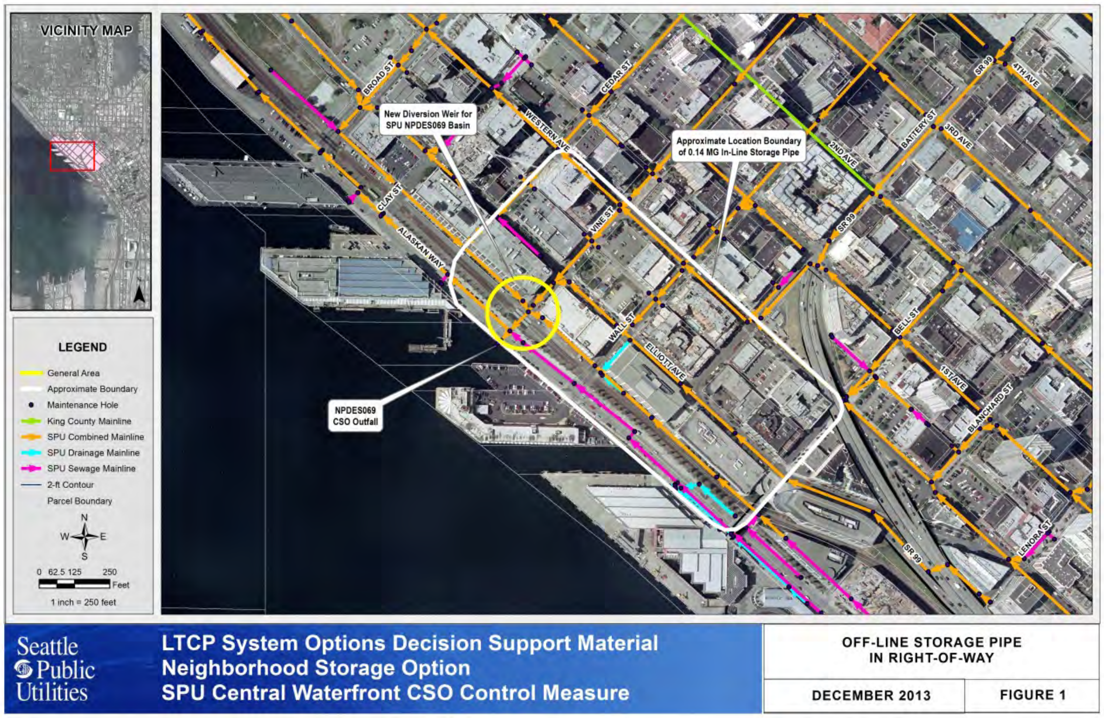


Figure 3-2. Central Waterfront Neighborhood Storage CSO control measure

3.2 Model Revisions

The model used for this analysis was based upon the SWMM5 v22 model that was documented in the LTCP modeling report (CH2M HILL, 2012j). This model was modified to incorporate the LTCP CSO control measure facilities. These modifications are described in the following sections.

3.2.1 NPDES069 Diversion Structure

The existing NPDES069 overflow structure contains a horizontal orifice to control flows to the downstream system and an overflow weir at an elevation of 12.05 feet. The layout of the structure is shown in Figure 3-3.

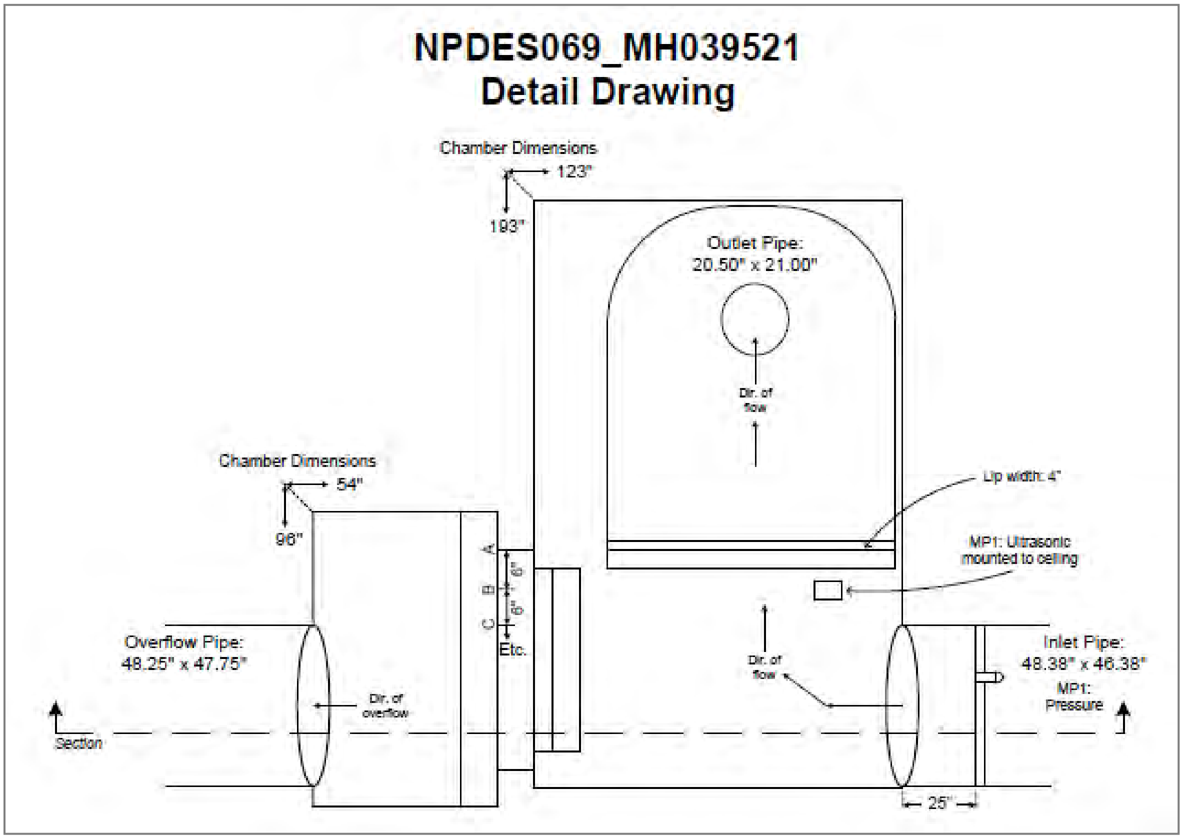


Figure 3-3. Existing NPDES069 overflow structure

Source: ADS Environmental Services

Model studies indicated that return of stored flows should bypass the existing overflow structure as described in Section 3.2.3. This allows the storage pipe to be lowered to an invert elevation of 2.5 feet without lowering the existing overflow structure.

3.2.2 Storage Pipe

The defined alternative includes an approximately 600-foot-long, 6-foot-diameter pipe with a 0.001 ft/ft slope to provide 0.13 MG of storage. The storage pipe was configured in the model to be a storage node with a surface area vs. depth curve corresponding to the 6-foot-diameter pipe. Construction and ventilation shafts 10 feet in diameter were assumed at either end of the storage pipe. The invert of the storage pipe at the end nearest the overflow structure was assumed to be at elevation 2.5 feet, just above the soffit elevation of the sewer receiving return flows.

A new 10-foot-long weir was assumed to be constructed on the side of the existing overflow structure to divert excess flow to the storage pipe. This weir was assumed to be at elevation 11.0 feet, compared to the existing overflow weir at elevation 12.05 feet. A 12-inch-diameter return pipe with a controllable gate was configured in the model to allow gravity return of stored flow from the storage pipe to the downstream sewer. An overview of the proposed storage and diversion structure as configured in the model is shown in Figure 3-4.

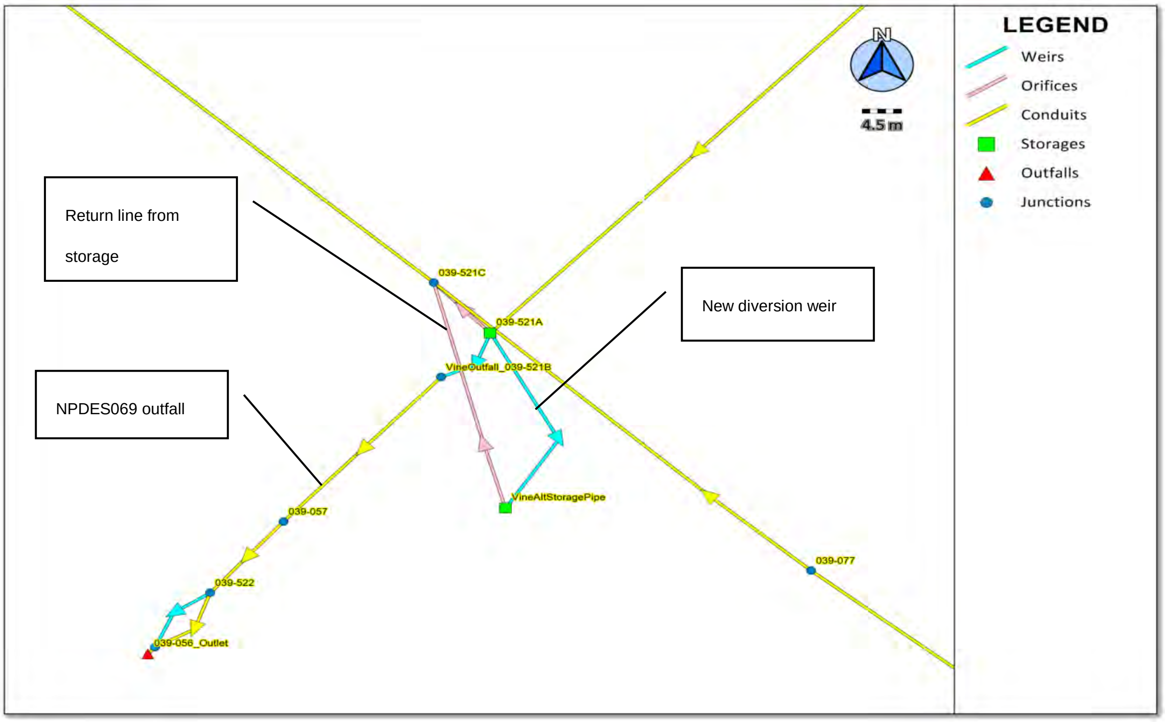


Figure 3-4. Plan view of proposed storage and diversion structure

3.2.3 Return of Stored Flows

Overflows at NPDES069 are dependent on the level in the downstream KC Elliott Bay Interceptor (EBI) and the capacity of the sewer downstream of the overflow delivering low flows to the EBI. The model was configured to return stored flows to the mainline sewer at the point where the existing low flow connection from the existing overflow structure occurs (MH039-521C on Figure 3-4). This will require a new structure.

In the modeling, a controllable sluice gate was assumed in the return line from the storage pipe to MH039-521C, with real-time controls (RTC) applied to allow the gate to open only when the depth at that point was below 2 feet. This allows drainage only after storm flows have receded and prevents the return flow from affecting the level in the overflow chamber.

In order to simulate the NIRR for this basin, the time series provided by KC was applied to directly control the flow leaving the storage pipe. Effluent flow was allowed up to a rate of 0.26 mgd whenever the NIRR exceeded this value.

3.3 CSO Performance Hydraulic Analysis

The SPU Consent Decree requires that performance be analyzed on a rolling 20-year average. Where possible, the analysis will use the period from 1993–2012 for the moving 20-year average to confirm CSO control compliance.

The Central Waterfront system is connected to the KC interceptor just upstream of the Denny-Lake Union Regulator Station at MH039W-005. Previous model development and LTSs were performed using time series of water surface elevation at the regulator station and flow in the interceptor just downstream of the KC King Street Regulator Station. These time series were provided by KC from its model run, as described in the LTCP Modeling Report (CH2M HILL, 2012j). These time series cover the period from 1978–2009, thus restricting the 20-year analysis to the period from 1990–2009.

The KC NIRR for discharge from the NPDES069 storage pipe included consideration of the Hanford-Lander-King Street-Kingdome (HLKK) wet weather treatment plant. According to KC staff, the HLKK plant is not expected to significantly modify the boundary conditions for NPDES069. The hydraulic analysis was conducted using the KC flow restrictions represented by the KC NIRR for the northern end of the EBI (CWFN_NIRR_MGD), as discussed in Section 1.3. Modeling indicated that using a control for effluent discharge based on depth in the downstream trunk would achieve similar results.

A summary of the simulation results is shown in Table 3-1, demonstrating conformance with the Consent Decree requirements. Appendix B presents a listing of the remaining overflow events.

Table 3-1. Central Waterfront Neighborhood Storage CSO Control Measure Overflow Results with KC No-Impact Release Rate

Location	Overflow frequency without climate change (per year)	Overflow frequency with climate change (per year)
	20-year (1990–2009)	20-year (1990–2009)
NPDES069	0.7	1.0

Table 3-2 presents the average annual volumes of flow delivered to KC in the existing condition and after the Neighborhood Storage CSO control measure is implemented. Climate change is not included in these volumes, and values are averages over the 1990–2009 period.

Table 3-2. Central Waterfront CSO Area Flow Volumes without Climate Change

Location	20-year average of flow volume delivered to KC (MG/year)	
	Existing condition	With storage CSO control measure
NPDES069	166.8	167.0

3.4 Summary of Central Waterfront Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

The CSO performance hydraulic analyses described above indicated the following:

- The model analysis for the most recent 20-year period for which the KC model data were available (1990–2009) under normal operations (no restrictions on flow due to KC NIRR) resulted in an overflow frequency of once per year at NPDES069 when climate change impacts were included.
- Using the KC NIRR time series (1990–2009) as a boundary condition to control the storage tank drainage resulted in an overflow frequency of once per year at NPDES069 when climate change impacts were included. Thus, no modifications of the alternative were necessary for the KC NIRR.
- The modeling analysis indicates that the alternative will meet the CSO performance control requirements with uncertainties including climate change, both with and without the imposition of the KC NIRR.

SECTION 4

Delridge Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

This section reviews the proposed Delridge NPDES099 Basin Neighborhood Storage CSO control measure, describes how the LTCP model of the area was updated to represent the CSO control measure, and summarizes the simulated CSO control performance against the Consent Decree performance criteria with and without climate change considerations.

4.1 Proposed Storage CSO Control Measure

The Delridge NPDES099 Basin Neighborhood Storage CSO control measure includes a new 0.17 MG storage pipe, a diversion weir and conduit to route flows to the storage pipe from the CSO chamber, and an effluent PS to deliver stored water back to the combined system upstream of the Chelan Street Regulator Station. The major components of the CSO control measure include the following:

- 0.17 MG off-line underground storage pipe: approximately 12 feet in diameter, 210 feet long, 0.02 ft/ft slope
- new flow diversion weir in the existing CSO structure (MH055-477) to divert combined sewage to the new storage pipe
- up to approximately 80 feet of 12-inch-diameter gravity pipe from the new flow diversion structure to the storage pipe, depending on the location selected for the storage pipe
- up to approximately 30 feet of 6-inch-diameter force main to connect the storage pipe to the SPU sewer line at MH055-170, depending on the location selected for the storage pipe
- an effluent submersible PS located at the west end of the storage pipe, with a peak capacity of 0.34 mgd

The Delridge CSO Area is shown in Figure 4-1 with the NPDES099 Basin indicated in the north. The proposed CSO control measure is shown in Figure 4-2. The entire basin drains to the KC Chelan Street Regulator Station.

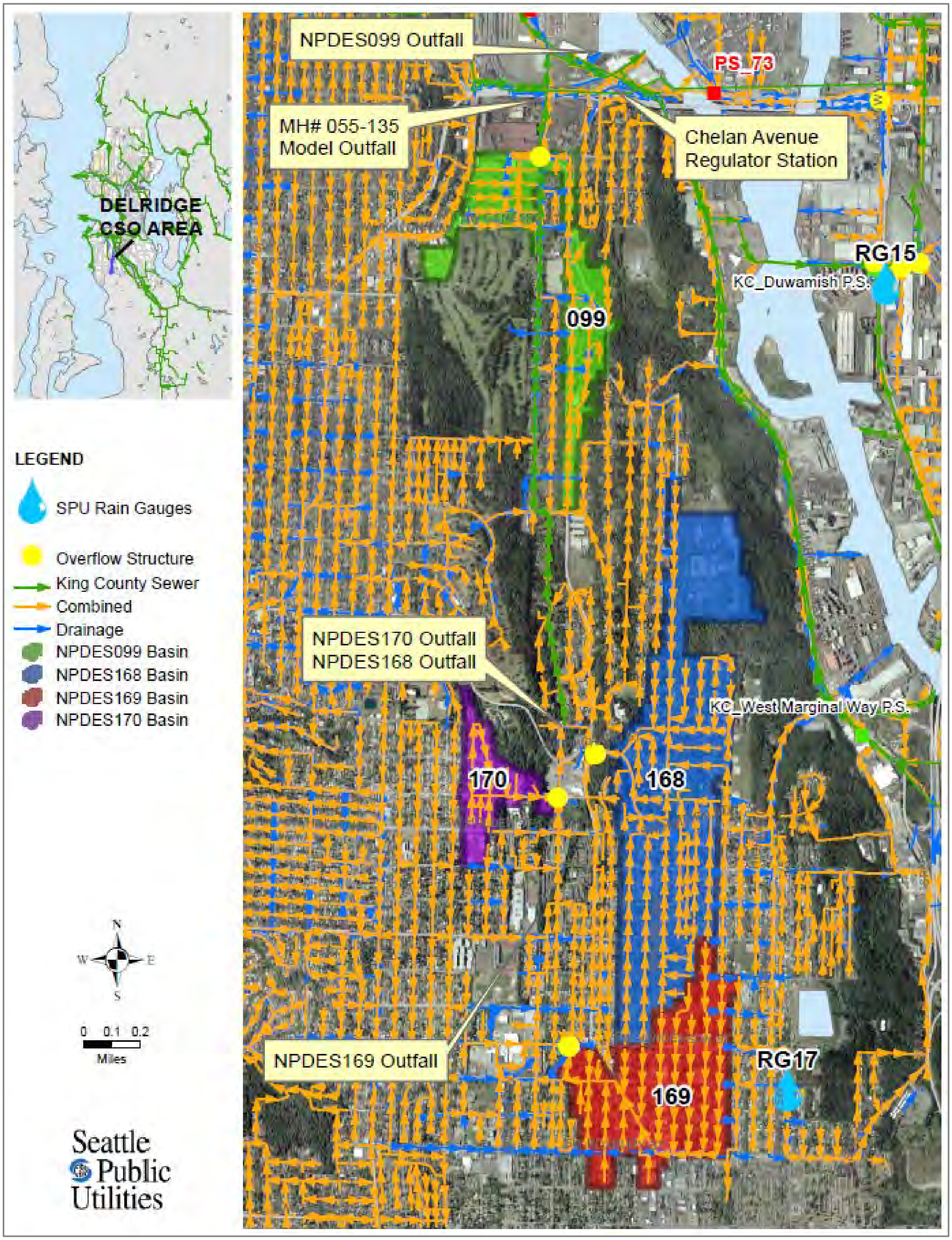


Figure 4-1. Delridge CSO Area

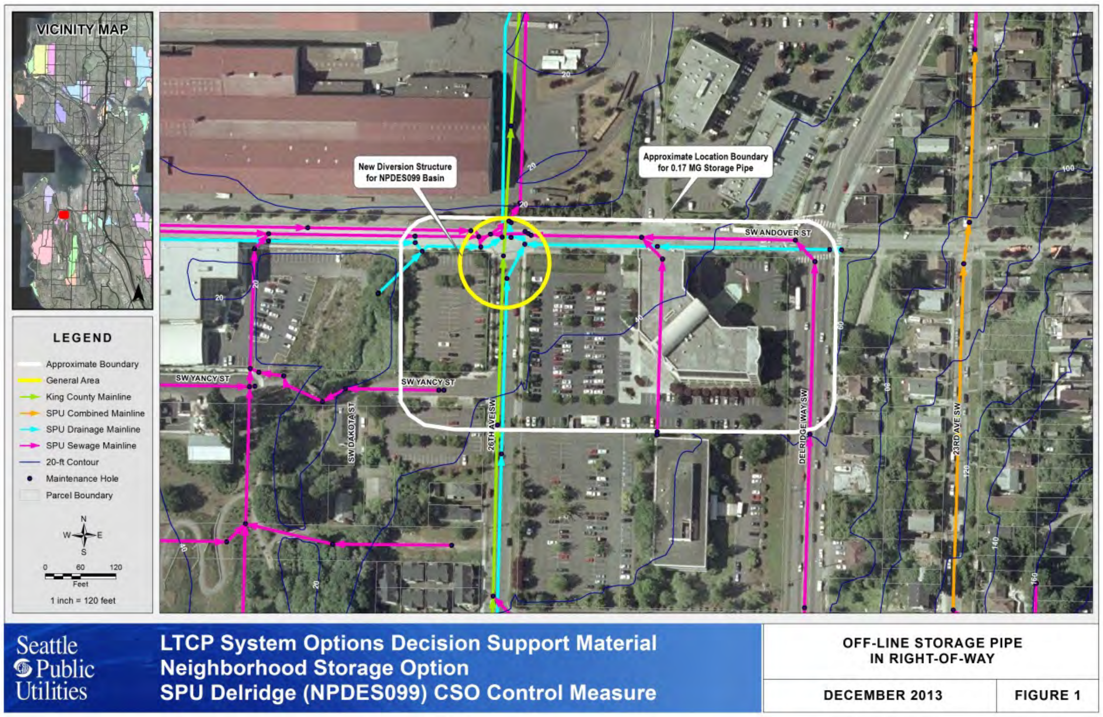


Figure 4-2. Delridge NPDES099 Basin Neighborhood Storage CSO control measure

4.2 Model Revisions

The model used for this analysis was based upon the SWMM5 v22 model that was documented in the LTCP modeling report (CH2M HILL, 2012b). This model was modified to incorporate the LTCP CSO control measure facilities. These modifications are described below.

4.2.1 CSO Structure

The CSO structure (MH055-477) currently diverts water to an existing off-line storage pipe when the HydroBrake restricts flow from leaving the basin. A new 10-foot diversion weir, at an elevation 1 foot below the CSO weir, will be installed in this CSO structure to divert flows to the new off-line storage pipe detailed in this alternative. The diversion weir was modeled as an outlet with equivalent weir equation parameters to simulate the hydraulics of the diversion weir using a more stable model element. This is the same approach taken to model the existing tank transfer weir.

4.2.2 Off-line Storage Pipe

The off-line storage pipe proposed for the Delridge NPDES099 Basin CSO control measure is a 210-foot-long, 12-foot-diameter pipe sloped at 0.02 ft/ft, in the vicinity of the new diversion structure located at SW Andover Street and 26th Avenue SW. To maximize storage in the pipe, the crown of the upstream side of the pipe was set equal to the diversion weir elevation. This allows the pipe to fill to capacity before the hydraulic grade line in the CSO structure can rise to the CSO weir elevation.

A 14-foot-diameter wet well shaft was assumed on the downstream side of the storage pipe and a 4-foot maintenance hole was assumed on the upstream side. The wet well was extended below the invert of the downstream side of the storage pipe so that a pump can shut off with water in the wet well but when the pipe is fully empty.

All three storage-related elements (wet well, storage pipe, maintenance hole) mentioned above were modeled as a single storage unit in SWMM with an assigned depth-area curve relationship. This method of simulating storage reduces model error as SWMM often has difficulty calculating the depths of the water surfaces in pipes used as off-line storages.

Figure 4-3 provides a layout of the NPDES099 model near the CSO control structure. New elements to the model are indicated as being "proposed."

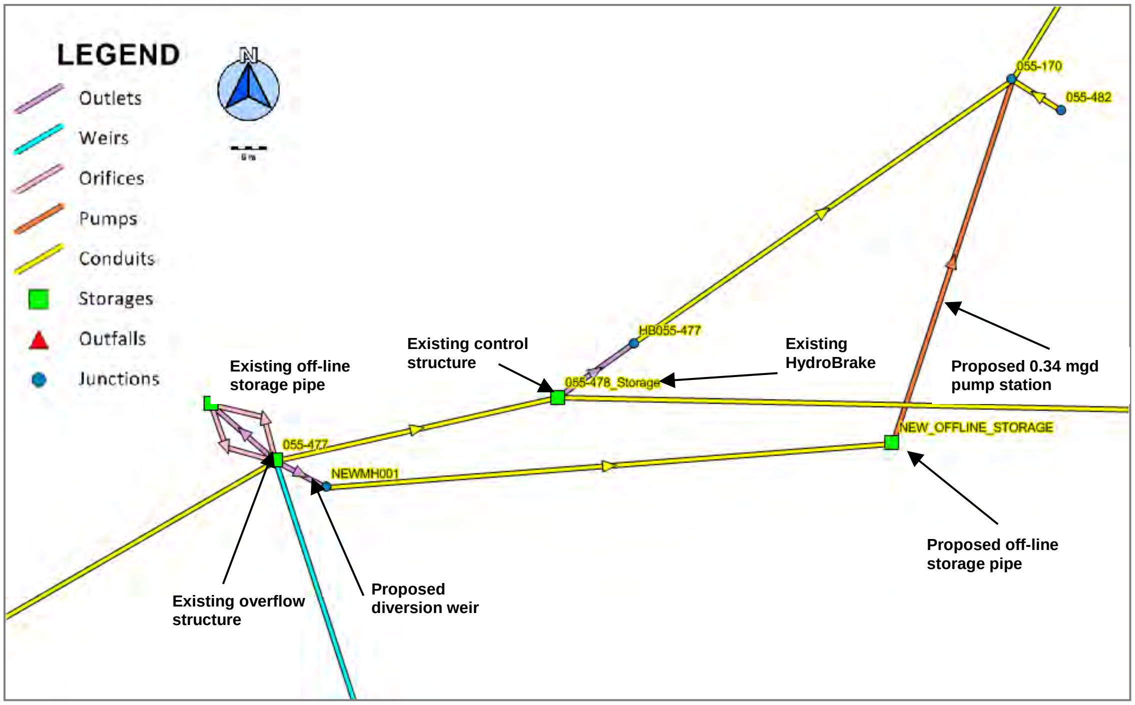


Figure 4-3. Plan view of proposed storage

4.2.3 Pumping and Controls

A 0.34 mgd pump station was added to the model to drain the new tank after a storm has passed. The effluent pump discharges downstream of the existing control structure. Modeling has indicated that the pump could discharge either to the control structure or to the existing overflow structure without adversely impacting CSO performance.

RTC rules were added to the model to activate the new pump station after a storm has passed. For operation using local control without the KC NIRR restriction, the water surface elevation of the control chamber can be used to turn on the pump, as it is indicative of when a storm has mostly passed. Through sensitivity testing across a range of large storms, water surface elevation set points in the control chamber were established to activate the pump station to drain the new storage tank after a storm has passed with minimal chance for repetitive pump cycling due to small changes in water surface elevation. When the control chamber water depth drops below 7.3 feet, the pump can safely turn on. By reducing the set point depth for pump operation to 2 to 3 feet, the pump operation generally conforms to the NIRR with occasional violations (pump allowed to operate under local control while the NIRR would dictate no discharge). If occasional violations of the NIRR for systems with small volume and peak flow rates are deemed acceptable, then local control can be used. If detailed analysis indicates that these occasional violations are unacceptable, then SPU and KC will need to interconnect their SCADA systems so that a signal from KC can be provided to allow SPU discharge. For model simulations using the NIRR, the effluent pumps were not allowed to activate unless the NIRR exceeded the capacity of the pumps.

4.3 CSO Performance Hydraulic Analysis

The SPU Consent Decree requires that performance be analyzed on a rolling 20-year average. Where possible, the analysis will use the period from 1993–2012 for the moving 20-year average to confirm CSO control compliance.

To account for climate change uncertainties, the rainfall was scaled by a factor of 1.076. This factor represents the factor necessary to have one standalone simulation produce a CSO volume equal to the best-estimate control volume (BECV) (CH2M HILL, 2013).

KC provided a time series of estimated NIRR for SPU at key locations in the interceptor system on July 11, 2014. The NIRR time series describes the available capacity in the interceptor system to handle releases from SPU as discussed in Section 1.3. In the case of Delridge NPDES099 Basin, the NIRR labeled DELR_NIRR_MGD was used. The NIRR provided covers the period from 1978–2009. The results of the model analysis using the NIRR to control releases from the Delridge NPDES099 Basin Neighborhood Storage CSO control measure are described below.

NPDES099 will be controlled with this storage CSO control measure as the CSO frequency is below 1.0 per year with or without climate change impacts. It was also found in the modeling that implementation of the NIRR did not change the overflow frequency performance compared to using local control for the effluent pump station based on depth in the control chamber as described in Section 4.2.3.

A summary of the simulation results using the KC NIRR time series is shown in Table 4-1 and Table 4-2. Appendix C presents a listing of the remaining overflow events.

Table 4-1. Delridge NPDES099 Basin CSO Area Storage CSO Control Measure Overflow Results with KC No-Impact Release Rate

Location	Overflow frequency without climate change (per year)	Overflow frequency with climate change (per year)
	20-year (1990–2009)	20-year (1990–2009)
NPDES099	0.8	0.9

Table 4-2 presents the average annual volumes of flow delivered to KC in the existing condition and after the Neighborhood Storage CSO control measure is implemented. Climate change is not included in these volumes, and values are averages over the 1990–2009 period.

Table 4-2. Delridge NPDES099 CSO Area Flow Volumes without Climate Change

Location	20-year average of flow volume delivered to KC (MG/year)	
	Existing condition	With storage CSO control measure
NPDES099	76.4	76.6

4.4 Summary of Delridge Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

For the moving 20-year average period of 1990–2009, the hydraulic CSO performance analysis indicated the following:

- The proposed Neighborhood Storage CSO control measure in the Delridge NPDES099 Basin would significantly reduce overflow volumes and frequency. The overflow frequency is reduced from 2.1 events per year to 0.9 event per year with uncertainties including climate change accounted for.
- Compared to the use of depth in the control structure (local control), using the KC NIRR time series to control storage releases does not adversely impact CSO performance at NPDES099. However, local control may result in occasional violations of the NIRR. Future study will be needed to determine whether control based on local depth or on a signal received from KC is required.

SECTION 5

Duwamish Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

This section reviews the proposed Duwamish Neighborhood Storage CSO control measure, describes how the LTCP model of the area was updated to represent the CSO control measure, and summarizes the simulated CSO control performance against the Consent Decree performance criteria with and without climate change considerations.

5.1 Proposed Storage CSO Control Measure

The Duwamish Neighborhood Storage CSO control measure will control CSOs from the NPDES111(B), NPDES111(C), and NPDES111(H) Basins. Facilities will be located near the existing overflows for each basin. The proposed storage CSO control measure includes:

- NPDES111(B): A new automated gate to utilize storage in the existing facility by limiting discharge to the drainage system. A new pump is included to return the stored flow to the combined sewer system (CSS). The existing storm drainage conveyance into the storage facility will be disconnected and re-routed to the storm drain downstream of the storage (see Appendix D). This configuration was adopted to address performance impacts caused by KC operation of the Duwamish PS and to disconnect the overflow from tidal influence.
- NPDES111(C): A new automated gate to utilize storage in the existing facility by limiting discharge to the drainage system. A new pump is included to return the stored flow to the CSS. The existing storm drainage conveyance into the storage facility will be disconnected and re-routed to the storm drain downstream of the storage (see Appendix D). Similar to NPDES111(B), this configuration addresses tidal influence and operation of the KC Duwamish PS.
- NPDES111(H): A new 0.01 MG storage pipe to be located underground in the 10th Avenue S right-of-way (5-foot diameter, 100-foot length). This CSO control measure includes a connection to the existing storage tanks and approximately 100 feet of 30-inch-diameter gravity conveyance pipe.

The Duwamish CSO Area is shown in Figure 5-1. The entire area drains to the KC Duwamish PS. The proposed NPDES111(B) and NPDES111(C) facilities are located within existing structures and are shown in Figure 5-2. The proposed NPDES111(H) facility is shown in Figure 5-3.

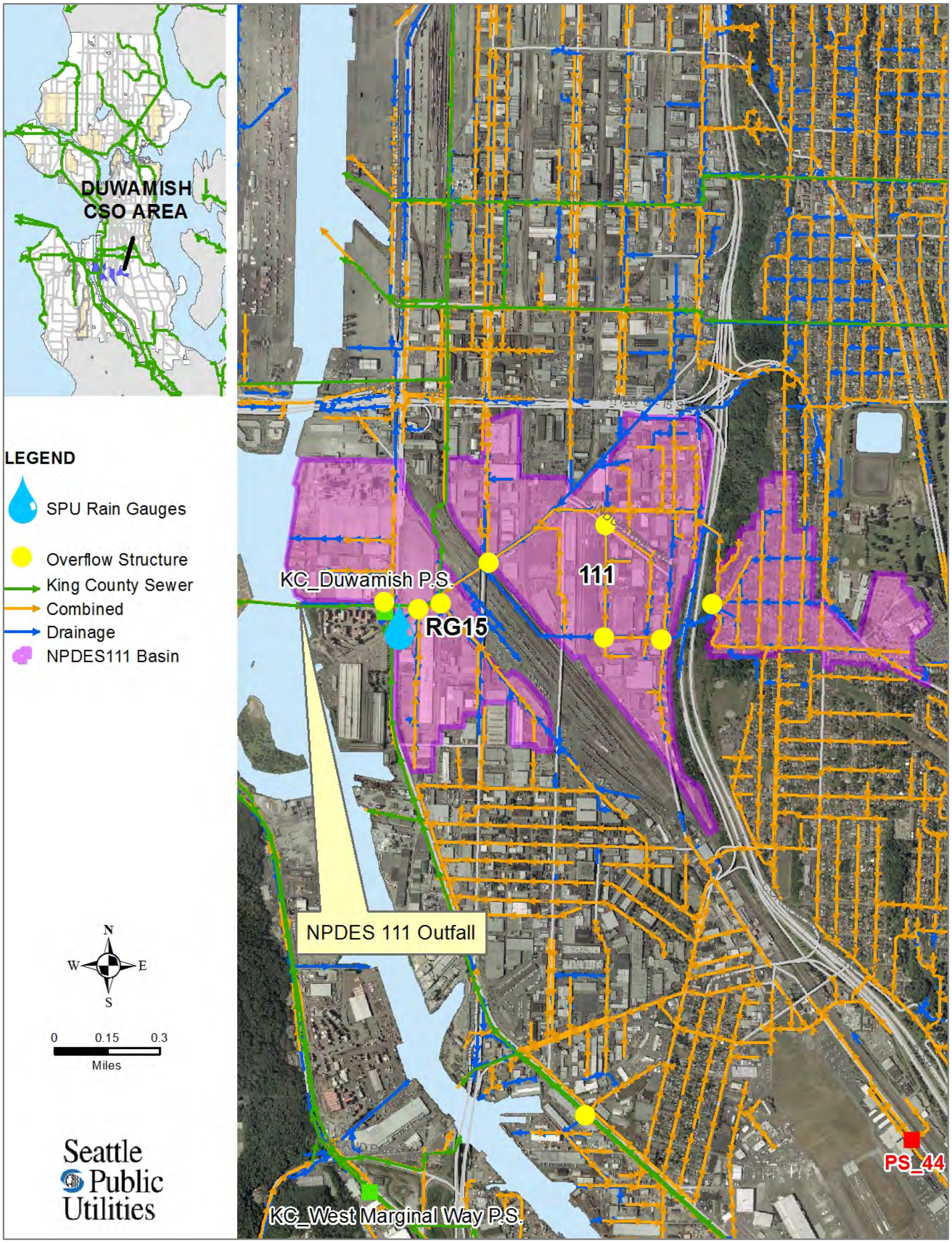


Figure 5-1. Duwamish CSO Area

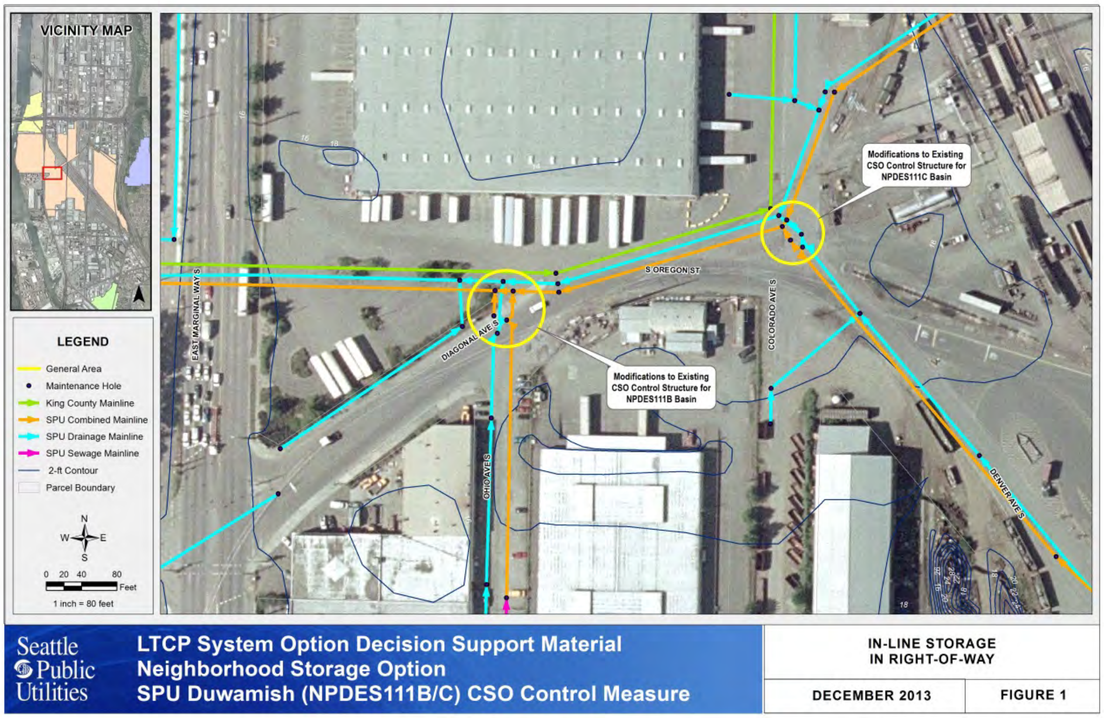


Figure 5-2. Duwamish NPDES111(B) and NPDES111(C) Neighborhood Storage CSO control measures

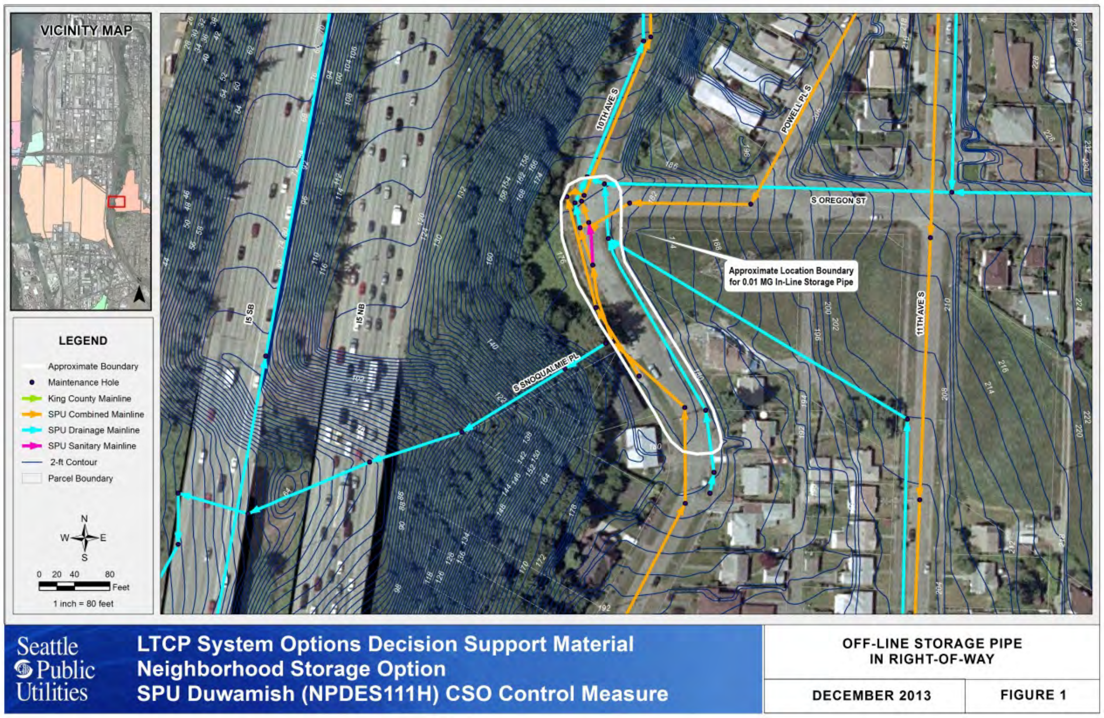


Figure 5-3. Duwamish (NPDES111[H]) Neighborhood Storage CSO control measure

5.2 Model Revisions

The model used for this analysis was based upon the SWMM5 v22 model that was documented in the LTCP modeling report (CH2M HILL, 2012c). This model was modified to incorporate the LTCP CSO control measure facilities. These modifications are described below.

5.2.1 NPDES111(B) Automated Gate

The alternative included a new automated gate at the outlet to the storm drainage system from the existing structure, located at MH056-270 (model node R056-270). The gate was located downstream of the CSO weir, and was dynamically controlled to limit CSOs. The automated gate was controlled by the water level at MH056-270. When the water level at MH056-270 exceeded an elevation of 11.6 feet, the gate opened, which produced a CSO to the storm system. The control elevation of 11.6 feet was set to minimize risk of flooding upstream properties. The tide elevation near the Duwamish basins equaled or exceeded the control elevation approximately 45 times in the last 35 years.

A new pump was also located in the existing storage facility at MH056-270 (model node R056-270), downstream of the CSO weir. The pump transferred storage from downstream to upstream of the CSO weir, when capacity was available. The pump was modeled to operate when the water surface elevation upstream of the CSO weir was 3 feet (which is slightly higher than the maximum water surface elevation during dry weather flow) or less, until the storage downstream of the CSO weir was empty. The pump was sized to lift 0.02 mgd, which is the capacity necessary to empty the storage (downstream of the CSO weir) within a 12-hour period after a flow event.

The storm pipe that enters the existing storage at MH056-270 was modified by re-routing its discharge to the storm drain downstream of the automated gate at MHD056-214.

Figure 5-4 shows a profile of the existing structure from ADS Environmental Services (ADS) drawings with the location of the automated gate and pump. Figure 5-5 shows the plan view of the modeled connection.

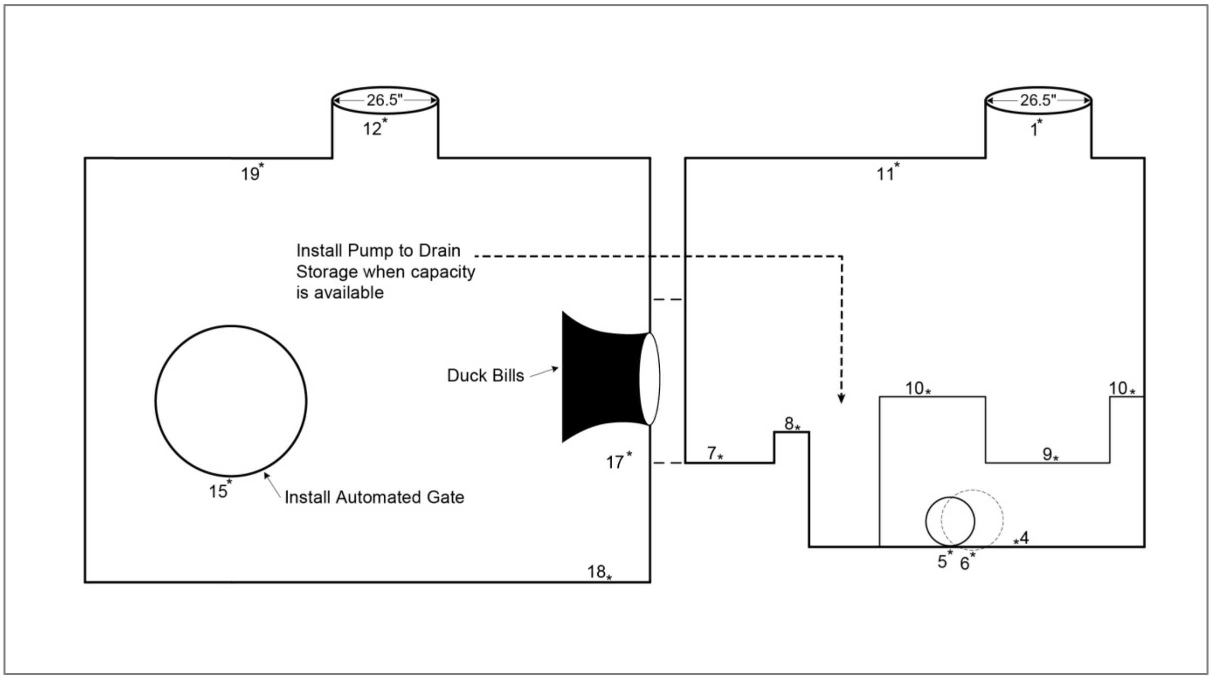


Figure 5-4. NPDES111(B) overflow structure

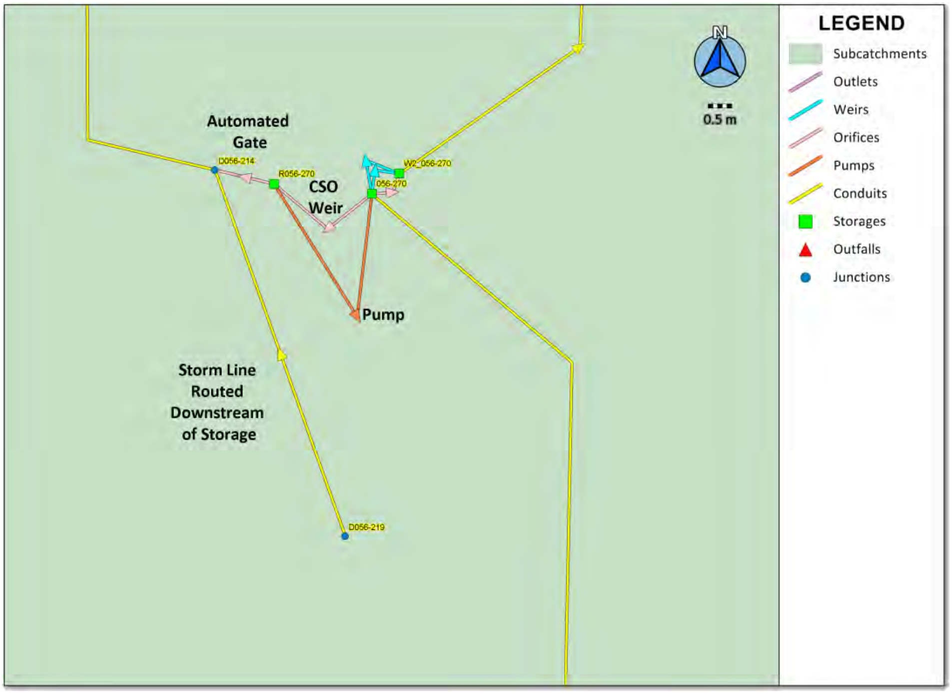


Figure 5-5. NPDES111(B) modeled alternative plan view

5.2.2 NPDES111C Automated Gate

As modeled, the NPDES111(C) alternative was conceptually very similar to the NPDES111(B) alternative. A new automated gate was simulated at the outlet to the storm drainage system from the existing structure, located at MH056-365 (model node 111C_Storm_Storage). The gate was located downstream of the CSO weir, and was dynamically controlled to limit CSOs. The automated gate was controlled by the water level at MH056-365. When the water level at MH056-365 exceeded an elevation of 11.6 feet, the gate opened, which produced a CSO to the storm system. Similar to NPDES111(B), the control elevation was assumed to minimize the risk of flooding properties upstream of the CSO location based on occurrence of high tidal data in the Duwamish Basin.

A new pump was also located in the existing storage facility at MH056-365 (model node 111C_Storm_Storage), downstream of the CSO weir. The pump transferred storage from downstream to upstream of the CSO weir, when capacity was available. The pump was modeled to operate when the water surface elevation upstream of the CSO weir was 7.4 feet (which is slightly higher than the maximum water surface elevation during dry weather flow) or less, until the storage downstream of the CSO weir was empty. The pump was sized to lift 0.02 mgd, which is the capacity necessary to empty the storage (downstream of the CSO weir) within a 12-hour period after a flow event.

Figure 5-6 shows a profile of the existing structure from ADS drawings with the location of the automated gate and pump. Figure 5-7 shows the plan view of the modeled connection.

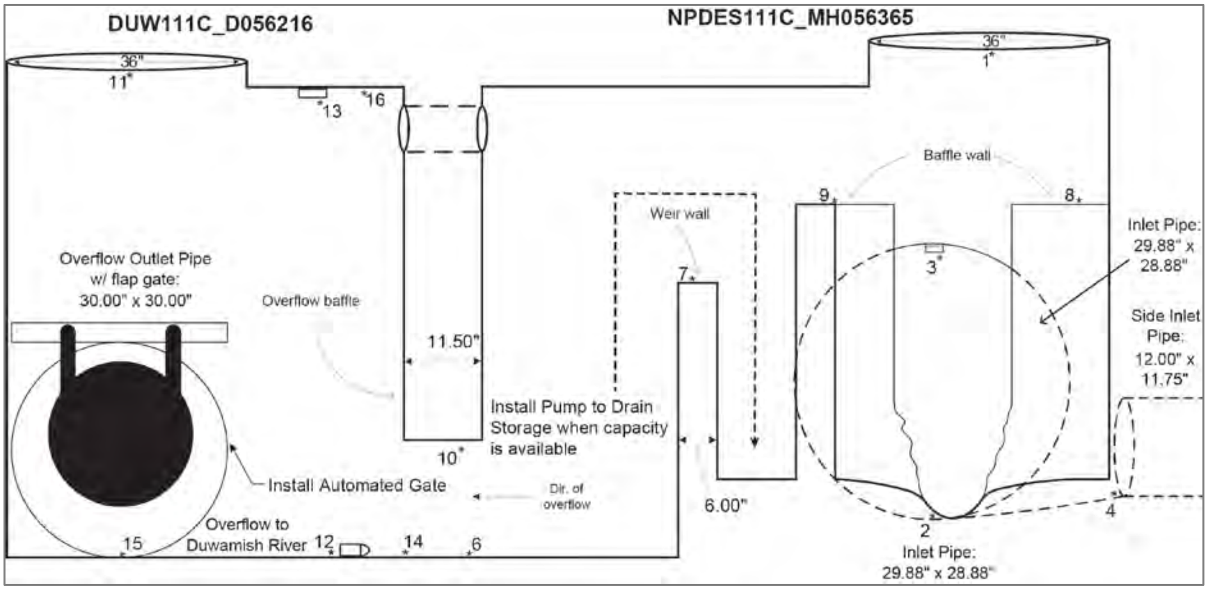


Figure 5-6. NPDES111(C) overflow structure

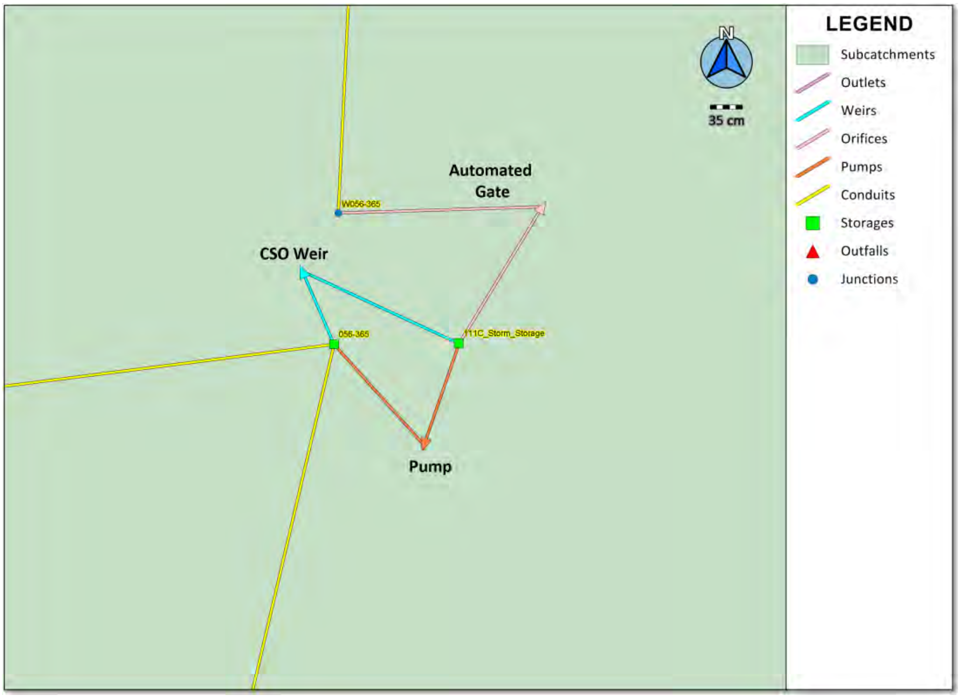


Figure 5-7. NPDES111(C) modeled alternative plan view

5.2.3 NPDES111(H) Storage

A 0.01 MG storage node was added to the model, upstream of the existing west storage for simulation of the NPDES111(H) alternative. This node represented the proposed 100-foot-long, 5-foot-diameter storage pipe with an 18-inch-diameter cunette. The new storage would have an invert elevation of 156.7, which is slightly higher than the existing in-line storage (model node 111H). The new storage would connect to the existing in-line storage with a short (~10-foot), 18-inch-diameter pipe. The new storage was drained by gravity, similar to the existing in-line storage. All stored flows pass through an existing HydroBrake.

The new storage was connected to the existing upstream conveyance at MH057-234 by approximately 70 feet of 30-inch-diameter pipe. Existing conveyance between MH057-234 and the existing in-line storage was assumed to be abandoned, and was deleted from the model.

Figure 5-8 shows the plan view of the modeled connections.

Figure 5-8. NPDES111(H) modeled alternative plan view

5.3 CSO Performance Hydraulic Analysis

The SPU Consent Decree requires that performance be analyzed on a rolling 20-year average. Where possible, the analysis will use the period from 1993–2012 for the moving 20-year average to confirm CSO control compliance.

The Duwamish system is connected to the KC Duwamish PS. Previous model development and LTSs were performed using a time series of water surface elevation upstream of the influent gate at the Duwamish PS wet well provided by KC from its model run, as described in the LTCP Modeling Report (CH2M HILL, 2012c) running from 1978–2009. This time series was extended using SCADA data for the level upstream of the Duwamish PS wet well to cover the period from 1978–2011.

For the alternatives modeling, the hydraulic analysis was conducted using the following two approaches:

- The existing system was simulated without imposing the NIRR. With this assumption and including climate change, the total overflows to NPDES111 for the 20-year simulation (1992–2011), based on the combined results of NPDES111(B), NPDES111(C), and NPDES111(H), was about 1.0 overflow per year. Climate change and other uncertainties were included by scaling the rainfall by a factor of 1.139 for the entire NPDES111 tributary area. This scaling factor includes climate change as well as other model uncertainties. It was chosen as a composite value to correspond with the BECV for the entire basin (CH2M HILL, 2013).
- The model was run with a downstream allowable release rate represented by the KC NIRR for Duwamish, as discussed in Section 1.3 (BSN111_NIRR_MGD). The NIRR restriction was implemented by using the time series to directly control the operation of the effluent pumps. Due to the limitations of the available period of the NIRR, the model simulations incorporating this NIRR were run for the 20-year period from 1990–2009. With the NIRR and including climate change, the combined overflow frequency for NPDES111 was about 1.0 per year.

A summary of the simulation results using the NIRR for control is shown in Table 5-1. Frequencies of overflow at each of the LTCP NPDES sites as well as the combined results for Outfall 111 are shown with and without climate change included. Overflow frequencies meet the Consent Decree requirement with or without climate change. As noted above, the expected overflow frequencies are the same whether local control or NIRR control is assumed. Appendix D presents a listing of the remaining overflow events.

Table 5-1. Duwamish Basin CSO Area Storage CSO Control Measure Overflow Results with KC No-Impact Release Rate

Location	Overflow frequency without climate change (per year)	Overflow frequency with climate change (per year)
	20-year (1992–2011)	20-year (1990–2009)
NPDES111(B)	0.4	0.6
NPDES111(C)	0.3	0.4
NPDES111(H)	0.5	0.9
Outfall 111	0.7	1.0

Table 5-2 presents the average annual volumes of flow delivered to KC in the existing condition and after the LTCP Neighborhood CSO control measures are implemented. Climate change is not included in these volumes, and values are averages over the 1990–2009 period.

Table 5-2. Duwamish CSO Area Flow Volumes without Climate Change

Location	20-year average of flow volume delivered to KC (MG/year)	
	Existing condition	With LTCP CSO control measures
NPDES111 total	339.5	340.0

5.4 Summary of Duwamish Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

The CSO performance hydraulic analyses described above indicated the following:

- The model analysis for the previous 20 years (1992–2011) with no restrictions on flow due to the KC NIRR resulted in an overflow frequency of 0.40 per year at NPDES111(B), 0.20 per year at NPDES111(C), and 0.95 per year at NPDES111(H) when climate change impacts were included. The total overflow frequency to NPDES111, combining the results of NPDES111(B), NPDES111(C), and NPDES111(H), was estimated to be 1.00 per year. The local control set point chosen in the simulations results in discharges at times approximating the NIRR. Occasional violations of the NIRR might occur, however.
- Using the KC NIRR time series (1990–2009) as an allowable release rate to control the new storage tank drainage resulted in an overflow frequency of 0.6 per year at NPDES111(B), 0.4 per year at NPDES111(C), and 0.9 per year at NPDES111(H) when climate change impacts were included. The overall frequency of overflow to the NPDES111 outfall was 1.0 per year. No system modifications were necessary as a result of imposing the KC NIRR.

- The modeling analysis indicates that the alternatives will meet the CSO performance control requirements with uncertainties including climate change, both with and without the imposition of the KC NIRR. Because of superior performance, it is recommended that any new storage added at NPDES111(H) be attached to the existing eastern off-line storage tank rather than the in-line tank to the west.

SECTION 6

East Waterway Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

This section reviews the proposed East Waterway Neighborhood Storage CSO control measure for NPDES107, describes how the LTCP model of the area was updated to represent the CSO control measures, and summarizes the simulated CSO control performance against the July 3, 2013, Consent Decree performance criteria with and without climate change considerations.

6.1 Proposed Storage CSO Control Measure

The proposed East Waterway Neighborhood Storage CSO control measure will control CSOs from the NPDES107 Basin. The proposed storage CSO control measure includes:

- a 0.5 MG off-line storage tank located in private property
- an effluent pump station with a pumping capacity of 1.0 mgd to empty the storage tank within 12 hours
- up to 500 linear feet (lf) of 36-inch-diameter gravity conveyance pipe, depending on the location selected for the storage tank
- up to 1,380 lf of 24-inch-diameter force main, depending on the location selected for the storage tank
- a diversion structure with an overflow weir to divert excess flows to the storage tank

The East Waterway CSO Area is shown in Figure 6-1. The area of the proposed CSO control measure is shown in Figure 6-2.

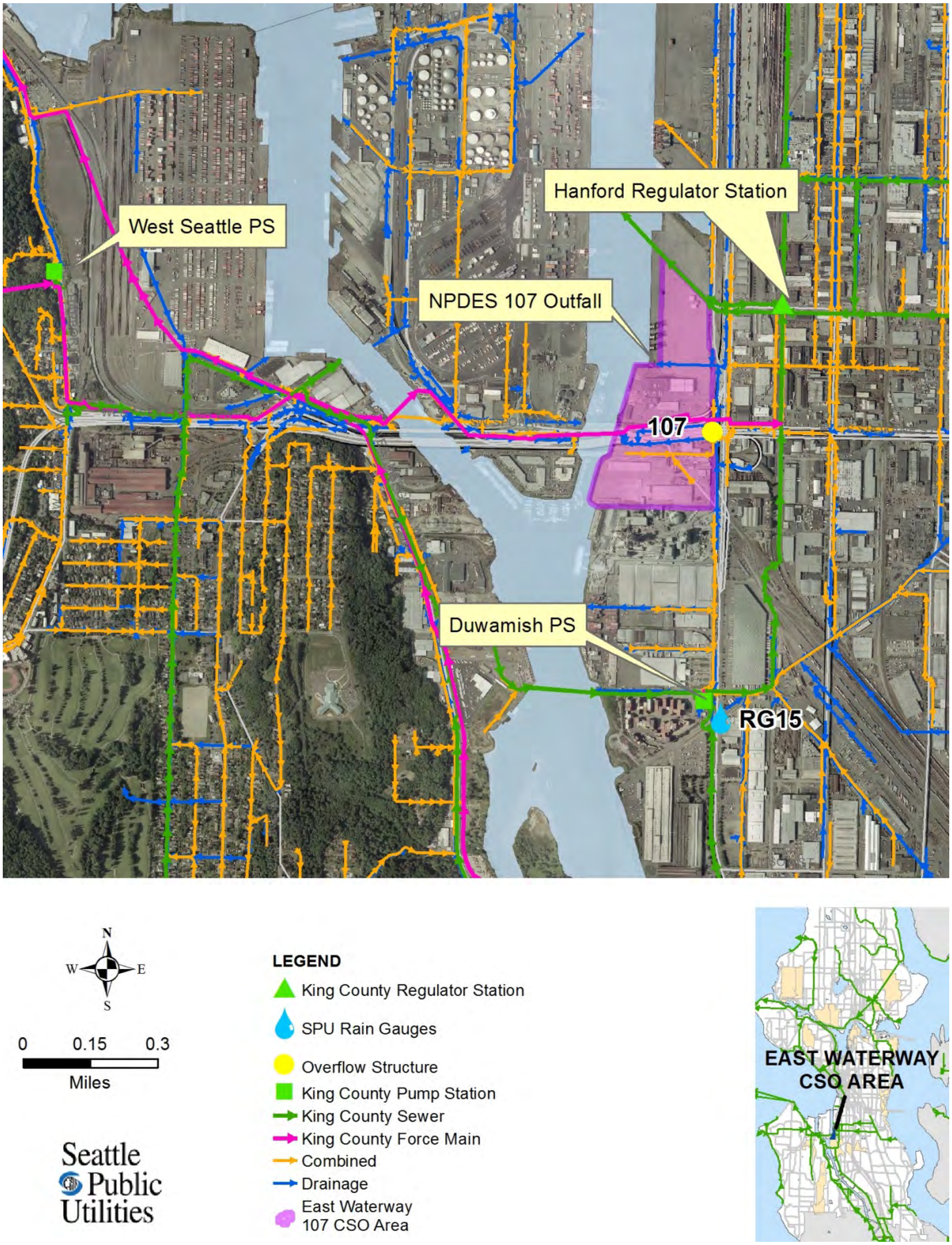


Figure 6-1. East Waterway CSO Area

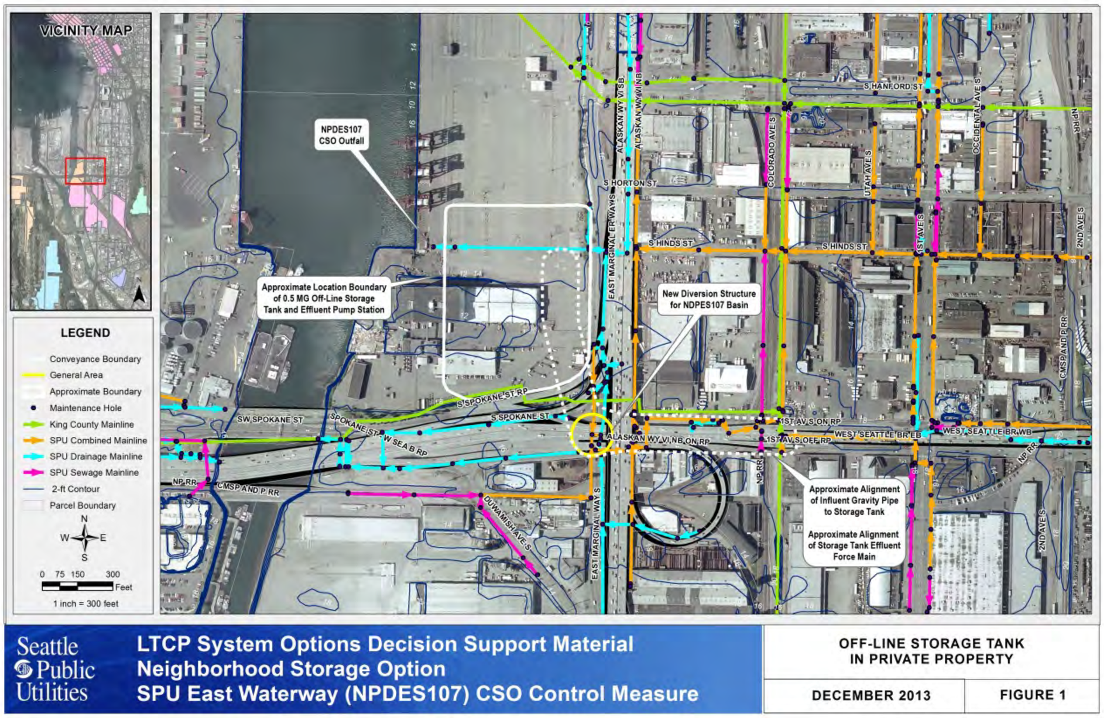


Figure 6-2. East Waterway Neighborhood Storage CSO control measure

6.2 Model Revisions

The model used for this analysis was based upon the SWMM5 v22 model that was documented in the LTCP modeling report (CH2M HILL, 2014b). This model was modified to incorporate the LTCP CSO control measure facilities. These modifications are described in the following sections.

6.2.1 NPDES107 Diversion Structure

A new diversion structure was added to the model at MH056-097, which is the location of the existing CSO structure. The existing overflow consists of an elevated overflow pipe at elevation 10.66 feet. A new weir was added to the structure to divert excess flow to the storage tank.

6.2.2 Storage Tank

The storage tank was represented in the model as a storage node with an active storage depth of about 15 feet and a cross-section area of 4,500 ft^2. The bottom elevation of the tank was set to provide a volume of 0.5 MG below the existing overflow elevation.

6.2.3 Return of Stored Flows

An effluent pump station is required to return stored flows to the KC system at MH056-370. The required pumping capacity is 1.0 mgd in order to drain the tank in 12 hours. The pump station operation would be controlled by the water level in the KC EBI, to prevent the pump station from operating when the water level in the EBI is high. To simulate the KC NIRR, a control rule was added to the model to prevent the pump from operating until the NIRR for flow to the KC EBI (BN107_NIRR_MGD) exceeded the effluent pumping rate. This configuration was modeled rather than discharge to the HLKK wet weather treatment plant because the plant site is unknown and may not be available until 5 years following the required control for NPES107 per the Consent Decree.

Local control could be implemented for this control measure. A depth in the EBI corresponding to the NIRR could be established, below which discharge would be allowed.

Figure 6-3 shows a plan view of the modeled alternative.

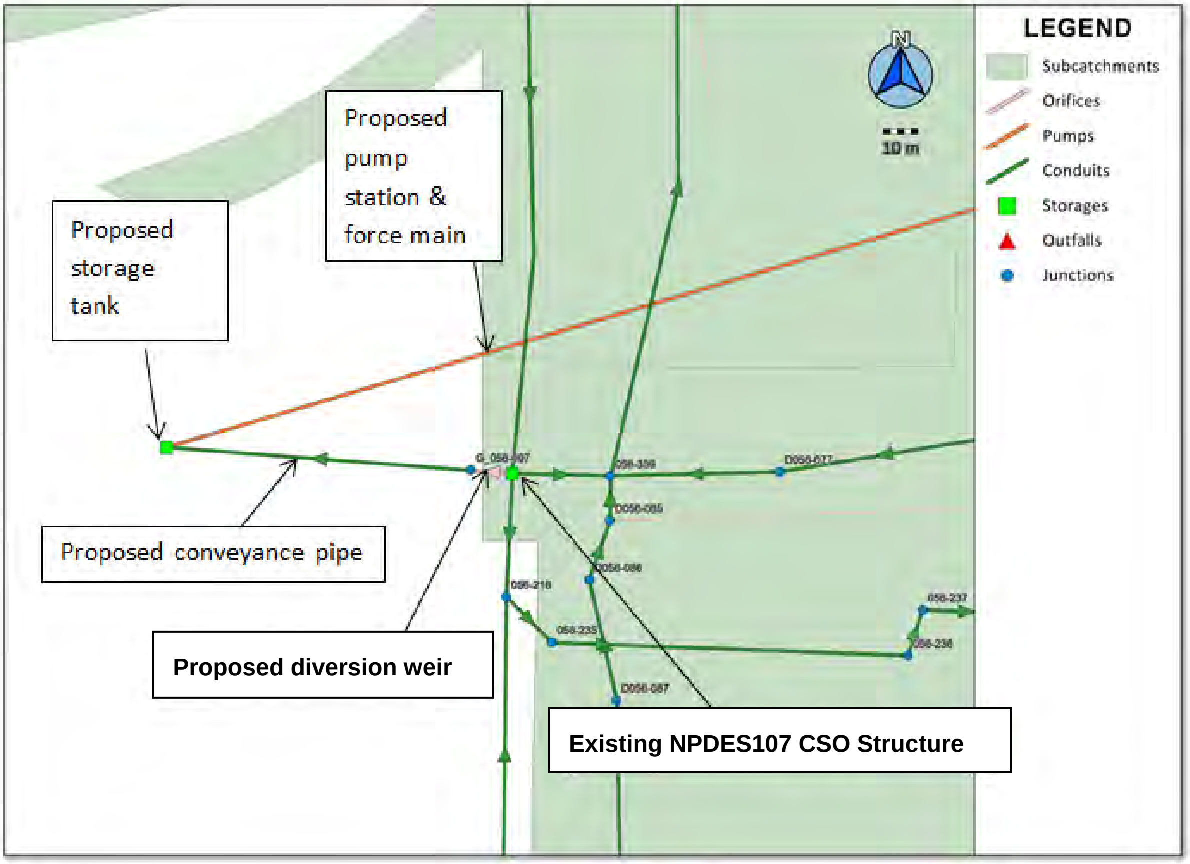


Figure 6-3. Plan view of modeled alternative

6.3 CSO Performance Hydraulic Analysis

The SPU Consent Decree requires that performance be analyzed on a rolling 20-year average. Where possible, the analysis will use the period from 1993–2012 for the moving 20-year average to confirm CSO control compliance.

The East Waterway system is connected to the KC interceptor upstream of the Hanford Regulator Station and downstream of the Duwamish PS. KC furnished results of its 2010 CSO model run (model used to develop the KC CSO Plan) for use in long-term simulations of this basin. Results were provided for the Duwamish PS discharge, the West Seattle PS discharge, the EBI level at the junction with the Hanford Regulator Station, and the EBI level just downstream of the Duwamish PS.

The model was run from January 1990–December 2009. Including climate change, 16 overflows were simulated at NPDES107—an overflow frequency of about 0.8 per year. Climate change and other uncertainties were included by scaling the rainfall by a factor of 1.07.

A summary of the simulation results is shown in Table 6-1. Appendix E presents a listing of the remaining overflow events without climate change included.

Table 6-1. East Waterway Neighborhood Storage CSO Control Measure Overflow Results with KC No-Impact Release Rate

Location	Overflow frequency without climate change (per year)	Overflow frequency with climate change (per year)
	20-year (1990–2009)	20-year (1990–2009)
NPDES107	0.7	0.8

Figure 6-2 presents the average annual volumes of flow delivered to KC in the existing condition and after the LTCP Neighborhood CSO control measure is implemented. The backflow from the EBI into the CSO area makes it difficult to separate the actual basin flows from the backflow. These results were therefore derived from a model in which backflow was not allowed. Climate change is not included in these volumes, and values are averages over the 1990–2009 period.

Table 6-2. East Waterway CSO Area Flow Volumes without Climate Change

Location	20-year average of flow volume delivered to KC (MG/year)	
	Existing condition	With LTCP CSO control measure
NPDES107	20.3	21.5

6.4 Summary of East Waterway Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

The CSO performance hydraulic analyses described above indicated the following:

- The modeling analysis indicates that the alternative will meet the CSO performance control requirements with or without uncertainties including climate change.
- The modeling indicates that the overflow frequency is dependent on the level in the KC EBI, the EBI level at which effluent pumping can begin, the effluent pumping rate, and the elevation of the weir diverting flow to storage. Modeling indicated that the alternative performance would be improved by eventual discharge directly to the KC HLKK wet weather treatment plant, or by insertion of a check valve near the connection of the system to the EBI to prevent backflow.

SECTION 7

Fremont/Wallingford Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

The Fremont/Wallingford CSO Basin includes two outfalls and three overflow structures covered by the LTCP: NPDES147 and NPDES174. The NPDES147 Basin includes two overflow points (NPDES147[A] and NPDES147[B]). The associated NPDES148 CSO Basin is considered controlled. This section reviews the proposed Fremont/Wallingford Neighborhood Storage CSO control measure, describes how the LTCP model of the area was updated to represent the CSO control measure, and summarizes the simulated CSO control performance against the Consent Decree performance criteria with climate change considerations.

7.1 Proposed Storage CSO Control Measure

The proposed Fremont/Wallingford Neighborhood Storage CSO control measure will control CSOs from the NPDES147 and NPDES174 Basin. The proposed storage CSO control measure includes:

- a new 3.3 MG off-line storage tank
- two PSs, and associated force mains and influent sewers to convey overflows from NPDES174 and NPDES147 to the tank
- an effluent PS to return stored flow to the KC Interceptor when capacity is available

In addition, it was assumed that the existing flap gate immediately downstream of the NPDES147A overflow structure is repaired or replaced to prevent backflow from the KC interceptor to the overflow structure. Backflows up to 1.0 mgd were observed in the LTCP flow monitoring CSO control measure.

The Fremont/Wallingford CSO area is shown in Figure 7-1. The layout of the CSO control measure is shown in Figure 7-2.

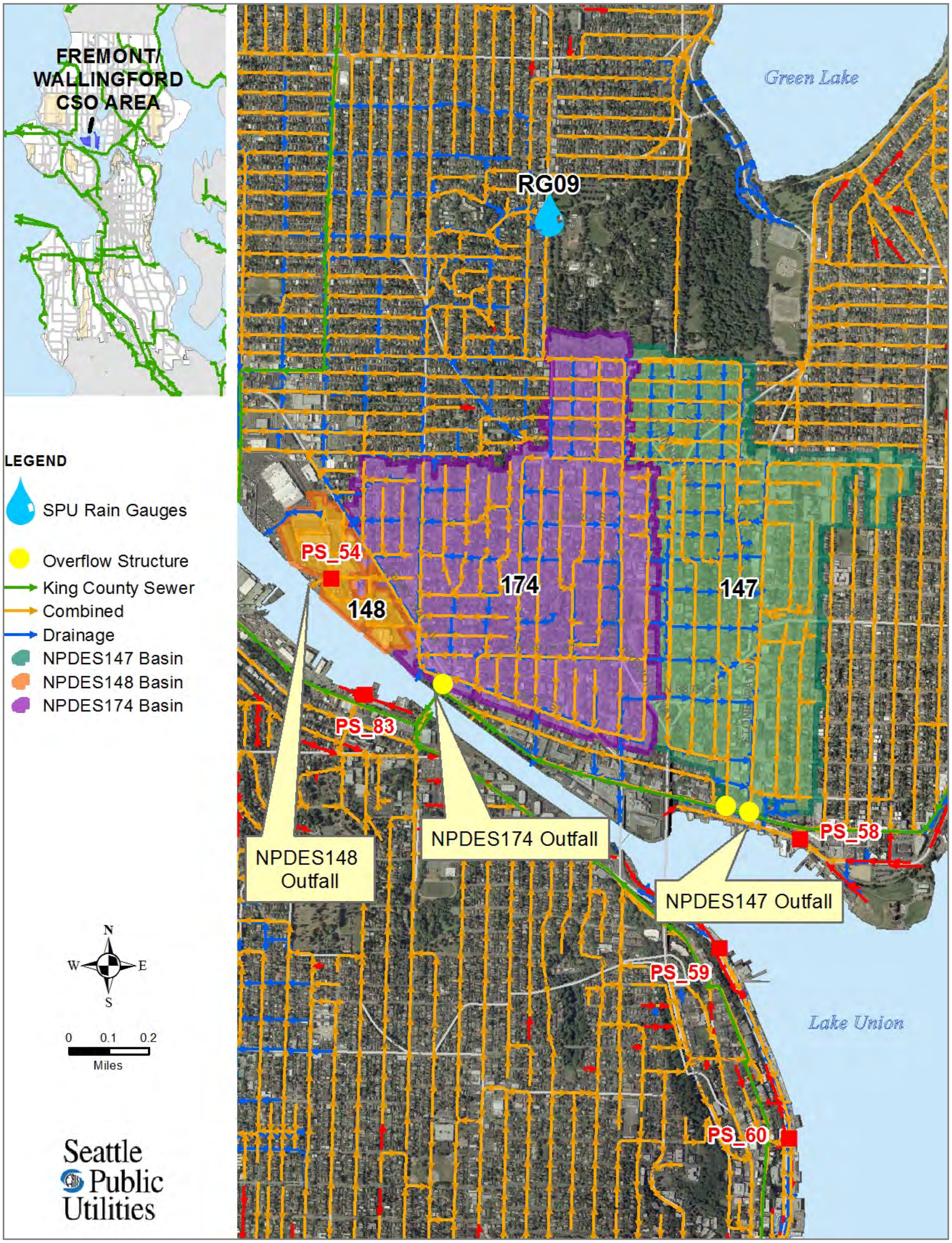


Figure 7-1. Fremont/Wallingford CSO Area

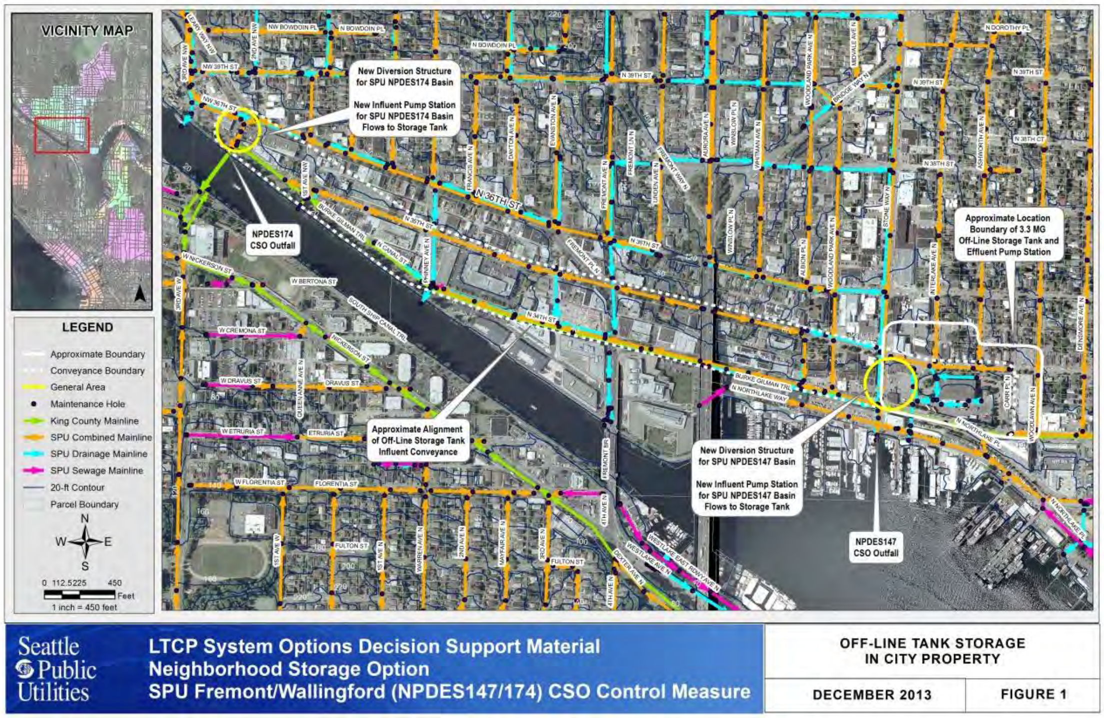


Figure 7-2. Fremont/Wallingford Neighborhood Storage CSO control measure facilities

7.2 Model Revisions

The model used for this analysis was based upon the SWMM5 v22 model that was documented in the LTCP modeling report (CH2M HILL, 2012d). This model was modified to incorporate the LTCP CSO control measure facilities. The full LTCP model was run with appropriate precipitation factors as described below and the flow time series at locations above the existing overflow structures saved. These were then added as inputs to a reduced-scale model including only the overflow structures and the alternative facilities (lower basin model) for the analyses reported herein.

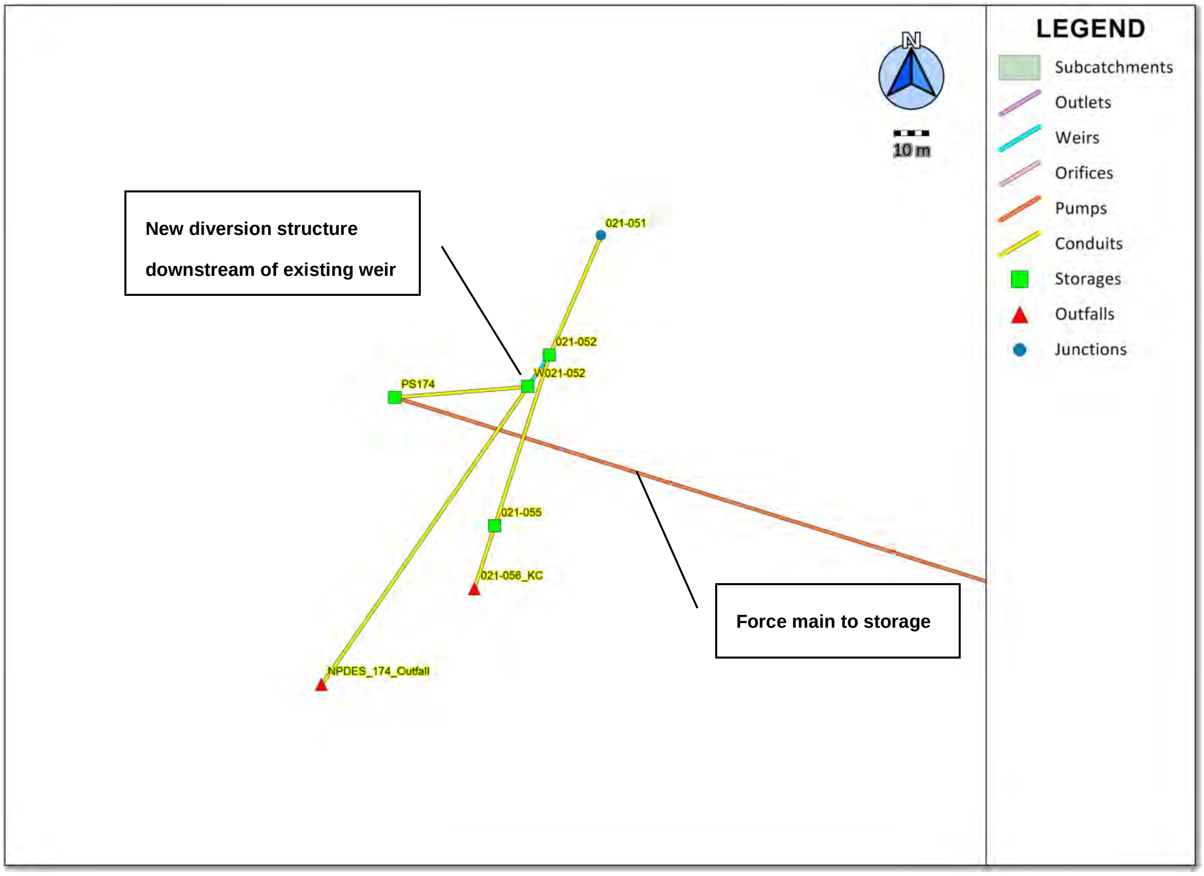
The modifications to the 2012 LTCP model that were performed to represent the CSO control measure are described in the following section.

7.2.1 NPDES174 Overflow Structure

Figure 7-3 shows the configuration of the model at the NPDES174 overflow structure. It was assumed that a new 10-foot-diameter structure would be constructed on the downstream side of the existing overflow weir with a bottom elevation of 15 feet. This structure provides for a connection at the invert leading to the PS (model element PS174) conveying overflow to the storage tank without interference with the operation of the existing overflow. This conduit conveyed up to 30 mgd while the wet well was filling in the long-term model simulations.

The existing overflow conduit would be attached to this structure at its existing elevation of 21.2 feet. Overflows would occur through the existing outfall if flows exceed the PS capacity.

The PS was assigned a maximum capacity of 10 mgd, which was found to be necessary to meet the performance requirement. This capacity was found necessary to capture flows from some short-duration, high-intensity storm events that could result in overflows even though the storage tank was not full.



New diversion structure downstream of existing weir

Force main to storage

Figure 7-3. Plan view of NPDES174 connections

7.2.2 NPDES147 Outfall

Figure 7-4 shows the configuration of the model at the NPDES147 overflow structure and outfall. It was assumed that the existing MH022-186 would be reconstructed or a new structure would be constructed nearby to provide a connection to the PS conveying overflows to the storage tank and a new final overflow weir to the existing outfall conduit. If a new diversion structure is constructed, the overflow lines from NPDES147A and NPDES147B can be intercepted at MH022-186 and re-directed to the new structure.

The new overflow weir will provide for overflows in excess of the PS conveying overflows to the alternative storage tank (PS147). The model assumes that this new weir is at elevation 21.5 feet with a total length of 25 feet in order to meet the performance requirements without flooding the existing overflow weir at MH022-187. The final weir configuration may depend on the final design of the diversion structure and pipeline connecting to the PS.

The PS conveying overflow to the storage tank (PS147) was assigned a maximum capacity of 25 mgd to meet the performance requirement. This capacity was found necessary to capture flows from some short-duration, high-intensity storm events that could result in overflows even though the storage tank was not full. The influent conduit conveying flows from MH022-186 to the PS was assigned a 36-inch diameter to meet the performance requirement. This conduit conveyed up to 35 mgd in the long-term model simulations.

The existing conduit from the existing overflow weir to the diversion structure (022-187_022-186) was enlarged from 18-inch to 36-inch diameter to prevent flooding of the existing weir.

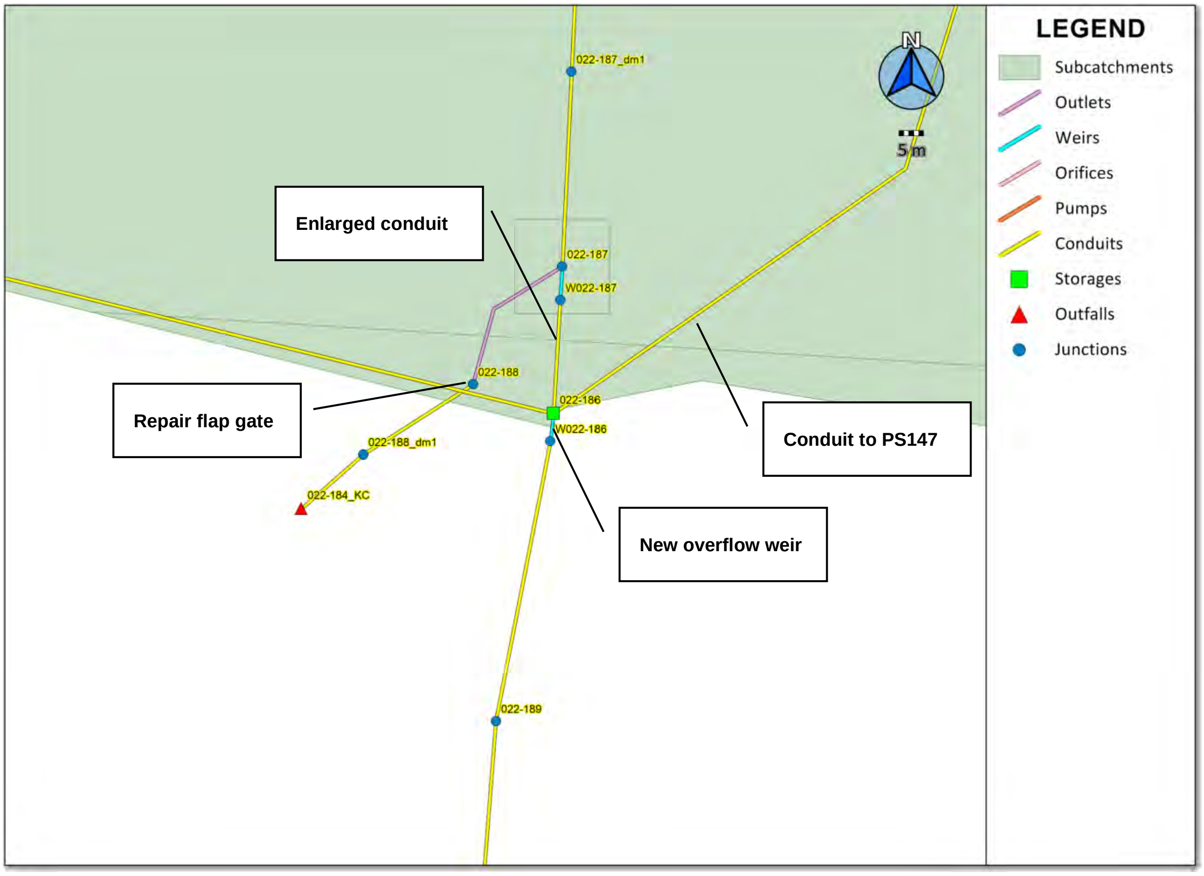


Figure 7-4. Plan view of NPDES147 connections

7.2.3 Storage Tank and Effluent PS

The BECV for the Fremont/Wallingford CSO Area is 3.22 MG (CH2M HILL, 2013). Using the KC Fremont NIRR time series as a boundary condition for drainage of the tank (FREM_NIRR_MGD) indicated that the total volume should be increased to 3.3 MG to meet performance requirements. A 30-foot side water depth would be required to provide this storage.

The effluent PS capacity was assumed to be 6.6 mgd in the model in order to drain the tank in 12 hours. The NIRR provided by KC was modified by subtracting 5 mgd (to account for releases from upstream SPU CSO control measures). The modified time series was used to control effluent pumping by allowing the pump to operate only when the modified NIRR time series exceeded 6.6 mgd.

The 5 mgd subtraction from the NIRR was applied as a simple way to account for upstream releases from storage in the Leschi, Montlake, and North Union Bay CSO Areas. The Windermere system is also upstream but is the subject of a separate agreement between SPU and KC. The total peak storage release flow rates from the upstream basins accounted for are: Leschi 0.8 mgd, Montlake 0.45 mgd, and an estimated 1 to 3 mgd excess flow from the North Union Bay project (final design is not complete). The total is thus potentially 2.25 to 4.25 mgd, which was rounded up to 5 mgd. In effect, the subtraction of this value from the NIRR serves to slightly delay the time at which storage releases can begin.

7.3 CSO Performance Hydraulic Analysis

The SPU Consent Decree requires that performance be analyzed on a rolling 20-year average. Where possible, the analysis will use the period from 1993–2012 for the moving 20-year average to confirm CSO control compliance.

The Fremont/Wallingford system is connected to the KC North Interceptor immediately upstream of the Fremont Siphon. Previous model development and LTSs were performed using a time series of water surface elevation at the interceptor connection points provided by KC from its model run, as described in the LTCP Modeling Report (CH2M HILL, 2012d). This time series covers the period from 1978–2009.

The hydraulic analysis was conducted using a restriction on effluent pumping represented by the modified KC NIRR for Fremont (FREM_NIRR_MGD), as discussed earlier. Due to the limitations of the available period of the NIRR, the model simulations incorporating this time series were run for the 20-year period from 1990–2009. Simulations including climate change were run using precipitation scaling factors of 1.0651 for the NPDES148(A) tributary area, 1.0719 for NPDES147(B), and 1.0679 for NPDES174. These scaling factors include climate change as well as other model uncertainties. They were chosen to correspond with the BECV for each overflow (CH2M HILL, 2013).

As noted in Section 7.2.3, the storage volume of the tank needs to increase from 3.22 MG to 3.3 MG in order to account for the impact of the KC NIRR. In addition, the influent PS capacities were increased in order to capture some high-intensity, short-duration events that would otherwise result in overflows even though the storage tank had not filled.

A summary of the simulation results with the KC NIRR time series is shown in Table 7-1. Table 7-1 presents the overflow frequency results of the simulation with existing rainfall (no climate change included) and with climate change included, documenting compliance with the Consent Decree requirement. Appendix F presents a listing of the remaining overflow events without climate change included.

Table 7-1. Fremont-Wallingford CSO Area Neighborhood Storage CSO Control Measure Overflow Results with KC No-Impact Release Rate

Location	Overflow frequency without climate change (per year)	Overflow frequency with climate change (per year)
	20-year (1990–2009)	20-year (1990–2009)
NPDES147	0.5	0.7
NPDES174	0.5	0.6

Table 7-2 presents the average annual volumes of flow delivered to KC in the existing condition and after the LTCP Neighborhood CSO control measures are implemented. Climate change is not included in these volumes, and values are averages over the 1990–2009 period.

Table 7-2. Fremont-Wallingford CSO Area Flow Volumes without Climate Change

Location	20-year average of flow volume delivered to KC (MG/year)	
	Existing condition	With storage CSO control measure
NPDES147	220	220
NPDES174	284	284
Effluent PS	NA	9
Total	504	513

7.4 Summary of Fremont/Wallingford Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

The CSO performance hydraulic analyses described above indicated the following:

- For the moving 20-year average period of 1990–2009 using the KC NIRR, the hydraulic CSO performance hydraulic analysis indicated that the proposed LTCP Fremont/ Wallingford Neighborhood Storage CSO control measure configured as described above results in an overflow frequency of less than once per year at both the NPDES147 and NPDES174 outfalls with or without climate change accounted for.
- Local control may not be able to mimic the NIRR sufficiently at this location, perhaps requiring an integration of the agencies' SCADA systems to provide a signal when discharge is allowed.

It was observed during this analysis that modifying the Fremont/Wallingford Neighborhood Storage CSO control measure to replace the 3.3 MG storage tank with a 12-foot-diameter conduit or tunnel running from NPDES174 to NPDES147 would permit elimination of the conveyance PSs and associated capacity restrictions, and improve the efficiency of operation.

SECTION 8

Leschi Neighborhood Storage CSO Control Measures Performance Hydraulic Analysis

This section reviews the proposed Leschi Neighborhood Storage CSO control measures (NPDES028–NPDES036), describes how the LTCP model of the area was updated to represent the CSO control measures, and summarizes the simulated CSO control performance against the July 3, 2013, Consent Decree performance criteria with climate change considerations.

8.1 Proposed Storage CSO Control Measures

The LTCP Leschi Neighborhood Storage CSO control measures include a series of pipe storage facilities and a single large storage tank (adjacent to the NPDES031 overflow structure). Flows into the storage facilities occur by gravity. Return of stored flows is via gravity or by pumped flow.

The Leschi CSO Area is shown in Figure 8-1. The NPDES026, NPDE027, NPDES030, NPDES033, NPDES034, and NPDES035 outfalls are considered controlled and no CSO control measure has been identified for these in the LTCP. Figure 8-2 through Figure 8-5 show the individual LTCP CSO control measures. The entire basin drains to the KC E Pine Street PS, which delivers flow to the KC SW Lake Washington Trunk and eventually to the KC Montlake Regulator Station.

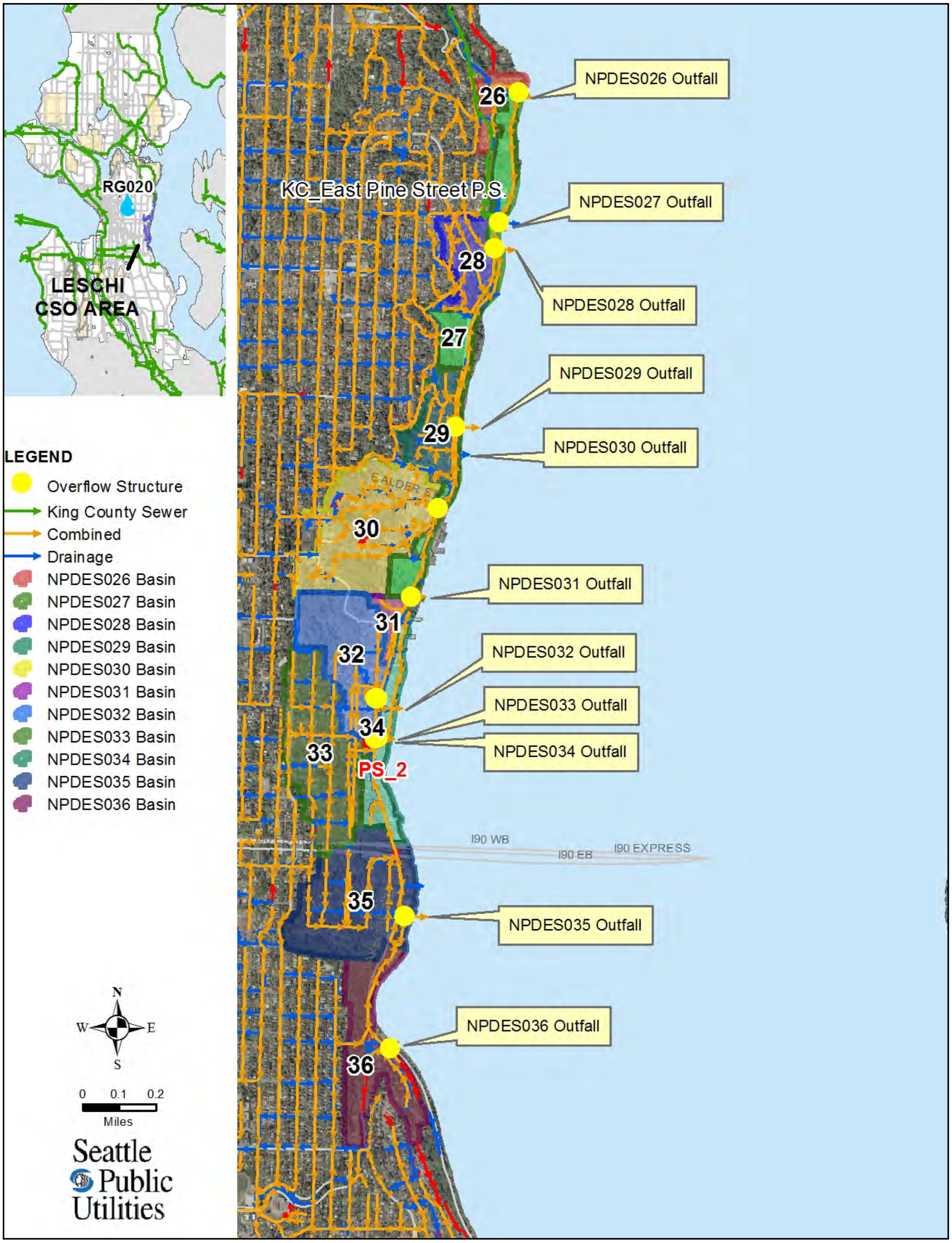


Figure 8-1. Leschi CSO Area

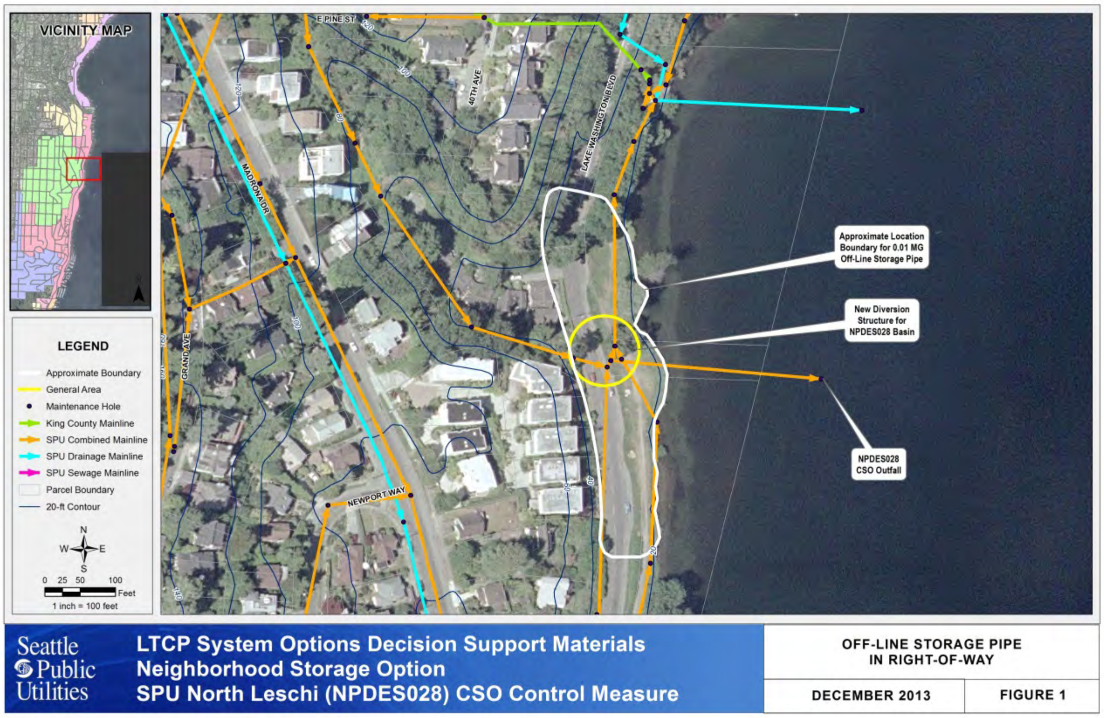


Figure 8-2. Leschi NPDES028 Neighborhood Storage CSO control measure facilities

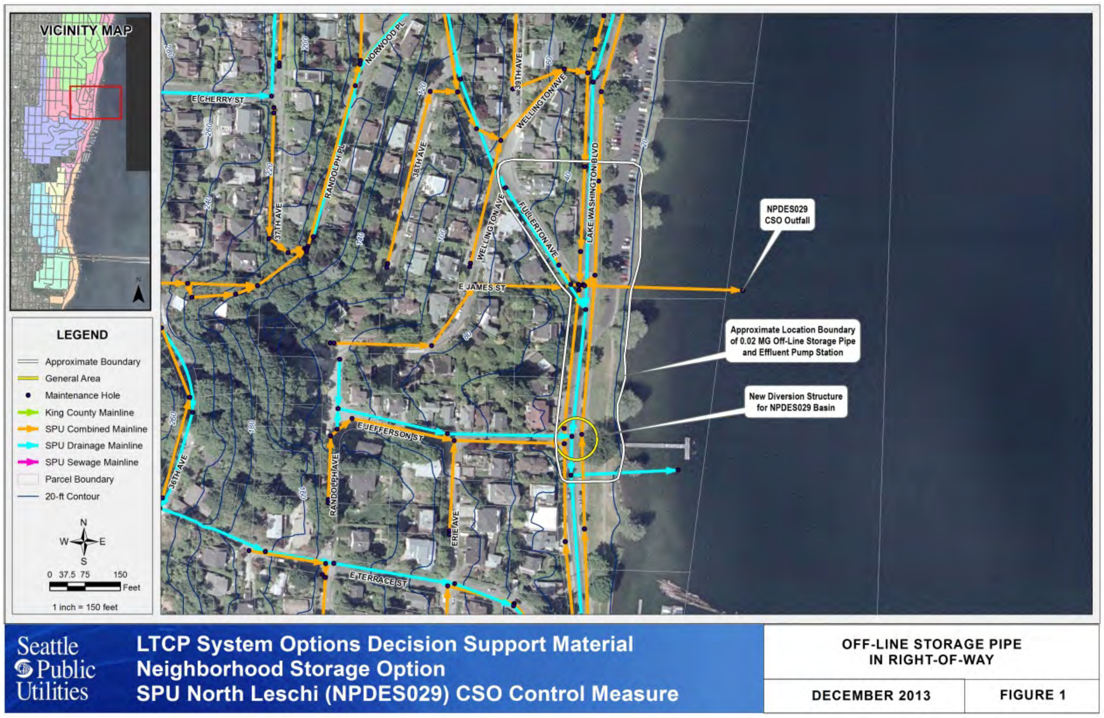


Figure 8-3. Leschi NPDES029 Neighborhood Storage CSO control measure facilities

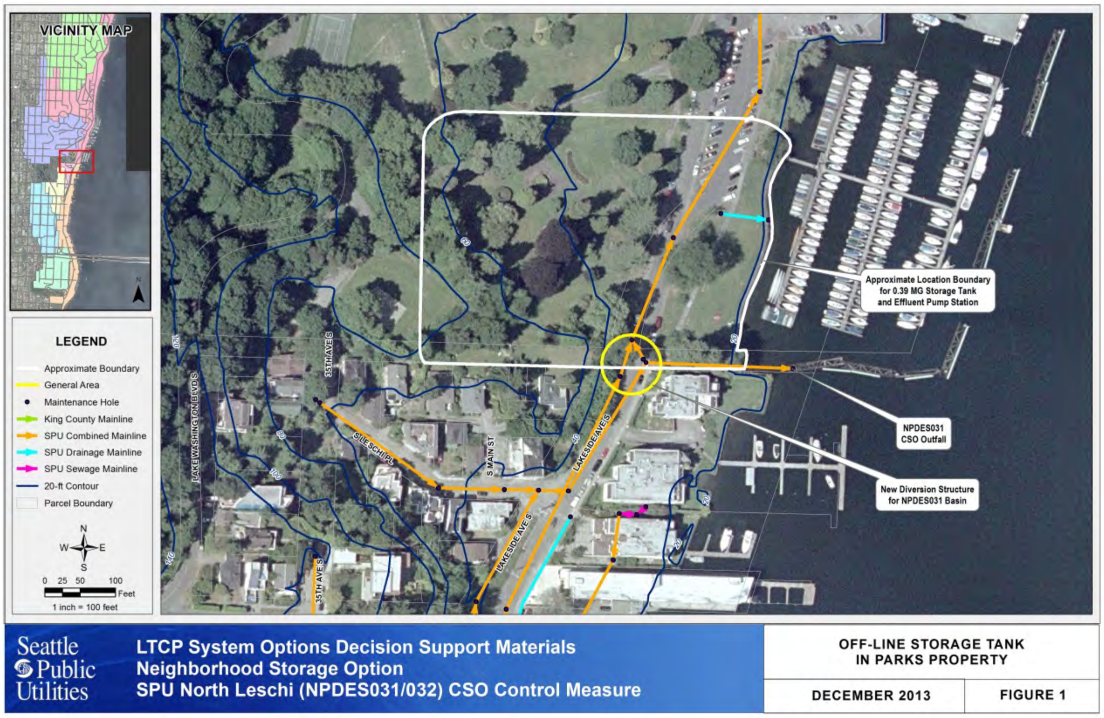


Figure 8-4. Leschi NPDES031 and NPDES032Neighborhood Storage CSO control measure facilities

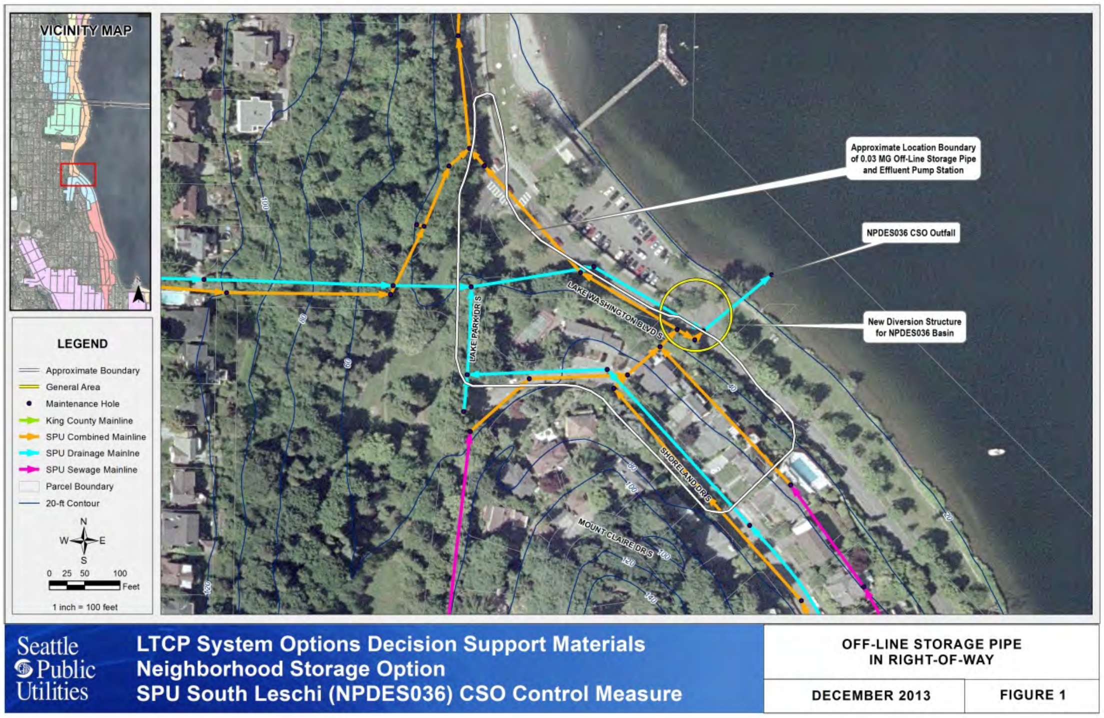


Figure 8-5. Leschi NPDES036 Neighborhood Storage CSO control measure facilities

8.2 Model Revisions

The model used for this analysis was based upon the SWMM5 v22 model that was documented in the LTCP modeling report (CH2M HILL, 2012e). The version of the model calibrated to conditions measured in 2010–11 was modified to incorporate the LTCP CSO control measure facilities. These modifications are described in the following sections.

8.2.1 NPDES028

The LTCP CSO control measure for NPDES028 includes a 0.01 MG off-line storage pipe, in the vicinity of the NPDES028 CSO Outfall. Overflows would be captured by gravity diversion to the storage pipe and gravity return to the existing overflow structure or to the adjacent trunk line when storms subside.

The model was updated to include the following elements:

- A new 3-foot-diameter by 210-foot-long pipe at a slope of 0.002 ft/ft, running from the existing overflow structure (MH042-275) parallel to the existing trunk line downstream to near MH042-273. The facilities included an 8-foot-diameter shaft at the inlet end to accept flow from the existing overflow structure with a diversion weir, and a 12-foot-diameter shaft at the outlet end near MH042-273 to accommodate a control sluice gate or small pump.
- A new diversion weir in the existing overflow structure set to elevation 19.5 feet just below the existing overflow weir at elevation 19.87 feet.
- Gravity drainage of the storage pipe to the trunk line at MH042-273 was configured using a controllable sluice gate or pump that allowed flow into the trunk line only when the depth of flow in the trunk line at this maintenance hole is less than 0.9 foot. Either the controlled sluice gate or pump station suffices to return stored flow.

Figure 8-6 shows the layout of the facilities in the model. The storage pipe was modeled as a storage node in the model with a depth-surface area relationship corresponding to the pipe and associated shafts.

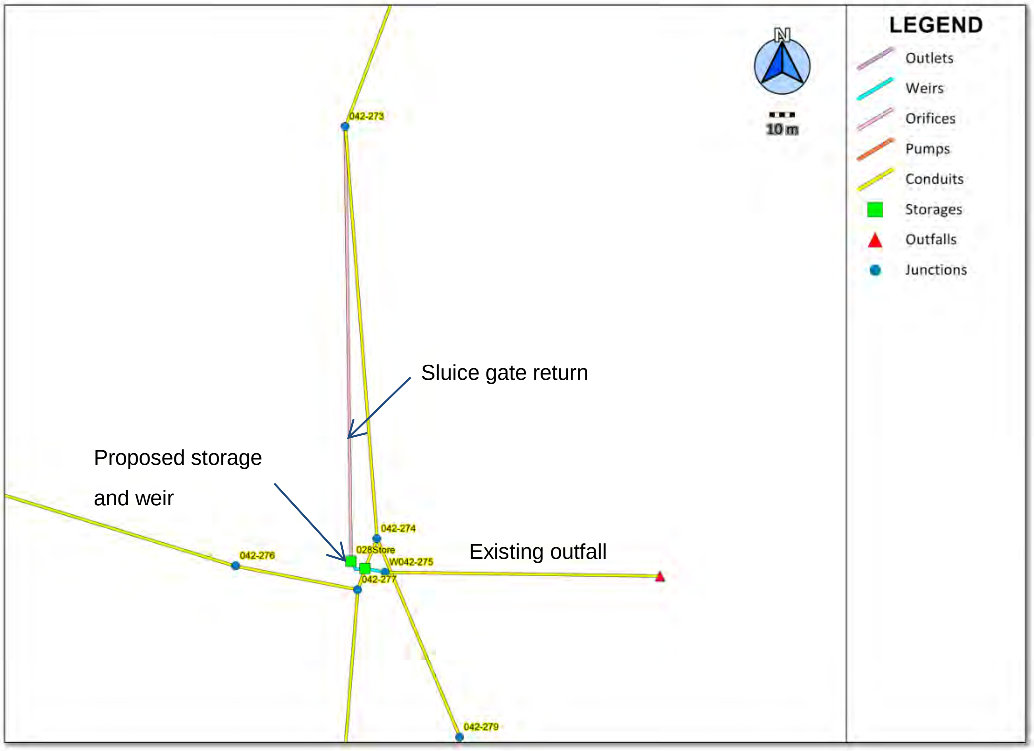


Figure 8-6. Leschi NPDES028 model layout

8.2.2 NPDES029

The LTCP CSO control measure for NPDES029 includes a 0.02 MG off-line storage pipe. The stored flow would be returned to the sewer (MH042-302) with a pump station having a capacity of 0.04 mgd.

Overflows at NPDES029 are affected by the level in the trunk sewer at MH042-305 as well as flows from the tributary area. Modeling indicated that the diversion into the new storage pipe should occur at the existing overflow point at MH042-303. The alternative was configured in the model as follows:

- The new storage pipe was attached to the existing overflow at MH042-303 via a new weir at elevation 24 feet (1 foot above the existing overflow weir) and the existing overflow weir was raised to elevation 24.5 feet.
- The new storage pipe was represented as a storage node having a depth vs. surface area relationship corresponding to a 5-foot-diameter by 150-foot-long pipe laid at 0.006 ft/ft slope. Shafts of 12-foot diameter at the end nearest MH042-303 and 4-foot diameter at the upstream end were included to accommodate the effluent pump and ventilation.

- A 0.04 mgd effluent pump station was included to drain the storage after storm events. The pump return was to the trunk line at MH042-305. The pump could be controlled to allow operation only when the depth of flow at MH042-305 was less than 0.7 foot. This ensures that the storage will be emptied after storm flows in the system have subsided significantly.
- The existing HydroBrake at MH042-302 was retained to take advantage of the available upstream storage.

Figure 8-7 shows the layout of facilities in the model.

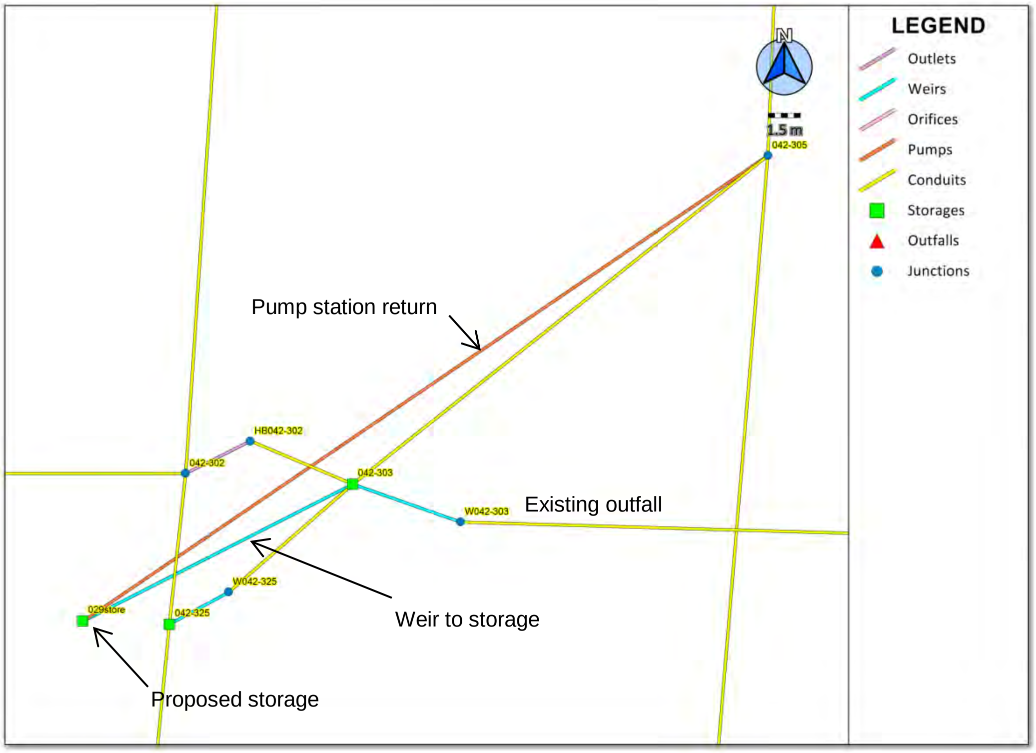


Figure 8-7. Leschi NPDES029 model layout

8.2.3 NPDES031 and 032

The proposed LTCP CSO control measure includes a 0.33 MG storage tank adjacent to the NPDES031 CSO Outfall. This tank is configured to provide control for NPDES032 as well. Alternative modeling indicates that it is also important to control overflows at the downstream outfall NPDES030.

The proposed CSO control measure was configured in the model with the following elements:

- The 65-foot-long by 60-foot-wide tank was set with an invert elevation of 16 feet to provide 0.33 MG of storage up to the elevation of the existing overflow weir at NPDES031.
- Implementation of a 0.66 mgd effluent PS to drain the storage to the existing Leschi trunk. This PS could be controlled based on the trunk level downstream at the NPDES030 junction.
- Construction of a new structure at MH046-032, which is currently a tee connection. The structure will accommodate valves and weirs associated with the filling of the storage tank described below.
- A new 10-foot-long weir connecting MH046-032 to the new storage tank. The weir was set at elevation 25.5 feet.
- A 12-inch-diameter gravity return pipe from the storage tank to MH046-032 fitted with a flap gate. This allows gravity return of stored flow from an elevation above the invert of MH046-032.
- Increase in the diameter of the existing connection of the NPDES031 overflow structure from MH046-033 to MH046-032 from 8 to 12 inches and rounding of the pipe entrance to eliminate the head loss included in the calibrated model.
- Elimination of the overflow weir at NPDES032B. This location overflows only when the water level in the trunk line is higher than the weir elevation and limits the ability to pass flows downstream to the new storage tank at NPDES031.
- Removal of the HydroBrake at the outlet of the existing NPDES032A storage facility (MH046-156), improving its performance.
- Removal of the HydroBrake at the NPDES033 overflow structure (MH046-171). This passes somewhat more flow downstream and reduces the flow diversion from this area into the existing NPDES034 storage facility, increasing the performance of NPDES034.
- Elimination of the capacity restriction from the calibrated model in the pipes from NPDES032 to NPDES031 to allow passage of higher flows downstream to the new storage facility. The calibrated model reduced the capacity of this reach by including 0.5 foot of sediment in the sewer. This was removed, returning the sewer to its full diameter of 1.5 feet. This implies maintenance as necessary to keep the trunk sewer clean.

Figure 8-8 shows the layout of the facilities in the model.

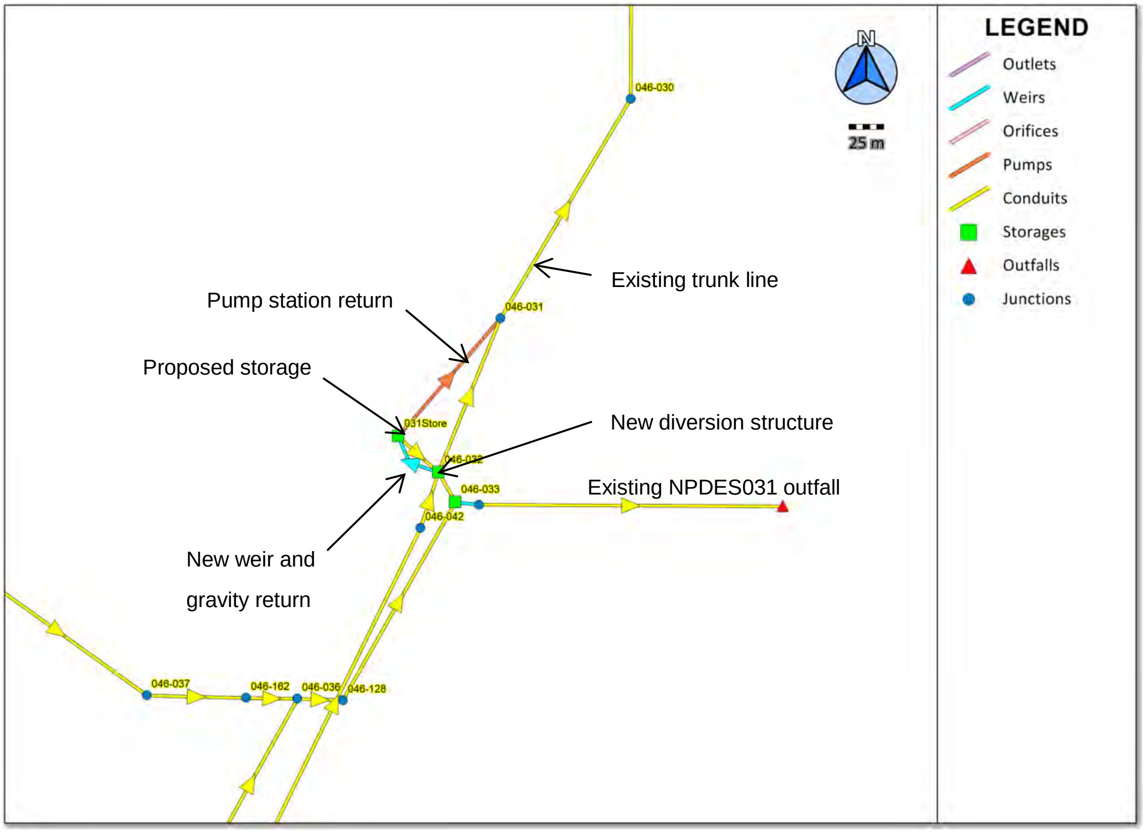


Figure 8-8. Leschi NPDES031, NPDES032, model layout

8.2.4 NPDES036

The current LTCP storage CSO control measure at this location includes a 0.03 MG off-line underground storage pipe (7-foot diameter by 120 feet long) with gravity inflow and pumped outflow. The model for this facility was configured with the following elements:

- The storage pipe was represented as a storage node with a depth vs. surface area relationship corresponding to the identified pipe laid at a slope of 0.0025 ft/ft. A 12-foot-diameter shaft was included at the downstream end to accommodate the effluent pump station. An 8-foot-diameter shaft was assumed at the upstream end to accommodate inflow.
- A new weir was added from MH046E-149 just downstream of the existing overflow point to the storage pipe. The weir was assumed to have a 10-foot length and set at an elevation of 28.6 feet (about 6 inches below the existing overflow weir at MH046E-150). A connecting pipe between the weir and the storage pipe was not included in the model. This connection should be at least 24 inches in diameter to pass the required flow.

- The effluent PS at the downstream end of the storage pipe (0.06 mgd capacity) was discharged to MH046E-104. RTCs were implemented in the model to prevent the effluent PS from operating unless the flow depth at MH046E-104 was less than 3 inches. Final design of this PS should consider variable-speed drives and RTC to manage the depth in the receiving sewer.

Figure 8-9 shows the layout of the facilities in the model.

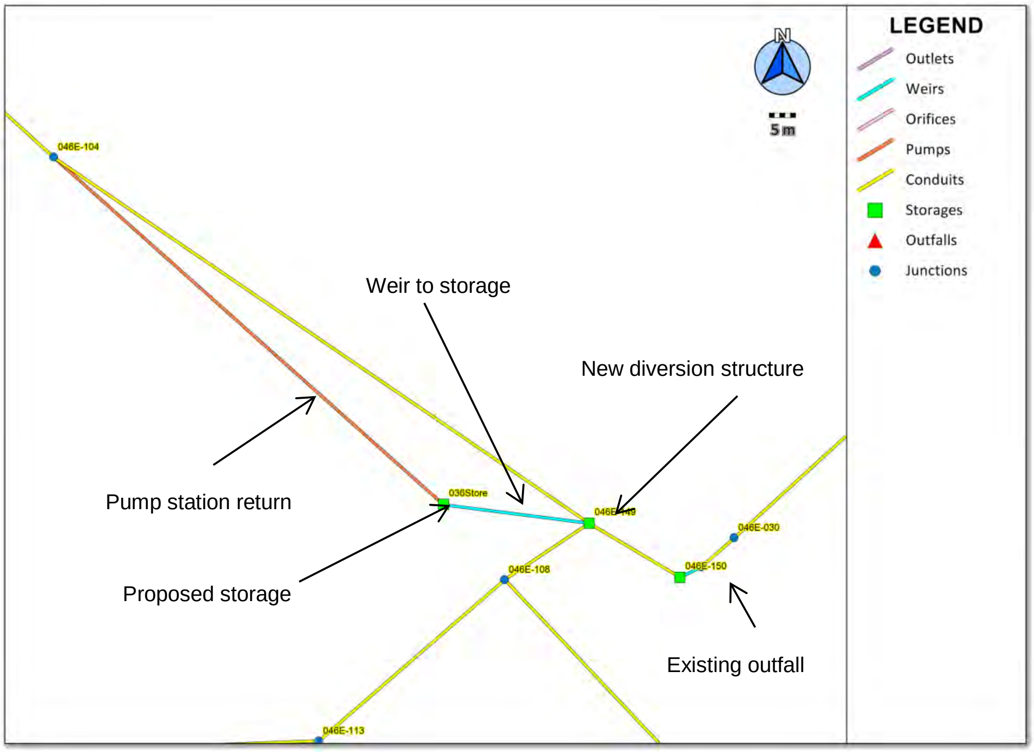


Figure 8-9. Leschi NPDES036 model layout

8.3 CSO Performance Hydraulic Analysis

The SPU Consent Decree requires that performance be analyzed on a rolling 20-year average. Where possible, the analysis will use the period from 1993–2012 for the moving 20-year average to confirm CSO control compliance.

The Leschi CSO Area discharges to the KC E Pine Street PS from which flows enter the South Lake Washington trunk and are conveyed to the KC Montlake Regulator Station. The model explicitly incorporates the E Pine Street PS.

- The model was run with no restrictions on the storage tanks emptying except as described in the previous section (local control) for the period from 1978–2012. Climate change and other uncertainties were included by scaling the rainfall by a factor of 1.065

for the entire Leschi CSO Area. This scaling factor includes climate change as well as other model uncertainties. It was chosen from review of the BECVs identified for each overflow (CH2M HILL, 2013).

- The model with and without climate change was run using the KC NIRR for the E Pine Street PS (EPINE_NIRR_MGD), as discussed in Section 1.3, to control discharge from the various new storage facilities added for the LTCP. The effluent PSs associated with the new storage facilities were not allowed to discharge unless the NIRR exceeded their capacity. Due to the limitations of the available period of the NIRR, the model simulation incorporating the NIRR was run for the 20-year period from 1990–2009.

Table 8-1 presents the results of the simulation including the imposition of the KC NIRR, demonstrating conformance with the Consent Decree requirements. A comparison of the simulation results not including the KC restriction indicated that the NIRR does not significantly affect the performance. Appendix G presents the remaining overflow events.

Table 8-1. Leschi CSO Area Neighborhood Storage CSO Control Measure Overflow Results with KC No-Impact Release Rate

Location	Overflow frequency without climate change (per year)	Overflow frequency with climate change (per year)
	20-year (1990–2009)	20-year (1990–2009)
NPDES026	0.2	0.2
NPDES027	0	0
NPDES028	0.5	0.6
NPDES029	0.5	0.5
NPDES030	0.8	0.9
NPDES031	0.5	0.6
NPDES032	0.4	0.5
NPDES033	0.2	0.2
NPDES034	0.4	0.6
NPDES035	0.4	0.6
NPDES036	0.5	0.8

Table 8-2 presents the average annual volumes of flow delivered to KC in the existing condition and after the LTCP Neighborhood CSO control measures are implemented. Climate change is not included in these volumes, and values are averages over the 1990–2009 period.

Table 8-2. Leschi CSO Area Flow Volumes without Climate Change

Location	20-year average of flow volume delivered to KC (MG/year)	
	Existing condition	With LTCP CSO control measures
Leschi total to E Pine Street PS	243.7	244.5

8.4 Summary of Leschi Neighborhood Storage CSO Control Measures Performance Hydraulic Analysis

For the moving 20-year average period of 1993–2012, the hydraulic CSO performance analysis indicated the following:

- The proposed Neighborhood Storage CSO control measures in the Leschi CSO Area would significantly reduce overflow volumes and frequency. Overflow frequency at all uncontrolled NPDES sites are reduced to below 1.0 event per year with uncertainties including climate change considered.
- Increased maintenance of the Leschi trunk to maintain full capacity may increase wet weather peak flows to KC's E Pine Street PS by 0.1 mgd to 0.25 mgd depending on the event.
- Using the KC E Pine Street NIRR time series to control storage facility releases does not adversely impact CSO performance of the LTCP CSO control measures when compared to local control.

SECTION 9

Magnolia Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

This section reviews the proposed Magnolia Neighborhood Storage CSO control measure for NPDES060, describes how the LTCP model of the area was updated to represent the alternative, and summarizes the simulated CSO control performance against the Consent Decree performance criteria with climate change considerations.

9.1 Proposed Storage CSO Control Measure

The proposed Magnolia Neighborhood Storage CSO control measure will control CSOs from the NPDES060 Basin. The proposed storage CSO control measure includes:

- a 0.11 MG off-line storage pipe to be located underground in the vicinity of the NPDES060 CSO Outfall
- a new weir and influent conduit to divert excess flows to storage
- a 0.22 mgd PS and associated effluent conduit to drain the storage between events

The Magnolia CSO Area is shown in Figure 9-1. The layout of the proposed CSO control measure is shown in Figure 9-2.

Figure 9-1. Magnolia CSO Area

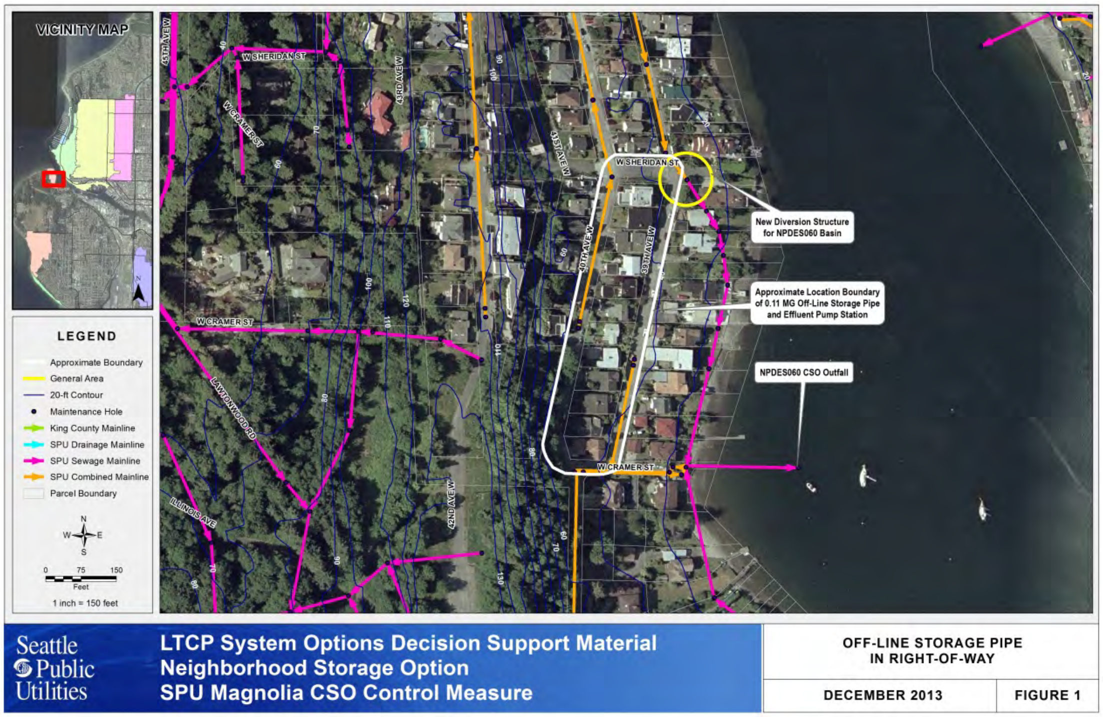


Figure 9-2. Magnolia NPDES060 Neighborhood Storage CSO control measure

9.2 Model Revisions

The model used for this analysis was based upon the calibrated SWMM5 v22 model that was documented in the LTCP modeling report (SPU, 2012). This model was modified to incorporate the LTCP CSO control measure facilities.

A 10-foot-long diversion weir was added to the model at MH010-167 to divert excess flow to the storage. The weir was set at an elevation of 10.3 feet; it should be field-adjustable to 11.0 feet to allow future modifications to optimize system operation. The model also includes 530 lf of 6-foot-diameter storage pipe at a slope of 0.001ft/ft in 39th Avenue W, upstream of MH010-156. A 10-foot-diameter shaft was added at each end of the proposed storage pipe. The model also includes 40 lf of 36-inch-diameter conveyance pipe to convey the peak flows to the off-line storage. Figure 9-3 shows a profile of the assumed storage conduit. Figure 9-4 shows the layout of the facilities in the model.

An effluent PS with a capacity of 0.22 mgd is required to drain the proposed storage within 12 hours. The pump station was configured to return flow to the CSS at MH010-156, located upstream of SPU PS 22. An RTC was implemented to prevent the effluent PS from operating until capacity is available in the downstream system. The PS operates only when the head at MH010-159 is less than 4.5 feet. No increase in PS 22 capacity is assumed so that peak flows to KC are the same as in the existing system.

The National Oceanic and Atmospheric Administration (NOAA) tide recordings were added to the model as a boundary condition to the existing outfall. The tide elevation exceeds the NPDES060 weir elevation about once every 5 years. A tide gate should be considered for the existing overflow weir to prevent inflow to the CSS when the tide elevation is above the CSO weir elevation.

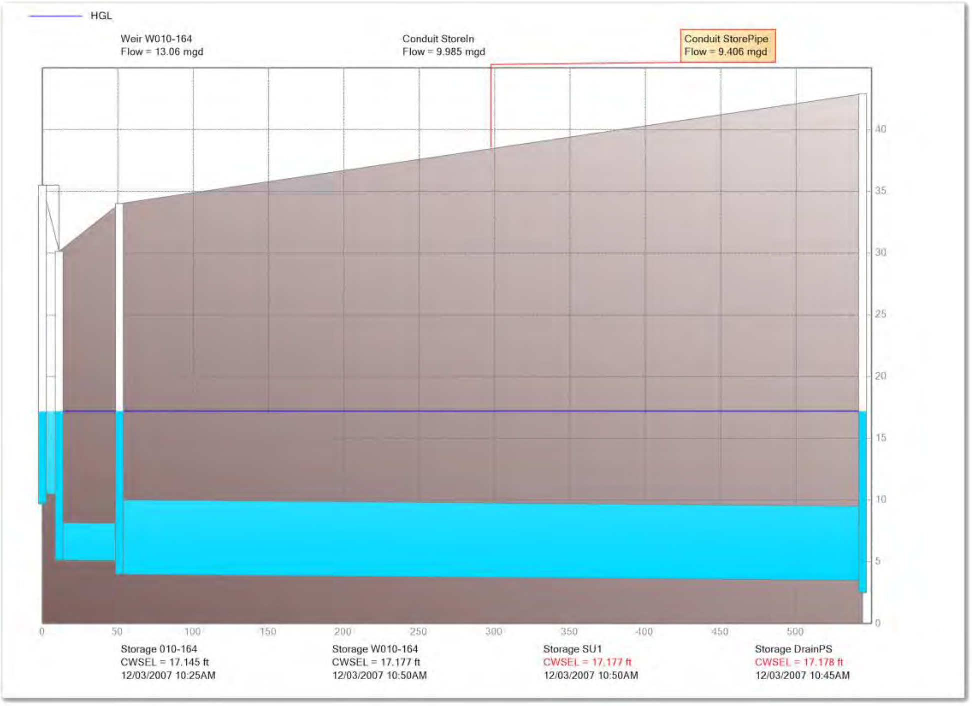


Figure 9-3. Profile of storage conduit with maximum predicted hydraulic grade line

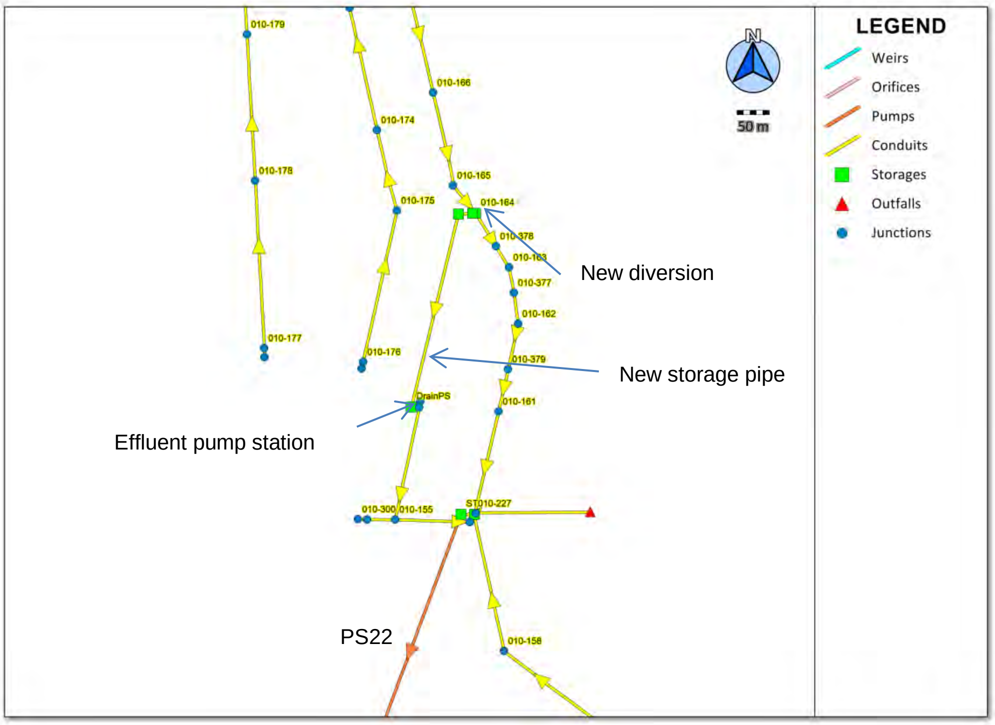


Figure 9-4. Model layout

9.3 CSO Performance Hydraulic Analysis

The SPU Consent Decree requires that performance be analyzed on a rolling 20-year average. Where possible, the analysis will use the period from 1993–2012 for the moving 20-year average to confirm CSO control compliance.

The Magnolia NPDES060 CSO Area discharges to the KC North Interceptor in W Commodore Way, immediately upstream of the West Point WWTP. For the alternatives modeling, the hydraulic analysis was conducted using the following two approaches:

- The model was run with no restrictions on the storage tanks emptying except as described in the previous section (local control) for the period from 1993–2012. With this assumption and including climate change, 18 overflows were simulated at NPDES060 in the 20-year simulation from 1993–2012—an overflow frequency of 0.90 per year. Climate change and other uncertainties were included by scaling the rainfall by a factor of 1.162 for the entire Magnolia CSO Area. This scaling factor includes climate change as well as other model uncertainties. It was chosen from review of the BECVs identified for each overflow (CH2M HILL, 2013).
- The model with and without climate change was run using the KC NIRR for NPDES60 (CSO60_NIRR_MGD), as discussed in Section 1.3, to control discharge from the

storage effluent pump station. This time series was modified by first subtracting 5 mgd to account for discharges from upstream facilities, and then the simulated outflows from the Shared West Ship Canal Tunnel CSO control measure described below were subtracted (up to 32 mgd). The 5 mgd subtraction accounts for discharges upstream of the Fremont Siphon, as described in Section 7.2.3. The Fremont-Wallingford and Ballard CSO Area outflows are part of the Shared West Ship Canal Tunnel and are accounted for in that subtraction. The resulting NIRR time series for the Magnolia CSO basin thus accounts for release rates from upstream facilities. Due to the limitations of the available period of the NIRR, the model simulations incorporating the NIRR could be run only for the 20-year period from 1990–2009. With this assumption and including climate change, 17 overflows were simulated at NPDES060—an overflow frequency of 0.9 per year.

Table 9-1 presents the results of the simulation with discharge controlled by the modified KC NIRR, demonstrating conformance with the Consent Decree requirements. Appendix H presents the remaining overflow events.

Table 9-1. Magnolia NPDES060 Neighborhood Storage CSO Control Measure Overflow Results with KC No-Impact Release Rate

Location	Overflow frequency without climate change (per year)	Overflow frequency with climate change (per year)
	20-year (1990–2009)	20-year (1990–2009)
NPDES060	0.5	0.9

Table 9-2 presents the average annual volumes of flow delivered to KC in the existing condition and after the Neighborhood Storage CSO control measure is implemented. Climate change is not included in these volumes, and values are averages over the 1990–2009 period.

Table 9-2. Magnolia CSO Area Flow Volumes without Climate Change

Location	20-year average of flow volume delivered to KC (MG/year)	
	Existing condition	With storage CSO control measure
NPDES060	26.0	26.1

9.4 Summary of Magnolia NPDES060 Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

The CSO performance hydraulic analyses described above indicated the following:

- The proposed Neighborhood Storage CSO control measure in the Magnolia CSO Area would significantly reduce overflow volumes and frequency. Overflow frequency is reduced to below 1.0 event per year with uncertainties including climate change considered.
- Using the KC NIRR time series to control storage does not significantly affect the performance. A local control scheme may be found that approximates the NIRR, but periodic violations are likely. If it is necessary to control this small system to the NIRR, then the agencies' SCADA systems will have to be integrated to provide a signal when discharge is allowed.

Several observations, listed below, were made during the conduct of this analysis that may affect future planning:

- The existing overflow weir for NPDES060 is at elevation 11.66 feet. During the 20-year simulations, the high tide exceeded the weir elevation on four occasions (January 1, 1997; January 3, 2003; December 31, 2005; and December 17, 2012). The December 17, 2012, event was a King Tide with a high elevation of 12.13 feet. An overflow was reported on this date in the absence of rainfall, which is confirmed by the model. The inflow rates to the system from the high tide exceeded the capacity of PS 22. The excess flow entering the system would have been stored in the defined alternative, but addition of a tide gate to the overflow weir should be considered.
- Flooding was simulated at MH010-162, MH010-379, and MH010-158 in the conduits along the water during large storm events. A review of these should be made to determine if they need to be sealed.
- The storage fills above the crown of the pipe about once per year. Adequate ventilation should be provided at both ends of the storage conduit.
- The diversion weir at MH010-167 needs to be set at elevation 10.3 feet to meet performance requirements with climate change. With existing rainfall, the model suggests that an elevation of 11 feet will meet performance requirements. The weir should be made field-adjustable over this range to allow optimization.

SECTION 10

Montlake Neighborhood Storage CSO Control Measures Performance Hydraulic Analysis

This section reviews the proposed Montlake Neighborhood Storage CSO control measures (NPDES020, NPDES139, and NPDES140), describes how the LTCP model of the area was updated to represent the CSO control measure, and summarizes the simulated CSO control performance against the Consent Decree performance criteria with climate change considerations.

10.1 Proposed Storage CSO Control Measures

The LTCP Montlake Neighborhood Storage CSO control measures include a series of pipe storage facilities. Flows into the storage facilities occur by gravity. Return of stored flows is via gravity or pumped flow. The Montlake CSO Area is shown in Figure 10-1. Figure 10-2 through Figure 10-4 show the individual LTCP CSO control measures as currently defined. The entire basin drains to the KC mainline upstream of the Montlake Regulator Station.

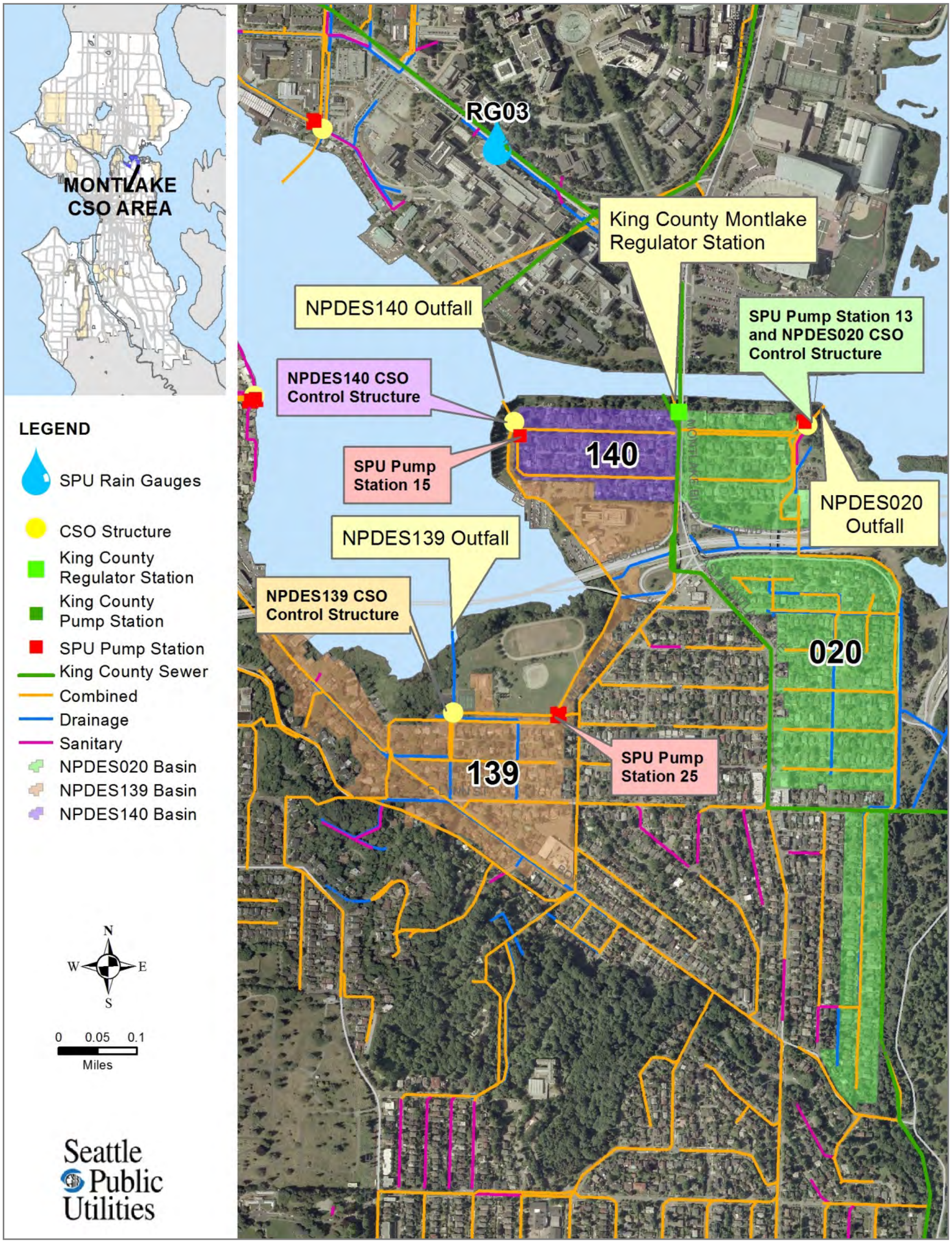


Figure 10-1. Montlake CSO Area

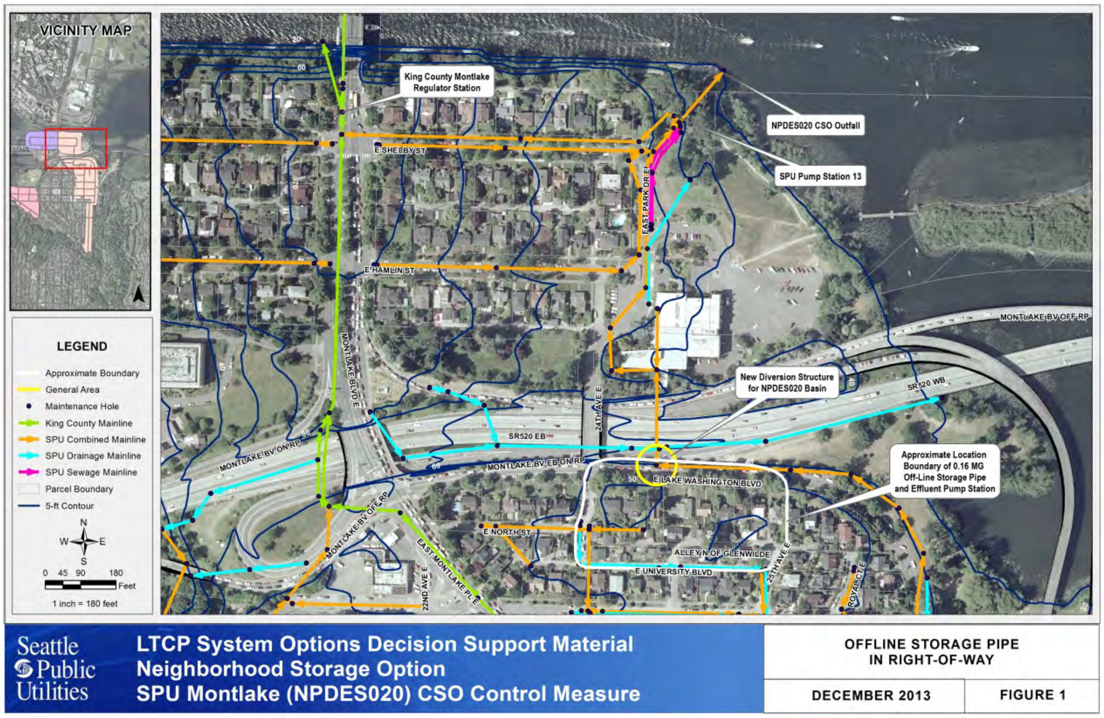


Figure 10-2. Montlake Basin 20 Neighborhood Storage CSO control measure

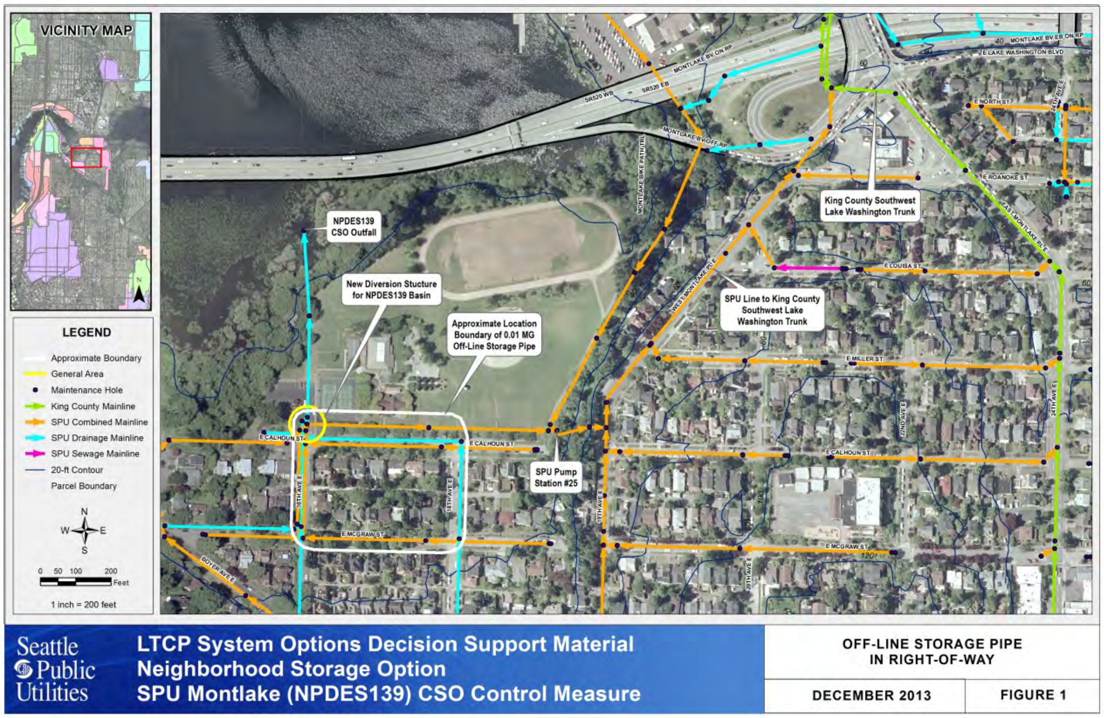


Figure 10-3. Montlake Basin 139 Neighborhood Storage CSO control measure

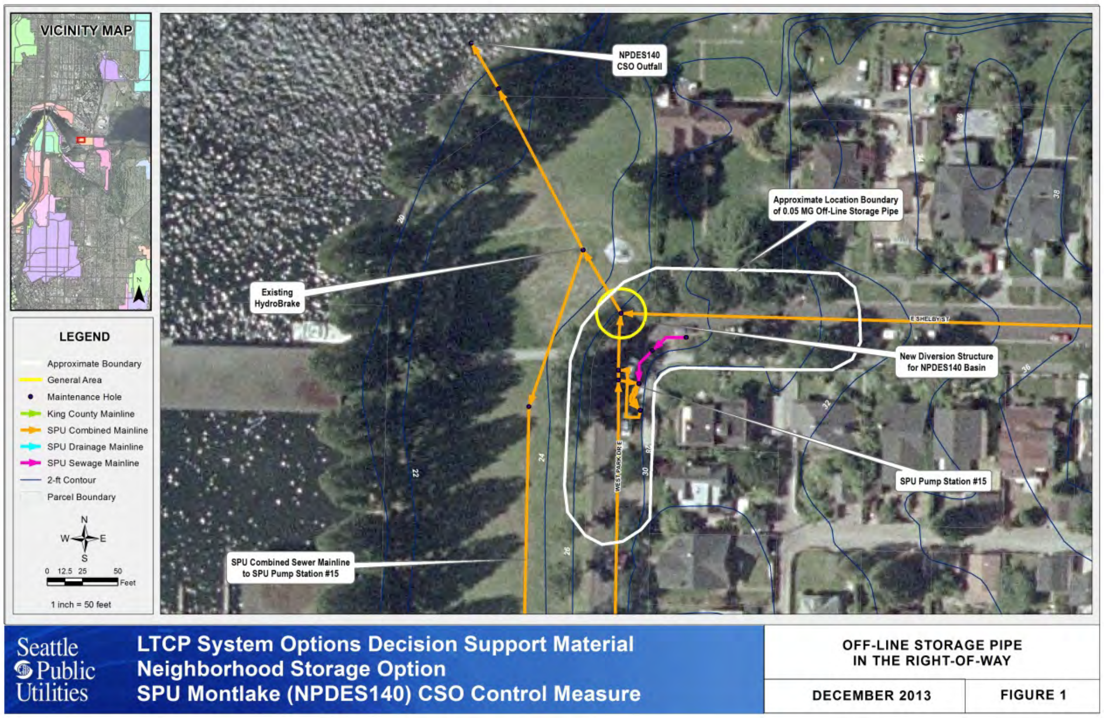


Figure 10-4. Montlake Basin 140 Neighborhood Storage CSO control measure

10.2 Model Revisions

The model used for this analysis was based upon the SWMM5 v22 model that was documented in the LTCP modeling report (CH2M HILL, 2012f). This model was modified to incorporate the LTCP CSO control measure facilities. These modifications are described in the following sections.

10.2.1 NPDES020

The LTCP CSO control measure for NPDES020 includes a 0.16 MG off-line storage pipe in the upper basin south of Highway 520, approximately 1,000 feet upstream of the NPDES020 control structure. Excess flows would be diverted to the storage pipe via gravity and pumped back to the system following storm events.

The model was updated to include the following elements:

- An off-line storage pipe consisting of a 200-foot-long, 12-foot-diameter pipe with a 0.001 ft/ft slope. The storage tank was represented in the model by a storage node with a cross-sectional area table equivalent to the proposed storage pipe. In order to guard against potential basement backups upstream, the invert elevation of the proposed storage tank was set at an invert elevation of 15 feet, resulting in a soffit elevation of 27 feet.

- An automated gate placed in the mainline at MH031-035, and a weir to divert flows into the off-line storage pipe. The automated gate is controlled by the water level at the NPDES020 CSO structure (MH031-382), which is located approximately 1,000 feet downstream. When the water level at MH031-382 reaches an elevation of 20 feet (1.95 feet below the elevation of the overflow weir), the automated gate modulates to control flow from the upper basin entering the lower basin to maintain the level at MH031-382. Excess flows from the upper basin are then diverted to the off-line storage pipe via a weir at MH031-035 (weir elevation 26 feet). When the water level at the NPDES020 CSO structure falls below an elevation of 20 feet, the gate opens and allows the normal flow regime to resume.
- An emergency overflow connection from the storage tank to the existing CSS downstream of the control gate at MH031-035 was added to guard against failure of the automated gates or the effluent PS controls. The emergency overflow is also used in the event that the storage tank is full, to bypass flows around the gate. This configuration would also avoid a more complex RTC for the automated gate.
- A new PS to drain the storage tank. In order to drain the storage tank in 12 hours, the required pump station capacity is 0.32 mgd. For simulations without KC flow restrictions, the proposed local control strategy for the pump station is based on the water level at PS 13 in the NPDES020 lower basin. The new pump station is restricted from operating and draining the storage when the water depth at PS 13 exceeds 3.5 feet (elevation 17.6 feet). Once the water level at PS 13 falls below 3.5 feet, the new pump station begins to operate and flows are pumped back to the CSS. For simulations incorporating the KC flow restrictions, the effluent PS is directly controlled by the NIRR time series for this basin as discussed below.

An overview of the proposed storage, pump station, automated gates, and weirs is shown in Figure 10-5.

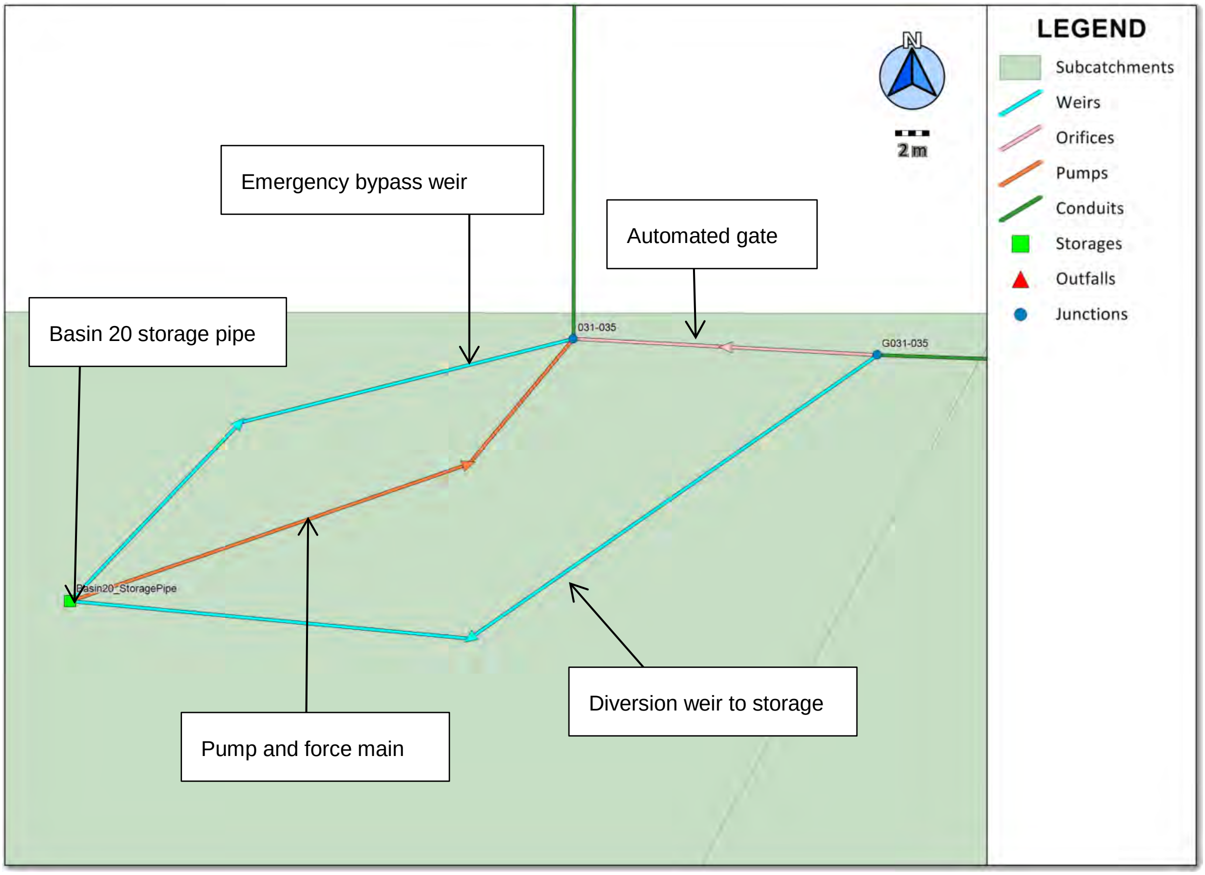


Figure 10-5. Plan view of proposed storage, pump station, automated gates, and weirs

10.2.2 NPDES139

The LTCP CSO control measure for NPDES139 includes a new 0.01 MG off-line storage pipe in the vicinity of the NPDES139 CSO Outfall and a new diversion structure to convey flows from the NPDES139 Basin to the off-line storage pipe.

The model was updated to include the following elements:

- A new 75-foot-long, 5-foot-diameter storage pipe with a 0.001 ft/ft slope attached to the existing CSO structure at MH031-313 via a weir. The storage pipe was represented in the model using a storage node with a cross-sectional area table equivalent to the proposed storage pipe.
- A new diversion weir to divert flows into the off-line storage pipe and a flap gate on the pipe draining the storage. The weir elevation is set at 17.9 feet (i.e., 1 foot below the elevation of the existing overflow weir). When the water level at MH031-313 reaches an elevation of 17.9 feet, flow is diverted to the off-line storage pipe.

- For the model with the KC NIRR, an effluent PS with a 0.02 mgd capacity replaces the gravity return line to control the emptying of the storage and prevent flows from being returned to the CSS when there is no capacity for SPU flows in the KC trunk. The effluent PS flow is directly controlled by the KC NIRR time series.

An overview of the proposed storage, pump station, gates, and weir is shown in Figure 10-6.

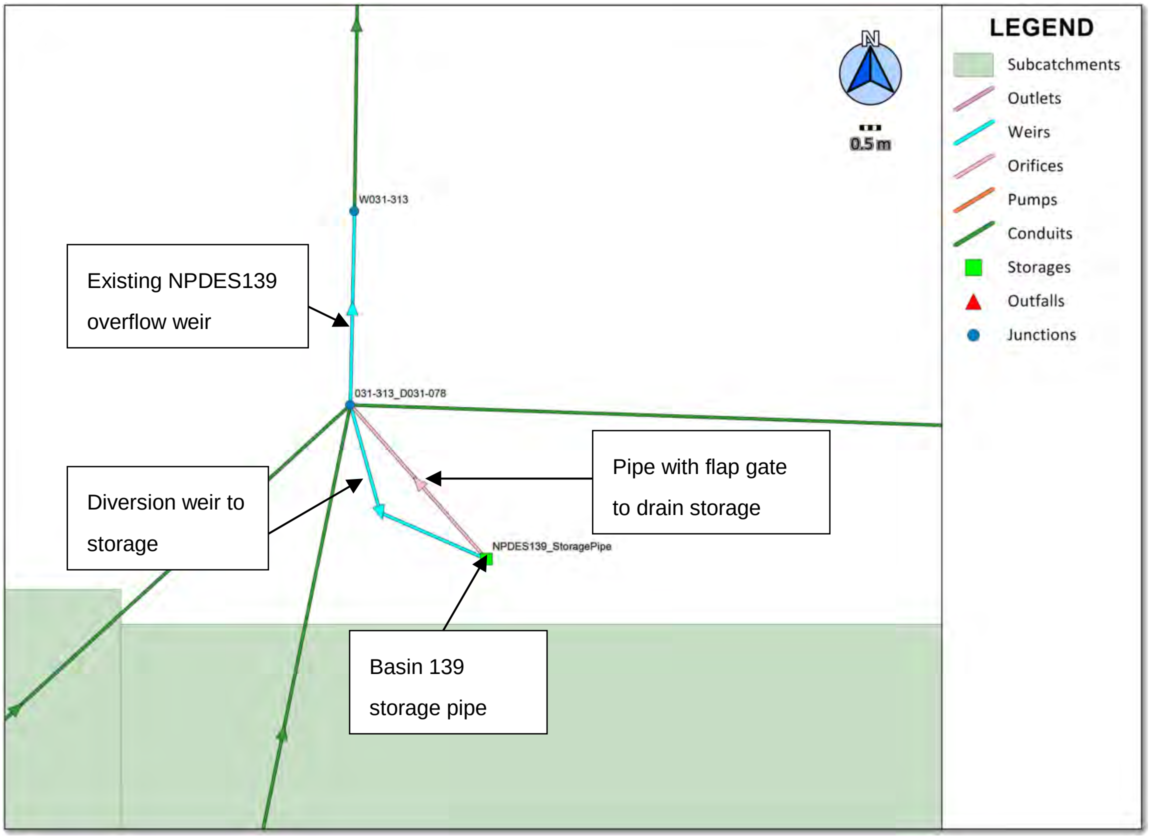


Figure 10-6. Plan view of proposed storage, gates, and weir

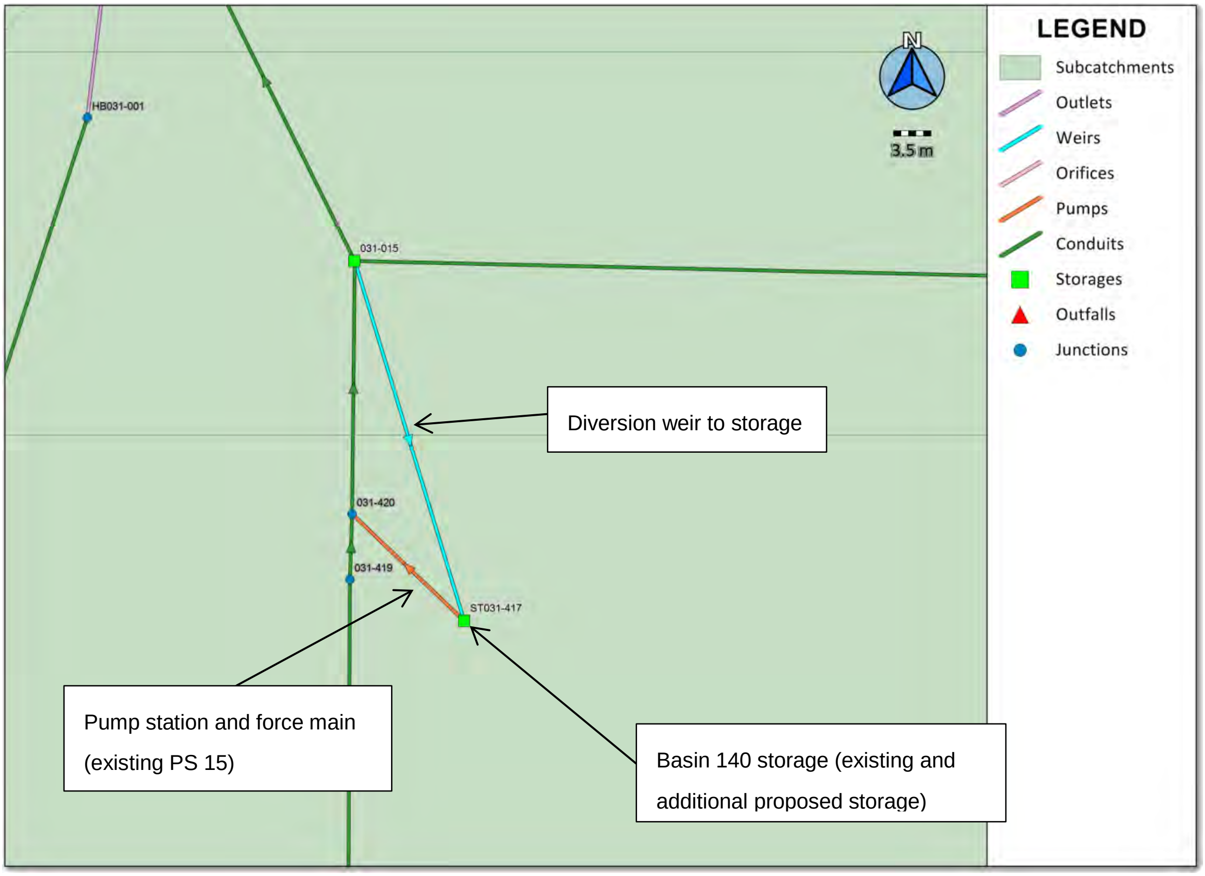
10.2.3 NPDES140

The LTCP CSO control measure for NPDES140 includes a new 0.05 MG storage pipe, and a weir to convey overflows from the NPDES140 Basin to the pipe. The alternative was configured in the model as follows:

- The new storage pipe would be provided by a 150-foot-long, 8-foot-diameter storage pipe with a 0.001 ft/ft slope. Instead of having two separate diversion and control regimes to return flows to the CSS, it is preferable to connect the new storage pipe to the existing PS 15 structure. In the existing system, PS 15 is located at the outlet end of the existing storage pipe. Flow is diverted into the existing storage pipe via a weir in the mainline at MH031-419 that will be replaced, and is pumped back by PS 15. The invert of the new pipe could be higher than the existing pipe so that it would fill last and empty first. However, for the purposes of the modeling analysis, the inverts of the new pipes and the existing pipe were set at the same elevation (7.13 feet).

- A new weir at MH031-015 and associated conduit to divert flows into the storage. This weir replaces the existing weir to the storage tank at MH031-419. The proposed weir elevation is set at 21.0 feet (i.e., 0.63 foot below the elevation of the existing overflow weir). For design purposes, the maximum flow over this weir in the long-term simulations was about 4.5 mgd. When the water level at MH031-315 reaches an elevation of 21.0 feet, flow is diverted to the off-line storage tank.
- The controls on PS 15 were modified to prevent it from operating when the water level at the CSO structure (MH031-001) was within 1 foot of the overflow weir elevation. The modeling analysis indicated that one pump in PS 15 was sufficient to drain the additional storage volume from the storage tank when the KC NIRR was not applied.

An overview of the proposed storage, pump station, and weirs is shown in Figure 10-7.



Diversion weir to storage

Pump station and force main (existing PS 15)

Basin 140 storage (existing and additional proposed storage)

Figure 10-7. Plan view of proposed storage, pump station, and weirs

10.3 CSO Performance Hydraulic Analysis

The SPU Consent Decree requires that performance be analyzed on a rolling 20-year average. Where possible, the analysis will use the period from 1993–2012 for the moving 20-year average to confirm CSO control compliance.

The Montlake CSO Area is connected to the KC Montlake Regulator Station. Previous model development and LTSs were performed without using a time series of water surface elevation at the regulator station, as it was determined that the maximum expected water surface elevation in the KC system would not impact the operation of PS 13 and PS 25. For the alternatives modeling, the hydraulic analysis was conducted using the following two approaches:

- The model was run with no KC flow restriction (local control). With this assumption and including climate change, 17 overflows were simulated at NPDES020, 15 at NPDES139, and 13 at NPDES140 in the 20-year simulation from 1993–2012—overflow frequencies of 0.85 per year at NPDES020, 0.75 per year at NPDES139, and 0.65 per year at NPDES140. Climate change and other uncertainties were included by scaling the rainfall by a factor of 1.133 for the entire NPDES020 tributary area and 1.12 for the entire NPDES139 and NPDES140 tributary areas. These scaling factors include climate change as well as other model uncertainties. It was chosen to correspond with the BECV for each overflow (CH2M HILL, 2013).
- The model was run with and without climate change and KC flow restrictions represented by the KC NIRR for Montlake (MONT_NIRR_MGD), as discussed in Section 1.3. To account for upstream inflows from SPU CSO control measures, 2.6 mgd was subtracted from the NIRR time series provided for NPDES020 and 2.9 mgd for NPDES139 and NPDES140. This subtraction accounts for 0.8 mgd maximum storage release rate from the Leschi CSO Area and an intermediate estimate of 1.5 mgd excess flow from the North Union Bay CSO Area for NPDES020. An additional 0.3 mgd was subtracted for analysis of NPDES139 and NPDES140 to account for storage release from NPDES020. The resultant time series were used to control effluent pumping as described below. Due to the limitations of the available period of the NIRR, the model simulations incorporating this boundary condition were run for the 20-year period from 1990–2009. With the modified NIRR and including climate change, it was found necessary to activate the second pump in PS 15 to meet the performance requirement.

Two pumps are currently installed at PS 15. However, review of SCADA run times during the calibration period indicated that the two pumps did not operate at the same time, even during major storm events. The second pump was therefore not included in the LTCP model. Modification of the pump station controls to allow both pumps to operate at the same time provides additional required pumping capacity to empty the NPDES140 storage, reducing the number of overflows to less than 1.0 per year. For the NIRR analysis, the existing second pump in PS 15 was added to the model and allowed to operate only when the modified NIRR time series was greater than that pump's capacity of about 0.1 mgd. This modification allowed the performance requirement to be met with climate change included.

A summary of the simulation results is shown in Table 10-1, demonstrating compliance with the performance requirement. Appendix I presents a listing of the remaining overflow events without climate change included and with the KC NIRR restriction.

Table 10-1. Montlake CSO Area Neighborhood Storage CSO Control Measure Overflow Results with KC No-Impact Release Rate

Location	Overflow frequency without climate change (per year)	Overflow frequency with climate change (per year)
	20-year (1990–2009)	20-year (1990–2009)
NPDES020	0.6	0.8
NPDES139	0.5	0.7
NPDES140	0.4	0.7

Table 10-2 presents the average annual volumes of flow delivered to KC in the existing condition and after the LTCP Neighborhood CSO control measures are implemented. Climate change is not included in these volumes, and values are averages over the 1990–2009 period.

Table 10-2. Montlake CSO Area Flow Volumes without Climate Change

Location	20-year average of flow volume delivered to KC (MG/year)	
	Existing condition	With storage CSO control measure
NPDES020	32.9	33.1
NPDES139/140 (PS 25)	109.1	109.2

10.4 Summary of Montlake Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

The CSO performance hydraulic analyses described above indicated the following:

- The model analysis for the previous 20 years (1993–2012) under normal operations (no restrictions on flow due to KC NIRR) resulted in an overflow frequency of 0.85 per year at NPDES020, 0.75 per year at NPDES139, and 0.65 per year at NPDES140 when climate change impacts were included.

- Using the KC NIRR time series as a boundary condition to control the storage tank drainage resulted in an overflow frequency of less than 1.0 per year at all Montlake CSO Area outfalls, when climate change impacts were included. For the NPDES020 and NPDES139 basins, there were no additional overflow events when the boundary condition was included and no model modifications were necessary for the KC NIRR. Model modifications as described above were necessary for the NPDES140 Basin to reduce the number of overflows to less than 1.0 per year.
- The modeling analysis indicates that the alternative will meet the CSO performance control requirements with uncertainties including climate change, both with and without the imposition of the KC NIRR with the proposed modifications.

SECTION 11

North Union Bay Retrofit CSO Control Measure Performance Hydraulic Analysis

This section reviews the proposed North Union Bay NPDES018 retrofit CSO control measures, describes how the LTCP model of the area was updated to represent the retrofits, and summarizes the simulated retrofit CSO control performance with the Consent Decree performance criteria with and without climate change considerations.

11.1 Proposed Retrofit CSO Control Measures

The proposed North Union Bay retrofit CSO control measure will control CSOs from the NPDES018(A) and NPDES018(B) Basins. SPU has been implementing retrofit CSO control measures in the North Union Bay CSO Area (Figure 11-1) to reduce frequency of CSO events. Phase 1, which was completed in 2010, involved raising the overflow weirs. The NPDES018(A) weir was raised about 4 inches and the NPDES018(B) weir was raised about 12 inches. The Phase 2 CSO control measures are described below.

The NPDES018(A) Phase 2 retrofit CSO control measure was constructed during summer 2012. The CSO control measure consisted of (a) raising the CSO weir, (b) reestablishing the original HydroBrake design capacity, (c) raising the overflow height at the HydroBrake structure, and (d) modifying sewer lateral connections to reduce the risk of backups. NPDES018(A) experienced one post-retrofit CSO event during the period from September 2012–March 2013. The 26,000-gallon overflow occurred on November 19, 2012, an event that far exceeded 1-year rainfall totals.

The NPDES018(B) Phase 2 retrofit CSO control measure has been scheduled for predesign. The CSO control measure will involve modifying the storage facility's outflow structure to achieve the current HydroBrake's manufacturer's design performance. SPU is currently evaluating hydraulic options (e.g., gate and valve types, settings, controls). The CSO control measure will also include closing the connection at 016-197 that allows a portion of NPDES018(B) Basin flows into the NPDES018(A) Basin.

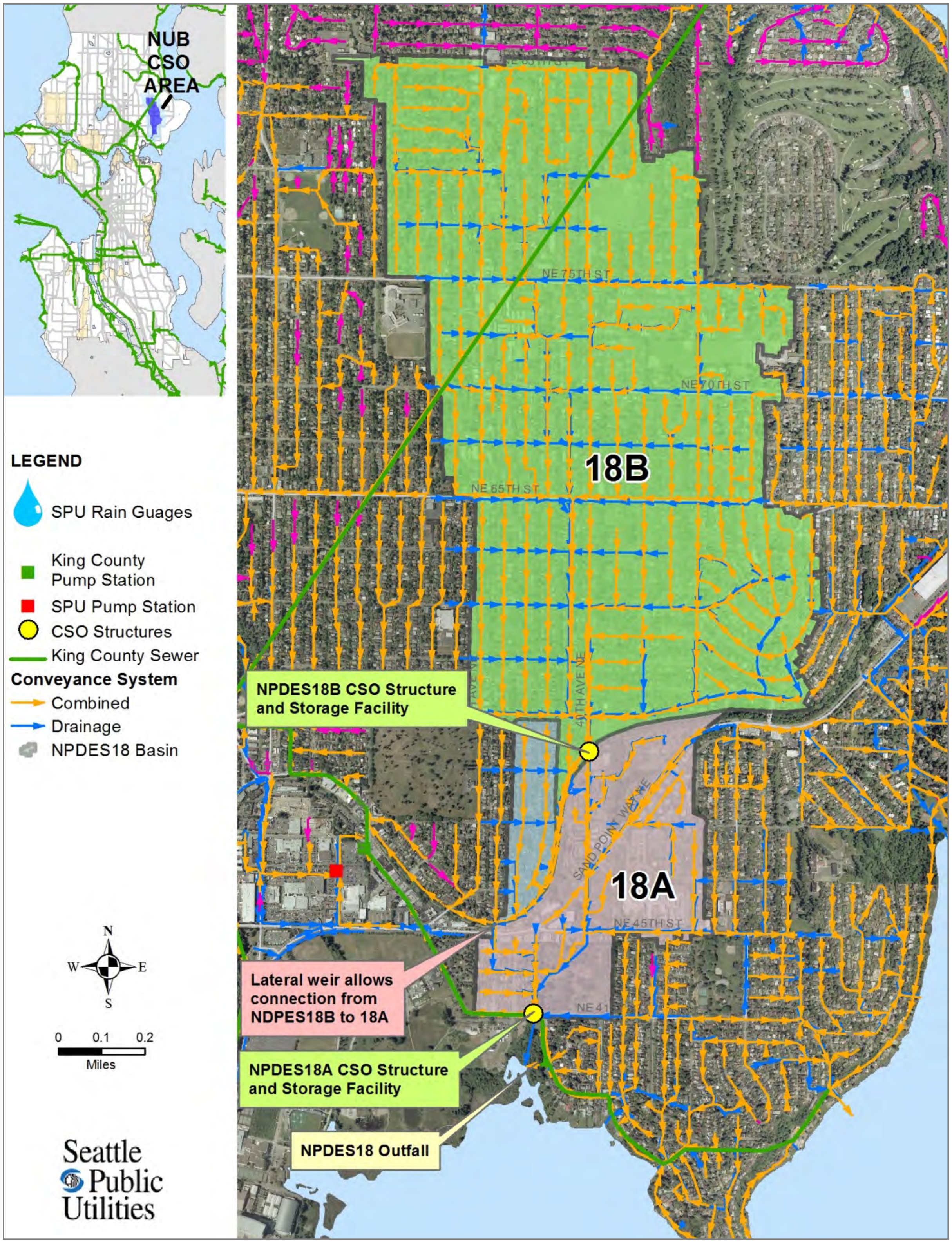


Figure 11-1. North Union Bay CSO Area

11.2 Model Revisions

The model used for this retrofit analysis was based upon the SWMM5 v22 model that was documented in the LTCP Final Hydraulic Model Report (CH2M HILL, 2012g). This model was used as a starting place, because it was recalibrated in v22 to flow monitoring data that were collected during the 2011–12 wet season and it represents the most up-to-date reflection of hydrologic conditions in the North Union Bay CSO Area. The 2012 LTCP SWMM5 model was then modified to incorporate the retrofit CSO control measures as described in the CSO Retrofits Preliminary Engineering Report (Davido, 2011b). The models included with this report were also reviewed.

Table 11-1 lists the modifications to the 2012 LTCP SWMM5 model that were performed to represent the retrofit condition. At NPDES018(A), the retrofit HydroBrake curve first follows the calibrated LTCP curve and then the manufacturer's curve. The maximum outflow from the HydroBrake was limited to that which would occur from the manufacturer's curve at an elevation corresponding to the original overflow weir elevation (Figure 11-2). The NPDES018(B) retrofit HydroBrake curve was assumed to match the original manufacturer's curves (Figure 11-3).

Table 11-1. North Union Bay Model Modifications

Location	Description	Modification
016-509	NPDES018(B) overflow weir	CSO weir crest raised to 107.56 feet Phase 1 elevation = 107.06 feet Pre-retrofit elevation = 106.07 feet
016-505	NPDES018(B) HydroBrake	HydroBrake performance curve set to match the manufacturer's curve.
016-197	Weir connecting NPDES018(B) basin to NPDES018(A) basin	The connecting link was removed from the model. It was assumed that SPU will close the pipe connecting the upper and lower basins.
025-380	NPDES018(A) overflow weir	CSO weir crest raised to 33.0 feet Phase 1 elevation = 30.98 feet Pre-retrofit elevation = 30.68 feet
024-072	NPDES018(A) HydroBrake	HydroBrake performance curve set to match the manufacturer's curve. The overflow crest at the HydroBrake was also raised from 32.49 feet to 34 feet.

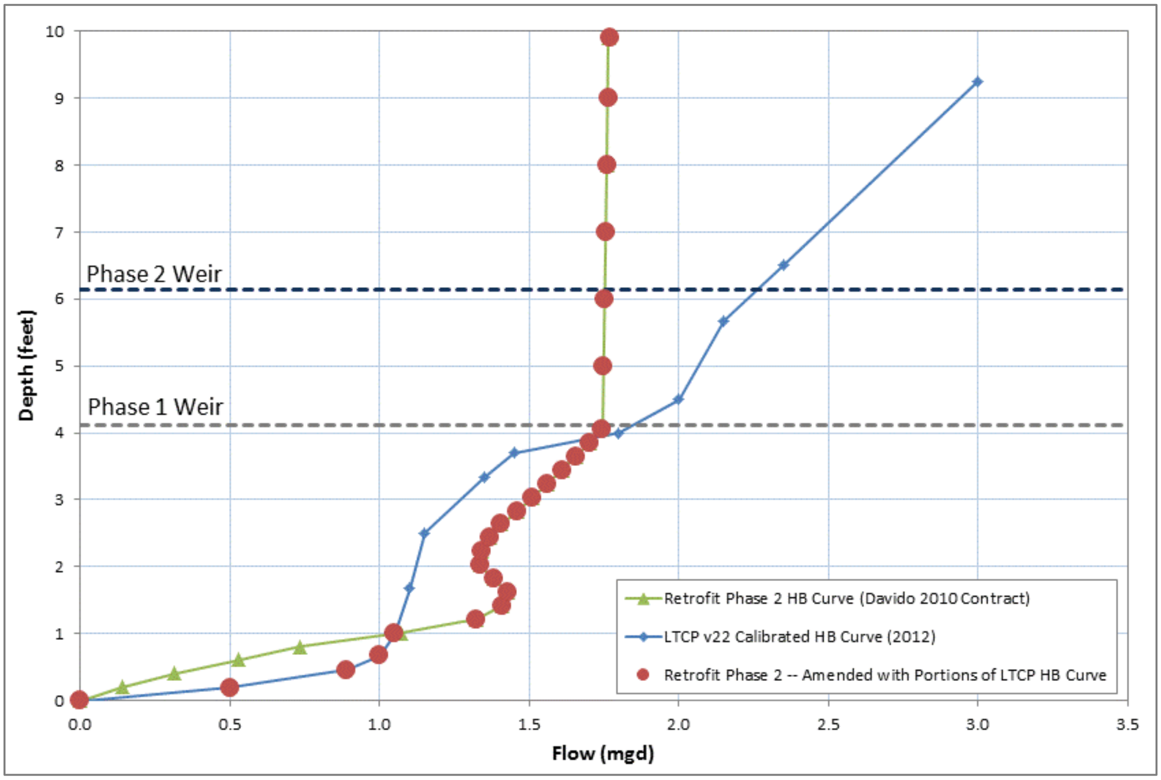


Figure 11-2. Performance curve for NPDES018(A) HydroBrake

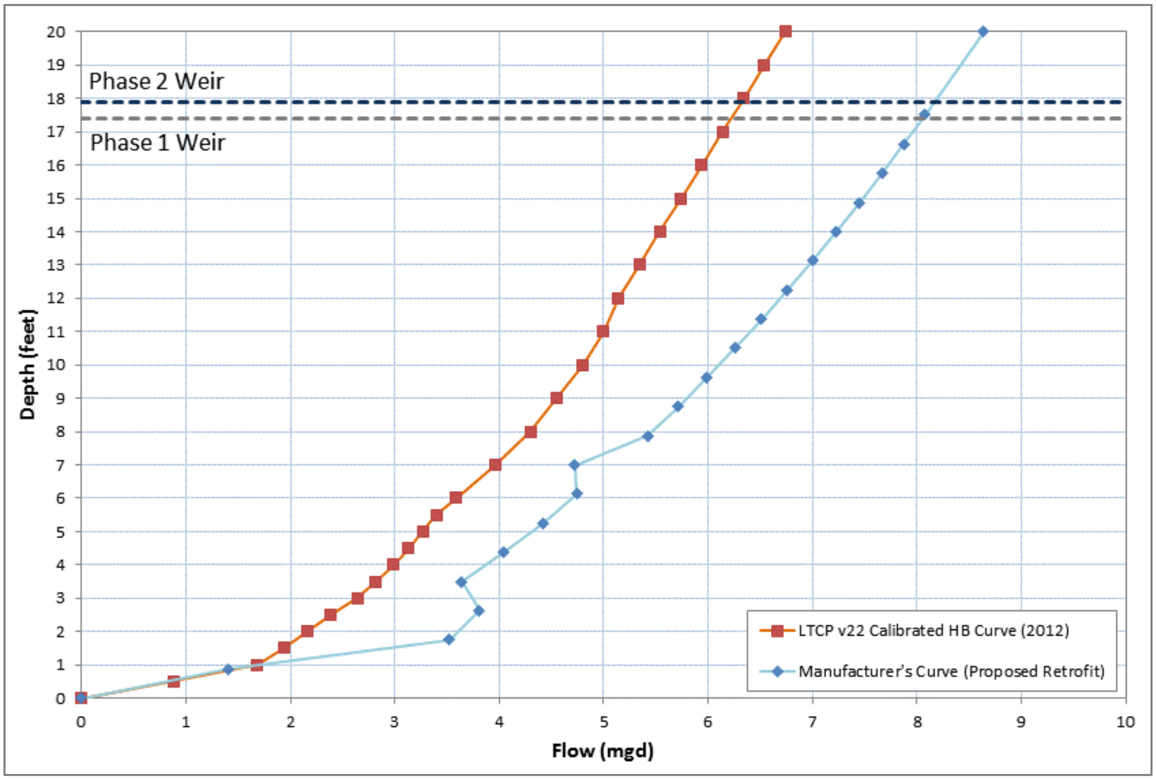


Figure 11-3. Performance curve for NPDES018(B) HydroBrake

11.3 CSO Performance Hydraulic Analysis

The updated retrofit model was run for the 20-year period from 1990–2009. The model output was then examined to determine the CSO frequency for the 20-year period. Simulations were performed using both historical rainfall data collected at SPU rain gauge (RG) 02 and RG 03 and with scaled rainfall data from these gauges that were increased by 6.6 percent to represent climate change and other uncertainty conditions. The precipitation scaling factor of 1.066 corresponds to the control volume listed in the LTCP Long-Term Control Plan Long-Term Simulation Results report (CH2M HILL, Brown and Caldwell, 2013). The model was not run with a KC NIRR. The retrofit will be designed to achieve once per year control at NPDES018 and an accounting of the impact of increased volumes sent to KC will be made later.

In the simulations, it was found necessary to modify the outlet capacity curve for NPDES018(B) to meet the performance requirement. The modification necessary was to increase the flows at lower depths in the control chamber so that a flow of 8 to 9 mgd was reached at a depth of about 12 feet (refer to Figure 11-3). Flows would then remain at about this level as the depth rises further. Suitable modifications to the revised outlet will be made in final design but these simulations indicate that it can be manipulated to achieve the performance standard.

The results of the analysis are listed in Table 11-2.

Table 11-2 North Union Bay CSO Area Neighborhood Storage CSO Control Measure Overflow Results without KC No-Impact Release Rate

Location	Overflow frequency without climate change (per year)	Overflow frequency with climate change (per year)
	20-year (1990–2009)	20-year (1990–2009)
NPDES018(A)	0.3	0.4
NPDES018(B)	0.8	1.0
Outfall 018	0.8	1.0

Table 11-3 presents the average annual volumes of flow delivered to KC in the existing condition and after the LTCP Neighborhood CSO control measures are implemented. Climate change is not included in these volumes, and values are averages over the 1990–2009 period.

Table 11-3. North Union Bay CSO Area Flow Volumes without Climate Change

Location	20-year average of flow volume delivered to KC (MG/year)	
	Existing condition	With storage CSO control measure
NPDES018(A)	113	117
NPDES018(B)	508	511

11.4 Summary of North Union Bay CSO Performance Hydraulic Analysis

For the moving 20-year average period of 1990–2009, the hydraulic CSO performance hydraulic analysis indicated the following:

- The constructed retrofit CSO control measure for NPDES018(A) appears to have brought this area into compliance. Only one CSO event occurred during the first post-construction wet season and the 6- to 12-hour rainfall intensities of storm that generated the overflow (November 19, 2012) were substantially larger than a once-per-year event.
- The proposed retrofit CSO control measure at NPDES018(B) may have to be modified to achieve the performance requirement as discussed above The final design will be based on additional pre-construction monitoring. Based on post-construction monitoring, the operations will be adjusted as necessary to reduce the CSO frequency to meet the Consent Decree CSO control performance criteria. SPU and KC will also jointly use the post-construction monitoring to assess downstream impacts and determine a solution if necessary.

SECTION 12

Portage Bay Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

This section reviews the proposed Portage Bay Neighborhood Storage CSO control measure for the NPDES138 Basin, describes how the LTCP model of the area was updated to represent the CSO control measure, and summarizes the simulated CSO control performance against the Consent Decree performance criteria with climate change considerations.

12.1 Proposed Storage CSO Control Measure

The proposed Portage Bay Neighborhood Storage CSO control measure will control CSOs from the NPDES138 Basin. It will be located upstream of existing CSO Facility 36, in the vicinity of the existing NPDES138 CSO Outfall. The proposed storage CSO control measure includes:

- a 0.12 MG storage pipe to be located underground in the right-of-way: 10-foot diameter, 210 feet long
- up to 160 feet of 12-inch-diameter gravity pipe connecting the new storage pipe to the existing HydroBrake structure, and up to 50 feet of gravity pipe connecting the storage pipe to MH023-188, depending on the location selected for the off-line storage pipe
- one new flow diversion structure (weir)

The Portage Bay CSO Area is shown in Figure 12-1. Only the NPDES138 CSO Basin is considered in the LTCP. The proposed CSO control measure is shown in Figure 12-2.

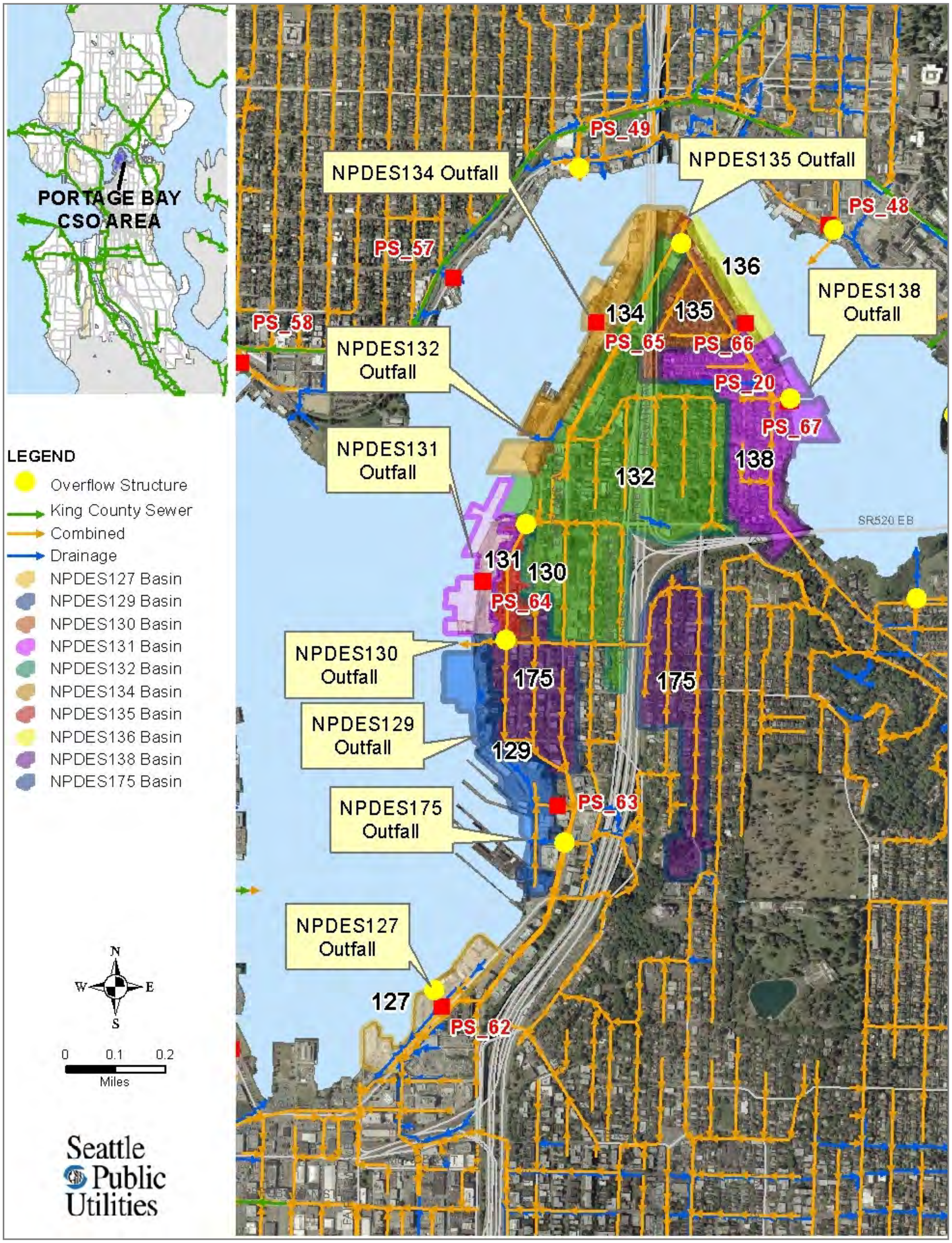


Figure 12-1. Portage Bay CSO Area

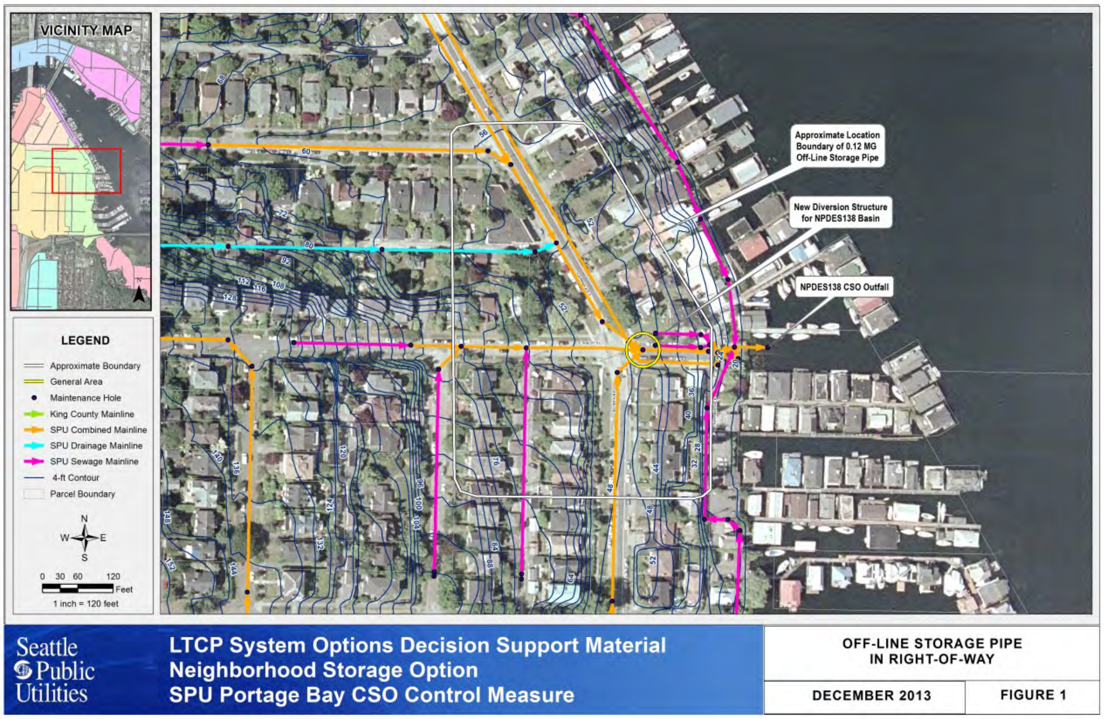


Figure 12-2. Portage Bay proposed storage CSO control measure

12.2 Model Revisions

The model used for this analysis was based upon the SWMM5 v22 model that was documented in the LTCP modeling report (CH2M HILL, 2012h). This model was modified to incorporate the LTCP CSO control measure facilities. These modifications are described below.

12.2.1 Diversion Structure

A new diversion structure would be constructed at the existing MH023-188 on E Shelby Street just east of Fuhrman Avenue E. The diversion structure was configured as a 10 ft^2 box with a 10-foot-long weir to pass excess flow to the new storage tank. Optimization with the model indicated that this weir should be set at the same elevation as the diversion weir to storage in CSO Facility 36 at MH023-434. This elevation is 29.55 feet. The new diversion weir should be adjustable over a range of plus or minus 6 inches.

The new diversion structure is connected to the storage pipe in the defined alternative via a 36-inch-diameter transfer pipe. This transfer pipe will need to carry 12 mgd or more to avoid impacting the hydraulics of the weir.

12.2.2 New Storage Pipe and Return Pipeline

The CSO control measure includes a 210-foot-long, 10-foot-diameter pipe to provide the storage needed to control the basin. The storage pipe was assigned a slope of 0.002 ft/ft in the model. Ten-foot-diameter shafts were included at both ends of the storage pipe in the simulation to provide access and venting. The storage pipe and shafts were modeled as a storage node. The invert of the outlet shaft was set at elevation 19.5 feet to permit the storage to be fully utilized and provide gravity drainage to MH023-418.

The 12-inch-diameter drainage pipe between the storage pipe and MH023-418 was provided with a flap gate at one end to prevent backflow from the existing CSO Facility 36. In order to simulate the KC NIRR, this flap gate was replaced with an effluent pump station that could be controlled by the NIRR time series.

An overview of the proposed storage, diversion structure, and return pipeline is shown in Figure 12-3.

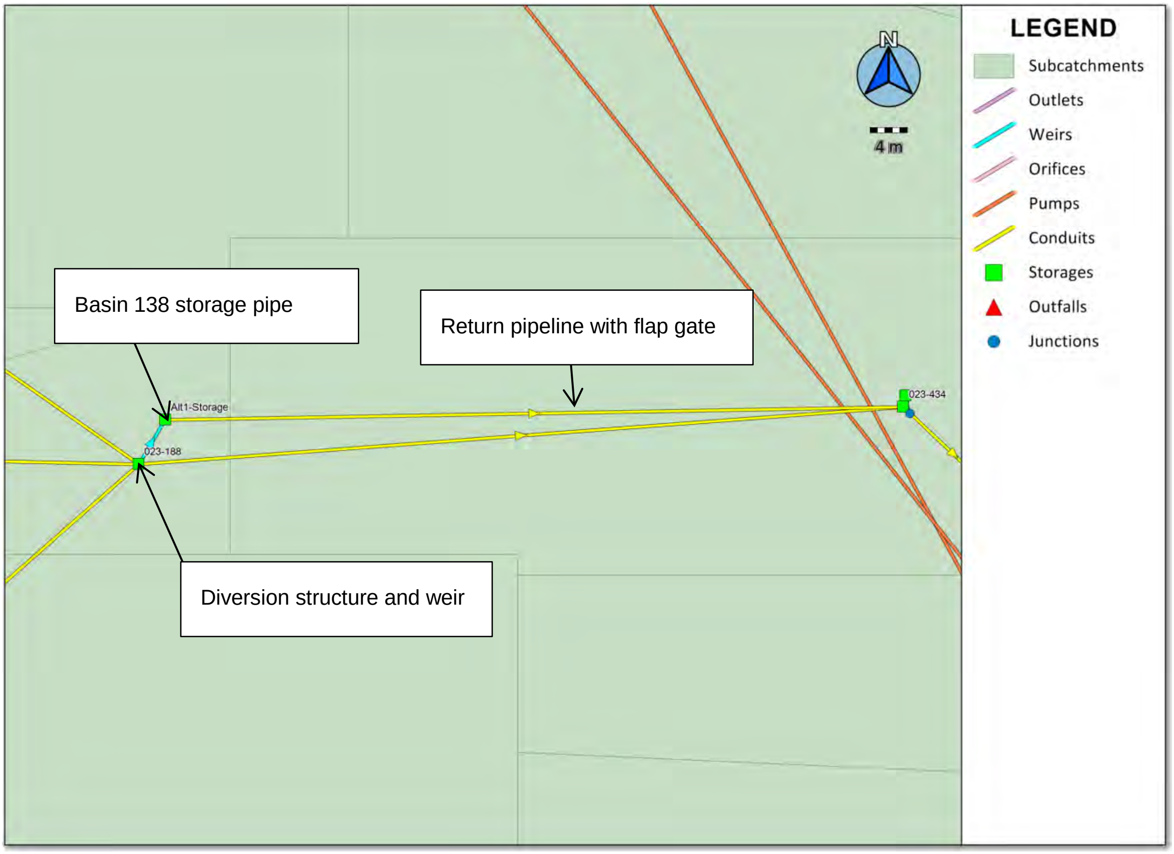


Figure 12-3. Plan view of proposed storage, diversion structure, and return pipeline

12.3 CSO Performance Hydraulic Analysis

The SPU Consent Decree requires that performance be analyzed on a rolling 20-year average. Where possible, the analysis will use the period from 1993–2012 for the moving 20-year average to confirm CSO control compliance.

The NPDES138 system flows through the existing SPU PS 20 so that implementation of the Neighborhood Storage CSO control measure would not increase peak flows into the KC system. Because the new storage would increase volume to the KC system, the CSO control measure was analyzed for the following two cases:

- The LTCP alternative described above was simulated without the KC NIRR restrictions for the 20-year period of 1993–2012. A precipitation scaling factor of 1.068 was used for the simulation. This scaling factor includes climate change as well as other model uncertainties. It was chosen to correspond with the BECV for the NPDES138 Basin (CH2M HILL, 2013).
- The model was run with KC flow restrictions represented by the KC NIRR time series (PORT2ECSO_NIRR_MGD), as discussed in Section 1.3. The NIRR provided covers the period from 1978–2009. A simulation of the Neighborhood Storage CSO control measure was run using an effluent PS controlled by the NIRR time series modified for a maximum value of 0.22 mgd (rate necessary to empty the tank in 12 hours).

Model simulations of the defined LTCP alternative described above without KC restrictions including climate change resulted in 17 overflow events in the 20-year period from 1993–2012, a frequency of 0.85 per year. Model simulations of the modified alternative with an effluent PS controlled by the NIRR time series resulted in 16 overflows for the 20-year period from 1990–2009.

A summary of the simulation results is shown in Table 12-1 indicating compliance with the performance standard. Appendix J presents a listing of the remaining overflow events.

Table 12-1. Portage Bay Neighborhood Storage CSO Control Measure Overflow Results with KC No-Impact Release Rate

Location	Overflow frequency without climate change (per year)	Overflow frequency with climate change (per year)
	20-year (1990–2009)	20-year (1990–2009)
NPDES138	0.6	0.8

Table 12-2 presents the average annual volumes of flow delivered to KC in the existing condition and after the Neighborhood Storage CSO control measure is implemented. Climate change is not included in these volumes, and values are averages over the 1990–2009 period.

Table 12-2. Portage Bay CSO Area Flow Volumes without Climate Change

Location	20-year average of flow volume delivered to KC (MG/year)	
	Existing condition	With storage CSO control measure
NPDES138	50.6	51.2

12.4 Summary of Portage Bay Neighborhood Storage CSO Control Measure Performance Hydraulic Analysis

The CSO performance hydraulic analyses described above indicated the following:

- The LTCP alternative configured as described above provided an overflow frequency of less than 1.0 per year over the 20-year period of 1990–2009 with climate change considered.
- Simulations with and without KC flow restrictions indicate that imposition of the KC NIRR for this basin will not significantly affect performance.
- The LTCP alternative will meet the performance criteria with or without a KC flow restriction. Imposition of the KC NIRR would require a modification of the alternative to provide either a small effluent PS (0.22 mgd) or an automated control gate to control release from storage. It is also likely that an integration of the agencies' SCADA systems will be required to provide a signal when storage release is acceptable.

SECTION 13

Shared West Ship Canal Tunnel Storage CSO Control Measure Performance Hydraulic Analysis

The Shared West Ship Canal Tunnel CSO control measure includes a deep storage tunnel running along the north side of the Lake Washington Ship Canal between Ballard and Fremont/ Wallingford. In this alternative, KC overflows that occur at their 11th Avenue NW and 3rd Avenue W structures would be diverted to the tunnel for control.

This section reviews the proposed shared CSO control measure, describes how the LTCP models of these areas were updated to represent the CSO control measure, and summarizes the simulated CSO control performance against the Consent Decree performance criteria with and without climate change considerations.

13.1 Proposed Storage CSO Control Measure

The Shared West Ship Canal Tunnel CSO control measure will accept overflows from SPU's four existing Ballard and Fremont/Wallingford NPDES sites (NPDES147, NPDES150/151, NPDES152, and NPDES174), and from the KC 11th Avenue NW and 3rd Avenue W overflow sites. The shared tunnel will be a 14-foot-diameter, 14,000-foot-long deep tunnel to replace four individual neighborhood storage tanks. An effluent PS would return stored flows to the wet weather siphon of the KC Ballard Regulator Station. The KC NIRR time series for discharge of degritted flows to the wet weather siphon (ball_ww_cleanwater_NIRR_2014) is assumed for this analysis. The location of the CSO control measure facilities is shown in Figure 13-1. The model setup is described in the following paragraphs.

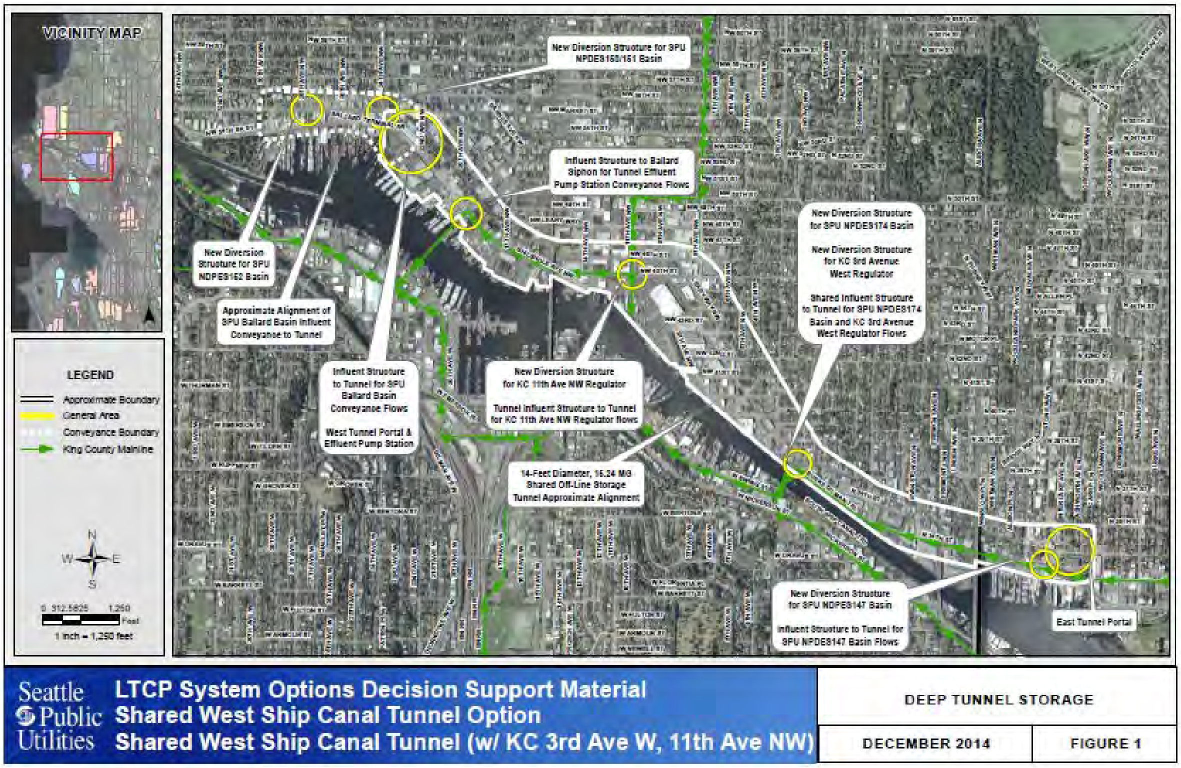


Figure 13-1. Neighborhood West Ship Canal Tunnel facilities layout

13.2 Model Revisions

The model for the Shared West Ship Canal Tunnel CSO control measure started with the models constructed for the Ballard Neighborhood Storage and Fremont/Wallingford Neighborhood Storage CSO control measures described in previous sections. These were combined into a single model and the deep tunnel was added. Facilities representing the KC overflow connections for 3rd Avenue W and 11th Avenue NW were then added to the model. The facilities noted for the Ballard and Fremont/Wallingford Neighborhood Storage CSO control measure models were largely retained in this combined model. Specific modifications for the Shared West Ship Canal Tunnel CSO control measure model are described below. A plan view of the model layout is shown in Figure 13-2.

Flow control gates were implemented at each inflow point to the tunnel. RTCs were also implemented to close these gates when the storage level in the tunnel rose to 3 to 5 feet below the soffit of the tunnel at the east portal in Wallingford. This control is designed to prevent the tunnel from completely filling to minimize transient surges and explosive air releases.

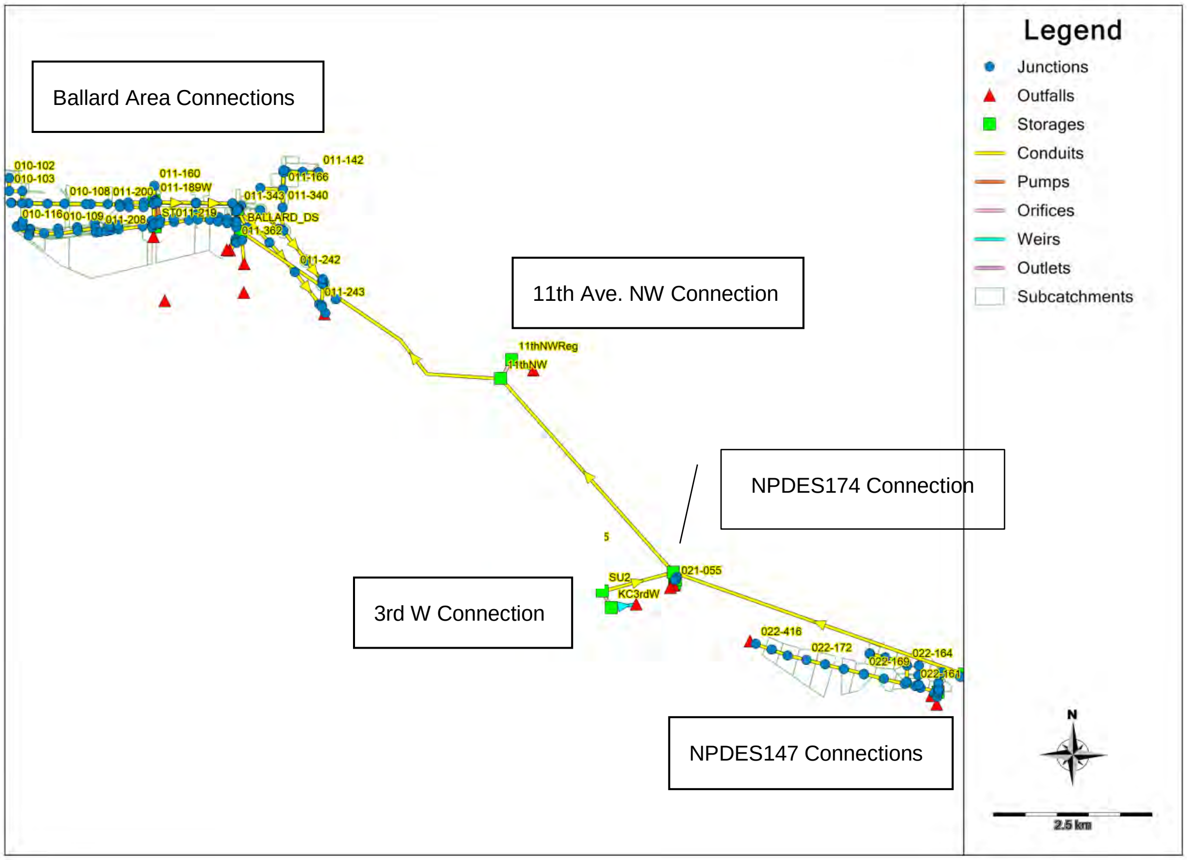


Figure 13-2. Model layout

13.2.1 Ballard Connection

The consolidation conduit for NPDES150/151 and NPDES152 described in Section 2, together with the diversion gates to control overfilling of storage, are included in the West Ship Canal Tunnel model. The consolidation conduit ends at the assumed location for a drop structure into the deep tunnel. The diversion gates are set to begin to close when the water surface elevation rises to within 4 to 5 feet below the soffit of the tunnel at the upstream end in Wallingford near NPDES147. Given the speed of gate closure and the volume included in the consolidation conduits when the gates begin to close, this control prevents the tunnel from filling beyond 2 feet below the tunnel soffit at the upstream end. All control gates were assumed to move at a rate of 12 inches per minute. The profile of this conduit is shown in Figure 13-3.

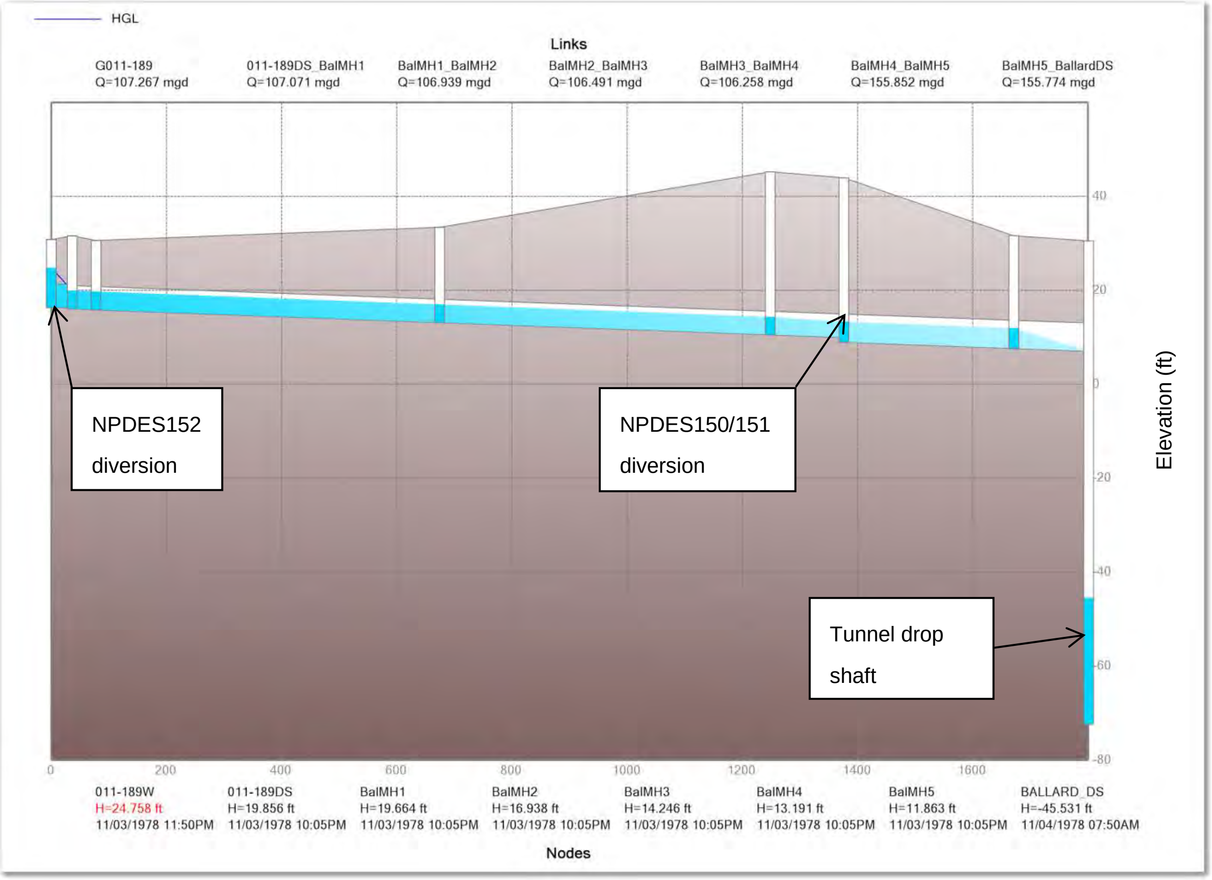


Figure 13-3. Profile of consolidation conduit from NPDES152 to tunnel drop structure

13.2.2 11th Avenue NW Connection

The Shared West Ship Canal tunnel will pass close by the existing KC 11th Avenue NW overflow structure and flow from this site will be diverted to the tunnel. KC provided a time series of overflows at this location from its model runs (11th_of_both_long.txt) representing the existing system without implementation of the flow transfer project identified in its CSO Plan or other flow reduction projects. A structure was added to the model to accept the inflow time series with a control gate to divert flow to the tunnel and manage water depths in the tunnel, and an overflow weir to bypass flow when the tunnel is full.

13.2.3 Fremont NPDES174 and KC 3rd Avenue W Connections

The SPU NPDES174 and KC 3rd Avenue W overflows are on opposite sides of the Ship Canal near 3rd Avenue W. The tunnel will pass near NPDES174 on the north side of the Ship Canal. Bringing 3rd Avenue W overflows across the Ship Canal to enter the tunnel will require a new siphon or a deep pipe connection. The layout of the assumed connections is shown in Figure 13-4.

For 3rd Avenue W, KC provided a time series of overflow rates from its 2010b hydraulic model run for use in this analysis. A structure was inserted in the model to accept this time series with an overflow weir and a control gate connected to a 700-foot-long, 48-inch-diameter conduit to convey flows to the tunnel drop shaft near NPDES174 as shown in Figure 13-4.

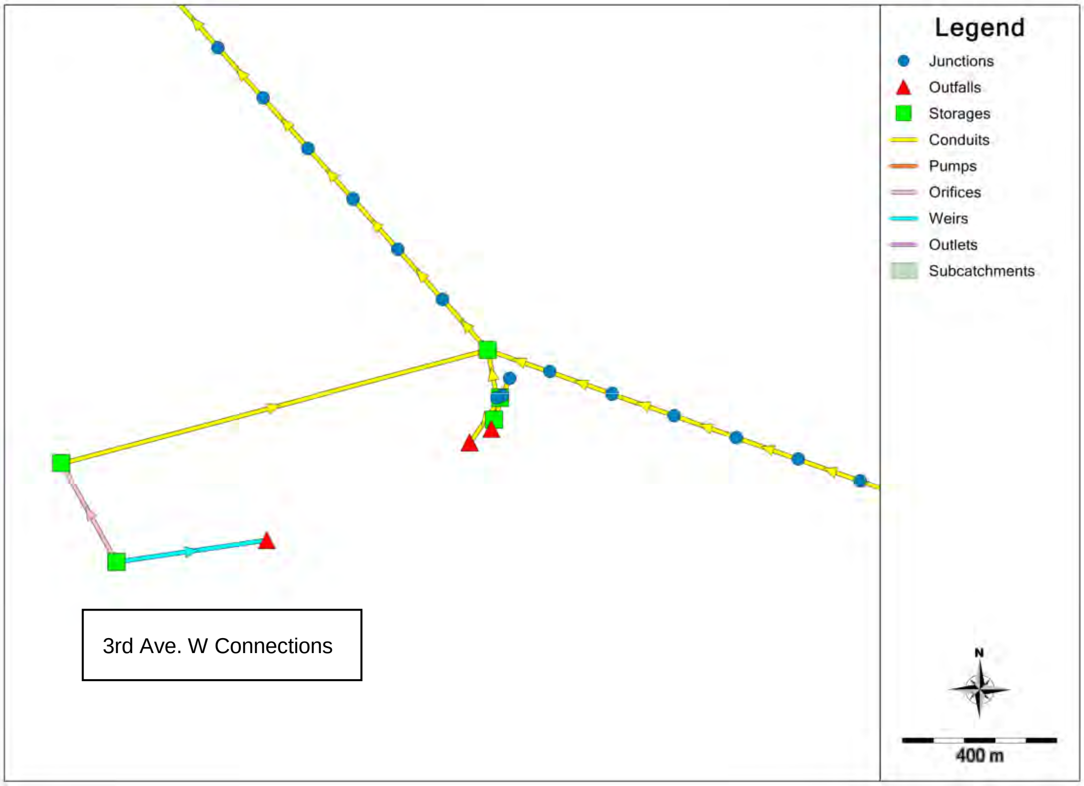


Figure 13-4. Plan view of Fremont NPDES174 and 3rd Avenue W connections

At NPDES174, a new structure is assumed immediately downstream of the existing overflow weir with a bottom elevation of approximately 17 feet. The existing weir and the existing outfall pipe at its current invert elevation (21.2 feet) would be connected to this structure to provide overflows when the tunnel is filled without interfering with the operation of the existing weir and connection to the KC interceptor. A 3-by-3-foot sluice gate would be installed at the bottom of the structure to divert overflows to the tunnel. The diversion gate is set to close when the water surface elevation rises to within 4 to 5 feet below the soffit of the tunnel at the east tunnel portal in Wallingford near NPDES147 to prevent the tunnel from filling above the soffit. A plan view of the connecting elements in the model is shown in Figure 13-5. All control gates were assumed to move at a rate of 12 inches per minute.

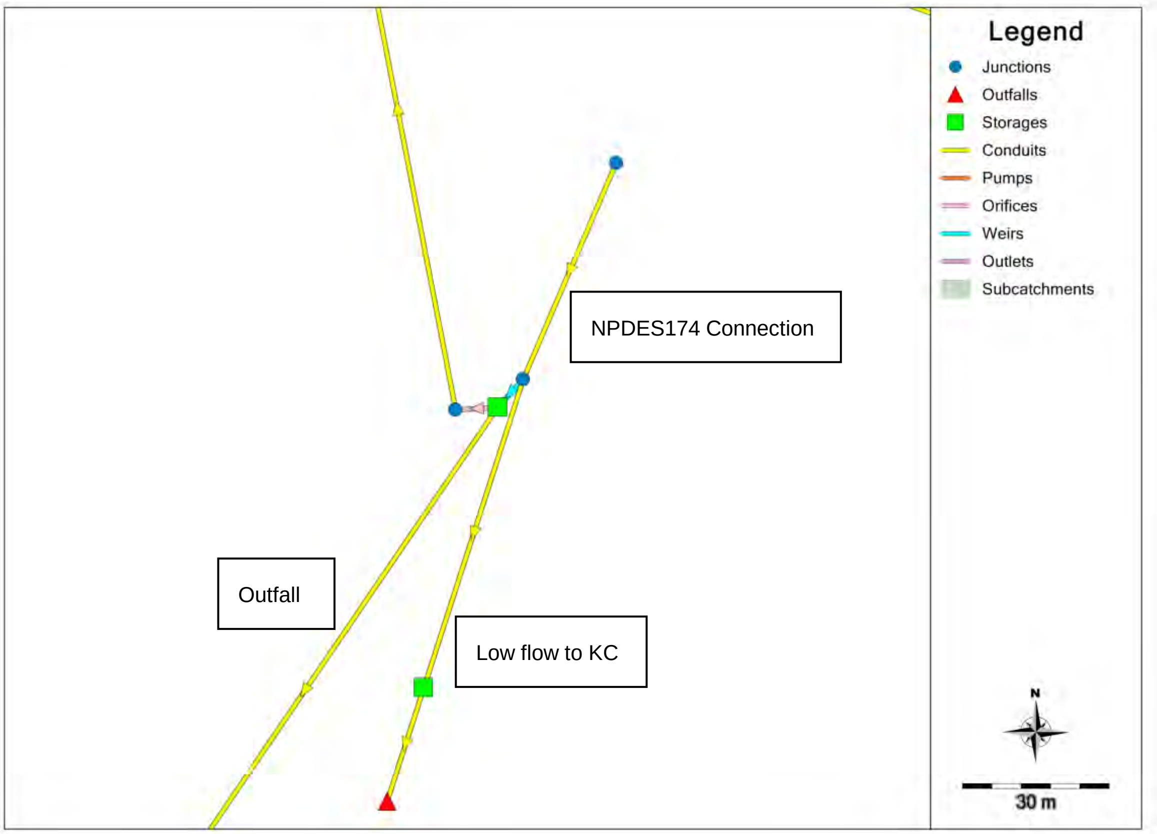


Figure 13-5. Detail of NPDES174 connection

13.2.4 Wallingford NPDES147 Connection

At NPDES147, many of the facilities included in the Fremont/Wallingford Neighborhood Storage CSO control measure model were retained in the Shared West Ship Canal Tunnel CSO control measure model. The connection to the PS was replaced with a 3-by-3-foot diversion gate connected to a 36-inch-diameter conduit leading to a drop structure to the tunnel, as shown in Figure 13-6. All control gates were assumed to move at a rate of 12 inches per minute.

The drop structure is assumed to be at the east tunnel portal near N 35th Street and Interlake Avenue N. The connecting 36-inch-diameter conduit is assumed to be approximately 788 feet long at a slope of 0.5 percent from the diversion at MH022-186 to the drop structure at the tunnel portal.

The following elements are included for the NPDES147 connection:

- Replace conduit 022-187_022-186 from the existing weir to the new diversion structure (18-inch-diameter existing pipe replaced with 36-inch-diameter pipe). This pipe is known to flood the overflow weir from observations during the flow monitoring period.

- New final overflow weir at 022-186, length 25 feet, elevation 21.5 feet. The length and elevation of the weir were found in the modeling to prevent interference with the existing weir at MH022-187.
- A 3-by-3-foot diversion gate to control flow into the tunnel. The model configuration includes this gate in the diversion structure at MH022-186. The gate could be relocated at the tunnel drop structure.
- 788 feet of 36-inch-diameter connecting conduit at a slope of 0.5 percent from the diversion at MH022-186 to the tunnel drop structure.
- Repair or replace the existing flap gate in the connection to the KC North Interceptor. This gate is known to allow up to 1.0 mgd of backflow from the interceptor to the SPU overflow structure when the interceptor is surcharged.

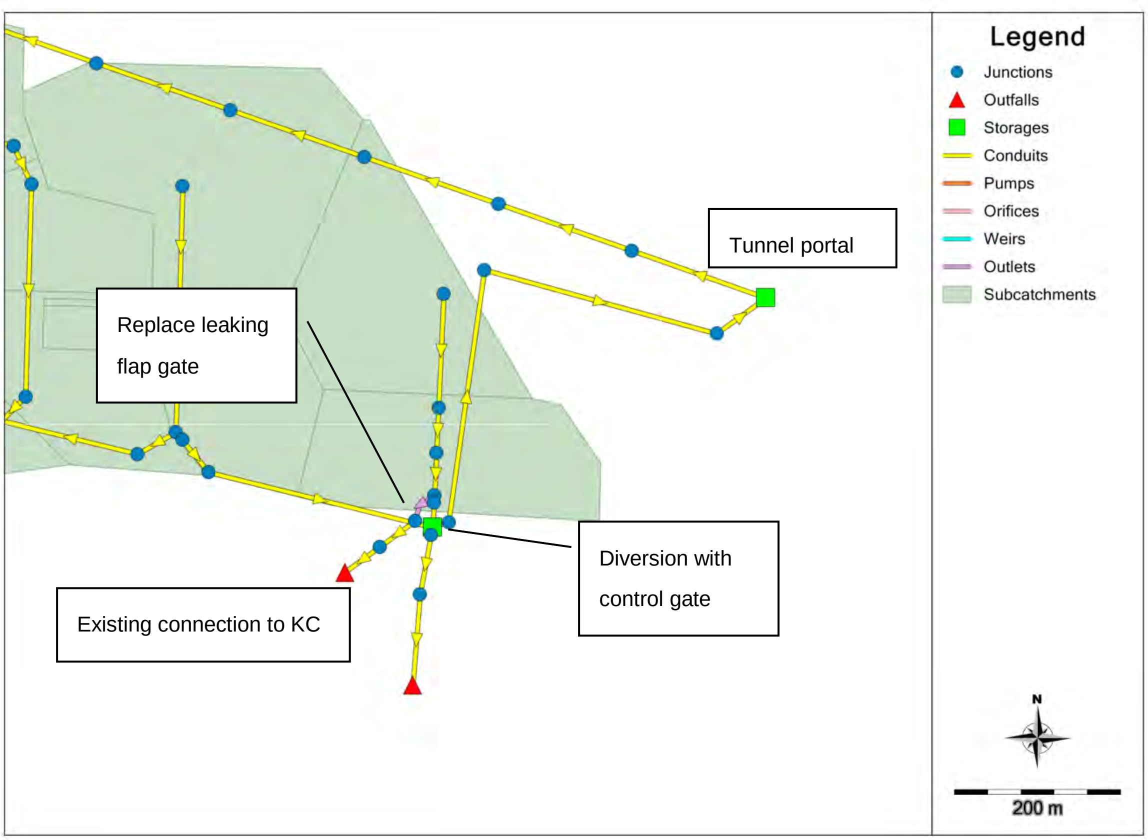


Figure 13-6. Plan view of Fremont/Wallingford NPDES147 connection

13.2.5 Deep Tunnel

The 14-foot inside diameter deep tunnel was configured with the effluent PS located at the west tunnel portal in Ballard. The tunnel is to be sloped at 0.001 ft/ft up to the east tunnel portal near NPDES147. The tunnel profile configured in the model is shown in Figure 13-7. With this configuration, the tunnel will surcharge at the west portal up to 28 feet when full.

Drop shafts were assumed at the Ballard end (40-foot-diameter tunnel machine entry shaft) where inflow from NPDES150/151 and NPDES152 occurs, at 11th Avenue NW where a 30-foot-diameter drop shaft is assumed, at the east portal (30-foot-diameter tunnel machine retrieval shaft) near NPDES147 in Wallingford, and a 30-foot-diameter drop shaft to collect inflow from NPDES174 and 3rd Avenue W overflows near 2nd Avenue NW and NW 36th Street. The total available volume in the tunnel is approximately 16 MG.

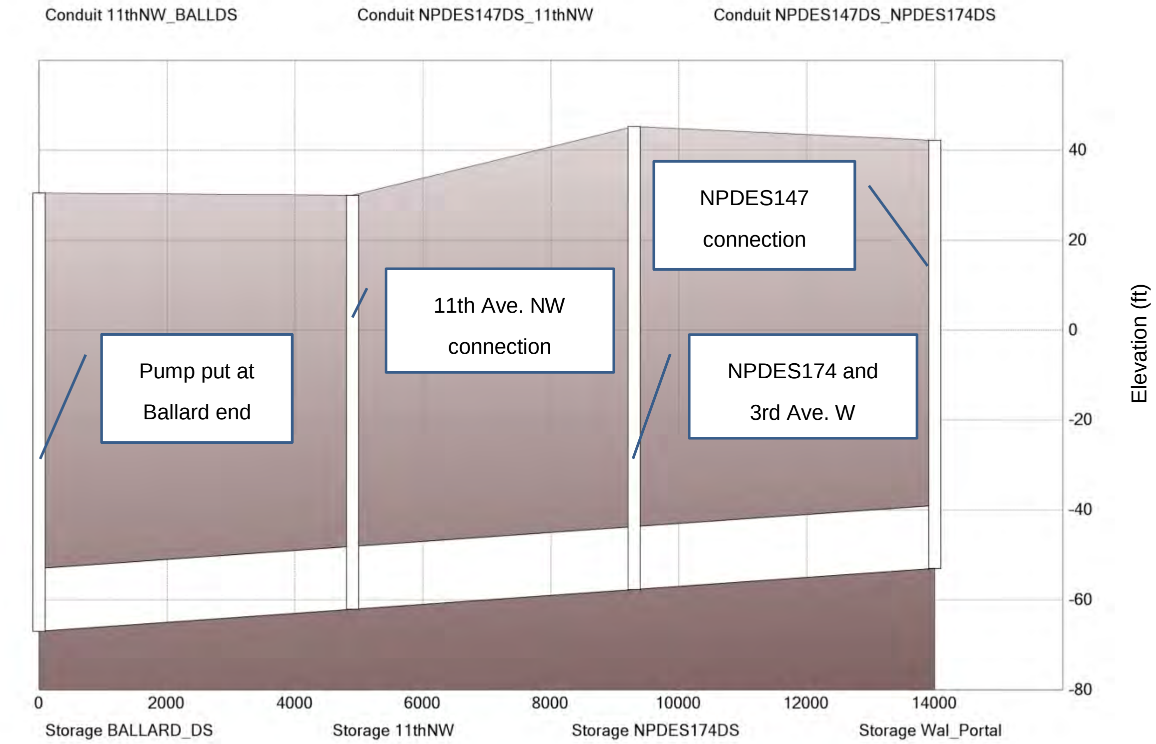


Figure 13-7. West Ship Canal Tunnel model profile

13.2.6 Tunnel Effluent Pump Station

The model was configured to pump to the KC Ballard wet weather siphon at a maximum rate of 32 mgd. This rate was chosen to drain the tunnel in a 12-hour period.

The model is configured with two 16 mgd pumps. These are separately controlled to allow activation only when the KC NIRR time series indicates that capacity is available (NIRR exceeds pump capacity; see Figure 1-5 for example). Actual system operation will likely depend on a SCADA signal of water level in the forebay of the Ballard wet weather siphon and the North Interceptor at the outlet of the siphon.

13.3 CSO Performance Hydraulic Analysis

The SPU Consent Decree requires that performance be analyzed on a rolling 20-year average. Where possible, the analysis will use the period from 1993–2012 for the moving 20-year average to confirm CSO control compliance. Previous model development and LTSs for the Ballard and Fremont/Wallingford basins were performed using time series of water surface elevation at the interceptor connection points provided by KC from its model run, as described in the LTCP Modeling Report (CH2M HILL, 2012a, d). These time series cover the period from 1978–2009, restricting the analysis to this period. These time series are not usable to control pump out from individual storage tanks or the Shared West Ship Canal Tunnel CSO control measure. As a result, the KC NIRR for discharge of degritted flow (ball_ww_clearwater_NIRR_2014) to the wet weather siphon of the KC Ballard regulator station was used to control drainage from the tunnel similar to use in the Ballard simulations discussed in Section 2.

Using the KC NIRR as the boundary condition, model simulations of the Shared West Ship Canal CSO control measure described above were run for the 20-year period from January 1, 1990–December 31, 2009, with and without climate change. The results and boundary condition for a representative event are shown in Figure 1-5.

KC did not explicitly account for climate change in its model runs. Two different runs to account for climate change were thus conducted. One run included climate change for SPU flows but not KC flows, and a second simulation included a 10 percent increase in KC flows. The 10 percent increase is an amplification factor derived from the SPU long-term model simulations conducted to assess the BECVs (CH2M HILL, 2013). The amplification factor represents the increase in overflow volume per unit increase in rainfall. The 10 percent increase corresponds to the simulated increase in overflow volume in the SPU Fremont/Wallingford CSO Area when the rainfall was increased by about 7 percent to account for climate change and other model uncertainties.

The overflow frequency results of the simulations with and without climate change included documenting compliance with the Consent Decree requirement are shown in Table 13-1. A complete listing of the remaining overflow events is given in Appendix K.

Table 13-1. Shared West Ship Canal Tunnel CSO Control Measure Overflow Results with KC No-Impact Release Rate

Location	Overflow frequency without climate change (per year)	Overflow frequency with climate change for SPU but not KC (per year)	Overflow frequency with climate change for all flows (per year)
	20-year (1990–2009)	20-year (1990–2009)	20-year (1990–2009)
NPDES147	0.5	0.6	0.6
NPDES174	0.5	0.5	0.6
3rd Ave. W	0.5	0.5	0.6
11th Ave. NW	0.4	0.4	0.4
NPDES150/151	0.5	0.6	0.6
NPDES152	0.5	0.7	0.7

Unlike the Neighborhood Storage alternatives, it is difficult to make a strict accounting of the post-CSO control measure increase in flow from SPU to KC. The values shown for the Ballard and Fremont/Wallingford Neighborhood CSO control measures may be used. Table 13-2 presents the average annual volumes of flow diverted to the tunnel by each agency. Climate change is not included in these volumes, and values are averages over the 1990–2009 period.

Table 13-2 Shared West Ship Canal Tunnel Flow Volumes without Climate Change

Location	20-year average of flow volume diverted to tunnel (MG/year)
	1990–2009
Ballard Area (152 + 150/151)	18.9
Fremont Area (174)	2.3
Wallingford Area (147)	5.6
11th Ave. NW	7.4
3rd Ave. W	14.4

13.4 Summary of Shared West Ship Canal Tunnel CSO Control Measure Performance Hydraulic Analysis

For the moving 20-year average period of 1990–2009 using the KC NIRR time series as a boundary condition, the CSO performance hydraulic analysis indicated that the defined LTCP Shared West Ship Canal Tunnel CSO control measure configured as described above results in an overflow frequency of less than 1.0 event per year at all outfalls with and without climate change accounted for.

The performance was verified in three ways:

- A model was created that simulates the tunnel as linked segments of pipe about 170 feet long. This approach minimizes continuity errors in SWMM 5 when using large conduits for storage. The pipe segment length is chosen to be just longer than that value at which SWMM 5 would internally increase the length to satisfy the Courant condition.
- A model was created that simulates the tunnel by replacing it with a single storage node. The storage node was given a depth vs. surface area table equivalent to the 14-foot-diameter, 14,000-foot-long tunnel.
- The simulated time series of flow to the tunnel at each diversion point were extracted, summed, and separated into events during which effluent pumping was disallowed by the NIRR.

The three methods of determining performance gave essentially the same computed overflow frequencies, verifying the values in Table 13-1.

SECTION 14

Delridge NPDES168 and NPDES169 Retrofit CSO Control Measure Performance Hydraulic Analysis

Retrofits are currently being designed for the NPDES168 and NPDES169 Basins. The City of Seattle 2010 NPDES Waste Discharge Permit WA-003168-2: Section 7, Compliance Schedules, requires a construction completion date of November 1, 2015.

This section reviews the proposed Delridge NPDES168 and NPDES169 Basin retrofit CSO control measures, describes how the LTCP model of the area was updated to represent the retrofits, and summarizes the simulated retrofit CSO control performance with the Consent Decree performance criteria with and without climate change considerations.

14.1 Proposed Retrofit CSO Control Measure

Design work for retrofits in the NPDES168 and NPDES169 Basins has been completed and a construction contract has been put out to bid. The proposed retrofits will use controllable valves to replace the existing HydroBrakes at the overflow structures. A control scheme was developed for the valves to maximize use of available storage and control flooding downstream. All design analyses were conducted using existing rainfall. The analyses used the 36-year rainfall record from 1978–2013.

The two basins in question are located in the sewer system in such a way that the outflows from each converge at the upper end of the KC Delridge trunk sewer as shown in Figure 14-1. Additional flows also join the system at this point.

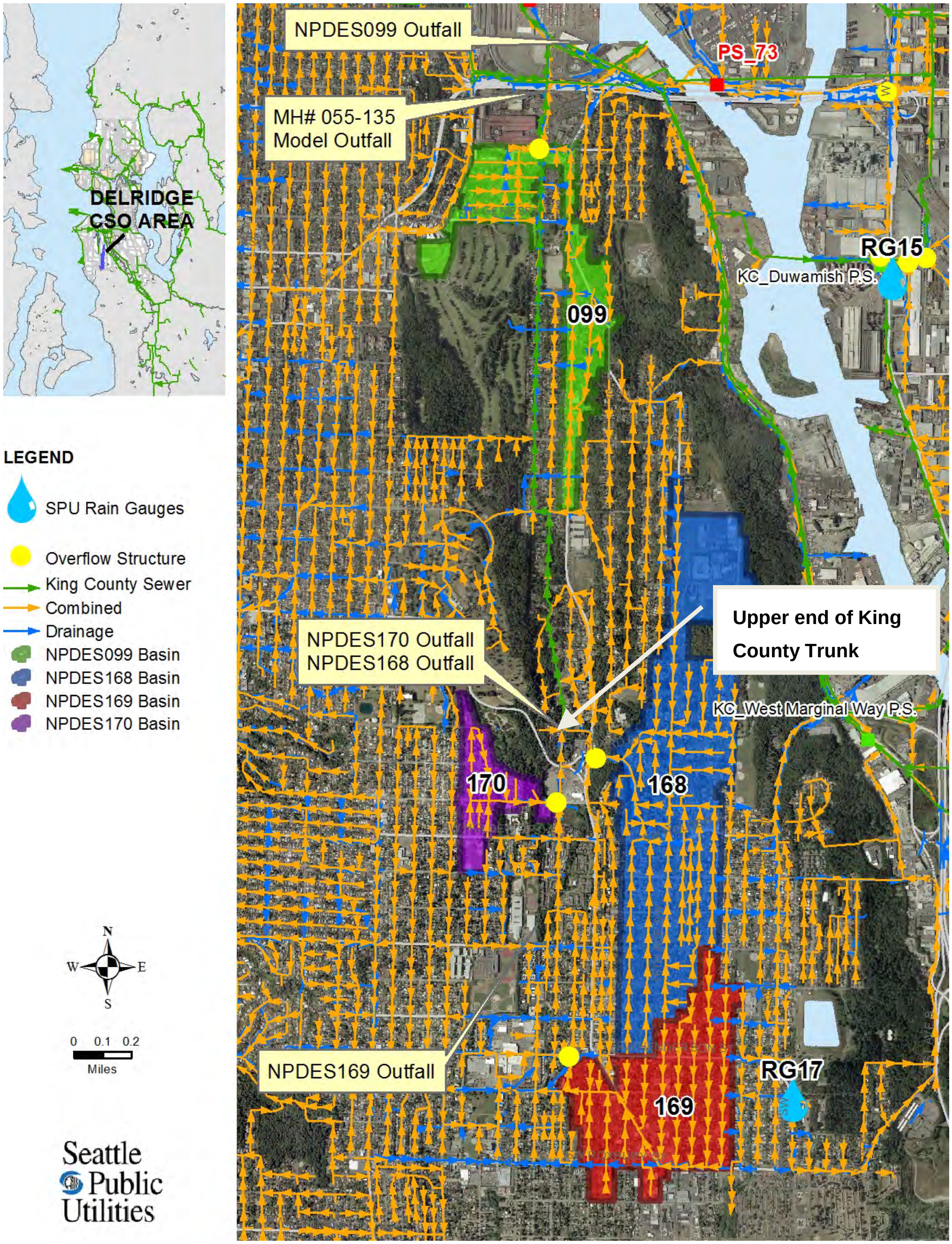


Figure 14-1. Delridge CSO Area

14.2 Model Revisions

The design team started with the LTCP model calibrated in the NPDES168 and NPDES169 Basins (CH2M HILL 2012a). The team then calibrated other portions of the Delridge CSO Area using flow monitoring data collected for the retrofit CSO control measure. Once calibrated, the HydroBrakes at the NPDES168 and NPDES169 overflow structures were replaced with controllable orifices in the model. These were configured to be open at the beginning of storms, and to close at peaks to maximize available storage and minimize downstream flooding.

To perform the analyses, the relevant flows to KC were assumed to come from the outflow of NPDES168, NPDES169, and the leaping weir that is installed upstream of NPDES169. The leaping weir diverts storm flows to the NPDES169 facility, bypassing low flows to the KC trunk. The design analysis was conducted with a target of not increasing system outflow to KC above that assumed in the original facility plan for these storage tanks (Brown and Caldwell, 1979). By adjusting the individual control valve peak outflow rates, the predesign team was able to achieve a result showing 35 overflows in the 35-year simulation period from 1978–2012 (average of once per year of the long-term simulation).

14.3 CSO Performance Hydraulic Analysis

As noted above, the Delridge retrofit predesign criteria were established to achieve an average overflow frequency of once per year for the period 1978–2013, without consideration of climate change. The SPU Consent Decree requires that performance be analyzed on a rolling 20-year average. Where possible, the analysis will use the period from 1993–2012 for the moving 20-year average to confirm CSO control compliance.

The design model was run for the period from 1993–2012. Assuming no climate change, the system exhibited an overflow frequency in this period of approximately 1.3 per year at NPDES168. The overflow frequency at NPDES169 was less than once per year.

Different model runs were made with varying peak outflow rates to examine increases in the peak flow rate at NPDES168 as a means of bringing it into control for the 20-year moving average analysis period 1993–2012. It was found that an increase in the peak outlet flow from NPDES168 above the design assumption but still below the facility plan value would bring the system into compliance for the 20-year period without climate change accounted for. It was also noted that further upward adjustments of the peak outflow rate at NPDES168 would keep that location in control with climate change included. Downward adjustments in the outflow from NPDES169 could be used to manage the total peak flow entering the KC system.

An estimate was made of the potential remaining control volume at these structures if the 6 percent increase in precipitation associated with climate change in the LTCP were included and peak flows were not increased above the facility plan values. It was found that an additional control volume of 0.2 to 0.3 MG may be needed for both NPDES168 and NPDES169 to account for climate change if peak outflow rates are not increased or inflows are not reduced.

Once the construction of the retrofit facilities is complete, the control valves will be optimized based on post-construction monitoring. At that time, the model will be finalized for final construction details, and will be recalibrated. Based on the results, modifications to the system including peak flow adjustments or addition of the storage tanks described in the LTCP will be constructed if the system fails to meet the Consent Decree requirements.

Table 14-1 shows the expected overflow frequency for the NPDES168 and NPDES169 retrofits indicating compliance with the performance standard.

Table 14-1. Delridge NPDES168 and NPDES169 Retrofit CSO Control Measure Overflow Results

Location	Overflow frequency without climate change (per year)	Overflow frequency with climate change (per year)
	20-year (1993–2012)	20-year (1993–2012)
NPDES168	1.0	1.0
NPDES169	0.5	0.9

Table 14-2 presents the average annual volume of flow delivered to KC in the existing condition and after the retrofit CSO control measure is implemented. Climate change is not included in these volumes, and values are averages over the 1990–2009 period.

Table 14-2. Delridge NPDES168 and NPDES169 CSO Area Flow Volumes without Climate Change

Location	20-year average of flow volume delivered to KC (MG/year)	
	Existing condition	With storage CSO control measure
MH069-184-KC inflow	548	552

14.4 Summary of Delridge NPDES168 and NPDES169 Retrofit CSO Control Measure Performance Hydraulic Analysis

The analyses described above indicated the following:

- Suitable modification of the peak outflow rates of the control valves included in the retrofit will result in overflow frequency meeting the Consent Decree requirements.
- Following construction and post-construction monitoring, the model will be recalibrated and adjustments will be made to ensure that the system is in compliance.
- If necessary, the peak outflow rates will be increased, or the small storage tanks described in the LTCP will be implemented, to achieve compliance with climate change.

SPU and KC will jointly use the post-construction monitoring to determine downstream impacts of the Delridge NPDES168 and NPDES169 retrofits on KC facilities. If significant impacts occur, the agencies will jointly determine a solution.

SECTION 15

References

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Appendix A: Ballard Neighborhood Storage CSO Control Measure

Remaining Overflow Events

Table A. Ballard CSO Area Remaining Overflows

Event summary for all Ballard CSO Area overflows (MG)
NPDES150/151, 152 no climate change; with KC degritted NIRR

Event	Date	Duration (h)	NPDES152(A)	NPDES152(B)	NPDES150/151
1	11/24/1990 15:45	22.17	0.4108	0	0
2	1/30/1992 19:20	27.25	1.481	0	0.09645
3	9/23/1992 18:50	0.25	0.0553	0	0
4	2/8/1996 23:10	7.17	0.3077	0	0.1542
5	12/29/1996 17:55	102.42	15.66	0	3.088
6	3/19/1997 4:55	23.92	4.832	0	0.7788
7	11/26/1998 4:35	4.58	0.04565	0	0
8	10/20/2003 10:55	29.58	11.02	0	2.254
9	11/18/2003 15:15	32.17	3.45	0	0.3642
10	12/3/2007 3:35	37.5	29.94	0.05351	11.21

Appendix B: Central Waterfront Neighborhood Storage CSO Control Measure

Remaining Overflow Events

Table B. Central Waterfront (NPDES069) Remaining Overflows

Event summary for NPDES069-039-521A.1 flow (mgd) (13 events)
NPDES069 without climate change; with KC no-impact release rate

Event	Date	Duration (h)	Maximum flow (mgd)	Total flow (MG)
1	5/12/1996 23:55	0.75	19.5	0.1858
2	9/3/1996 18:25	0.83	22.47	0.2706
3	11/23/1997 19:20	1	16.18	0.2858
4	2/17/1998 14:40	1.42	23.33	0.6072
5	8/22/2001 16:20	1.33	18.31	0.5357
6	10/20/2003 8:00	8	11.5	1.229
7	11/18/2003 10:30	1.75	6.704	0.1029
8	5/27/2004 14:50	0.42	11.93	0.09258
9	12/14/2006 16:30	1.42	24.05	0.6792
10	12/3/2007 2:25	11.75	22.1	5.626
11	6/3/2008 19:30	0.5	8.588	0.1033
12	5/19/2009 20:40	0.5	7.52	0.08375
13	10/16/2009 20:15	13.5	15.74	0.2198

Appendix C: Delridge Neighborhood Storage CSO Control Measure

Remaining Overflow Events

Table C. Delridge NPDES099 Remaining Overflows

Event summary for WR_055-477_CSO (NPDES099) flow (mgd) (15 events)
NPDES099 with climate change and KC no-impact release rate

Event	Date	Duration (h)	Maximum flow (mgd)	Total flow (MG)
1	1/9/1990 8:40	13.5	2.183	0.4509
2	11/24/1990 8:50	14.92	3.149	0.6922
3	4/4/1991 17:45	20.67	4.378	0.842
4	2/8/1996 9:40	27.83	5.613	1.539
5	4/23/1996 14:10	10.83	7.047	0.3193
6	12/29/1996 19:40	16.75	1.94	0.2887
7	12/31/1996 20:05	52.33	6.01	0.6808
8	3/18/1997 20:40	27	2.683	0.9025
9	11/25/1998 16:40	23.17	1.842	0.5146
10	11/12/1999 15:25	12.83	1.209	0.114
11	11/14/2001 12:45	11	2.366	0.4309
12	12/16/2001 16:30	8.33	1.693	0.2499
13	12/14/2003 12:35	6.42	2.88	0.2194
14	12/14/2006 16:30	8.92	5.284	0.2047
15	12/3/2007 2:35	39.67	6.337	3.605

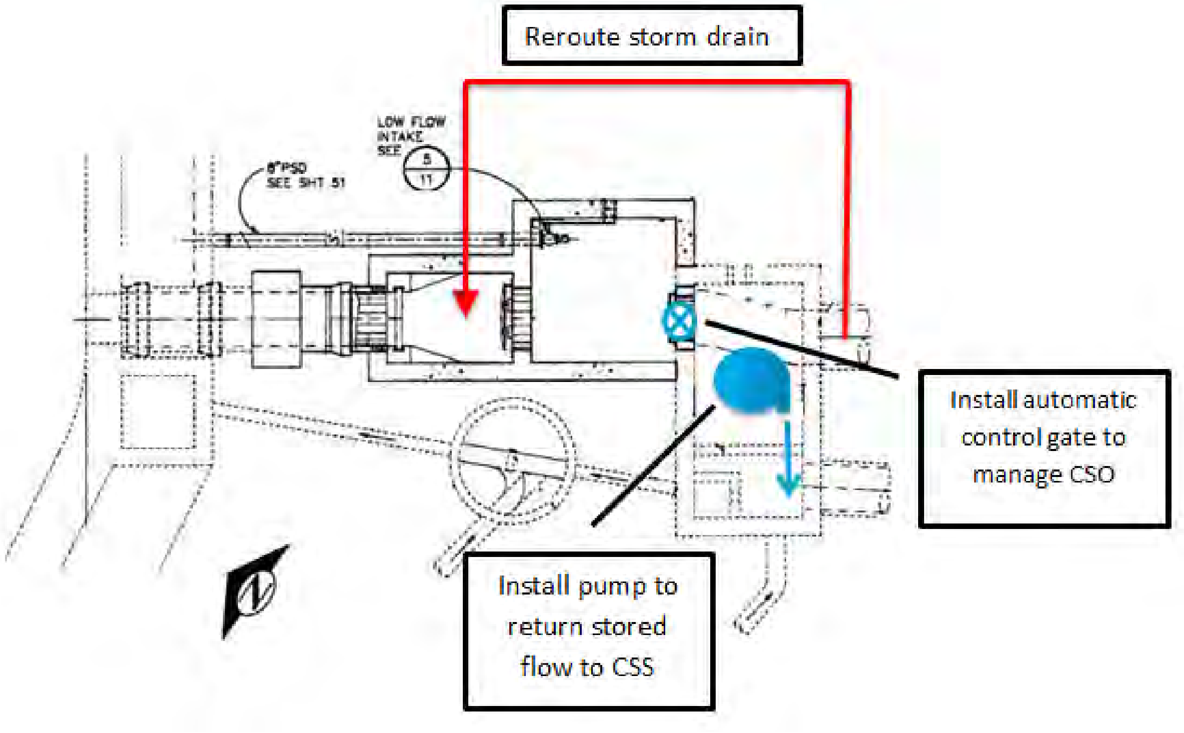
Appendix D: Duwamish 111(B), 111(C), and 111(H) Neighborhood Storage CSO Control Measure

Remaining Overflow Events

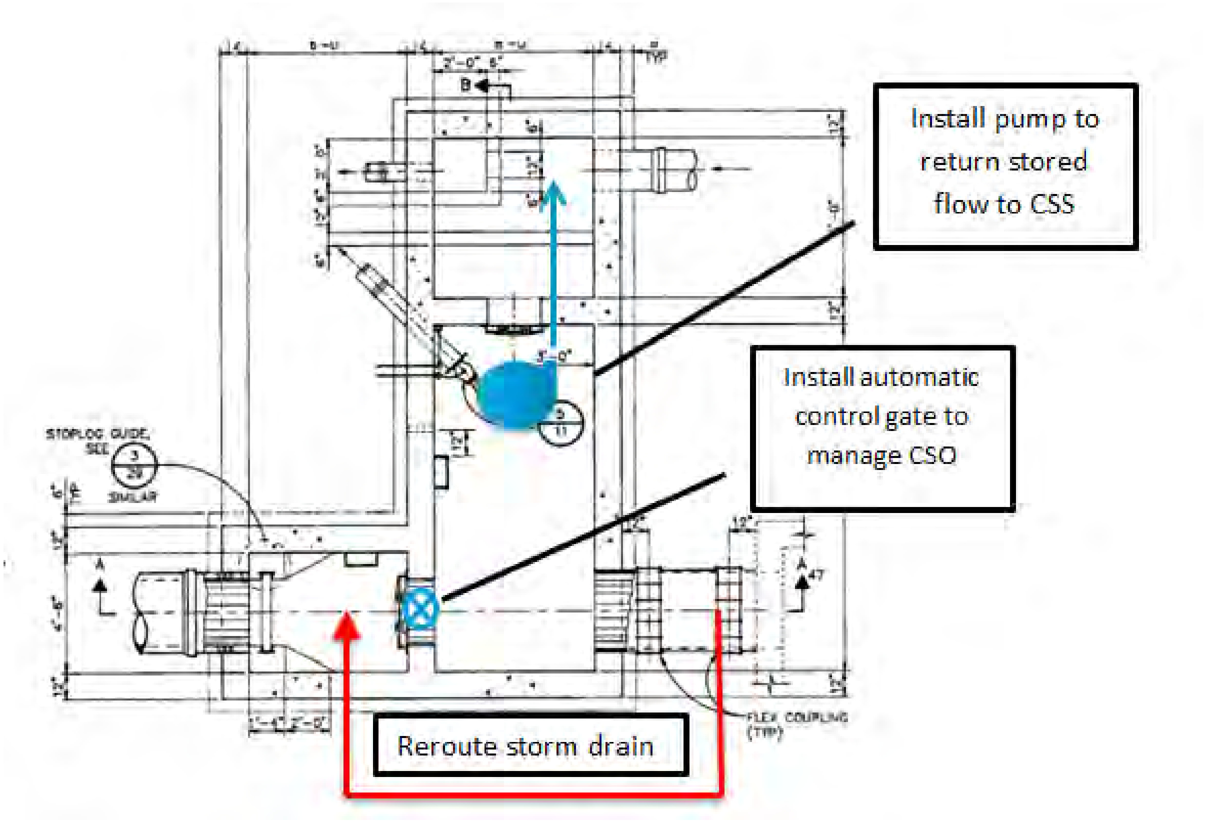
Table D. Duwamish NPDES111 Remaining Overflows

Event summary for total overflow for all Duwamish CSO Area overflows (MG)
NPDES111 without climate change; with KC no-impact release rate

Event	Date	Duration (h)	111C (MG)	111B (MG)	111H (MG)
1	1/9/1990 7:40	8.83	0.0221	0.0047	0.0225
2	11/24/1990 8:15	4.42	0	0.0119	0.0156
3	4/5/1991 1:35	2.42	0	0	1.03E-06
4	2/8/1996 9:35	14	0.0075	0.0215	0.0731
5	12/29/1996 15:20	3.08	0.0021	0.0275	0
6	3/19/1997 2:55	2.67	0	0	0.0265
7	8/16/1998 15:55	0.25	0	0.0179	0
8	11/26/1998 0:45	1.92	0	0	0.0517
9	11/14/2001 15:25	3.25	0	0	0.0197
10	10/20/2003 10:35	0.17	0	0.0031	0
11	12/14/2003 11:50	2	0	0	0.0039
12	12/14/2006 16:30	1	0.0449	0.0986	0.0218
13	12/3/2007 2:20	20.92	0.5006	0.3889	0.4619



111B overflow structure modifications


Install pump to return stored flow to CSS

Install automatic control gate to manage CSO

Reroute storm drain

111B overflow structure modifications

Appendix E: East Waterway NPDES107 Neighborhood Storage CSO Control Measure

Remaining Overflow Events

Table E. NPDES107 Remaining Overflows

Event summary for 056-097__056-359 (NPDES107) flow (mgd) (14 events)
NPDES107 without climate change; with KC no-impact release rate

Event	Date	Duration (h)	Maximum flow (mgd)	Total flow (MG)
1	11/24/1990 10:30	1	0.205	0.002894
2	4/4/1991 17:40	9.33	0.195	0.007832
3	2/8/1996 23:45	0.83	0.068	0.001071
4	4/23/1996 10:45	4	0.291	0.01949
5	12/31/1996 20:20	2.33	0.320	0.01438
6	1/2/1997 11:20	0.5	0.004	2.74E-05
7	3/19/1997 5:00	1.58	0.246	0.009493
8	10/20/2003 14:10	1.42	1.369	0.03382
9	11/19/2003 5:05	1.83	0.283	0.008435
10	1/30/2006 2:15	0.83	0.121	0.001604
11	12/3/2007 1:50	12.42	2.448	0.4379
12	10/26/2009 12:30	0.67	0.043	0.00045
13	11/7/2009 11:50	0.75	0.295	0.003737
14	11/26/2009 9:00	0.17	0.000	1.62E-07

Appendix F: Fremont/Wallingford Neighborhood Storage CSO Control Measure

Remaining Overflow Events

Table F. Fremont/Wallingford Remaining Overflows

Event summary for NPDES147 and 174 overflow (MG) time series (10 events)
NPDES147 and NPDES174 without climate change; with KC no-impact release rate

Event	Date	Duration (h)	NPDES174 overflow (MG)	Final147 overflow (MG)
1	1/9/1990 17:00	24.33	0.1303	0.2031
2	11/24/1990 13:35	30.25	0.2127	0.4671
3	2/8/1996 19:20	19.58	0.679	0.809
4	4/23/1996 14:25	30	0.2139	0.511
5	12/30/1996 10:45	97.25	2.57	3.202
6	3/19/1997 1:30	36.83	1.257	1.834
7	10/20/2003 12:10	35.58	2.796	5.428
8	1/30/2006 2:55	19.58	0.3271	0.5588
9	12/3/2007 1:55	57.33	8.936	13.42
10	11/26/2009 8:40	16.83	0.06316	0.06618

Appendix G: Leschi Neighborhood Storage CSO Control Measure

Remaining Overflow Events

Table G. Leschi CSO Area Remaining Overflows

Event summary for Leschi lower basin overflows (MG)
Leschi overflows without climate change; with KC no-impact release rate

Event	Date	Duration (h)	NPDES 026	NPDES 027	NPDES 028	NPDES 029	NPDES 030
1	1/9/1990	11.5	0	0	7.92E-05	0.0503	0.09588
2	10/4/1990	1.58	0	0	0.004536	0	0.00495
3	4/5/1991	2.92	0	0	1.96E-05	0.00216	0.01268
4	4/13/1993	0.17	0	0	0	0	0.00013
5	2/8/1996	13.17	0	0	0.001806	0.01875	0.04259
6	5/13/1996	0.42	0.00256	0	0.02214	0	0.02522
7	12/31/1996	18.42	0	0	0	0	0.0009
8	11/25/1998	10.75	0	0	0	0.01875	0.03854
9	11/12/1999	4.17	0	0	0	0.00161	0.00195
10	8/22/2001	0.25	0	0	0.000176	0	0.0017
11	11/12/2002	0.42	0.00397	0	0.01441	0	0.00416
12	10/20/2003	18	0	0	0	0.09119	0.0979
13	11/19/2003	1	0	0	0	0	0.00435
14	8/22/2004	1.33	0	0	0.02643	0.0068	0.02736
15	12/14/2006	1	0.00665	0	0.0806	0.05291	0.1296
16	12/3/2007	30.83	0	0	0.3355	0.5651	1.046

Event summary for Leschi upper basin overflows (MG) (15 events)

Leschi overflows without climate change; with KC no-impact release rate

Event	Date	Duration (h)	NPDES 031 (MG)	NPDES 034 (MG)	NPDES 032 (MG)	NPDES 033 (MG)	NPDES 035 (MG)	NPDES 036 (MG)
1	1/9/1990	15.5	0.3313	0.239	0	0	0.0005	0.1533
2	10/4/1990	1.58	0	0	0	0	0.0053	0
3	4/5/1991	6.5	0.0739	0.0253	0	0	0	0.0214
4	2/8/1996	22.92	0.3517	0.1865	0.0018	0	0	0.1792
5	5/13/1996	0.5	0	0	0.0074	0.0009	0.0155	0
6	12/31/1996	19.83	0.0163	0	0	0	0	0.0023
7	11/25/1998	18.08	0.391	0.0576	0	0	0	0.1216
8	11/12/1999	7.67	0.1262	0	0	0	0	0.0066
9	11/12/2002	0.58	0	0	0.0001	0.0014	0.0081	0
10	10/20/2003	23.33	0.5554	0.3474	0.0034	0	0.0062	0
11	11/19/2003	5.92	0.0891	0	0	0	0	0.0030
12	8/22/2004	1.83	0	0.0543	0.0006	0	0.0318	0
13	12/14/2006	8.42	0	0.1457	0.0289	0.0052	0.0663	0.0533
14	12/27/2006	3.33	0	0	0	0	0	0.0097
15	12/3/2007	35.5	1.247	2.018	0.2517	0	0.0643	0.5993

Appendix H: Magnolia NPDES060 Neighborhood Storage CSO Control Measure

Remaining Overflow Events

Table H. NPDES060 Remaining Overflows

Event summary for 010-159_W010-159 (NPDES060) flow (mgd)
NPDES060 without climate change; with KC no-impact release rate

Event	Date	Duration (h)	Maximum flow (mgd)	Total flow (MG)
1	11/24/1990 10:20	4.92	1.29	0.08
2	9/23/1992 18:45	0.75	3.15	0.07
3	12/29/1996 15:20	7.5	1.81	0.33
4	12/31/1996 20:20	17.42	2.11	0.09
5	2/8/2000 16:45	0.17	0.87	0.00
6	8/22/2001 17:10	0.33	2.43	0.02
7	10/20/2003 9:50	18.92	2.81	0.66
8	11/18/2003 11:35	19.83	1.37	0.16
9	12/3/2007 2:50	14.33	4.83	1.51

Appendix I: Montlake Neighborhood Storage CSO Control Measures

Remaining Overflow Events

Table I. Montlake CSO Area Remaining Overflows

Event summary for all Montlake CSO Area overflows (MG)
NPDES020, 139, 140 without climate change, with KC no-impact release rate

Event	Date	Duration (h)	NPDES140 (MG)	NPDES139 (MG)	NPDES020 (MG)
1	1/9/1990 8:05	13.75	0.08108	0.01309	0.6798
2	11/24/1990 7:55	9.58	0.03048	0	0.1663
3	2/8/1996 19:10	9.67	0	0	0.2563
4	12/29/1996 12:00	11.92	0.1729	0.02404	0.4602
5	12/31/1996 21:00	20.33	0	0.003055	0.09992
6	3/19/1997 0:35	21.58	0	0	0.6227
7	11/23/1997 19:20	0.5	0	0.01544	0
8	11/25/1998 17:15	10.33	0	0	0.2491
9	10/20/2003 9:50	20.25	0.1964	0.01626	0.9631
10	5/27/2004 15:50	0.33	0	0.008055	0
11	8/22/2004 5:35	2	0.07535	0.05665	0.002012
12	12/14/2006 16:30	5.83	0.09683	0.04255	0.1848
13	12/3/2007 2:10	28.5	0.9539	0.1872	3.804
14	5/19/2009 19:40	1.5	0.01132	0.02182	0
Count			8	10	11

Appendix J: Portage Bay Neighborhood Storage CSO Control Measure

Remaining Overflow Events

Table J. Portage Bay NPDES138 remaining overflows

Event summary for 023-192_W023-192 flow (NPDES138))
NPDES138 without climate change; with KC no-impact release rate

Event	Date	Duration (h)	Maximum flow (mgd)	Total flow (MG)
1	11/3/1978 22:30	2.58	4.332	0.05296
2	12/17/1979 15:55	12.67	2.49	0.08948
3	10/5/1981 23:45	21.25	8.136	0.7589
4	12/3/1982 8:55	7.58	5.987	0.6305
5	1/5/1983 6:45	3.75	3.317	0.2199
6	11/20/1983 2:45	3.58	1.248	0.06291
7	1/18/1986 10:20	11.58	7.998	0.8809
8	10/26/1986 14:00	0.75	4.555	0.05049
9	11/24/1986 3:45	2.75	1.103	0.0534
10	1/9/1990 8:15	9.25	2.085	0.2114
11	11/24/1990 7:30	4.33	1.257	0.08109
12	4/5/1991 2:30	2.5	4.676	0.05629
13	2/8/1996 12:20	13.42	3.897	0.08105
14	12/29/1996 12:10	8	3.65	0.4446
15	3/18/1997 20:30	10.42	1.926	0.1408
16	10/20/2003 10:40	6.83	3.349	0.2608
17	8/22/2004 6:20	1.25	4.969	0.1083
18	1/30/2006 2:35	0.75	1.818	0.02034
19	12/14/2006 16:25	1.83	12.47	0.2623
20	12/3/2007 1:30	14.33	5.223	1.388

Appendix K: Shared West Ship Canal Tunnel Storage CSO Control Measure

Remaining Overflow Events

Table K. Shared West Ship Canal Tunnel remaining overflows

Event summary for Ballard end of Shared West Ship Canal overflows
Climate change not included; KC no-impact release rate imposed

Event	Date	Duration (h)	NPDES 152A (MG)	NPDES 152B (MG)	NPDES 150/151 (MG)	KC 11th Ave. NW (MG)
1	1/9/1990 16:40	6.67	0.4645	0	0.0027	0
2	11/24/1990 11:20	26.58	1.893	0	0.0911	0.06687
3	2/8/1996 17:50	12.58	0.749	0	0.1629	0.0942
4	4/23/1996 12:30	11.17	1.049	0	0.112	0.3988
5	12/29/1996 16:25	103.92	16.53	0	3.363	8.457
6	3/19/1997 0:15	28.58	6.019	0	0.887	0.6273
7	10/20/2003 10:30	30	11.79	0	2.61	14.88
8	11/19/2003 3:15	20.17	2.315	0	0.302	0
9	12/3/2007 1:35	39.42	31.79	0.05368	11.97	52.88

Event summary for Fremont/Wallingford end of Shared West Ship Canal overflows
Climate change not included; KC no-impact release rate imposed

Event	Date	Duration (h)	NPDES174 (MG)	KC 3rd Ave. W (MG)	NPDES147 (MG)
1	1/9/1990 16:40	3.42	0.2045	0.179	0.2523
2	11/24/1990 11:20	26.42	0.4684	1.643	0.8407
3	2/8/1996 17:45	10.5	0.9105	1.291	1.002
4	4/23/1996 12:30	11.67	0.5349	1.853	0.9644
5	12/29/1996 16:25	103.58	3.417	12.11	4.378
6	3/19/1997 0:20	22.92	1.315	3.549	1.771
7	10/20/2003 10:30	25.25	3.364	11.78	6.169
8	11/19/2003 3:15	7.83	0.4105	1.953	0.5154
9	12/3/2007 1:35	37.83	9.032	26.77	13.37

Appendix M: Updated LTCP Options Decision Support Material

Control Measure Summary: Chapter 5 Updated Costs

	Neighborhood Storage Option	***Shared West Ship Canal Tunnel Option***
Leschi North	N - 1	N - 1
Leschi South	N - 2	N - 2
Montlake 020	N - 3	N - 3
Montlake 139	N - 4	N - 4
Montlake 140	N - 5	N - 5
Portage Bay	N - 6	N - 6
Duwamish	N - 7	N - 7
East Waterway	N - 8	N - 8
Magnolia	N - 9	N - 9
Central Waterfront	N - 10	N - 10
Ballard	N - 11	T - 2
Fremont/Wallingford	N - 12	T - 2
Delridge 99	N - 13	N - 13
Delridge 168	N - 14	N - 14
Delridge 169	N - 15	N - 15
North Union Bay	N - 16	N - 16
Cost Distribution	CD-1	CD-3

Control Measure N series: Neighborhood Storage
Control Measure T series: Tunnel Storage
CD: Cost Distribution Tables

Total of Updated Summary Document Packages: 16 (N) + 1 (T) = 17
Each Summary Document Package contains:

A 2-page narrative, a 1 to 3 page figure, a capital cost summary, an operating cost summary, and a NPV calculation summary

N-1

CSO Area:	Leschi North
NPDES CSO Outfalls:	028/029/031/032
CSO Control Measure Description:	Off-line Storage

Capital Cost Summary

	2014 Dollars	**Notes**
Hard Cost	$ 10,278,000	
Soft Cost	$ 5,037,000	
Property Cost	$ 1,650,000	Based on King County tax assessor values
Base Cost	**$ 16,965,000**	
Construction Contingency	**$ 3,393,000**	
Management Reserve	**$ 2,545,000**	
Commissioning	**$ 620,000**	
Stabilization	**$ 414,000**	
Total Project Cost	***$ 23,937,000***	

Operating Cost Summary

	2014 Dollars	**Notes**
Post construction monitoring cost	$ 1,034,000	
Annual Operating Cost	$ 65,000	Cost Range $51,000 to $65,000
Annual Flow Meter Maintenance	$ 167,000	14 permanent meters
Annual King County Treatment Fee	$ 770	

NPV Calculation Summary

Construction start:	Year 9
Construction completion; O&M Start:	Year 11
Post-Construction Monitoring:	Year 12
Temporary Flow Monitoring Start:	Year 5
Temporary Flow Monitoring Completion:	Year 14

	2014 Dollars	**Notes**
Capital Costs	$ 22,379,000	
Annual Operating Costs	$ 65,000	
Electrical Replacements (10 year cycle)	$ 234,000	
Mechanical Replacements (25 year cycle)	$ 510,000	
Structural Replacements (50 year cycle)	$ 542,000	
Treatment Fees	$ 770	
Meter Replacement (5 year cycle)	$ 292,000	14 flow meters.
Meter Maintenance - Annual Cost	$ 167,000	14 flow meters.
Net Present Value	$ 27,510,000	

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)

Takeoff By:
Estimate By: C.Au-Yeung
Date: 7/29/2013
Rev: 8/29/2013 C.Au-Yeung
Rev: 12/18/2013 C.Au-Yeung
Rev: 2/11/2014 C.Au-Yeung
Rev: 11/12/2014 C.Au-Yeung

Project Type: SPU North Leschi (NPDES028,029,031,032) CSO Control Measure - Storage Tank in Parks Property, Two Storage Pipes in Right-of-Way

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 7,500,000	$ 790,000	$ -	$ -	$ -	$ 6,050,000	$ 660,000	$ -
B	**Subtotal**	**$ 7,500,000**	**$ 790,000**	**$ -**	**$ -**	**$ -**	**$ 6,050,000**	**$ 660,000**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 75,000	$ 7,900	$ -	$ -	$ -	$ 60,500	$ 6,600	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 7,575,000	$ 797,900	$ -	$ -	$ -	$ 6,110,500	$ 666,600	$ -
F	Construction Line Item Pricing (See above for ENR Index Date)	$ 8,162,000	$ 860,000	$ -	$ -	$ -	$ 6,584,000	$ 718,000	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 1,224,300	$ 129,000	$ -	$ -	$ -	$ 987,600	$ 107,700	$ -
I	**Construction Bid Amount**	**$ 9,387,000**	**$ 989,000**	**$ -**	**$ -**	**$ -**	**$ 7,572,000**	**$ 826,000**	**$ -**
J	Sales Tax[2]	$ 891,765	$ 93,955	$ -	$ -	$ -	$ 719,340	$ 78,470	$ -
K	**Construction Contract Amount**	**$ 10,278,000**	**$ 1,083,000**	**$ -**	**$ -**	**$ -**	**$ 8,291,000**	**$ 904,000**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 10,278,000**	**$ 1,083,000**	**$ -**	**$ -**	**$ -**	**$ 8,291,000**	**$ 904,000**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 5,037,000	$ 531,000	$ -	$ -	$ -	$ 4,063,000	$ 443,000	$ -
Q	Property Cost (Per SPU Real Estate)	$ 1,650,000	$ -	$ -	$ -	$ -	$ 1,650,000	$ -	$ -
R	**Base Cost**	**$ 16,965,000**	**$ 1,614,000**	**$ -**	**$ -**	**$ -**	**$ 14,004,000**	**$ 1,347,000**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 3,393,000	$ 323,000	$ -	$ -	$ -	$ 2,801,000	$ 269,000	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 2,545,000	$ 242,000	$ -	$ -	$ -	$ 2,101,000	$ 202,000	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 22,910,000**	**$ 2,180,000**	**$ -**	**$ -**	**$ -**	**$ 18,910,000**	**$ 1,820,000**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **North Leschi (NPDES028/029/031/032) updated for model results**

5/13/2014

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/ Base Cost*	*Ann Freq*	*Anticipated Annual Cost*	*Variability Multiplier*	*High End Annual Cost*
Conveyance Pipeline- special cleaning	7	Typical	250	LF	$ 1.75	1	$ 438	1	$ 438
		Arterial	1600	LF	$ 2.00	1	$ 3,200	1	$ 3,200
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main	120	LF	$ 1.00	1	$ 120	1	$ 120
Diversion Structure									
		Type 1 - Basic	3	ea	$ 260	4	$ 3,120	1.5	$ 4,680
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized	1	ea	$ 1,000	4	$ 2,040	1.5	$ 3,060
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	$ -
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP	2	ea	$ 5,000	1	$ 10,000	1.25	$ 12,500
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge	15	HP		1	$ 138	1	$ 138
Storage Tanks	12								
		Type 1 - < 72-inch pipe	360	LF	$ 1.75	2	$ 2,300	1.25	$ 2,875
		Type 2 - < 1.5 MG	1	ea	$ 16,500	1	$ 16,500	1.25	$ 20,625
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket	2	ea	$ 1,040	1	$ 2,080	1.5	$ 3,120
Odor Control									
			0.39	MG	$ 7,121	1	$ 7,121	1.25	$ 8,901
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance			2	ea	$ 2,040	6	$ 4,080	1.25	$ 5,100
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 51,137		$ 64,757

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟫	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%	
	Notes	
Project Title		Long Term CSO Control Plan
Option		Neighborhood
CSO Area		Leschi (North)
CSO Basin(s)		028, 029, 031, 032
Control Measure		Off-Line Storage Tank and Pipes
ENR CCI		10161.68
Construction Completion (Start of O&M)		11
Start of Flow Monitoring (end of year)		4
End of Flow Monitoring		100
Present Value Cost over 100yrs at discount		$ 27,510,000
CAPITAL COSTS		
Hard Cost		$ 10,278,000
Property Cost (burdened)		$ 2,228,000
Total Costs		$ 22,910,000

				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			*$ 1,449,000*	$ -	$ -	$ -	$ -	$ 827,300	$ 827,300	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Design			*$ 2,560,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,551,188	$ 1,551,188	$ -	$ -	$ -	$ -	$ -	$ -
Bid/Award			*$ 327,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 413,650	$ -	$ -	$ -	$ -	$ -
Construction			*$ 11,800,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,877,969	$ 7,755,938	$ 3,877,969	$ -	$ -	$ -
Property			*$ 1,812,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,228,000	$ -	$ -	$ -	$ -	$ -	$ -
			$ -														
Commissioning	1		*$ 455,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 310,238	$ 310,238	$ -	$ -
Operations Acceptance Testing	2		*$ 303,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 206,825	$ 206,825	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		*$ 736,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 517,063	$ 517,063	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance				$ -											
Annual Operations & Main1	1	$ 65,000	*$ 1,496,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 65,000*	*$ 65,000*	*$ 65,000*
Replacements	10	$ 234,000	*$ 459,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	25	$ 510,000	*$ 309,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	50	$ 542,000	*$ 92,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
KC Annual Fee	1	$ 770	*$ 18,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 770*	*$ 770*	*$ 770*
Meter Replacements	5	$ 20,880	*$ 1,409,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 41,760*	$ -	$ -	$ -	$ -	*$ 334,080*
Meter Maintenance	1	$ 11,950	*$ 4,037,000*	$ -	$ -	$ -	$ -	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 191,200*	*$ 191,200*	*$ 191,200*
New Meter Installation		$ 20,880	*$ 248,000*	$ -	$ -	$ -	$ -	*$ 41,760*	$ -	$ -	$ -	$ -	$ -	$ -	*$ 292,320*	$ -	$ -
SUM CAPITAL			**$ 20,363,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 7,147,000**														

Notes:
1. 2% Commissioning
2. 3% Acceptance Testing
3. 2% Post Construction Monitoring

Yellow indicates output

Bold Box = Inputs

Italics indicates formula

N-2

CSO Area:	Leschi South
NPDES CSO Outfalls:	036
CSO Control Measure Description:	Offline Storage Pipe

Capital Cost Summary

	2014 Dollars	Notes
Hard Cost	$ 1,672,000	
Soft Cost	$ 819,000	
Property Cost	$ -	Based on King County tax assessor values
Base Cost	**$ 2,491,000**	
Construction Contingency	**$ 499,000**	
Management Reserve	**$ 374,000**	
Commissioning	**$ 101,000**	
Stabilization	**$ 67,000**	
Total Project Cost	***$ 3,532,000***	

Operating Cost Summary

	2014 Dollars	Notes
Post construction monitoring cost	$ 169,000	
Annual Operating Cost	$ 34,000	Cost Range $27,000 to $34,000
Annual Flow Meter Maintenance	$ 48,000	4 permanent meters
Annual King County Treatment Fee	$ 40	

NPV Calculation Summary

Construction start:	Year 9
Construction completion; O&M Start:	Year 11
Post-Construction Monitoring:	Year 12
Temporary Flow Monitoring Start:	Year 12
Temporary Flow Monitoring Completion:	Year 14

	2014 Dollars	Notes
Capital Costs	$ 3,275,000	
Annual Operating Costs	$ 34,000	
Electrical Replacements (10 year cycle)	$ 40,000	
Mechanical Replacements (25 year cycle)	$ 128,000	
Structural Replacements (50 year cycle)	$ 195,000	
Treatment Fees	$ 40	
Meter Replacement (5 year cycle)	$ 84,000	4 flow meters.
Meter Maintenance - Annual Cost	$ 48,000	4 flow meters.
Net Present Value	$ 5,521,000	

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)

Takeoff By:					
Estimate By:	C.Au-Yeung				
Date:	7/31/2013				
Rev:	8/29/2013	C.Au-Yeung	Rev:	2/11/2014	C.Au-Yeung
Rev:	12/18/2013	C.Au-Yeung	Rev:	11/12/2014	C.Au-Yeung
Rev:	1/3/2014	C.Au-Yeung			

Project Type: SPU South Leschi (NPDES036) CSO Control Measure - Off-Line Storage Pipe in the Right-of-Way

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 1,220,000	$ 330,000	$ -	$ -	$ -	$ 790,000	$ 100,000	$ -
B	**Subtotal**	**$ 1,220,000**	**$ 330,000**	**$ -**	**$ -**	**$ -**	**$ 790,000**	**$ 100,000**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 12,200	$ 3,300	$ -	$ -	$ -	$ 7,900	$ 1,000	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 1,232,200	$ 333,300	$ -	$ -	$ -	$ 797,900	$ 101,000	$ -
F	Construction Line Item Pricing (See above for ENR Index Date	$ 1,328,000	$ 359,000	$ -	$ -	$ -	$ 860,000	$ 109,000	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 199,200	$ 53,850	$ -	$ -	$ -	$ 129,000	$ 16,350	$ -
I	**Construction Bid Amount**	**$ 1,527,000**	**$ 413,000**	**$ -**	**$ -**	**$ -**	**$ 989,000**	**$ 125,000**	**$ -**
J	Sales Tax[2]	$ 145,065	$ 39,235	$ -	$ -	$ -	$ 93,955	$ 11,875	$ -
K	**Construction Contract Amount**	**$ 1,672,000**	**$ 452,000**	**$ -**	**$ -**	**$ -**	**$ 1,083,000**	**$ 137,000**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 1,672,000**	**$ 452,000**	**$ -**	**$ -**	**$ -**	**$ 1,083,000**	**$ 137,000**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 819,000	$ 221,000	$ -	$ -	$ -	$ 531,000	$ 67,000	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 2,491,000**	**$ 673,000**	**$ -**	**$ -**	**$ -**	**$ 1,614,000**	**$ 204,000**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 499,000	$ 135,000	$ -	$ -	$ -	$ 323,000	$ 41,000	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 374,000	$ 101,000	$ -	$ -	$ -	$ 242,000	$ 31,000	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 3,370,000**	**$ 910,000**	**$ -**	**$ -**	**$ -**	**$ 2,180,000**	**$ 280,000**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **South Leschi (NPDES036) updated for model results**

5/13/2014

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/*	*Ann*	*Anticipated*	*Variability*	*High End*
					Base Cost	*Freq*	*Annual Cost*	*Multiplier*	*Annual Cost*
Conveyance Pipeline- special cleaning	7	Typical	50	LF	$ 1.75	1	$ 88	1	$ 88
		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main	50	LF	$ 1.00	1	$ 50	1	$ 50
Diversion Structure									
		Type 1 - Basic	1	ea	$ 260	4	$ 1,040	1.5	$ 1,560
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized		ea	$ 1,000	4	$ -	1.5	$ -
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	$ -
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP	1	ea	$ 5,000	1	$ 5,000	1.25	$ 6,250
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge	5	HP		1	$ 46	1	$ 46
Storage Tanks	12								
		Type 1 - < 72-inch pipe		LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG	1	ea	$ 16,500	1	$ 16,500	1.25	$ 20,625
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
			0.03	MG	$ 2,117	1	$ 2,117	1.25	$ 2,646
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance			1	ea	$ 2,040	6	$ 2,040	1.25	$ 2,550
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 26,881		$ 33,815

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟧	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%	
	Notes	
Project Title		Long Term CSO Control Plan
Option		Neighborhood
CSO Area		Leschi (South)
CSO Basin(s)		036
Control Measure		Off-Line Storage Pipe
ENR CCI		10161.68
Construction Completion (Start of O&M)		11
Start of Flow Monitoring (end of year)		11
End of Flow Monitoring		100
Present Value Cost over 100yrs at discount		$ 5,521,000
CAPITAL COSTS		
Hard Cost		$ 1,672,000
Property Cost (burdened)		$ -
Total Costs		$ 3,370,000

				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			*$ 236,000*	$ -	$ -	$ -	$ -	$ 134,800	$ 134,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Design			*$ 417,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ 252,750	$ 252,750	$ -	$ -	$ -	$ -	$ -	$ -
Bid/Award			*$ 53,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 67,400	$ -	$ -	$ -	$ -	$ -
Construction			*$ 1,923,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 631,875	$ 1,263,750	$ 631,875	$ -	$ -	$ -
Property			*$ -*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
			$ -														
Commissioning	1		*$ 74,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 50,550	$ 50,550	$ -	$ -
Operations Acceptance Testing	2		*$ 49,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 33,700	$ 33,700	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		*$ 120,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 84,250	$ 84,250	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance				$ -											
Annual Operations & Main1	1	$ 33,800	*$ 778,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 33,800*	*$ 33,800*	*$ 33,800*
Replacements	10	$ 40,000	*$ 78,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	25	$ 128,000	*$ 78,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	50	$ 195,000	*$ 33,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
KC Annual Fee	1	$ 40	*$ 1,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 40*	*$ 40*	*$ 40*
Meter Replacements	5	$ 20,880	*$ 359,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Meter Maintenance	1	$ 11,950	*$ 1,201,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 95,600*	*$ 95,600*	*$ 95,600*
New Meter Installation		$ 20,880	*$ 121,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 167,040*	$ -	$ -
SUM CAPITAL			**$ 3,232,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 2,289,000**														

Notes:
1. 2% Commissioning
2. 3% Acceptance Testing
3. 2% Post Construction Monitoring
Yellow indicates output
Bold Box = Inputs
Italics indicates formula

N-3

CSO Area:	Montlake
NPDES CSO Outfalls:	020
CSO Control Measure Description:	Off-Line Storage Pipe in Right-of-Way

Capital Cost Summary

	2014 Dollars	Notes
Hard Cost	$ 3,960,000	
Soft Cost	$ 1,940,000	
Property Cost	$ -	Based on King County tax assessor values
Base Cost	**$ 5,900,000**	
Construction Contingency	**$ 1,179,000**	
Management Reserve	**$ 886,000**	
Commissioning	**$ 239,000**	
Stabilization	**$ 159,000**	
Total Project Cost	***$ 8,363,000***	

Operating Cost Summary

	2014 Dollars	Notes
Post construction monitoring cost	$ 399,000	
Annual Operating Cost	$ 41,000	Cost Range $32,000 to $41,000
Annual Flow Meter Maintenance	$ 60,000	5 permanent meters
Annual King County Treatment Fee	$ 120	

NPV Calculation Summary

Construction start:	Year 10
Construction completion; O&M Start:	Year 11
Post-Construction Monitoring:	Year 12
Temporary Flow Monitoring Start:	Year 7
Temporary Flow Monitoring Completion:	Year 13

	2014 Dollars	Notes
Capital Costs	$ 8,363,000	
Annual Operating Costs	$ 41,000	
Electrical Replacements (10 year cycle)	$ 159,000	
Mechanical Replacements (25 year cycle)	$ -	
Structural Replacements (50 year cycle)	$ -	
Treatment Fees	$ 120	
Meter Replacement (5 year cycle)	$ 104,000	5 flow meters.
Meter Maintenance - Annual Cost	$ 60,000	5 flow meters.
Net Present Value	$ 9,989,000	

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)

Takeoff By:
Estimate By: C.Au-Yeung
Date: 8/1/2013
Rev: 8/29/2013 C.Au-Yeung
Rev: 12/31/2013 C.Au-Yeung
Rev: 2/11/2014 C.Au-Yeung
Rev: 11/10/2014 C.Au-Yeung

Project Type: SPU Montlake (NPDES020) CSO Control Measure: Off-Line Pipe Storage in Right-of-Way

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 2,890,000	$ 300,000	$ -	$ -	$ -	$ 2,180,000	$ 410,000	$ -
B	**Subtotal**	**$ 2,890,000**	**$ 300,000**	**$ -**	**$ -**	**$ -**	**$ 2,180,000**	**$ 410,000**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 28,900	$ 3,000	$ -	$ -	$ -	$ 21,800	$ 4,100	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 2,918,900	$ 303,000	$ -	$ -	$ -	$ 2,201,800	$ 414,100	$ -
F	Construction Line Item Pricing (See above for ENR Index Date)	$ 3,145,000	$ 326,000	$ -	$ -	$ -	$ 2,372,000	$ 446,000	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 471,600	$ 48,900	$ -	$ -	$ -	$ 355,800	$ 66,900	$ -
I	**Construction Bid Amount**	**$ 3,616,000**	**$ 375,000**	**$ -**	**$ -**	**$ -**	**$ 2,728,000**	**$ 513,000**	**$ -**
J	Sales Tax[2]	$ 343,520	$ 35,625	$ -	$ -	$ -	$ 259,160	$ 48,735	$ -
K	**Construction Contract Amount**	**$ 3,960,000**	**$ 411,000**	**$ -**	**$ -**	**$ -**	**$ 2,987,000**	**$ 562,000**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 3,960,000**	**$ 411,000**	**$ -**	**$ -**	**$ -**	**$ 2,987,000**	**$ 562,000**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 1,940,000	$ 201,000	$ -	$ -	$ -	$ 1,464,000	$ 275,000	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 5,900,000**	**$ 612,000**	**$ -**	**$ -**	**$ -**	**$ 4,451,000**	**$ 837,000**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 1,179,000	$ 122,000	$ -	$ -	$ -	$ 890,000	$ 167,000	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 886,000	$ 92,000	$ -	$ -	$ -	$ 668,000	$ 126,000	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 7,970,000**	**$ 830,000**	**$ -**	**$ -**	**$ -**	**$ 6,010,000**	**$ 1,130,000**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **Montlake Neighborhood NPDES020 with climate change, updated for model results**

5/13/2014

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/*	*Ann*	*Anticipated*	*Variability*	*High End*
					Base Cost	*Freq*	*Annual Cost*	*Multiplier*	*Annual Cost*
Conveyance Pipeline-	7	Typical	50	LF	$ 1.75	1	$ 88	1	$ 88
special cleaning		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main	50	LF	$ 1.00	1	$ 50	1	$ 50
Diversion Structure									
		Type 1 - Basic	2	ea	$ 260	4	$ 2,080	1.5	$ 3,120
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized	1	ea	$ 1,000	4	$ 2,040	1.5	$ 3,060
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	$ -
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP	1	ea	$ 5,000	1	$ 5,000	1.25	$ 6,250
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge	10	HP		1	$ 92	1	$ 92
Storage Tanks	12								
		Type 1 - < 72-inch pipe		LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG	1	ea	$ 16,500	1	$ 16,500	1.25	$ 20,625
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
			0.16	MG	$ 3,924	1	$ 3,924	1.25	$ 4,905
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance			1	ea	$ 2,040	6	$ 2,040	1.25	$ 2,550
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 31,814		$ 40,740

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟫	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Neighborhood															
CSO Area		Montlake															
CSO Basin(s)		020															
Control Measure		Off-Line Storage Pipe in Right-of-Way															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		11															
Start of Flow Monitoring (end of year)		6															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 9,989,000															
CAPITAL COSTS																	
Hard Cost		$ 3,960,000															
Property Cost (burdened)		$ -															
Total Costs		$ 7,970,000															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			*$ 518,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 637,600	$ -	$ -	$ -	$ -	$ -	$ -
Design			*$ 944,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,195,500	$ -	$ -	$ -	$ -	$ -
Bid/Award			*$ 122,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 159,400	$ -	$ -	$ -	$ -
Construction			*$ 4,479,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,988,750	$ 2,988,750	$ -	$ -	$ -
Property			*$ -*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		*$ 175,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 119,550	$ 119,550	$ -	$ -
Operations Acceptance Testing	2		*$ 117,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 79,700	$ 79,700	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		*$ 284,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 199,250	$ 199,250	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance															
Annual Operations & Main1	1	$ 40,700	*$ 937,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 40,700*	*$ 40,700*	*$ 40,700*
Replacements	10	$ 159,000	*$ 312,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	25	$ -	*$ -*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	6	$ -	*$ -*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
KC Annual Fee	1	$ 120	*$ 3,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 120*	*$ 120*	*$ 120*
Meter Replacements	5	$ 20,880	*$ 479,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 41,760*	$ -	$ -	$ -
Meter Maintenance	1	$ 11,950	*$ 1,522,000*	$ -	$ -	$ -	$ -	$ -	$ -	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 71,700*	*$ 71,700*	*$ 71,700*	*$ 59,750*
New Meter Installation		$ 20,880	*$ 97,000*	$ -	$ -	$ -	$ -	$ -	$ -	*$ 41,760*	$ -	$ -	$ -	*$ 83,520*	$ -	$ -	$ -
SUM CAPITAL			**$ 6,931,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 3,058,000**														
Notes:																	
1. 2% Commissioning																	
2. 3% Acceptance Testing																	
3. 2% Post Construction Monitoring																	
Yellow indicates output																	
Bold Box = Inputs																	
Italics indicates formula																	

N-4

CSO Area:	Montlake
NPDES CSO Outfalls:	139
CSO Control Measure Description:	Off-Line Storage Pipe in Right-of-Way

Capital Cost Summary

		2014 Dollars	Notes
Hard Cost	$	699,000	
Soft Cost	$	342,000	
Property Cost	$	-	Based on King County tax assessor values
Base Cost	**$**	**1,041,000**	
Construction Contingency	**$**	**208,000**	
Management Reserve	**$**	**156,000**	
Commissioning	**$**	**42,000**	
Stabilization	**$**	**28,000**	
Total Project Cost	***$***	***1,475,000***	

Operating Cost Summary

		2014 Dollars	Notes
Post construction monitoring cost	$	71,000	
Annual Operating Cost	$	6,000	Cost Range $4,000 to $6,000
Annual Flow Meter Maintenance	$	24,000	2 permanent meters
Annual King County Treatment Fee	$	5	

NPV Calculation Summary

Construction start:	Year 10
Construction completion; O&M Start:	Year 10
Post-Construction Monitoring:	Year 12
Temporary Flow Monitoring Start:	Year 7
Temporary Flow Monitoring Completion:	Not applicable

		2014 Dollars	Notes
Capital Costs	$	1,475,000	
Annual Operating Costs	$	6,000	
Electrical Replacements (10 year cycle)	$	32,000	
Mechanical Replacements (25 year cycle)	$	-	
Structural Replacements (50 year cycle)	$	-	
Treatment Fees	$	5	
Meter Replacement (5 year cycle)	$	42,000	2 flow meters.
Meter Maintenance - Annual Cost	$	24,000	2 flow meters.
Net Present Value	$	2,217,000	

Note 1: Included in system-wide NPV value

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)

Takeoff By:
Estimate By: C.Au-Yeung
Date: 8/1/2013
Rev: 8/29/2013 C.Au-Yeung Rev: 11/10/2014 C.Au-Yeung
Rev: 12/26/2013 C.Au-Yeung
Rev: 2/11/2014 C.Au-Yeung

Project Type: SPU Montlake (NPDES139) CSO Control Measure: Off-Line Pipe Storage in Right-of-Way

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 510,000	$ 160,000	$ -	$ -	$ -	$ 350,000	$ -	$ -
B	**Subtotal**	**$ 510,000**	**$ 160,000**	**$ -**	**$ -**	**$ -**	**$ 350,000**	**$ -**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 5,100	$ 1,600	$ -	$ -	$ -	$ 3,500	$ -	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 515,100	$ 161,600	$ -	$ -	$ -	$ 353,500	$ -	$ -
F	Construction Line Item Pricing (See above for ENR Index Date	$ 555,000	$ 174,000	$ -	$ -	$ -	$ 381,000	$ -	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 83,250	$ 26,100	$ -	$ -	$ -	$ 57,150	$ -	$ -
I	**Construction Bid Amount**	**$ 638,000**	**$ 200,000**	**$ -**	**$ -**	**$ -**	**$ 438,000**	**$ -**	**$ -**
J	Sales Tax[2]	$ 60,610	$ 19,000	$ -	$ -	$ -	$ 41,610	$ -	$ -
K	**Construction Contract Amount**	**$ 699,000**	**$ 219,000**	**$ -**	**$ -**	**$ -**	**$ 480,000**	**$ -**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 699,000**	**$ 219,000**	**$ -**	**$ -**	**$ -**	**$ 480,000**	**$ -**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 342,000	$ 107,000	$ -	$ -	$ -	$ 235,000	$ -	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 1,041,000**	**$ 326,000**	**$ -**	**$ -**	**$ -**	**$ 715,000**	**$ -**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 208,000	$ 65,000	$ -	$ -	$ -	$ 143,000	$ -	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 156,000	$ 49,000	$ -	$ -	$ -	$ 107,000	$ -	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 1,410,000**	**$ 440,000**	**$ -**	**$ -**	**$ -**	**$ 970,000**	**$ -**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **Montlake Neighborhood** **NPDES139**

5/13/2014

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/ Base Cost*	*Ann Freq*	*Anticipated Annual Cost*	*Variability Multiplier*	*High End Annual Cost*
Conveyance Pipeline- special cleaning	7	Typical	25	LF	$ 1.75	1	$ 44	1	$ 44
		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main		LF	$ 1.00	1	$ -	1	$ -
Diversion Structure									
		Type 1 - Basic	1	ea	$ 260	4	$ 1,040	1.5	$ 1,560
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized	1	ea	$ 1,000	4	$ 2,040	1.5	$ 3,060
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	$ -
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP		ea	$ 5,000	1	$ -	1.25	$ -
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	$ -
Storage Tanks	12								
		Type 1 - < 72-inch pipe	75	LF	$ 1.75	2	$ 1,303	1.25	$ 1,628
		Type 2 - < 1.5 MG		ea	$ 16,500	1	$ -	1.25	$ -
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
				MG	$ 1,700	1	$ -	1.25	$ -
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance				ea	$ 2,040	6	$ -	1.25	$ -
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 4,426		$ 6,292

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟧	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Neighborhood															
CSO Area		Montlake															
CSO Basin(s)		139															
Control Measure		Off-Line Storage Pipe in Right-of-Way															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		11															
Start of Flow Monitoring (end of year)		6															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 2,217,000															
CAPITAL COSTS																	
Hard Cost		$ 699,000															
Property Cost (burdened)		$ -															
Total Costs		$ 1,410,000															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			*$ 92,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 112,800	$ -	$ -	$ -	$ -	$ -	$ -
Design			*$ 167,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 211,500	$ -	$ -	$ -	$ -	$ -
Bid/Award			*$ 22,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 28,200	$ -	$ -	$ -	$ -
Construction			*$ 792,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 528,750	$ 528,750	$ -	$ -	$ -
Property			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		*$ 31,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 21,150	$ 21,150	$ -	$ -
Operations Acceptance Testing	2		*$ 21,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 14,100	$ 14,100	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		*$ 50,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 35,250	$ 35,250	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance				0											
Annual Operations & Main1	1	$ 6,300	*$ 145,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 6,300*	*$ 6,300*	*$ 6,300*
Replacements	10	$ 32,000	*$ 63,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Replacements	25	$ -	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Replacements	6	$ -	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
KC Annual Fee	1	$ 5	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 5*	*$ 5*	*$ 5*
Meter Replacements	5	$ 20,880	*$ 195,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 20,880*	*$ -*	*$ -*	*$ -*
Meter Maintenance	1	$ 11,950	*$ 606,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 11,950*	*$ 11,950*	*$ 11,950*	*$ 11,950*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*
New Meter Installation		$ 20,880	*$ 33,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 20,880*	*$ -*	*$ -*	*$ -*	*$ 20,880*	*$ -*	*$ -*	*$ -*
SUM CAPITAL			**$ 1,353,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 864,000**														
Notes:																	
1. 2% Commissioning																	
2. 3% Acceptance Testing																	
3. 2% Post Construction Monitoring																	
Yellow indicates output																	
Bold Box = Inputs																	
Italics indicates formula																	

N-5

CSO Area:	Montlake
NPDES CSO Outfalls:	140
CSO Control Measure Description:	Off-Line Storage Pipe in Right-of-Way

Capital Cost Summary

	2014 Dollars		Notes
Hard Cost	$	1,686,000	
Soft Cost	$	826,000	
Property Cost	$	-	Based on King County tax assessor values
Base Cost	**$**	**2,512,000**	
Construction Contingency	**$**	**502,000**	
Management Reserve	**$**	**377,000**	
Commissioning	**$**	**102,000**	
Stabilization	**$**	**68,000**	
Total Project Cost	***$***	***3,561,000***	

Operating Cost Summary

	2014 Dollars		Notes
Post construction monitoring cost	$	170,000	
Annual Operating Cost	$	25,000	Cost Range $20,000 to $25,000
Annual Flow Meter Maintenance	$	48,000	4 permanent meters
Annual King County Treatment Fee	$	60	

NPV Calculation Summary

Construction start:	Year 10
Construction completion; O&M Start:	Year 11
Post-Construction Monitoring:	Year 12
Temporary Flow Monitoring Start:	Year 7
Temporary Flow Monitoring Completion:	Not applicable

	2014 Dollars		Notes
Capital Costs	$	3,561,000	
Annual Operating Costs	$	25,000	
Electrical Replacements (10 year cycle)	$	45,000	
Mechanical Replacements (25 year cycle)	$	-	
Structural Replacements (50 year cycle)	$	-	
Treatment Fees	$	60	
Meter Replacement (5 year cycle)	$	84,000	4 flow meters.
Meter Maintenance - Annual Cost	$	48,000	4 flow meters.
Net Present Value	$	5,164,000	

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)

Takeoff By:
Estimate By: C.Au-Yeung
Date: 8/1/2013
Rev: 8/29/2013 C.Au-Yeung
Rev: 12/31/2013 C.Au-Yeung
Rev: 2/11/2014 C.Au-Yeung
Rev: 11/10/2014 C.Au-Yeung

Project Type: SPU Montlake (NPDES140) CSO Control Measure: Off-Line Storage Pipe in Right-of-Way

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 1,230,000	$ 170,000	$ -	$ -	$ -	$ 1,060,000	$ -	$ -
B	**Subtotal**	**$ 1,230,000**	**$ 170,000**	**$ -**	**$ -**	**$ -**	**$ 1,060,000**	**$ -**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 12,300	$ 1,700	$ -	$ -	$ -	$ 10,600	$ -	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 1,242,300	$ 171,700	$ -	$ -	$ -	$ 1,070,600	$ -	$ -
F	Construction Line Item Pricing (See above for ENR Index Date	$ 1,339,000	$ 185,000	$ -	$ -	$ -	$ 1,154,000	$ -	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 200,850	$ 27,750	$ -	$ -	$ -	$ 173,100	$ -	$ -
I	**Construction Bid Amount**	**$ 1,540,000**	**$ 213,000**	**$ -**	**$ -**	**$ -**	**$ 1,327,000**	**$ -**	**$ -**
J	Sales Tax[2]	$ 146,300	$ 20,235	$ -	$ -	$ -	$ 126,065	$ -	$ -
K	**Construction Contract Amount**	**$ 1,686,000**	**$ 233,000**	**$ -**	**$ -**	**$ -**	**$ 1,453,000**	**$ -**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 1,686,000**	**$ 233,000**	**$ -**	**$ -**	**$ -**	**$ 1,453,000**	**$ -**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 826,000	$ 114,000	$ -	$ -	$ -	$ 712,000	$ -	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 2,512,000**	**$ 347,000**	**$ -**	**$ -**	**$ -**	**$ 2,165,000**	**$ -**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 502,000	$ 69,000	$ -	$ -	$ -	$ 433,000	$ -	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 377,000	$ 52,000	$ -	$ -	$ -	$ 325,000	$ -	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 3,390,000**	**$ 470,000**	**$ -**	**$ -**	**$ -**	**$ 2,920,000**	**$ -**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **Montlake Neighborhood** **NPDES140**

5/13/2014

Cost Element	***Note***	***Type/Condition***	***Quantity***	***Unit***	***Unit Cost/ Base Cost***	***Ann Freq***	***Anticipated Annual Cost***	***Variability Multiplier***	***High End Annual Cost***
Conveyance Pipeline- special cleaning	7	Typical	60	LF	$ 1.75	1	$ 105	1	$ 105
		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main		LF	$ 1.00	1	$ -	1	$ -
Diversion Structure									
		Type 1 - Basic	1	ea	$ 260	4	$ 1,040	1.5	$ 1,560
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized		ea	$ 1,000	4	$ -	1.5	$ -
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	$ -
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP		ea	$ 5,000	1	$ -	1.25	$ -
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	$ -
Storage Tanks	12								
		Type 1 - < 72-inch pipe		LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG	1	ea	$ 16,500	1	$ 16,500	1.25	$ 20,625
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
			0.05	MG	$ 2,395	1	$ 2,395	1.25	$ 2,994
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance				ea	$ 2,040	6	$ -	1.25	$ -
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 20,040		$ 25,284

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟫	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%	
	Notes	
Project Title		Long Term CSO Control Plan
Option		Neighborhood
CSO Area		Montlake
CSO Basin(s)		140
Control Measure		Off-Line Storage Pipe in Right-of-Way
ENR CCI		10161.68
Construction Completion (Start of O&M)		11
Start of Flow Monitoring (end of year)		6
End of Flow Monitoring		100
Present Value Cost over 100yrs at discount		$ 5,164,000
CAPITAL COSTS		
Hard Cost		$ 1,686,000
Property Cost (burdened)		$ -
Total Costs		$ 3,390,000

				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Engineering Report			$ 221,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 271,200	$ -	$ -	$ -	$ -	$ -	$ -
Design			$ 401,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 508,500	$ -	$ -	$ -	$ -	$ -
Bid/Award			$ 52,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 67,800	$ -	$ -	$ -	$ -
Construction			$ 1,905,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,271,250	$ 1,271,250	$ -	$ -	$ -
Property			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		$ 75,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 50,850	$ 50,850	$ -	$ -
Operations Acceptance Testing	2		$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 33,900	$ 33,900	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		$ 121,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 84,750	$ 84,750	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance															
Annual Operations & Main1	1	$ 25,300	$ 582,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 25,300	$ 25,300	$ 25,300
Replacements	10	$ 45,000	$ 88,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	25	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	6	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
KC Annual Fee	1	$ 60	$ 1,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 60	$ 60	$ 60
Meter Replacements	5	$ 20,880	$ 390,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 41,760	$ -	$ -	$ -
Meter Maintenance	1	$ 11,950	$ 1,212,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 23,900	$ 23,900	$ 23,900	$ 23,900	$ 47,800	$ 47,800	$ 47,800	$ 47,800
New Meter Installation		$ 20,880	$ 66,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 41,760	$ -	$ -	$ -	$ 41,760	$ -	$ -	$ -
SUM CAPITAL			$ 3,160,000														
SUM OPERATIONS AND MAINTENANCE			$ 2,004,000														

Notes:
1. 2% Commissioning
2. 3% Acceptance Testing
3. 2% Post Construction Monitoring
Yellow indicates output
Bold Box = Inputs
Italics indicates formula

N-6

CSO Area:	Portage Bay
NPDES CSO Outfalls:	138
CSO Control Measure Description:	Off-Line Storage Pipe in Right-of-Way

Capital Cost Summary

	2014 Dollars	**Notes**
Hard Cost	$ 4,084,000	
Soft Cost	$ 2,001,000	
Property Cost	$ -	Based on King County tax assessor values
Base Cost	**$ 6,085,000**	
Construction Contingency	**$ 1,217,000**	
Management Reserve	**$ 913,000**	
Commissioning	**$ 247,000**	
Stabilization	**$ 164,000**	
Total Project Cost	***$ 8,626,000***	

Operating Cost Summary

	2014 Dollars	**Notes**
Post construction monitoring cost	$ 411,000	
Annual Operating Cost	$ 30,000	Cost Range $23,000 to $30,000
Annual Flow Meter Maintenance	$ 24,000	2 permanent meters
Annual King County Treatment Fee	$ 90	

NPV Calculation Summary

Construction start:	Year 5
Construction completion; O&M Start:	Year 6
Post-Construction Monitoring:	Year 7
Temporary Flow Monitoring Start:	Year 3
Temporary Flow Monitoring Completion:	Year 5

	2014 Dollars	**Notes**
Capital Costs	$ 8,626,000	
Annual Operating Costs	$ 30,000	
Electrical Replacements (10 year cycle)	$ 81,000	
Mechanical Replacements (25 year cycle)	$ 51,000	
Structural Replacements (50 year cycle)	$ -	
Treatment Fees	$ 90	
Meter Replacement (5 year cycle)	$ 42,000	2 flow meters.
Meter Maintenance - Annual Cost	$ 24,000	2 flow meters.
Net Present Value	$ 10,158,000	

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)

Takeoff By: C.Au-Yeung
Estimate By: C.Au-Yeung
Date: 7/19/2013
Rev: 8/29/2013 C.Au-Yeung Rev: 2/17/2014 C.Au-Yeung
Rev: 12/11/2013 C.Au-Yeung Rev: 11/10/2014 C.Au-Yeung

SPU Portage Bay CSO Control Measure: Off-Line Pipe Storage in Right-of-Way

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 2,980,000	$ 710,000	$ -	$ -	$ -	$ 2,270,000	$ -	$ -
B	**Subtotal**	**$ 2,980,000**	**$ 710,000**	**$ -**	**$ -**	**$ -**	**$ 2,270,000**	**$ -**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 29,800	$ 7,100	$ -	$ -	$ -	$ 22,700	$ -	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 3,009,800	$ 717,100	$ -	$ -	$ -	$ 2,292,700	$ -	$ -
F	Construction Line Item Pricing (See above for ENR Index Date	$ 3,243,000	$ 773,000	$ -	$ -	$ -	$ 2,470,000	$ -	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Construction Contingency/Allowance for Indeterminates and Indirects[6] 15%	$ 486,450	$ 115,950	$ -	$ -	$ -	$ 370,500	$ -	$ -
I	**Construction Bid Amount**	**$ 3,730,000**	**$ 889,000**	**$ -**	**$ -**	**$ -**	**$ 2,841,000**	**$ -**	**$ -**
J	Sales Tax[2]	$ 354,350	$ 84,455	$ -	$ -	$ -	$ 269,895	$ -	$ -
K	**Construction Contract Amount**	**$ 4,084,000**	**$ 973,000**	**$ -**	**$ -**	**$ -**	**$ 3,111,000**	**$ -**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 4,084,000**	**$ 973,000**	**$ -**	**$ -**	**$ -**	**$ 3,111,000**	**$ -**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 2,001,000	$ 477,000	$ -	$ -	$ -	$ 1,524,000	$ -	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 6,085,000**	**$ 1,450,000**	**$ -**	**$ -**	**$ -**	**$ 4,635,000**	**$ -**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 1,217,000	$ 290,000	$ -	$ -	$ -	$ 927,000	$ -	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 913,000	$ 218,000	$ -	$ -	$ -	$ 695,000	$ -	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 8,220,000**	**$ 1,960,000**	**$ -**	**$ -**	**$ -**	**$ 6,260,000**	**$ -**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number

Alternative Description **Portage Bay Neighborhood**
Updated for modeling results

5/13/2014

Cost Element	***Note***	***Type/Condition***	***Quantity***	***Unit***	***Unit Cost/ Base Cost***	***Ann Freq***	***Anticipated Annual Cost***	***Variability Multiplier***	***High End Annual Cost***
Conveyance Pipeline- special cleaning	7	Typical	210	LF	$ 1.75	1	$ 368	1	$ 368
		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main		LF	$ 1.00	1	$ -	1	$ -
Diversion Structure									
		Type 1 - Basic	1	ea	$ 260	4	$ 1,040	1.5	$ 1,560
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized	1	ea	$ 1,000	4	$ 2,040	1.5	$ 3,060
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	$ -
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP		ea	$ 5,000	1	$ -	1.25	$ -
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	$ -
Storage Tanks	12								
		Type 1 - < 72-inch pipe		LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG	1	ea	$ 16,500	1	$ 16,500	1.25	$ 20,625
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
			0.12	MG	$ 3,368	1	$ 3,368	1.25	$ 4,210
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance				ea	$ 2,040	6	$ -	1.25	$ -
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 23,316		$ 29,823

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
▨	Force main at $1/lf/year
░	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Neighborhood															
CSO Area		Portage Bay															
CSO Basin(s)		138															
Control Measure		Off-Line Storage Tank in Right-of-Way															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		6															
Start of Flow Monitoring (end of year)		2															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 10,158,000															
CAPITAL COSTS																	
Hard Cost		$ 4,084,000															
Property Cost (burdened)		$ -															
Total Costs		$ 8,220,000															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			*$ 620,000*	$ -	$ -	$ 657,600	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Design			*$ 1,128,000*	$ -	$ -	$ -	$ 1,233,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Bid/Award			*$ 146,000*	$ -	$ -	$ -	$ -	$ 164,400	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Construction			*$ 5,378,000*	$ -	$ -	$ -	$ -	$ 3,082,500	$ 3,082,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Property			*$ -*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		*$ 210,000*	$ -	$ -	$ -	$ -	$ -	$ 123,300	$ 123,300	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operations Acceptance Testing	2		*$ 140,000*	$ -	$ -	$ -	$ -	$ -	$ 82,200	$ 82,200	$ -	$ -	$ -	$ -	$ -	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		*$ 339,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ 205,500	$ 205,500	$ -	$ -	$ -	$ -	$ -	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance				$ -											
Annual Operations & Main1	1	$ 29,800	*$ 804,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 29,800*	*$ 29,800*	*$ 29,800*	*$ 29,800*	*$ 29,800*	*$ 29,800*	*$ 29,800*	*$ 29,800*
Replacements	10	$ 81,000	*$ 189,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Replacements	25	$ 51,000	*$ 36,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Replacements	50	$ -	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
KC Annual Fee	1	$ 90	*$ 2,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 90*	*$ 90*	*$ 90*	*$ 90*	*$ 90*	*$ 90*	*$ 90*	*$ 90*
Meter Replacements	5	$ 20,880	*$ 239,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 41,760*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 41,760*	*$ -*	*$ -*
Meter Maintenance	1	$ 11,950	*$ 829,000*	*$ -*	*$ -*	*$ 59,750*	*$ 59,750*	*$ 59,750*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*
New Meter Installation		$ 20,880	*$ 98,000*	*$ -*	*$ -*	*$ 104,400*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
SUM CAPITAL			**$ 7,959,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 2,199,000**														

Notes:
1. 2% Commissioning
2. 3% Acceptance Testing
3. 2% Post Construction Monitoring

Yellow indicates output
Bold Box = Inputs
Italics indicates formula

N-7

CSO Area:	Duwamish
NPDES CSO Outfalls:	111
CSO Control Measure Description:	Inline Storage and Off-Line Storage Pipe

Capital Cost Summary

	2014 Dollars	Notes
Hard Cost	$ 1,892,000	
Soft Cost	$ 927,000	
Property Cost	$ -	Based on King County tax assessor values
Base Cost	**$ 2,819,000**	
Construction Contingency	**$ 563,000**	
Management Reserve	**$ 423,000**	
Commissioning	**$ 114,000**	
Stabilization	**$ 76,000**	
Total Project Cost	***$ 3,995,000***	

Operating Cost Summary

	2014 Dollars	Notes
Post construction monitoring cost	$ 191,000	
Annual Operating Cost	$ 27,000	Cost Range $22,000 to $27,000
Annual Flow Meter Maintenance	$ 131,000	11 permanent meters
Annual King County Treatment Fee	$ 10	

NPV Calculation Summary

Construction start:	Year 10
Construction completion; O&M Start:	Year 11
Post-Construction Monitoring:	Year 12
Temporary Flow Monitoring Start:	Year 8
Temporary Flow Monitoring Completion:	Year 14

	2014 Dollars	Notes
Capital Costs	$ 3,995,000	
Annual Operating Costs	$ 27,000	
Electrical Replacements (10 year cycle)	$ 26,000	
Mechanical Replacements (25 year cycle)	$ 134,000	
Structural Replacements (50 year cycle)	$ -	
Treatment Fees	$ 10	
Meter Replacement (5 year cycle)	$ 230,000	11 flow meters.
Meter Maintenance - Annual Cost	$ 131,000	11 flow meters.
Net Present Value	$ 8,520,000	

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)

Takeoff By:
Estimate By: C.Au-Yeung
Date: 8/1/2013
Rev: 8/29/2013 C.Au-Yeung Rev: 11/6/2014 C.Au-Yeung
Rev: 12/5/2013 C.Au-Yeung
Rev: 2/11/2014 C.Au-Yeung

Project Type: SPU Duwamish (NPDES111B/C) CSO Control Measure - In-Line Storage in Right-of-Way

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 1,090,000	$ 350,000	$ -	$ -	$ -	$ -	$ 740,000	$ -
B	**Subtotal**	**$ 1,090,000**	**$ 350,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 740,000**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 10,900	$ 3,500	$ -	$ -	$ -	$ -	$ 7,400	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 1,100,900	$ 353,500	$ -	$ -	$ -	$ -	$ 747,400	$ -
F	Construction Line Item Pricing (See above for ENR Index Date)	$ 1,186,000	$ 381,000	$ -	$ -	$ -	$ -	$ 805,000	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 177,900	$ 57,150	$ -	$ -	$ -	$ -	$ 120,750	$ -
I	**Construction Bid Amount**	**$ 1,364,000**	**$ 438,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 926,000**	**$ -**
J	Sales Tax[2]	$ 129,580	$ 41,610	$ -	$ -	$ -	$ -	$ 87,970	$ -
K	**Construction Contract Amount**	**$ 1,494,000**	**$ 480,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,014,000**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 1,494,000**	**$ 480,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,014,000**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 732,000	$ 235,000	$ -	$ -	$ -	$ -	$ 497,000	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 2,226,000**	**$ 715,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,511,000**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 445,000	$ 143,000	$ -	$ -	$ -	$ -	$ 302,000	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 334,000	$ 107,000	$ -	$ -	$ -	$ -	$ 227,000	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 3,010,000**	**$ 970,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 2,040,000**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

Seattle Public Utilities Takeoff By:
LTCP Basin: Estimate By: C.Au-Yeung
Project Definition Cost Estimate (Class 4) Date: 8/1/2013
Rev: 8/29/2013 C.Au-Yeung Rev: 11/6/2014 C.Au-Yeung
Rev: 2/11/2014 C.Au-Yeung

Project Type: SPU Duwamish (NPDES111H) CSO Control Measure - Off-Line Storage Pipe in Right-of-Way

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 290,000	$ 120,000	$ -	$ -	$ -	$ 170,000	$ -	$ -
B	**Subtotal**	**$ 290,000**	**$ 120,000**	**$ -**	**$ -**	**$ -**	**$ 170,000**	**$ -**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 2,900	$ 1,200	$ -	$ -	$ -	$ 1,700	$ -	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 292,900	$ 121,200	$ -	$ -	$ -	$ 171,700	$ -	$ -
F	Construction Line Item Pricing (See above for ENR Index Date	$ 316,000	$ 131,000	$ -	$ -	$ -	$ 185,000	$ -	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 47,400	$ 19,650	$ -	$ -	$ -	$ 27,750	$ -	$ -
I	**Construction Bid Amount**	**$ 364,000**	**$ 151,000**	**$ -**	**$ -**	**$ -**	**$ 213,000**	**$ -**	**$ -**
J	Sales Tax[2]	$ 34,580	$ 14,345	$ -	$ -	$ -	$ 20,235	$ -	$ -
K	**Construction Contract Amount**	**$ 398,000**	**$ 165,000**	**$ -**	**$ -**	**$ -**	**$ 233,000**	**$ -**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 398,000**	**$ 165,000**	**$ -**	**$ -**	**$ -**	**$ 233,000**	**$ -**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 195,000	$ 81,000	$ -	$ -	$ -	$ 114,000	$ -	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 593,000**	**$ 246,000**	**$ -**	**$ -**	**$ -**	**$ 347,000**	**$ -**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 118,000	$ 49,000	$ -	$ -	$ -	$ 69,000	$ -	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 89,000	$ 37,000	$ -	$ -	$ -	$ 52,000	$ -	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 800,000**	**$ 330,000**	**$ -**	**$ -**	**$ -**	**$ 470,000**	**$ -**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **Duwamish Neighborhood ROW 111B/C**

5/13/2014

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/*	*Ann*	*Anticipated*	*Variability*	*High End*
					Base Cost	*Freq*	*Annual Cost*	*Multiplier*	*Annual Cost*
Conveyance Pipeline-	7	Typical	115	LF	$ 1.75	1	$ 201	1	$ 201
special cleaning		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main	75	LF	$ 1.00	1	$ 75	1	$ 75
Diversion Structure									
		Type 1 - Basic		ea	$ 260	4	$ -	1.5	$ -
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized	2	ea	$ 1,000	4	$ 3,080	1.5	$ 4,620
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP	2	ea	$ 5,000	1	$ 10,000	1.25	$ 12,500
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge	10	HP		1	$ 92	1	$ 92
Storage Tanks	12								
		Type 1 - < 72-inch pipe	0	LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG		ea	$ 16,500	1	$ -	1.25	$ -
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
			0.02	MG	$ 1,978	1	$ 1,978	1.25	$ 2,473
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance			2	ea	$ 2,040	6	$ 4,080	1.25	$ 5,100
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 19,506		$ 25,061

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟫	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **Duwamish Neighborhood ROW 111H**

5/13/2014

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/ Base Cost*	*Ann Freq*	*Anticipated Annual Cost*	*Variability Multiplier*	*High End Annual Cost*
Conveyance Pipeline-	7	Typical	100	LF	$ 1.75	1	$ 175	1	$ 175
special cleaning		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main		LF	$ 1.00	1	$ -	1	$ -
Diversion Structure									
		Type 1 - Basic		ea	$ 260	4	$ -	1.5	$ -
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized		ea	$ 1,000	4	$ -	1.5	$ -
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP		ea	$ 5,000	1	$ -	1.25	$ -
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	$ -
Storage Tanks	12								
		Type 1 - < 72-inch pipe	100	LF	$ 1.75	2	$ 1,390	1.25	$ 1,738
		Type 2 - < 1.5 MG		ea	$ 16,500	1	$ -	1.25	$ -
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
				MG	$ 1,700	1	$ -	1.25	$ -
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance				ea	$ 2,040	6	$ -	1.25	$ -
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 1,565		$ 1,913

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟫	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Neighborhood															
CSO Area		Duwamish															
CSO Basin(s)		111															
Control Measure		Inline Storage and Off-Line Storage Pipe															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		11															
Start of Flow Monitoring (end of year)		7															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 8,520,000															
CAPITAL COSTS																	
Hard Cost		$ 1,892,000															
Property Cost (burdened)		$ -															
Total Costs		$ 3,810,000															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			*$ 248,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 304,800	$ -	$ -	$ -	$ -	$ -	$ -
Design			*$ 451,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 571,500	$ -	$ -	$ -	$ -	$ -
Bid/Award			*$ 58,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 76,200	$ -	$ -	$ -	$ -
Construction			*$ 2,141,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,428,750	$ 1,428,750	$ -	$ -	$ -
Property			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		*$ 84,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 57,150	$ 57,150	$ -	$ -
Operations Acceptance Testing	2		*$ 56,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 38,100	$ 38,100	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		*$ 136,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 95,250	$ 95,250	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance				$ -											
Annual Operations & Main1	1	$ 27,000	*$ 621,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 27,000*	*$ 27,000*	*$ 27,000*
Replacements	10	$ 26,000	*$ 51,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	25	$ 134,000	*$ 81,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	50	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
KC Annual Fee	1	$ 10	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 10*	*$ 10*	*$ 10*
Meter Replacements	5	$ 20,880	*$ 1,003,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 62,640*	$ -	$ -
Meter Maintenance	1	$ 11,950	*$ 3,313,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 35,850*	*$ 35,850*	*$ 35,850*	*$ 35,850*	*$ 215,100*	*$ 215,100*	*$ 215,100*
New Meter Installation		$ 20,880	*$ 277,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 62,640*	$ -	$ -	$ -	*$ 313,200*	$ -	$ -
SUM CAPITAL			**$ 4,318,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 4,202,000**														

Notes:

1. 2% Commissioning
2. 3% Acceptance Testing
3. 2% Post Construction Monitoring

Yellow indicates output

Bold Box = Inputs

Italics indicates formula

N-8

CSO Area:	East Waterway
NPDES CSO Outfalls:	107
CSO Control Measure Description:	Off-Line Storage Tank in Private Property

Capital Cost Summary

		2014 Dollars	Notes
Hard Cost	$	12,992,000	
Soft Cost	$	6,366,000	
Property Cost	$	3,300,000	Based on King County tax assessor values
Base Cost	**$**	**22,658,000**	
Construction Contingency	**$**	**4,532,000**	
Management Reserve	**$**	**3,398,000**	
Commissioning	**$**	**131,000**	
Stabilization	**$**	**261,000**	
Total Project Cost	***$***	***30,980,000***	

Operating Cost Summary

		2014 Dollars	Notes
Post construction monitoring cost	$	131,000	
Annual Operating Cost	$	49,000	Cost Range $39,000 to $49,000
Annual Flow Meter Maintenance	$	60,000	5 permanent meters
Annual King County Treatment Fee	$	1,800	

NPV Calculation Summary

Construction start:	Year 7
Construction completion; O&M Start:	Year 9
Post-Construction Monitoring:	Year 10
Temporary Flow Monitoring Start:	Year 3
Temporary Flow Monitoring Completion:	Not applicable

		2014 Dollars	Notes
Capital Costs	$	30,980,000	
Annual Operating Costs	$	49,000	
Electrical Replacements (10 year cycle)	$	98,000	
Mechanical Replacements (25 year cycle)	$	361,000	
Structural Replacements (50 year cycle)	$	260,000	
Treatment Fees	$	1,800	
Meter Replacement (5 year cycle)	$	104,000	5 flow meters.
Meter Maintenance - Annual Cost	$	60,000	5 flow meters.
Net Present Value	$	29,878,000	

Seattle Public Utilities
LTCP Basin: SPU East Waterway Neighborhood Option - Stora
Project Definition Cost Estimate (Class 4)

Takeoff By:
Estimate By: C.Au-Yeung
Date: 8/29/2013
Rev: 2/11/2014 C.Au-Yeung
Rev: 11/6/2014 C.Au-Yeung

Project Type: SPU East Waterway CSO Control Measure - Off-Line Storage Tank in Private Property

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 9,480,000	$ 4,200,000	$ -	$ -	$ -	$ 4,580,000	$ 700,000	$ -
B	**Subtotal**	**$ 9,480,000**	**$ 4,200,000**	**$ -**	**$ -**	**$ -**	**$ 4,580,000**	**$ 700,000**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 94,800	$ 42,000	$ -	$ -	$ -	$ 45,800	$ 7,000	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 9,574,800	$ 4,242,000	$ -	$ -	$ -	$ 4,625,800	$ 707,000	$ -
F	Construction Line Item Pricing (See above for ENR Index Date	$ 10,317,000	$ 4,571,000	$ -	$ -	$ -	$ 4,984,000	$ 762,000	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 1,547,550	$ 685,650	$ -	$ -	$ -	$ 747,600	$ 114,300	$ -
I	**Construction Bid Amount**	**$ 11,865,000**	**$ 5,257,000**	**$ -**	**$ -**	**$ -**	**$ 5,732,000**	**$ 876,000**	**$ -**
J	Sales Tax[2]	$ 1,127,175	$ 499,415	$ -	$ -	$ -	$ 544,540	$ 83,220	$ -
K	**Construction Contract Amount**	**$ 12,992,000**	**$ 5,756,000**	**$ -**	**$ -**	**$ -**	**$ 6,277,000**	**$ 959,000**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 12,992,000**	**$ 5,756,000**	**$ -**	**$ -**	**$ -**	**$ 6,277,000**	**$ 959,000**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 6,366,000	$ 2,820,000	$ -	$ -	$ -	$ 3,076,000	$ 470,000	$ -
Q	Property Cost (Per SPU Real Estate)	$ 3,300,000	$ -	$ -	$ -	$ -	$ 3,300,000	$ -	$ -
R	**Base Cost**	**$ 22,658,000**	**$ 8,576,000**	**$ -**	**$ -**	**$ -**	**$ 12,653,000**	**$ 1,429,000**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 4,532,000	$ 1,715,000	$ -	$ -	$ -	$ 2,531,000	$ 286,000	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 3,398,000	$ 1,286,000	$ -	$ -	$ -	$ 1,898,000	$ 214,000	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 30,590,000**	**$ 11,580,000**	**$ -**	**$ -**	**$ -**	**$ 17,080,000**	**$ 1,930,000**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **Neighborhood Storage Tank NPDES107 (East Waterway)**

5/14/2014

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/ Base Cost*	*Ann Freq*	*Anticipated Annual Cost*	*Variability Multiplier*	*High End Annual Cost*
Conveyance Pipeline- special cleaning	7	Typical	500	LF	$ 1.75	1	$ 875	1	$ 875
		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main	1380	LF	$ 1.00	1	$ 1,380	1	$ 1,380
Diversion Structure									
		Type 1 - Basic		ea	$ 260	4	$ -	1.5	$ -
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized	1	ea	$ 1,000	4	$ 2,040	1.5	$ 3,060
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	$ -
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP	1	ea	$ 5,000	1	$ 5,000	1.25	$ 6,250
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge	10	HP		1	$ 92	1	$ 92
Storage Tanks	12								
		Type 1 - < 72-inch pipe		LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG	1	ea	$ 16,500	1	$ 16,500	1.25	$ 20,625
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket	2	ea	$ 1,040	1	$ 2,080	1.5	$ 3,120
Odor Control									
			0.5	MG	$ 8,650	1	$ 8,650	1.25	$ 10,813
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance			1	ea	$ 2,040	6	$ 2,040	1.25	$ 2,550
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 38,657		$ 48,765

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟧	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Neighborhood															
CSO Area		East Waterway															
CSO Basin(s)		107															
Control Measure		Offline Storage Tank in Private Property															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		9															
Start of Flow Monitoring (end of year)		2															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 29,878,000															
CAPITAL COSTS																	
Hard Cost		$ 12,992,000															
Property Cost (burdened)		$ 4,455,000															
Total Costs		$ 30,590,000															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			*$ 1,942,000*	$ -	$ -	$ 1,045,400	$ 1,045,400	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Design			*$ 3,432,000*	$ -	$ -	$ -	$ -	$ 1,960,125	$ 1,960,125	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Bid/Award			*$ 438,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ 522,700	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Construction			*$ 15,847,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,900,313	$ 9,800,625	$ 4,900,313	$ -	$ -	$ -	$ -	$ -
Property			*$ 3,843,000*	$ -	$ -	$ -	$ -	$ -	$ 4,455,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		*$ 102,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 65,338	$ 65,338	$ -	$ -	$ -	$ -
Operations Acceptance Testing	2		*$ 203,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 130,675	$ 130,675	$ -	$ -	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		*$ 99,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 65,338	$ 65,338	$ -	$ -	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance				$ -											
Annual Operations & Main1	1	$ 48,800	*$ 1,197,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 48,800*	*$ 48,800*	*$ 48,800*	*$ 48,800*	*$ 48,800*
Replacements	10	$ 98,000	*$ 209,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Replacements	25	$ 361,000	*$ 232,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Replacements	50	$ 260,000	*$ 47,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
KC Annual Fee	1	$ 1,800	*$ 44,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 1,800*	*$ 1,800*	*$ 1,800*	*$ 1,800*	*$ 1,800*
Meter Replacements	5	$ 20,880	*$ 546,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 41,760*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 104,400*	*$ -*	*$ -*
Meter Maintenance	1	$ 11,950	*$ 1,610,000*	*$ -*	*$ -*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 59,750*	*$ 59,750*	*$ 59,750*	*$ 59,750*	*$ 59,750*
New Meter Installation		$ 20,880	*$ 87,000*	*$ -*	*$ -*	*$ 41,760*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 62,640*	*$ -*	*$ -*	*$ -*	*$ -*
SUM CAPITAL			**$ 26,440,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 3,438,000**														
Notes:																	
1. 2% Commissioning																	
2. 3% Acceptance Testing																	
3. 2% Post Construction Monitoring																	
Yellow indicates output																	
Bold Box = Inputs																	
Italics indicates formula																	

N-9

CSO Area:	Magnolia
NPDES CSO Outfalls:	060
CSO Control Measure Description:	Off-Line Storage Pipe in Private Property

Capital Cost Summary

	2014 Dollars	Notes
Hard Cost	$ 2,932,000	
Soft Cost	$ 1,437,000	
Property Cost	$ -	Based on King County tax assessor values
Base Cost	**$ 4,369,000**	
Construction Contingency	**$ 874,000**	
Management Reserve	**$ 656,000**	
Commissioning	**$ 177,000**	
Stabilization	**$ 118,000**	
Total Project Cost	***$ 6,194,000***	

Operating Cost Summary

	2014 Dollars	Notes
Post construction monitoring cost	$ 296,000	
Annual Operating Cost	$ 18,000	Cost Range $14,000 to $18,000
Annual Flow Meter Maintenance	$ 48,000	4 permanent meters
Annual King County Treatment Fee	$ 160	

NPV Calculation Summary

Construction start:	Year 10
Construction completion; O&M Start:	Year 11
Post-Construction Monitoring:	Year 12
Temporary Flow Monitoring Start:	Year 8
Temporary Flow Monitoring Completion:	Not applicable

	2014 Dollars	Notes
Capital Costs	$ 6,194,000	
Annual Operating Costs	$ 18,000	
Electrical Replacements (10 year cycle)	$ 93,000	
Mechanical Replacements (25 year cycle)	$ 165,000	
Structural Replacements (50 year cycle)	$ 170,000	
Treatment Fees	$ 160	
Meter Replacement (5 year cycle)	$ 84,000	4 flow meters.
Meter Maintenance - Annual Cost	$ 48,000	4 flow meters.
Net Present Value	$ 7,275,000	

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)

Takeoff By:
Estimate By: C.Au-Yeung
Date: 7/24/2013
Rev: 8/29/2013 C.Au-Yeung
Rev: 1/2/2014 C.Au-Yeung
Rev: 2/11/2014 C.Au-Yeung
Rev: 11/10/2014 C.Au-Yeung

Project Type: SPU Magnolia CSO Control Measure - Off-Line Storage Pipe in Right-of-Way

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 2,140,000	$ 290,000	$ -	$ -	$ -	$ 1,540,000	$ 310,000	$ -
B	**Subtotal**	**$ 2,140,000**	**$ 290,000**	**$ -**	**$ -**	**$ -**	**$ 1,540,000**	**$ 310,000**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 21,400	$ 2,900	$ -	$ -	$ -	$ 15,400	$ 3,100	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 2,161,400	$ 292,900	$ -	$ -	$ -	$ 1,555,400	$ 313,100	$ -
F	Construction Line Item Pricing (See above for ENR Index Date	$ 2,329,000	$ 316,000	$ -	$ -	$ -	$ 1,676,000	$ 337,000	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 349,350	$ 47,400	$ -	$ -	$ -	$ 251,400	$ 50,550	$ -
I	**Construction Bid Amount**	**$ 2,678,000**	**$ 363,000**	**$ -**	**$ -**	**$ -**	**$ 1,927,000**	**$ 388,000**	**$ -**
J	Sales Tax[2]	$ 254,410	$ 34,485	$ -	$ -	$ -	$ 183,065	$ 36,860	$ -
K	**Construction Contract Amount**	**$ 2,932,000**	**$ 397,000**	**$ -**	**$ -**	**$ -**	**$ 2,110,000**	**$ 425,000**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 2,932,000**	**$ 397,000**	**$ -**	**$ -**	**$ -**	**$ 2,110,000**	**$ 425,000**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 1,437,000	$ 195,000	$ -	$ -	$ -	$ 1,034,000	$ 208,000	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 4,369,000**	**$ 592,000**	**$ -**	**$ -**	**$ -**	**$ 3,144,000**	**$ 633,000**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 874,000	$ 118,000	$ -	$ -	$ -	$ 629,000	$ 127,000	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 656,000	$ 89,000	$ -	$ -	$ -	$ 472,000	$ 95,000	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 5,910,000**	**$ 800,000**	**$ -**	**$ -**	**$ -**	**$ 4,250,000**	**$ 860,000**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **Magnolia Neighborhood updated for model results**

5/14/2014

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/ Base Cost*	*Ann Freq*	*Anticipated Annual Cost*	*Variability Multiplier*	*High End Annual Cost*
Conveyance Pipeline- special cleaning	7	Typical	50	LF	$ 1.75	1	$ 88	1	$ 88
		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main	50	LF	$ 1.00	1	$ 50	1	$ 50
Diversion Structure									
		Type 1 - Basic	1	ea	$ 260	4	$ 1,040	1.5	$ 1,560
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized		ea	$ 1,000	4	$ -	1.5	$ -
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP	1	ea	$ 5,000	1	$ 5,000	1.25	$ 6,250
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge	5	HP		1	$ 46	1	$ 46
Storage Tanks	12								
		Type 1 - < 72-inch pipe	530	LF	$ 1.75	2	$ 2,895	1.25	$ 3,619
		Type 2 - < 1.5 MG		ea	$ 16,500	1	$ -	1.25	$ -
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
			0.11	MG	$ 3,229	1	$ 3,229	1.25	$ 4,036
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance			1	ea	$ 2,040	6	$ 2,040	1.25	$ 2,550
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 14,388		$ 18,199

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟫	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Neighborhood															
CSO Area		Magnolia															
CSO Basin(s)		060															
Control Measure		Off-Line Storage Pipe in Right-of-Way															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		11															
Start of Flow Monitoring (end of year)		7															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 7,275,000															
CAPITAL COSTS																	
Hard Cost		$ 2,352,000															
Property Cost (burdened)		$ -															
Total Costs		$ 4,730,000															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			*$ 384,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 472,800	$ -	$ -	$ -	$ -	$ -	$ -
Design			*$ 700,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 886,500	$ -	$ -	$ -	$ -	$ -
Bid/Award			*$ 91,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 118,200	$ -	$ -	$ -	$ -
Construction			*$ 3,322,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,216,250	$ 2,216,250	$ -	$ -	$ -
Property			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		*$ 130,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 88,650	$ 88,650	$ -	$ -
Operations Acceptance Testing	2		*$ 87,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 59,100	$ 59,100	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		*$ 210,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 147,750	$ 147,750	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance															
Annual Operations & Main1	1	$ 18,200	*$ 419,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 18,200*	*$ 18,200*	*$ 18,200*
Replacements	10	$ 93,000	*$ 182,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Replacements	25	$ 165,000	*$ 100,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Replacements	50	$ 170,000	*$ 29,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
KC Annual Fee	1	$ 160	*$ 4,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 160*	*$ 160*	*$ 160*
Meter Replacements	5	$ 20,880	*$ 378,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 41,760*	*$ -*	*$ -*
Meter Maintenance	1	$ 11,950	*$ 1,175,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 47,800*	*$ 47,800*	*$ 47,800*
New Meter Installation		$ 20,880	*$ 64,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 41,760*	*$ -*	*$ -*	*$ -*	*$ 41,760*	*$ -*	*$ -*
SUM CAPITAL			**$ 5,156,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 2,119,000**														

Notes:
1. 2% Commissioning
2. 3% Acceptance Testing
3. 2% Post Construction Monitoring

Yellow indicates output
Bold Box = Inputs
Italics indicates formula

N-10

CSO Area:	Central Waterfront
NPDES CSO Outfalls:	069
CSO Control Measure Description:	Off-Line Storage Pipe in Right-of-Way

Capital Cost Summary

	2014 Dollars		Notes
Hard Cost	$	4,893,000	
Soft Cost	$	2,398,000	
Property Cost	$	-	Based on King County tax assessor values
Base Cost	**$**	**7,291,000**	
Construction Contingency	**$**	**1,458,000**	
Management Reserve	**$**	**1,094,000**	
Commissioning	**$**	**295,000**	
Stabilization	**$**	**197,000**	
Total Project Cost	***$***	***10,335,000***	

Operating Cost Summary

	2014 Dollars		Notes
Post construction monitoring cost	$	492,000	
Annual Operating Cost	$	13,000	Cost Range $10,000 to $13,000
Annual Flow Meter Maintenance	$	36,000	3 permanent meters
Annual King County Treatment Fee	$	160	

NPV Calculation Summary

Construction start:	Year 9
Construction completion; O&M Start:	Year 11
Post-Construction Monitoring:	Year 12
Temporary Flow Monitoring Start:	Year 5
Temporary Flow Monitoring Completion:	Year 14

	2014 Dollars		Notes
Capital Costs	$	10,335,000	
Annual Operating Costs	$	13,000	
Electrical Replacements (10 year cycle)	$	55,000	
Mechanical Replacements (25 year cycle)	$	85,000	
Structural Replacements (50 year cycle)	$	-	
Treatment Fees	$	160	
Meter Replacement (5 year cycle)	$	63,000	3 flow meters.
Meter Maintenance - Annual Cost	$	36,000	3 flow meters.
Net Present Value	$	10,368,000	

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)

Takeoff By:
Estimate By: C.Au-Yeung
Date: 7/24/2013
Rev: 8/29/2013 C.Au-Yeung
Rev: 11/19/2013 C.Au-Yeung
Rev: 12/31/2013 C.Au-Yeung
Rev: 2/11/2014 C.Au-Yeung
Rev: 11/10/2014 C.Au-Yeung

Project Type: SPU Central Waterfront CSO Control Measure: Off-Line Storage Pipe in Right-of-Way

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 3,570,000	$ 90,000	$ -	$ -	$ -	$ 3,480,000	$ -	$ -
B	**Subtotal**	**$ 3,570,000**	**$ 90,000**	**$ -**	**$ -**	**$ -**	**$ 3,480,000**	**$ -**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 35,700	$ 900	$ -	$ -	$ -	$ 34,800	$ -	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 3,605,700	$ 90,900	$ -	$ -	$ -	$ 3,514,800	$ -	$ -
F	Construction Line Item Pricing (See above for ENR Index Date)	$ 3,885,000	$ 98,000	$ -	$ -	$ -	$ 3,787,000	$ -	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 582,750	$ 14,700	$ -	$ -	$ -	$ 568,050	$ -	$ -
I	**Construction Bid Amount**	**$ 4,468,000**	**$ 113,000**	**$ -**	**$ -**	**$ -**	**$ 4,355,000**	**$ -**	**$ -**
J	Sales Tax[2]	$ 424,460	$ 10,735	$ -	$ -	$ -	$ 413,725	$ -	$ -
K	**Construction Contract Amount**	**$ 4,893,000**	**$ 124,000**	**$ -**	**$ -**	**$ -**	**$ 4,769,000**	**$ -**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 4,893,000**	**$ 124,000**	**$ -**	**$ -**	**$ -**	**$ 4,769,000**	**$ -**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 2,398,000	$ 61,000	$ -	$ -	$ -	$ 2,337,000	$ -	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 7,291,000**	**$ 185,000**	**$ -**	**$ -**	**$ -**	**$ 7,106,000**	**$ -**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 1,458,000	$ 37,000	$ -	$ -	$ -	$ 1,421,000	$ -	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 1,094,000	$ 28,000	$ -	$ -	$ -	$ 1,066,000	$ -	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 9,840,000**	**$ 250,000**	**$ -**	**$ -**	**$ -**	**$ 9,590,000**	**$ -**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **Central Waterfront Neighborhood updated for model results**

5/14/2014

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/ Base Cost*	*Ann Freq*	*Anticipated Annual Cost*	*Variability Multiplier*	*High End Annual Cost*
Conveyance Pipeline-	7	Typical	50	LF	$ 1.75	1	$ 88	1	$ 88
special cleaning		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main		LF	$ 1.00	1	$ -	1	$ -
Diversion Structure									
		Type 1 - Basic	1	ea	$ 260	4	$ 1,040	1.5	$ 1,560
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized	1	ea	$ 1,000	4	$ 2,040	1.5	$ 3,060
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP		ea	$ 5,000	1	$ -	1.25	$ -
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	$ -
Storage Tanks	12								
		Type 1 - < 72-inch pipe	600	LF	$ 1.75	2	$ 3,140	1.25	$ 3,925
		Type 2 - < 1.5 MG		ea	$ 16,500	1	$ -	1.25	$ -
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
			0.13	MG	$ 3,507	1	$ 3,507	1.25	$ 4,384
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance				ea	$ 2,040	6	$ -	1.25	$ -
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 9,815	$ 34	$ 13,016

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟫	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Neighborhood															
CSO Area		Central Waterfront															
CSO Basin(s)		069															
Control Measure		Off-Line Storage Pipe in Right-of-Way															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		10															
Start of Flow Monitoring (end of year)		4															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 10,368,000															
CAPITAL COSTS																	
Hard Cost		$ 4,893,000															
Property Cost (burdened)		$ -															
Total Costs		$ 9,840,000															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Engineering Report			$ 689,000	$ -	$ -	$ -	$ -	$ 393,600	$ 393,600	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Design			$ 1,218,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 738,000	$ 738,000	$ -	$ -	$ -	$ -	$ -	$ -
Bid/Award			$ 155,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 196,800	$ -	$ -	$ -	$ -	$ -
Construction			$ 5,618,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,845,000	$ 3,690,000	$ 1,845,000	$ -	$ -	$ -
Property			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		$ 216,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 147,600	$ 147,600	$ -	$ -
Operations Acceptance Testing	2		$ 144,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 98,400	$ 98,400	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		$ 350,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 246,000	$ 246,000	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance				$ -											
Annual Operations & Main1	1	$ 13,000	$ 309,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 13,000	$ 13,000	$ 13,000	$ 13,000
Replacements	10	$ 55,000	$ 114,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	25	$ 85,000	$ 53,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	50	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
KC Annual Fee	1	$ 160	$ 4,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 160	$ 160	$ 160	$ 160
Replacements -KC/SPU Boundary Conditions	5	$ 20,880	$ 364,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 41,760	$ -	$ -	$ -	$ -	$ 125,280
Meter Maintenance-Pre-Construction Monitoring	1	$ 11,950	$ 1,037,000	$ -	$ -	$ -	$ -	$ 23,900	$ 23,900	$ 23,900	$ 23,900	$ 23,900	$ 23,900	$ 23,900	$ 71,700	$ 71,700	$ 71,700
Replacements-Pre-Construction Monitoring		$ 20,880	$ 97,000	$ -	$ -	$ -	$ -	$ 41,760	$ -	$ -	$ -	$ -	$ -	$ -	$ 83,520	$ -	$ -
SUM CAPITAL			$ 8,501,000														
SUM OPERATIONS AND MAINTENANCE			$ 1,867,000														
Notes:																	
1. 2% Commissioning																	
2. 3% Acceptance Testing																	
3. 2% Post Construction Monitoring																	
Yellow indicates output																	
Bold Box = Inputs																	
Italics indicates formula																	

N-11

CSO Area:	Ballard
NPDES CSO Outfalls:	150/151/152
CSO Control Measure Description:	Off-line Storage Tank on Private Property

Capital Cost Summary

	2014 Dollars	Notes
Hard Cost	$ 65,930,000	
Soft Cost	$ 32,174,000	
Property Cost	$ 11,500,000	Based on King County tax assessor values
Base Cost	**$ 109,604,000**	
Construction Contingency	**$ 5,969,000**	
Management Reserve	**$ 28,893,000**	
Art and Sustainability	**$ 820,000**	
Commissioning	**$ 669,000**	
Stabilization	**$ 2,676,000**	
Total Project Cost	***$ 148,631,000***	

Operating Cost Summary

	2014 Dollars	Notes
Post construction monitoring cost	$ 669,000	
Annual Operating Cost	$ 255,000	Cost Range $188,000 to $255,000
Annual Flow Meter Maintenance	$ 108,000	9 permanent meters
Annual King County Treatment Fee	$ 14,900	

NPV Calculation Summary

Construction start:	Year 8
Construction completion; O&M Start:	Year 11
Post-Construction Monitoring:	Year 13
Temporary Flow Monitoring Start:	Year 2
Temporary Flow Monitoring Completion:	Year 13

	2014 Dollars	Notes
Capital Costs	$ 148,631,000	
Annual Operating Costs	$ 255,000	
Electrical Replacements (10 year cycle)	$ 636,000	
Mechanical Replacements (25 year cycle)	$ 1,651,000	
Structural Replacements (50 year cycle)	$ 1,750,000	
Treatment Fees	$ 14,900	
Meter Replacement (5 year cycle)	$ 188,000	9 flow meters.
Meter Maintenance - Annual Cost	$ 108,000	9 flow meters.
Net Present Value	$ 133,965,000	

DNRP and SPU CSO Tank to Tunnel Comparisons

CONTRACT NUMBER: C09-104, AMENDMENT 6, PO 955687

TASK 4: SPU BALLARD STORAGE TANK ESTIMATE

BASIS OF ESTIMATE

PROJECT NAME:	CSO TUNNEL & STORAGE TANK COST ESTIMATING REVIEW
PREPARED FOR:	KING COUNTY DNRP WTD AND SEATTLE PUBLIC UTILITIES DWW
PREPARED BY:	KEVIN DOUR, PE, TETRA TECH DIRECTOR MARK HOPKINSON, PE, TETRA TECH PROJECT ENGINEER ERIC BENTON, CPE, P&M PRINCIPAL COST ENGINEER
ANALYSIS DATE:	SEPTEMBER 29, 2014
VERSION:	FINAL
PROJECT:	SPU BALLARD CSO STORAGE TANK

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ATTACHMENTS

- BINDER_SPU_Ballard_Tank_Class4_Estimate_Final_20140929

ESTIMATE ORGANIZATION

The attached PDF binder includes cost reports which are organized as follows:

- Total Cost Summary
    - Work Break Down Structure
- Detail Cost Report
    - Work Break Down Structure
    - CSI

PURPOSE OF ESTIMATE

The purpose of this Conceptual level estimate is to establish an opinion of probable cost at the conceptual design phase for the 6.0 MG Ballard tank proposed by SPU. The Ballard tank is one of three CSO Storage Tanks that will be compared to the Shared DNRP / SPU Ballard/Fremont-Wallingford/3rd Ave. West Tunnel.

GENERAL PROJECT DESCRIPTION

This project is located within the Ballard area of the City of Seattle and is a portion of the LTCP Neighborhood CSO Storage Option. The project consists of a six (6) million gallon underground combined sewer overflow storage tank with odor control and pumping stations. The total system will include 3 diversion structures, 150 lineal feet of direct bury conveyance piping and 1,860 lineal feet of conveyance micro tunnel piping.

ESTIMATE CLASSIFICATION

This cost estimate is considered to be in the Conceptual Phase (2% Design) or Class 4 Estimate as defined by the Association for the Advancement of Cost Engineering International (AACE). The expected accuracy range according to these standards is a low of -10%; and high +30% which is the recommended accuracy range recommended for General Construction according to AACE Publication 56R-08.

AACE Class	Level of Project Definition	Estimate Use	Allowance for Indeterminates	Construction Contingency
Class 5	0 – 2%	Study of Feasibility	30 to 40%	10%
Class 4	**1 – 15%**	**Budget Authorization**	**20 to 30%**	**10%**
Class 3	10 – 40%	Budget Check	15 to 20%	10%
Class 2	30 – 70%	Budget Check	10 to 15%	10%
Class 1	90 – 100%	Bid Check	0 to 5%	10%

Figure 1 – AACE Contingency Markups

This cost estimate has been prepared from the information available at the time of preparation. The final cost of the project will depend upon the actual labor and material costs, competitive market conditions, final project scope, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. The estimate is based on material, equipment, and labor pricing as of August 2014. The client should be cautioned that such prices are subject to variation.

OVERALL COSTS

The following is a summary of the construction cost and the probable range based on AACE expected accuracy range for Class 4 estimates. Please note the applied markups and assumptions, below.

Bid Amount	**Low Range**	**Estimate of Probable Construction Cost**	**High Range**
	-10%	**Total $**	30%
Total Bid Amount[1]	$53,722,980	$59,692,200	$77,599,860

Figure 2

1. Total Bid Amount includes markups and assumptions as listed below.

MARKUPS

The following markups were applied to the Cost Estimate:

Mobilization	3.0%
General Conditions	10.0%
Overhead and Profit	8.0%
Permits	1%
Allowance for Indeterminates	25.0%
Construction Bonds and Insurance	1.5%

It is the estimator's professional opinion that the allowance for indeterminates should be set at 25 percent due to the level of design on the project being at 2 percent. This will provide more budgetary room in the cost estimate for further design clarifications that cannot be ascertained at the conceptual design level.

Please note that Construction Change Order Contingency is not included in this estimate as it is normally carried as an owner's expense.

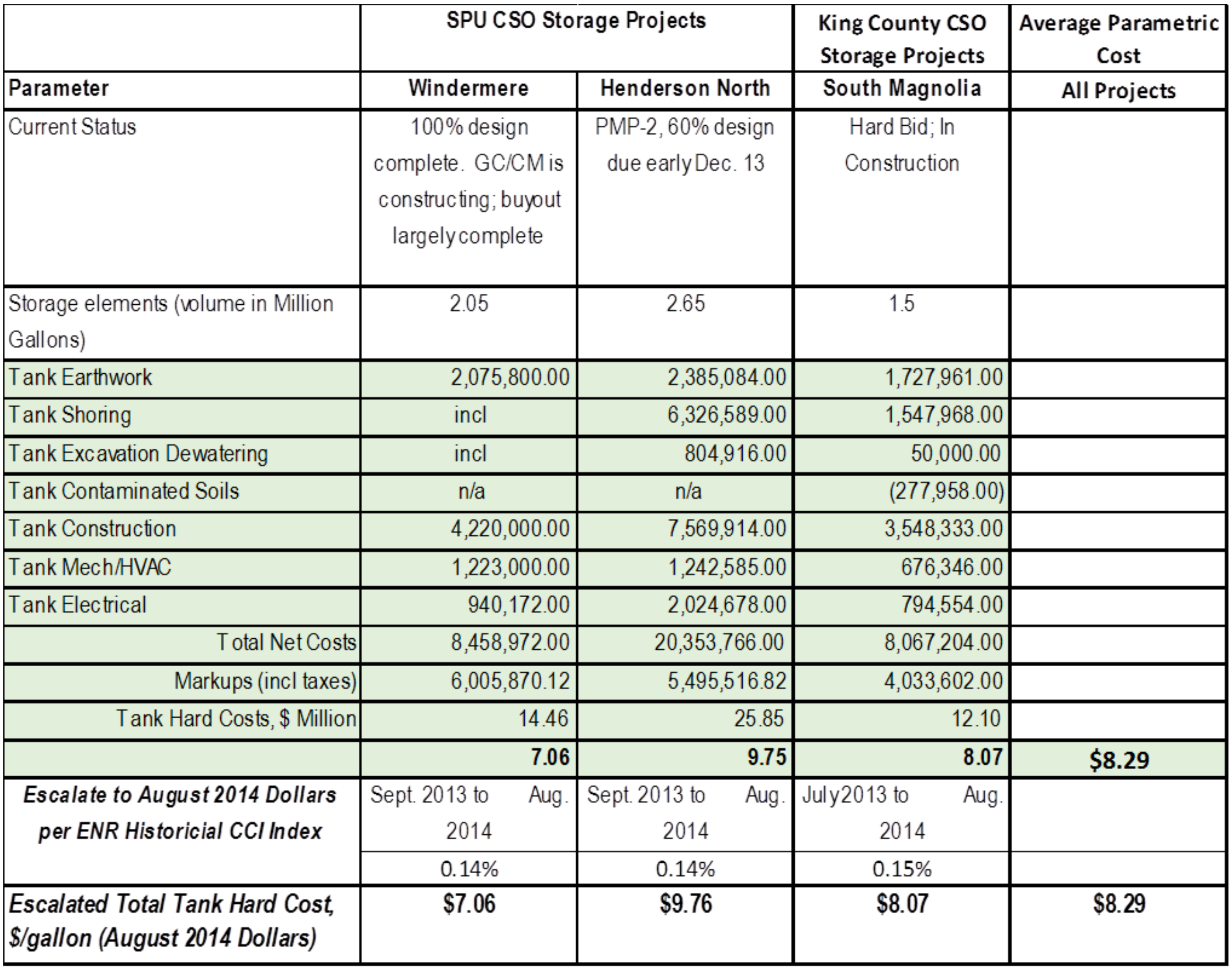
ASSUMPTIONS

The list of assumptions included in this conceptual estimate is as follows:

- Escalation of benchmark pricing to August 2014 is included in the estimate.
- Contractor will be allowed to work normal work day hours.
- Project will be bid competitively with a minimum of 4 to 5 bidders.
- Building demolition is not needed, thus is not included.
- Any additional Allowances and or Force Account Items are not included in this estimate.
- Sales Tax is not included in the estimate.
- Owners costs not included in the estimate.
- Escalation to mid-point of construction is not included in this estimate.

CSO TANK PRICING METHOD

The Storage Tank consists of 83 percent of the project cost and consists of the Tank, Odor Control, Effluent Pumping, Mechanical, Electrical and Instrumentation; these components comprise the Tank System. To obtain the most comprehensive and complete conceptual cost for this tank system a weighted-average parametric cost has been determined by using DNRP and SPU CSO Projects which have been recently bid and or negotiated by general contractors. The following table lists these recent tanks, their volume and cost of the Tank System only. Other portions of the projects such as conveyances, improvements and landscaping are not included in this parametric value. The tank system cost was divided by the volume to obtain a cost per gallon parametric cost. These parametric costs have been escalated to August 2014 costs as seen in the table below:



	SPU CSO Storage Projects		**King County CSO Storage Projects**	**Average Parametric Cost**
Parameter	**Windermere**	**Henderson North**	**South Magnolia**	**All Projects**
Current Status	100% design complete. GC/CM is constructing; buyout largely complete	PMP-2, 60% design due early Dec. 13	Hard Bid; In Construction	
Storage elements (volume in Million Gallons)	2.05	2.65	1.5	
Tank Earthwork	2,075,800.00	2,385,084.00	1,727,961.00	
Tank Shoring	incl	6,326,589.00	1,547,968.00	
Tank Excavation Dewatering	incl	804,916.00	50,000.00	
Tank Contaminated Soils	n/a	n/a	(277,958.00)	
Tank Construction	4,220,000.00	7,569,914.00	3,548,333.00	
Tank Mech/HVAC	1,223,000.00	1,242,585.00	676,346.00	
Tank Electrical	940,172.00	2,024,678.00	794,554.00	
Total Net Costs	8,458,972.00	20,353,766.00	8,067,204.00	
Markups (incl taxes)	6,005,870.12	5,495,516.82	4,033,602.00	
Tank Hard Costs, $ Million	14.46	25.85	12.10	
	7.06	**9.75**	**8.07**	**$8.29**
Escalate to August 2014 Dollars per ENR Historicial CCI Index	Sept. 2013 to Aug. 2014	Sept. 2013 to Aug. 2014	July2013 to Aug. 2014	
	0.14%	0.14%	0.15%	
Escalated Total Tank Hard Cost, $/gallon (August 2014 Dollars)	**$7.06**	**$9.76**	**$8.07**	**$8.29**

Figure 3

Escalation was determined using the Engineering News Record (ENR) Construction Cost Index (CCI), which is a nationally recognized indicator of construction cost escalation/inflation. The ENR CCI index mathematically measures the price movement of construction materials and labor on a monthly basis. This price movement is given a monthly index number which can be compared back to previous year's sense 1927.

Finding the escalation rate from a previous year to the current date is obtained by subtracting the earlier date from the later date. Then dividing the result by the earlier date, the result is a percentage. This percentage is then multiplied into the dollar amount of the earlier year to obtain the cost of construction at our current date.

Using the CCI index of the earlier estimates' dollars (Sept. 2013) and today's August 2014 index the escalation method is as shown below:

ENR – Sept 2013 CCI	10147.96
ENR – August 2014 CCI	10161.68
	13.72
Divide result by earlier CCI	0.14%

This percentage of 0.14% has been used to obtain August 2014 construction cost as found above in figure 3 for the Windermere and Henderson North Tanks. Similarly the same method was used for the South Magnolia Tank resulting in a 0.15% CCI seen in figure 3 above.

The Escalated Total Tank Hard Cost per gallon in August 2014 dollars is adjusted to accommodate a reduction in parametric cost due to an economy of scale factor. The economy of scale factor was determined by estimating the cost of constructing the concrete portion and the excavation portion of a 6 million gallon tank in the same structural design as the 1.5 million gallon South Magnolia tank, which is one of the comparative tanks in figure 2. As stated above the tank system comprises 83% of the total project cost and the Concrete and Excavation portions comprise of 94% of this tank system cost.

The comparison of costs resulted in an anticipated cost reduction of 25.1 percent for a 6 million gallon tank from the weighted average costs of the previously bid/negotiated tanks. This is shown in the following:

Storage Tank	**Ballard Storage Tank**
Storage elements (volume in Million Gallons)	6
Average Parametric Cost, $/gallon (August 2014 Dollars)	**$8.29**
Economy of Scale Savings	25.1%
Parametric Cost for each Tank per $/gallon and size.	**$6.21**

Figure 4

The theory of economy of scale is the cost advantage that is obtained due to size or scale of a project, with cost per unit generally decreasing with the increasing scale as the fixed costs are spread out over a larger project size. The cost found in the attached estimate is the adjusted to economy scale parametric cost of $6.21 per gallon multiplied by the size of the tank.

A full discussion of how the Economy of Scale factor was determined can be found in the (currently pending) Technical Memo for Contract Number: C09-104, Amendment 6, PO Number 955687.

COST RESOURCES

The following is a list of the various cost resources used to development this estimate:

- Modified (Seattle) RS Means Construction Cost Data with Assemblies, 2014 database
- Washington State Labor Table
- Historical Cost Data
- Estimator's judgment

ESTIMATE METHODOLOGY

- Estimate methodology: Top Down and Bottoms Up
- This estimate is based on Conceptual Design Information provided by CH2MHILL
    - Ballard Tank – Quantities 20140620
    - Work Scope Quantities provided by CH2MHILL.
    - Permit Fees provided by City of Seattle SPU.

Div	Description	Qty	Unit	Total	% Net
	1. Storage / Odor Control / Effluent Pumping	1.00	ls	39,822,157	84.22 %
	2. Diversion Structures and Influent Pump Stations	1.00	ls	477,162	1.01 %
	3. Conveyance Piping and Force Mains	1.00	ls	273,209	0.58 %
	4. Conveyance Micro Tunneling	1.00	ls	6,708,402	14.19 %
	Net Costs			47,280,929	100.00 %
	Percent Net				
	Hours				
	Market Conditions		%		
	Subtotal			47,280,929	100.00 %
	Permitting	1.00	%	472,809	1.00 %
	Subtotal			47,753,738	101.00 %
	Allowance for Indetermainates (AFI)	25.00	%	11,938,435	25.25 %
	Total Bid Amount 2014 Dollars	6,000,000.00	gal	59,692,173	126.25 %

Row No.	Item Description	Qty	Unit	Mat Unit Price	Labor Unit Price	Equip Unit Price	Total Unit Price	Grand Total
1	1. Storage / Odor Control / Effluent Pumping	1.00	ls	270,498.78	723,027.95	505,270.90	39,822,157.05	39,822,157
2	1.1 Site Work	1.00	ls	270,498.78	723,027.95	505,270.90	2,562,157.05	2,562,157
3	1.1.1 Site Work	1.00	ls	270,498.78	723,027.95	505,270.90	2,562,157.05	2,562,157
4	Asphalt pavement 3" with 6" Crushed Base	93,303.00	SF	2.22	0.37	0.33	2.92	272,405
5	Contaminated Disposal Fee at 3rd & Lander dump site	22,300.00	ton				47.16	1,051,724
6	Contaminated Soil, Handle, Load	22,300.00	ton	2.83	27.80	19.52	50.15	1,118,290
7	Demo existing asphalt	10,367.00	SY		6.64	3.74	10.38	107,612
8	Haul Asphalt & Conc to dump site at 3rd and Lan	1,727.00	L.C.Y.				6.74	11,636
9	Saw Cut Asphalt and Curbs	150.00	LF	0.66	1.69	0.92	3.27	490
10	1.2 Storage Tank	6,000,000.00	gal				6.21	37,260,000
11	1.2.1 Storage Tank	6,000,000.00	gal				6.21	37,260,000
12	CSO Tank Complete, weighted average cost	6,000,000.00	gal				6.21	37,260,000
13	2. Diversion Structures and Influent Pump Stations	1.00	ls	147,997.52	188,973.04	22,698.24	477,161.92	477,162
14	2.1 Diversion Structures	3.00	ea	49,332.51	62,991.01	7,566.08	159,053.97	477,162
15	2.1.1 Diversion Structures	3.00	ea	49,332.51	62,991.01	7,566.08	159,053.97	477,162
16	Automatic Gate and Control	3.00	each	29,155.00	3,486.49	44.10	32,685.59	98,057
17	Concrete Street Panels, Remove and Replace	75.00	sy				254.91	19,118
18	Diversion Structure 120" dia. Manhole, 10' deep	3.00	EA				32,679.33	98,038
19	Haul Asphalt & Conc to dump site at 3rd and Lan	50.00	L.C.Y.				6.74	337
20	Manhole Grout, steps, interior work	30.00	EA	1,041.25	1,143.91	77.17	2,262.33	67,870
21	Saw Cut Asphalt and Curbs	240.00	LF	0.66	1.69	0.92	3.27	784
22	Sewer Hauling/Dispose Trench Exc, 1.5 hour round tr	340.00	L.C.Y.	4.29	5.35	7.97	17.60	5,985
23	Sewer Trench Import Backfill, incls delivery	234.00	L.C.Y.	15.31	5.35	7.97	28.63	6,699
24	Sewer Trench, backfill all	234.00	L.C.Y.		7.80	3.16	10.96	2,564
25	Sewer Trench, compact all	180.00	E.C.Y.		8.48	2.14	10.62	1,911
26	Sewer Trench, excavate all	261.00	B.C.Y.		4.06	11.00	15.06	3,930
27	Shaft Shoring	1,800.00	SF	12.98	63.34	6.37	82.69	148,838
28	Two Flagger / Traffic Control	4.00	week	183.75	5,573.75		5,757.50	23,030
29	3. Conveyance Piping and Force Mains	1.00	ls	44,979.88	68,723.66	36,811.69	273,208.68	273,209
30	3.1 Conveyance Piping	1.00	ls	44,979.88	68,723.66	36,811.69	251,158.68	251,159
31	3.1.1 Conveyance Pipe	1.00	ls	44,979.88	68,723.66	36,811.69	251,158.68	251,159
32	30" Reinforced Concrete Pipe	50.00	LF	49.61	43.92	10.41	103.94	5,197
33	60" Reinforced Concrete Pipe	100.00	LF	165.38	80.08	28.79	274.25	27,425
34	Concrete Street Panels, Remove and Replace	388.00	sy				254.91	98,905
35	Erosion Control for Piping	6.00	EA	275.63			275.63	1,654
36	Haul Asphalt & Conc to dump site at 3rd and Lan	258.00	L.C.Y.				6.74	1,738
37	Saw Cut Asphalt and Curbs	320.00	LF	0.66	1.69	0.92	3.27	1,046
38	Sewer Hauling/Dispose Trench Exc, 1.5 hour round tr	1,256.00	L.C.Y.	4.29	5.35	7.97	17.60	22,109
39	Sewer Trench Import Backfill, incls delivery	1,150.00	L.C.Y.	15.31	5.35	7.97	28.63	32,922
40	Sewer Trench, backfill all	1,150.00	L.C.Y.		4.46	1.81	6.26	7,201
41	Sewer Trench, compact all	884.00	E.C.Y.		4.24	1.07	5.31	4,694
42	Sewer Trench, excavate all	966.00	B.C.Y.		2.90	7.85	10.76	10,391
43	Trench box 10' x 20'	2.00	week			1,666.00	1,666.00	3,332
44	Two Flagger / Traffic Control	6.00	week	183.75	5,573.75		5,757.50	34,545
45	3.2 Utility Conflicts	1.00	ls				22,050.00	22,050
46	3.2.1 Conveyance Pipe Conflicts	1.00	ls				22,050.00	22,050
47	Existing Utility Conflicts - Heavy	150.00	lf				147.00	22,050
48	4. Conveyance Micro Tunneling	1.00	ls	228,393.46	1,423,138.41	270,495.72	6,708,401.52	6,708,402
49	4.1 Conveyance Micro Tunneling	1.00	ls	228,393.46	1,423,138.41	270,495.72	6,708,401.52	6,708,402
50	4.1.1 Conveyance Micro Tunneling	1.00	ls	228,393.46	1,423,138.41	270,495.72	6,708,401.52	6,708,402
51	120" dia. Manhole, 10' deep	7.00	EA				22,687.00	158,809
52	120" dia. Manhole, extra depth	107.00	EA				918.75	98,306
53	Concrete Street Panels, Remove and Replace	378.00	sy				254.91	96,356
54	Erosion Control for Micro Tunnel Shafts	10.00	EA	275.63			275.63	2,756
55	Existing Utility Conflicts - Heavy	240.00	lf				147.00	35,280
56	Haul Asphalt & Conc to dump site at 3rd and Lan	252.00	L.C.Y.				6.74	1,698
57	Manhole Grout, steps, interior work	7.00	EA	1,041.25	1,143.91	77.17	2,262.33	15,836
58	Micro Tunnel 30" Dia.	150.00	LF				1,178.45	176,768
59	Micro Tunnel 60" Dia.	1,710.00	LF				1,765.22	3,018,535

Row No.	Item Description	Qty	Unit	Mat Unit Price	Labor Unit Price	Equip Unit Price	Total Unit Price	Grand Total
60	MTBM Mobilization / Demobe, 30" Machine	1.00	Job				545,737.50	545,738
61	MTBM Mobilization / Demobe, 60" Machine	1.00	Job				654,885.00	654,885
62	Saw Cut Asphalt and Curbs	480.00	LF	0.66	1.69	0.92	3.27	1,569
63	Shaft compact all	2,359.00	E.C.Y.		4.24	1.07	5.31	12,525
64	Shaft Dewatering	20.00	days		444.47	75.95	520.42	10,408
65	Shaft Hauling/Dispose Trench Exc, 1.5 hour round tr	3,694.00	L.C.Y.	4.29	5.35	7.97	17.60	65,025
66	Shaft Import Backfill, incls delivery	3,067.00	L.C.Y.	15.31	5.35	7.97	28.63	87,802
67	Shaft Shoring	14,710.00	SF	8.65	84.46	8.49	101.60	1,494,504
68	Shaft, backfill all	3,067.00	L.C.Y.		5.57	2.26	7.83	24,006
69	Shaft, excavate all	2,841.00	B.C.Y.		4.06	11.00	15.06	42,784
70	Tunnel Hauling/Dispose Trench Exc, 1.5 hour round	6,092.00	L.C.Y.	4.29	5.35	7.97	17.60	107,237
71	Two Flagger / Traffic Control	10.00	week	183.75	5,573.75		5,757.50	57,575
72	Grand Total	6,000,000.00	gal	0.12	0.40	0.14	7.88	47,280,929

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **Ballard Offline Tank - 6 MG (with climate change) Updated for model results**

1/25/2015

Cost Element	***Note***	***Type/Condition***	***Quantity***	***Unit***	***Unit Cost/ Base Cost***	***Ann Freq***	***Anticipated Annual Cost***	***Variability Multiplier***	***High End Annual Cost***
Conveyance Pipeline- special cleaning	7	Typical	1600	LF	$ 1.75	1	$ 2,800	1	$ 2,800
		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main	1900	LF	$ 1.00	1	$ 1,900	1	$ 1,900
Diversion Structure									
		Type 1 - Basic	1	ea	$ 260	4	$ 1,040	1.5	$ 1,560
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized	2	ea	$ 1,000	4	$ 3,080	1.5	$ 4,620
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP		ea	$ 5,000	1	$ -	1.25	$ -
		Type 2 - 50HP & up	1	ea	$ 9,600	1	$ 9,600	1.25	$ 12,000
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge	90	HP		1	$ 830	1	$ 830
Storage Tanks	12								
		Type 1 - < 72-inch pipe		LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG		ea	$ 16,500	1	$ -	1.25	$ -
		Type 3 - > 1.5 MG	6	MG	$ 73,169	1	$ 73,169	1.5	$ 109,754
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket	8	ea	$ 1,040	1	$ 8,320	1.5	$ 12,480
Odor Control									
			6	MG	$ 85,100	1	$ 85,100	1.25	$ 106,375
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance			1	ea	$ 2,040	6	$ 2,040	1.25	$ 2,550
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 187,879		$ 254,868

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟫	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Neighborhood															
CSO Area		Ballard															
CSO Basin(s)		150/151, 152															
Control Measure		Off-line Tank Storage in Private Property															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		10															
Start of Flow Monitoring (end of year)		1															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 133,965,000															
CAPITAL COSTS																	
Hard Cost		$ 71,899,222															
Property Cost (unburdened)		$ 11,500,000		Note: cash flow created October 2014 for Ballard-Fremont/Wallingford CSO Reduction Project does not use burdened property cost													
Total Costs		$ 145,287,397															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			*$ 8,830,000*	$ -	$ 3,121,706	$ 3,121,706	$ 3,121,706	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Design			*$ 16,162,000*	$ -	$ -	$ -	$ -	$ 6,243,412	$ 6,243,412	$ 6,243,412	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Bid/Award			*$ 2,176,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,675,748	$ -	$ -	$ -	$ -	$ -	$ -
Construction			*$ 79,609,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 17,169,383	$ 34,338,765	$ 34,338,765	$ 17,169,383	$ -	$ -	$ -
Property			*$ 11,333,000*	$ 5,750,000	$ 5,750,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		*$ 498,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 668,937	$ -		
Operations Acceptance Testing	2		*$ 1,933,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,675,748	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		*$ 469,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 668,937	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance															
Annual Operations & Main1	1	$ 254,900	*$ 6,057,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 254,900*	*$ 254,900*	*$ 254,900*	*$ 254,900*
Replacements	10	$ 636,000	*$ 1,318,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	25	$ 1,651,000	*$ 1,031,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	50	$ 1,750,000	*$ 306,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
KC Fee	1	$ 14,900	*$ 354,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 14,900*	*$ 14,900*	*$ 14,900*	*$ 14,900*
Meter Replacements	5	$ 20,880	*$ 874,000*	$ -	$ -	$ -	$ -	$ -	*$ 41,760*	$ -	$ -	$ -	$ -	*$ 41,760*	$ -	$ -	$ -
Meter Maintenance	1	$ 11,950	*$ 2,819,000*	$ -	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 143,400*	*$ 143,400*	*$ 143,400*	*$ 107,550*
New Meter Installation		$ 20,880	*$ 196,000*	$ -	*$ 41,760*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 208,800*	$ -	$ -	$ -
SUM CAPITAL			**$ 121,611,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 12,354,000**														

Notes:
1. 2% Commissioning
2. 3% Acceptance Testing
3. 2% Post Construction Monitoring
Yellow indicates output
Bold Box = Inputs
Italics indicates formula

N-12

CSO Area:	Fremont/Wallingford
NPDES CSO Outfalls:	147, 174
CSO Control Measure Description:	Off-Line Tank Storage in City Property

Capital Cost Summary

	2014 Dollars	**Notes**
Hard Cost	$ 53,694,000	
Soft Cost	$ 26,203,000	
Property Cost	$ 4,826,000	Based on King County tax assessor values
Base Cost	**$ 84,722,000**	
Construction Contingency	**$ 4,861,000**	
Management Reserve	**$ 22,396,000**	
Art and Sustainability	**$ 668,000**	
Commissioning	**$ 539,000**	
Stabilization	**$ 2,156,000**	
Total Project Cost	***$ 115,342,000***	

Operating Cost Summary

	2014 Dollars	**Notes**
Post construction monitoring cost	$ 539,000	
Annual Operating Cost	$ 213,000	Cost Range $163,000 to $213,000
Annual Flow Meter Maintenance	$ 131,000	11 permanent meters
Annual King County Treatment Fee	$ 6,300	

NPV Calculation Summary

Construction start:	Year 8
Construction completion; O&M Start:	Year 11
Post-Construction Monitoring:	Year 13
Temporary Flow Monitoring Start:	Year 2
Temporary Flow Monitoring Completion:	Year 13

	2014 Dollars	**Notes**
Capital Costs	$ 115,342,000	
Annual Operating Costs	$ 213,000	
Electrical Replacements (10 year cycle)	$ 3,732,000	
Mechanical Replacements (25 year cycle)	$ 3,227,000	
Structural Replacements (50 year cycle)	$ 3,209,000	
Treatment Fees	$ 6,300	
Meter Replacement (5 year cycle)	$ 230,000	11 flow meters.
Meter Maintenance - Annual Cost	$ 131,000	11 flow meters.
Net Present Value	$ 118,630,000	

DNRP and SPU CSO Tank to Tunnel Comparisons

CONTRACT NUMBER: C09-104, AMENDMENT 6, PO 955687

TASK 4: SPU FREMONT/WALLINGFORD STORAGE TANK ESTIMATE

BASIS OF ESTIMATE

PROJECT NAME:	CSO TUNNEL & STORAGE TANK COST ESTIMATING REVIEW
PREPARED FOR:	KING COUNTY DNRP WTD AND SEATTLE PUBLIC UTILITIES DWW
PREPARED BY:	KEVIN DOUR, PE, TETRA TECH DIRECTOR
	MARK HOPKINSON, PE, TETRA TECH PROJECT ENGINEER
	ERIC BENTON, CPE, P&M PRINCIPAL COST ENGINEER
ANALYSIS DATE:	SEPTEMBER 29, 2014
VERSION:	FINAL
PROJECTS:	SPU FREMONT/WALLINGFORD CSO STORAGE TANK

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ATTACHMENTS

- BINDER_SPU_Fremont-Wallingford_Tank_Class4_Estimate_Final_20140929

ESTIMATE ORGANIZATION

The attached PDF binder includes cost reports which are organized as follows:

- Total Cost Summary
  - Work Break Down Structure
- Detail Cost Report
  - Work Break Down Structure
  - CSI

PURPOSE OF ESTIMATE

The purpose of this Conceptual level estimate is to establish an opinion of probable cost at the conceptual design phase for the 3.3 MG Fremont/Wallingford tank proposed by SPU. The Fremont/Wallingford tank is one of three CSO Storage Tanks that will be compared to the Shared DNRP / SPU Ballard/Fremont-Wallingford/3rd Ave. West Tunnel.

GENERAL PROJECT DESCRIPTION

This project is located within the Ballard area of the City of Seattle and is a portion of the LTCP Neighborhood CSO Storage Option. The project consists of a three point three (3.3) million gallon underground combined sewer overflow storage tank with odor control and pumping stations. The total system includes 2 diversion structures, 395 lineal feet of direct bury conveyance piping, 6,282 lineal feet of effluent force main piping, one 8 mgd and one 16 mgd influent pump stations.

ESTIMATE CLASSIFICATION

This cost estimate is considered to be in the Conceptual Phase (2% Design) or Class 4 Estimate as defined by the Association for the Advancement of Cost Engineering International (AACE). The expected accuracy range according to these standards is a low of -10%; and high +30% which is the recommended accuracy range recommended for General Construction according to AACE Publication 56R-08.

AACE Class	Level of Project Definition	Estimate Use	Allowance for Indeterminates	Construction Contingency
Class 5	0 – 2%	Study of Feasibility	30 to 40%	10%
Class 4	**1 – 15%**	**Budget Authorization**	**20 to 30%**	**10%**
Class 3	10 – 40%	Budget Check	15 to 20%	10%
Class 2	30 – 70%	Budget Check	10 to 15%	10%
Class 1	90 – 100%	Bid Check	0 to 5%	10%

Figure 1 – AACE Contingency Markups

This cost estimate has been prepared from the information available at the time of preparation. The final cost of the project will depend upon the actual labor and material costs, competitive market conditions, final project scope, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. The estimate is based on material, equipment, and labor pricing as of August 2014. The client should be cautioned that such prices are subject to variation.

OVERALL COSTS

The following is a summary of the construction cost and the probable range based on AACE expected accuracy range for Class 4 estimates. Please note the applied markups and assumptions below.

Bid Amount	**Low Range**	**Estimate of Probable Construction Cost**	**High Range**
	-10%	**Total $**	30%
Total Bid Amount[1]	$43,751,880	$48,613,200	$63,197,160

Figure 2

1. Total Bid Amount includes markups and assumptions as listed below.

MARKUPS

The following markups were applied to the Cost Estimate:

Mobilization	3.0%
General Conditions	10.0%
Overhead and Profit	8.0%
Permits	1.0%
Allowance for Indeterminates	25.0%
Construction Bonds and Insurance	1.5%

It is the estimator's professional opinion that the allowance for indeterminates should be set at 25 percent due to the level of design on the project being at 2 percent. This will provide more budgetary room in the cost estimate for further design clarifications that cannot be ascertained at the conceptual design level.

Please note that Construction Change Order Contingency is not included in this estimate as it is normally carried as an owner's expense.

ASSUMPTIONS

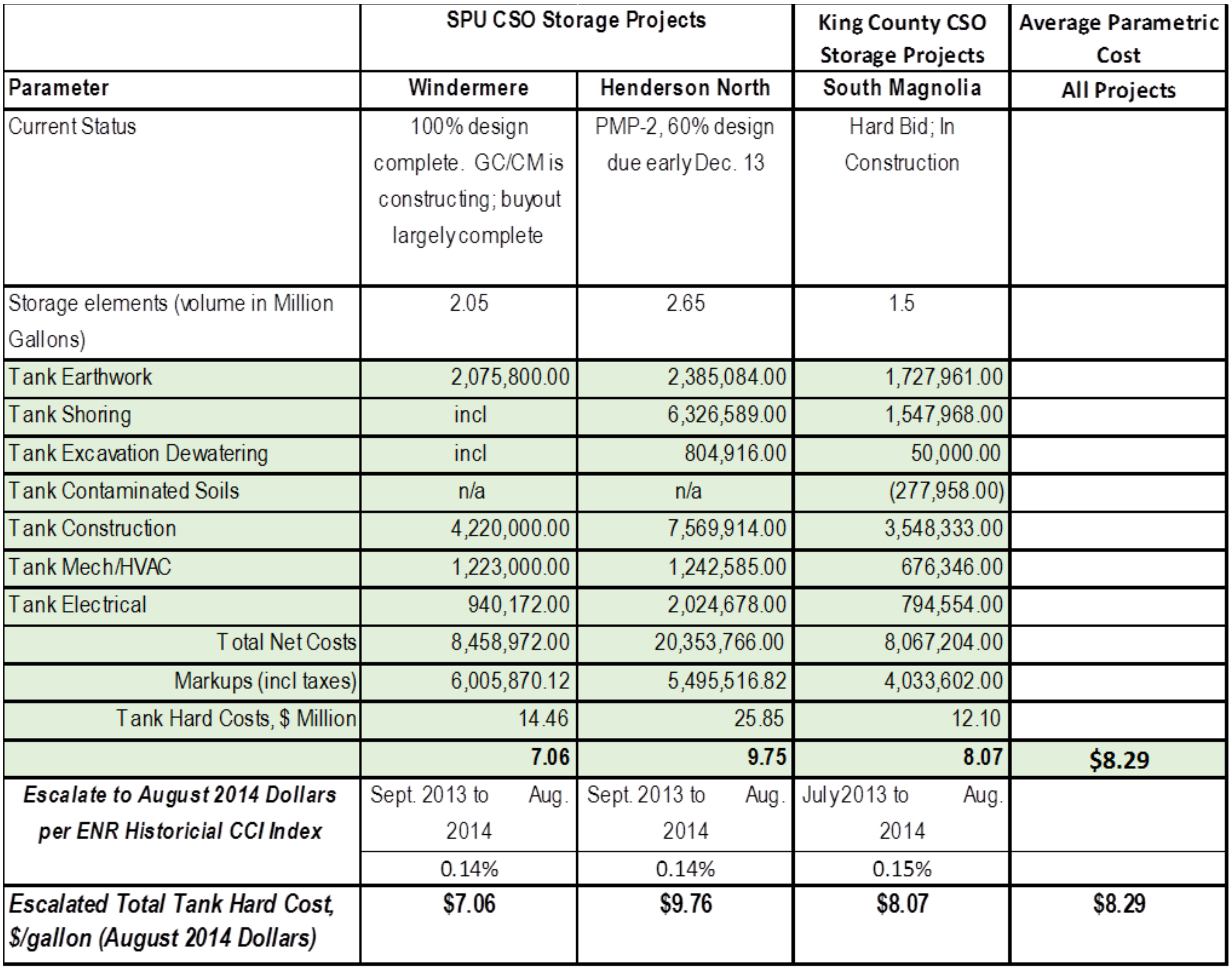
The list of assumptions included in this conceptual estimate is as follows:

- Escalation of benchmark pricing to August 2014 is included in the estimate.
- Contractor will be allowed to work normal work day hours.
- Project will be bid competitively with a minimum of 4 to 5 bidders.
- Building demolition is not needed, thus is not included.
- All work to be performed in right-a-way, or on city owned property.
- Any additional Allowances and or Force Account Items are not included in this estimate.

- Sales Tax is not included in the estimate.
- Owners Cost not included in the estimate.
- Escalation to mid-point of construction is not included in this estimate.

CSO TANK PRICING METHOD

The Storage Tank consists of 65 percent of the project cost and consists of the Tank, Odor Control, Effluent Pumping, Mechanical, Electrical and Instrumentation; these components comprise the Tank System. To obtain the most comprehensive and complete conceptual cost for this tank system a weighted-average parametric cost has been determined by using DNRP and SPU CSO Projects which have been recently bid and or negotiated by general contractors. The following table lists these recent tanks, their volume and cost of the Tank System only. Other portions of the projects such as conveyances, improvements and landscaping are not included in this parametric value. The tank system cost was divided by the volume to obtain a cost per gallon parametric cost. These parametric costs have been escalated to August 2014 costs as seen in the table below:



	SPU CSO Storage Projects		**King County CSO Storage Projects**	**Average Parametric Cost**
Parameter	**Windermere**	**Henderson North**	**South Magnolia**	**All Projects**
Current Status	100% design complete. GC/CM is constructing; buyout largely complete	PMP-2, 60% design due early Dec. 13	Hard Bid; In Construction	
Storage elements (volume in Million Gallons)	2.05	2.65	1.5	
Tank Earthwork	2,075,800.00	2,385,084.00	1,727,961.00	
Tank Shoring	incl	6,326,589.00	1,547,968.00	
Tank Excavation Dewatering	incl	804,916.00	50,000.00	
Tank Contaminated Soils	n/a	n/a	(277,958.00)	
Tank Construction	4,220,000.00	7,569,914.00	3,548,333.00	
Tank Mech/HVAC	1,223,000.00	1,242,585.00	676,346.00	
Tank Electrical	940,172.00	2,024,678.00	794,554.00	
Total Net Costs	8,458,972.00	20,353,766.00	8,067,204.00	
Markups (incl taxes)	6,005,870.12	5,495,516.82	4,033,602.00	
Tank Hard Costs, $ Million	14.46	25.85	12.10	
	7.06	**9.75**	**8.07**	**$8.29**
Escalate to August 2014 Dollars per ENR Historicial CCI Index	Sept. 2013 to Aug. 2014	Sept. 2013 to Aug. 2014	July2013 to Aug. 2014	
	0.14%	0.14%	0.15%	
Escalated Total Tank Hard Cost, $/gallon (August 2014 Dollars)	**$7.06**	**$9.76**	**$8.07**	**$8.29**

Figure 3

Escalation was determined using the Engineering News Record (ENR) Construction Cost Index (CCI), which is a nationally recognized indicator of construction cost escalation/inflation. The ENR CCI index mathematically measures the price movement of construction materials and labor on a monthly basis. This price movement is given a monthly index number which can be compared back to previous year's sense 1927.

Finding the escalation rate from a previous year to the current date is obtained by subtracting the earlier date from the later date. Then dividing the result by the earlier date, the result is a percentage. This percentage is then multiplied into the dollar amount of the earlier year to obtain the cost of construction at our current date.

Using the CCI index of the earlier estimates' dollars (Sept. 2013) and today's August 2014 index the escalation method is as shown below:

ENR – Sept 2013 CCI	10147.96
ENR – August 2014 CCI	10161.68
	13.72
Divide result by earlier CCI	0.14%

This percentage of 0.14% has been used to obtain August 2014 construction cost as found above in figure 3 for the Windermere and Henderson North Tanks. Similarly the same method was used for the South Magnolia Tank resulting in a 0.15% CCI seen in figure 3 above.

The Escalated Total Tank Hard Cost per gallon in August 2014 dollars is adjusted to accommodate a reduction in parametric cost due to an economy of scale factor. The economy of scale factor was determined by estimating the cost of constructing the concrete portion and the excavation portion of a 6 million gallon tank in the same structural design as the 1.5 million gallon South Magnolia tank, which is one of the comparative tanks in figure 2. As stated above the tank system comprises 65% of the total project cost and the Concrete and Excavation portions comprise of 94% of this tank system cost.

The comparison of costs resulted in an anticipated cost reduction of 10 percent for a 3.3 million gallon tank from the weighted average costs of the previously bid/negotiated tanks. This is shown in the following:

Storage Tank	**Freemont / Wallingford**
Storage elements (volume in Million Gallons)	3.3
Average Parametric Cost, $/gallon (August 2014 Dollars)	**$8.29**
Economy of Scale Savings	10.0%
Parametric Cost for each Tank per $/gallon and size.	**$7.46**

Figure 4

The theory of economy of scale is the cost advantage that is obtained due to size or scale of a project, with cost per unit generally decreasing with the increasing scale as the fixed costs are spread out over a larger project size. The cost found in the attached estimate is the adjusted to economy scale parametric cost of $7.46 per gallon multiplied by the size of the tank.

A full discussion of how the Economy of Scale factor was determined can be found in the (currently pending) Technical Memo for Contract Number: C09-104, Amendment 6, PO Number 955687.

COST RESOURCES

The following is a list of the various cost resources used to development this estimate:

- Modified (Seattle) RS Means Construction Cost Data with Assemblies, 2014 database
- Washington State Labor Table
- Historical Cost Data
- Estimator's judgment

ESTIMATE METHODOLOGY

- Estimate methodology: Top Down and Bottoms up.
- This estimate is based on Conceptual Design Information provided by CH2MHILL
    - FremontWallingford Tank – Quantities 20140620
    - Fremont/Wallingford Narrative, dated March 2014
    - Work Scope Quantities provided by CH2MHILL.
    - Permit Fees provided by City of Seattle SPU.

Div	Description	Qty	Unit	Total	% Net
	1. Storage / Odor Control / Effluent Pumping	1.00	ls	24,721,722	64.20 %
	2. Diversion Structures and Influent Pump Stations	1.00	ls	6,630,397	17.22 %
	3. Conveyance Piping and Force Mains	1.00	ls	7,153,372	18.58 %
	Net Costs			38,505,491	100.00 %
	Percent Net				
	Hours				
	Market Conditions		%		
	Subtotal			38,505,491	100.00 %
	Permitting	1.00	%	385,055	1.00 %
	Subtotal			38,890,546	101.00 %
	Allowance for Indetermainates (AFI)	25.00	%	9,722,637	25.25 %
	Total Bid Amount 2014 Dollars	3,300,000.00	gal	48,613,183	126.25 %

Row No.	Item Description	Qty	Unit	Mat Unit Price	Labor Unit Price	Equip Unit Price	Total Unit Price	Grand Total
1	1. Storage / Odor Control / Effluent Pumping	1.00	ls	58,124.21	25,026.16	17,041.15	24,721,721.97	24,721,722
2	1.1 Site Work	1.00	ls	58,124.21	25,026.16	17,041.15	103,721.97	103,722
3	1.1.1 Site Work	1.00	ls	58,124.21	25,026.16	17,041.15	103,721.97	103,722
4	Demo existing asphalt	2,314.00	SY		6.64	3.74	10.38	24,020
5	Haul Asphalt & Conc to dump site at 3rd and Lan	524.00	L.C.Y.				6.74	3,530
6	Pavement Base Gravel 6" thick	20,826.00	SF	0.77	0.08	0.06	0.92	19,098
7	Pavement, Asphalt Haul, 1.5 hour round trip	537.00	L.C.Y.		5.35	7.97	13.32	7,150
8	Pavement, HMA, 4"	2,314.00	SY	18.13	2.07	1.16	21.36	49,433
9	Saw Cut Asphalt and Curbs	150.00	LF	0.66	1.69	0.92	3.27	490
10	1.2 Storage Tank	3,300,000.00	gal				7.46	24,618,000
11	1.2.1 Storage Tank	3,300,000.00	gal				7.46	24,618,000
12	CSO Tank Complete, weighted average cost	3,300,000.00	gal				7.46	24,618,000
13	2. Diversion Structures and Influent Pump Stations	1.00	ls	306,257.99	910,618.08	155,700.60	6,630,397.34	6,630,397
14	2.1 Diversion Structures	2.00	ea	68,797.82	130,371.47	14,656.76	245,314.06	490,628
15	2.1.1 Diversion Structures	2.00	ea	68,797.82	130,371.47	14,656.76	245,314.06	490,628
16	Automatic Gate and Control	2.00	each	29,155.00	3,486.49	44.10	32,685.59	65,371
17	Demo existing asphalt	32.00	SY		6.64	3.74	10.38	332
18	Diversion Structure, 72"	2.00	EA				31,454.33	62,909
19	Erosion Control for Piping	10.00	EA	275.63			275.63	2,756
20	Haul Asphalt & Conc to dump site at 3rd and Lan	10.00	L.C.Y.				6.74	67
21	Manhole Grout, steps, interior work	30.00	EA	1,041.25	1,143.91	77.17	2,262.33	67,870
22	Pavement Base Gravel 6" thick	288.00	SF	0.77	0.08	0.06	0.92	264
23	Pavement, Asphalt Haul, 1.5 hour round trip	12.00	L.C.Y.		5.35	7.97	13.32	160
24	Pavement, HMA, 2" wear course	32.00	SY	10.17	1.49	0.83	12.49	400
25	Pavement, HMA, 4" binder course	32.00	SY	18.13	2.07	1.16	21.36	684
26	Saw Cut Asphalt and Curbs	100.00	LF	0.66	1.69	0.92	3.27	327
27	Sewer Hauling/Dispose Trench Exc, 1.5 hour round tr	290.00	L.C.Y.	4.29	5.35	7.97	17.60	5,105
28	Sewer Trench Import Backfill, incls delivery	208.00	L.C.Y.	15.31	5.35	7.97	28.63	5,955
29	Sewer Trench, backfill all	208.00	L.C.Y.		7.80	3.16	10.96	2,279
30	Sewer Trench, compact all	160.00	E.C.Y.		8.48	2.14	10.62	1,699
31	Sewer Trench, excavate all	223.00	B.C.Y.		4.06	11.00	15.06	3,358
32	Shaft Shoring	3,000.00	SF	12.98	63.34	6.37	82.69	248,062
33	Two Flagger / Traffic Control	4.00	week	183.75	5,573.75		5,757.50	23,030
34	2.2 Influent Pump Stations	2.00	ea	84,331.17	324,937.57	63,193.54	3,069,884.60	6,139,769
35	2.2.1 Influent Pump Station	2.00	ea	84,331.17	324,937.57	63,193.54	3,069,884.60	6,139,769
36	CMU Above Grade Building	600.00	sf				226.63	135,975
37	Demo Clear and Grub, small quantity	104.00	SY		13.28	7.48	20.76	2,159
38	Demo existing asphalt	1,467.00	SY		6.64	3.74	10.38	15,228
39	Erosion Control for Piping	10.00	EA	275.63			275.63	2,756
40	Haul Asphalt & Conc to dump site at 3rd and Lan	489.00	L.C.Y.				6.74	3,295
41	Pavement Base Gravel 6" thick	13,203.00	SF	0.77	0.08	0.06	0.92	12,108
42	Pavement, Asphalt Haul, 1.5 hour round trip	342.00	L.C.Y.		5.35	7.97	13.32	4,554
43	Pavement, HMA, 4" binder course	1,467.00	SY	18.13	2.07	1.16	21.36	31,339
44	Pump Station System Complete, 16 mgd	1.00	EA				2,572,500.00	2,572,500
45	Pump Station System Complete, 8 mgd	1.00	EA				2,483,075.00	2,483,075
46	Saw Cut Asphalt and Curbs	150.00	LF	0.66	1.69	0.92	3.27	490
47	Sewer Hauling/Dispose Trench Exc, 1.5 hour round tr	3,612.00	L.C.Y.	4.29	5.35	7.97	17.60	63,582
48	Sewer Trench Import Backfill, incls delivery	151.00	L.C.Y.	15.31	5.35	7.97	28.63	4,323
49	Sewer Trench, backfill all	151.00	L.C.Y.		7.80	3.16	10.96	1,655
50	Sewer Trench, compact all	116.00	E.C.Y.		8.48	2.14	10.62	1,232
51	Sewer Trench, excavate all	2,778.00	B.C.Y.		4.06	11.00	15.06	41,835
52	Shaft Shoring	8,400.00	SF	12.98	63.34	6.37	82.69	694,575
53	Two Flagger / Traffic Control	12.00	week	183.75	5,573.75		5,757.50	69,090
54	3. Conveyance Piping and Force Mains	1.00	ls	3,716,144.09	1,668,273.95	762,486.19	7,153,372.19	7,153,372
55	3.1 Conveyance Piping	1.00	ls	3,716,144.09	1,668,273.95	762,486.19	6,171,853.19	6,171,853
56	3.1.1 Conveyance Pipe	1.00	ls	78,769.59	89,708.95	36,016.58	205,970.63	205,971
57	18" Reinforced Concrete Pipe	65.00	LF	20.52	24.01	3.39	47.92	3,115
58	36" Reinforced Concrete Pipe	330.00	LF	67.38	53.39	12.68	133.44	44,036
59	Demo existing asphalt	657.00	SY		6.64	3.74	10.38	6,820

Row No.	Item Description	Qty	Unit	Mat Unit Price	Labor Unit Price	Equip Unit Price	Total Unit Price	Grand Total
60	Erosion Control for Piping	16.00	EA	275.63			275.63	4,410
61	Haul Asphalt & Conc to dump site at 3rd and Lan	219.00	L.C.Y.				6.74	1,476
62	Manhole 4' dia, flat top frame & cover	1.00	EA	300.13	202.04	55.74	557.90	558
63	Manhole 4' dia. 8' deep	1.00	EA	1,347.50	1,078.03	128.63	2,554.16	2,554
64	Manhole connect to existing	1.00	EA	367.50	285.98	809.19	1,462.67	1,463
65	Manhole Grout, steps, interior work	8.00	EA	1,041.25	1,143.91	77.17	2,262.33	18,099
66	Pavement Base Gravel 6" thick	5,913.00	SF	0.77	0.08	0.06	0.92	5,422
67	Pavement, Asphalt Haul, 1.5 hour round trip	225.00	L.C.Y.		5.35	7.97	13.32	2,996
68	Pavement, HMA, 2" wear course	657.00	SY	10.17	1.49	0.83	12.49	8,204
69	Pavement, HMA, 4" binder course	657.00	SY	18.13	2.07	1.16	21.36	14,035
70	Saw Cut Asphalt and Curbs	810.00	LF	0.66	1.69	0.92	3.27	2,647
71	Sewer Hauling/Dispose Trench Exc, 1.5 hour round tr	830.00	L.C.Y.	4.29	5.35	7.97	17.60	14,610
72	Sewer Trench Import Backfill, incls delivery	790.00	L.C.Y.	15.31	5.35	7.97	28.63	22,616
73	Sewer Trench, backfill all	790.00	L.C.Y.		4.46	1.81	6.26	4,947
74	Sewer Trench, compact all	607.00	E.C.Y.		4.24	1.07	5.31	3,223
75	Sewer Trench, excavate all	638.00	B.C.Y.		2.90	7.85	10.76	6,863
76	Trench box 10' x 20'	2.00	week			1,666.00	1,666.00	3,332
77	Two Flagger / Traffic Control	6.00	week	183.75	5,573.75		5,757.50	34,545
78	3.1.2 Force Main Pipe	1.00	ls	3,637,374.50	1,578,565.00	726,469.61	5,965,882.56	5,965,883
79	24" Ductile Iron 45 and 22.5 degree bend	1.00	EA	2,566.38	817.39	189.39	3,573.15	3,573
80	24" Ductile Iron Sewer pipe	390.00	LF	274.58	119.74	28.41	422.73	164,864
81	24" Mechanical Joint kit	22.00	EA	1,283.80	851.45	157.82	2,293.07	50,448
82	36" Ductile Iron bend	3.00	EA	3,111.50	1,193.94	333.73	4,639.17	13,918
83	36" Ductile Iron Sewer pipe, push on joint	5,892.00	LF	361.77	119.39	32.22	513.38	3,024,854
84	36" Mechanical Joint kit	327.00	EA	2,022.47	1,021.74	282.60	3,326.82	1,087,869
85	Demo existing asphalt	10,451.00	SY		6.64	3.74	10.38	108,484
86	Erosion Control for Piping	252.00	EA	275.63			275.63	69,458
87	Haul Asphalt & Conc to dump site at 3rd and Lan	3,484.00	L.C.Y.				6.74	23,473
88	Pavement Base Gravel 6" thick	94,059.00	SF	0.77	0.08	0.06	0.92	86,256
89	Pavement, Asphalt Haul, 1.5 hour round trip	3,484.00	L.C.Y.		5.35	7.97	13.32	46,391
90	Pavement, HMA, 2" wear course	10,451.00	SY	10.17	1.49	0.83	12.49	130,502
91	Pavement, HMA, 4" binder course	10,451.00	SY	18.13	2.07	1.16	21.36	223,258
92	Pipe Spacers	4.00	EA	183.75	681.16	125.60	990.51	3,962
93	Saw Cut Asphalt and Curbs	12,584.00	LF	0.66	1.69	0.92	3.27	41,130
94	Sewer Hauling/Dispose Trench Exc, 1.5 hour round tr	13,191.00	L.C.Y.	4.29	5.35	7.97	17.60	232,200
95	Sewer Trench Import Backfill, incls delivery	12,554.00	L.C.Y.	15.31	5.35	7.97	28.63	359,394
96	Sewer Trench, backfill all	12,554.00	L.C.Y.		4.46	1.81	6.26	78,611
97	Sewer Trench, compact all	9,657.00	E.C.Y.		4.24	1.07	5.31	51,275
98	Sewer Trench, excavate all	10,147.00	B.C.Y.		2.90	7.85	10.76	109,148
99	Trench box 10' x 20'	3.00	week			1,666.00	1,666.00	4,998
100	Two Flagger / Traffic Control	9.00	week	183.75	5,573.75		5,757.50	51,818
101	3.2 Utility Conflicts	1.00	ls				981,519.00	981,519
102	3.2.1 Conveyance Pipe Conflicts	1.00	ls				58,065.00	58,065
103	Existing Utility Conflicts - Heavy	395.00	lf				147.00	58,065
104	3.2.2 Force Main Pipe Conflicts	1.00	ls				923,454.00	923,454
105	Existing Utility Conflicts - Heavy	6,282.00	lf				147.00	923,454
106	Grand Total	3,300,000.00	gal	1.24	0.79	0.28	11.67	38,505,491

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **Fremont Wallingford Tank-3.3 MG**
with climate change, updated for model results

1/25/2015

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/*	*Ann*	*Anticipated*	*Variability*	*High End*
					Base Cost	*Freq*	*Annual Cost*	*Multiplier*	*Annual Cost*
Conveyance Pipeline-	7	Typical	165	LF	$ 1.75	1	$ 289	1	$ 289
special cleaning		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main	6540	LF	$ 1.00	1	$ 6,540	1	$ 6,540
Diversion Structure									
		Type 1 - Basic	1	ea	$ 260	4	$ 1,040	1.5	$ 1,560
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized	1	ea	$ 1,000	4	$ 2,040	1.5	$ 3,060
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up	2	ea	$ 11,600	1	$ 23,200	1.25	$ 29,000
	9	Demand charge	290	HP		1	$ 2,673	1	
		Odor Control	2	ea	$ 6,000		$ 12,000	1.25	$ 15,000
Effluent Pump Station									
		Type 1 - <50HP		ea	$ 5,000	1	$ -	1.25	$ -
		Type 2 - 50HP & up	1	ea	$ 9,600	1	$ 9,600	1.25	$ 12,000
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge	60	HP		1	$ 553	1	$ 553
Storage Tanks	12								
		Type 1 - < 72-inch pipe		LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG		ea	$ 16,500	1	$ -	1.25	$ -
		Type 3 - > 1.5 MG	3.3	MG	$ 41,224	1	$ 41,224	1.5	$ 61,836
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket	10	ea	$ 1,040	1	$ 10,400	1.5	$ 15,600
Odor Control									
			3.3	MG	$ 47,570	1	$ 47,570	1.25	$ 59,463
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance			3	ea	$ 2,040	6	$ 6,120	1.25	$ 7,650
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 163,249		$ 212,550

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟫	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Neighborhood															
CSO Area		Fremont/Wallingford															
CSO Basin(s)		147, 174															
Control Measure		Off-Line Tank Storage in City Property															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		12															
Start of Flow Monitoring (end of year)		1															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 118,630,000															
CAPITAL COSTS																	
Hard Cost		$ 58,554,579															
Property Cost (unburdened)		$ 4,825,900		Note: cash flow created October 2014 for Ballard-Fremont/Wallingford CSO Reduction Project does not use burdened property cost													
Total Costs		$ 112,647,161															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			*$ 7,116,000*	$ -	$ 2,515,829	$ 2,515,829	$ 2,515,829	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Design			*$ 19,537,000*	$ -	$ -	$ -	$ -	$ 7,547,489	$ 7,547,489	$ 7,547,489	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Bid/Award			*$ 1,753,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,156,425	$ -	$ -	$ -	$ -	$ -	$ -
Construction			*$ 64,069,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 13,837,062	$ 27,674,124	$ 27,674,124	$ 13,837,062	$ -	$ -	$ -
Property			*$ 4,042,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,825,900	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		*$ 401,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 539,106	$ -	$ -	$ -
Operations Acceptance Testing	2		*$ 1,558,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,156,425	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		*$ 378,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 539,106	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance															
Annual Operations & Main1	1	$ 212,600	*$ 4,740,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 212,600*	*$ 212,600*
Replacements	10	$ 3,732,000	*$ 7,103,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	25	$ 3,227,000	*$ 1,899,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	50	$ 3,209,000	*$ 529,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
KC Fee	1	$ 6,300	*$ 140,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 6,300*	*$ 6,300*
Meter Replacements	5	$ 20,880	*$ 1,221,000*	$ -	$ -	$ -	$ -	$ -	*$ 146,160*	$ -	$ -	$ -	$ -	*$ 146,160*	$ -	$ -	$ -
Meter Maintenance	1	$ 11,950	*$ 3,878,000*	$ -	*$ 83,650*	*$ 83,650*	*$ 83,650*	*$ 83,650*	*$ 83,650*	*$ 83,650*	*$ 83,650*	*$ 83,650*	*$ 83,650*	*$ 179,250*	*$ 179,250*	*$ 179,250*	*$ 131,450*
New Meter Installation		$ 20,880	*$ 266,000*	$ -	*$ 146,160*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 167,040*	$ -	$ -	$ -
SUM CAPITAL			**$ 99,963,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 18,667,000**														
Notes:																	
1. 2% Commissioning																	
2. 3% Acceptance Testing																	
3. 2% Post Construction Monitoring																	
Yellow indicates output																	
Bold Box = Inputs																	
Italics indicates formula																	

N-13

CSO Area:	Delridge
NPDES CSO Outfalls:	099
CSO Control Measure Description:	Off-Line Storage Pipe in Right-of-Way

Capital Cost Summary

		2014 Dollars	Notes
Hard Cost	$	3,563,000	
Soft Cost	$	1,746,000	
Property Cost	$	-	Based on King County tax assessor values
Base Cost	**$**	**5,309,000**	
Construction Contingency	**$**	**1,062,000**	
Management Reserve	**$**	**796,000**	
Commissioning	**$**	**215,000**	
Stabilization	**$**	**143,000**	
Total Project Cost	***$***	***7,525,000***	

Operating Cost Summary

		2014 Dollars	Notes
Post construction monitoring cost	$	359,000	
Annual Operating Cost	$	36,000	Cost Range $29,000 to $36,000
Annual Flow Meter Maintenance	$	72,000	6 permanent meters
Annual King County Treatment Fee	$	160	

NPV Calculation Summary

Construction start:	Year 6
Construction completion; O&M Start:	Year 7
Post-Construction Monitoring:	Year 8
Temporary Flow Monitoring Start:	Year 4
Temporary Flow Monitoring Completion:	Year 9

		2014 Dollars	Notes
Capital Costs	$	7,525,000	
Annual Operating Costs	$	36,000	
Electrical Replacements (10 year cycle)	$	72,000	
Mechanical Replacements (25 year cycle)	$	201,000	
Structural Replacements (50 year cycle)	$	54,000	
Treatment Fees	$	160	
Meter Replacement (5 year cycle)	$	125,000	6 flow meters.
Meter Maintenance - Annual Cost	$	72,000	6 flow meters.
Net Present Value	$	10,868,000	

Seattle Public Utilities Takeoff By:
LTCP Basin: Estimate By: C.Au-Yeung
Project Definition Cost Estimate (Class 4) Date: 7/24/2013
Rev: 8/29/2013 C.Au-Yeung Rev: 11/6/2014 C.Au-Yeung
Rev: 2/11/2014 C.Au-Yeung

Project Type: SPU Delridge (NPDES099) CSO Control Measure -Off-Line Storage Pipe in Right-of-Way

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 2,600,000	$ 210,000	$ -	$ -	$ -	$ 1,850,000	$ 540,000	$ -
B	**Subtotal**	**$ 2,600,000**	**$ 210,000**	**$ -**	**$ -**	**$ -**	**$ 1,850,000**	**$ 540,000**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 26,000	$ 2,100	$ -	$ -	$ -	$ 18,500	$ 5,400	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 2,626,000	$ 212,100	$ -	$ -	$ -	$ 1,868,500	$ 545,400	$ -
F	Construction Line Item Pricing (See above for ENR Index Date	$ 2,830,000	$ 229,000	$ -	$ -	$ -	$ 2,013,000	$ 588,000	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 424,500	$ 34,350	$ -	$ -	$ -	$ 301,950	$ 88,200	$ -
I	**Construction Bid Amount**	**$ 3,254,000**	**$ 263,000**	**$ -**	**$ -**	**$ -**	**$ 2,315,000**	**$ 676,000**	**$ -**
J	Sales Tax[2]	$ 309,130	$ 24,985	$ -	$ -	$ -	$ 219,925	$ 64,220	$ -
K	**Construction Contract Amount**	**$ 3,563,000**	**$ 288,000**	**$ -**	**$ -**	**$ -**	**$ 2,535,000**	**$ 740,000**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 3,563,000**	**$ 288,000**	**$ -**	**$ -**	**$ -**	**$ 2,535,000**	**$ 740,000**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 1,746,000	$ 141,000	$ -	$ -	$ -	$ 1,242,000	$ 363,000	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 5,309,000**	**$ 429,000**	**$ -**	**$ -**	**$ -**	**$ 3,777,000**	**$ 1,103,000**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 1,062,000	$ 86,000	$ -	$ -	$ -	$ 755,000	$ 221,000	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 796,000	$ 64,000	$ -	$ -	$ -	$ 567,000	$ 165,000	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 7,170,000**	**$ 580,000**	**$ -**	**$ -**	**$ -**	**$ 5,100,000**	**$ 1,490,000**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **Delridge Neighborhood NPDES099**

5/14/2014

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/ Base Cost*	*Ann Freq*	*Anticipated Annual Cost*	*Variability Multiplier*	*High End Annual Cost*
Conveyance Pipeline- special cleaning	7	Typical	80	LF	$ 1.75	1	$ 140	1	$ 140
		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main	30	LF	$ 1.00	1	$ 30	1	$ 30
Diversion Structure									
		Type 1 - Basic	1	ea	$ 260	4	$ 1,040	1.5	$ 1,560
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized		ea	$ 1,000	4	$ -	1.5	$ -
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP	1	ea	$ 5,000	1	$ 5,000	1.25	$ 6,250
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge	5	HP		1	$ 46	1	$ 46
Storage Tanks	12								
		Type 1 - < 72-inch pipe		LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG	1	ea	$ 16,500	1	$ 16,500	1.25	$ 20,625
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
			0.17	MG	$ 4,063	1	$ 4,063	1.25	$ 5,079
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance			1	ea	$ 2,040	6	$ 2,040	1.25	$ 2,550
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 28,859		$ 36,280

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟫	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Neighborhood															
CSO Area		Delridge															
CSO Basin(s)		099															
Control Measure		Off-Line Storage Pipe in Right-of-Way															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		7															
Start of Flow Monitoring (end of year)		3															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 10,868,000															
CAPITAL COSTS																	
Hard Cost		$ 3,563,000															
Property Cost (burdened)		$ -															
Total Costs		$ 7,170,000															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			$ 525,000	$ -	$ -	$ -	$ 573,600	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Design			$ 956,000	$ -	$ -	$ -	$ -	$ 1,075,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Bid/Award			$ 124,000	$ -	$ -	$ -	$ -	$ -	$ 143,400	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Construction			$ 4,551,000	$ -	$ -	$ -	$ -	$ -	$ 2,688,750	$ 2,688,750	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Property			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		$ 178,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 107,550	$ 107,550	$ -	$ -	$ -	$ -	$ -	$ -
Operations Acceptance Testing	2		$ 118,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 71,700	$ 71,700	$ -	$ -	$ -	$ -	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		$ 287,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 179,250	$ 179,250	$ -	$ -	$ -	$ -	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance															
Annual Operations & Main1	1	$ 36,300	$ 949,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 36,300	$ 36,300	$ 36,300	$ 36,300	$ 36,300	$ 36,300	$ 36,300
Replacements	10	$ 72,000	$ 163,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	25	$ 201,000	$ 137,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	50	$ 54,000	$ 10,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
KC Annual Fee	1	$ 160	$ 4,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 160	$ 160	$ 160	$ 160	$ 160	$ 160	$ 160
Meter Replacements	5	$ 20,880	$ 714,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 146,160	$ -	$ -	$ -	$ -	$ 125,280	$ -
Meter Maintenance	1	$ 11,950	$ 2,026,000	$ -	$ -	$ -	$ 23,900	$ 23,900	$ 23,900	$ 83,650	$ 83,650	$ 83,650	$ 71,700	$ 71,700	$ 71,700	$ 71,700	$ 71,700
New Meter Installation	5	$ 20,880	$ 126,000	$ -	$ -	$ -	$ 41,760	$ -	$ -	$ 104,400	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SUM CAPITAL			**$ 7,292,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 3,576,000**														
Notes:																	
1. 2% Commissioning																	
2. 3% Acceptance Testing																	
3. 2% Post Construction Monitoring																	
Yellow indicates output																	
Bold Box = Inputs																	
Italics indicates formula																	

N-14

CSO Area:	Delridge
NPDES CSO Outfalls:	168
CSO Control Measure Description:	Off-Line Storage Pipe in Right-of-Way

Capital Cost Summary

	2014 Dollars		**Notes**
Hard Cost	$	4,152,000	
Soft Cost	$	2,034,000	
Property Cost	$	-	Based on King County tax assessor values
Base Cost	**$**	**6,186,000**	
Construction Contingency	**$**	**1,237,000**	
Management Reserve	**$**	**928,000**	
Commissioning	**$**	**251,000**	
Stabilization	**$**	**167,000**	
Total Project Cost	***$***	***8,769,000***	

Operating Cost Summary

	2014 Dollars		**Notes**
Post construction monitoring cost	$	418,000	
Annual Operating Cost	$	41,000	Cost Range $33,000 to $41,000
Annual Flow Meter Maintenance	$	84,000	7 permanent meters
Annual King County Treatment Fee	$	830	

NPV Calculation Summary

Construction start:	Year 10
Construction completion; O&M Start:	Year 11
Post-Construction Monitoring:	Year 12
Temporary Flow Monitoring Start:	Year 8
Temporary Flow Monitoring Completion:	Year 14

	2014 Dollars		**Notes**
Capital Costs	$	8,769,000	
Annual Operating Costs	$	41,000	
Electrical Replacements (10 year cycle)	$	72,000	
Mechanical Replacements (25 year cycle)	$	201,000	
Structural Replacements (50 year cycle)	$	100,000	
Treatment Fees	$	830	
Meter Replacement (5 year cycle)	$	146,000	7 permanent flow meters
Meter Maintenance - Annual Cost	$	84,000	7 permanent flow meters
Net Present Value	$	11,081,000	

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)

Takeoff By:
Estimate By: C.Au-Yeung
Date: 7/24/2013
Rev: 8/29/2013 C.Au-Yeung Rev: 11/10/2014 C.Au-Yeung
Rev: 2/11/2014 C.Au-Yeung

Project Type: SPU Delridge (NPDES168) CSO Control Measure - Off-Line Storage Pipe in Right-of-Way

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 3,030,000	$ 740,000	$ -	$ -	$ -	$ 1,980,000	$ 310,000	$ -
B	**Subtotal**	**$ 3,030,000**	**$ 740,000**	**$ -**	**$ -**	**$ -**	**$ 1,980,000**	**$ 310,000**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 30,300	$ 7,400	$ -	$ -	$ -	$ 19,800	$ 3,100	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 3,060,300	$ 747,400	$ -	$ -	$ -	$ 1,999,800	$ 313,100	$ -
F	Construction Line Item Pricing (See above for ENR Index Date	$ 3,297,000	$ 805,000	$ -	$ -	$ -	$ 2,155,000	$ 337,000	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 494,550	$ 120,750	$ -	$ -	$ -	$ 323,250	$ 50,550	$ -
I	**Construction Bid Amount**	**$ 3,792,000**	**$ 926,000**	**$ -**	**$ -**	**$ -**	**$ 2,478,000**	**$ 388,000**	**$ -**
J	Sales Tax[2]	$ 360,240	$ 87,970	$ -	$ -	$ -	$ 235,410	$ 36,860	$ -
K	**Construction Contract Amount**	**$ 4,152,000**	**$ 1,014,000**	**$ -**	**$ -**	**$ -**	**$ 2,713,000**	**$ 425,000**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 4,152,000**	**$ 1,014,000**	**$ -**	**$ -**	**$ -**	**$ 2,713,000**	**$ 425,000**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 2,034,000	$ 497,000	$ -	$ -	$ -	$ 1,329,000	$ 208,000	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 6,186,000**	**$ 1,511,000**	**$ -**	**$ -**	**$ -**	**$ 4,042,000**	**$ 633,000**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 1,237,000	$ 302,000	$ -	$ -	$ -	$ 808,000	$ 127,000	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 928,000	$ 227,000	$ -	$ -	$ -	$ 606,000	$ 95,000	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 8,360,000**	**$ 2,040,000**	**$ -**	**$ -**	**$ -**	**$ 5,460,000**	**$ 860,000**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for porject average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **Delridge Neighborhood NPDES168**

5/14/2014

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/ Base Cost*	*Ann Freq*	*Anticipated Annual Cost*	*Variability Multiplier*	*High End Annual Cost*
Conveyance Pipeline-	7	Typical	100	LF	$ 1.75	1	$ 175	1	$ 175
special cleaning		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main	500	LF	$ 1.00	1	$ 500	1	$ 500
Diversion Structure									
		Type 1 - Basic	1	ea	$ 260	4	$ 1,040	1.5	$ 1,560
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized	1	ea	$ 1,000	4	$ 2,040	1.5	$ 3,060
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP	1	ea	$ 5,000	1	$ 5,000	1.25	$ 6,250
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge	5	HP		1	$ 46	1	$ 46
Storage Tanks	12								
		Type 1 - < 72-inch pipe		LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG	1	ea	$ 16,500	1	$ 16,500	1.25	$ 20,625
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
			0.25	MG	$ 5,175	1	$ 5,175	1.25	$ 6,469
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance			1	ea	$ 2,040	6	$ 2,040	1.25	$ 2,550
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 32,516		$ 41,235

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟧	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Neighborhood															
CSO Area		Delridge															
CSO Basin(s)		168															
Control Measure		Off-Line Storage Pipe in Right-of-Way															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		11															
Start of Flow Monitoring (end of year)		7															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 11,081,000															
CAPITAL COSTS																	
Hard Cost		$ 4,152,000															
Property Cost (burdened)		$ -															
Total Costs		$ 8,360,000															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			*$ 544,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 668,800	$ -	$ -	$ -	$ -	$ -	$ -
Design			*$ 990,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,254,000	$ -	$ -	$ -	$ -	$ -
Bid/Award			*$ 128,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 167,200	$ -	$ -	$ -	$ -
Construction			*$ 4,698,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,135,000	$ 3,135,000	$ -	$ -	$ -
Property			*$ -*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		*$ 184,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 125,400	$ 125,400	$ -	$ -
Operations Acceptance Testing	2		*$ 123,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 83,600	$ 83,600	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		*$ 298,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 209,000	$ 209,000	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance															
Annual Operations & Main1	1	$ 41,200	*$ 948,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 41,200*	*$ 41,200*	*$ 41,200*
Replacements	10	$ 72,000	*$ 141,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	25	$ 201,000	*$ 122,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	50	$ 100,000	*$ 17,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
KC Annual Fee	1	$ 830	*$ 19,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	*$ 830*	*$ 830*	*$ 830*
Meter Replacements	5	$ 20,880	*$ 639,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 41,760*	*$ -*	*$ -*
Meter Maintenance	1	$ 11,950	*$ 2,075,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 23,900*	*$ 119,500*	*$ 119,500*	*$ 119,500*
New Meter Installation		$ 20,880	*$ 155,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 41,760*	*$ -*	*$ -*	*$ -*	*$ 167,040*	*$ -*	*$ -*
SUM CAPITAL			**$ 7,461,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 3,620,000**														
Notes:																	
1. 2% Commissioning																	
2. 3% Acceptance Testing																	
3. 2% Post Construction Monitoring																	
Yellow indicates output																	
Bold Box = Inputs																	
Italics indicates formula																	

N-15

CSO Area:	Delridge
NPDES CSO Outfalls:	169
CSO Control Measure Description:	Off-Line Storage Pipe in Right-of-Way

Capital Cost Summary

	2014 Dollars		Notes
Hard Cost	$	3,700,000	
Soft Cost	$	1,813,000	
Property Cost	$	-	Based on King County tax assessor values
Base Cost	**$**	**5,513,000**	
Construction Contingency	**$**	**1,103,000**	
Management Reserve	**$**	**827,000**	
Commissioning	**$**	**224,000**	
Stabilization	**$**	**149,000**	
Total Project Cost	***$***	***7,816,000***	

Operating Cost Summary

	2014 Dollars		Notes
Post construction monitoring cost	$	373,000	
Annual Operating Cost	$	41,000	Cost Range $32,000 to $41,000
Annual Flow Meter Maintenance	$	96,000	8 permanent meters
Annual King County Treatment Fee	$	680	

NPV Calculation Summary

Construction start:	Year 10
Construction completion; O&M Start:	Year 11
Post-Construction Monitoring:	Year 12
Temporary Flow Monitoring Start:	Year 8
Temporary Flow Monitoring Completion:	Year 14

	2014 Dollars		Notes
Capital Costs	$	7,816,000	
Annual Operating Costs	$	41,000	
Electrical Replacements (10 year cycle)	$	72,000	
Mechanical Replacements (25 year cycle)	$	201,000	
Structural Replacements (50 year cycle)	$	100,000	
Treatment Fees	$	680	
Meter Replacement (5 year cycle)	$	167,000	8 permanent flow meters
Meter Maintenance - Annual Cost	$	96,000	8 permanent flow meters
Net Present Value	$	10,645,000	

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)

Takeoff By:
Estimate By: C.Au-Yeung
Date: 7/24/2013
Rev: 8/29/2013 C.Au-Yeung Rev: 11/10/2014 C.Au-Yeung
Rev: 2/11/2014 C.Au-Yeung

Project Type: SPU Delridge (NPDES169) CSO Control Measure - Off-Line Storage Pipe in Right-of-Way

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 2,700,000	$ 250,000	$ -	$ -	$ -	$ 2,140,000	$ 310,000	$ -
B	**Subtotal**	**$ 2,700,000**	**$ 250,000**	**$ -**	**$ -**	**$ -**	**$ 2,140,000**	**$ 310,000**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 27,000	$ 2,500	$ -	$ -	$ -	$ 21,400	$ 3,100	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 2,727,000	$ 252,500	$ -	$ -	$ -	$ 2,161,400	$ 313,100	$ -
F	Construction Line Item Pricing (See above for ENR Index Date	$ 2,938,000	$ 272,000	$ -	$ -	$ -	$ 2,329,000	$ 337,000	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 440,700	$ 40,800	$ -	$ -	$ -	$ 349,350	$ 50,550	$ -
I	**Construction Bid Amount**	**$ 3,379,000**	**$ 313,000**	**$ -**	**$ -**	**$ -**	**$ 2,678,000**	**$ 388,000**	**$ -**
J	Sales Tax[2]	$ 321,005	$ 29,735	$ -	$ -	$ -	$ 254,410	$ 36,860	$ -
K	**Construction Contract Amount**	**$ 3,700,000**	**$ 343,000**	**$ -**	**$ -**	**$ -**	**$ 2,932,000**	**$ 425,000**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 3,700,000**	**$ 343,000**	**$ -**	**$ -**	**$ -**	**$ 2,932,000**	**$ 425,000**	**$ -**
O	Soft Cost %[3]		49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 1,813,000	$ 168,000	$ -	$ -	$ -	$ 1,437,000	$ 208,000	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 5,513,000**	**$ 511,000**	**$ -**	**$ -**	**$ -**	**$ 4,369,000**	**$ 633,000**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)		20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 1,103,000	$ 102,000	$ -	$ -	$ -	$ 874,000	$ 127,000	$ -
U	Management Reserve 15%[5] (Base Cost)		15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 827,000	$ 77,000	$ -	$ -	$ -	$ 655,000	$ 95,000	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)		0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 7,450,000**	**$ 690,000**	**$ -**	**$ -**	**$ -**	**$ 5,900,000**	**$ 860,000**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for project average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **Delridge Neighborhood NPDES169**

5/14/2014

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/ Base Cost*	*Ann Freq*	*Anticipated Annual Cost*	*Variability Multiplier*	*High End Annual Cost*
Conveyance Pipeline- special cleaning	7	Typical	50	LF	$ 1.75	1	$ 88	1	$ 88
		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main	50	LF	$ 1.00	1	$ 50	1	$ 50
Diversion Structure									
		Type 1 - Basic	1	ea	$ 260	4	$ 1,040	1.5	$ 1,560
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized	1	ea	$ 1,000	4	$ 2,040	1.5	$ 3,060
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP	1	ea	$ 5,000	1	$ 5,000	1.25	$ 6,250
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge	5	HP		1	$ 46	1	$ 46
Storage Tanks	12								
		Type 1 - < 72-inch pipe		LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG	1	ea	$ 16,500	1	$ 16,500	1.25	$ 20,625
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
			0.25	MG	$ 5,175	1	$ 5,175	1.25	$ 6,469
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance			1	ea	$ 2,040	6	$ 2,040	1.25	$ 2,550
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 31,979		$ 40,697

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟧	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Neighborhood															
CSO Area		Delridge															
CSO Basin(s)		169															
Control Measure		Off-Line Storage Pipe in Right-of-Way															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		11															
Start of Flow Monitoring (end of year)		7															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 10,645,000															
CAPITAL COSTS																	
Hard Cost		$ 3,700,000															
Property Cost (burdened)		$ -															
Total Costs		$ 7,450,000															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			$ 485,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 596,000	$ -	$ -	$ -	$ -	$ -	$ -
Design			$ 882,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,117,500	$ -	$ -	$ -	$ -	$ -
Bid/Award			$ 114,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 149,000	$ -	$ -	$ -	$ -
Construction			$ 4,187,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,793,750	$ 2,793,750	$ -	$ -	$ -
Property			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		$ 164,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 111,750	$ 111,750	$ -	$ -
Operations Acceptance Testing	2		$ 109,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 74,500	$ 74,500	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		$ 265,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 186,250	$ 186,250	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance															
Annual Operations & Main1	1	$ 40,700	$ 937,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 40,700	$ 40,700	$ 40,700
Replacements	10	$ 72,000	$ 141,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	25	$ 201,000	$ 122,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replacements	50	$ 100,000	$ 17,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
KC Annual Fee	1	$ 680	$ 16,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 680	$ 680	$ 680
Meter Replacements	5	$ 20,880	$ 726,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 41,760	$ -	$ -
Meter Maintenance	1	$ 11,950	$ 2,325,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 23,900	$ 23,900	$ 23,900	$ 23,900	$ 119,500	$ 119,500	$ 119,500
New Meter Installation		$ 20,880	$ 155,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 41,760	$ -	$ -	$ -	$ 167,040	$ -	$ -
SUM CAPITAL			**$ 6,822,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 3,823,000**														
Notes:																	
1. 2% Commissioning																	
2. 3% Acceptance Testing																	
3. 2% Post Construction Monitoring																	
Yellow indicates output																	
Bold Box = Inputs																	
Italics indicates formula																	

N-16

CSO Area:	North Union Bay
NPDES CSO Outfalls:	018
CSO Control Measure Description:	Retrofit

Capital Cost Summary

	2014 Dollars	**Notes**
Hard Cost	$ 615,000	
Soft Cost	$ 301,000	
Property Cost	$ -	Based on King County tax assessor values
Base Cost	**$ 916,000**	
Construction Contingency	**$ 183,000**	
Management Reserve	**$ 137,000**	
Commissioning	**$ 99,000**	
Stabilization	**$ 62,000**	
Total Project Cost	***$ 1,397,000***	

Operating Cost Summary

	2013 Dollars	**Notes**
Post construction monitoring cost	$ 186,000	
Annual Operating Cost	$ 3,000	Cost Range $2,000 to $3,000
Annual Flow Meter Maintenance	$ 84,000	7 permanent meters
Annual King County Treatment Fee	$ 1,700	

NPV Calculation Summary

Construction start:	Year 2
Construction completion; O&M Start:	Year 3
Post-Construction Monitoring:	Year 4
Temporary Flow Monitoring Start:	Year 2
Temporary Flow Monitoring Completion:	Year 6

	2013 Dollars	**Notes**
Capital Costs	$ 1,397,000	
Annual Operating Costs	$ 3,000	
Electrical Replacements (20 year cycle)	$ 20,000	
Mechanical Replacements (25 year cycle)	$ 40,000	
Structural Replacements (50 year cycle)	$ -	
Treatment Fees	$ 1,700	
Meter Replacement (5 year cycle)	$ 146,000	7 flow meters.
Meter Maintenance - Annual Cost	$ 84,000	7 flow meters.
Net Present Value	$ 5,456,000	

Seattle Public Utilities
LTCP Basin:
Project Definition Cost Estimate (Class 4)

Takeoff By:
Original Estimate By: Tara Wong-Esteban (SPU)
Date: 3/11/2013
Transferred to LTCP 3C Tool by: Candice Au-Yeung
Date: 2/11/2014
Rev. 11/12/2014 Candice Au-Yeung

Project Type: North Union Bay Retrofit

Total Cost Estimate Summary

Unit Cost Escalation to Today

Description	ENR CCI Index
Estimate Unit Cost Index ENR CCI (Seattle), April 2013	9430.77
Current ENR CCI Index (Seattle), August 2014	10161.68
Unit Cost Adjustment	1.078
Market Conditions % (Set by SPU Finance office)[1]	0.0%
Current Seattle WA Sales Tax rate[2]	9.5%

	Cost Element Description	Totals	Pipe/Horz Conveyance	Trenchless Technology	Storage Pond	Water Quality Vaults	Storage Tank/Pipe	Pump Station	Green Stormwater Infrastructure
A	Facility Cost Estimate	$ 449,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
B	**Subtotal**	**$ 449,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
C	Retrofit Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
D	Permit Fees (Use 1% based on Windermere)	$ 4,490	$ -	$ -	$ -	$ -	$ -	$ -	$ -
E	Construction Line Item Pricing (April 2013 Dollars)	$ 453,490	$ -	$ -	$ -	$ -	$ -	$ -	$ -
F	Construction Line Item Pricing (See above for ENR Index Date)	$ 489,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
G	Adjustment for Market Conditions[1]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
H	Allowance for Indeterminates and Indirects[6] 15%	$ 73,350	$ -	$ -	$ -	$ -	$ -	$ -	$ -
I	**Construction Bid Amount**	**$ 562,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
J	Sales Tax[2]	$ 53,390	$ -	$ -	$ -	$ -	$ -	$ -	$ -
K	**Construction Contract Amount**	**$ 615,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
L	Crew Construction Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
M	Miscellaneous Hard Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	**Hard Cost Total**	**$ 615,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
O	Soft Cost %[3]	49%	49%	49%	49%	49%	49%	49%	180%
P	Soft Cost Amount	$ 301,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Q	Property Cost (Per SPU Real Estate)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
R	**Base Cost**	**$ 916,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
S	Construction Contingency 20%[4] (Base Cost)	20%	20%	20%	20%	20%	20%	20%	20%
T	Construction Contingency Amount	$ 183,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
U	Management Reserve 15%[5] (Base Cost)	15%	15%	15%	15%	15%	15%	15%	15%
V	Management Reserve Amount	$ 137,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
W	GC/CM Allowance 10%[7] (Construction Contract Amount)	0%	0%	0%	0%	0%	0%	0%	0%
X	GC/CM Allowance Amount	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	**Total Costs, 2014 Dollars[8]**	**$ 1,240,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**

Notes:

[1] SPU Finance office to provide market condition adjustment

[2] WA State Dept of Revenue 2 Qtr 2013 Seattle Tax Rate of 9.5%

[3] Soft Cost % for large drainage or wastewater projects (TCP>$5M) is 49% per SPU guidelines. Soft cost for GSI range from 119% to 240% per SPU, use 180% for porject average.

[4] Contingency for SPU Options Analysis ranges from 15% to 25% of Base Cost.

[5] Management Reserve for SPU Options Analysis ranges from 10% to 20% of Base Cost.

[6] Allowance for Indeterminates and contingency markup of 15% of Construction Line Item Pricing per SPU guidance February 2014.

[7] GCCM vs Design Build cost based on 1/9/13 guidence memo per Patrick Burke. Only used on Tank Projects with Construction Bid Amount greater than $10 million.

[8] Total Project Dollar values are rounded to the nearest $10,000.

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number
Alternative Description **North Union Bay Retrofit**
(with climate change) Updated for model results

1/25/2015

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/ Base Cost*	*Ann Freq*	*Anticipated Annual Cost*	*Variability Multiplier*	*High End Annual Cost*
Conveyance Pipeline-	7	Typical		LF	$ 1.75	1	$ -	1	$ -
special cleaning		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main		LF	$ 1.00	1	$ -	1	$ -
Diversion Structure									
		Type 1 - Basic		ea	$ 260	4	$ -	1.5	$ -
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized	1	ea	$ 1,000	4	$ 2,040	1.5	$ 3,060
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP		ea	$ 5,000	1	$ -	1.25	$ -
		Type 2 - 50HP & up		ea	$ 9,600	1	$ -	1.25	$ -
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	$ -
Storage Tanks	12								
		Type 1 - < 72-inch pipe		LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG		ea	$ 16,500	1	$ -	1.25	$ -
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel		MG	$ 2,180	1	$ -	1.5	$ -
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
				MG	$ 1,700	1	$ -	1.25	$ -
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance				ea	$ 2,040	6	$ -	1.25	$ -
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 2,040		$ 3,060

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟫	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Neighborhood															
CSO Area		North Union Bay															
CSO Basin(s)		018															
Control Measure		Retrofit															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		3															
Start of Flow Monitoring (end of year)		1															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 5,456,000															
CAPITAL COSTS																	
Hard Cost		$ 615,000															
Property Cost (burdened)		$ -															
Total Costs		$ 1,240,000															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			*$ -*														
Design			*$ 186,000*	$ 186,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Bid/Award			*$ 24,000*	$ -	$ 24,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Construction			*$ 888,000*	$ -	$ 465,000	$ 465,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Property			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Commissioning	1		*$ 92,000*	$ -	$ -	$ 49,600	$ 49,600	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operations Acceptance Testing	2		*$ 58,000*	$ -	$ -	$ 31,000	$ 31,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		*$ 168,000*	$ -	$ -	$ -	$ 93,000	$ 93,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance															
Annual Operations & Main1	1	$ 3,060	*$ 91,000*	*$ -*	*$ -*	*$ -*	*$ 3,060*	*$ 3,060*	*$ 3,060*	*$ 3,060*	*$ 3,060*	*$ 3,060*	*$ 3,060*	*$ 3,060*	*$ 3,060*	*$ 3,060*	*$ 3,060*
Replacements	20	$ 20,000	*$ 21,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Replacements	25	$ 40,000	*$ 31,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Replacements	50	$ -	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
KC Annual Fee	1	$ 1,700	*$ 50,000*	*$ -*	*$ -*	*$ -*	*$ 1,700*	*$ 1,700*	*$ 1,700*	*$ 1,700*	*$ 1,700*	*$ 1,700*	*$ 1,700*	*$ 1,700*	*$ 1,700*	*$ 1,700*	*$ 1,700*
Meter Replacements	5	$ 20,880	*$ 934,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 229,680*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 146,160*	*$ -*	*$ -*	*$ -*
Meter Maintenance	1	$ 11,950	*$ 2,698,000*	*$ -*	*$ 47,800*	*$ 47,800*	*$ 131,450*	*$ 131,450*	*$ 131,450*	*$ 83,650*	*$ 83,650*	*$ 83,650*	*$ 83,650*	*$ 83,650*	*$ 83,650*	*$ 83,650*	*$ 83,650*
New Meter Installation		$ 20,880	*$ 215,000*	*$ -*	*$ 83,520*	*$ -*	*$ 146,160*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
SUM CAPITAL			**$ 2,397,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 3,059,000**														

Notes:
1. 2% Commissioning
2. 3% Acceptance Testing
3. 2% Post Construction Monitoring
Yellow indicates output
Bold Box = Inputs
Italics indicates formula

T-2

CSO Area:	Ballard, Fremont/Wallingford, King County 3rd Ave W Regulator
NPDES CSO Outfalls:	147, 150/151, 152, 174, King County 3rd Ave W Regulator
CSO Control Measure Description:	Shared West Ship Canal Tunnel

Capital Cost Summary

	2014 Dollars	**Notes**
Hard Cost	$ 210,022,000	
Soft Cost	$ 76,720,000	
Property Cost	$ 2,800,000	Based on King County tax assessor values
Base Cost	**$ 272,106,000**	
Construction Contingency	**$ 17,436,000**	
Management Reserve/Project Contingency	**$ 75,185,000**	
Art and Sustainability	**$ 1,247,000**	
Commissioning	**$ 1,872,000**	
Stabilization	**$ 7,487,000**	
Total Project Cost	***$ 375,333,000***	

Operating Cost Summary

	2014 Dollars	**Notes**
Post construction monitoring cost	$ 1,872,000	
Annual Operating Cost	$ 586,000	Cost Range $434,000 to $586,000
Annual Flow Meter Maintenance	$ 215,000	20 permanent meters
Annual King County Treatment Fee	$ -	

NPV Calculation Summary

Construction start:	Year 5
Construction completion; O&M Start:	Year 10
Post-Construction Monitoring:	Year 13
Temporary Flow Monitoring Start:	Year 2
Temporary Flow Monitoring Completion:	Year 13

	2014 Dollars	**Notes**
Capital Costs	$ 375,333,000	
Annual Operating Costs	$ 586,000	
Electrical Replacements (10 year cycle)	$ 1,630,000	
Mechanical Replacements (25 year cycle)	$ 3,498,000	
Structural Replacements (50 year cycle)	$ 10,800,000	
Treatment Fees	$ -	
Meter Replacement (5 year cycle)	$ 376,000	20 flow meters.
Meter Maintenance - Annual Cost	$ 215,000	20 flow meters.
Net Present Value	$ 336,210,000	

KC Wastewater Treatment Division Revised Capital Project Cost Budgeting Model (as of January 2014)
Model Variation - Conveyance Over $10,000,000.

SPU/KC Shared WSCT

Description	**SPU/KC Shared WSCT** 2014 model, current year dollars (policies in effect as of Jan. 2014)	Primary calc.	Secondary calc.	Multiplier/Other	
CONSTRUCTION					
Construction Contracts					
Pipe/Horz Conveyance	3,814,360				CH2M HILL estimate from LTCP, escalated from 4/2013 $'s to 8/2014 $'s
Trenchless Technology (Storage Tunnel)	108,458,708			Unescalated amount: $100.66M	Hilton estimate for 14' dia. Tunnel, escalated from 4/2013 $'s to 8/2014 $'s
Trenchless Technology (Microtunnel)	7,413,218				CH2M HILL estimate from LTCP, escalated from 4/2013 $'s to 8/2014 $'s
3rd Avenue Conveyance	7,402,443				CH2M HILL estimate
Pump Station	8,501,496				CH2M HILL estimate from LTCP, escalated from 4/2013 $'s to 8/2014 $'s
Grit Removal / Drop Structure Odor Control	2,520,000				CH2M HILL estimate
Construction Contracts	138,110,226				Contractor(s) bid amount, does not include retail sales tax
Street Use Permit	1,381,102	1.0%	per SPU August 2014		New in 2014. WTD has elected to have the contractors negotiate the permit/cost with the City of Seattle directly and include the cost in their bid price
Mitigation Construction Contracts	-	*(not anticipated to be separate)*			Only if separate contract, otherwise any constructioned mitigations costs would be included in above contract, does not include retail sales tax
Design Contingency (AFI)	34,872,832	25.0000%	*(% per estimator)*		New in 2014. Design contingency (sometimes called Allowance for Indeterminates). Percentage is based upon revised WTD Contingency Policy/project phase
Subtotal Construction Bid Opening Amount	174,364,160				
Owner Furnished Equipment	-				Equipment purchased directly by WTD, generally only necessary on items with especially long lead times
Outside Agency Construction	-				Most utilities do not allow WTD or its contractors to relocate their services. WTD must hire/pay the outside agencies or their designated subs directly for such relocations
Change Order Contingency	17,436,416	10.0000%			Not a general design or AIF contingency. This 10% contingency is reserved for change orders that are identified during actual construction. 10% is per County policy
Subtotal Direct Cost of Construction	191,800,576				
Sales Tax	18,221,055	9.5000%			Calculated on all above items except outside agency construction
Other Capital Charges					
KC/WTD Direct Implementation	-	*(none anticipated)*			Rarely used category. Should KC or WTD workforce provide direct labor, such costs would be included in this line item
Misc. Capital Costs	-	0.0000%	NA for SPU		Minor capital construction related costs paid for by WTD such as electricity used during construciton, chemicals used during startup, etc.
Total Construction	**210,021,631**				
NON-CONSTRUCTION					
Engineering Services	-	0.0000%	NA for SPU		
Engineering Services		0.0000%	NA for SPU		External engineering design services (any internal engineering efforts would be included in staff labor)
Engineering Services During Construction		0.0000%	NA for SPU		Services provided by the external engineer during construction such as rfi and submittal reviews, etc.
Planning & Management Services	-	0.0000%	NA for SPU		Includes external services such as Planning/Studies, Program/Project Mgmt, CM, Other Consulting/Technical, Outside Legal, Testing, etc.
External Construction Management		0.0000%	NA for SPU		By far the most significant of the external planning and management services. KC requires use of external CM on construction contracts over $10 million
Permitting & Other Agency Support		0.0000%	NA for SPU		
Permits & Licenses	-	0.0000%	NA for SPU		The costs of general project, building, incidental and misc. permits. Does not include costs associated with Street Use Permits/Fees (included in construction)
Local Agency Project Costs	-	0.0000%	NA for SPU		Would include the costs of service agreements entered into with outside agencies such as Master Cooperation Agreements, Interagency Agreements, etc.
Right-of-Way					
Land Purchases/Easements	14,000,000				Not calculated, requires direct user input for project specific items
Local Agency Mitigation	-				Not calculated, requires direct user input for project specific items. In some instances, mitigation is self performed directly be the jurisdiction affected. This item covers
Misc. Service & Materials					
Misc. Services	-	0.0000%	NA for SPU		Minor project costs for misc. services
Misc Materials	-	0.0000%	NA for SPU		Minor project costs for misc. materials such as office supplies, etc.
Non-WTD Support	-	0.0000%	NA for SPU		Includes costs charged to WTD by other King County agencies for work performed directly on behalf of the project (such as the Prosecuting Attorney's Office, etc.)
WTD Staff Labor	-	0.0000%	NA for SPU		WTD staff labor charges. Includes director's office, finance, operations (capital project related only), environmental and community services and project planning and
Burden	-	0.0000%	NA for SPU		Calculated on WTD staff labor costs. Burden charged to WTD covers general King County functions such as Procurement, Accounts Payable/Receivable, etc. In 2014,
SPU Soft Costs	76,720,230	40.0000%			SPU soft costs - percentage shown in cell E46 is equivalent to SPU's 40% soft cost percentage
Subtotal Non-Construction	90,720,230				
Project Contingency	75,185,465	25.0000%	*(class 4)*		The note for this line was incorrect on the 3rd Ave valuation forwarded on 9/5/14. The value of change order contingency is no longer deducted from project contingency
Intiatives					
1% for Art	287,701	1.0000%	10.0000%	1.5	PM indicates what % of construction cost is art eligible. 1% for Art eligibility is based upon cost of above ground structures and associated design and staff labor. 2014
Sustainability	959,003	0.5000%			New in 2014. Default sustainability budget for projects over $10 million is 1/2%
Total Non-Construction	**167,152,400**				
TOTAL PROJECT COST	**377,174,030**				
Revenues	(11,200,000)				Rental income, sales of surplus property, etc. The County's accounting system does not include both expenses and income in the same data pool. Income must be
TOTAL PROJECT COST INCLUDING REVENUES	**365,974,030**				

Notes:
- •Items in yellow represent the changes incorporated into this revised model.
- •There is no requirement that the model be followed exactly. PM's are allowed to deviate from suggested %'s/costs should unique aspects of a particular project indicate higher or lower costs
- •Items outlined (cells with borders) are not calculated and require manual inputs
- •By default, contingency percentages are based upon WTD policyand a project's active phase. PM's are allowed to deviate from policy with justification
- •Contingencies only cover issues within the estimated scope of the project. Items that are outside the scope or that were never budgeted are generally not contingency items and can only be added via KC's rebaselining policy
- •Future escalation is not included in the above figures

LTCP Alternatives
Operation and Maintenance Cost Template

Alternative Number

Alternative Description **Shared West Ship Canal Tunnel (14' Diameter)**
(with climate change) Updated for model results

1/25/2015

Cost Element	*Note*	*Type/Condition*	*Quantity*	*Unit*	*Unit Cost/ Base Cost*	*Ann Freq*	*Anticipated Annual Cost*	*Variability Multiplier*	*High End Annual Cost*
Conveyance Pipeline- special cleaning	7	Typical	3400	LF	$ 1.75	1	$ 5,950	1	$ 5,950
		Arterial		LF	$ 2.00	1	$ -	1	$ -
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main	1900	LF	$ 1.00	1	$ 1,900	1	$ 1,900
Diversion Structure									
		Type 1 - Basic	2	ea	$ 260	4	$ 2,080	1.5	$ 3,120
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized	6	ea	$ 1,000	4	$ 7,240	1.5	$ 10,860
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	
		Odor Control		ea	$ 6,000		$ -	1.25	$ -
Effluent Pump Station									
		Type 1 - <50HP		ea	$ 5,000	1	$ -	1.25	$ -
		Type 2 - 50HP & up	1	ea	$ 9,600	1	$ 9,600	1.25	$ 12,000
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge	1000	HP		1	$ 9,217	1	$ 9,217
Storage Tanks	12								
		Type 1 - < 72-inch pipe		LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG		ea	$ 16,500	1	$ -	1.25	$ -
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel	15.24	MG	$ 182,493	1	$ 182,493	1.5	$ 273,739
Tank cleaning equipment									
		Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
	11	Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control									
			15.24	MG	$ 213,536	1	$ 213,536	1.25	$ 266,920
Landscape Maintenance	13			SF	$ 0.145	29	$ -	1.2	$ -
Generator Maintenance			1	ea	$ 2,040	6	$ 2,040	1.25	$ 2,550
NDS Maintenance							$ -	1	$ -
Water Quality Structures							$ -	1.5	$ -
Annual O&M							$ 434,056		$ 586,256

🟧	Adjusted to actual number of tipping buckets (per Windermere design)
🟨	Adjusted to account for $2/lb carbon, annual carbon replacement
🟦	Added PS odor control maintenance
🟧	Force main at $1/lf/year
⬜	C.Cox landscape maintenance

Discount rate	3%																
	Notes																
Project Title		Long Term CSO Control Plan															
Option		Shared West Ship Canal Tunnel															
CSO Area		Ballard/Fremont/Wallingford/3rd Ave W/11th Ave NW															
CSO Basin(s)		147, 150/151, 152, 174, 3rd Ave W, 11th Ave NW															
Control Measure		Shared West Ship Canal Tunnel															
ENR CCI		10161.68															
Construction Completion (Start of O&M)		12															
Start of Flow Monitoring (end of year)		1															
End of Flow Monitoring		100															
Present Value Cost over 100yrs at discount		$ 336,210,000															
CAPITAL COSTS																	
Hard Cost																	
Property Cost (unburdened)		$ 14,000,000															
Total Costs		$ 365,974,030	Note - includes sale of a portion of Ballard site (80% of original cost recovered)														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
			Present Value	2014	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*
Engineering Report			*$ 23,583,000*	$ 6,159,546	$ 6,159,546	$ 6,159,546	$ 6,159,546	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Design			*$ 44,490,000*	$ -	$ 8,212,727	$ 8,212,727	$ 8,212,727	$ 8,212,727	$ 8,212,727	$ 8,212,727	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Bid/Award			*$ 6,254,000*	$ -	$ -	$ -	$ -	$ 7,039,481	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Construction			*$ 218,153,000*	$ -	$ -	$ -	$ -	$ 13,551,000	$ 27,102,000	$ 40,653,000	$ 67,755,001	$ 81,306,001	$ 40,653,000	$ -	$ -	$ -	$ -
Property			*$ 7,287,000*	$ -	$ 11,600,000	$ -	$ 2,400,000	$ 600,000	$ -	$ -	$ -	$ -	$ -	$ -	$ (9,280,000)	$ -	$ -
Commissioning	1		*$ 1,310,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,759,870	$ -		
Operations Acceptance Testing	2		*$ 5,085,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,039,481	$ -	$ -
OPERATING COSTS																	
Post-Construction Monitoring	3		*$ 1,234,000*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,759,870	$ -
MAINTENACE COSTS	Freq(yr)	Cost of Maintenance															
Annual Operations & Main1	1	$ 586,300	*$ 13,071,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 586,300*	*$ 586,300*
Replacements	10	$ 1,630,000	*$ 3,102,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Replacements	25	$ 3,498,000	*$ 2,059,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Replacements	50	$ 10,800,000	*$ 1,780,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
KC Fee	1	$ 21,200	*$ 473,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 21,200*	*$ 21,200*
Meter Replacements	5	$ 18,792	*$ 1,885,000*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 169,128*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 169,128*	*$ -*	*$ -*	*$ -*
Meter Maintenance	1	$ 10,755	*$ 6,028,000*	*$ -*	*$ 96,795*	*$ 96,795*	*$ 96,795*	*$ 96,795*	*$ 96,795*	*$ 96,795*	*$ 96,795*	*$ 96,795*	*$ 96,795*	*$ 290,385*	*$ 290,385*	*$ 290,385*	*$ 215,100*
New Meter Installation		$ 18,792	*$ 416,000*	*$ -*	*$ 169,128*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ 338,256*	*$ -*	*$ -*	*$ -*
SUM CAPITAL			**$ 308,463,000**														
SUM OPERATIONS AND MAINTENANCE			**$ 27,747,000**														

Notes:
1. 2% Commissioning
2. 3% Acceptance Testing
3. 2% Post Construction Monitoring

Yellow indicates output

Bold Box = Inputs

Italics indicates formula

CD-1: Neighborhood Storage Option Capital Cost Distribution (August 2014 Dollars, Millions)

CSO Area	CSO Basins	NPV (100-year)	City Share Percentage	City Share NPV
Leschi	028-036	$ 33.0	100%	$ 33.0
Montlake	020, 139, 140	$ 17.4	100%	$ 17.4
Portage Bay	138	$ 10.2	100%	$ 10.2
Duwamish	111	$ 8.5	100%	$ 8.5
East Waterway	107	$ 29.9	100%	$ 29.9
Magnolia	060	$ 7.3	100%	$ 7.3
Central Waterfront	069	$ 10.4	100%	$ 10.4
Ballard	150/151, 152	$ 134.0	100%	$ 134.0
Fremont/Wallingford	147, 174	$ 112.1	100%	$ 112.1
Delridge	099	$ 10.9	100%	$ 10.9
	168	$ 11.1	100%	$ 11.1
	169	$ 10.6	100%	$ 10.6
North Union Bay	018	$ 5.5	100%	$ 5.5
City Share Total NPV				***$ 400.9***

CD-3: Shared West Ship Canal Tunnel Option Capital Cost Distribution (August 2014 Dollars, Millions)

CSO Area	CSO Basins	NPV (100-year)	City Share Percentage	City Share NPV
Leschi	028-036	$ 33.0	100%	$ 33.0
Montlake	020, 139, 140	$ 17.4	100%	$ 17.4
Portage Bay	138	$ 10.2	100%	$ 10.2
Duwamish	111	$ 8.5	100%	$ 8.5
East Waterway	107	$ 29.9	100%	$ 29.9
Magnolia	060	$ 7.3	100%	$ 7.3
Central Waterfront	069	$ 10.4	100%	$ 10.4
Ballard	150/151, 152		100%	
Fremont/Wallingford	147, 174		100%	
Delridge	099	$ 10.9	100%	$ 10.9
	168	$ 11.1	100%	$ 11.1
	169	$ 10.6	100%	$ 10.6
North Union Bay	018	$ 5.5	100%	$ 5.5
Shared West Ship Canal Tunnel	147, 150/151, 152, 174, 3rd Ave W	$ 336.2	69%	$ 232.0
City Share Total NPV				***$ 386.8***