Appendix G.1

Ship Canal – 11th Ave NW, 3rd Ave W, University, and Montlake

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Appendix G.1.1

11th Ave NW Site Alternatives

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11th Ave NW Site Alternative

DSN004-STOR-1 (KC) or SC-11th Ave NW-KC-STOR

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DSN004-STOR-1 (KC) or SC-11th Ave NW-KC-STOR

Alternative DSN004-STOR-1 (KC) controls King County's 11th Ave NW CSOs by building a storage tank near the 11th Ave NW Overflow Structure. This alternative is an independent alternative and only controls King County CSOs.

Design Criteria

- King County Storage Volume Requirement: 1.85 MG (11th Ave NW)
- King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 51.5 MGD (11th Ave NW)
- Storage tank is required to drain within 12 hours of event.

Description

Alternative DSN004-STOR-1 (KC) consists of a storage tank to control King County 11th Ave NW CSOs. A CSO control volume of approximately 1.85 MG is required to reduce overflows at the 11th Ave NW CSO Outfall to an average of one untreated discharge per year. Storage of this volume could be provided with an offline storage tank located within or adjacent to the approximate boundary shown in Figure G.1.1-1. See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundary.

The main components of this alternative would include:

- 1.85-MG offline storage tank with pumps to empty the storage tank.
- Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
- Modifications to the 11th Ave NW Overflow Structure.
- Up to approximately 775 ft of 16-inch-diameter force main, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.1-1.
- Up to approximately 1,550 ft of 48-inch-diameter influent gravity sewer, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.1-1.

Storage Tank

The CSO control volume for King County could be stored in a buried, rectangular structure, approximately 210 feet long and 80 feet wide with a sidewater depth of approximately 20 feet.

Flows would enter the storage tank during a wet-weather event. The tank may be configured with multiple chambers, so that only those chambers required to store the volume of the wet-weather event would be used. Storage of flows would start in the first chamber and as that chamber fills and reaches capacity, flows would be transferred into subsequent chambers until either the wet-weather event ends or the capacity of the storage tank is reached. Each chamber would contain equipment for flushing and self-cleaning, and only chambers used in a wet-weather event would require flushing. Control of odors and sediment in the storage chambers may require regularly-scheduled cleaning between events.

Facilities Building(s)

Facilities building(s) would be located above or below ground level and would contain an odor control system, electrical controls, and a standby generator. The actual contents of the building(s) will be determined during preferred alternative development. The representative footprint shown in Figure G.1.1-1 for this alternative locates the facilities buildings adjacent to the storage tank for conservative purposes; however, the facilities buildings could be located above the storage tank to minimize space requirements.

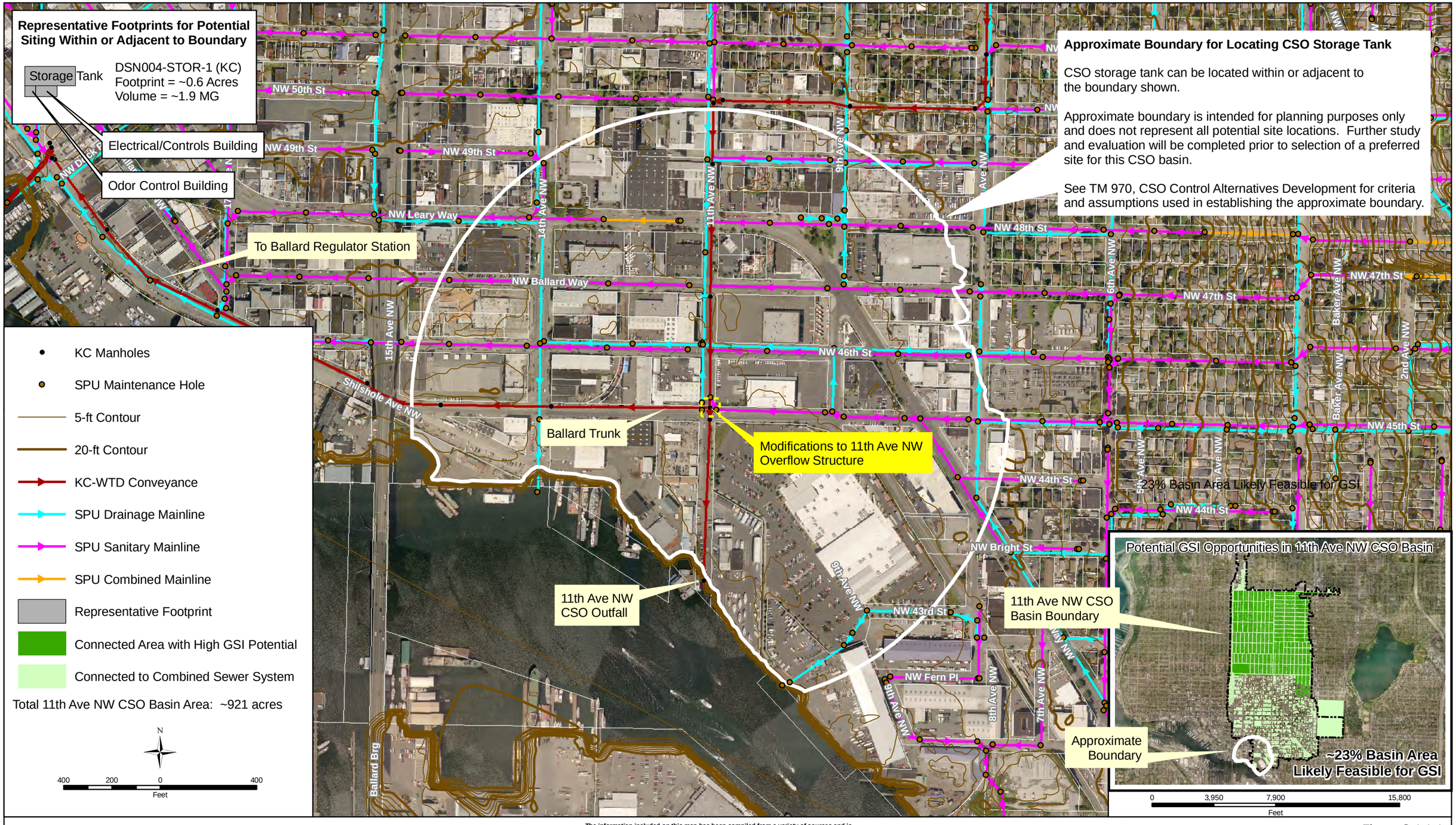
Flow Diversion and Discharge

One regulator station will be required to divert King County flows from the 11th Ave NW Overflow Structure to the storage tank. For this planning phase, it is assumed that the diversion would occur at the 11th Ave NW Overflow Structure. Evaluation of whether flows can be diverted upstream of the 11th Ave NW Overflow Structure will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the storage tank via a 48-inch-diameter influent gravity sewer. The length of the gravity sewer will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development. The influent gravity sewer can be up to 1,550 feet long based on the criteria and assumptions listed in Section 6.1.

After a wet-weather event, the chambers inside the storage tank would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County conveyance system through a 16-inch-diameter force main that is up to approximately 775 feet in length. The length of the force main will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development.

Construction Assumptions

King County's Tabula cost estimating program was used to develop a Class 5 estimate for this alternative. The attached documentation lists the construction assumptions used.



King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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Figure G.1.1-1

11th Ave NW - DSN004-STOR-1 (KC)
Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN004-STOR-1 (KC)

Escalation Assumptions

Description	ENR CCI
ENR CCI (Seattle), January 2010	8645.35

Total Project Cost, 2010 Dollars

Description	Total Costs (11th Ave NW)
1.85-MG Storage Tank Construction Cost =	$9,470,000
Influent Gravity Sewer Construction Cost (1,550 LF of 48-inch-diameter pipe) =	$2,530,000
Force Main Construction Cost (775 LF of 16-inch-diameter pipe) =	$360,000
Modifications to 11th Ave NW Overflow Structure Construction Cost =	$490,000
SDOT Street Use Permit Fee Cost =	$180,000
Total Construction Cost =	$13,030,000
Sales Tax (10% of Construction Cost) =	$1,300,000
[1]Allied Costs (46.07% of Construction Cost) =	$6,000,000
Property Costs =	$3,910,000
Subtotal of Project Costs =	$24,240,000
[1]Construction Contingency (10% of Construction Cost) =	$1,300,000
[1, 2]Project Contingency =	$5,970,000
Total Project Cost, 2010 Dollars =	**$31,500,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

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STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility
Printed date : 12/20/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Storage Capacity: 1.85 Mgal
Facility Footprint: 26110 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	2,900.00	SY	$43	$125,000
Dewatering	1	LS	$1,040,000	$1,040,000
Odor Control	1	LS	$309,000	$309,000
Effluent Pump Station	1	LS	$239,000	$239,000
Construction Cost	1.8	Mgal	4,000,000	$7,400,000
			Year 2008 Subtotal	$9,110,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$9,470,000

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INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Gravity)
Printed date : 12/20/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 1550 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 48 in.

Geometry

Outer Diameter	4.83	ft
Trench Width	8.78	ft
Excavation Depth	15.8	ft
Complete Surface Rest. Width	10.8	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	7,980.00	CY	$13	$104,000
Backfill	4,540.00	CY	$34	$154,000
Complete Pavement Restoration	1,860.00	SY	$86	$160,000
Overlay Pavement Restoration	5,720.00	SY	$28	$160,000
Trench Safety	49,100.00	SF	$17	$834,000
Spoil Load and Haul	7,980.00	CY	$16	$128,000
Pipe Unit Material Cost	1,550.00	lf	$123	$191,000
Pipe Installation	1,550.00	lf	$60	$93,000
Place Pipe Zone Fill	2,390.00	CY	$34	$81,300
Manholes	4	MH	$12,600	$50,200
Existing Utilities	1,550.00	lf	$166	$257,000
Dewatering	1,550.00	lf	$107	$166,000
Traffic Control	1,550.00	lf	$36	$55,800
			Year 2008 Subtotal	$2,430,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$2,530,000

Year 2010 Total: $2,530,000

FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Force Main
Printed date : 12/20/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 775 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Standard
Pipe Diameter: 16 in.

Geometry

Outer Diameter	1.45	ft
Trench Width	4.38	ft
Excavation Depth	8.45	ft
Complete Surface Rest. Width	6.39	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,060.00	CY	$13	$13,800
Backfill	629	CY	$34	$21,400
Complete Pavement Restoration	550	SY	$86	$47,300
Overlay Pavement Restoration	1,340.00	SY	$28	$37,600
Trench Safety	13,100.00	SF	$1	$6,940
Spoil Load and Haul	1,060.00	CY	$16	$17,000
Pipe Unit Material Cost	775	lf	$75	$58,100
Pipe Installation	775	lf	$27	$20,900
Place Pipe Zone Fill	387	CY	$34	$13,200
Existing Utilities	775	lf	$42	$32,600
Dewatering	775	lf	$87	$67,400
Traffic Control	775	lf	$16	$12,400
			Year 2008 Subtotal	$349,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$363,000

Year 2010 Total: $363,000

MODIFICATIONS TO 11TH AVE NW OVERFLOW STRUCTURE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 11/09/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$485,000

Year 2010 Total: $485,000

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PROPERTY AND PERMITTING COSTS

Land and Building Cost, Average Cost per Square Foot (January 2007 to August 2010)

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building ($/SF)	Average Cost per Square Foot for Industrial Land ($/SF)
DSN004 11th Ave NW	$149.89	$21.91

Land Costs, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Storage Tank	19,800	$149.89	100%	$2,967,822
Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.)	6,310	$149.89	100%	$945,806
			Total Land Costs	$3,913,628

SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.

Closure of construction area will occur in phases. Assumed construction phasing in:	1,000	ft segments
Assumed production rate during working days =	15	LF/d
For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula.	22	ft
For pipe diameters greater than 36 inches, assume full width of road will be closed during construction. Width is based on the full width for arterial pavement restoration in Tabula.	44	ft

Source of methodology for estimating permit fees: http://www.seattle.gov/transportation/cams/CAM2115.pdf

SDOT Street Use Permit Fee Estimation, 2010 Dollars

Description	Diameter of Pipe (in)	Length (ft)	Width of Construction Area (ft)	Estimated Construction Area (SF)	Construction Duration (Calendar Days)	Number of 10-Day Periods	Use Fee ($/SF)	Estimated Permit Costs
Regulator Station Upgrade at 11th Ave NW Overflow Structure	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Gravity Sewer, First Phase of Construction	48	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer, Second Phase of Construction	48	550	44	24,200	51.3	6	$0.90	$21,780
Installation of Force Main	16	775	22	17,050	72.3	8	$1.70	$28,985
							Total SDOT Street Use Fee Estimation:	$184,865

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Operations and Maintenance Cost Estimate Summary

Basin Name: **11th Ave NW (Ind)**

Alternative Name: **SC-11th Ave NW-KC-STOR**

Current ENR	**8645.4**
Power Cost (per kwh)	**0.065**
Labor rate (loaded) /hr	**51.17**
SPU Water Cost $/CCF	**4.50**
Carbon Cost/Lb	**2.00**

Acres of Raingarden for GSI	**0.00**
Annual Overflow Vol (MG)	**1.00**
Annual Vol Capture	**1.00**
Annual Events	**1**
Stor Vol	**1.85**
Peak Flow Rate	**61.30**
ENR 1994	5747

Annual Costs

Components	**Annual Maintenance & Inspection Cost**	**Annual Operation Cost**	**Annual Energy Cost**	**Annual Chemical Cost**
Gravity Sewer/Combined Sewers	$2,341			
Force Mains	$28			
Regulator/Flow Control Structures	$38,459			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$0			
Pump Stations	$0	$0	$0	
Rectangular Storage Facilities	$41,566	$4,395	$10,498	$34,626
High Rate Treatment	$0	$0	$0	$0
Additonal Secondary Treatment	NA	$657	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$82,393**	**$5,052**	**$10,498**	**$34,626**

Total Annual O&M

General	**$122,070**
Energy	**$10,498**
Total	**$132,569**

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WTD Business Case Evaluation Results

11th Ave NW CSO Control

Lower Bound Discount Rate (WTD Borrowing Cost) (1)

Scenario	Lifetime	Initial Capital Outlay	Total Project Life Costs (2)	Total Project Life Benefits	Net Project Life Costs	Average Project Annual Cost	Annual Costs over(under) Status quo
Alternatives							
SC-11th Ave NW-KC-STOR	50	$31,500,000	$36,055,480	$0	$36,055,480	$1,192,342	$1,192,342

Upper Bound Discount Rate (OMB, Private Rate of Return) (3)

Scenario	Lifetime	Initial Capital Outlay	Total Project Life Costs (2)	Total Project Life Benefits	Net Project Life Costs	Average Project Annual Cost	Annual Costs over(under) Status quo
Alternatives							
SC-11th Ave NW-KC-STOR	50	$31,500,000	$26,293,203	$0	$26,293,203	$869,507	$869,507

First Year of Construction	2010	Additional inflation rate > 3%	1.00%

Notes:

(1) WTD Discount rate based on recent WTD borrowing costs net of 3% annual inflation. 2.18%

(2) Costs include risk and uncertainty, if estimated.

(3) Discount rate net of inflation, per the King County Budget Office. 7.00%

The option with the largest net equivalent annualized cost is the financially preferred option.

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11th Ave NW Site Alternative

DSN004-CON-1 (KC) or SC-11th Ave NW-KC-Conv

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DSN004-CON-1 (KC) or SC-11th Ave NW-KC-Conv

Alternative DSN004-CON-1 (KC) controls King County's 11th Ave NW CSOs by increasing the conveyance capacity from the 11th Ave NW Overflow Structure to the Ballard Regulator Station. Flows would be conveyed downstream of the Ballard Regulator Station to the Ballard Siphons or 84-inch-diameter tunnel crossing the Ship Canal. This alternative is an independent alternative and only controls King County CSOs.

Design Criteria

- An equivalent pipe diameter of 84 inches from the 11th Ave NW Overflow Structure to the Ballard Regulator Station, along with modifications to the Ballard Regulator Station, are required to control King County 11th Ave NW CSOs.

Description

Alternative DSN004-CON-1 (KC) consists of a conveyance pipe and regulator modifications to control King County 11th Ave NW CSOs. An equivalent pipe diameter of 84 inches is required to reduce overflows at the 11th Ave NW CSO Outfall to an average of one untreated discharge per year. For planning purposes, a new 84-inch-diameter conveyance pipe is assumed to parallel the existing Ballard Trunk from the 11th Ave NW Overflow Structure to the Ballard Regulator Station (see Figure G.1.1-2). It may be possible that the diameter of the new conveyance pipe could be reduced if it is determined that the existing Ballard Trunk is in adequate condition and could operate in parallel with the new pipe. Operating pipes in parallel could provide operational flexibility as well.

The main components of this alternative would include:

- Approximately 3,200 ft of 84-inch-diameter pipe, paralleling the existing Ballard Trunk from the 11th Ave NW Overflow Structure to the Ballard Regulator Station.
- Modifications to the existing 11th Ave NW Overflow Structure.
- Modifications to the existing Ballard Regulator Station, including two new weirs and a regulator gate.

Conveyance Upgrade

Approximately 3,200 ft of 84-inch-diameter pipe would parallel the existing Ballard Trunk from 11th Ave NW to the Ballard Regulator Station along Shilshole Ave NW. The new pipe would discharge to the Ballard Regulator Station where flows would continue downstream to the Ballard Siphons or 84-inch-diameter tunnel crossing the Ship Canal; see Figure G.1.1-2.

Regulator Modifications

Modifications would be required at the existing 11th Ave NW Overflow Structure to divert flows to the new 84-inch-diameter pipe or divert flows between the existing Ballard Trunk and new parallel pipe, depending on how the modified conveyance system is operated.

Modifications would also be required at the Ballard Regulator Station. Modifications would include adding a new weir gate structure that diverts flows to either the Ballard Siphons or the 84-inch-diameter tunnel. Under normal flow conditions, flows would be diverted to the Ballard Siphons. However, when the capacities of the dual siphons are exceeded, the new weir gate

structure would allow flows to overflow into the forebay structure of the 84-inch-diameter tunnel.

Construction Assumptions

King County's Tabula cost estimating program was used to develop a Class 5 estimate for this alternative. The attached documentation lists the construction assumptions used.

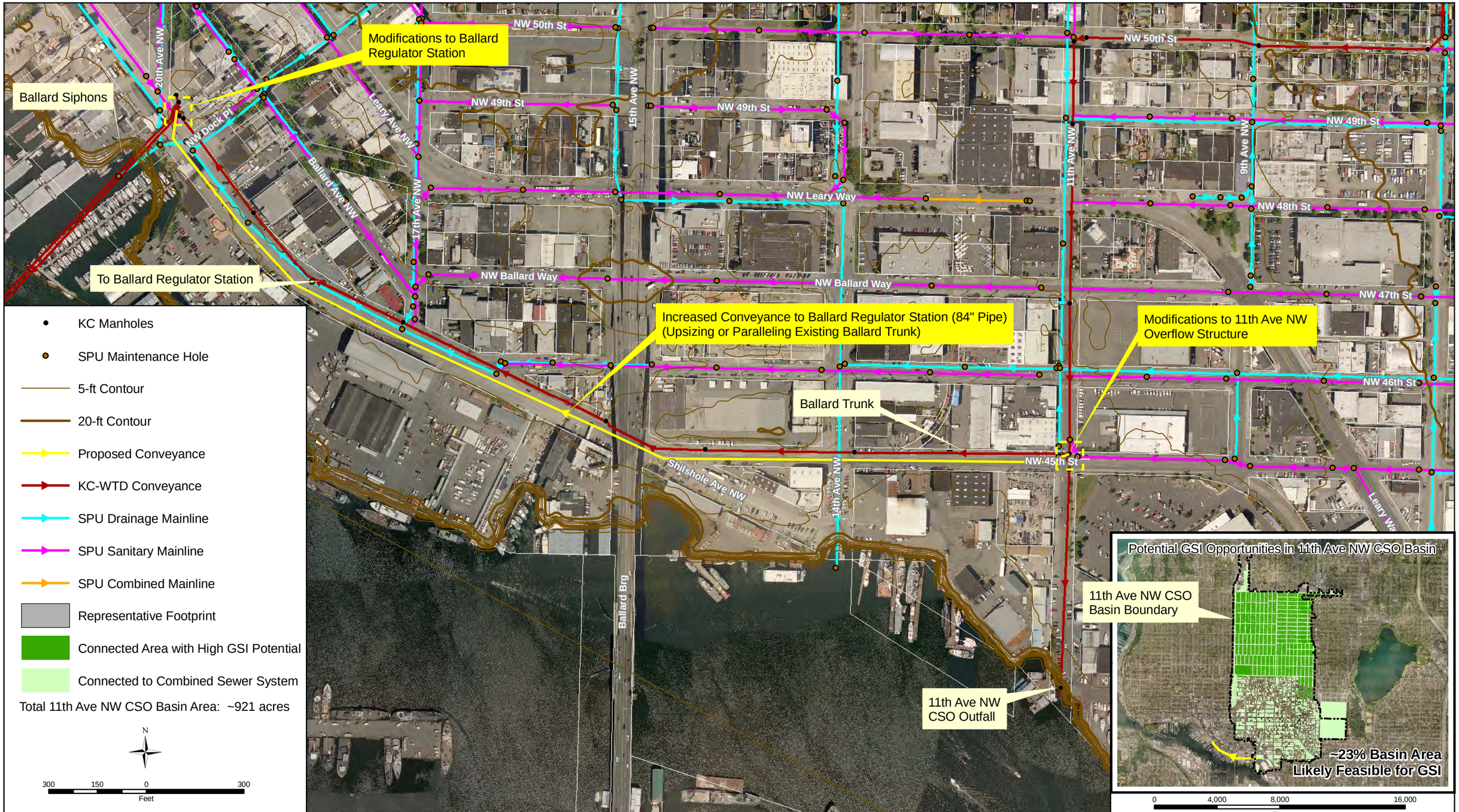

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Figure G.1.1-2

11th Ave NW - DSN004-CON-1 (KC)
Increased Conveyance

TM 970, CSO Control Alternatives Development

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Alternative DSN004-CON-1 (KC)

Escalation Assumptions

Description	ENR CCI
ENR CCI (Seattle), January 2010	8645.35

Total Project Cost, 2010 Dollars

Description	Total Costs (11th Ave NW)
Conveyance Pipe Construction Cost (3,200 LF of 84-inch-diameter pipe) =	$10,400,000
Modifications to Ballard Regulator Station Construction Cost =	$490,000
Modifications to 11th Ave NW Overflow Structure Construction Cost =	$490,000
SDOT Street Use Permit Fee Cost	$280,000
Total Construction Cost =	$11,660,000
Sales Tax (10% of Construction Cost) =	$1,170,000
[1]Allied Costs (46.07% of Construction Cost) =	$5,370,000
Subtotal of Project Cost =	$18,200,000
[1]Construction Contingency (10% of Construction Cost) =	$1,170,000
[1, 2]Project Contingency =	$4,290,000
Total Project Cost, 2010 Dollars =	**$23,700,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

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CONVEYANCE PIPE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Conveyance Pipe
Printed date : 12/22/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Modificatior
SDOT Street Use Permit Fee Cost
Assumptions

Construction Year: 2010
Length: 3200 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 84 in.

Geometry

Outer Diameter	8.33	ft
Trench Width	13.3	ft
Excavation Depth	19.3	ft
Complete Surface Rest. Width	15.3	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	30,600.00	CY	$13	$397,000
Backfill	14,200.00	CY	$34	$484,000
Complete Pavement Restoration	5,450.00	SY	$86	$469,000
Overlay Pavement Restoration	10,200.00	SY	$28	$285,000
Trench Safety	124,000.00	SF	$17	$2,100,000
Spoil Load and Haul	30,600.00	CY	$16	$489,000
Pipe Unit Material Cost	3,200.00	lf	$490	$1,570,000
Pipe Installation	3,200.00	lf	$146	$467,000
Place Pipe Zone Fill	9,870.00	CY	$34	$335,000
Manholes	7	MH	$41,700	$292,000
Existing Utilities	3,200.00	lf	$773	$2,470,000
Dewatering	3,200.00	lf	$147	$470,000
Traffic Control	3,200.00	lf	$50	$160,000
			Year 2008 Subtotal	$9,990,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$10,400,000

Year 2010 Total: $10,400,000

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MODIFICATIONS TO BALLARD REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 11/09/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Modificatio
SDOT Street

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$485,000

Year 2010 Total: $485,000

MODIFICATIONS TO 11TH AVE NW OVERFLOW STRUCTURE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 11/09/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Modificatio
SDOT Street

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$485,000

Year 2010 Total: $485,000

MODIFICATIONS TO BALLARD REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.

Closure of construction area will occur in phases. Assumed construction phasing in:	1,000	ft segments
Assumed production rate during working days =	15	LF/d
For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula.	22	ft
For pipe diameters greater than 36 inches, assume full width of road will be closed during construction. Width is based on the full width for arterial pavement restoration in Tabula.	44	ft

Source of methodology for estimating permit fees: http://www.seattle.gov/transportation/cams/CAM2115.pdf

Modifications to 11th Ave NW Overflow Structure Construction Cost =

SDOT Street Use Permit Fee Estimation, 2010 Dollars

Description	Diameter of Pipe (in)	Length (ft)	Width of Construction Area (ft)	Estimated Construction Area (SF)	Construction Duration (Calendar Days)	Number of 10-Day Periods	Use Fee ($/SF)	Estimated Permit Costs
Regulator Station Upgrade at 11th Ave NW Overflow Structure	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Conveyance Pipe From 11th Ave NW to 14th Ave NW	84	730	44	32,120	68.1	7	$1.30	$41,756
Conveyance Pipe From 14th Ave NW to 15th Ave NW	84	690	44	30,360	64.4	7	$1.30	$39,468
Conveyance Pipe From 15th Ave NW to 17th Ave NW	84	780	44	34,320	72.8	8	$1.70	$58,344
Conveyance Pipe from 17th Ave NW to Ballard Regulator Station	84	1,000	44	44,000	93.3	10	$2.90	$127,600
Upgrade to Ballard Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
							Total SDOT Street Use Fee Estimation:	$280,168

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Operations and Maintenance Cost Estimate Summary

Basin Name: **11th Ave NW (Ind)**

Alternative Name: **SC-11th Ave NW-KC-Conv**

Current ENR	**8645.4**
Power Cost (per kwh)	**0.065**
Labor rate (loaded) /hr	**51.17**
SPU Water Cost $/CCF	**4.50**
Carbon Cost/Lb	**2.00**

Acres of Raingarden for GSI	**0.00**
Annual Overflow Vol (MG)	**1.00**
Annual Vol Capture	**1.00**
Annual Events	**1**
Stor Vol	**1.85**
Peak Flow Rate	**61.30**
ENR 1994	5747

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$4,832			
Force Mains	$0			
Regulator/Flow Control Structures	$0			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$0			
Pump Stations	$0	$0	$0	
Rectangular Storage Facilities	$0	$0	$0	$0
High Rate Treatment	$0	$0	$0	$0
Additonal Secondary Treatment	NA	$657	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$4,832**	**$657**	**$0**	**$0**

Total Annual O&M

General	**$5,489**
Energy	**$0**
Total	**$5,489**

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WTD Business Case Evaluation Results

11th Ave NW CSO Control

Lower Bound Discount Rate (WTD Borrowing Cost) (1)

Scenario	Lifetime	Initial Capital Outlay	Total Project Life Costs (2)	Total Project Life Benefits	Net Project Life Costs	Average Project Annual Cost	Annual Costs over(under) Status quo
Alternatives							
SC-11th Ave NW-KC-Conv	50	$23,700,000	$22,064,619	$0	$22,064,619	$729,669	$729,669

Upper Bound Discount Rate (OMB, Private Rate of Return) (3)

Scenario	Lifetime	Initial Capital Outlay	Total Project Life Costs (2)	Total Project Life Benefits	Net Project Life Costs	Average Project Annual Cost	Annual Costs over(under) Status quo
Alternatives							
SC-11th Ave NW-KC-Conv	50	$23,700,000	$18,352,500	$0	$18,352,500	$606,911	$606,911

First Year of Construction	2010	Additional inflation rate > 3%	1.00%

Notes:

(1) WTD Discount rate based on recent WTD borrowing costs net of 3% annual inflation. 2.18%

(2) Costs include risk and uncertainty, if estimated.

(3) Discount rate net of inflation, per the King County Budget Office. 7.00%

The option with the largest net equivalent annualized cost is the financially preferred option.

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Appendix G.1.2

3rd Ave W Site Alternatives

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3rd Ave W Site Alternative

DSN008-STOR-1 (KC) or SC-3rd Ave W-KC-STOR

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DSN008-STOR-1 (KC) or SC-3rd Ave W-KC-STOR

Alternative DSN008-STOR-1 (KC) controls King County's 3rd Ave W CSOs by building a storage tank on the south side of the Ship Canal. This alternative is an independent alternative and only controls King County CSOs.

Design Criteria

- King County Storage Volume Requirement: 4.18 MG (3rd Ave W)
- King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 61.3 MGD (3rd Ave W)
- Storage tank is required to drain within 12 hours of event.

Description

Alternative DSN008-STOR-1 (KC) consists of a storage tank to control King County 3rd Ave W CSOs. A CSO control volume of approximately 4.18 MG is required to reduce overflows at the 3rd Ave W CSO Outfall to an average of one untreated discharge per year. Storage of this volume could be provided with an offline storage tank located within or adjacent to the approximate boundary shown in Figure G.1.2-1. See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundary.

The main components of this alternative would include:

- 4.18-MG offline storage tank with pumps to empty the storage tank.
- Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
- Modifications to 3rd Ave W Overflow Structure.
- Up to approximately 605 ft of 24-inch-diameter force main, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.2-1.
- Up to approximately 1,210 ft of 48-inch-diameter influent gravity sewer, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.2-1.

Storage Tank

The CSO control volume for King County could be stored in a buried, rectangular structure, approximately 390 feet long and 90 feet wide with a sidewater depth of approximately 20 feet.

Flows would enter the storage tank during a wet-weather event. The tank may be configured with multiple chambers, so that only those chambers required to store the volume of the wet-weather event would be used. Storage of flows would start in the first chamber and as that chamber fills and reaches capacity, flows would be transferred into subsequent chambers until either the wet-weather event ends or the capacity of the storage tank is reached. Each chamber would contain equipment for flushing and self-cleaning, and only chambers used in a wet-weather event would require flushing. Control of odors and sediment in the storage chambers may require regularly-scheduled cleaning between events.

Facilities Building(s)

Facilities building(s) would be located above or below ground level and would contain an odor control system, electrical controls, and a standby generator. The actual contents of the building(s) will be determined during preferred alternative development. The representative footprint shown in Figure G.1.2-1 for this alternative locates the facilities buildings adjacent to the storage tank for conservative purposes; however, the facilities buildings could be located above the storage tank to minimize space requirements.

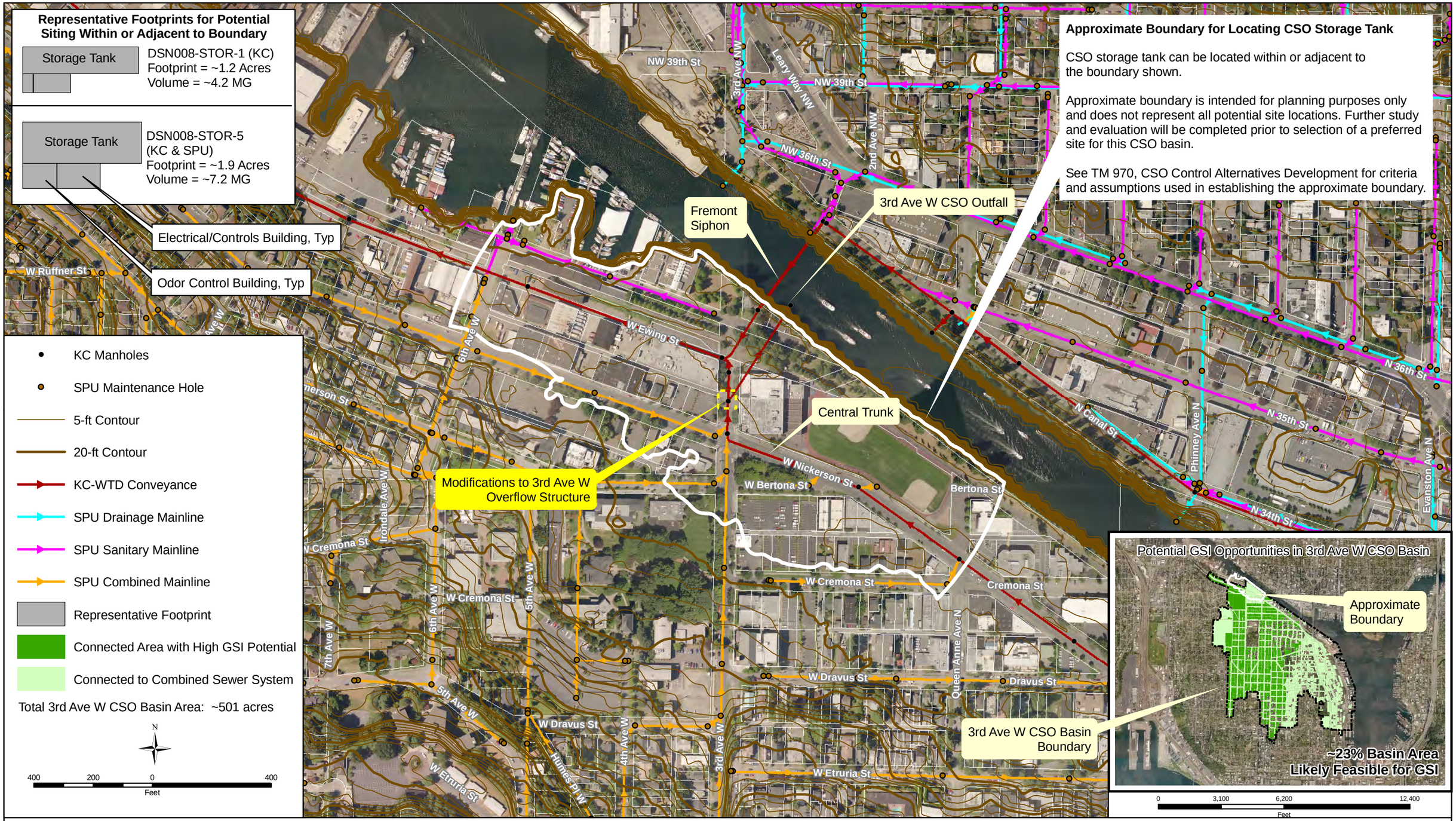
Flow Diversion and Discharge

One regulator station will be required to divert King County flows from the 3rd Ave W Overflow Structure to the storage tank. For this planning phase, it is assumed that the diversion would occur at the 3rd Ave W Overflow Structure. Evaluation of whether flows can be diverted upstream of the 3rd Ave W Overflow Structure will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the storage tank via a 48-inch-diameter influent gravity sewer. The length of the influent gravity sewer will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development. The influent gravity sewer can be up to 1,210 feet long based on the criteria and assumptions listed in Section 6.1.

After a wet-weather event, the chambers inside the storage tank would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County Central Trunk through a 24-inch-diameter force main that is up to approximately 605 feet in length. The length of the force main will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development.

Construction Assumptions

King County's Tabula cost estimating program was used to develop a Class 5 estimate for this alternative. The attached documentation lists the construction assumptions used.



King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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File Name:

Data Source:

Figure G.1.2-1

3rd Ave W Storage Alternatives
Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN008-STOR-1 (KC)

Escalation Assumptions

Description	ENR CCI
ENR CCI (Seattle), January 2010	8645.35

Total Project Cost, 2010 Dollars

Description	Total Costs (3rd Ave W)
4.18-MG Storage Tank Construction Cost =	$20,000,000
Influent Gravity Sewer Construction Cost (1,210 LF of 48-inch-diameter pipe) =	$1,940,000
Force Main Construction Cost (605 LF of 24-inch-diameter pipe) =	$350,000
Modifications to 3rd Ave W Overflow Structure Construction Cost =	$490,000
SDOT Street Use Permit Fee Cost =	$150,000
Total Construction Cost =	$22,930,000
Sales Tax (10% of Construction Cost) =	$2,290,000
[1]Allied Costs (46.07% of Construction Cost) =	$10,560,000
Property Cost =	$7,580,000
Subtotal of Project Cost =	$43,360,000
[1]Construction Contingency (10% of Construction Cost) =	$2,290,000
[1, 2]Project Contingency =	$10,720,000
Total Project Cost, 2010 Dollars =	**$56,400,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and tota construction cost.

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility
Printed date : 12/01/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Storage Capacity: 4.18 Mgal
Facility Footprint: 50600 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	5,620.00	SY	$43	$242,000
Dewatering	1	LS	$1,270,000	$1,270,000
Odor Control	1	LS	$682,000	$682,000
Effluent Pump Station	1	LS	$295,000	$295,000
Construction Cost	4.2	Mgal	4,000,000	$16,700,000
			Year 2008 Subtotal	$19,200,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$20,000,000

INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Gravity)
Printed date : 11/09/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 1210 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Collector Street (36 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 48 in.

Geometry

Outer Diameter	4.83	ft
Trench Width	8.78	ft
Excavation Depth	15.8	ft
Complete Surface Rest. Width	10.8	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	6,230.00	CY	$13	$81,000
Backfill	3,540.00	CY	$34	$120,000
Complete Pavement Restoration	1,450.00	SY	$86	$125,000
Overlay Pavement Restoration	3,390.00	SY	$28	$94,900
Trench Safety	38,300.00	SF	$17	$651,000
Spoil Load and Haul	6,230.00	CY	$16	$99,700
Pipe Unit Material Cost	1,210.00	lf	$123	$149,000
Pipe Installation	1,210.00	lf	$60	$72,600
Place Pipe Zone Fill	1,870.00	CY	$34	$63,500
Manholes	3	MH	$12,600	$37,700
Existing Utilities	1,210.00	lf	$166	$201,000
Dewatering	1,210.00	lf	$107	$129,000
Traffic Control	1,210.00	lf	$36	$43,600
			Year 2008 Subtotal	$1,870,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$1,940,000

Year 2010 Total: $1,940,000

FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Force Main
Printed date : 11/09/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 605 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Collector Street (18 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Standard
Pipe Diameter: 24 in.

Geometry

Outer Diameter	2.15	ft
Trench Width	5.3	ft
Excavation Depth	9.15	ft
Complete Surface Rest. Width	7.3	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,090.00	CY	$13	$14,100
Backfill	593	CY	$34	$20,200
Complete Pavement Restoration	490	SY	$86	$42,200
Overlay Pavement Restoration	720.00	SY	$28	$20,100
Trench Safety	11,100.00	SF	$1	$5,870
Spoil Load and Haul	1,090.00	CY	$16	$17,400
Pipe Unit Material Cost	605	lf	$114	$69,000
Pipe Installation	605	lf	$33	$20,000
Place Pipe Zone Fill	411	CY	$34	$14,000
Existing Utilities	605	lf	$58	$35,100
Dewatering	605	lf	$100	$60,500
Traffic Control	605	lf	$24	$14,500
			Year 2008 Subtotal	$333,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$346,000

Year 2010 Total: $346,000

MODIFICATIONS TO 3RD AVE W OVERFLOW STRUCTURE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 11/09/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$485,000

Year 2010 Total: $485,000

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PROPERTY AND PERMITTING COSTS

Land and Building Cost, Average Cost per Square Foot (January 2007 to August 2010)

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building ($/SF)	Average Cost per Square Foot for Industrial Land ($/SF)
DSN008 3rd Ave W	$149.89	$21.91

Land Costs, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Storage Tank	40,000	$149.89	100%	$5,995,600
Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.)	10,600	$149.89	100%	$1,588,834
			Total Land Costs	$7,584,434

SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.

Closure of construction area will occur in phases. Assumed construction phasing in:	1,000	ft segments
Assumed production rate during working days =	15	LF/d
For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula.	22	ft
For pipe diameters greater than 36 inches, assume full width of road will be closed during construction. Width is based on the full width for arterial pavement restoration in Tabula.	44	ft

Source of methodology for estimating permit fees: http://www.seattle.gov/transportation/cams/CAM2115.pdf

SDOT Street Use Permit Fee Estimation, 2010 Dollars

Description	Diameter of Pipe (in)	Length (ft)	Width of Construction Area (ft)	Estimated Construction Area (SF)	Construction Duration (Calendar Days)	Number of 10-Day Periods	Use Fee ($/SF)	Estimated Permit Costs
Regulator Station Upgrade at 3rd Ave W Overflow Structure	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Pipe, First Phase of Construction	48	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Pipe, Second Phase of Construction	48	210	44	9,240	19.6	2	$0.20	$1,848
Installation of Force Main	24	605	22	13,310	56.5	6	$0.90	$11,979
							Total SDOT Street Use Fee Estimation:	$147,927

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Operations and Maintenance Cost Estimate Summary

Basin Name: **3rd Ave W (KC Ind)**

Alternative Name: **SC-3RD AVE W-KC-STOR**

ENR 1994	5747
Current ENR	**8645.4**
Power Cost (per kwh)	**0.065**
Labor rate (loaded) /hr	**51.17**
SPU Water Cost $/CCF	**4.50**
Carbon Cost/Lb	**2.00**

Acres of Raingarden for GSI	**0.00**
Annual Overflow Vol (MG)	**17.10**
Annual Vol Capture	**13.10**
Annual Events	**17**
Stor Vol	**4.18**
Peak Flow Rate	**61.30**

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$1,827			
Force Mains	$22			
Regulator/Flow Control Structures	$38,459			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$0			
Pump Stations	$0	$0	$0	
Rectangular Storage Facilities	$87,213	$41,710	$24,206	$78,235
High Rate Treatment	$0	$0	$0	$0
Additonal Secondary Treatment	NA	$8,604	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$127,521**	**$50,314**	**$24,206**	**$78,235**

Total Annual O&M

General	**$256,070**
Energy	**$24,206**
Total	**$280,276**

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WTD Business Case Evaluation Results
3rd Ave W CSO Control 2010

WTD Borrowing Cost as Discount Rate (1)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
SC-3rd Ave W-KC-STOR	50	$56,400,000	$0	$66,861,632	($66,861,632)	($2,211,090)	0.0

Budget Office Discount Rate (3)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
SC-3rd Ave W-KC-STOR	50	$56,400,000	$0	$47,728,447	($47,728,447)	($3,458,396)	0.0

Notes: All costs are in 2010$.
(1) WTD Discount rate is 2.2%, based on recent WTD borrowing costs net of 3% annual inflation.
(2) Costs include risk and uncertainty, if estimated.
(3) Discount rate is 7% net of inflation, per the King County Budget Office.
The option with the largest net equivalent annualized cost is the financially preferred option.

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3rd Ave W Site Alternative

DSN008-STOR-5 (KC & SPU) or SC-3rd Ave W-Collab-STOR 1

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DSN008-STOR-5 (KC & SPU) or SC-3rd Ave W-Collab-STOR 1

Alternative DSN008-STOR-5 (KC & SPU) controls King County's 3rd Ave W CSOs and SPU's CSO Basins 60, 147, and 174 by building a storage tank on the south side of the Ship Canal. This alternative is a collaborative alternative that was developed by King County.

Design Criteria

- King County Storage Volume Requirement: 4.18 MG (3rd Ave W)
- SPU Storage Volume Requirement: 3.05 MG (SPU CSO Basins 60, 147, and 174)
- King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 61.3 MGD (3rd Ave W)
- SPU CSO Peak Flow Rate for Sizing Conveyance to Storage: 23.7 MGD (SPU CSO Basins 60, 147, and 174)
- Storage tank is required to drain within 12 hours of event.

Description

Alternative DSN008-STOR-5 (KC & SPU) consists of a joint storage tank to control King County 3rd Ave W CSOs and SPU CSO Basin 60, 147, and 174 CSOs. A CSO control volume of approximately 4.18 MG is required to reduce overflows at the 3rd Ave W CSO Outfall to an average of one untreated discharge per year. A total maximum storage volume of 7.23 MG is required to control all four CSO outfalls. Storage of this volume could be provided with an offline storage tank located within or adjacent to the approximate boundary shown in Figure G.1.2-1. See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundary. This alternative does not include the conveyance components and costs associated with SPU conveying flows to the 3rd Ave W Overflow Structure.

The main components of this alternative would include:

- 7.23-MG offline storage tank with pumps to empty the storage tank.
- Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
- Modifications to 3rd Ave W Overflow Structure.
- Up to approximately 605 ft of 30-inch-diameter force main, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.2-1.
- Up to approximately 1,210 ft of 54-inch-diameter influent gravity sewer, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.2-1.

Storage Tank

The CSO control volumes for King County and SPU could be stored in a buried, rectangular structure, approximately 400 feet long and 140 feet wide with a sidewater depth of approximately 20 feet.

Flows would enter the storage tank during a wet-weather event. The tank may be configured with multiple chambers, so that only those chambers required to store the volume of the wet-weather event would be used. Storage of flows would start in the first chamber and as that chamber fills and reaches capacity, flows would be transferred into subsequent chambers until either the wet-weather event ends or the capacity of the storage tank is reached. Each chamber would contain equipment for flushing and self-cleaning, and only chambers used in a wet-weather event would require flushing. Control of odors and sediment in the storage chambers may require regularly-scheduled cleaning between events.

Facilities Building(s)

Facilities building(s) would be located above or below ground level and would contain an odor control system, electrical controls, and a standby generator. The actual contents of the building(s) will be determined during preferred alternative development. The representative footprint shown in Figure G.1.2-1 for this alternative locates the facilities buildings adjacent to the storage tank for conservative purposes; however, the facilities buildings could be located above the storage tank to minimize space requirements.

Flow Diversion and Discharge

One regulator station will be required to divert King County and SPU flows from the 3rd Ave W Overflow Structure to the storage tank. For this planning phase, it is assumed that the diversion would occur at the 3rd Ave W Overflow Structure. Evaluation of whether flows can be diverted upstream of the 3rd Ave W Overflow Structure will be completed during preferred alternative development. Diverted King County and SPU flow would discharge to the location of the storage tank via a 54-inch-diameter influent gravity sewer. The length of the influent gravity sewer will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development. The influent gravity sewer can be up to 1,210 feet long based on the criteria and assumptions listed in Section 6.1.

After a wet-weather event, the chambers inside the storage tank would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County Elliott Bay Interceptor through a 30-inch-diameter force main that is up to approximately 605 feet in length. The length of the force main will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development.

Construction Assumptions

King County's Tabula cost estimating program was used to develop a Class 5 estimate for this alternative. The attached documentation lists the construction assumptions used.

Alternative DSN008-STOR-5 (KC & SPU)

Percentage of Cost Attributed to King County and SPU, Based on Volume[3]

Agency	Volume (MG)	Percentage of Costs (%)
King County	4.18	57.8%
SPU	3.05	42.2%

Escalation Assumptions

Description	ENR CCI
ENR CCI (Seattle), January 2010	8645.35

Total Project Cost, 2010 Dollars

Description	Total Costs (King County & SPU)	Costs Attributed to King County (3rd Ave W)[3]	Costs Attributed to SPU[3, 4]
7.226-MG Storage Tank Construction Cost =	$33,700,000	$19,490,000	$14,210,000
Influent Gravity Sewer Construction Cost (1,210 LF of 54-inch-diameter pipe) =	$2,140,000	$1,240,000	$900,000
Force Main Construction Cost (605 LF of 30-inch-diameter pipe) =	$400,000	$230,000	$170,000
Modifications to 3rd Ave W Overflow Structure Construction Cost =	$490,000	$280,000	$210,000
SDOT Street Use Permit Fee Cost =	$150,000	$90,000	$60,000
Total Construction Cost =	$36,880,000	$21,330,000	$15,550,000
Sales Tax (10% of Construction Cost) =	$3,690,000	$2,130,000	$1,560,000
[1]Allied Costs (46.07% of Construction Cost) =	$16,990,000	$9,830,000	$7,160,000
Property Cost =	$12,580,000	$7,280,000	$5,300,000
Subtotal of Project Cost =	$70,140,000	$40,570,000	$29,570,000
[1]Construction Contingency (10% of Construction Cost) =	$3,690,000	$2,130,000	$1,560,000
[1, 2]Project Contingency =	$17,350,000	$10,040,000	$7,310,000
Total Project Cost, 2010 Dollars =	**$91,200,000**	**$52,800,000**	**$38,400,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

[3]Allocation of costs is pending confirmation from management.

[4]Costs attributed to SPU do not include conveyance costs from the SPU system to the 3rd Ave W Overflow Structure.

STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility
Printed date : 12/01/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Storage Capacity: 7.226 Mgal
Facility Footprint: 83900 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	9,320.00	SY	$43	$401,000
Dewatering	1	LS	$1,590,000	$1,590,000
Odor Control	1	LS	$1,170,000	$1,170,000
Effluent Pump Station	1	LS	$362,000	$362,000
Construction Cost	7.2	Mgal	4,000,000	$28,900,000
			Year 2008 Subtotal	$32,400,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04

Construction Year 2010 Subtotal	$33,700,000

INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Gravity)
Printed date : 12/01/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 1210 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Collector Street (36 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 54 in.

Geometry

Outer Diameter	5.54	ft
Trench Width	9.7	ft
Excavation Depth	16.5	ft
Complete Surface Rest. Width	11.7	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	7,190.00	CY	$13	$93,500
Backfill	3,910.00	CY	$34	$133,000
Complete Pavement Restoration	1,570.00	SY	$86	$135,000
Overlay Pavement Restoration	3,270.00	SY	$28	$91,500
Trench Safety	40,000.00	SF	$17	$681,000
Spoil Load and Haul	7,190.00	CY	$16	$115,000
Pipe Unit Material Cost	1,210.00	lf	$168	$203,000
Pipe Installation	1,210.00	lf	$70	$84,700
Place Pipe Zone Fill	2,200.00	CY	$34	$74,800
Manholes	3	MH	$15,400	$46,100
Existing Utilities	1,210.00	lf	$166	$201,000
Dewatering	1,210.00	lf	$127	$154,000
Traffic Control	1,210.00	lf	$36	$43,600
			Year 2008 Subtotal	$2,060,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$2,140,000

Year 2010 Total: $2,140,000

FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Force Main
Printed date : 12/01/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 605 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Standard
Pipe Diameter: 30 in.

Geometry

Outer Diameter	2.67	ft
Trench Width	5.97	ft
Excavation Depth	9.67	ft
Complete Surface Rest. Width	7.97	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,290.00	CY	$13	$16,800
Backfill	668	CY	$34	$22,700
Complete Pavement Restoration	536	SY	$86	$46,100
Overlay Pavement Restoration	943.00	SY	$28	$26,400
Trench Safety	11,700.00	SF	$1	$6,200
Spoil Load and Haul	1,290.00	CY	$16	$20,700
Pipe Unit Material Cost	605	lf	$159	$96,200
Pipe Installation	605	lf	$38	$23,000
Place Pipe Zone Fill	499	CY	$34	$17,000
Existing Utilities	605	lf	$58	$35,100
Dewatering	605	lf	$100	$60,500
Traffic Control	605	lf	$24	$14,500
			Year 2008 Subtotal	$385,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$400,000

Year 2010 Total: $400,000

MODIFICATIONS TO 3RD AVE W OVERFLOW STRUCTURE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 11/09/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$485,000

Year 2010 Total: $485,000

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PROPERTY AND PERMITTING COSTS

Land and Building Cost, Average Cost per Square Foot (January 2007 to August 2010)

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building ($/SF)	Average Cost per Square Foot for Industrial Land ($/SF)
DSN008 3rd Ave W	$149.89	$21.91

Land Costs, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Storage Tank	61,500	$149.89	100%	$9,218,235
Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.)	22,400	$149.89	100%	$3,357,536
			Total Land Costs	$12,575,771

SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.		
Closure of construction area will occur in phases. Assumed construction phasing in:	1,000	ft segments
Assumed production rate during working days =	15	LF/d
For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula.	22	ft
For pipe diameters greater than 36 inches, assume full width of road will be closed during construction. Width is based on the full width for arterial pavement restoration in Tabula.	44	ft

Source of methodology for estimating permit fees: http://www.seattle.gov/transportation/cams/CAM2115.pdf

SDOT Street Use Permit Fee Estimation, 2010 Dollars

Description	Diameter of Pipe (in)	Length (ft)	Width of Construction Area (ft)	Estimated Construction Area (SF)	Construction Duration (Calendar Days)	Number of 10-Day Periods	Use Fee ($/SF)	Estimated Permit Costs
Regulator Station Upgrade at 3rd Ave W Overflow Structure	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Pipe, First Phase of Construction	54	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Pipe, Second Phase of Construction	54	210	44	9,240	19.6	2	$0.20	$1,848
Installation of Force Main	30	605	22	13,310	56.5	6	$0.90	$11,979
							Total SDOT Street Use Fee Estimation:	$147,927

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3rd Ave W Site Alternative

DSN008-STOR-2 (KC & SPU) or SC-3rd Ave W-Collab-STOR 2

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DSN008-STOR-2 (KC & SPU) or SC-3rd Ave W-Collab-STOR 2

Alternative DSN008-STOR-2 (KC & SPU) controls King County's 3rd Ave W CSOs and SPU's CSO Basins 60, 147, and 174 by building a storage facility on the north side of the Ship Canal. This alternative is a collaborative alternative that was developed by SPU.

SPU evaluated multiple storage alternatives on the north side of the Ship Canal, so SPU selected a representative alternative for King County to include in their evaluations. SPU refers to the representative alternative as Alternative N-13a.

SPU provided the following documentation for this alternative, which are included in this appendix:

- Description
- Figure
- Tabula Model Inputs
- Tabula Output Files.

The Tabula output files from SPU were used to develop construction and property acquisition costs using the King County cost estimating methodology. These cost estimates are presented after the documentation provided by SPU.

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3rd Ave W Site Alternative

DSN008-STOR-2 (KC & SPU) or SC-3rd Ave W-Collab-STOR 2

Documentation Provided by SPU:

- Description
- Figure
- Tabula Model Inputs
- Tabula Output Files

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Final Alternatives - N-13a: Joint SPU/King County Storage Upstream of the Fremont Siphon - In-Line Storage in Right of Way

Design Criteria

- SPU Storage Volume requirements: 1.931 MG (NPDES147 Basin), 0.93 MG (NPDES174 Basin), and 0.185 MG (NPDES060 Basin)
- King County Storage Volume Requirements: 4.18 MG (3rd Avenue West Regulator)
- Peak Flows: 15.0 MGD (NPDES147 Basin), 7.5 MGD (NPDES174 Basin), and 29.3 MGD (3rd Avenue West Regulator)
- Average dry weather flows will require continuous pumping to convey flows to the King County system

Description

Alternative N-13 consists of distributed or joint combined sewer overflow (CSO) storage upstream of the Fremont Siphon for SPU NPDES147 and NPDES174 Basins and the King County 3rd Avenue West Regulator. Based on the draft 2010 CSO Reduction Plan, a CSO control volume of 2.86 MG is required to reduce overflows at NPDES147 and NPDES174 Outfalls to an average of one untreated overflow per year. A total maximum storage volume of 7.226 MG is required to control all three outfalls. In-line storage for a portion of this volume could be provided with an in-line storage tunnel and effluent pump station. This would consist of a storage tunnel from the undeveloped commercial property at the intersection of North 40th Street and Stone Way North, located in the middle of NPDES147 Basin to the private commercial property located at North 34th Street and Stone Way North. A layout of the alternative is shown on the attached figure.

The main components of this alternative would include:

- 7.226 MG In-line storage tunnel, 22foot-diameter, 2,560 feet
- 14.45 MGD effluent pump station
- Two diversion structures
- Approximately 250 feet of force main
- Approximately 1,150 feet of gravity conveyance pipes

Storage Tunnel

The control volume for NPDES147 and NPDES174 Basins and the 3rd Avenue West Regulator could be stored in a 22foot-diameter, 2,560 feet long tunnel at a slope of 0.001 ft/ft.

The tunnel boring machine (TBM) would launch from private property at North 34th Street and Stone Way North and bore north towards the undeveloped commercial property at the intersection of North 40th Street and Stone Way North. Typical tunnel design standards require one to two and half times the tunnel diameter of soil/ground cover depending on the type of material being tunneled through. For this phase of alternative development, approximately 2.5 times is assumed. Further research and exploration of the geotechnical conditions may allow the tunnel to have less cover and will be determined during preferred alternative development.

The tunnel would be an in-line facility with flows from the upper part of NPDES147 Basin permanently routed to the tunnel. This would require that the effluent pump station be

designed for continuous operation. Flows from the lower portion of NPDES147 Basin would be directed to the tunnel during a storm event. Since the tunnel is deeper than the surrounding existing sewer facilities, all flows that enter the tunnel will need to be pumped to the King County North Interceptor.

Facilities Building

An above grade facilities building would be located on private property at North 34th Street and Stone Way North. These facilities would contain an odor control system, electrical controls, and a stand-by power generator for the tunnel and associated effluent pump station. The actual contents of the building will be determined during preferred alternative development.

Flow Diversion and Discharge

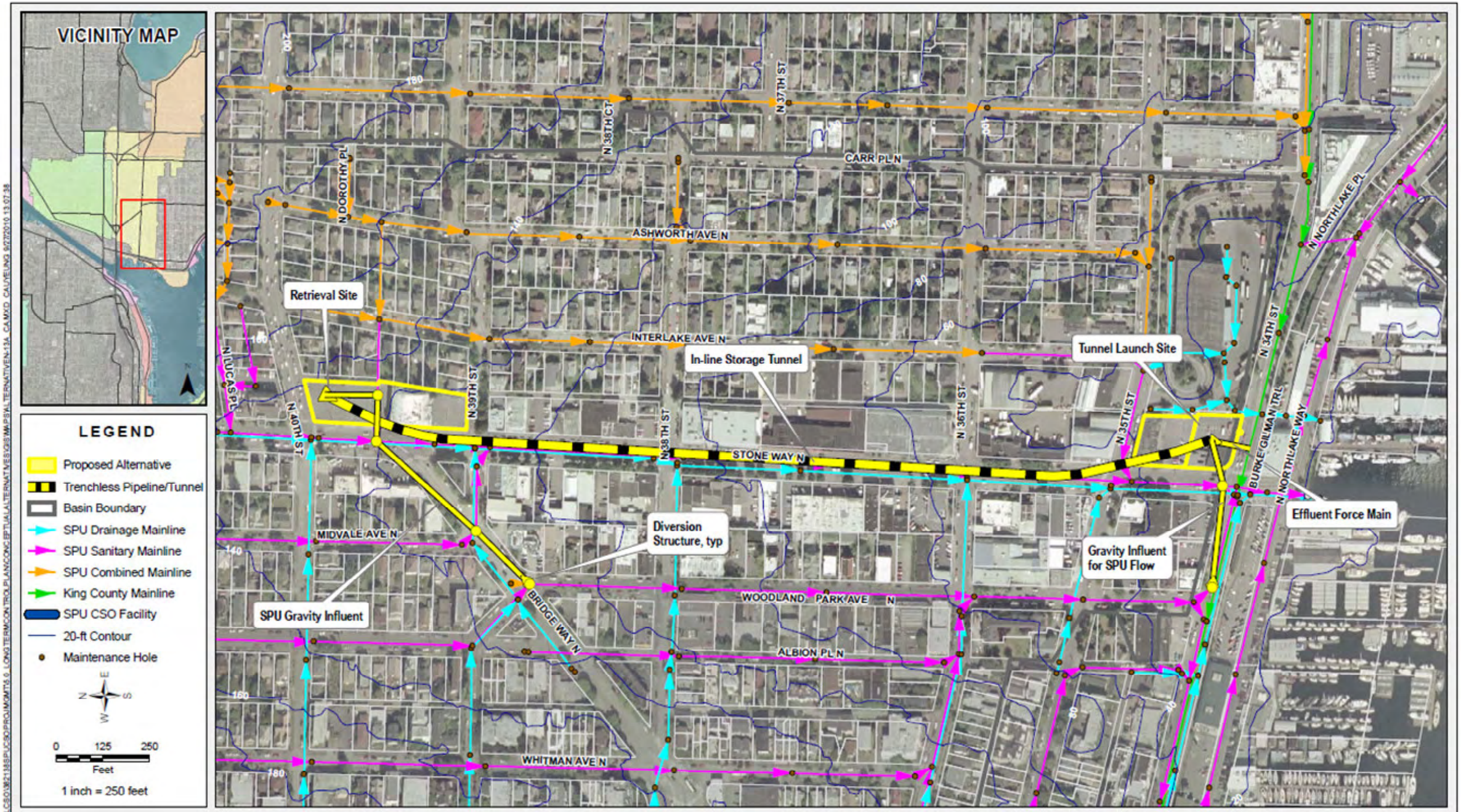
Diverting flows to the beginning of the storage tunnel would require reconfiguring the surrounding combined sewer. Four new structures would divert SPU flow from the upper portion of NPDES147 Basin to the inlet of the tunnel. These structures would be located along Bridge Way North at Woodland Park Avenue North, Midvale Avenue North, and Stone Way North, with one structure on undeveloped commercial property to pick up the sewer flows that bisect the property. Based on flow monitoring data from meters located at Stone Way North and North 40th Street and at NPDES147 Outfall, this gravity diversion would capture approximately 40 percent of the NPDES147 Basin flow.

Flow that enters NPDES147 Basin south of Bridge Way North would be collected by a diversion structure located just upstream of NPDES147 Outfall. From the diversion structure, approximately 250 feet of gravity pipe would carry flow to the downstream end of the storage tunnel located on private property at Stone Way North and North 34th Street.

Since the storage tunnel is located in NPDES147 Basin and is upstream of NPDES174 Outfall, flows from NPDES174 Basin would not be diverted to the storage tunnel. It is assumed that diverting and storing sufficient flow from NPDES147 Basin will allow NPDES174 Basin flows to enter the interceptor that would otherwise overflow to NPDES174 Outfall. This will be confirmed during modeling and the next phase of alternative development.

Construction Assumptions

King County's Tabula cost estimating program was used to develop a Class 5 estimate for this storage facility. The attached documentation lists the construction assumptions used.



Seattle Public Utilities

Long Term Control Plan Final Alternative Evaluation
King County/SPU Collaborative Options

ALTERNATIVE N-13a
IN-LINE STORAGE IN STONE WAY

JANUARY 2011 | **FIGURE 1**

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Tabula Model Inputs

General Project Assumptions

Current ENR CCI	8645	Seattle January 2010 ENR CCI
Escalation	3.0%	Agreed upon input per SPU & King County
Year of Construction	2010	All projects will be cost as if construction was in 2010 for cost comparison purposes

Project Types

Pipeline

			Alternative N-13a - In-Line Storage Tunnel		
Field	**Drop Down Entry**	**Comment**	Influent Line for upper Basin 147 SPU flows	Influent Line for lower Basin 147 SPU flows to Tunnel	Force main from influent pump station
Conduit Type					
	Gravity	Use for all gravity pipelines	Yes	Yes	
	Force Main	Use for all pressure pipeline			Yes
	High Head Force Main	Only use this input if engineer directs special input			
Diameter					
	Gravity pipes vary from 8" to 144"	Use as sized by Engineer; For sizes outside this range use special input and consult with cost estimator.	18"	24"	
	Force Main pipes vary from 8" to 60"	Use as sized by Engineer; For sizes outside this range use special input and consult with cost estimator.			24"
	High Head Force Main pipes vary from 8" to 60"	Use as sized by Engineer; For sizes outside this range use special input and consult with cost estimator.			
Length					
	Input per drawing or engineer direction		750 feet	400 feet	200 feet
Backfill					
	Import	Use in all urban areas, under any pavement restoration, or in any area where significant dewatering is expected. When unsure of soil conditions use imported backfill as default.	Yes	Yes	Yes
	Native	Use only if outside of urban location such as park and only if no significant dewatering is expected.			
Cover Depth					
	Gravity	Use 8' cover depth for all gravity pipeline unless directed by engineer for project specific circumstances.	Use 20' based on existing sewer IE and ground elevations	Use 10' cover	
	Force Main	Use 6' cover depth for all gravity pipeline unless directed by engineer for project specific circumstances.			Use 8' cover, same as existing
	High Head Force Main	Use 6' cover depth for all gravity pipeline unless directed by engineer for project specific circumstances.			
Manhole Spacing					
Gravity pipe only	None	Not used unless directed by engineer for project specific requirements.			
	Close (250')	Not used unless directed by engineer for project specific requirements.			
	Average (500')	Default; Use for all projects unless directed by engineer for project specific requirements.	Average	Average	
	Far (1000')	Not used unless directed by engineer for project specific requirements.			
Trench Safety					
	Standard	Default; Use for all projects unless directed by engineer for project specific requirements.	Standard		
	Special Shoring	Use if soil condition is know to be poor or if significant dewatering is expected as this may indicate soil may be wet and in poor condition.		Special - wet ground conditions make poor soil condition	Special - wet ground conditions make poor soil condition
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.	Minimal		
	Significant	Use is project is near body of water or at or below ground water level.		Significant - near waterfront	Significant - near waterfront
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.	Complex	Complex	Complex
Traffic Control					
	None	Not used unless directed by engineer for project specific requirements.			
	Light	Only use if project is well outside of traffic or roadway influences where traffic control is only needed to bring trucks or equipment on and off roadways.			
	Heavy	Default; Due to the general urban environment of the Seattle area use for all projects unless directed by engineer for project specific requirements.	Heavy	Heavy	Heavy

Pipeline			Alternative N-13a - In-Line Storage Tunnel		
Field	**Drop Down Entry**	**Comment**	Influent Line for upper Basin 147 SPU flows	Influent Line for lower Basin 147 SPU flows to Tunnel	Force main from influent pump station
Required Easement					
	None	When pipe line is located in City roadway or property.	None - ROW	None - ROW	None - ROW
	Residential	Use if residential easement is required but doesn't effect any buildings on the property.			
	Industrial	Use if easement is required in industrial area but doesn't effect any buildings on the property.			
	Office Commercial	Use if easement is required on commercial office location but doesn't effect any buildings on the property.			
Easement Adjustment					
	Use Seattle				
Land Acquisition					
	None	When pipe line is located in City roadway or property.	None - ROW	None - ROW	None - ROW
	Residential-Urban	Use if pipeline requires the removal of any building on the property.			
	Residential-Sub urban	Not used. Only occurs outside of Seattle			
	Residential-Rural	Not used. Only occurs outside of Seattle			
	Industrial	Use if pipeline requires the removal of any building on the property.			
	Office Commercial	Use if pipeline requires the removal of any building on the property.			
Pavement Restoration					
	None	Use only if outside of urban location such as park. May need to add additional cost for park restoration.			
	Trench Width	Use when pipeline is crossing perpendicular to roadway.			Trench width, traveling perpendicular to roadway
	Half Width-Arterial (22'), Collector Street (18'), Residential Street (14')	Use 1/2 width for all pipes 36" or less. Use appropriate roadway type with Arterial roadway the default choice if in doubt.	Half width	Half width	
	Full Width-Arterial (44'), Collector Street (36'), Residential Street (28')	Use full width for all pipes greater than 36". Use appropriate roadway type with Arterial roadway the default choice if in doubt.			
Additional Costs					
	Use for items such as park, residential restoration, special manholes, or other		No diversion structure, hard line into tunnel	2 - Diversion structures w/ Standard maintenance holes with side cast weirs.	Add manhole for force main to discharge into and tie into existing system; SPU Type 205A use SPU unit cost report $25,000
	cost items directed by engineer for specific project.		Per P. Carpenter 7.21.10--16,500SF half-width arterial street use fee $34,650 SPU ($2.10/SF)	Per P. Carpenter 7.21.10--8,800SF half-width arterial street use fee $18,480 SPU ($2.10/SF)	Per P. Carpenter 7.21.10--1,200SF trench-width street use fee $2,520 SPU ($2.10/SF)--Tabula calculates trench width of 5.3 ft, and complete surface restoration width of 7.3 ft. Kept 6ft width from P. Carpenter.

Tabula Model Inputs

General Project Assumptions

Year of Construction	2010	All projects will be cost as if construction was in 2010 for cost comparison purposes

Project Types

Pump Station

Field	Drop Down Entry	Comment	Alternative N-13a - Effluent Pump Station
Capacity			
	Input per engineer direction; Default for storage tank flow is storage tank volume divided by 24 hrs		14.45 MGD
Excavation Depth			
	Input per drawing or engineer direction		0 ft; Pump placed in launch shaft
Total Dynamic Head			
	Input per engineer direction		98 feet
Additional Costs			
	Use for cost items directed by engineer for specific project.		Standby generator 500 kW cost per RS Means adjusted for Seattle; Private property acquisition/easement included in tunnel costs

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Tabula Model Inputs

General Project Assumptions

Year of Construction	2010	All projects will be cost as if construction was in 2010 for cost comparison purposes

Project Types

Tunnel

Field	Drop Down Entry	Comment	Alternative N-13 In-Line Storage Tunnel
Diameter			
	Tunnel diameters vary from 8' to 18'	Use as sized by Engineer; For sizes outside this range use special input and consult with cost estimator.	21' Diameter
Length			
	Input per drawing or engineer direction		2560 ft
Launch Shaft/Retrieval Shaft			
Excavation Depth			
	Input per drawing or engineer direction		70' / 170'
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.	Average (Launch/retrieval)
	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			
	Standard	Default	Yes
	Oversized	Only used if required for specific project needs.	
Surface Restoration			
	None	Not used. Only used if special additional unit cost for surface restoration is used.	
	Hydroseed	Use only if outside of urban location such as park. May need to add additional cost for park restoration.	
	Pavement	This is the default selection.	Pavement
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.	Yes, portion is near body of water
Required Easement			
	None	When pipe line is located in City roadway or property.	None- Tunnel is under Stoneway
	Residential	Use if residential easement is needed.	
	Industrial	Use if easement is required in industrial area.	
	Office Commercial	Use if easement is required on commercial office location.	
Easement Adjustment			
	Use Seattle		
Additional Costs			
	Use for items such as park, residential restoration, special manholes, or other cost items directed by engineer for specific project.		Tabula tunneling only sizes up to 18' diameter. Add an additional $360,000 for procurement costs and an additional $600/LF for the tunneling to upsize the cost to 21' diameter. These costs are extrapolated from the tunneling costs currently in Tabula. The launch and retrieval shaft need land acquisition purchased of 31250 sf and 56250 sf respectively. Use Office/Commercial property values from storage module.--Per P. Carpenter on 7.21.10, launch site $968,750 SPU ($31/SF-Industrial?), (not $1,530,000 est by C. Moore). Retrieval site (45,380SF not 56250SF) $2,223,620 SPU ($49/SF), (not $2,760,000 est by C. Moore) Per P. Carpenter 7.21.10, street use fee $253,440 ($4.50/SF)

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Cost Calculations for Project: **Alternative N-13a, In-Line Storage**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Project Year: 2010
Responsible Party:
Comments:

Sub Items

Name	Type	Year	Cost	Multiplier	2010 Cost
21' Dia Tunnel	Tunnel	2010	42,700,000	1.00	42,700,000
14.45 MGD Pump Station	Pump Station	2010	4,310,000	1.00	4,310,000
Influent Line for Upper Basin 147	Pipe	2010	476,000	1.00	476,000
Influent Line for Lower Basin 147	Pipe	2010	652,000	1.00	652,000
Force Main from Pump Station	Pipe	2010	218,000	1.00	218,000
			Year 2008 Subtotal		$48,300,000

Year 2010 Total: $48,300,000

Cost Calculations for Tunnel: **21' Dia Tunnel**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Inside Diameter: 18 ft.
Length: 2560 ft
Dewatering: Significant
Launch Shaft Existing Utilities: Average
Launch Shaft Excavation Depth: 70 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 170 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Existing Utilities: Average
Tunnel Easement Length: 0 ft
Easement Type: None
Land Adjustment Factor: Seattle
Launch Shaft Footprint: Standard
Retrieval Shaft Footprint: Standard

Tunnel Geometry

Outer Diameter	19.5 ft
Spoils Volume	28,300 CY

Launch Shaft Geometry

Width	59 ft
Length	186 ft
Footprint	11,000 SF
Volume	28,500 CY
Easement Footprint	25,700 SF

Retrieval Shaft Geometry

Width	49 ft
Length	69 ft
Footprint	3,380 SF
Volume	21,300 CY
Easement Footprint	11,800 SF

Miscellaneous

Spoils Loads 2,830 loads

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	It
Spoils Haul	28,300.0	CY	12.0	
Launch Shaft Excavation	28,500.0	CY	15.0	
Launch Shaft Shoring	34,300.0	SF	140.0	
Launch Shaft Existing Utilities	11,000.0	SF	6.0	
Launch Shaft Backfill	28,500.0	CY	18.0	
Launch Shaft Surface Restoration	1,220.0	SY	74.0	
Retrieval Shaft Excavation	21,300.0	CY	15.0	
Retrieval Shaft Shoring	40,100.0	SF	325.0	
Retrieval Shaft Existing Utilities	3,380.0	SF	6.0	
Retrieval Shaft Backfill	21,300.0	CY	18.0	
Retrieval Shaft Surface Restoration	376.0	SY	74.0	
Tunnel Dewatering	1.0	LS	80,000.0	
TBM Procurment	1.0	LS	6,190,000.0	
Tunnel Boring	2,560.0	ft	3,530.0	
Additional TBM Procurement to Upsize to 21'	1	LS	360,000.0	
Additional Tunnel Boring to Upsize to 21' dia	2,560	LF	600.0	
Land Aquistion for Launch Shaft Industrial	31,250	SF	31.0	
Land Aquisition for Retrieval Shaft Office/Commericial	45,380	SF	49.0	
Seattle DOT Street Use Fee	56,320	SF	11.7	
			Year 2008 Subtotal	$

Mobilization/Demobilization at 6%
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)

Effective Multiplier

Construction Year 2010 Subtotal $

Year 2010 Total: $42,700,000

Cost Calculations for Pump Station: **14.45 MGD Pump Station**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Capacity: 14.45 mgd
Total Dynamic Head: 98 ft
Excavation Depth: 0 ft

Calculated Parameters

Required Pump Power	487 Hp
Base Architectural/Structural Unit Cost	144,000 $/mgd
Architectural/Structural Unit Cost Adjustment	-43,200 $/mgd
Base Mechanical Unit Cost	71,600 $/mgd
Mechanical Unit Cost Adjustment	-12,400 $/mgd

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1.0	LS	858,000	858,000
Electrical/Instrumentation	1.0	LS	1,070,000	1,070,000
Architectural/Structural	14.5	mgd	101,000	1,460,000
Mechanical	14.5	mgd	59,200	855,000
Standby Generator 500 kW	1	EA	150,000	150,000
			Year 2008 Subtotal	$4,390,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Construction Year 2010 Subtotal	$4,310,000

Year 2010 Total: $4,310,000

Cost Calculations for Pipe: **Influent Line for Upper Basin 147**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 750 ft
Conduit Type: Gravity
Depth of Cover: 20 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Minimal
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Standard
Pipe Diameter: 18 in.

Geometry

Outer Diameter	1.92 ft
Trench Width	4.99 ft
Excavation Depth	22.9 ft
Complete Surface Rest. Width	6.99 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	3,180.0	CY	13.00	41,300
Backfill	2,630.0	CY	34.00	89,600
Complete Pavement Restoration	583.0	SY	86.00	50,100
Overlay Pavement Restoration	1,250.0	SY	28.00	35,000
Trench Safety	34,400.0	SF	0.53	18,200
Spoil Load and Haul	3,180.0	CY	16.00	50,800
Pipe Unit Material Cost	750.0	lf	24.00	18,000
Pipe Installation	750.0	lf	29.00	21,800
Place Pipe Zone Fill	463.0	CY	34.00	15,700
Manholes	2.0	MH	10,700.00	21,400
Existing Utilities	750.0	lf	42.00	31,500

Dewatering	750.0	lf	24.00	18,000
Traffic Control	750.0	lf	16.00	12,000
Street use fee	16,500	SF	2.10	34,700
			Year 2008 Subtotal	$458,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$476,000

Year 2010 Total: $476,000

Cost Calculations for Pipe: **Influent Line for Lower Basin 147**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 400 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 24 in.

Geometry

Outer Diameter	2.5 ft
Trench Width	5.75 ft
Excavation Depth	13.5 ft
Complete Surface Rest. Width	7.75 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,150.0	CY	13.00	15,000
Backfill	767.0	CY	34.00	26,100
Complete Pavement Restoration	344.0	SY	86.00	29,600
Overlay Pavement Restoration	633.0	SY	28.00	17,700
Trench Safety	10,800.0	SF	17.00	184,000
Spoil Load and Haul	1,150.0	CY	16.00	18,400
Pipe Unit Material Cost	400.0	lf	36.00	14,400
Pipe Installation	400.0	lf	33.00	13,200
Place Pipe Zone Fill	311.0	CY	34.00	10,600
Manholes	1.0	MH	7,390.00	7,390
Existing Utilities	400.0	lf	58.00	23,200

Dewatering	400.0	lf	100.00	40,000
Traffic Control	400.0	lf	24.00	9,600
Diversion Structure	2	EA	100,000.00	200,000
Street use fee	8,800	SF	2.10	18,500
			Year 2008 Subtotal	$627,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$652,000

Year 2010 Total: $652,000

Cost Calculations for Pipe: **Force Main from Pump Station**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 200 ft
Conduit Type: Force Main
Depth of Cover: 8 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Trench Width
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 24 in.

Geometry

Outer Diameter	2.15 ft
Trench Width	5.3 ft
Excavation Depth	11.2 ft
Complete Surface Rest. Width	7.3 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	437.0	CY	13.00	5,690
Backfill	275.0	CY	34.00	9,340
Complete Pavement Restoration	162.0	SY	86.00	13,900
Trench Safety	4,460.0	SF	17.00	75,800
Spoil Load and Haul	437.0	CY	16.00	7,000
Pipe Unit Material Cost	200.0	lf	114.00	22,800
Pipe Installation	200.0	lf	33.00	6,600
Place Pipe Zone Fill	136.0	CY	34.00	4,620
Existing Utilities	200.0	lf	58.00	11,600
Dewatering	200.0	lf	100.00	20,000
Traffic Control	200.0	lf	24.00	4,800

Type 205A Manhole	1	EA	25,000.00	25,000
Street use fee	1,200	SF	2.10	2,520
			Year 2008 Subtotal	$210,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$218,000

Year 2010 Total: $218,000

3rd Ave W Site Alternative

DSN008-STOR-2 (KC & SPU) or SC-3rd Ave W-Collab-STOR 2

Cost Estimate of SPU-Developed Alternative Using King County Cost Estimating Methodology

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Alternative DSN008-STOR-2 (KC & SPU)

Percentage of Cost Attributed to King County and SPU, Based on Volume [3]

Agency	Volume (MG)	Percentage of Costs (%)
King County	4.18	57.8%
SPU	3.05	42.2%

Escalation Assumptions

Description	ENR CCI
ENR CCI (Seattle), January 2010	8645.35

KING COUNTY METHODOLOGY, Total Project Cost, 2010 Dollars

Description	Total Costs (King County & SPU)	Costs Attributed to King County (3rd Ave W)[3]	Costs Attributed to SPU[3, 4]
7.226-MG Storage Tank Construction Cost =	$33,700,000	$19,490,000	$14,210,000
Influent Gravity Sewer Construction Cost (400 LF of 24-inch-diameter pipe) =	$430,000	$250,000	$180,000
Force Main Construction Cost (200 LF of 24-inch-diameter pipe) =	$120,000	$70,000	$50,000
Regulator Construction Cost =	$490,000	$280,000	$210,000
SDOT Street Use Permit Fee Cost =	$12,000	$7,000	$5,000
Total Construction Cost =	$34,750,000	$20,100,000	$14,650,000
Sales Tax (10% of Construction Cost) =	$3,480,000	$2,010,000	$1,470,000
[1]Allied Costs (46.07% of Construction Cost) =	$16,010,000	$9,260,000	$6,750,000
Property Cost =	$12,580,000	$7,280,000	$5,300,000
Subtotal of Project Cost =	$66,820,000	$38,650,000	$28,170,000
[1]Construction Contingency (10% of Construction Cost) =	$3,480,000	$2,010,000	$1,470,000
[1, 2]Project Contingency =	$16,570,000	$9,590,000	$6,980,000
Total Project Cost, 2010 Dollars =	**$86,900,000**	**$50,300,000**	**$36,600,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

[3]Allocation of costs is pending confirmation from management.

[4]Costs attributed to SPU do not include all SPU conveyance costs from the SPU system to the Stoneway Tunnel.

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STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility
Printed date : 01/14/2011

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Storage Capacity: 7.226 Mgal
Facility Footprint: 83900 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	9,320.00	SY	$43	$401,000
Dewatering	1	LS	$1,590,000	$1,590,000
Odor Control	1	LS	$1,170,000	$1,170,000
Effluent Pump Station	1	LS	$362,000	$362,000
Construction Cost	7.2	Mgal	4,000,000	$28,900,000
			Year 2008 Subtotal	$32,400,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$33,700,000

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INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Gravity)
Printed date : 09/23/2011

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 400 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 24 in.

Geometry

Outer Diameter	2.5	ft
Trench Width	5.75	ft
Excavation Depth	13.5	ft
Complete Surface Rest. Width	7.75	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,150.00	CY	$13	$15,000
Backfill	767.00	CY	$34	$26,100
Complete Pavement Restoration	344.00	SY	$86	$29,600
Overlay Pavement Restoration	633.00	SY	$28	$17,700
Trench Safety	10,800.00	SF	$17	$184,000
Spoil Load and Haul	1,150.00	CY	$16	$18,400
Pipe Unit Material Cost	400.00	lf	$36	$14,400
Pipe Installation	400.00	lf	$33	$13,200
Place Pipe Zone Fill	311.00	CY	$34	$10,600
Manholes	1	MH	$7,390	$7,390
Existing Utilities	400.00	lf	$58	$23,200
Dewatering	400.00	lf	$100	$40,000
Traffic Control	400.00	lf	$24	$9,600
			Year 2008 Subtotal	$409,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$425,000

Year 2010 Total: $425,000

FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Force Main
Printed date : 09/23/2011

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 200 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Standard
Pipe Diameter: 24 in.

Geometry

Outer Diameter	2.15	ft
Trench Width	5.3	ft
Excavation Depth	9.15	ft
Complete Surface Rest. Width	7.3	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	359.00	CY	$13	$4,670
Backfill	196	CY	$34	$6,670
Complete Pavement Restoration	162	SY	$86	$13,900
Overlay Pavement Restoration	327.00	SY	$28	$9,150
Trench Safety	3,660.00	SF	$1	$1,940
Spoil Load and Haul	359.00	CY	$16	$5,740
Pipe Unit Material Cost	200	lf	$114	$22,800
Pipe Installation	200	lf	$33	$6,600
Place Pipe Zone Fill	136	CY	$34	$4,620
Existing Utilities	200	lf	$58	$11,600
Dewatering	200	lf	$100	$20,000
Traffic Control	200	lf	$24	$4,800
			Year 2008 Subtotal	$113,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$117,000

Year 2010 Total: $117,000

REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 11/09/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$485,000

Year 2010 Total: $485,000

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PROPERTY AND PERMITTING COSTS

Land and Building Cost, Average Cost per Square Foot (January 2007 to August 2010)

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building ($/SF)	Average Cost per Square Foot for Industrial Land ($/SF)
DSN008 3rd Ave W	$149.89	$21.91

Land Costs, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Storage Tank	61,500	$149.89	100%	$9,218,235
Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.)	22,400	$149.89	100%	$3,357,536
			Total Land Costs	$12,575,771

SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.

Closure of construction area will occur in phases. Assumed construction phasing in:	1,000	ft segments
Assumed production rate during working days =	15	LF/d
For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula.	22	ft
For pipe diameters greater than 36 inches, assume full width of road will be closed during construction. Width is based on the full width for arterial pavement restoration in Tabula.	44	ft

Source of methodology for estimating permit fees: http://www.seattle.gov/transportation/cams/CAM2115.pdf

SDOT Street Use Permit Fee Estimation, 2010 Dollars

Description	Diameter of Pipe (in)	Length (ft)	Width of Construction Area (ft)	Estimated Construction Area (SF)	Construction Duration (Calendar Days)	Number of 10-Day Periods	Use Fee ($/SF)	Estimated Permit Costs
Regulator Station Upgrade at 3rd Ave W Overflow Structure	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Gravity Sewer	24	400	22	8,800	37.3	4	$0.50	$4,400
Installation of Force Main	24	200	22	4,400	18.7	2	$0.20	$880
							Total SDOT Street Use Fee Estimation:	$11,780

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Operations and Maintenance Cost Estimate Summary

Basin Name: 3rd Ave W (Collab)

Alternative Name: SC-3RD SPU-STOR Stone (KC O&M Model)

ENR 1994	5747	*Acres of Raingarden for GSI*	0.00
Current ENR	8645.35	*Annual Overflow Vol (MG)*	17.10
ENR 1994	5747	*Annual Vol Captured*	22.7
Power Cost (per kwh)	0.065	*Annual Events*	17
Labor rate (loaded) /hr	51.17	*Stor Vol*	7.23
SPU Water Cost $/CCF	4.50	*Peak Flow Rate*	51.80
Carbon Cost/Lb	2.00		

Annual Costs

	SHARED COSTS				KC ONLY COSTS				SPU ONLY COSTS			
Components	**Annual Maintenance & Inspection Cost**	**Annual Operation Cost**	**Annual Energy Cost**	**Annual Chemical Cost**	**Annual Maintenance & Inspection Cost**	**Annual Operation Cost**	**Annual Energy Cost**	**Annual Chemical Cost**	**Annual Maintenance & Inspection Cost**	**Annual Operation Cost**	**Annual Energy Cost**	**Annual Chemical Cost**
Gravity Sewer/Combined Sewers	$604				$0				$1,133			
Force Mains	$7				$0				$0			
Regulator/Flow Control Structures	$0				$38,459				$0			
Deep/Shallow Tunnels	$0								$0			
Off-Line Storage Pipes	$0								$0			
River Outfalls	$0								$0			
Pump Stations									$55,856	$18,702	$38,866	
Rectangular Storage Facilities	$11,932	$0	$45,348	$135,321								
High Rate Treatment	$0	$0	$0	$0								
Additonal Secondary Treatment	NA	$14,877	NA	NA								
Green Stormwater Infrastructure	$0				$0				$0			
Annual Cost Subtotals:	**$12,543**	**$14,877**	**$45,348**	**$135,321**	**$38,459**	**$0**	**$0**	**$0**	**$56,988**	**$18,702**	**$38,866**	**$0**

Total Annual Shared O&M		**Total Annual KC Only O&M**		**Total Annual SPU Only O&M**	
General	**$162,740**	**General**	**$38,459**	**General**	**$75,690**
Energy	**$45,348**	**Energy**	**$0**	**Energy**	**$38,866**
Total	**$208,088**	**Total**	**$38,459**	**Total**	**$114,556**
KC share at 57.8%	$120,275	**Total KC=**	**$158,734**	**Total SPU=**	**$202,370**
SPUShare at 42.2%	$87,813				
Total O&M both=	$361,103				

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WTD Business Case Evaluation Results
3rd Ave W CSO Control 2010

WTD Borrowing Cost as Discount Rate (1)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
Stor-Collab Stone Way	50	$50,300,000	$0	$51,517,158	($51,517,158)	($1,703,654)	0.0

Budget Office Discount Rate (3)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
Stor-Collab Stone Way	50	$50,300,000	$0	$40,554,857	($40,554,857)	($2,938,599)	0.0

Notes: All costs are in 2010$.
(1) WTD Discount rate is 2.2%, based on recent WTD borrowing costs net of 3% annual inflation.
(2) Costs include risk and uncertainty, if estimated.
(3) Discount rate is 7% net of inflation, per the King County Budget Office.
The option with the largest net equivalent annualized cost is the financially preferred option.

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Appendix G.1.3

University Site Alternatives

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University Site Alternative

DSN015-STOR-1 (KC) or SC-University-KC-STOR

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DSN015-STOR-1 (KC) or SC-University-KC-STOR

Alternative DSN015-STOR-1 controls King County's University CSOs by building a storage tank adjacent to the North Interceptor. This alternative is an independent alternative that was developed by King County.

Design Criteria

- King County Storage Volume Requirement: 2.94 MG[1] (University)
- King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 94.7 MGD[1] (University)
- Storage tank is required to drain within 12 hours of event.

Description

Alternative DSN015-STOR-1 (KC) consists of a storage tank to control King County University CSOs. A CSO control volume of approximately 2.94 MG[1] is required to reduce overflows at the University CSO Outfall to an average of one untreated discharge per year. Storage of this volume could be provided with an offline storage tank located within or adjacent to the approximate boundary shown in Figure G.1.3-1. See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundary.

The main components of this alternative would include:

- 2.94-MG offline storage tank with pumps to empty the storage tank.
- Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
- A new regulator station (diversion structure) along the North Interceptor to divert King County CSOs to the storage tank.
- Up to approximately 1,650 ft of 20-inch-diameter force main, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.3-1.
- Up to approximately 3,300 ft of 60-inch-diameter influent gravity sewer, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.3-1.

Storage Tank

The CSO control volume for King County could be stored in a buried, rectangular structure, approximately 260 feet long and 90 feet wide with a sidewater depth of approximately 20 feet.

Flows would enter the storage tank during a wet-weather event. The tank may be configured with multiple chambers, so that only those chambers required to store the volume of the wet-weather event would be used. Storage of flows would start in the first chamber and as that

[1] This alternative assumes that flows are diverted upstream of the University Regulator Station along the North Interceptor. Refined modeling may indicate an increase in storage volume and conveyance size to control University CSOs.

chamber fills and reaches capacity, flows would be transferred into subsequent chambers until either the wet-weather event ends or the capacity of the storage tank is reached. Each chamber would contain equipment for flushing and self-cleaning, and only chambers used in a wet-weather event would require flushing. Control of odors and sediment in the storage chambers may require regularly-scheduled cleaning between events.

Facilities Building(s)

Facilities building(s) would be located above or below ground level and would contain an odor control system, electrical controls, and a standby generator. The actual contents of the building(s) will be determined during preferred alternative development. The representative footprint shown in Figure G.1.3-1 for this alternative locates the facilities buildings adjacent to the storage tank for conservative purposes; however, the facilities buildings could be located above the storage tank to minimize space requirements.

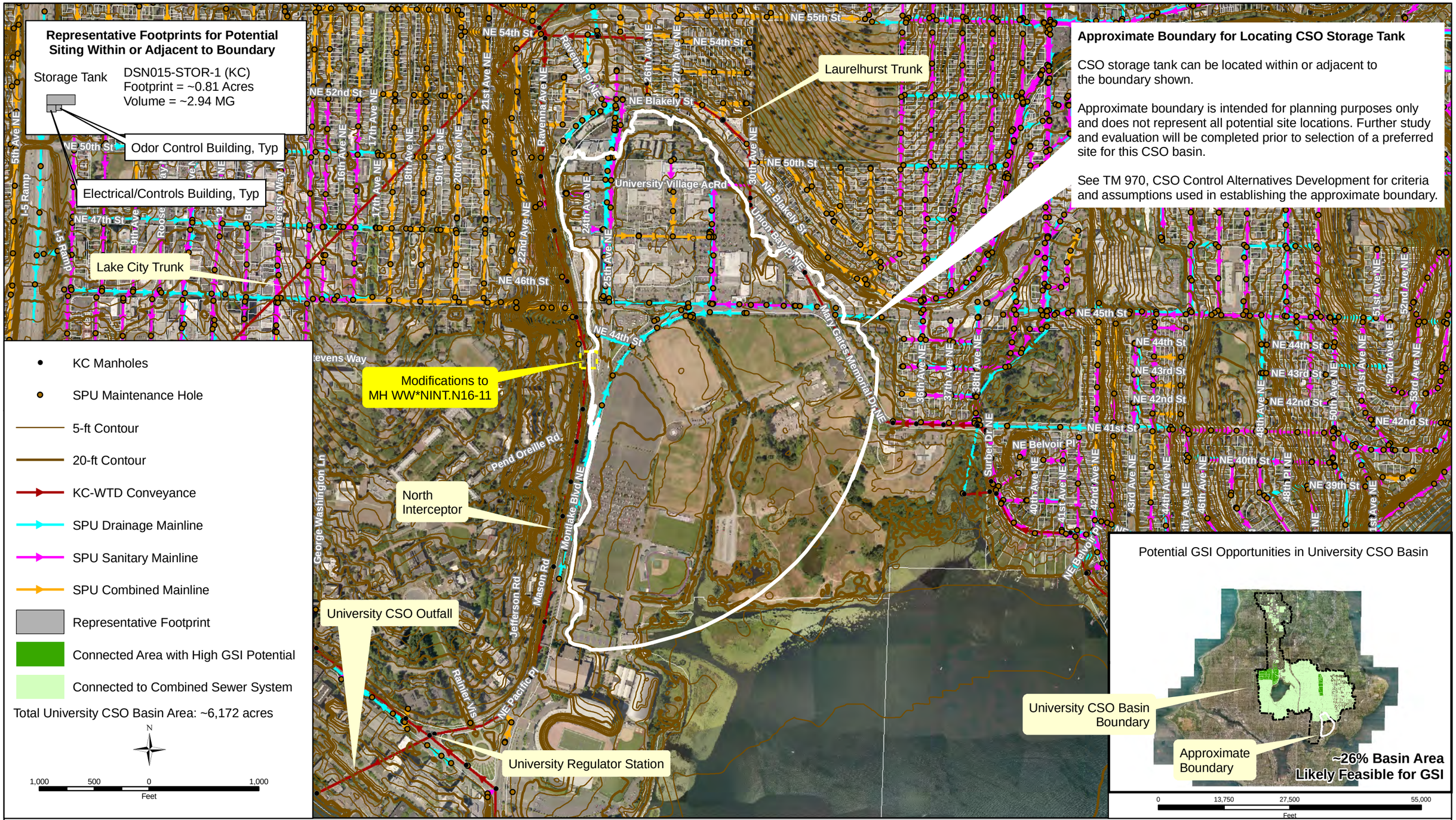
Flow Diversion and Discharge

One regulator station will be required to divert King County flows from the North Interceptor to the storage tank. For this planning phase, it is assumed that the diversion would occur at King County manhole WW*NINT.N16-11. Evaluation of whether flows can be diverted upstream of this manhole or at a different location along the North Interceptor will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the storage tank via a 60-inch-diameter influent gravity sewer. The length of the influent gravity sewer will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development. The influent gravity sewer can be up to 3,300 feet long based on the criteria and assumptions listed in Section 6.1.

After a wet-weather event, the chambers inside the storage tank would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County North Interceptor through a 20-inch-diameter force main that is up to approximately 1,650 feet in length. The length of the force main will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development.

Construction Assumptions

King County's Tabula cost estimating program was used to develop a Class 5 estimate for this alternative. The attached documentation lists the construction assumptions used.



King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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Figure G.1.3-1

University - DSN015-STOR-1 (KC)
Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN015-STOR-1 (KC)

Escalation Assumptions

Description	ENR CCI
ENR CCI (Seattle), January 2010	8645.35

Total Project Cost, 2010 Dollars

Description	Total Costs (University)
2.94-MG Storage Tank Construction Cost =	$14,400,000
Influent Gravity Sewer Construction Cost (3,300 LF of 60-inch-diameter pipe) =	$6,660,000
Force Main Construction Cost (1,650 LF of 20-inch-diameter pipe) =	$860,000
Regulator Construction Cost =	$490,000
SDOT Street Use Permit Fee Cost =	$480,000
Total Construction Cost =	$22,890,000
Sales Tax (10% of Construction Cost) =	$2,290,000
[1]Allied Costs (46.07% of Construction Cost) =	$10,550,000
Property Cost =	$6,190,000
Subtotal of Project Cost =	$41,920,000
[1]Construction Contingency (10% of Construction Cost) =	$2,290,000
[1, 2]Project Contingency =	$10,290,000
Total Project Cost, 2010 Dollars =	**$54,500,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility
Printed date : 01/13/2011

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Storage Capacity: 2.94 Mgal
Facility Footprint: 35225 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	3,910.00	SY	43	168,000
Dewatering	1	LS	1,140,000	1,140,000
Odor Control	1	LS	484,000	484,000
Effluent Pump Station	1	LS	266,000	266,000
Construction Cost	2.9	Mgal	4,000,000	11,800,000
			Year 2008 Subtotal	$13,800,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$14,400,000

INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe
Printed date : 01/13/2011

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 3298 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 60 in.

Geometry

Outer Diameter	6.13	ft
Trench Width	10.5	ft
Excavation Depth	17.1	ft
Complete Surface Rest. Width	12.5	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	21,900.00	CY	$13	$285,000
Backfill	11,500.00	CY	$34	$391,000
Complete Pavement Restoration	4,570.00	SY	$86	$393,000
Overlay Pavement Restoration	11,600.00	SY	$28	$324,000
Trench Safety	113,000.00	SF	$17	$1,920,000
Spoil Load and Haul	21,900.00	CY	$16	$350,000
Pipe Unit Material Cost	3,300.00	lf	$220	$726,000
Pipe Installation	3,300.00	lf	$81	$267,000
Place Pipe Zone Fill	6,780.00	CY	$34	$231,000
Manholes	7	MH	$15,400	$108,000
Existing Utilities	3,300.00	lf	$265	$874,000
Dewatering	3,300.00	lf	$127	$419,000
Traffic Control	3,300.00	lf	$36	$119,000
			Year 2008 Subtotal	$6,400,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$6,660,000

Year 2010 Total: $6,660,000

FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Forcemain
Printed date : 01/13/2011

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 1650 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Standard
Pipe Diameter: 20 in.

Geometry

Outer Diameter	1.8	ft
Trench Width	4.84	ft
Excavation Depth	8.8	ft
Complete Surface Rest. Width	6.84	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	2,600.00	CY	$13	$33,800
Backfill	1,480.00	CY	$34	$50,300
Complete Pavement Restoration	1,250.00	SY	$86	$108,000
Overlay Pavement Restoration	2,780.00	SY	$28	$77,800
Trench Safety	29,000.00	SF	$1	$15,400
Spoil Load and Haul	2,600.00	CY	$16	$41,600
Pipe Unit Material Cost	1,650.00	lf	$91	$150,000
Pipe Installation	1,650.00	lf	$30	$49,500
Place Pipe Zone Fill	968.00	CY	$34	$32,900
Existing Utilities	1,650.00	lf	$58	$95,700
Dewatering	1,650.00	lf	$87	$144,000
Traffic Control	1,650.00	lf	$16	$26,400
			Year 2008 Subtotal	$825,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$858,000

Year 2010 Total: $858,000

REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 11/09/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$485,000

Year 2010 Total: $485,000

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PROPERTY AND PERMITTING COSTS

Land and Building Cost, Average Cost per Square Foot (January 2007 to August 2010)

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building ($/SF)	Average Cost per Square Foot for Industrial Land ($/SF)
DSN015 University Regulator	$175.83	N/A

Land Costs, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Storage Tank	27,000	$175.83	100%	$4,747,410
Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.)	8,225	$175.83	100%	$1,446,202
			Total Land Costs	$6,193,612

SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.

Closure of construction area will occur in phases. Assumed construction phasing in:	1,000	ft segments
Assumed production rate during working days =	15	LF/d
For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula.	22	ft
For pipe diameters greater than 36 inches, assume full width of road will be closed during construction. Width is based on the full width for arterial pavement restoration in Tabula.	44	ft

Source of methodology for estimating permit fees: http://www.seattle.gov/transportation/cams/CAM2115.pdf

SDOT Street Use Permit Fee Estimation, 2010 Dollars

Description	Diameter of Pipe (in)	Length (ft)	Width of Construction Area (ft)	Estimated Construction Area (SF)	Construction Duration (Calendar Days)	Number of 10-Day Periods	Use Fee ($/SF)	Estimated Permit Costs
Regulator Station Upgrade at University Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Gravity Sewer, First Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer, Second Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer, Third Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer, Fourth Phase of Construction	60	300	44	13,200	28.0	3	$0.30	$3,960
Installation of Force Main, First Phase of Construction	20	1,000	22	22,000	93.3	10	$2.90	$63,800
Installation of Force Main, Second Phase of Construction	20	650	22	14,300	60.7	7	$1.30	$18,590
							Total SDOT Street Use Fee Estimation:	$475,650

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Operations and Maintenance Cost Estimate Summary

Basin Name: **University (Ind)**

Alternative Name: **SC-University-KC-STOR**

ENR 1994	5747
Current ENR	**8645.4**
Power Cost (per kwh)	**0.065**
Labor rate (loaded) /hr	**51.17**
SPU Water Cost $/CCF	**4.50**
Carbon Cost/Lb	**2.00**

Acres of Raingarden for GSI	**0.00**
Annual Overflow Vol (MG)	**19.40**
Annual Vol Capture	**3.70**
Annual Events	**2**
Stor Vol	**2.94**
Peak Flow Rate	**94.70**
ENR 1994	5747

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$4,983			
Force Mains	$59			
Regulator/Flow Control Structures	$38,459			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$0			
Pump Stations	$0	$0	$0	
Rectangular Storage Facilities	$62,920	$8,382	$16,705	$55,027
High Rate Treatment	$0	$0	$0	$0
Additonal Secondary Treatment	NA	$2,430	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$106,421**	**$10,812**	**$16,705**	**$55,027**

Total Annual O&M

General	**$172,260**
Energy	**$16,705**
Total	**$188,965**

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WTD Business Case Evaluation Results
University CSO Control 2010

WTD Borrowing Cost as Discount Rate (1)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
SC-University-KC-STOR	50	$54,500,000	$0	$60,211,833	($60,211,833)	($1,991,183)	0.0

Budget Office Discount Rate (3)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
SC-University-KC-STOR	50	$54,500,000	$0	$44,878,648	($44,878,648)	($3,251,900)	0.0

Notes: All costs are in 2010$.
(1) WTD Discount rate is 2.2%, based on recent WTD borrowing costs net of 3% annual inflation.
(2) Costs include risk and uncertainty, if estimated.
(3) Discount rate is 7% net of inflation, per the King County Budget Office.
The option with the largest net equivalent annualized cost is the financially preferred option.

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University Site Alternative

DSN015-STOR-4 (KC & SPU) or SC-University-Collab-STOR

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DSN015-STOR-4 (KC & SPU) or SC-University-Collab-STOR

Alternative DSN015-STOR-4 (KC & SPU) controls King County's University CSOs and SPU's North Union Bay CSOs by building a storage tank adjacent to the North Interceptor. This alternative is a collaborative alternative that was developed by King County.

Design Criteria

- King County Storage Volume Requirement: 2.94 MG[1] (University)
- SPU Storage Volume Requirement: 2.29 MG (North Union Bay)
- King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 94.7 MGD[1] (University)
- SPU CSO Peak Flow Rate for Sizing Conveyance to Storage: 17.2 MGD (North Union Bay)
- Storage tank is required to drain within 12 hours of event.

Description

Alternative DSN015-STOR-4 (KC & SPU) consists of a storage tank to control King County University CSOs and SPU North Union Bay CSOs. A CSO control volume of approximately 2.94 MG[1] is required to reduce overflows at the University CSO Outfall to an average of one untreated discharge per year. A CSO control volume of approximately 2.29 MG is required to reduce SPUs North Union Bay CSOs. A total maximum storage volume of 5.23 MG is required to control the two CSO outfalls. Storage of this volume could be provided with an offline storage tank located within or adjacent to the approximate boundary shown in Figure G.1.3-2. See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundary. This alternative does not include the conveyance components and costs associated with SPU conveying flows to the storage tank.

The main components of this alternative would include:

- 5.23-MG offline storage tank with pumps to empty the storage tank.
- Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
- A new regulator station (diversion structure) along the North Interceptor to divert King County CSOs to the storage tank.
- Up to approximately 1,570 ft of 30-inch-diameter force main, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.3-2.
- Up to approximately 3,130 ft of 60-inch-diameter influent gravity sewer, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.3-2.

[1] This alternative assumes that flows are diverted upstream of the University Regulator Station along the North Interceptor. Refined modeling may indicate an increase in storage volume and conveyance size to control University CSOs.

Storage Tank

The CSO control volume for King County and SPU could be stored in a buried, rectangular structure, approximately 350 feet long and 130 feet wide with a sidewater depth of approximately 20 feet.

Flows would enter the storage tank during a wet-weather event. The tank may be configured with multiple chambers, so that only those chambers required to store the volume of the wet-weather event would be used. Storage of flows would start in the first chamber and as that chamber fills and reaches capacity, flows would be transferred into subsequent chambers until either the wet-weather event ends or the capacity of the storage tank is reached. Each chamber would contain equipment for flushing and self-cleaning, and only chambers used in a wet-weather event would require flushing. Control of odors and sediment in the storage chambers may require regularly-scheduled cleaning between events.

Facilities Building(s)

Facilities building(s) would be located above or below ground level and would contain an odor control system, electrical controls, and a standby generator. The actual contents of the building(s) will be determined during preferred alternative development. The representative footprint shown in Figure G.1.3-2 for this alternative locates the facilities buildings adjacent to the storage tank for conservative purposes; however, the facilities buildings could be located above the storage tank to minimize space requirements.

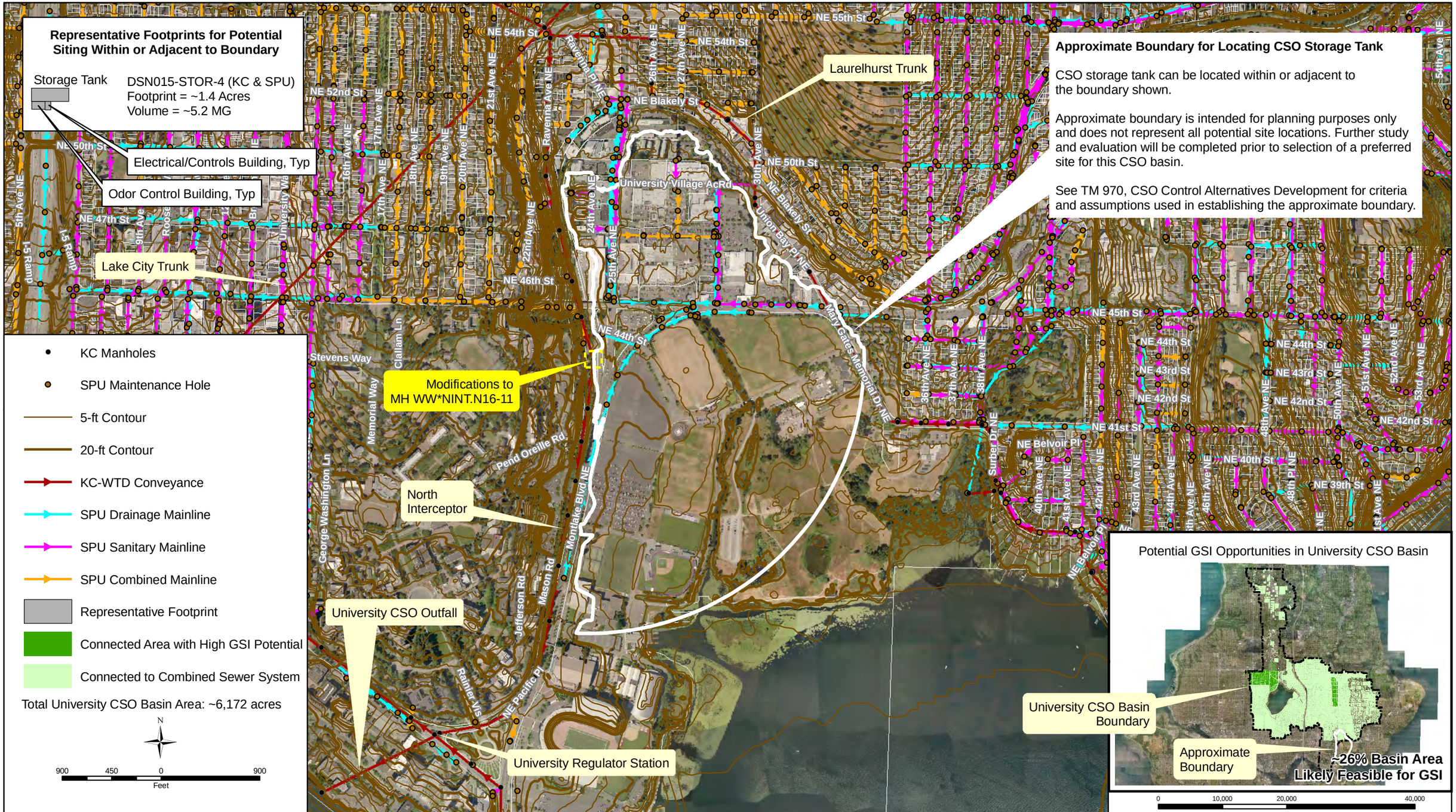
Flow Diversion and Discharge

One regulator station will be required to divert King County and SPU flows from the North Interceptor to the storage tank. For this planning phase, it is assumed that the diversion would occur at King County manhole WW*NINT.N16-11. Evaluation of whether flows can be diverted upstream of this manhole or at a different location along the North Interceptor will be completed during preferred alternative development. Diverted King County and SPU flow would discharge to the location of the storage tank via a 60-inch-diameter influent gravity sewer. The length of the influent gravity sewer will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development. The influent gravity sewer can be up to 3,130 feet long based on the criteria and assumptions listed in Section 6.1.

After a wet-weather event, the chambers inside the storage tank would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County North Interceptor through a 30-inch-diameter force main that is up to approximately 1,570 feet in length. The length of the force main will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development.

Construction Assumptions

King County's Tabula cost estimating program was used to develop a Class 5 estimate for this alternative. The attached documentation lists the construction assumptions used.



King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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Figure G.1.3-2

University - DSN015-STOR-4 (KC & SPU)
Potential Site Boundary and Representative Footprints
TM 970, CSO Control Alternatives Development

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Alternative DSN015-STOR-4 (KC & SPU)

Percentage of Cost Attributed to King County and SPU, Based on Volume[3]

Agency	Volume (MG)	Percentage of Costs (%)
King County	2.94	56.2%
SPU	2.29	43.8%

Escalation Assumptions

Description	ENR CCI
ENR CCI (Seattle), January 2010	8645.35

Total Project Cost, 2010 Dollars

Description	Total Costs	Costs Attributed to King County (University)[3]	Costs Attributed to SPU[3, 4]
5.23-MG Storage Tank Construction Cost =	$24,700,000	$13,880,000	$10,820,000
Influent Gravity Sewer Construction Cost (3,130 LF of 60-inch-diameter pipe) =	$6,330,000	$3,560,000	$2,770,000
Force Main Construction Cost (1,570 LF of 30-inch-diameter pipe) =	$1,040,000	$580,000	$460,000
Regulator Construction Cost =	$490,000	$280,000	$210,000
SDOT Street Use Permit Fee Cost =	$470,000	$260,000	$210,000
Total Construction Cost =	$33,030,000	$18,560,000	$14,470,000
Sales Tax (10% of Construction Cost) =	$3,300,000	$1,850,000	$1,450,000
[1]Allied Costs (46.07% of Construction Cost) =	$15,220,000	$8,550,000	$6,670,000
Property Cost =	$10,360,000	$5,820,000	$4,540,000
Subtotal of Project Cost =	$61,910,000	$34,790,000	$27,120,000
[1]Construction Contingency (10% of Construction Cost) =	$3,300,000	$1,850,000	$1,450,000
[1, 2]Project Contingency =	$15,270,000	$8,580,000	$6,690,000
Total Project Cost, 2010 Dollars =	**$80,500,000**	**$45,240,000**	**$35,260,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cos

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost

[3]Allocation of costs is pending confirmation from management.

[4]Costs attributed to SPU do not include conveyance costs from the SPU system to MH WW*NINT.N16-11

STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility
Printed date : 12/13/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Storage Capacity: 5.23 Mgal
Facility Footprint: 58925 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	6,550.00	SY	43	282,000
Dewatering	1	LS	1,380,000	1,380,000
Odor Control	1	LS	850,000	850,000
Effluent Pump Station	1	LS	319,000	319,000
Construction Cost	5.2	Mgal	4,000,000	20,900,000
			Year 2008 Subtotal	$23,700,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$24,700,000

INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe
Printed date : 12/13/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 3131 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 60 in.

Geometry

Outer Diameter	6.13	ft
Trench Width	10.5	ft
Excavation Depth	17.1	ft
Complete Surface Rest. Width	12.5	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	20,800.00	CY	$13	$270,000
Backfill	10,900.00	CY	$34	$371,000
Complete Pavement Restoration	4,340.00	SY	$86	$373,000
Overlay Pavement Restoration	11,000.00	SY	$28	$307,000
Trench Safety	107,000.00	SF	$17	$1,820,000
Spoil Load and Haul	20,800.00	CY	$16	$332,000
Pipe Unit Material Cost	3,130.00	lf	$220	$689,000
Pipe Installation	3,130.00	lf	$81	$254,000
Place Pipe Zone Fill	6,440.00	CY	$34	$219,000
Manholes	7	MH	$15,400	$108,000
Existing Utilities	3,130.00	lf	$265	$830,000
Dewatering	3,130.00	lf	$127	$398,000
Traffic Control	3,130.00	lf	$36	$113,000
			Year 2008 Subtotal	$6,090,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$6,330,000

Year 2010 Total: $6,330,000

FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Forcemain
Printed date : 12/13/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 1566 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Standard
Pipe Diameter: 30 in.

Geometry

Outer Diameter	2.67	ft
Trench Width	5.97	ft
Excavation Depth	9.67	ft
Complete Surface Rest. Width	7.97	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	3,350.00	CY	$13	$43,500
Backfill	1,730.00	CY	$34	$58,800
Complete Pavement Restoration	1,390.00	SY	$86	$119,000
Overlay Pavement Restoration	2,440.00	SY	$28	$68,400
Trench Safety	30,300.00	SF	$1	$16,000
Spoil Load and Haul	3,350.00	CY	$16	$53,500
Pipe Unit Material Cost	1,570.00	lf	$159	$249,000
Pipe Installation	1,570.00	lf	$38	$59,500
Place Pipe Zone Fill	1,290.00	CY	$34	$43,900
Existing Utilities	1,570.00	lf	$58	$90,800
Dewatering	1,570.00	lf	$100	$157,000
Traffic Control	1,570.00	lf	$24	$37,600
			Year 2008 Subtotal	$997,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$1,040,000

Year 2010 Total: $1,040,000

REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 11/09/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$485,000

Year 2010 Total: $485,000

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PROPERTY AND PERMITTING COSTS

Land and Building Cost, Average Cost per Square Foot (January 2007 to August 2010)

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building ($/SF)	Average Cost per Square Foot for Industrial Land ($/SF)
DSN015 University Regulator	$175.83	NA

Land Costs, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Storage Tank	45,500	$175.83	100%	$8,000,265
Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.)	13,425	$175.83	100%	$2,360,518
			Total Land Costs	$10,360,783

SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.

Closure of construction area will occur in phases. Assumed construction phasing in:	1,000	ft segments
Assumed production rate during working days =	15	LF/d
For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula.	22	ft
For pipe diameters greater than 36 inches, assume full width of road will be closed during construction. Width is based on the full width for arterial pavement restoration in Tabula.	44	ft

Source of methodology for estimating permit fees: http://www.seattle.gov/transportation/cams/CAM2115.pdf

SDOT Street Use Permit Fee Estimation, 2010 Dollars

Description	Diameter of Pipe (in)	Length (ft)	Width of Construction Area (ft)	Estimated Construction Area (SF)	Construction Duration (Calendar Days)	Number of 10-Day Periods	Use Fee ($/SF)	Estimated Permit Costs
Regulator Station Upgrade at University Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Gravity Sewer, First Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer, Second Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer, Third Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer, Fourth Phase of Construction	60	131	44	5,764	12.2	2	$0.20	$1,153
Installation of Force Main, First Phase of Construction	30	1,000	22	22,000	93.3	10	$2.90	$63,800
Installation of Force Main, Second Phase of Construction	30	566	22	12,452	52.8	6	$0.90	$11,207
							Total SDOT Street Use Fee Estimation:	$465,460

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All Shared Costs

Operations and Maintenance Cost Estimate Summary

Basin Name: University (Collab)

Alternative Name: SC-University-Collab-STOR

ENR 1994	5747
Current ENR	**8645.4**
Power Cost (per kwh)	**0.065**
Labor rate (loaded) /hr	**51.17**
SPU Water Cost $/CCF	**4.50**
Carbon Cost/Lb	**2.00**

Acres of Raingarden for GSI	**0.00**
Annual Overflow Vol (MG)	**19.40**
Annual Vol Capture	**6.50**
Annual Events	**6**
Stor Vol	**5.23**
Peak Flow Rate	**94.70**

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$4,726			
Force Mains	$57			
Regulator/Flow Control Structures	$38,459			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$0			
Pump Stations	$0	$0	$0	
Rectangular Storage Facilities	$107,784	$24,851	$29,869	$195,775
High Rate Treatment	$0	$0	$0	$0
Additonal Secondary Treatment	NA	$4,269	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$151,026**	**$29,120**	**$29,869**	**$195,775**

Total Annual O&M

General	**$375,921**
Energy	**$29,869**
Total	**$405,790**

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WTD Business Case Evaluation Results
University CSO Control 2010

WTD Borrowing Cost as Discount Rate (1)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
SC-University-Collab-STOR	50	$45,240,000	$0	$53,761,816	($53,761,816)	($1,777,884)	0.0

Budget Office Discount Rate (3)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
SC-University-Collab-STOR	50	$45,240,000	$0	$38,321,098	($38,321,098)	($2,776,741)	0.0

Notes: All costs are in 2010$.
(1) WTD Discount rate is 2.2%, based on recent WTD borrowing costs net of 3% annual inflation.
(2) Costs include risk and uncertainty, if estimated.
(3) Discount rate is 7% net of inflation, per the King County Budget Office.
The option with the largest net equivalent annualized cost is the financially preferred option.

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Appendix G.1.4

Montlake Site Alternatives

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Montlake Site Alternative

DSN014-STOR-1 (KC) or SC-Montlake-KC-STOR

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DSN014-STOR-1 (KC) or SC-Montlake-KC-STOR

Alternative DSN014-STOR-1 (KC) controls King County's Montlake CSOs by building a storage tank near the Montlake Regulator Station. This alternative is an independent alternative and only controls King County CSOs.

Design Criteria

- King County Storage Volume Requirement: 6.6 MG (Montlake)
- King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 148.5 MGD (Montlake)
- Storage tank is required to drain within 12 hours of event.

Description

Alternative DSN014-STOR-1 (KC) consists of a storage tank to control King County Montlake CSOs. A CSO control volume of approximately 6.6 MG is required to reduce overflows at the Montlake CSO Outfall to an average of one untreated discharge per year. Storage of this volume could be provided with an offline storage tank located within or adjacent to the approximate boundary shown in Figure G.1.4-1. See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundary.

The main components of this alternative would include:

- 6.6-MG offline storage tank with pumps to empty the storage tank.
- Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
- Modifications to Montlake Regulator Station.
- Up to approximately 1,840 ft of 30-inch-diameter force main, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.4-1.
- Up to approximately 3,680 ft of 60-inch-diameter influent gravity sewer, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.4-1.

Storage Tank

The CSO control volume for King County could be stored in a buried, rectangular structure, approximately 490 feet long and 110 feet wide with a sidewater depth of approximately 20 feet.

Flows would enter the storage tank during a wet-weather event. The tank may be configured with multiple chambers, so that only those chambers required to store the volume of the wet-weather event would be used. Storage of flows would start in the first chamber and as that chamber fills and reaches capacity, flows would be transferred into subsequent chambers until either the wet-weather event ends or the capacity of the storage tank is reached. Each chamber would contain equipment for flushing and self-cleaning, and only chambers used in a wet-weather event would require flushing. Control of odors and sediment in the storage chambers may require regularly-scheduled cleaning between events.

Facilities Building(s)

Facilities building(s) would be located above or below ground level and would contain an odor control system, electrical controls, and a standby generator. The actual contents of the building(s) will be determined during preferred alternative development. The representative footprint shown in Figure G.1.4-1 for this alternative locates the facilities buildings adjacent to the storage tank for conservative purposes; however, the facilities buildings could be located above the storage tank to minimize space requirements.

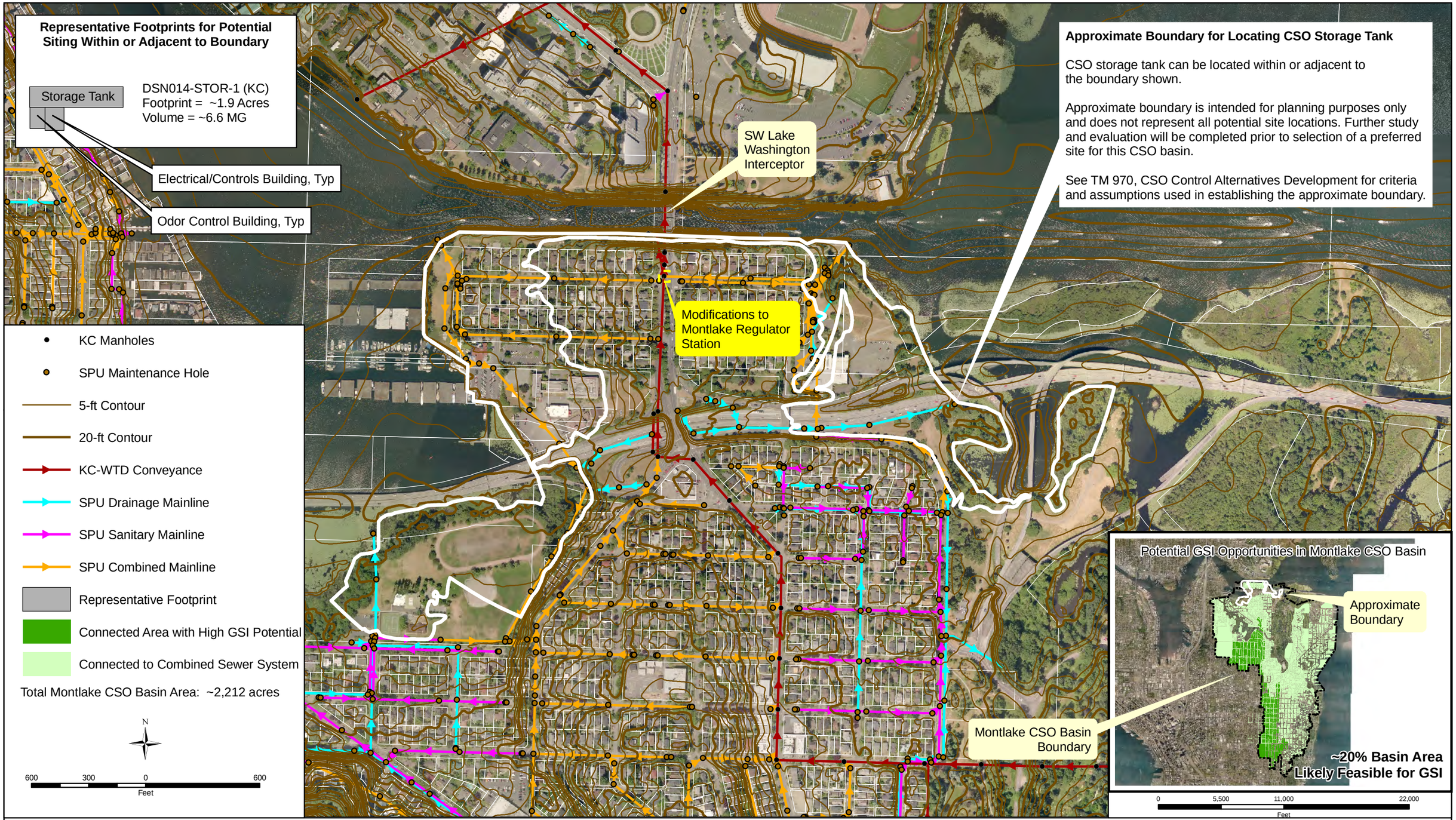
Flow Diversion and Discharge

One regulator station will be required to divert King County flows from the Montlake Regulator Station to the storage tank. For this planning phase, it is assumed that the diversion would occur at the Montlake Regulator Station. Evaluation of whether flows can be diverted upstream of the Montlake Regulator Station will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the storage tank via a 60-inch-diameter influent gravity sewer. The length of the influent gravity sewer will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development. The influent gravity sewer can be up to 3,680 long based on the criteria and assumptions listed in Section 6.1.

After a wet-weather event, the chambers inside the storage tank would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County SW Lake Washington Interceptor through a 30-inch-diameter force main that is up to approximately 1,840 feet in length. The length of the force main will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development.

Construction Assumptions

King County's Tabula cost estimating program was used to develop a Class 5 estimate for this alternative. The attached documentation lists the construction assumptions used.



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File Name:

Data Source:

Figure G.1.4-1

Montlake - DSN014-STOR-1 (KC)
Potential Site Boundary and Representative Footprints
TM 970, CSO Control Alternatives Development

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Alternative DSN014-STOR-1 (KC)

Escalation Assumptions

Description	ENR CCI
ENR CCI (Seattle), January 2010	8645.35

Total Project Cost, 2010 Dollars

Description	Total Costs (Montlake)
6.6-MG Storage Tank Construction Cost =	$30,900,000
Influent Gravity Sewer Construction Cost, Pipe Installed by Microtunneling (1,500 LF of 60-inch-diameter pipe) =	$4,120,000
Influent Gravity Sewer Construction Cost, Pipe Installed by Open Cut Construction (2,175 LF of 60-inch-diameter pipe) =	$4,400,000
Force Main Construction Cost (1,840 LF of 30-inch-diameter pipe) =	$1,220,000
Modifications to Montlake Regulator Construction Cost =	$490,000
SDOT Street Use Permit Fee Cost =	$400,000
Total Construction Cost =	$41,530,000
Sales Tax (10% of Construction Cost) =	$4,150,000
[1]Allied Costs (46.07% of Construction Cost) =	$19,130,000
Property Cost =	$14,260,000
Subtotal of Project Cost =	$79,070,000
[1]Construction Contingency (10% of Construction Cost) =	$4,150,000
[1, 2]Project Contingency =	$19,570,000
Total Project Cost, 2010 Dollars =	**$102,800,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility
Printed date : 12/10/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Storage Capacity: 6.6 Mgal
Facility Footprint: 81125 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	9,010.00	SY	$43	$388,000
Dewatering	1	LS	$1,520,000	$1,520,000
Odor Control	1	LS	$1,070,000	$1,070,000
Effluent Pump Station	1	LS	$349,000	$349,000
Construction Cost	6.6	Mgal	4,000,000	$26,400,000
			Year 2008 Subtotal	$29,700,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$30,900,000

INFLUENT GRAVITY SEWER, INSTALLED BY MICROTUNNELING - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Microtunnel: Microtunnel
Printed date : 12/13/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Inside Diameter: 60 in.
Length: 1500 ft
Dewatering: Significant
Launch Shaft Existing Utilities: Complex
Launch Shaft Excavation Depth: 40 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 20 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Existing Utilities: Complex
Tunnel Easement Length: 0 ft
Easement Type: None
Traffic: Heavy
Casing Required: false
Number of Intermediate Shafts: 1
Land Adjustment Factor: Seattle
Intermediate Shaft Existing Utilities: Complex
Intermediate Shaft Excavation Depth: 30 ft
Intermediate Shaft Surface Restoration: Pavement

Tunnel Geometry

Outer Diameter	6.12	ft
Spoils Volume	1,630	CY

Casing Pipe Diameter	N/A	in

Launch Shaft Geometry

Width	20.00	ft
Length	33.00	ft
Footprint	660.00	SF
Volume	978.00	CY
Easement Footprint	5,810.00	SF

Retrieval Shaft Geometry

Width	24.00	ft
Length	24.00	ft
Footprint	576	SF
Volume	427	CY
Easement Footprint	2,920	SF

Miscellaneous

Spoils Loads	$164	loads

Intermediate Shaft Geometry

Width	20	ft
Length	33	ft
Footprint	660	SF
Volume	978	CY
Easement Footprint	5,810	SF

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Spoils Haul	1,630.00	CY	33	53,900
Launch Shaft Excavation	978	CY	25	24,400
Launch Shaft Shoring	4,240.00	SF	84	356,000
Launch Shaft Existing Utilities	660	SF	13	8,580
Launch Shaft Backfill	978	CY	4	3,910
Launch Shaft Surface Restoration	73.3	SY	74	5,430
Retrieval Shaft Excavation	427	CY	25	10,700

Retrieval Shaft Shoring	1,920.00	SF	47	90,200
Retrieval Shaft Existing Utilities	576	SF	13	7,490
Retrieval Shaft Backfill	427	CY	4	1,710
Retrieval Shaft Surface Restoration	64	SY	74	4,740
Intermediate Shaft Excavation	978.00	CY	25	24,400
Intermediate Shaft Shoring	3,180.00	SF	65.5	208,000
Intermediate Shaft Existing Utilities	660.00	SF	13	8,580
Intermediate Shaft Backfill	978.00	CY	4	3,910
Intermediate Shaft Surface Restoration	73.30	SY	74	5,430
MTBM Fixed Costs	1	LS	661,000.00	661,000
Microtunnel Boring	1,500.00	ft	1,540.00	2,320,000
Tunnel Dewatering	1	LS	82,700.00	82,700
Traffic Control	3.00	shaft	27,600.00	82,800
			Year 2008 Subtotal	$3,960,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,120,000

Year 2010 Total: $4,120,000

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INFLUENT GRAVITY SEWER, INSTALLED BY OPEN CUT CONSTRUCTION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Gravity)
Printed date : 12/10/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 2175 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 60 in.

Geometry

Outer Diameter	6.13	ft
Trench Width	10.5	ft
Excavation Depth	17.1	ft
Complete Surface Rest. Width	12.5	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	14,400.00	CY	$13	$188,000
Backfill	7,590.00	CY	$34	$258,000
Complete Pavement Restoration	3,010.00	SY	$86	$259,000
Overlay Pavement Restoration	7,620.00	SY	$28	$213,000
Trench Safety	74,500.00	SF	$17	$1,270,000
Spoil Load and Haul	14,400.00	CY	$16	$231,000
Pipe Unit Material Cost	2,180.00	lf	$220	$479,000
Pipe Installation	2,180.00	lf	$81	$176,000
Place Pipe Zone Fill	4,470.00	CY	$34	$152,000
Manholes	5	MH	$15,400	$76,900
Existing Utilities	2,180.00	lf	$265	$576,000
Dewatering	2,180.00	lf	$127	$276,000
Traffic Control	2,180.00	lf	$36	$78,300
			Year 2008 Subtotal	$4,230,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,400,000

Year 2010 Total: $4,400,000

FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Force Main
Printed date : 12/10/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 1838 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Standard
Pipe Diameter: 30 in.

Geometry

Outer Diameter	2.67	ft
Trench Width	5.97	ft
Excavation Depth	9.67	ft
Complete Surface Rest. Width	7.97	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	3,930.00	CY	$13	$51,000
Backfill	2,030.00	CY	$34	$69,100
Complete Pavement Restoration	1,630.00	SY	$86	$140,000
Overlay Pavement Restoration	2,870.00	SY	$28	$80,200
Trench Safety	35,500.00	SF	$1	$18,800
Spoil Load and Haul	3,930.00	CY	$16	$62,800
Pipe Unit Material Cost	1,840.00	lf	$159	$292,000
Pipe Installation	1,840.00	lf	$38	$69,800
Place Pipe Zone Fill	1,520.00	CY	$34	$51,500
Existing Utilities	1,840.00	lf	$58	$107,000
Dewatering	1,840.00	lf	$100	$184,000
Traffic Control	1,840.00	lf	$24	$44,100
			Year 2008 Subtotal	$1,170,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$1,220,000

Year 2010 Total: $1,220,000

MODIFICATIONS TO MONTLAKE REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 12/10/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	180,000	180,000
Electrical/Instrumentation	1	LS	195,000	195,000
Architectural/Structural	1	LS	40,000	$40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	$1
Construction Year 2010 Subtotal	$485,000

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PROPERTY AND PERMITTING COSTS

Land and Building Cost, Average Cost per Square Foot (January 2007 to August 2010)

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building ($/SF)	Average Cost per Square Foot for Industrial Land ($/SF)
DSN014 Montlake Regulator	$175.83	NA

Land Costs, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Storage Tank	60,000	$175.83	100%	$10,549,800
Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.)	21,125	$175.83	100%	$3,714,409
			Total Land Costs	$14,264,209

SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.

Closure of construction area will occur in phases. Assumed construction phasing in:	1,000	ft segments
Assumed production rate for open cut construction during working days =	15	LF/d
Assumed production rate for microtunneling during working days =	20	LF/d
Assumed number of calendar days for set-up of MTBM and slurry plant =	42	calendar days
Assumed number of calendar days for excavation of the retrieval shaft =	21	calendar days
Assumed number of calendar days for restoration of microtunneling shafts =	14	calendar days
For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula.	22	ft
For pipe diameters greater than 36 inches, assume full width of road will be closed during construction. Width is based on the full width for arterial pavement restoration in Tabula.	44	ft

Source of methodology for estimating permit fees: http://www.seattle.gov/transportation/cams/CAM2115.pdf

SDOT Street Use Permit Fee Estimation, 2010 Dollars

Description	Diameter of Pipe (in)	Length (ft)	Width of Construction Area (ft)	Estimated Construction Area (SF)	Construction Duration (Calendar Days)	Number of 10-Day Periods	Use Fee ($/SF)	Estimated Permit Costs
Regulator Station Upgrade at Montlake Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Open Cut Installation of Influent Gravity Sewer, First Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Open Cut Installation of Influent Gravity Sewer, Second Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Open Cut Installation of Influent Gravity Sewer, Third Phase of Construction	60	175	44	7,700	16.3	2	$0.20	$1,540
Launch Shaft for Microtunneling	NA	NA	NA	5,810	108.5	11	$3.70	$21,497
Intermediate Shaft for Microtunneling	NA	NA	NA	5,810	108.5	11	$3.70	$21,497
Retrieval Shaft for Microtunneling	NA	NA	NA	2,920	35	4	$0.50	$1,460
Installation of Force Main, First Phase of Construction	30	1,000	22	22,000	93.3	10	$2.90	$63,800
Installation of Force Main, Second Phase of Construction	30	838	22	18,436	78.2	8	$1.70	$31,341
							Total SDOT Street Use Fee Estimation:	$402,835

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Operations and Maintenance Cost Estimate Summary

Basin Name: **Montlake (Ind)**

Alternative Name: **SC-MONTLAKE-KC-STOR**

ENR 1994	5747
Current ENR	**8645.4**
Power Cost (per kwh)	**0.065**
Labor rate (loaded) /hr	**51.17**
SPU Water Cost $/CCF	**4.50**
Carbon Cost/Lb	**2.00**

Acres of Raingarden for GSI	**0.00**
Annual Overflow Vol (MG)	**28.80**
Annual Vol Capture	**17.90**
Annual Events	**11**
Stor Vol	**6.60**
Peak Flow Rate	**148.50**

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$5,557			
Force Mains	$66			
Regulator/Flow Control Structures	$38,459			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$0			
Pump Stations	$0	$0	$0	
Rectangular Storage Facilities	$134,624	$47,041	$37,933	$123,529
High Rate Treatment	$0	$0	$0	$0
Additonal Secondary Treatment	NA	$11,757	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$178,706**	**$58,798**	**$37,933**	**$123,529**

Total Annual O&M

General	**$361,033**
Energy	**$37,933**
Total	**$398,966**

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WTD Business Case Evaluation Results
Template: Montlake CSO Control 2010

WTD Borrowing Cost as Discount Rate (1)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
SC-Montlake-KC-STOR	50	$102,800,000	$0	$115,859,695	($115,859,695)	($3,831,438)	0.0

Budget Office Discount Rate (3)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
SC-Montlake-KC-STOR	50	$55,169,333	$0	$83,999,870	($83,999,870)	($6,086,618)	0.0

Notes: All costs are in 2010$.
(1) WTD Discount rate is 2.2%, based on recent WTD borrowing costs net of 3% annual inflation.
(2) Costs include risk and uncertainty, if estimated.
(3) Discount rate is 7% net of inflation, per the King County Budget Office.
The option with the largest net equivalent annualized cost is the financially preferred option.

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Montlake Site Alternative

DSN014-STOR-2 (KC & SPU) or SC-Montlake-Collab-STOR

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DSN014-STOR-2 (KC & SPU) or SC-Montlake-Collab-STOR

Alternative DSN014-STOR-2 (KC & SPU) controls King County's Montlake CSOs and SPU's Leschi, Madison Park, and Montlake CSOs by building a storage tank near the Montlake Regulator Station. This alternative is a collaborative alternative that was developed by King County.

Design Criteria

- King County Storage Volume Requirement: 6.6 MG (Montlake)
- SPU Storage Volume Requirement: 1.27 MG[1] (Leschi, Madison Park, and Montlake)
- King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 148.5 MGD (Montlake)
- SPU CSO Peak Flow Rate for Sizing Conveyance to Storage: 11.5 MGD[1] (Leschi, Madison Park, and Montlake)
- Storage tank is required to drain within 12 hours of event.

Description

Alternative DSN014-STOR-2 (KC & SPU) consists of a joint storage tank to control King County Montlake CSOs and SPU Leschi, Madison Park, and Montlake CSOs. A CSO control volume of approximately 6.6 MG is required to reduce overflows at the Montlake CSO Outfall to an average of one untreated discharge per year. A total maximum storage volume of 7.87 MG[1] is required to control all four CSO outfalls. Storage of this volume could be provided with an offline storage tank located within or adjacent to the approximate boundary shown in Figure G.1.4-2. See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundary. This alternative does not include the conveyance components and costs associated with SPU conveying flows to the Montlake Regulator Station.

The main components of this alternative would include:

- 7.87-MG offline storage tank with pumps to empty the storage tank.
- Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
- Modifications to Montlake Regulator Station.
- Up to approximately 1,430 ft of 30-inch-diameter force main, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.4-2.
- Up to approximately 2,860 ft of 60-inch-diameter influent gravity sewer, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.1.4-2.

[1] SPU may be sending less flow to this collaborative storage tank, so the storage volume and CSO peak flow rate contributed by SPU may decrease. SPU may not convey flows from the Leschi CSO Basin to the storage tank.

Storage Tank

The CSO control volumes for King County and SPU could be stored in a buried, rectangular structure, approximately 530 feet long and 120 feet wide with a sidewater depth of approximately 20 feet.

Flows would enter the storage tank during a wet-weather event. The tank may be configured with multiple chambers, so that only those chambers required to store the volume of the wet-weather event would be used. Storage of flows would start in the first chamber and as that chamber fills and reaches capacity, flows would be transferred into subsequent chambers until either the wet-weather event ends or the capacity of the storage tank is reached. Each chamber would contain equipment for flushing and self-cleaning, and only chambers used in a wet-weather event would require flushing. Control of odors and sediment in the storage chambers may require regularly-scheduled cleaning between events.

Facilities Building(s)

Facilities building(s) would be located above or below ground level and would contain an odor control system, electrical controls, and a standby generator. The actual contents of the building(s) will be determined during preferred alternative development. The representative footprint shown in Figure G.1.4-2 for this alternative locates the facilities buildings adjacent to the storage tank for conservative purposes; however, the facilities buildings could be located above the storage tank to minimize space requirements.

Flow Diversion and Discharge

One regulator station will be required to divert King County and SPU flows from the Montlake Regulator Station to the storage tank. For this planning phase, it is assumed that the diversion would occur at the Montlake Regulator Station. Evaluation of whether flows can be diverted upstream of the Montlake Regulator Station will be completed during preferred alternative development. Diverted King County and SPU flow would discharge to the location of the storage tank via a 60-inch-diameter influent gravity sewer. The length of the influent gravity sewer will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development. The influent gravity sewer can be up to 2,860 feet long based on the criteria and assumptions listed in Section 6.1.

After a wet-weather event, the chambers inside the storage tank would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County SW Lake Washington Interceptor through a 30-inch-diameter force main that is up to approximately 1,430 feet in length. The length of the force main will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development.

Construction Assumptions

King County's Tabula cost estimating program was used to develop a Class 5 estimate for this alternative. The attached documentation lists the construction assumptions used.

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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File Name:

Data Source:

Figure G.1.4-2

Montlake - DSN014-STOR-2 (KC & SPU)
Potential Site Boundary and Representative Footprints
TM 970, CSO Control Alternatives Development

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Alternative DSN014-STOR-2 (KC & SPU)

Percentage of Cost Attributed to King County and SPU, Based on Volume[3]

Agency	Volume (MG)	Percentage of Costs (%)
King County	6.6	83.9%
SPU	1.27	16.1%

Escalation Assumptions

Description	ENR CCI
ENR CCI (Seattle), January 2010	8645.35

Total Project Cost, 2010 Dollars

Description	Total Costs (King County & SPU)	Costs Attributed to King County (Montlake)[3]	Costs Attributed to SPU[3, 4]
7.87-MG Storage Tank Construction Cost =	$36,600,000	$30,690,000	$5,910,000
Influent Gravity Sewer Construction Cost, Pipe Installed by Microtunneling (1,500 LF of 60-inch-diameter pipe) =	$4,120,000	$3,460,000	$660,000
Influent Gravity Sewer Construction Cost, Pipe Installed by Open Cut Construction (1,360 LF of 60-inch-diameter pipe) =	$2,750,000	$2,310,000	$440,000
Force Main Construction Cost (1,430 LF of 30-inch-diameter pipe) =	$950,000	$800,000	$150,000
Modifications to Montlake Regulator Construction Cost =	$490,000	$410,000	$80,000
SDOT Street Use Permit Fee Cost =	$260,000	$220,000	$40,000
Total Construction Cost =	$45,170,000	$37,880,000	$7,290,000
Sales Tax (10% of Construction Cost) =	$4,520,000	$3,790,000	$730,000
[1]Allied Costs (46.07% of Construction Cost) =	$20,810,000	$17,450,000	$3,360,000
Property Cost =	$16,960,000	$14,220,000	$2,740,000
Subtotal of Project Cost =	$87,460,000	$73,350,000	$14,110,000
[1]Construction Contingency (10% of Construction Cost) =	$4,520,000	$3,790,000	$730,000
[1, 2]Project Contingency =	$21,720,000	$18,210,000	$3,510,000
Total Project Cost, 2010 Dollars =	**$113,700,000**	**$95,400,000**	**$18,300,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

[3]Allocation of costs is pending confirmation from management.

[4]Costs attributed to SPU do not include conveyance costs from the SPU system to the Montlake Regulator Station.

STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility
Printed date : 12/10/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Storage Capacity: 7.87 Mgal
Facility Footprint: 96440 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	10,700.00	SY	$43	$461,000
Dewatering	1	LS	$1,660,000	$1,660,000
Odor Control	1	LS	$1,270,000	$1,270,000
Effluent Pump Station	1	LS	$376,000	$376,000
Construction Cost	7.9	Mgal	4,000,000	$31,500,000
			Year 2008 Subtotal	$35,300,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$36,600,000

INFLUENT GRAVITY SEWER, INSTALLED BY MICROTUNNELING - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Microtunnel: Microtunnel
Printed date : 12/13/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Inside Diameter: 60 in.
Length: 1500 ft
Dewatering: Significant
Launch Shaft Existing Utilities: Complex
Launch Shaft Excavation Depth: 40 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 20 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Existing Utilities: Complex
Tunnel Easement Length: 0 ft
Easement Type: None
Traffic: Heavy
Casing Required: false
Number of Intermediate Shafts: 1
Land Adjustment Factor: Seattle
Intermediate Shaft Existing Utilities: Complex
Intermediate Shaft Excavation Depth: 30 ft
Intermediate Shaft Surface Restoration: Pavement

Tunnel Geometry

Outer Diameter		6.12	ft
Spoils Volume		1,630	CY
Casing Pipe Diameter	N/A		in

Launch Shaft Geometry

Width	20.00	ft
Length	33.00	ft
Footprint	660.00	SF
Volume	978.00	CY
Easement Footprint	5,810.00	SF

Retrieval Shaft Geometry

Width	24.00	ft
Length	24.00	ft
Footprint	576	SF
Volume	427	CY
Easement Footprint	2,920	SF

Miscellaneous

Spoils Loads	$164	loads

Intermediate Shaft Geometry

Width	20	ft
Length	33	ft
Footprint	660	SF
Volume	978	CY
Easement Footprint	5,810	SF

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Spoils Haul	1,630.00	CY	33	53,900
Launch Shaft Excavation	978	CY	25	24,400
Launch Shaft Shoring	4,240.00	SF	84	356,000
Launch Shaft Existing Utilities	660	SF	13	8,580
Launch Shaft Backfill	978	CY	4	3,910
Launch Shaft Surface Restoration	73.3	SY	74	5,430
Retrieval Shaft Excavation	427	CY	25	10,700
Retrieval Shaft Shoring	1,920.00	SF	47	90,200
Retrieval Shaft Existing Utilities	576	SF	13	7,490
Retrieval Shaft Backfill	427	CY	4	1,710
Retrieval Shaft Surface Restoration	64	SY	74	4,740

Intermediate Shaft Excavation	978.00	CY	25	24,400
Intermediate Shaft Shoring	3,180.00	SF	65.5	208,000
Intermediate Shaft Existing Utilities	660.00	SF	13	8,580
Intermediate Shaft Backfill	978.00	CY	4	3,910
Intermediate Shaft Surface Restoration	73.30	SY	74	5,430
MTBM Fixed Costs	1	LS	661,000.00	661,000
Microtunnel Boring	1,500.00	ft	1,540.00	2,320,000
Tunnel Dewatering	1	LS	82,700.00	82,700
Traffic Control	3.00	shaft	27,600.00	82,800
			Year 2008 Subtotal	$3,960,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$4,120,000			

Year 2010 Total: $4,120,000

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INFLUENT GRAVITY SEWER, INSTALLED BY OPEN CUT CONSTRUCTION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Gravity)
Printed date : 12/10/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 1360 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 60 in.

Geometry

Outer Diameter	6.13	ft
Trench Width	10.5	ft
Excavation Depth	17.1	ft
Complete Surface Rest. Width	12.5	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	9,020.00	CY	$13	$117,000
Backfill	4,740.00	CY	$34	$161,000
Complete Pavement Restoration	1,880.00	SY	$86	$162,000
Overlay Pavement Restoration	4,770.00	SY	$28	$133,000
Trench Safety	46,600.00	SF	$17	$792,000
Spoil Load and Haul	9,020.00	CY	$16	$144,000
Pipe Unit Material Cost	1,360.00	lf	$220	$299,000
Pipe Installation	1,360.00	lf	$81	$110,000
Place Pipe Zone Fill	2,800.00	CY	$34	$95,100
Manholes	3	MH	$15,400	$46,100
Existing Utilities	1,360.00	lf	$265	$360,000
Dewatering	1,360.00	lf	$127	$173,000
Traffic Control	1,360.00	lf	$36	$49,000
			Year 2008 Subtotal	$2,640,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$2,750,000

Year 2010 Total: $2,750,000

FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Force Main
Printed date : 12/10/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 1430 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Standard
Pipe Diameter: 30 in.

Geometry

Outer Diameter	2.67	ft
Trench Width	5.97	ft
Excavation Depth	9.67	ft
Complete Surface Rest. Width	7.97	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	3,050.00	CY	$13	$39,700
Backfill	1,580.00	CY	$34	$53,700
Complete Pavement Restoration	1,270.00	SY	$86	$109,000
Overlay Pavement Restoration	2,230.00	SY	$28	$62,400
Trench Safety	27,600.00	SF	$1	$14,700
Spoil Load and Haul	3,050.00	CY	$16	$48,900
Pipe Unit Material Cost	1,430.00	lf	$159	$227,000
Pipe Installation	1,430.00	lf	$38	$54,300
Place Pipe Zone Fill	1,180.00	CY	$34	$40,100
Existing Utilities	1,430.00	lf	$58	$82,900
Dewatering	1,430.00	lf	$100	$143,000
Traffic Control	1,430.00	lf	$24	$34,300
			Year 2008 Subtotal	$910,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$946,000

Year 2010 Total: $946,000

MODIFICATIONS TO MONTLAKE REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 12/10/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	195,000
Architectural/Structural	$1	LS	40,000	$40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	$1
Construction Year 2010 Subtotal	$485,000

Year 2010 Total: $485,000

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PROPERTY AND PERMITTING COSTS

Land and Building Cost, Average Cost per Square Foot (January 2007 to August 2010)

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building ($/SF)	Average Cost per Square Foot for Industrial Land ($/SF)
DSN014 Montlake Regulator	$175.83	NA

Land Costs, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Storage Tank	70,200	$175.83	100%	$12,343,266
Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.)	26,240	$175.83	100%	$4,613,779
			Total Land Costs	$16,957,045

SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.

Closure of construction area will occur in phases. Assumed construction phasing in:	1,000	ft segments
Assumed production rate for open cut construction during working days =	15	LF/d
Assumed production rate for microtunneling during working days =	20	LF/d
Assumed number of calendar days for set-up of MTBM and slurry plant =	42	calendar days
Assumed number of calendar days for excavation of the retrieval shaft =	21	calendar days
Assumed number of calendar days for restoration of microtunneling shafts =	14	calendar days
For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula.	22	ft
For pipe diameters greater than 36 inches, assume full width of road will be closed during construction. Width is based on the full width for arterial pavement restoration in Tabula.	44	ft

Source of methodology for estimating permit fees: http://www.seattle.gov/transportation/cams/CAM2115.pdf

SDOT Street Use Permit Fee Estimation, 2010 Dollars

Description	Diameter of Pipe (in)	Length (ft)	Width of Construction Area (ft)	Estimated Construction Area (SF)	Construction Duration (Calendar Days)	Number of 10-Day Periods	Use Fee ($/SF)	Estimated Permit Costs
Regulator Station Upgrade at Montlake Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Open Cut Installation of Influent Gravity Sewer, First Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Open Cut Installation of Influent Gravity Sewer, Second Phase of Construction	60	360	44	15,840	33.6	4	$0.50	$7,920
Launch Shaft for Microtunneling	NA	NA	NA	5,810	108.5	11	$3.70	$21,497
Intermediate Shaft for Microtunneling	NA	NA	NA	5,810	108.5	11	$3.70	$21,497
Retrieval Shaft for Microtunneling	NA	NA	NA	2,920	35	4	$0.50	$1,460
Installation of Force Main, First Phase of Construction	30	1,000	22	22,000	93.3	10	$2.90	$63,800
Installation of Force Main, Second Phase of Construction	30	430	22	9,460	40.1	5	$0.70	$6,622
							Total SDOT Street Use Fee Estimation:	$256,896

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All Shared Costs

Operations and Maintenance Cost Estimate Summary

Basin Name: **Montlake (Collab)**

Alternative Name: **SC-Montlake-Collab-STOR**

ENR 1994	5747
Current ENR	**8645.4**
Power Cost (per kwh)	**0.065**
Labor rate (loaded) /hr	**51.17**
SPU Water Cost $/CCF	**4.50**
Carbon Cost/Lb	**2.00**

Acres of Raingarden for GSI	**0.00**
Annual Overflow Vol (MG)	**28.80**
Annual Vol Capture	**18.40**
Annual Events	**11**
Stor Vol	**7.87**
Peak Flow Rate	**160.00**

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$4,319			
Force Mains	$51			
Regulator/Flow Control Structures	$38,459			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$0			
Pump Stations	$0	$0	$0	
Rectangular Storage Facilities	$159,505	$56,093	$45,232	$147,299
High Rate Treatment	$0	$0	$0	$0
Additonal Secondary Treatment	NA	$12,085	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$202,334**	**$68,178**	**$45,232**	**$147,299**

Total Annual O&M

General	**$417,812**
Energy	**$45,232**
Total	**$463,044**

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WTD Business Case Evaluation Results
Template: Montlake CSO Control 2010

WTD Borrowing Cost as Discount Rate (1)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
SC-Montlake-Collab-STOR	50	$95,350,000	$0	$105,510,205	($105,510,205)	($3,489,184)	0.0

Budget Office Discount Rate (3)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
SC-Montlake-Collab-STOR	50	$51,171,167	$0	$78,137,346	($78,137,346)	($5,661,820)	0.0

Notes: All costs are in 2010$.
(1) WTD Discount rate is 2.2%, based on recent WTD borrowing costs net of 3% annual inflation.
(2) Costs include risk and uncertainty, if estimated.
(3) Discount rate is 7% net of inflation, per the King County Budget Office.
The option with the largest net equivalent annualized cost is the financially preferred option.

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Appendix G.1.5

Consolidated Alternatives – 11th Ave NW, 3rd Ave W, University, and Montlake

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Consolidated Alternatives – 11th Ave NW, 3rd Ave W, University, and Montlake

DSN004/008/014/015-STOR-1 (KC & SPU) or SC-Cons Tunnel-Collab-STOR

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DSN004/008/014/015-STOR-1 (KC & SPU) or SC-Cons Tunnel Collab-STOR

Alternative DSN004/008/014/015-STOR-1 (KC & SPU) controls King County's 11th Ave NW, 3rd Ave W, University, and Montlake CSOs and SPU's CSO Basins 138 (Portage Bay/Lake Union), 140 and 20 (Montlake), 18 (North Union Bay), 24 and 25 (Union Bay/Madison Park), and 147 and 174 (Fremont/Wallingford) by building a storage and conveyance tunnel from the University Regulator Station to the 3rd Ave W Regulator Station beneath Lake Union. This alternative is a collaborative alternative that was developed by SPU.

SPU evaluated two tunnel alternatives (two tunnel alignments), and King County selected one of the alternatives to include in their evaluations. SPU refers to the selected alternative as Alternative N-3a.

SPU provided the following documentation for this alternative, which are included in this appendix:

- Description
- Figures
- Tabula Model Inputs
- Tabula Output Files.

The Tabula output files from SPU were used to develop construction and property acquisition costs using the King County cost estimating methodology. These cost estimates are presented after the documentation provided by SPU.

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Consolidated Alternatives – 11th Ave NW, 3rd Ave W, University, and Montlake

DSN004/008/014/015-STOR-1 (KC & SPU) or SC-Cons Tunnel-Collab-STOR

Documentation Provided by SPU:

- Description
- Figures
- Tabula Model Inputs
- Tabula Output Files

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Final Alternatives - N-3a: Joint SPU/King County Storage and Conveyance Tunnel from University Regulator to 3rd Avenue West Regulator; Storage and Conveyance Tunnel beneath Lake Union

Design Criteria

SPU Storage Volume requirements:

- Portage Bay/Lake Union (NPDES138 Basin) 0.074 MG
- Montlake (NPDES140, NPDES020 Basins) 0.100 MG
- North Union Bay (NPDES018 Basin) 2.292 MG
- Union Bay/Madison Park (NPDES024,NPDES025 Basins) 0.543 MG
- Fremont/Wallingford (NPDES147, NPDES174 Basins) 2.861 MG

King County Storage Volume requirements:

- Montlake Regulator 6.6 MG
- University Regulator 2.94 MG
- 3rd Avenue West Regulator 4.18 MG
- 11th Avenue Northwest Regulator 1.85 MG

Description

Alternative N-3a consists of a joint combined sewer overflow (CSO) storage and conveyance tunnel beneath the north side of Lake Union to capture excess flow from both SPU and King County's north end overflow points. The SPU basins and King County facilities included in this alternative are listed above. The alternative is shown on the attached figures. The total required storage volume is 21.4 MG. SPU control volumes are based on the current model; King County provided King County control volumes in October 2010.

The storage and conveyance facility would consist of a new 2.7-mile-long tunnel with a minimum 16-foot inside diameter from the north side of the Montlake Cut to the south side of the Lake Washington Ship Canal at 6th Avenue West. The University of Washington owns the parcel for the East Tunnel Portal. The West Tunnel Portal would be located on commercial property at West Ewing Street and 6th Avenue West. Both Tunnel Portal locations would require property acquisition. The Tunnel alignment generally follows the alignment recommended in King County's 1995 Regional Wastewater Services Plan (RWSP) and attempts to stay beneath right-of-way where possible to avoid property acquisition and easement costs. The depth of the Tunnel ranges from approximately 135 feet to 155 feet and is controlled by the depth of Lake Union and the existing Fremont and Montlake Siphons. The controlling feature is the depth of the Fremont Siphon. The new Tunnel was aligned to provide a minimum of 40 feet of clearance between the top of the new Tunnel and the bottom of the Fremont Siphon.

The main components of this alternative include:

- 21.4 MG below-grade storage Tunnel, 16-foot inside diameter, 2.7 miles long with a Tunnel portal at each end
- Two drop shafts for connections to the Tunnel between the Tunnel portals

- Aboveground facilities housing electrical equipment and odor control at each portal and drop shaft
- A 42.8 MGD effluent pump station at the West Tunnel Portal to drain the Tunnel
- Approximately 150 feet of 30-inch-diameter force main from the effluent pump station

Montlake Basins (NPDES020 and NPDES140):
- Two wet weather pump stations to pump influent to the Tunnel from NPDES020 and NPDES140
- Approximately 1,250 linear feet of 6-inch-diameter force main from NPDES140 Basin
- Approximately 1,000 linear feet of 8-inch-diameter force main from NPDES020 Basin

Montlake Regulator:
- One diversion/drop structure to capture overflows from the Montlake Siphon
- Approximately 825 linear feet of 42-inch-diameter microtunnel underneath the Montlake Cut

Madison Park Basins (NPDES024 and NPDES025):
- A new wet weather pump station to convey an additional 3.5 MGD of flow to King County's Southwest Lake Washington Trunk
- Approximately 1,050 feet of 20-inch- diameter force main

Portage Bay/Lake Union Basin (NPDES138):
- Approximately 550 feet of 18-inch-diameter gravity microtunnel influent pipe
- One diversion structure to capture overflow from NPDES138 Basin
- One drop structure connection to the Tunnel

North Union Bay Basin (NPDES018):
- Approximately 1,650 feet of 36-inch-diameter gravity influent pipe from NPDES018B Basin to NPDES018A Basin diversion structure
- Approximately 4,000 feet of 36-inch-diameter gravity influent pipe from NPDES018A Basin to the connection with the University Regulator diversion structure
- Approximately 3,600 feet of 72-inch-diameter microtunnel
- Two diversion structures to capture overflow from NPDES018A and NPDES018B Basins
- One drop structure connection to the Tunnel

University Regulator Diversion Connection:
- One diversion structure to capture overflows from the North Interceptor for diversion to the NPDES018 Basin influent pipeline
- Approximately 250 linear feet of 60-inch-diameter microtunnel

Fremont/Wallingford; 3rd Avenue West Regulator (NPDES147 and NPDES174):
- One diversion/drop structure to divert flow from the North Interceptor into the Tunnel

11th Avenue Northwest Regulator:
- One diversion structure to capture overflows from the 11th Avenue Northwest Regulator
- Approximately 4,400 linear feet of 42-inch-diameter gravity microtunnel influent pipe

- One drop structure to connect to Fremont Siphon

Tunnel

Based on the current model and the control volumes provided by King County, a CSO storage volume of 21.4 MG would be required to reduce overflows at each of the basins and facilities listed above to an average of one overflow per year. Based on the 2.7-mile-long alignment, the Tunnel would need a 16-foot inside diameter. As mentioned above, the Tunnel elevation is controlled by maintaining approximately 40 feet of clearance between the top of the Tunnel and the bottom of the existing Fremont Siphon.

Because the Tunnel would be used only to store and convey flow during storm events, the Tunnel would be designed to be drained and flushed following the storm event. The Tunnel would be sloped to drain to the effluent pump station at the West Portal. The pump station would be sized to drain the volume back into the North Interceptor in 2 days (pump station size = 42.9 MGD). The Tunnel would contain equipment for flushing and self-cleaning after the Tunnel contents are pumped out and would need to be maintained on a scheduled basis for manual cleaning to control odors and sediment buildup.

One particular area of concern for the Tunnel is availability of land to site the East Portal. The area south of Husky Stadium near the proposed site will soon include a new Sound Transit tunnel and transit facility, a new off-ramp from the new State Route 520 bridge, and a second Montlake bridge. The amount and location of available land in this area would have to be verified during preferred alternative development.

Facilities Building

A facilities building containing an odor control system would be located aboveground at each of the Tunnel portals and drop shafts. The facilities building at the West Portal would also include electrical controls and a standby power generator for the effluent pump station. The actual contents of each building would be determined during preferred alternative development.

Flow Diversion and Discharge

Madison Park Basin: NPDES025

Based upon the current model, it was determined that Pump Station 13 in Madison Park requires an additional 0.5 MGD of pumping capacity. This pumping capacity would be provided by constructing a wet weather pump station and 1,050 feet of new 20-inch-diameter force main to convey all flow to King County's Southwest Lake Washington Trunk. The Southwest Lake Washington Trunk is believed to have sufficient capacity to convey this extra flow. King County would convey the additional flow to the Montlake Regulator, where a new diversion structure would route excess flow to the new Tunnel.

Montlake Basins: NPDES020 and NPDES140

Based upon the current model, it was determined that NPDES020 and NPDES140 Basins require an additional 2.0 and 1.0 MGD of pumping capacity, respectively. The additional pumping capacity for NPDES020 would be provided by constructing a wet weather pump station and 1,000 feet of new 8-inch-diameter force main to convey all flow to the Montlake Regulator. The additional pumping capacity for NPDES140 would be provided by constructing a wet weather

pump station and 1,250 feet of new 6-inch-diameter force main to convey all flow to the Montlake Siphon. A new diversion structure would be constructed at the Montlake Regulator to route excess flow to the new Tunnel.

Montlake Regulator

Based upon data provided by King County, the peak overflow rate from the Montlake Regulator is 93.5 MGD. For design purposes, this overflow rate has been increased to 97.0 MGD to include the additional overflow from Montlake and Madison Park as described above. A new diversion structure would be constructed at the Montlake Regulator to send excess flow to the Tunnel. The diversion structure is anticipated to be a deep shaft from which a 42-inch-diameter microtunneled pipe would travel underneath the Montlake Cut and Montlake Siphon to connect the diversion structure to the East Tunnel Portal.

North Lake Union Basin: NPDES018

Based upon a review of 2 years of flow monitoring data, it was determined that NPDES018 has a peak overflow rate of approximately 17.2 MGD. To convey this flow to the Tunnel, two diversion structures would be constructed, one each at the downstream end of NPDES018A and NPDES018B. A 36-inch-diameter pipe would convey NPDES018B flow to NPDES018A. A 36-inch-diameter pipe would convey flow from both basins to a connection with the University Regulator diversion (described below). A 72-inch-diameter pipe would convey flow from the University Regulator diversion connection and NPDES018 Basin to the drop structure at the East Tunnel Portal. The 72-inch-diameter section of the influent pipe would be microtunneled due to the pipe depth.

University Regulator Diversion

Based upon data provided by King County, the peak overflow rate from the University Regulator is 74.9 MGD. To avoid utility congestion and the new Sound Transit light rail station and tunnel near the intersection of Montlake Boulevard Northeast and Northeast Pacific Street, 74.9 MGD of flow would be diverted from the North Interceptor upstream of the University Regulator. This flow would be diverted to the NPDES018 pipeline and conveyed to the East Tunnel Portal as described above. A new diversion structure would be constructed and a 60-inch-diameter gravity influent pipe would be microtunneled to the connection to the NPDES018 pipeline.

Portage Bay/Lake Union Basin: NPDES138

Based upon the current models, it was determined that NPDES138 Basin has a peak overflow rate of approximately 2.5 MGD. To convey this flow to the Tunnel, a diversion structure would be constructed downstream of the existing pump station. An 18-inch-diameter pipe would convey flow from the diversion structure to a new drop structure connection to the new Tunnel located at approximately East Gwinn Place and Fuhrman Avenue East.

Fremont/Wallingford: NPDES147 and NPDES174

Based upon the current model, it was determined that NPDES147 and NPDES174 have a combined peak overflow rate of approximately 15 MGD. A new diversion structure would be constructed at the intersection of North 34th Street and Woodlawn Avenue North (upstream of NPDES147 and NPDES174) to remove flow from King County's North Interceptor to offset the addition of excess flow from NPDES147 and NPDES174 to the North Interceptor. It is assumed

that diverting and storing sufficient flow at this point would allow the North Interceptor to accept NPDES147 and NPDES174 Basin peak flow. This assumption will need to be confirmed during modeling and the next phase of alternative development. The diversion structure would include a drop structure connection to the new Tunnel. The drop structure would be located near the SPU-owned Oroweat site to allow for contractor staging.

3rd Avenue West Regulator

Based upon data provided by King County, the peak overflow rate from the 3rd Avenue West Regulator is 29.3 MGD. A new diversion structure would be constructed at the intersection of North 34th Street and Woodlawn Avenue North (upstream of the 3rd Avenue West Regulator) to remove flow from King County's North Interceptor to offset the addition of excess flow from the 3rd Avenue West Regulator to the North Interceptor. It is assumed that diverting and storing sufficient flow upstream of the 3rd Avenue West Regulator would allow the North Interceptor to accept the excess peak flow. This assumption will need to be confirmed during modeling and the next phase of alternative development. The diversion structure would require real time control gates and would include a drop structure connection to the new Tunnel.

11th Avenue Northwest Regulator

Based upon data provided by King County, the peak overflow rate from the 11th Avenue Northwest Regulator is 33 MGD. The diversion/drop structure in North 34th Street would remove flow from King County's North Interceptor to offset the addition of excess flow from the 11th Avenue Northwest Regulator to the North Interceptor. It is assumed that diverting and storing sufficient flow upstream of the 11th Avenue Northwest Regulator would allow the North Interceptor to accept the excess peak flow. This assumption will need to be confirmed during modeling and the next phase of alternative development. A new diversion structure would be constructed at the 11th Avenue Northwest Regulator to convey excess flow to the Fremont Siphon via a new 42-inch-diameter microtunneled pipe.

Construction Assumptions

King County's Tabula cost estimating program was used to develop a Class 5 estimate for this storage facility. The attached documentation lists the construction assumptions used.

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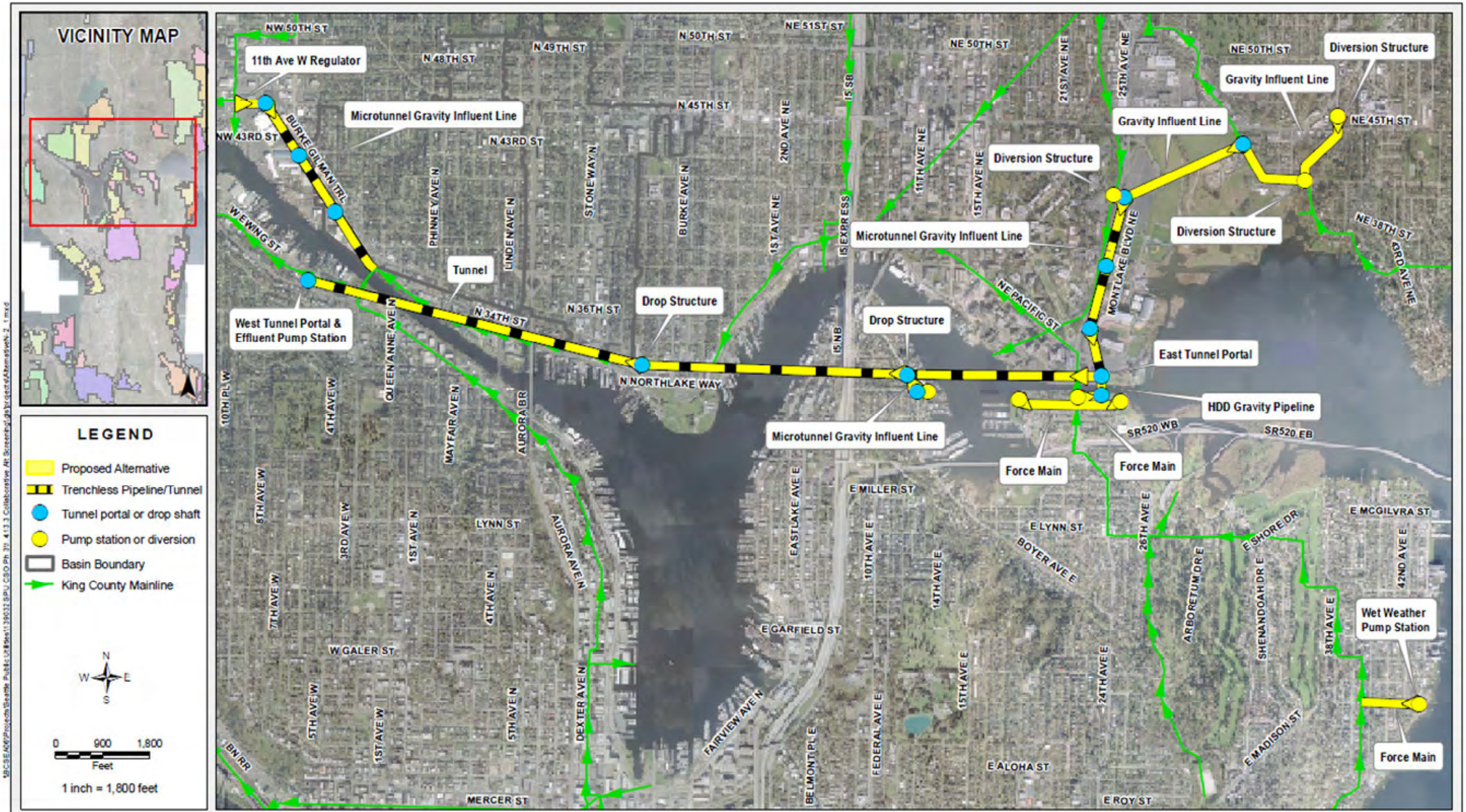
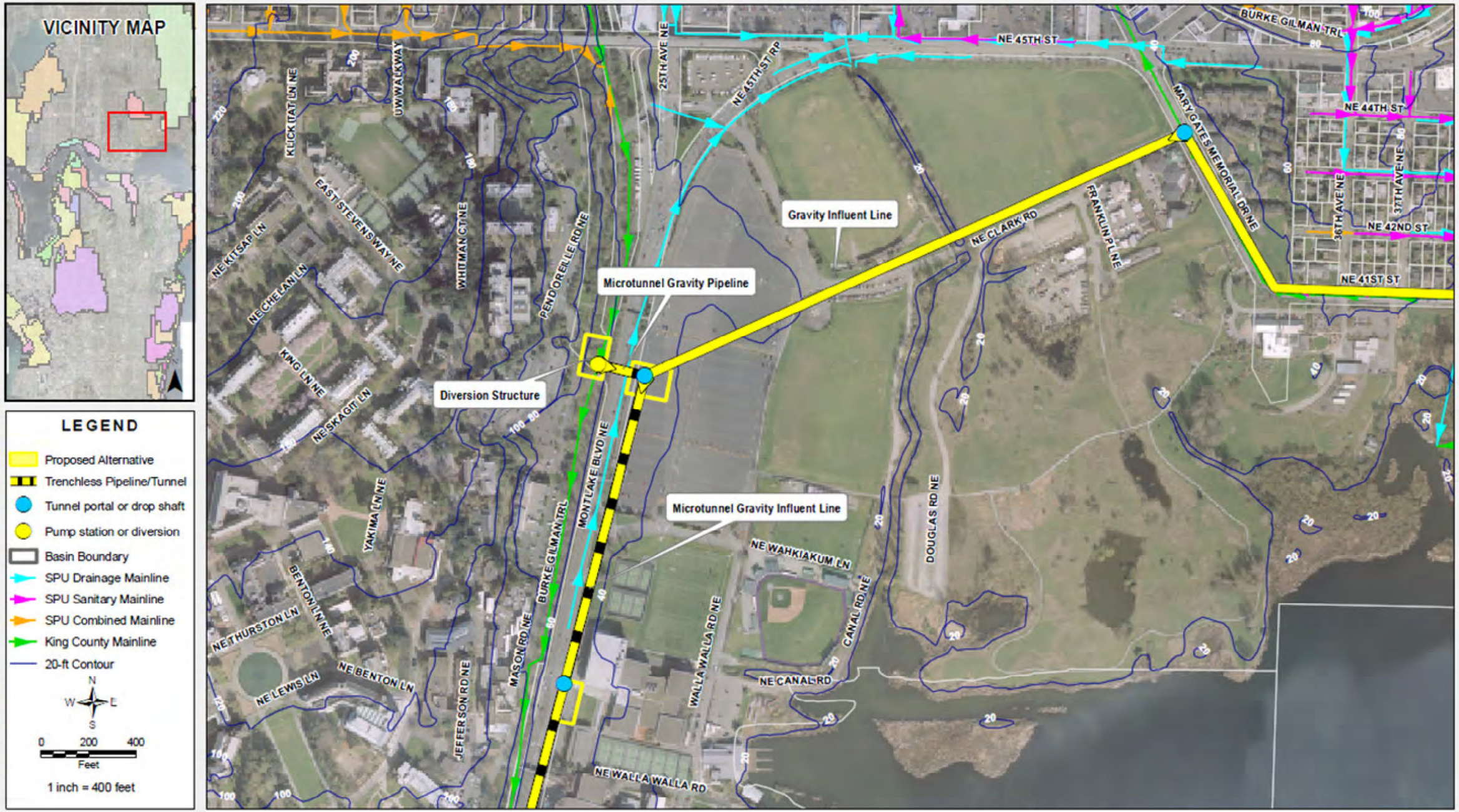


Seattle Public Utilities

Long Term Control Plan Final Alternative Evaluation
King County/SPU Collaborative Options

ALTERNATIVE N-3a
STORAGE & CONVEYANCE TUNNEL BENEATH LAKE UNION

JANUARY 2011 | **FIGURE 1**

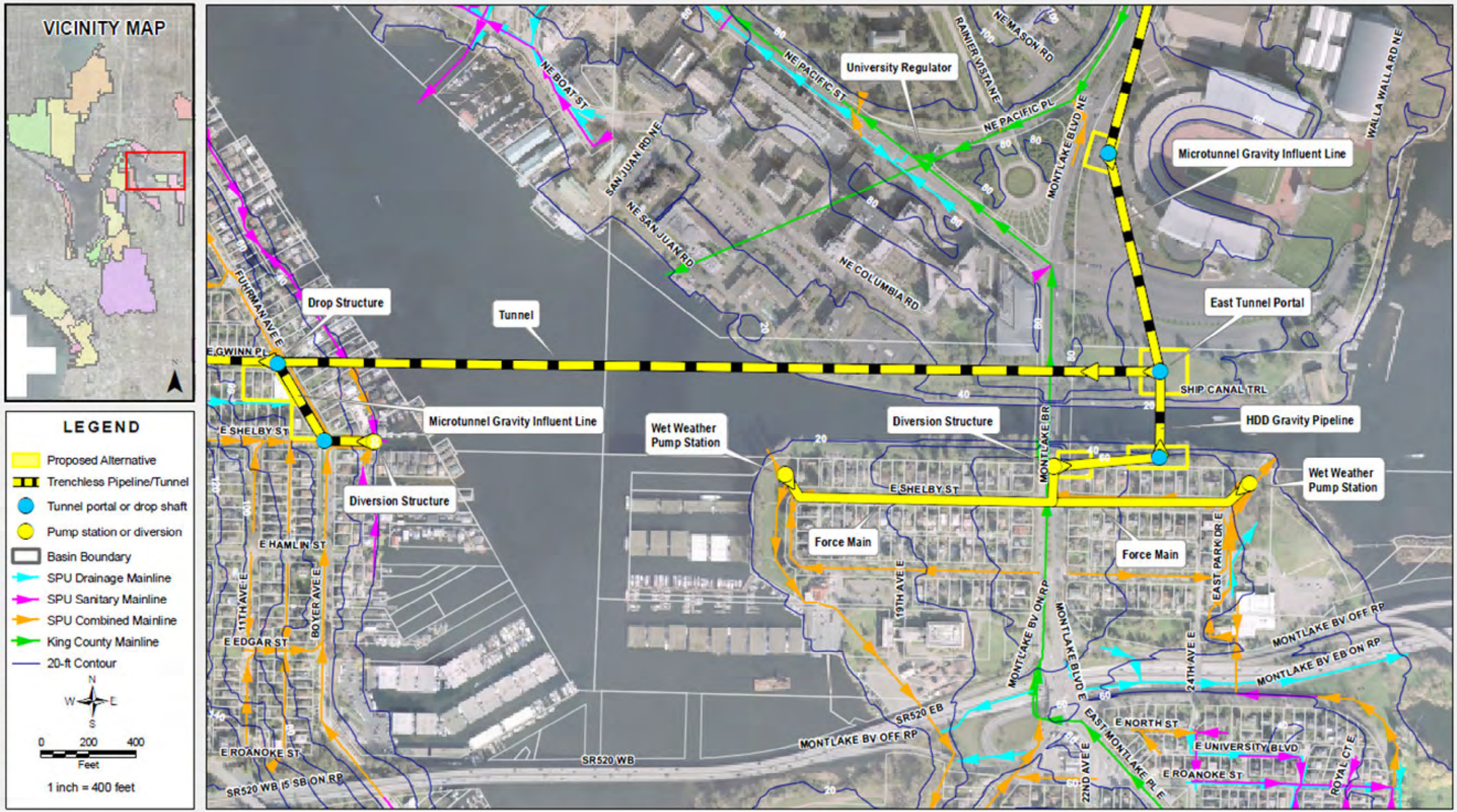


Seattle Public Utilities

Long Term Control Plan Final Alternative Evaluation
King County/SPU Collaborative Options

ALTERNATIVE N-3a
UNIVERSITY REGULATOR DIVERSION

JANUARY 2011 | **FIGURE 2**

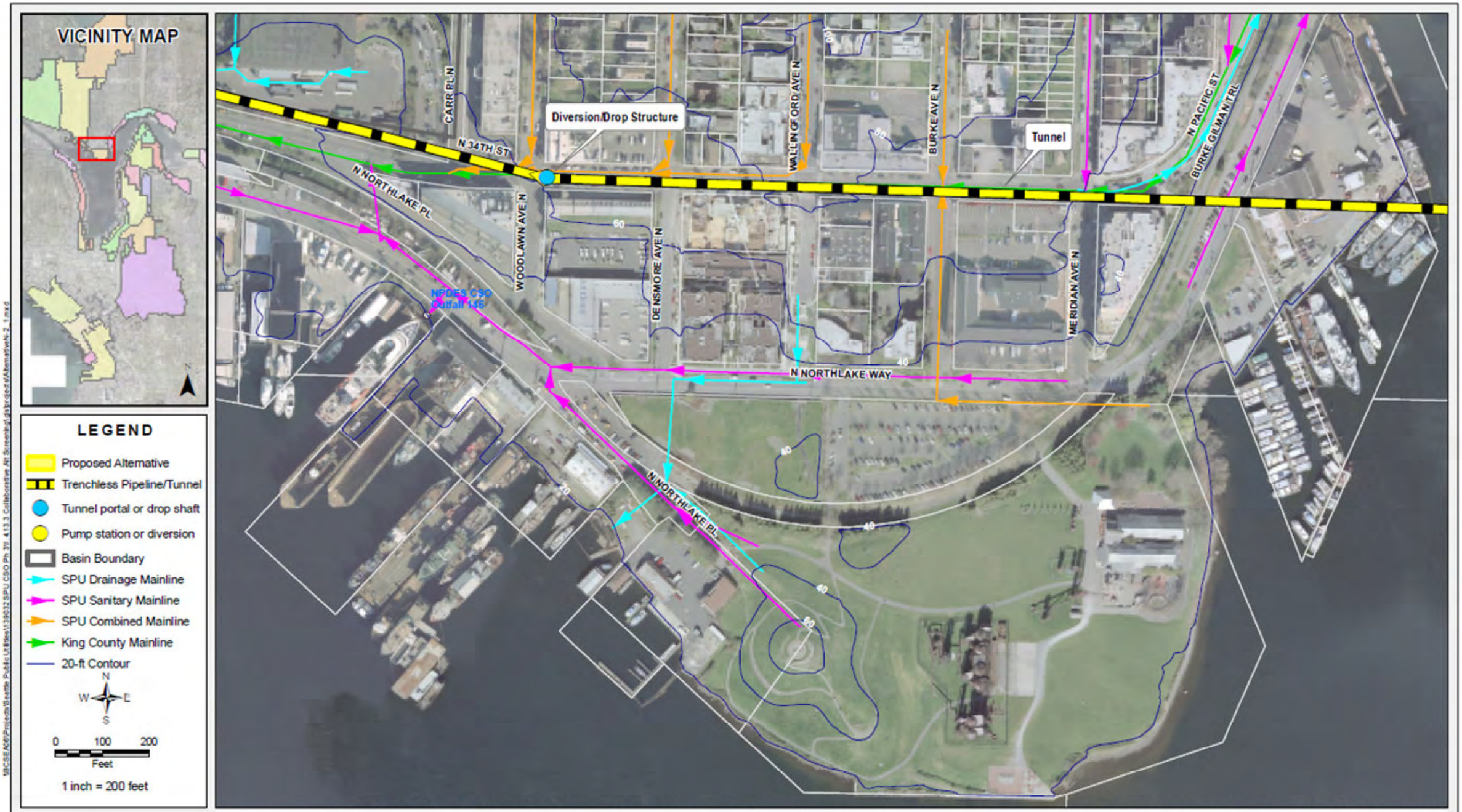


Seattle Public Utilities

Long Term Control Plan Final Alternative Evaluation
King County/SPU Collaborative Options

ALTERNATIVE N-3a
DROP STRUCTURE &
EAST TUNNEL PORTAL

JANUARY 2011 | **FIGURE 3**



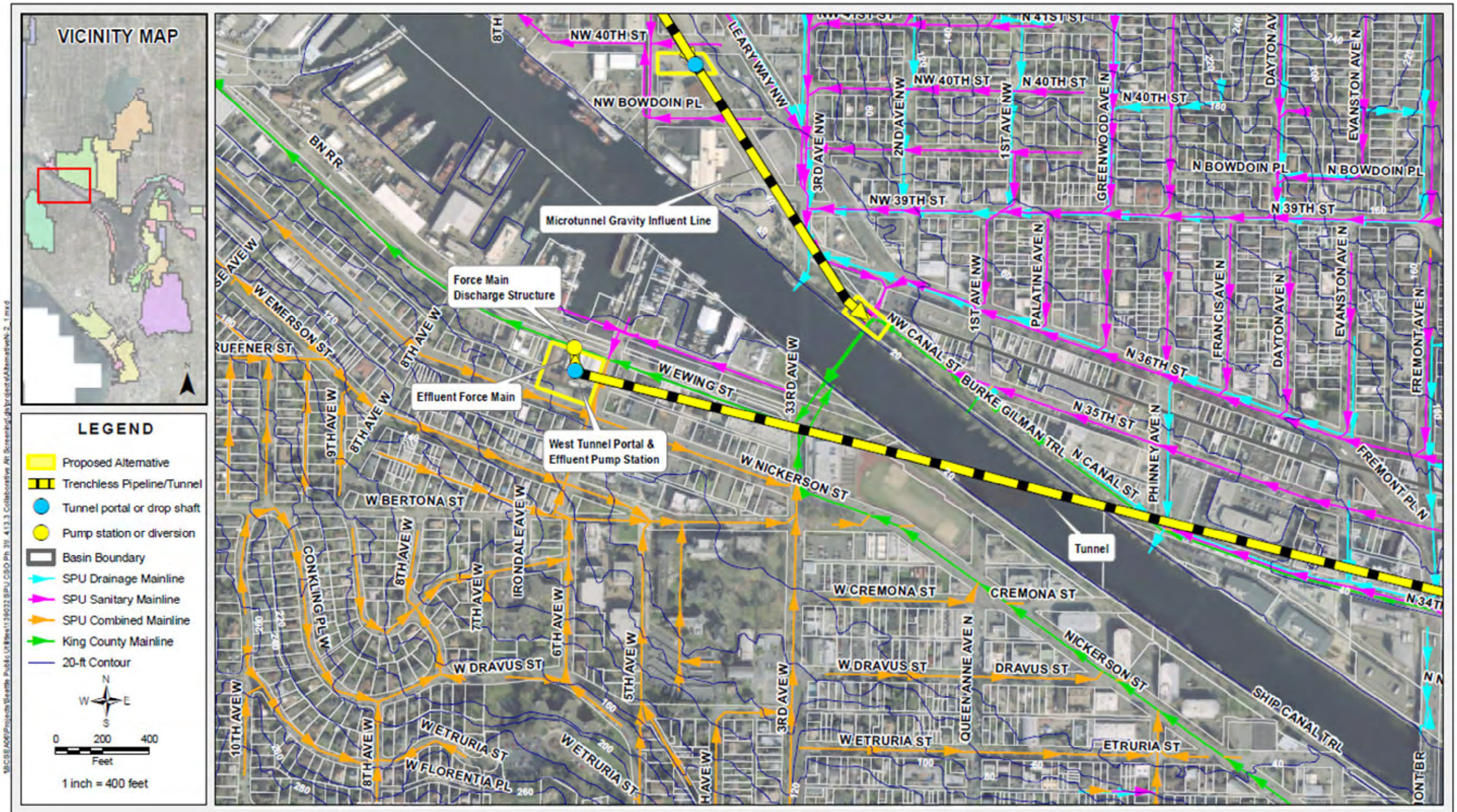
Seattle Public Utilities

Long Term Control Plan Final Alternative Evaluation
King County/SPU Collaborative Options

ALTERNATIVE N-3a
DROP STRUCTURE

JANUARY 2011

FIGURE 4



Seattle Public Utilities

Long Term Control Plan Final Alternative Evaluation
King County/SPU Collaborative Options

ALTERNATIVE N-3a
WEST TUNNEL PORTAL

JANUARY 2011 | **FIGURE 5**

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Tabula Model Inputs

General Project Assumptions

Current ENR CCI	8645	Seattle January 2010 ENR CCI
Escalation	3.0%	Agreed upon input per SPU & King County
Year of Construction	2010	All projects will be cost as if construction was in 2010 for cost comparison purposes

Project Types

Pipeline

Field	Drop Down Entry	Comment	Alternative N-3a						
			Force Main from Effluent Pump Station	Force Main from Montlake Basin 140 to Montlake Reg	Force Main from Montlake Basin 20 to Montlake Reg	Force Main from Madison Park to SW Lk WA Trunk	Gravity Influent from Basin 18B to Basin 18A	Gravity Influent from Basin 18A to microtunnel section	Drop Structure for Fremont/Wallingford & 3rd Ave W Regulator
Conduit Type									
	Gravity	Use for all gravity pipelines	14,300ft				gravity	gravity	
	Force Main	Use for all pressure pipeline	Force Main	Force Main	Force Main	Force Main			
	High Head Force Main	Only use this input if engineer directs special input							
Diameter									
	Gravity pipes vary from 8" to 144"	Use as sized by Engineer; For sizes outside this range use special input and consult with cost estimator.							
	Force Main pipes vary from 8" to 60"	Use as sized by Engineer; For sizes outside this range use special input and consult with cost estimator.	30"	8" (note: minimum tabula input = 8"; Engineering calcs indicate 6" may be acceptable. To be refined in future studies.	8"	20"	36"	36"	
	High Head Force Main pipes vary from 8" to 60"	Use as sized by Engineer; For sizes outside this range use special input and consult with cost estimator.							
Length									
	Input per drawing or engineer direction		150 feet	1,250 ft	1,000 ft	1,050 ft	1,650 ft	4,000 ft	
Backfill									
	Import	Use in all urban areas, under any pavement restoration, or in any area where significant dewatering is expected. When unsure of soil conditions use imported backfill as default.	Imported	Imported	Imported	Imported	Imported	Imported	
	Native	Use only if outside of urban location such as park and only if no significant dewatering is expected.							
Cover Depth									
	Gravity	Use 8' cover depth for all gravity pipeline unless directed by engineer for project specific circumstances.					8 ft	8 ft	
	Force Main	Use 6' cover depth for all gravity pipeline unless directed by engineer for project specific circumstances.	6 ft	6 ft	6 ft	6 ft			
	High Head Force Main	Use 6' cover depth for all gravity pipeline unless directed by engineer for project specific circumstances.							
Manhole Spacing									
Gravity pipe only	None	Not used unless directed by engineer for project specific requirements.	N/A	N/A	N/A	N/A			
	Close (250')	Not used unless directed by engineer for project specific requirements.							
	Average (500')	Default; Use for all projects unless directed by engineer for project specific requirements.					Average	Average	
	Far (1000')	Not used unless directed by engineer for project specific requirements.							

Tabula Model Inputs

General Project Assumptions

Current ENR CCI	8645	Seattle January 2010 ENR CCI
Escalation	3.0%	Agreed upon input per SPU & King County
Year of Construction	2010	All projects will be cost as if construction was in 2010 for cost comparison purposes

Project Types

Pipeline

Field	Drop Down Entry	Comment	Alternative N-3a						
			Force Main from Effluent Pump Station	Force Main from Montlake Basin 140 to Montlake Reg	Force Main from Montlake Basin 20 to Montlake Reg	Force Main from Madison Park to SW Lk WA Trunk	Gravity Influent from Basin 18B to Basin 18A	Gravity Influent from Basin 18A to microtunnel section	Drop Structure for Fremont/Wallingford & 3rd Ave W Regulator
Trench Safety									
	Standard	Default; Use for all projects unless directed by engineer for project specific requirements.							
	Special Shoring	Use if soil condition is know to be poor or if significant dewatering is expected as this may indicate soil may be wet and in poor condition.	Special	Special	Special	Special	Special	Special	
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.	Significant	Significant	Significant	Significant	Significant	Significant	
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.	Complex	Complex	Complex	Complex	Complex	Complex	
Traffic Control									
	None	Not used unless directed by engineer for project specific requirements.							
	Light	Only use if project is well outside of traffic or roadway influences where traffic control is only needed to bring trucks or equipment on and off roadways.							
	Heavy	Default; Due to the general urban environment of the Seattle area use for all projects unless directed by engineer for project specific requirements.	Heavy	Heavy	Heavy	Heavy	Heavy	Heavy	
Required Easement									
	None	When pipe line is located in City roadway or property.	None - in ROW	None - in ROW	None - in ROW	None - in ROW			
	Residential	Use if residential easement is required but doesn't effect any buildings on the property.							
	Industrial	Use if easement is required in industrial area but doesn't effect any buildings on the property.							
	Office Commercial	Use if easement is required on commercial office location but doesn't effect any buildings on the property.					1,300' - conference center land (note: Tabula does not allow an easement length different than pipe length; thus, entire length is used in estimate. Exact easement cost will be refined in future project phases.)	2,500' - UW property (note: Tabula does not allow an easement length different than pipe length; thus, entire length is used in estimate. Exact easement cost will be refined in future project phases.)	

Tabula Model Inputs

General Project Assumptions

Current ENR CCI	8645	Seattle January 2010 ENR CCI
Escalation	3.0%	Agreed upon input per SPU & King County
Year of Construction	2010	All projects will be cost as if construction was in 2010 for cost comparison purposes

Project Types

Pipeline

Field	Drop Down Entry	Comment	Alternative N-3a						
			Force Main from Effluent Pump Station	Force Main from Montlake Basin 140 to Montlake Reg	Force Main from Montlake Basin 20 to Montlake Reg	Force Main from Madison Park to SW Lk WA Trunk	Gravity Influent from Basin 18B to Basin 18A	Gravity Influent from Basin 18A to microtunnel section	Drop Structure for Fremont/Wallingford & 3rd Ave W Regulator
Easement Adjustment									
	Use Seattle		Seattle	Seattle	Seattle	Seattle	Seattle	Seattle	
Land Acquisition									
	None	When pipe line is located in City roadway or property.	None - incl in Tunnel costs	None	None	None	None	None	
	Residential-Urban	Use if pipeline requires the removal of any building on the property.							
	Residential-Sub urban	Not used. Only occurs outside of Seattle							
	Residential-Rural	Not used. Only occurs outside of Seattle							
	Industrial	Use if pipeline requires the removal of any building on the property.							
	Office Commercial	Use if pipeline requires the removal of any building on the property.							
Pavement Restoration									
	None	Use only if outside of urban location such as park. May need to add additional cost for park restoration.							
	Trench Width	Use when pipeline is crossing perpendicular to roadway.							
	Half Width-Arterial (22'), Collector Street (18'), Residential Street (14')	Use 1/2 width for all pipes 36" or less. Use appropriate roadway type with Arterial roadway the default choice if in doubt.	Half width - Arterial	Half width - Arterial	Half width - Arterial	Half width - Arterial			
	Full Width-Arterial (44'), Collector Street (36'), Residential Street (28')	Use full width for all pipes greater than 36". Use appropriate roadway type with Arterial roadway the default choice if in doubt.					Full Width - Arterial	Full Width - Arterial	
Additional Costs									
	Use for items such as park, residential restoration, special manholes, or other cost								
	Drop Structures	per email from Craig Moore (6/7/2010)	$25,000 for 15' drop structure	Incl. in Montlake Regulator Microtunnel costs	Incl. in Montlake Regulator Microtunnel costs	$25,000 for 20' drop structure			$560,000 for 145' discharge structure and 104' vortex
	Diversion Structures	$100,000 per diversion structure					$100k for Basin 18B diversion structure	$100k for Basin 18A diversion structure	$100k for diversion structure from N Interceptor
	Credit for easement cost (calculated by tabula)						-$575,000	-$1,390,000	
	Adjusted property/easement costs (per SPU provided costs (P. Carpenter email 7/21/10))		Property cost is 150 LF of 22 ft wide street at $0.60/sq ft use fee for a total of $1,980	Property cost is 1,250 LF of 22 ft wide street at $0.60/sq ft use fee for a total of $16,500	Property cost is 1000 LF of 22 ft wide street at $0.60/sq ft use fee for a total of $13,200	Property cost is 1,050 LF of 22 ft wide street at $0.60/sq ft use fee for a total of $13,860	Property cost is 880 LF of 44 ft street at $3/sq ft use fee, plus 23,100 sq ft of property at $18.50/sq ft for a total of $543,510	Property cost is 1,800 LF of 44 ft street at $3/sq ft use fee, plus 66,000 sq ft of property at $38.70/sq ft for a total of $2,910,600	

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Tabula Model Inputs

General Project Assumptions

Year of Construction	2010	All projects will be cost as if construction was in 2010 for cost comparison purposes

Project Types

Pump Station

Field	Drop Down Entry	Comment	Alt N-3a			
Capacity			Tunnel Effluent PS	Madison Park (Basin 25) wet weather PS	Montlake (Basin 140) wet weather PS	Montlake (Basin 20) wet weather PS
	Input per engineer direction; Default for storage tank flow is storage tank volume divided by 24 hrs		42.9 MGD	0.5 MGD	1.0 MGD	2 MGD
Excavation Depth						
	Input per drawing or engineer direction		None - use tunnel portal	20ft	10ft	20ft
Total Dynamic Head			14,300ft			
	Input per engineer direction		127ft	65ft	70ft	63ft
Additional Costs						
	Use for cost items directed by engineer for specific project.		Add Standby generator, 1800kW cost per RS Means adjusted for Seattle	Add Standby generator, 10kW cost per RS Means adjusted for Seattle	Add Standby generator, 30kW cost per RS Means adjusted for Seattle	Add Standby generator, 30kW cost per RS Means adjusted for Seattle
	Adjusted property/easement costs (per SPU provided costs (P. Carpenter email 7/21/10))		none	Property cost is 5,000 sq ft at $78/sq ft for a total of $390,000	Property cost is 5,000 sq ft at $78/sq ft for a total of $390,000	Property cost is 5,000 sq ft at $78/sq ft for a total of $390,000

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Tabula Model Inputs

General Project Assumptions

Year of Construction	2010	All projects will be cost as if construction was in 2010 for cost comparison purposes	

Project Types

Microtunneling

Field	Drop Down Entry	Comment	Alt N-3a				
			Gravity Influent Line from Montlake Regulator to East Tunnel Portal	Gravity connection from University Regulator Diversion to 2nd half of Basin 18 gravity influent line	2nd half of gravity Influent Line from Basin 18 to East Tunnel Portal	Gravity Influent Line from 11th Ave Regulator to exist Fremont Siphon	Gravity Influent Line from Portage Bay (Basin 138) to Tunnel Drop Structure
Diameter							
	Microtunnels vary from 12" to 84"	Use as sized by Engineer; For sizes outside this range use special input and consult with cost estimator.	42"	60"	72"	42"	18"
Length							
	Input per drawing or engineer direction		14,300ft	250 ft	3,600 ft	4,400 feet	550 feet
Casing Required							
	Yes	Default choice is yes.	Yes	Yes	Yes	Yes	Yes
	No	Use only if directed by engineer for specific project.					
Launch Shaft/Retrieval Shaft							
Excavation Depth							
	Input per drawing or engineer direction (Launch/Retrieval/Intermediate)		135 ft / 120 ft	35 ft/ 33.5 ft	30 ft /155 ft /50 ft /37 ft	15 ft/35 ft /17 ft / 30 ft /32 ft	15ft/45ft/40ft
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.	Complex	Complex	Complex	Complex	Complex
Surface Restoration							
	None	Not used. Only used if special additional unit cost for surface restoration is used.					
	Hydroseed	Use only if outside of urban location such as park. May need to add additional cost for park restoration.					
	Pavement	This is the default selection.	Pavement	Pavement	Pavement	Pavement	Pavement
Intermediate Shafts							
Number of Shafts							
	Input of # of needed shafts needed. Insert shaft any time direction changes.		None	None	2	3	1
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.	Significant	Significant	Significant	Significant	Significant

Microtunneling

Field	Drop Down Entry	Comment	Alt N-3a				
			Gravity Influent Line from Montlake Regulator to East Tunnel Portal	Gravity connection from University Regulator Diversion to 2nd half of Basin 18 gravity influent line	2nd half of gravity Influent Line from Basin 18 to East Tunnel Portal	Gravity Influent Line from 11th Ave Regulator to exist Fremont Siphon	Gravity Influent Line from Portage Bay (Basin 138) to Tunnel Drop Structure
Required Easement							
	None	When pipe line is located in City roadway or property.	None			None - ROW	None - ROW
	Residential	Use if residential easement is needed.					
	Industrial	Use if easement is required in industrial area.					
	Office Commercial	Use if easement is required on commercial office location.		250 ft - UW Property	3,600 ft - UW Property		
Easement Adjustment							
	Use Seattle						
Traffic Control							
	None	Not used unless directed by engineer for project specific requirements.					
	Light	Only use if project is well outside of traffic or roadway influences where traffic control is only needed to bring trucks or equipment on and off roadways.					
	Heavy	Default; Due to the general urban environment of the Seattle area use for all projects unless directed by engineer for project specific requirements.	Heavy	Heavy	Heavy	Heavy	Heavy
Additional Costs							
	Use for items such as park, residential restoration, special manholes, or other cost items directed by engineer for specific project.						
	Drop Structures	per email from Craig Moore (6/7/2010)	136' drop structure & vortex ($560K) plus 22' vortex ($10,000) at Tunnel Portal	N/A	153' drop structure ($400K) plus 93' vortex ($80,000) for East Tunnel Portal	82' structure ($200K) plus 47' vortex ($20,000) for connection to Fremont Siphon	160' structure ($400K) plus 100' vortex ($80,000) for connection to Tunnel
	Diversion Structures	$100,000 per diversion structure	N/A	$100k for diversion structure at North Interceptor	N/A	$100k for diversion structure at 11th Ave NW Reg	$100k for diversion structure
	Credit for easement cost (calculated by tabula)			-$141,600	-$1,507,100		
	Adjusted property/easement costs (per SPU provided costs (P. Carpenter email 7/21/10))		Property cost is 825 LF of 30 ft wide at $15/sq ft use fee for a total of $371,250; 2 x microtunnel pits (total area = 10,990 sq ft * $38.70/sq ft = $425,313)	Property cost is 250 LF of 30 ft wide at $15/sq ft use fee for a total of $112,500; launch pit/shaft (total area = 5,810 sq ft * $38.70/sq ft = $224,847)	Property cost is 3,600 LF of 26 ft wide at $38.70/sq ft use fee for a total of $3,622,320; launch pit/shaft & 2 microtunnel pits (total area = 17,880 sq ft * $38.70/sq ft = $691,956)	Property cost is 4,400 LF of 18 ft wide street at $0.60/sq ft use fee for a total of $47,520; 3 x microtunnel pits (total area = 11,410 sq ft * $61.60/sq ft = $702,856)	Property cost is 550 LF of 14 ft wide at $2.10/sq ft or $0.60 use fee for a total of $939; launch& retrieval pit/shaft & 1 microtunnel pit (total area = 10,680 sq ft * $45.80/sq ft = $489,144)

Tabula Model Inputs

General Project Assumptions

Year of Construction	2010	All projects will be cost as if construction was in 2010 for cost comparison purposes

Project Types

Tunnel

Field	Drop Down Entry	Comment	Alt N-3a
			Storage / Conveyance Tunnel
Diameter			
	Tunnel diameters vary from 8' to 18'	Use as sized by Engineer; For sizes outside this range use special input and consult with cost estimator.	16ft
Length			
	Input per drawing or engineer direction		14,300ft
Launch Shaft/Retrieval Shaft			
Excavation Depth			
	Input per drawing or engineer direction		155ft / 135ft
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.	Complex
Footprint			
	Standard	Default	Standard
	Oversized	Only used if required for specific project needs.	
Surface Restoration			
	None	Not used. Only used if special additional unit cost for surface restoration is used.	
	Hydroseed	Use only if outside of urban location such as park. May need to add additional cost for park restoration.	
	Pavement	This is the default selection.	Pavement
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.	Significant
Required Easement			
	None	When pipe line is located in City roadway or property.	
	Residential	Use if residential easement is needed.	4,000 ft; (note: approx 1,600 ft is on UW property. Tabula only allows input of one easement type. Most of easement length is residential & resid unit cost is greater so easement calculated as if all easement is residential)
	Industrial	Use if easement is required in industrial area.	
	Office Commercial	Use if easement is required on commercial office location.	
Easement Adjustment			
	Use Seattle		Seattle
Additional Costs			
	Use for items such as park, residential restoration, special manholes, or other cost items directed by engineer for specific project.		W. Tunnel Portal - $3.95M for 50K sq ft property, incl land & buildings; E. Tunnel Portal - $730,000 for 25K sq ft property at $29.20/sq ft
	Adjusted property/easement costs (per SPU provided costs (P. Carpenter email 7/21/10))		
	Credit for easement cost (calculated by tabula)		-$531,000

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Cost Calculations for Project: **N-3a**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Project Year: 2010
Responsible Party:
Comments:

Sub Items

Name	Type	Year	Cost	Multiplier	2010 Cost
Tunnel					
	Tunnel	2010	93,700,000	1.00	93,700,000
11th Ave Reg to Fremont Siphon					
	Microtunnel	2010	10,700,000	1.00	10,700,000
Montlake Reg to E Portal					
	Microtunnel	2010	10,200,000	1.00	10,200,000
Univ Reg Diversion to Basin 18 Line					
	Microtunnel	2010	2,540,000	1.00	2,540,000
2nd segment Basin 18 Influent Pipe					
	Microtunnel	2010	21,500,000	1.00	21,500,000
Portage Bay to Drop Structure					
	Microtunnel	2010	2,970,000	1.00	2,970,000
Tunnel Effluent PS					
	Pump Station	2010	11,500,000	1.00	11,500,000
Madison Park Wet Weather PS					
	Pump Station	2010	657,000	1.00	657,000
Montlake Basin 20 wet weather PS					
	Pump Station	2010	1,170,000	1.00	1,170,000
Montlake Basin 140 wet weather PS					
	Pump Station	2010	867,000	1.00	867,000
Effluent PS force main					
	Pipe	2010	177,000	1.00	177,000
Montlake Basin 140 force main					
	Pipe	2010	810,000	1.00	810,000
Montlake Basin 20 force main					
	Pipe	2010	648,000	1.00	648,000
Madison Park Basin 25 force main					
	Pipe	2010	903,000	1.00	903,000
Basin 18B to Basin 18A					
	Pipe	2010	2,770,000	1.00	2,770,000
Basin 18A to microtunnel section					
	Pipe	2010	8,800,000	1.00	8,800,000

	Pipe	2010	8,800,000	1.00	8,800,000
Fremont/3rd Ave W Drop Structure					
	Pipe	2010	686,000	1.00	686,000
			Year 2008 Subtotal		$171,000,000

Year 2010 Total: $171,000,000

Cost Calculations for Tunnel: **Tunnel**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Inside Diameter: 16 ft.
Length: 14300 ft
Dewatering: Significant
Launch Shaft Existing Utilities: Complex
Launch Shaft Excavation Depth: 155 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 135 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Existing Utilities: Complex
Tunnel Easement Length: 4000 ft
Easement Type: Residential
Land Adjustment Factor: Seattle
Launch Shaft Footprint: Standard
Retrieval Shaft Footprint: Standard

Tunnel Geometry

Outer Diameter	17.5 ft
Spoils Volume	127,000 CY

Launch Shaft Geometry

Width	53 ft
Length	167 ft
Footprint	8,850 SF
Volume	50,800 CY
Easement Footprint	22,400 SF

Retrieval Shaft Geometry

Width	44 ft
Length	62 ft
Footprint	2,730 SF
Volume	13,600 CY
Easement Footprint	10,500 SF

Miscellaneous

Spoils Loads 12,700 loads

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Spoils Haul	127,000.0	CY	12.0	1,530,000
Launch Shaft Excavation	50,800.0	CY	15.0	762,000
Launch Shaft Shoring	68,200.0	SF	297.0	20,200,000
Launch Shaft Existing Utilities	8,850.0	SF	13.0	115,000
Launch Shaft Backfill	50,800.0	CY	18.0	915,000
Launch Shaft Surface Restoration	983.0	SY	74.0	72,800
Launch Shaft Easement	8,850.0	SF	45.8	406,000
Retrieval Shaft Excavation	13,600.0	CY	15.0	205,000
Retrieval Shaft Shoring	28,600.0	SF	260.0	7,430,000
Retrieval Shaft Existing Utilities	2,730.0	SF	13.0	35,500
Retrieval Shaft Backfill	13,600.0	CY	18.0	246,000
Retrieval Shaft Surface Restoration	303.0	SY	74.0	22,400
Retrieval Shaft Easement	2,730.0	SF	45.8	125,000
Tunnel Dewatering	1.0	LS	120,000.0	120,000
Tunnel Easement	150,000.0	SF	13.4	2,010,000
TBM Procurment	1.0	LS	6,070,000.0	6,070,000
Tunnel Boring	14,300.0	ft	3,190.0	45,600,000
Property Acquisition - W. Tunnel Portal	1	LS	3,950,000.0	3,950,000
Property Acquisition - E. Tunnel Portal	25,000	sq ft	29.2	730,000
Credit for Tabula Calc'd Easement Cost	1	LS	-531,000.0	-531,000
			Year 2008 Subtotal	$90,100,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$93,700,000

Year 2010 Total: $93,700,000

Cost Calculations for Microtunnel: **11th Ave Reg to Fremont Siphon**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Inside Diameter: 42 in.
Length: 4400 ft
Dewatering: Significant
Launch Shaft Existing Utilities: Complex
Launch Shaft Excavation Depth: 15 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 35 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Existing Utilities: Complex
Tunnel Easement Length: 0 ft
Easement Type: None
Traffic: Heavy
Casing Required: true
Number of Intermediate Shafts: 3
Land Adjustment Factor: Seattle
Intermediate Shaft Existing Utilities: Complex
Intermediate Shaft Excavation Depth: 27 ft
Intermediate Shaft Surface Restoration: Pavement

Tunnel Geometry

Outer Diameter	5.54 ft
Spoils Volume	3,930 CY
Casing Pipe Diameter	54 in

Launch Shaft Geometry

Width	19 ft
Length	32 ft
Footprint	608 SF
Volume	338 CY
Easement Footprint	3,040 SF

Retrieval Shaft Geometry

Width	23 ft

Length	23 ft
Footprint	529 SF
Volume	686 CY
Easement Footprint	5,330 SF

Miscellaneous

Spoils Loads	393 loads

Intermediate Shaft Geometry

Width	19 ft
Length	32 ft
Footprint	608 SF
Volume	338 CY
Easement Footprint	3,040 SF

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Spoils Haul	3,930.0	CY	33.0	130,000
Launch Shaft Excavation	338.0	CY	25.0	8,440
Launch Shaft Shoring	1,530.0	SF	37.8	57,800
Launch Shaft Existing Utilities	608.0	SF	13.0	7,900
Launch Shaft Backfill	338.0	CY	4.0	1,350
Launch Shaft Surface Restoration	67.6	SY	74.0	5,000
Retrieval Shaft Excavation	686.0	CY	25.0	17,100
Retrieval Shaft Shoring	3,220.0	SF	74.8	241,000
Retrieval Shaft Existing Utilities	529.0	SF	13.0	6,880
Retrieval Shaft Backfill	686.0	CY	4.0	2,740
Retrieval Shaft Surface Restoration	58.8	SY	74.0	4,350
Cased Carrier Pipe Cost	4,400.0	ft	286.0	1,260,000
Intermediate Shaft Excavation	1,010.0	CY	25.0	25,300
Intermediate Shaft Shoring	8,260.0	SF	60.0	495,000
Intermediate Shaft Existing Utilities	1,820.0	SF	13.0	23,700
Intermediate Shaft Backfill	1,010.0	CY	4.0	4,050
Intermediate Shaft Surface Restoration	203.0	SY	74.0	15,000
MTBM Fixed Costs	1.0	LS	595,000.0	595,000
Microtunnel Boring	4,400.0	ft	1,360.0	5,980,000
Tunnel Dewatering	1.0	LS	171,000.0	171,000
Traffic Control	5.0	shaft	27,600.0	138,000
Diversion structure at 11th Ave NW Reg	1	LS	100,000.0	100,000
Drop Structure at Fremont Siphon	1	LS	220,000.0	220,000
Adj Property & Easement Cost	1	LS	750,000.0	750,000
			Year 2008 Subtotal	$10,300,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$10,700,000

Year 2010 Total: $10,700,000

Cost Calculations for Microtunnel: **Montlake Reg to E Portal**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Inside Diameter: 42 in.
Length: 825 ft
Dewatering: Significant
Launch Shaft Existing Utilities: Complex
Launch Shaft Excavation Depth: 135 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 120 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Existing Utilities: Complex
Tunnel Easement Length: 0 ft
Easement Type: None
Traffic: Heavy
Casing Required: true
Number of Intermediate Shafts: 0
Land Adjustment Factor: Seattle
Intermediate Shaft Existing Utilities: Average
Intermediate Shaft Excavation Depth: 40 ft
Intermediate Shaft Surface Restoration: Hydroseed

Tunnel Geometry

Outer Diameter	5.54 ft
Spoils Volume	737 CY
Casing Pipe Diameter	54 in

Launch Shaft Geometry

Width	19 ft
Length	32 ft
Footprint	608 SF
Volume	3,040 CY
Easement Footprint	5,660 SF

Retrieval Shaft Geometry

Width	23 ft

Length	23 ft
Footprint	529 SF
Volume	2,350 CY
Easement Footprint	5,330 SF

Miscellaneous

Spoils Loads	74 loads

Intermediate Shaft Geometry

Width	19 ft
Length	32 ft
Footprint	608 SF
Volume	3,040 CY
Easement Footprint	5,660 SF

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Spoils Haul	737.0	CY	33	24,300
Launch Shaft Excavation	3,040.0	CY	25	76,000
Launch Shaft Shoring	13,800.0	SF	260	3,580,000
Launch Shaft Existing Utilities	608.0	SF	13	7,900
Launch Shaft Backfill	3,040.0	CY	4	12,200
Launch Shaft Surface Restoration	67.6	SY	74	5,000
Retrieval Shaft Excavation	2,350.0	CY	25	58,800
Retrieval Shaft Shoring	11,000.0	SF	232	2,560,000
Retrieval Shaft Existing Utilities	529.0	SF	13	6,880
Retrieval Shaft Backfill	2,350.0	CY	4	9,400
Retrieval Shaft Surface Restoration	58.8	SY	74	4,350
Cased Carrier Pipe Cost	825.0	ft	286	236,000
MTBM Fixed Costs	1.0	LS	595,000	595,000
Microtunnel Boring	825.0	ft	1,360	1,120,000
Tunnel Dewatering	1.0	LS	55,300	55,300
Traffic Control	2.0	shaft	27,600	55,200
Drop Structure at E Portal	1	LS	570,000	570,000
Adj Property & Easement Cost	1	LS	797,000	797,000
			Year 2008 Subtotal	$9,770,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$10,200,000

Year 2010 Total: $10,200,000

Cost Calculations for Microtunnel: **Univ Reg Diversion to Basin 18 Line**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Inside Diameter: 60 in.
Length: 250 ft
Dewatering: Significant
Launch Shaft Existing Utilities: Complex
Launch Shaft Excavation Depth: 35 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 33.5 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Existing Utilities: Complex
Tunnel Easement Length: 250 ft
Easement Type: Office/Commercial
Traffic: Heavy
Casing Required: true
Number of Intermediate Shafts: 0
Land Adjustment Factor: Seattle
Intermediate Shaft Existing Utilities: Complex
Intermediate Shaft Excavation Depth: 50 ft
Intermediate Shaft Surface Restoration: Pavement

Tunnel Geometry

Outer Diameter	7.29 ft
Spoils Volume	386 CY
Casing Pipe Diameter	72 in

Launch Shaft Geometry

Width	20 ft
Length	33 ft
Footprint	660 SF
Volume	856 CY
Easement Footprint	5,810 SF

Retrieval Shaft Geometry

Width	24 ft
Length	24 ft
Footprint	576 SF
Volume	715 CY
Easement Footprint	5,480 SF

Miscellaneous

Spoils Loads	39 loads

Intermediate Shaft Geometry

Width	20 ft
Length	33 ft
Footprint	660 SF
Volume	856 CY
Easement Footprint	5,810 SF

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Spoils Haul	386.0	CY	33.0	12,800
Launch Shaft Excavation	856.0	CY	25.0	21,400
Launch Shaft Shoring	3,710.0	SF	74.8	277,000
Launch Shaft Existing Utilities	660.0	SF	13.0	8,580
Launch Shaft Backfill	856.0	CY	4.0	3,420
Launch Shaft Surface Restoration	73.3	SY	74.0	5,430
Launch Shaft Easement	660.0	SF	38.7	25,500
Retrieval Shaft Excavation	715.0	CY	25.0	17,900
Retrieval Shaft Shoring	3,220.0	SF	72.0	231,000
Retrieval Shaft Existing Utilities	576.0	SF	13.0	7,490
Retrieval Shaft Backfill	715.0	CY	4.0	2,860
Retrieval Shaft Surface Restoration	64.0	SY	74.0	4,740
Retrieval Shaft Easement	576.0	SF	38.7	22,300
Microtunnel Easement	6,250.0	SF	15.0	93,800
Cased Carrier Pipe Cost	250.0	ft	542.0	136,000
MTBM Fixed Costs	1.0	LS	727,000.0	727,000
Microtunnel Boring	250.0	ft	1,750.0	437,000
Tunnel Dewatering	1.0	LS	55,300.0	55,300
Traffic Control	2.0	shaft	27,600.0	55,200
Diversion Structure	1	LS	100,000.0	100,000
Credit for Tabula Calc'd Easement Cost	1	LS	-142,000.0	-142,000
Adj Property & Easement Cost	1	LS	337,000.0	337,000
			Year 2008 Subtotal	$2,440,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$2,540,000

Year 2010 Total: $2,540,000

Cost Calculations for Microtunnel: **2nd segment Basin 18 Influent Pipe**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Inside Diameter: 72 in.
Length: 3600 ft
Dewatering: Significant
Launch Shaft Existing Utilities: Complex
Launch Shaft Excavation Depth: 30 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 155 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Existing Utilities: Complex
Tunnel Easement Length: 3600 ft
Easement Type: Office/Commercial
Traffic: Heavy
Casing Required: true
Number of Intermediate Shafts: 2
Land Adjustment Factor: Seattle
Intermediate Shaft Existing Utilities: Complex
Intermediate Shaft Excavation Depth: 44 ft
Intermediate Shaft Surface Restoration: Pavement

Tunnel Geometry

Outer Diameter	8.33 ft
Spoils Volume	7,270 CY
Casing Pipe Diameter	84 in

Launch Shaft Geometry

Width	21 ft
Length	34 ft
Footprint	714 SF
Volume	793 CY
Easement Footprint	5,960 SF

Retrieval Shaft Geometry

Width	25 ft
Length	25 ft
Footprint	625 SF
Volume	3,590 CY
Easement Footprint	5,630 SF

Miscellaneous

Spoils Loads	727 loads

Intermediate Shaft Geometry

Width	21 ft
Length	34 ft
Footprint	714 SF
Volume	793 CY
Easement Footprint	5,960 SF

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Spoils Haul	7,270.0	CY	33.0	240,000
Launch Shaft Excavation	793.0	CY	25.0	19,800
Launch Shaft Shoring	3,300.0	SF	65.5	216,000
Launch Shaft Existing Utilities	714.0	SF	13.0	9,280
Launch Shaft Backfill	793.0	CY	4.0	3,170
Launch Shaft Surface Restoration	79.3	SY	74.0	5,870
Launch Shaft Easement	714.0	SF	38.7	27,600
Retrieval Shaft Excavation	3,590.0	CY	25.0	89,700
Retrieval Shaft Shoring	15,500.0	SF	297.0	4,600,000
Retrieval Shaft Existing Utilities	625.0	SF	13.0	8,130
Retrieval Shaft Backfill	3,590.0	CY	4.0	14,400
Retrieval Shaft Surface Restoration	69.4	SY	74.0	5,140
Retrieval Shaft Easement	625.0	SF	38.7	24,200
Microtunnel Easement	93,600.0	SF	15.0	1,400,000
Cased Carrier Pipe Cost	3,600.0	ft	455.0	1,640,000
Intermediate Shaft Excavation	1,590.0	CY	25.0	39,700
Intermediate Shaft Shoring	9,680.0	SF	91.4	885,000
Intermediate Shaft Existing Utilities	1,430.0	SF	13.0	18,600
Intermediate Shaft Backfill	1,590.0	CY	4.0	6,350
Intermediate Shaft Surface Restoration	159.0	SY	74.0	11,700
Intermediate Shaft Easement	1,430.0	SF	38.7	55,300
MTBM Fixed Costs	1.0	LS	793,000.0	793,000
Microtunnel Boring	3,600.0	ft	1,970.0	7,090,000
Tunnel Dewatering	1.0	LS	123,000.0	123,000
Traffic Control	4.0	shaft	27,600.0	110,000
Drop Structure at East Tunnel Portal	1	LS	480,000.0	480,000
Credit for Tabula Calc'd Easement Cost	1	LS	-1,510,000.0	-1,510,000
Adj Property & Easement Cost	1	LS	4,310,000.0	4,310,000
		Year 2008 Subtotal		$20,700,000

Mobilization/Demobilization at 6%	1.06

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$21,500,000

Year 2010 Total: $21,500,000

Cost Calculations for Microtunnel: **Portage Bay to Drop Structure**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Inside Diameter: 18 in.
Length: 550 ft
Dewatering: Significant
Launch Shaft Existing Utilities: Complex
Launch Shaft Excavation Depth: 15 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 45 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Existing Utilities: Complex
Tunnel Easement Length: 0 ft
Easement Type: None
Traffic: Heavy
Casing Required: true
Number of Intermediate Shafts: 1
Land Adjustment Factor: Seattle
Intermediate Shaft Existing Utilities: Complex
Intermediate Shaft Excavation Depth: 40 ft
Intermediate Shaft Surface Restoration: Pavement

Tunnel Geometry

Outer Diameter	3.08 ft
Spoils Volume	152 CY
Casing Pipe Diameter	30 in

Launch Shaft Geometry

Width	17 ft
Length	30 ft
Footprint	510 SF
Volume	283 CY
Easement Footprint	2,820 SF

Retrieval Shaft Geometry

Width	21 ft

Length	21 ft
Footprint	441 SF
Volume	735 CY
Easement Footprint	5,040 SF

Miscellaneous

Spoils Loads	16 loads

Intermediate Shaft Geometry

Width	17 ft
Length	30 ft
Footprint	510 SF
Volume	283 CY
Easement Footprint	2,820 SF

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Spoils Haul	152.0	CY	33.0	5,010
Launch Shaft Excavation	283.0	CY	25.0	7,080
Launch Shaft Shoring	1,410.0	SF	37.8	53,200
Launch Shaft Existing Utilities	510.0	SF	13.0	6,630
Launch Shaft Backfill	283.0	CY	4.0	1,130
Launch Shaft Surface Restoration	56.7	SY	74.0	4,190
Retrieval Shaft Excavation	735.0	CY	25.0	18,400
Retrieval Shaft Shoring	3,780.0	SF	93.3	352,000
Retrieval Shaft Existing Utilities	441.0	SF	13.0	5,730
Retrieval Shaft Backfill	735.0	CY	4.0	2,940
Retrieval Shaft Surface Restoration	49.0	SY	74.0	3,630
Cased Carrier Pipe Cost	550.0	ft	90.0	49,500
Intermediate Shaft Excavation	283.0	CY	25.0	7,080
Intermediate Shaft Shoring	3,760.0	SF	84.0	316,000
Intermediate Shaft Existing Utilities	510.0	SF	13.0	6,630
Intermediate Shaft Backfill	283.0	CY	4.0	1,130
Intermediate Shaft Surface Restoration	56.7	SY	74.0	4,190
MTBM Fixed Costs	1.0	LS	330,000.0	330,000
Microtunnel Boring	550.0	ft	820.0	451,000
Tunnel Dewatering	1.0	LS	82,700.0	82,700
Traffic Control	3.0	shaft	27,600.0	82,800
Diversion structure at Basin 138 overflow	1	LS	100,000.0	100,000
Drop Structure to connect to tunnel	1	LS	480,000.0	480,000
Adj Property & Easement Cost	1	LS	490,000.0	490,000
			Year 2008 Subtotal	$2,860,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$2,970,000

Year 2010 Total: $2,970,000

Cost Calculations for Pump Station: **Tunnel Effluent PS**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Capacity: 42.9 mgd
Total Dynamic Head: 127 ft
Excavation Depth: 0 ft

Calculated Parameters

Required Pump Power	1,880 Hp
Base Architectural/Structural Unit Cost	128,000 $/mgd
Architectural/Structural Unit Cost Adjustment	-38,500 $/mgd
Base Mechanical Unit Cost	52,300 $/mgd
Mechanical Unit Cost Adjustment	3,960 $/mgd

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1.0	LS	2,290,000	2,290,000
Electrical/Instrumentation	1.0	LS	2,740,000	2,740,000
Architectural/Structural	42.9	mgd	89,900	3,860,000
Mechanical	42.9	mgd	56,300	2,410,000
1800 kW Standby Generator	1	LS	402,000	402,000
			Year 2008 Subtotal	$11,700,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Construction Year 2010 Subtotal	$11,500,000

Year 2010 Total: $11,500,000

Cost Calculations for Pump Station: **Madison Park Wet Weather PS**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Capacity: .5 mgd
Total Dynamic Head: 65 ft
Excavation Depth: 20 ft

Calculated Parameters

Required Pump Power	11.2 Hp
Base Architectural/Structural Unit Cost	206,000 $/mgd
Architectural/Structural Unit Cost Adjustment	-61,800 $/mgd
Base Mechanical Unit Cost	189,000 $/mgd
Mechanical Unit Cost Adjustment	-31,100 $/mgd

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1.0	LS	41,600	41,600
Electrical/Instrumentation	1.0	LS	76,100	76,100
Architectural/Structural	0.5	mgd	144,000	72,100
Mechanical	0.5	mgd	158,000	79,100
10 kW Standby Generator (RS Means)	1	LS	11,000	11,000
Adj Property & Easement Cost	5,000	sq ft	78	390,000
			Year 2008 Subtotal	$670,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Construction Year 2010 Subtotal	$657,000

Year 2010 Total: $657,000

Cost Calculations for Pump Station: **Montlake Basin 20 wet weather PS**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Capacity: 2 mgd
Total Dynamic Head: 63 ft
Excavation Depth: 20 ft

Calculated Parameters

Required Pump Power	43.4 Hp
Base Architectural/Structural Unit Cost	178,000 $/mgd
Architectural/Structural Unit Cost Adjustment	-53,400 $/mgd
Base Mechanical Unit Cost	127,000 $/mgd
Mechanical Unit Cost Adjustment	-32,200 $/mgd

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1.0	LS	145,000	145,000
Electrical/Instrumentation	1.0	LS	197,000	197,000
Architectural/Structural	2.0	mgd	124,000	249,000
Mechanical	2.0	mgd	94,600	189,000
30 kW Standby Generator (RS Means)	1	LS	25,000	25,000
Adj Property & Easement Cost	5,000	sq ft	78	390,000
			Year 2008 Subtotal	$1,190,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Construction Year 2010 Subtotal	$1,170,000

Year 2010 Total: $1,170,000

Cost Calculations for Pump Station: **Montlake Basin 140 wet weather PS**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Capacity: 1 mgd
Total Dynamic Head: 70 ft
Excavation Depth: 10 ft

Calculated Parameters

Required Pump Power	24.1 Hp
Base Architectural/Structural Unit Cost	191,000 $/mgd
Architectural/Structural Unit Cost Adjustment	-57,400 $/mgd
Base Mechanical Unit Cost	155,000 $/mgd
Mechanical Unit Cost Adjustment	-28,300 $/mgd

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1.0	LS	77,600	77,600
Electrical/Instrumentation	1.0	LS	130,000	130,000
Architectural/Structural	1.0	mgd	134,000	134,000
Mechanical	1.0	mgd	127,000	127,000
30 kW Standby Generator (RS Means)	1	LS	25,000	25,000
Adj Property & Easement Cost	5,000	sq ft	78	390,000
			Year 2008 Subtotal	$884,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Construction Year 2010 Subtotal	$867,000

Year 2010 Total: $867,000

Cost Calculations for Pipe: **Effluent PS force main**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 150 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 30 in.

Geometry

Outer Diameter	2.67 ft
Trench Width	5.97 ft
Excavation Depth	9.67 ft
Complete Surface Rest. Width	7.97 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	320.0	CY	13	4,170
Backfill	166.0	CY	34	5,640
Complete Pavement Restoration	133.0	SY	86	11,400
Overlay Pavement Restoration	234.0	SY	28	6,550
Trench Safety	2,900.0	SF	17	49,300
Spoil Load and Haul	320.0	CY	16	5,130
Pipe Unit Material Cost	150.0	lf	159	23,900
Pipe Installation	150.0	lf	38	5,700
Place Pipe Zone Fill	124.0	CY	34	4,210
Existing Utilities	150.0	lf	58	8,700
Dewatering	150.0	lf	100	15,000

Traffic Control	150.0	lf	24	3,600
Drop Structure	1	LS	25,000	25,000
Adj Property & Easement Cost	1	LS	1,980	1,980
			Year 2008 Subtotal	$170,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$177,000

Year 2010 Total: $177,000

Cost Calculations for Pipe: **Montlake Basin 140 force main**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 1250 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 8 in.

Geometry

Outer Diameter	0.754 ft
Trench Width	3.48 ft
Excavation Depth	7.75 ft
Complete Surface Rest. Width	5.48 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,250.0	CY	13	16,200
Backfill	806.0	CY	34	27,400
Complete Pavement Restoration	761.0	SY	86	65,500
Overlay Pavement Restoration	2,290.0	SY	28	64,200
Trench Safety	19,400.0	SF	17	330,000
Spoil Load and Haul	1,250.0	CY	16	20,000
Pipe Unit Material Cost	1,250.0	lf	30	37,500
Pipe Installation	1,250.0	lf	22	27,500
Place Pipe Zone Fill	423.0	CY	34	14,400
Existing Utilities	1,250.0	lf	32	40,000
Dewatering	1,250.0	lf	80	100,000

Traffic Control	1,250.0	lf	16	20,000
Adj Property & Easement Cost	1	LS	16,500	16,500
			Year 2008 Subtotal	$779,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$810,000

Year 2010 Total: $810,000

Cost Calculations for Pipe: **Montlake Basin 20 force main**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 1000 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 8 in.

Geometry

Outer Diameter	0.754 ft
Trench Width	3.48 ft
Excavation Depth	7.75 ft
Complete Surface Rest. Width	5.48 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,000.0	CY	13	13,000
Backfill	645.0	CY	34	21,900
Complete Pavement Restoration	609.0	SY	86	52,400
Overlay Pavement Restoration	1,840.0	SY	28	51,400
Trench Safety	15,500.0	SF	17	264,000
Spoil Load and Haul	1,000.0	CY	16	16,000
Pipe Unit Material Cost	1,000.0	lf	30	30,000
Pipe Installation	1,000.0	lf	22	22,000
Place Pipe Zone Fill	338.0	CY	34	11,500
Existing Utilities	1,000.0	lf	32	32,000
Dewatering	1,000.0	lf	80	80,000

Traffic Control	1,000.0	lf	16	16,000
Adj Property & Easement Cost	1	LS	13,200	13,200
			Year 2008 Subtotal	$623,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$648,000

Year 2010 Total: $648,000

Cost Calculations for Pipe: **Madison Park Basin 25 force main**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 1050 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 20 in.

Geometry

Outer Diameter	1.8 ft
Trench Width	4.84 ft
Excavation Depth	8.8 ft
Complete Surface Rest. Width	6.84 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,660.0	CY	13	21,500
Backfill	941.0	CY	34	32,000
Complete Pavement Restoration	798.0	SY	86	68,600
Overlay Pavement Restoration	1,770.0	SY	28	49,500
Trench Safety	18,500.0	SF	17	314,000
Spoil Load and Haul	1,660.0	CY	16	26,500
Pipe Unit Material Cost	1,050.0	lf	91	95,600
Pipe Installation	1,050.0	lf	30	31,500
Place Pipe Zone Fill	616.0	CY	34	21,000
Existing Utilities	1,050.0	lf	58	60,900
Dewatering	1,050.0	lf	87	91,400

Traffic Control	1,050.0	lf	16	16,800
Drop Structure	1	LS	25,000	25,000
Adj Property & Easement Cost	1	LS	13,900	13,900
			Year 2008 Subtotal	$868,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$903,000

Year 2010 Total: $903,000

Cost Calculations for Pipe: **Basin 18B to Basin 18A**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 1650 ft
Conduit Type: Gravity
Depth of Cover: 8 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: Office/Commercial
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 36 in.

Geometry

Outer Diameter	3.67 ft
Trench Width	7.27 ft
Excavation Depth	12.7 ft
Complete Surface Rest. Width	9.27 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	5,620.0	CY	13.0	73,100
Backfill	3,110.0	CY	34.0	106,000
Complete Pavement Restoration	1,700.0	SY	86.0	146,000
Overlay Pavement Restoration	6,370.0	SY	28.0	178,000
Trench Safety	41,800.0	SF	17.0	711,000
Easement	49,500.0	SF	11.6	575,000
Spoil Load and Haul	5,620.0	CY	16.0	90,000
Pipe Unit Material Cost	1,650.0	lf	77.0	127,000
Pipe Installation	1,650.0	lf	45.0	74,300
Place Pipe Zone Fill	1,870.0	CY	34.0	63,600
Manholes	4.0	MH	9,720.0	38,900

Existing Utilities	1,650.0	lf	120.0	198,000
Dewatering	1,650.0	lf	107.0	177,000
Traffic Control	1,650.0	lf	24.0	39,600
Basin 18B diversion structure	1	LS	100,000.0	100,000
Credit for Tabula Calc'd Easement Cost	1	LS	-575,000.0	-575,000
Adj Property & Easement Cost	1	LS	544,000.0	544,000
			Year 2008 Subtotal	$2,670,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$2,770,000

Year 2010 Total: $2,770,000

Cost Calculations for Pipe: **Basin 18A to microtunnel section**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 4000 ft
Conduit Type: Gravity
Depth of Cover: 8 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: Office/Commercial
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 36 in.

Geometry

Outer Diameter	3.67 ft
Trench Width	7.27 ft
Excavation Depth	12.7 ft
Complete Surface Rest. Width	9.27 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	13,600.0	CY	13.0	177,000
Backfill	7,540.0	CY	34.0	256,000
Complete Pavement Restoration	4,120.0	SY	86.0	354,000
Overlay Pavement Restoration	15,400.0	SY	28.0	432,000
Trench Safety	101,000.0	SF	17.0	1,720,000
Easement	120,000.0	SF	11.6	1,390,000
Spoil Load and Haul	13,600.0	CY	16.0	218,000
Pipe Unit Material Cost	4,000.0	lf	77.0	308,000
Pipe Installation	4,000.0	lf	45.0	180,000
Place Pipe Zone Fill	4,540.0	CY	34.0	154,000
Manholes	8.0	MH	9,720.0	77,700

Existing Utilities	4,000.0	lf	120.0	480,000
Dewatering	4,000.0	lf	107.0	428,000
Traffic Control	4,000.0	lf	24.0	96,000
Basin 18A diversion structure	1	LS	100,000.0	100,000
Credit for Tabula calc'd easement cost	1	LS	-1,390,000.0	-1,390,000
Adj Property & Easement Cost	1	LS	3,480,000.0	3,480,000
			Year 2008 Subtotal	$8,470,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$8,800,000

Year 2010 Total: $8,800,000

Cost Calculations for Pipe: **Fremont/3rd Ave W Drop Structure**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 0 ft
Conduit Type: Gravity
Depth of Cover: 12 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Minimal
Pavement Restoration: Trench Width
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: King County Average
Trench Safety: Standard
Pipe Diameter: 12 in.

Geometry

Outer Diameter	1.42 ft
Trench Width	4.34 ft
Excavation Depth	14.4 ft
Complete Surface Rest. Width	6.34 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	It
Drop Structure for Fremont/3rd Ave Reg/11th Ave Reg	1	LS	560,000	
Diiversion Structure from N interceptor to Drop Structure	1	LS	100,000	
			Year 2008 Subtotal	$

Mobilization/Demobilization at 6%
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)

Effective Multiplier

Construction Year 2010 Subtotal $

Year 2010 Total: $686,000

Consolidated Alternatives – 11th Ave NW, 3rd Ave W, University, and Montlake

DSN004/008/014/015-STOR-1 (KC & SPU) or SC-Cons Tunnel-Collab-STOR

Cost Estimate of SPU-Developed Alternative Using King County Cost Estimating Methodology

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Alternative DSN004/008/014/015-STOR-1 (KC & SPU)

Percentage of Cost Attributed to King County and SPU, Based on Volume[3]

Agency	Volume (MG)	Percentage of Costs (%)
King County	15.57	72.6%
SPU	5.87	27.4%

King County CSO Basins	Volume (MG)	Corresponding SPU CSO Basins	Volume (MG)
Montlake	6.6	Montlake (Basin 140, 20)	0.1
		Madison Park	0.543
University	2.94	North Union Bay	2.292
3rd Ave W	4.18	Fremont/Wallingford	2.861
11th Ave NW	1.85	NA	NA

King County CSO Basins	KC Allocation of Costs in Basin Areas (%)	SPU Allocation of Costs in Basin Areas (%)
Montlake	91.1%	8.9%
University	56.2%	43.8%
3rd Ave W	59.4%	40.6%
11th Ave NW	100.0%	0.0%

Escalation Assumptions

Description	ENR CCI
ENR CCI (Seattle), January 2010	8645.35

KING COUNTY METHODOLOGY, Total Project Cost, 2010 Dollars

Description	Total Costs (King County & SPU)	Costs Attributed to King County[3]	Costs Attributed to SPU[3]
21.4-MG Storage Tunnel Construction Cost (14,300 LF of 16-ft-diameter pipe) =	$89,390,000	$64,920,000	$24,470,000
Conveyance Pipe from 11th Ave NW Overflow Structure to Fremont Siphon Construction Cost, Installed by Microtunneling (4,400 LF of 42-inch-diameter pipe) =	$10,580,000	$10,580,000	$0
Conveyance Pipe from Montlake Regulator to East Portal Construction Cost, Installed by Microtunneling (825 LF of 42-inch-diameter pipe) =	$9,330,000	$8,500,000	$830,000
Conveyance Pipe from University Regulator to Influent Line Construction Cost, Installed by Microtunneling (250 LF of 60-inch-diameter pipe) =	$2,720,000	$2,720,000	$0
Influent Line for University and North Union Bay CSOs to East Portal Construction Cost, Installed by Microtunneling (3,600 LF of 72-inch-diameter pipe) =	$18,620,000	$10,460,000	$8,160,000
Conveyance Pipe from Portage Bay to Drop Structure Construction Cost, Installed by Microtunneling (550 LF of 18-inch-diameter pipe) =	$2,850,000	$0	$2,850,000
Tunnel Effluent Pump Station (42.9 MGD) Construction Cost =	$11,500,000	$8,350,000	$3,150,000
Madison Park Wet Weather Pump Station (0.5 MGD) Construction Cost =	$270,000	$0	$270,000
Montlake Basin 20 Wet Weather Pump Station (2 MGD) Construction Cost =	$780,000	$0	$780,000
Montlake Basin 140 Wet Weather 1-MGD Pump Station Construction Cost =	$480,000	$0	$480,000
Effluent Pump Station Force Main Construction Cost, Installed by Open Cut Construction (150 LF of 30-inch-diameter pipe) =	$170,000	$120,000	$50,000
Montlake Basin 140 Force Main Construction Cost, Installed by Open Cut Construction (1,250 LF of 8-inch-diameter pipe) =	$790,000	$0	$790,000
Montlake Basin 20 Force Main Construction Cost, Installed by Open Cut Construction (1,000 LF of 8-inch-diameter pipe) =	$630,000	$0	$630,000
Madison Park Basin 25 Force Main Construction Cost, Installed by Open Cut Construction (1,050 LF of 20-inch-diameter pipe) =	$890,000	$0	$890,000

Description	Total Costs (King County & SPU)	Costs Attributed to King County[3]	Costs Attributed to SPU[3]
Conveyance Pipe from Basin 18B to Basin 18A to Influent Pipe Construction Cost, Installed by Open Cut Cosntruction (1,650 LF of 36-inch-diameter pipe) =	$3,170,000	$0	$3,170,000
Conveyance Pipe from Basin 18A to Influent Pipe Construction Cost, Installed by Open Cut Construction (4,000 LF of 36-inch-diameter pipe)	$9,190,000	$0	$9,190,000
Fremont/3rd Ave W/11th Ave NW Drop Structure Construction Cost =	$580,000	$340,000	$240,000
Diversion Structure from North Interceptor to Drop Structure Construction Cost =	$490,000	$490,000	$0
SDOT Street Use Permit Fee =	$250,000	$60,000	$190,000
Total Construction Cost =	$162,680,000	$106,540,000	$56,140,000
Sales Tax (10% of Construction Cost) =	$16,270,000	$10,650,000	$5,610,000
[1]Allied Costs (46.07% of Construction Cost) =	$74,950,000	$49,080,000	$25,860,000
Property Cost =	$25,890,000	$16,410,000	$9,480,000
Subtotal of Project Cost =	$279,790,000	$182,680,000	$97,090,000
[1]Construction Contingency (10% of Construction Cost) =	$16,270,000	$10,650,000	$5,610,000
[1, 2]Project Contingency =	$67,670,000	$44,150,000	$23,520,000
Total Project Cost, 2010 Dollars =	**$363,700,000**	**$237,500,000**	**$126,200,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

[3]Allocation of costs is pending confirmation from management.

Alternative DSN004/008/014/015-STOR-1 (KC & SPU)

Percentage of Cost Attributed to King County and SPU, Based on Volume[3]

Agency	Volume (MG)	Percentage of Costs (%)
King County	15.57	72.6%
SPU	5.87	27.4%

King County CSO Basins	Volume (MG)	Corresponding SPU CSO Basins	Volume (MG)	King County: KC Allocation of Costs in Basin Areas (%)	SPU: SPU Allocation of Costs in Basin Areas (%)
Montlake	6.6	Montlake (Basin 140, 20)	0.1	91.1%	8.9%
		Madison Park	0.543		
University	2.94	North Union Bay	2.292	56.2%	43.8%
3rd Ave W	4.18	Fremont/Wallingford	2.861	59.4%	40.6%
11th Ave NW	1.85	NA	NA	100.0%	0.0%

Escalation Assumptions

Description	ENR CCI
ENR CCI (Seattle), January 2010	8645.35

KING COUNTY METHODOLOGY, Total Project Cost, 2010 Dollars

Description	Total Costs (King County & SPU)	Costs Attributed to King County[3]	Costs Attributed to 11th Ave NW[3]	Costs Attributed to 3rd Ave W[3]	Costs Attributed to University[3]	Costs Attributed to Montlake[3]	Costs Attributed to SPU[3]
21.4-MG Storage Tunnel Construction Cost (14,300 LF of 16-ft-diameter pipe) =	$89,390,000	$64,920,000	$7,710,000	$17,430,000	$12,260,000	$27,520,000	$24,470,000
Conveyance Pipe from 11th Ave NW Overflow Structure to Fremont Siphon Construction Cost, Installed by Microtunneling (4,400 LF of 42-inch-diameter pipe) =	$10,580,000	$10,580,000	$10,580,000	$0	$0	$0	$0
Conveyance Pipe from Montlake Regulator to East Portal Construction Cost, Installed by Microtunneling (825 LF of 42-inch-diameter pipe) =	$9,330,000	$8,500,000	$0	$0		$8,500,000	$830,000
Conveyance Pipe from University Regulator to Influent Line Construction Cost, Installed by Microtunneling (250 LF of 60-inch-diameter pipe) =	$2,720,000	$2,720,000	$0	$0	$2,720,000	$0	$0
Influent Line for University and North Union Bay CSOs to East Portal Construction Cost, Installed by Microtunneling (3,600 LF of 72-inch-diameter pipe) =	$18,620,000	$10,460,000	$0	$0	$10,460,000	$0	$8,160,000
Conveyance Pipe from Portage Bay to Drop Structure Construction Cost, Installed by Microtunneling (550 LF of 18-inch-diameter pipe) =	$2,850,000	$0	$0	$0	$0	$0	$2,850,000
Tunnel Effluent Pump Station (42.9 MGD) Construction Cost =	$11,500,000	$8,350,000	$990,000	$2,240,000	$1,580,000	$3,540,000	$3,150,000
Madison Park Wet Weather Pump Station (0.5 MGD) Construction Cost =	$270,000	$0	$0	$0	$0	$0	$270,000

Description	Total Costs (King County & SPU)	Costs Attributed to King County[3]	Costs Attributed to 11th Ave NW[3]	Costs Attributed to 3rd Ave W[3]	Costs Attributed to University[3]	Costs Attributed to Montlake[3]	Costs Attributed to SPU[3]
Montlake Basin 20 Wet Weather Pump Station (2 MGD) Construction Cost =	$780,000	$0	$0	$0	$0	$0	$780,000
Montlake Basin 140 Wet Weather 1-MGD Pump Station Construction Cost =	$480,000	$0	$0	$0	$0	$0	$480,000
Effluent Pump Station Force Main Construction Cost, Installed by Open Cut Construction (150 LF of 30-inch-diameter pipe) =	$170,000	$120,000	$10,000	$30,000	$20,000	$50,000	$50,000
Montlake Basin 140 Force Main Construction Cost, Installed by Open Cut Construction (1,250 LF of 8-inch-diameter pipe) =	$790,000	$0	$0	$0	$0	$0	$790,000
Montlake Basin 20 Force Main Construction Cost, Installed by Open Cut Construction (1,000 LF of 8-inch-diameter pipe) =	$630,000	$0	$0	$0	$0	$0	$630,000
Madison Park Basin 25 Force Main Construction Cost, Installed by Open Cut Construction (1,050 LF of 20-inch-diameter pipe) =	$890,000	$0	$0	$0	$0	$0	$890,000
Conveyance Pipe from Basin 18B to Basin 18A to Influent Pipe Construction Cost, Installed by Open Cut Cosntruction (1,650 LF of 36-inch-diameter pipe) =	$3,170,000	$0	$0	$0	$0	$0	$3,170,000
Conveyance Pipe from Basin 18A to Influent Pipe Construction Cost, Installed by Open Cut Construction (4,000 LF of 36-inch-diameter pipe)	$9,190,000	$0	$0	$0	$0	$0	$9,190,000
Fremont/3rd Ave W/11th Ave NW Drop Structure Construction Cost =	$580,000	$340,000	$100,000	$240,000	$0	$0	$240,000
Diversion Structure from North Interceptor to Drop Structure Construction Cost =	$490,000	$490,000	$0	$0	$490,000	$0	$0
SDOT Street Use Permit Fee =	$250,000	$60,000	$60,000	$0	$0	$0	$190,000
Total Construction Cost =	$162,680,000	$106,540,000	$19,450,000	$19,940,000	$27,530,000	$39,610,000	$56,140,000
Sales Tax (10% of Construction Cost) =	$16,270,000	$10,650,000	$1,950,000	$1,990,000	$2,750,000	$3,960,000	$5,610,000
[1]Allied Costs (46.07% of Construction Cost) =	$74,950,000	$49,080,000	$8,960,000	$9,190,000	$12,680,000	$18,250,000	$25,860,000
Property Cost =	$25,890,000	$16,410,000	$2,740,000	$2,320,000	$5,940,000	$5,420,000	$9,480,000
Subtotal of Project Cost =	$279,790,000	$182,680,000	$33,100,000	$33,440,000	$48,900,000	$67,240,000	$97,090,000
[1]Construction Contingency (10% of Construction Cost) =	$16,270,000	$10,650,000	$1,950,000	$1,990,000	$2,750,000	$3,960,000	$5,610,000
[1, 2]Project Contingency =	$67,670,000	$44,150,000	$7,980,000	$8,040,000	$11,920,000	$16,210,000	$23,520,000
Total Project Cost, 2010 Dollars =	**$363,700,000**	**$237,500,000**	**$43,000,000**	**$43,500,000**	**$63,600,000**	**$87,400,000**	**$126,200,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

[3]Allocation of costs is pending confirmation from management.

PROPERTY AND PERMITTING COSTS

Land and Building Cost, Average Cost per Square Foot (January 2007 to August 2010)

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building ($/SF)	Average Cost per Square Foot for Industrial Land ($/SF)
DSN004 11th Ave NW	$149.89	$21.91
DSN008 3rd Ave W	$149.89	$21.91
DSN014 Montlake Regulator	$175.83	NA
DSN015 University Regulator	$175.83	NA

Land Costs, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)	Comments
Tunnel - East Portal	25,000	$175.83	100%	$4,395,750	KC/SPU
Tunnel - West Portal	50,000	$149.89	100%	$7,494,500	KC/SPU
11th Ave NW Overflow Structure to Fremont Siphon (3 Intermediate Pits)	11,410	$149.89	100%	$1,710,245	KC (11th Ave NW)
Montlake Regulator to East Portal (Launch Shaft and Retrieval Shaft)	10,990	$175.83	100%	$1,932,372	KC/SPU (Montlake)
University Regulator to Basin 18 Line (Launch Shaft and Retrieval Shaft)	11,290	$175.83	100%	$1,985,121	KC
University and Basin 18 Influent Line (Launch Shaft, 2 Intermediate Shafts, and Retrieval Shaft)	23,510	$175.83	100%	$4,133,763	KC/SPU (University)
Portage Bay to Drop Structure (Launch Shaft, Intermediate Shaft, Retrieval Shaft)	10,680	$149.89	100%	$1,600,825	SPU
Madison Park Wet Weather Pump Station	5,000	$175.83	100%	$879,150	SPU
Montlake Basin 20 Wet Weather Pump Station	5,000	$175.83	100%	$879,150	SPU
Montlake Basin 140 Wet Weather Pump Station	5,000	$175.83	100%	$879,150	SPU
			Total Land Costs	$25,890,026	

SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.

Closure of construction area will occur in phases. Assumed construction phasing in:	1,000	ft segments
Assumed production rate during working days =	15	LF/d
For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula.	22	ft
For pipe diameters greater than 36 inches, assume full width of road will be closed during construction. Width is based on the full width for arterial pavement restoration in Tabula.	44	ft

Source of methodology for estimating permit fees: http://www.seattle.gov/transportation/cams/CAM2115.pdf

SDOT Street Use Permit Fee Estimation, 2010 Dollars

Description	Diameter of Pipe (in)	Length (ft)	Width of Construction Area (ft)	Estimated Construction Area (SF)	Construction Duration (Calendar Days)	Number of 10-Day Periods	Use Fee ($/SF)	Estimated Permit Costs
Ballard Bike Trail (SDOT), First Phase of Construction	42	1,000	18	18,000	93.3	10	$0.80	$14,400
Ballard Bike Trail (SDOT), First Phase of Construction	42	1,000	18	18,000	93.3	10	$0.80	$14,400
Ballard Bike Trail (SDOT), First Phase of Construction	42	1,000	18	18,000	93.3	10	$0.80	$14,400
Ballard Bike Trail (SDOT), First Phase of Construction	42	1,000	18	18,000	93.3	10	$0.80	$14,400
Ballard Bike Trail (SDOT), First Phase of Construction	42	400	18	7,200	37.3	4	$0.10	$720
Effluent Force Main	30	150	22	3,300	14.0	2	$0.20	$660
Montlake Basin 140 Force Main, First Phase of Construction	8	1,000	22	22,000	93.3	10	$2.90	$63,800
Montlake Basin 140 Force Main, Second Phase of Construction	8	250	22	5,500	23.3	3	$0.30	$1,650
Montlake Basin 20 Force Main	8	1,000	22	22,000	93.3	10	$2.90	$63,800
Madison Park Basin 25 Force Main, First Phase of Construction	20	1,000	22	22,000	93.3	10	$2.90	$63,800
Madison Park Basin 25 Force Main, Second Phase of Construction	20	50	22	1,100	4.7	1	$0.10	$110
							Total SDOT Street Use Fee Estimation:	$252,140

Shared Operations and Maintenance Cost Estimate Summary

Basin Name: Tunnel N-3a

Alternative Name: Collab Ship Canal Tunnel

ENR 1994	5747
Current ENR	**8645.4**
Power Cost (per kwh)	**0.065**
Labor rate (loaded) /hr	**51.17**
SPU Water Cost $/CCF	**4.50**
Carbon Cost/Lb	**2.00**

Acres of Raingarden for GSI	**NA**
Annual Overflow Vol (MG)	**164.98**
Annual Vol Captured	**137.18**
Annual Events	**20**
Stor Vol	**21.44**
Peak Flow Rate	varies

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$0			
Force Mains	$5			
Regulator/Flow Control Structures	$192,294			
Deep/Shallow Tunnels **	$16,159			
Off-Line Storage Pipes	$0			
River Outfalls	$0			
Pump Stations*	$0	$0	$0	
Rectangular Storage Facilities	$424,575	$244,043	$141,027	$400,535
High Rate Treatment	$0	$0	$0	$0
Additonal Secondary Treatment	NA	$90,101	NA	NA
Green Stormwater Infrastructure				
Annual Cost Subtotals:	**$633,033**	**$334,144**	**$141,027**	**$400,535**

Total Annual O&M		**KC 73%**	**SPU 27%**
General	**$1,367,712**	**$998,430**	**$369,282**
Energy	**$141,027**	**$102,950**	**$32,436**
Total	**$1,508,739**	**$1,101,380**	**$347,010**

* Effluent PS accounted for in the rectangular storage tank

** Storage tunnel operation accounted for in the rectangular storage facility

Total Annual O&M

General	**$1,945,950**
Energy	**$152,710**
Total	**$2,098,660**

SPU project $327-450 K/Y

King County Operations and Maintenance Cost Estimate Summary

Basin Name: Tunnel N-3a

Alternative Name: Collab Ship Canal Tunnel

ENR 1994	5747
Current ENR	**8645.35**
Power Cost (per kwh)	**0.065**
Labor rate (loaded) /hr	**51.17**
SPU Water Cost $/CCF	**4.50**
Carbon Cost/Lb	**2.00**

Acres of Raingarden for GSI	**0.00**
Annual Overflow Vol (MG)	**159.10**
Annual Vol Captured	**131.30**
Annual Events	**20**
Stor Vol	**21.44**
Peak Flow Rate	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$0			
Force Mains	$0			
Regulator/Flow Control Structures	$115,376			
Deep/Shallow Tunnels	$6,187			
Off-Line Storage Pipes	$0			
River Outfalls	$0			
Pump Stations	NA	NA	NA	NA
Rectangular Storage Facilities	NA	NA	NA	NA
High Rate Treatment	NA	NA	NA	NA
Additonal Secondary Treatment	NA	NA	NA	NA
Green Stormwater Infrastructure				
Annual Cost Subtotals:	**$121,563**	**$0**	**$0**	**$0**

Total Annual O&M	**KC-only**	**With Shared Costs**
General	**$121,563**	**$1,119,993**
Energy	**$0**	**$102,950**
Total	**$121,563**	**$1,222,943**

Seattle Operations and Maintenance Cost Estimate Summary

Basin Name: Tunnel N-3a

Alternative Name: Collab Ship Canal Tunnel

ENR 1994	5747
Current ENR	**8645.35**
Power Cost (per kwh)	**0.065**
Labor rate (loaded) /hr	**51.17**
SPU Water Cost $/CCF	**4.50**
Carbon Cost/Lb	**2.00**

Acres of Raingarden for GSI	**0.00**
Annual Overflow Vol (MG)	**5.88**
Annual Vol Captured	**5.88**
Annual Events	**20**
Stor Vol	**21.44**
Peak Flow Rate	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$8,532			
Force Mains	$119			
Regulator/Flow Control Structures	$230,752			
Deep/Shallow Tunnels	$4,690			
Off-Line Storage Pipes	$0			
River Outfalls	$0			
Pump Stations	$164,563	$48,019	$11,683	
Rectangular Storage Facilities	NA	NA	NA	NA
High Rate Treatment	NA	NA	NA	NA
Additonal Secondary Treatment	NA	NA	NA	NA
Green Stormwater Infrastructure				
Annual Cost Subtotals:	**$408,655**	**$48,019**	**$11,683**	**$0**

Total Annual O&M	**SPU-only**	**With Shared Costs**
General	**$456,675**	**$825,957**
Energy	**$11,683**	**$44,120**
Total	**$468,358**	**$815,368**

WTD Business Case Evaluation Results
Joint Consolidated Ship Canal Tunnel

WTD Borrowing Cost as Discount Rate (1)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
KC Comp tunnel	50	$237,140,000	$0	$283,516,963	($283,516,963)	($9,375,803)	0.0
Total Tunnel	50	$363,700,000	$0	$446,808,700	($446,808,700)	($14,775,801)	0.0

Budget Office Discount Rate (3)

Alternative	Lifetime	Initial Capital	Present Value: Benefits	Present Value: Costs (2)	Net	Net Equivalent Annual Cost	Benefit-Cost Ratio
KC Comp tunnel	50	$237,140,000	$0	$201,354,528	($201,354,528)	($14,590,119)	0.0
Total	50	$363,700,000	$0	$312,200,022	($312,200,022)	($22,621,967)	0.0

Notes: All costs are in 2010$.
(1) WTD Discount rate is 2.2%, based on recent WTD borrowing costs net of 3% annual inflation.
(2) Costs include risk and uncertainty, if estimated.
(3) Discount rate is 7% net of inflation, per the King County Budget Office.
The option with the largest net equivalent annualized cost is the financially preferred option.

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