Appendix G.5

South EBI – S Michigan St and Brandon St

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Appendix G.5.1

S Michigan St Site Alternatives

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S Michigan St Site Alternative

DSN039-WWT-1 (KC) or SEBI-SMichigan-KC-WWTF

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DSN039-WWT-1 (KC) or SEBI-SMichigan-KC-WWTF

Alternative DSN039-WWT-1 (KC) controls King County's S Michigan St CSOs by building an equalization basin and wet-weather treatment facility (WWTF) to store and treat CSOs prior to discharge into the Lower Duwamish Waterway. The WWTF would be located near the S Michigan St Regulator Station and designed to meet NPDES effluent water quality limits. This alternative is an independent alternative which would store or treat King County CSOs.

Design Criteria

- Conveyance from S Michigan St Regulator Station to WWTF (Common to Both CSO Treatment Processes)
    - CSO Peak Flow Rate for Sizing Conveyance to Influent Pump Station, Equalization Basin, and WWTF: 66.1 MGD
- Ballasted Sedimentation
    - WWTF and Influent Pump Station Peak Design Flow Rate: 40.0 MGD
    - Equalization Basin Volume: 0.86 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to S Michigan St Regulator Station: 40.0 MGD
    - CSO Peak Flow Rate for Sizing Outfall: Capacity of Existing S Michigan St CSO Outfall
- Chemically Enhanced Primary Treatment with Lamella Plates
    - WWTF and Influent Pump Station Peak Design Flow Rate: 41.0 MGD
    - Equalization Basin Volume: 0.77 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to S Michigan St Regulator Station: 41.0 MGD
    - CSO Peak Flow Rate for Sizing Outfall: Capacity of Existing S Michigan St CSO Outfall

Description

Alternative DSN039-WWT-1 (KC) consists of a WWTF to treat S Michigan CSOs, which discharge into the Lower Duwamish Waterway. The WWTF includes an influent pump station, equalization basin, screening facility, CSO treatment process, and disinfection. Modifications to the S Michigan St Regulator Station would be required for diversion of flows to the WWTF. Ancillary facilities include an odor control facility, electrical/controls building, and emergency generator. The CSO treatment process could be either a) Ballasted Sedimentation or b) Chemically Enhanced Primary Treatment (CEPT) with Lamella Plates. See Section 6.1 and Appendix F.3 for more details about the treatment facilities and CSO treatment processes.

The WWTF could be located within or adjacent to the approximate boundary shown in Figure G.5.1-1. 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:

- Conveyance from S Michigan St Regulator Station to WWTF (Common to Both CSO Treatment Processes)
    - Modifications to the S Michigan St Regulator Station.
    - Up to approximately 1,920 ft of 54-inch-diameter influent gravity sewer to convey S Michigan St CSOs from the S Michigan St Regulator Station to the WWTF. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.5.1-1.
- CSO Treatment Processes (One of the Following)
    - Ballasted Sedimentation
        - 40.0-MGD WWTF.
        - 0.86-MG equalization basin.
        - 40.0-MGD influent pump station.
        - Up to approximately 1,920 ft of 42-inch-diameter effluent gravity sewer from the WWTF to the S Michigan St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.5.1-1.
        - Approximately 600 ft of 102-inch-diameter pipe for the extension of the existing CSO outfall. The alternative assumes that the outfall will be submerged and extended from the S Michigan St Outfall Station to the center of the Lower Duwamish Waterway[1].
    - Chemically Enhanced Primary Treatment with Lamella Plates
        - 41.0-MGD WWTF.
        - 0.77-MG equalization basin.
        - 41.0-MGD influent pump station.
        - Up to approximately 1,920 ft of 42-inch diameter effluent gravity sewer from the WWTF to the S Michigan St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.5.1-1.
        - Approximately 600 ft of 102-inch-diameter pipe for the extension of the existing CSO outfall. The alternative assumes a new CSO outfall will be submerged and extended from the S Michigan St Outfall Station to the center of the Lower Duwamish Waterway[1].

[1] Preliminary outfall assumptions (see Appendix F.3 for WWTF design criteria) were used during the alternatives development and evaluation process. Refined outfall design concepts and cost estimates were prepared separately from this technical memorandum and are included in *Technical Memorandum 954.03, Preliminary CSO Outfall Concepts Analysis*.

Wet-Weather Treatment Facility

Two treatment technologies have been developed for use in the CSO treatment processes for this alternative based on the findings of the *Technical Memorandum 700, Treatment Technology Selection.* Table 1 summarizes the unit processes of the WWTF that are included for each CSO treatment process evaluated. See Section 6.1 and Appendix E.3 for more details about the treatment facilities and CSO treatment processes.

Table 1. Unit Process for CSO Treatment Processes

Ballasted Sedimentation	CEPT with Lamella Plates
• Influent Pump Station, • Fine Screening, • Grit Removal, • Ballasted Sedimentation System, (including Chemical Feed System), • Solids Handling Facility, • Disinfection System, and • Facilities Building (odor control, electrical controls, standby generator).	• Influent Pump Station, • Coarse Screening, • CEPT System, (including Chemical Feed System and Additional Depth for Solids Handling), • Solids Handling Facility, • Disinfection System, and • Facilities Building (odor control, electrical controls, standby generator).

Equalization Basin

The equalization basin allows for shaving peak flows to the WWTF. The shaving of peak flows results in a reduced design capacity requirement for the WWTF. In this alternative, CSOs would be pumped to the WWTF, and flows in excess of the hydraulic capacity of the WWTF would be diverted to the equalization basin prior to the WWTF. This operational mode ensures that CSOs are being treated, and the equalization basin is used only during peak wet-weather events that exceed the WWTF design capacity.

An alternate operational mode includes routing all flows to the equalization basin prior to sending flows to the WWTF to minimize operational costs associated with the WWTF. However, the capacity of the WWTF would need to increase to handle higher peak wet-weather events.

Flow Diversion and Discharge

The WWTF and equalization basin is located upstream of the S Michigan St Regulator Station and would store or treat King County CSOs diverted from the S Michigan St Regulator Station.

One regulator station will be required to divert King County flows from the S Michigan St Regulator Station to the WWTF and equalization basin. For this planning phase, it is assumed that the diversion would occur at the S Michigan St Regulator Station. Evaluation of whether flows can be diverted upstream of the regulator will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the WWTF and equalization basin via a 54-inch-diameter influent gravity sewer. The length of the gravity sewer will vary depending on the selected location of the WWTF, which will be evaluated during

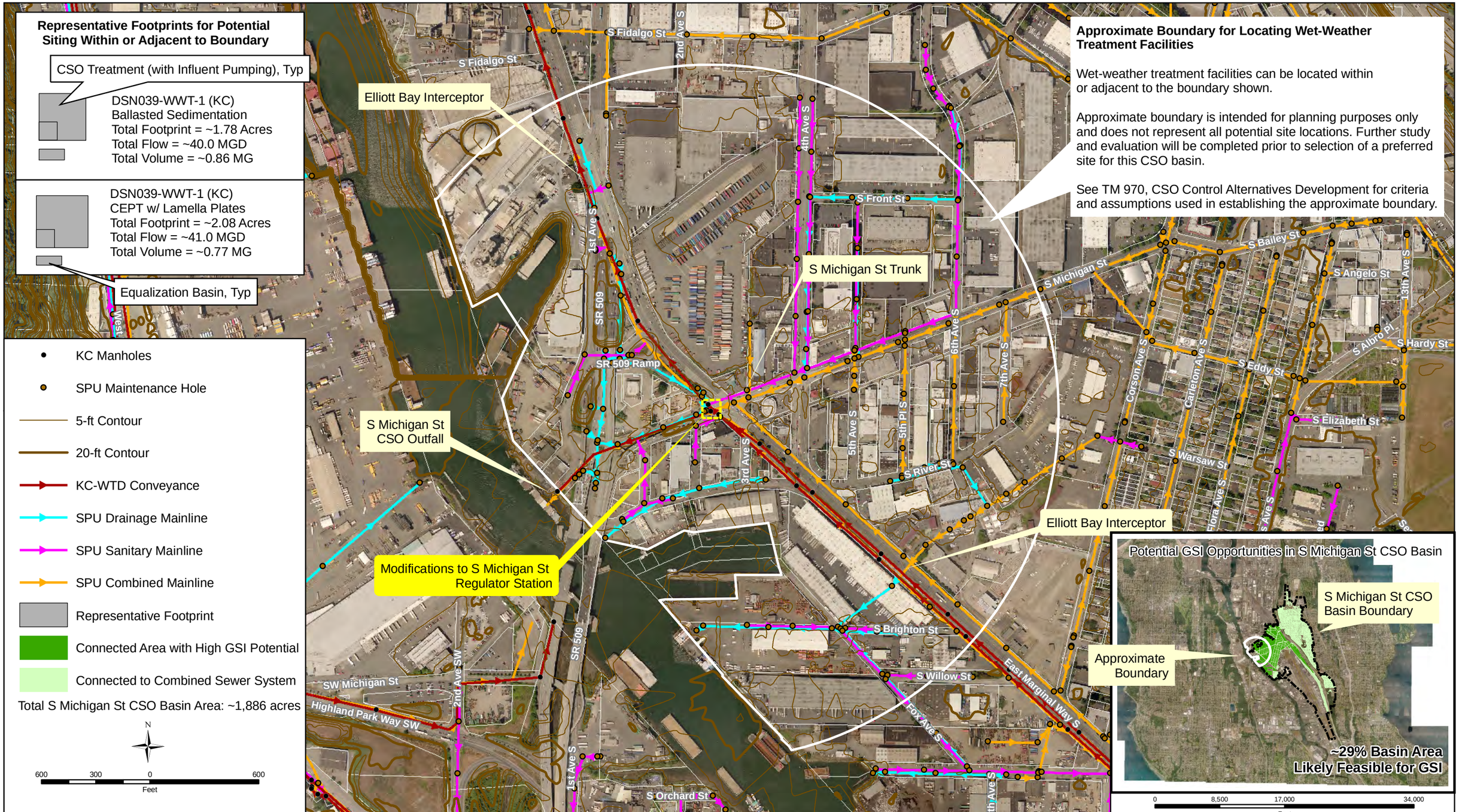
preferred alternative development. The gravity sewer can be up to 1,920 feet long based on the criteria and assumptions listed in Section 6.1.

Treated CSOs would be conveyed to the S Michigan St Regulator Station via a 42-inch-diameter effluent gravity sewer[2], up to approximately 1,920 feet in length. The length of the gravity sewer will vary depending on the selected location of the WWTF, which will be evaluated during preferred alternative development.

Treated and untreated CSOs would be conveyed via the existing CSO outfall from the S Michigan St Regulator Station to the S Michigan St Outfall Station. The flows would then be conveyed via the new extension of the CSO outfall from the S Michigan St Outfall Station to the Lower Duwamish Waterway. The outfall extension is approximately 600 feet long assuming the discharge is located at the center of the Lower Duwamish Waterway[3]. For planning purposes, the new outfall extension will be 102 inches in diameter to match the existing CSO outfall capacity. The length of the CSO outfall extension will be modified depending on the selected location of the discharge, which will be evaluated during preferred alternative development.

[2] The 42-inch-diameter effluent pipe would operate as a gravity sewer for the Ballasted Sedimentation alternative, but it would operate as a pressure sewer for the CEPT with Lamella Plates alternative at peak flow rates.

[3] Preliminary outfall assumptions (see Appendix F.3 for WWTF design criteria) were used during the alternatives development and evaluation process. Refined outfall design concepts and cost estimates were prepared separately from this technical memorandum and are included in *Technical Memorandum 954.03, Preliminary CSO Outfall Concepts Analysis*.



King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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File Name:

Data Source:

Figure G.5.1-1

S Michigan St - DSN039-WWT-1 (KC)
Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN039-WWT-1 (KC)

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)
DSN039 Michigan Regulator	66.1

Escalation Assumptions

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

Total Project Cost for Ballasted Sedimentation, 2010 Dollars

Description	Total Costs (S Michigan)
40.0-MGD Ballasted Sedimentation Construction Cost =	$14,480,000
0.86-MG Equalization Basin Construction Cost =	$4,990,000
40.0-MGD Influent Pump Station Construction Cost =	$9,250,000
Solids Handling Facility Construction Cost =	$1,760,000
Grit Removal Facility Construction Cost =	$310,000
Modifications to Michigan Regulator Construction Cost =	$490,000
Influent Gravity Sewer Construction Cost (1,920 LF of 54-inch-diameter pipe) =	$3,420,000
Effluent Gravity Sewer Construction Cost (1,920 LF of 42-inch-diameter pipe) =	$2,780,000
[3]Outfall Construction Cost (600 LF of 102-inch-diameter pipe) =	$3,670,000
SDOT Street Use Permit Fee Cost =	$430,000
Total Construction Cost =	$41,580,000
Sales Tax (10% of Construction Cost) =	$4,160,000
[1]Allied Costs (46.22% of Construction Cost) =	$19,220,000
Property Cost =	$8,650,000
Subtotal of Project Cost =	$73,610,000
[1]Construction Contingency (10% of Construction Cost) =	$4,160,000
[1, 2]Project Contingency =	$17,920,000
Total Project Cost for Ballasted Sedimentation, 2010 Dollars =	**$95,700,000**

[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)

[3]Placeholder Costs for CSO Outfall: Assume new CSO outfall extension at $60/in-dia/LF. This cost may be refined following the evaluation of wet-weather treatment facility CSO outfall options in the Duwamish River, which will include the preparation of the *CSO Treatment Plant Outfall Evaluation TM* .

Alternative DSN039-WWT-1 (KC)

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)
DSN039 Michigan Regulator	66.1

Escalation Assumptions

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

Total Project Cost for Chemically Enhanced Primary Treatment With Lamella Plates, 2010 Do

Description	Total Costs (S Michigan)
41.0-MGD CEPT with Lamella Construction Cost =	$12,710,000
0.77-MG Equalization Basin Construction Cost =	$4,580,000
41.0-MGD Influent Pump Station Construction Cost =	$9,450,000
Lamella Plates Construction Cost =	$860,000
Solids Handling Facility Construction Cost =	$2,360,000
Modifications to Michigan Regulator Construction Cost =	$490,000
Influent Gravity Sewer Construction Cost (1,920 LF of 54-inch-diameter pipe) =	$3,420,000
Effluent Gravity Sewer Construction Cost (1,920 LF of 42-inch-diameter pipe) =	$2,780,000
[3]Outfall Construction Cost (600 LF of 102-inch-diameter pipe) =	$3,670,000
SDOT Street Use Permit Fee Cost =	$430,000
Total Construction Cost =	$40,750,000
Sales Tax (10% of Construction Cost) =	$4,080,000
[1]Allied Costs (46.22% of Construction Cost) =	$18,830,000
Property Cost =	$10,530,000
Subtotal of Project Cost =	$74,190,000
[1]Construction Contingency (10% of Construction Cost) =	$4,080,000
[1, 2]Project Contingency =	$18,180,000
Total Project Cost for CEPT with Lamella Plates, 2010 Dollars =	**$96,500,000**

[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)

[3]Placeholder Costs for CSO Outfall: Assume new CSO outfall extension at $60/in-dia/LF. This cost may be refined following the evaluation of wet-weather treatment facility CSO outfall options in the Duwamish River, which will include the preparation of the *CSO Treatment Plant Outfall Evaluation TM.*

WET-WEATHER TREATMENT FACILITY COSTS

Wet-Weather Treatment Facility - Design Flow Rate

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Ballasted Sedimentation Reduced CSO Peak Flow Rate[1] (MGD)	CEPT with Lamella Plates Reduced CSO Peak Flow Rate[1] (MGD)
DSN039 Michigan Regulator	66.1	40.0	41.0

[1]Reduction in peak flow rate due to incorporation of an equalization basin.

Wet-Weather Treatment Facility - Construction Costs (2010 Dollars)

Description	Ballasted Sedimentation	CEPT with Lamella Plates
Treatment Facility	$14,479,660	$12,705,135
Influent Pump Station	$9,249,832	$9,451,104
Solids Handling Facility	$1,760,195	$2,355,000
Grit Removal Facility	$310,436	$0
Lamella Plates	$0	$863,137
Regulator Station	$485,000	$485,000
Total Construction Costs	$26,285,123	$25,859,376

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EQUALIZATION BASIN FOR BALLASTED SEDIMENTATION - 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: 0.86 Mgal
Facility Footprint: 10500 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	1,170.00	SY	$43	$50,200
Dewatering	1	LS	$944,000	$944,000
Odor Control	1	LS	$151,000	$151,000
Effluent Pump Station	1	LS	$212,000	$212,000
Construction Cost	0.9	Mgal	4,000,000	$3,440,000
			Year 2008 Subtotal	$4,800,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,990,000

EQUALIZATION BASIN FOR CEPT WITH LAMELLA PLATES - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Equalization Basin_CEPT
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.).

Assumptions

Construction Year: 2010
Storage Capacity: 0.77 Mgal
Facility Footprint: 9000 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	1,000.00	SY	$43	$43,000
Dewatering	1	LS	$936,000	$936,000
Odor Control	1	LS	$137,000	$137,000
Effluent Pump Station	1	LS	$209,000	$209,000
Construction Cost	0.8	Mgal	4,000,000	$3,080,000
			Year 2008 Subtotal	$4,400,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,580,000

MODIFICATIONS TO S MICHIGAN ST REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
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
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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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: 1917 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: 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	11,400.00	CY	$13	$148,000
Backfill	6,200.00	CY	$34	$211,000
Complete Pavement Restoration	2,490.00	SY	$86	$214,000
Overlay Pavement Restoration	6,880.00	SY	$28	$193,000
Trench Safety	63,400.00	SF	$17	$1,080,000
Spoil Load and Haul	11,400.00	CY	$16	$182,000
Pipe Unit Material Cost	1,920.00	lf	$168	$322,000
Pipe Installation	1,920.00	lf	$70	$134,000
Place Pipe Zone Fill	3,480.00	CY	$34	$118,000
Manholes	4	MH	$15,400	$61,500
Existing Utilities	1,920.00	lf	$166	$318,000
Dewatering	1,920.00	lf	$127	$243,000
Traffic Control	1,920.00	lf	$36	$69,000
			Year 2008 Subtotal	$3,290,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$3,420,000

Year 2010 Total: $3,420,000

EFFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Effluent 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: 1917 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: 42 in.

Geometry

Outer Diameter	4.25	ft
Trench Width	8.03	ft
Excavation Depth	15.3	ft
Complete Surface Rest. Width	10	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	8,690.00	CY	$13	$113,000
Backfill	5,130.00	CY	$34	$174,000
Complete Pavement Restoration	2,140.00	SY	$86	$184,000
Overlay Pavement Restoration	7,240.00	SY	$28	$203,000
Trench Safety	58,500.00	SF	$17	$994,000
Spoil Load and Haul	8,690.00	CY	$16	$139,000
Pipe Unit Material Cost	1,920.00	lf	$86	$165,000
Pipe Installation	1,920.00	lf	$52	$99,700
Place Pipe Zone Fill	2,550.00	CY	$34	$86,800
Manholes	4	MH	$9,720	$38,900
Existing Utilities	1,920.00	lf	$120	$230,000
Dewatering	1,920.00	lf	$107	$205,000
Traffic Control	1,920.00	lf	$24	$46,000
			Year 2008 Subtotal	$2,680,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$2,780,000

Year 2010 Total: $2,780,000

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)
DSN039 Michigan Regulator	$111.86	$22.44

Land Costs for Ballasted Sedimentation, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Influent Pump Station, Equalization Basin, Grit Removal, CSO Treatment Process (Ballasted Sedimentation), Disinfection, Solids Handling Facility, Odor Control/Electrical/Controls/Generator Building , Restrooms, Site Buffer, etc.	77,343	$111.86	100%	$8,651,588
			Total Land Costs	$8,651,588

Land Costs for Chemically Enhanced Primary Treatment with Lamella Plates, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Influent Pump Station, Equalization Basin, CSO Treatment Process (CEPT with Lamella Plates), Chemical Storage and Feed System, Disinfection, Odor Control/Electrical/Controls/Generator Building , Restrooms, Site Buffer, etc.	90,810	$111.86	100%	$10,158,007
Additional Solids Handling Facility	3,342	$111.86	100%	$373,839
			Total Land Costs	$10,531,845

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 S Michigan St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Gravity Sewer, First Phase of Construction	54	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer, Second Phase of Construction	54	917	44	40,348	85.6	9	$2.10	$84,731
Installation of Effluent Gravity Sewer, First Phase of Construction	42	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Effluent Gravity Sewer, Second Phase of Construction	42	917	44	40,348	85.6	9	$2.10	$84,731
							Total SDOT Street Use Fee Estimation:	$431,162

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Operations and Maintenance Cost Estimate Summary

Basin Name: South Michigan

Alternative Name: SEBI-SMichigan-KC-WWTF (Ballasted w/ UV)

ENR 1994	5747	*Acres of Raingarden for GSI*	**0.00**	
Current ENR	**8645.4**	*Annual Overflow Vol (MG)*	**91.20**	
Power Cost (per kwh)	**0.065**	*Annual Vol Capture*	**78.20**	
Labor rate (loaded) /hr	**51.17**	*Annual Events*	**25**	
SPU Water Cost $/CCF	**4.50**	*Stor Vol*	**0.86**	equalization
		Peak Flow Rate	**161.40**	
Carbon Cost/Lb	**2.00**	*Peak Flow Rate w/Equal*	**40.00**	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$5,798			
Force Mains	$0			
Regulator/Flow Control Structures	$0			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$1,656			
Pump Stations	$18,848	$55,910	$40,009	
Rectangular Storage Facilities	$22,170	$11,851	$5,030	$16,096
High Rate Treatment	$380,410	$7,042	$0	$41,170
Additonal Secondary Treatment	NA	$63,007	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$428,882**	**$137,809**	**$45,039**	**$57,266**

Total Annual O&M

General	**$623,957**
Energy	**$45,039**
Total	**$668,997**

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WTD Business Case Evaluation Results

S Michigan CSO Control Alternatives

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							
SEBI-SMichigan-KC-WWTF	50	$95,700,000	$123,841,099	$0	$123,841,099	$4,095,380	$4,095,380

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							
SEBI-SMichigan-KC-WWTF	50	$95,700,000	$83,920,623	$0	$83,920,623	$2,775,225	$2,775,225

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.5.2

Brandon St Site Alternatives

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Brandon St Site Alternative

DSN041-WWT-1 (KC) or SEBI-Brandon-KC-WWTF

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DSN041-WWT-1 (KC) or SEBI-Brandon-KC-WWTF

Alternative DSN041-WWT-1 (KC) controls King County's Brandon St CSOs by building an equalization basin and wet-weather treatment facility (WWTF) to store and treat CSOs prior to discharge into the Lower Duwamish Waterway. The WWTF would be located near the Brandon St Regulator Station and designed to meet NPDES effluent water quality limits. This alternative is an independent alternative which would store or treat King County CSOs.

Design Criteria

- Conveyance from Brandon St Regulator Station to WWTF (Common to Both CSO Treatment Processes)
    - CSO Peak Flow Rate for Sizing Conveyance to Influent Pump Station, Equalization Basin, and WWTF: 35.2 MGD
- Ballasted Sedimentation
    - WWTF and Influent Pump Station Peak Design Flow Rate: 24.0 MGD
    - Equalization Basin Volume: 0.41 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Brandon St Regulator Station: 24.0 MGD
    - CSO Peak Flow Rate for Sizing Outfall: Capacity of Existing Brandon St CSO Outfall
- Chemically Enhanced Primary Treatment with Lamella Plates
    - WWTF and Influent Pump Station Peak Design Flow Rate: 25.0 MGD
    - Equalization Basin Volume: 0.33 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Brandon St Regulator Station: 25.0 MGD
    - CSO Peak Flow Rate for Sizing Outfall: Capacity of Existing Brandon St CSO Outfall

Description

Alternative DSN041-WWT-1 (KC) consists of a WWTF to treat Brandon CSOs, which discharge into the Lower Duwamish Waterway. The WWTF includes an influent pump station, equalization basin, screening facility, CSO treatment process, and disinfection. Modifications to the Brandon St Regulator Station would be required for diversion of flows to the WWTF. Ancillary facilities include an odor control facility, electrical/controls building, and emergency generator. The CSO treatment process could be either a) Ballasted Sedimentation or b) Chemically Enhanced Primary Treatment (CEPT) with Lamella Plates. See Section 6.1 and Appendix F.3 for more details about the treatment facilities and CSO treatment processes.

The WWTF could be located within or adjacent to the approximate boundary shown in Figure G.5.2-1. 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:

- Conveyance from Brandon St Regulator Station to WWTF (Common to Both CSO Treatment Processes)
    - Modifications to the Brandon St Regulator Station.
    - Up to approximately 1,130 ft of 42-inch-diameter influent gravity sewer to convey Brandon St CSOs from the Brandon St Regulator Station to the WWTF. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.5.2-1.
- CSO Treatment Processes (One of the Following)
    - Ballasted Sedimentation
        - 24.0-MGD WWTF.
        - 0.41-MG equalization basin.
        - 24.0-MGD influent pump station.
        - Up to approximately 1,130 ft of 36-inch-diameter effluent gravity sewer from the WWTF to the Brandon St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.5.2-1.
        - Approximately 500 ft of 72-inch-diameter pipe for the extension of the existing CSO outfall. The alternative assumes that the outfall will be submerged and extended from the Brandon St Outfall Station to the center of the Lower Duwamish Waterway[1].
    - Chemically Enhanced Primary Treatment with Lamella Plates
        - 25.0-MGD WWTF.
        - 0.33-MG equalization basin.
        - 25.0-MGD influent pump station.
        - Up to approximately 1,130 ft of 36-inch diameter effluent gravity sewer from the WWTF to the Brandon St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.5.2-1.
        - Approximately 500 ft of 72-inch-diameter pipe for the extension of the existing CSO outfall. The alternative assumes a new CSO outfall will be submerged and extended from the Brandon St Outfall Station to the center of the Lower Duwamish Waterway[1].

[1] Preliminary outfall assumptions (see Appendix F.3 for WWTF design criteria) were used during the alternatives development and evaluation process. Refined outfall design concepts and cost estimates were prepared separately from this technical memorandum and are included in *Technical Memorandum 954.03, Preliminary CSO Outfall Concepts Analysis*.

Wet-Weather Treatment Facility

Two treatment technologies have been developed for use in the CSO treatment processes for this alternative based on the findings of the *Technical Memorandum 700, Treatment Technology Selection.* Table 1 summarizes the unit processes of the WWTF that are included for each CSO treatment process evaluated. See Section 6.1 and Appendix F.3 for more details about the treatment facilities and CSO treatment processes.

Table 1. Unit Process for CSO Treatment Processes

Ballasted Sedimentation	CEPT with Lamella Plates
• Influent Pump Station, • Fine Screening, • Grit Removal, • Ballasted Sedimentation System, (including Chemical Feed System), • Solids Handling Facility, • Disinfection System, and • Facilities Building (odor control, electrical controls, standby generator).	• Influent Pump Station, • Coarse Screening, • CEPT System, (including Chemical Feed System and Additional Depth for Solids Handling), • Solids Handling Facility, • Disinfection System, and • Facilities Building (odor control, electrical controls, standby generator).

Equalization Basin

The equalization basin allows for shaving peak flows to the WWTF. The shaving of peak flows results in a reduced design capacity requirement for the WWTF. In this alternative, CSOs would be pumped to the WWTF, and flows in excess of the hydraulic capacity of the WWTF would be diverted to the equalization basin prior to the WWTF. This operational mode ensures that CSOs are being treated, and the equalization basin is used only during peak wet-weather events that exceed the WWTF design capacity.

An alternate operational mode includes routing all flows to the equalization basin prior to sending flows to the WWTF to minimize operational costs associated with the WWTF. However, the capacity of the WWTF would need to increase to handle higher peak wet-weather events.

Flow Diversion and Discharge

The WWTF and equalization basin is located upstream of the Brandon St Regulator Station and would store or treat King County CSOs diverted from the Brandon St Regulator Station.

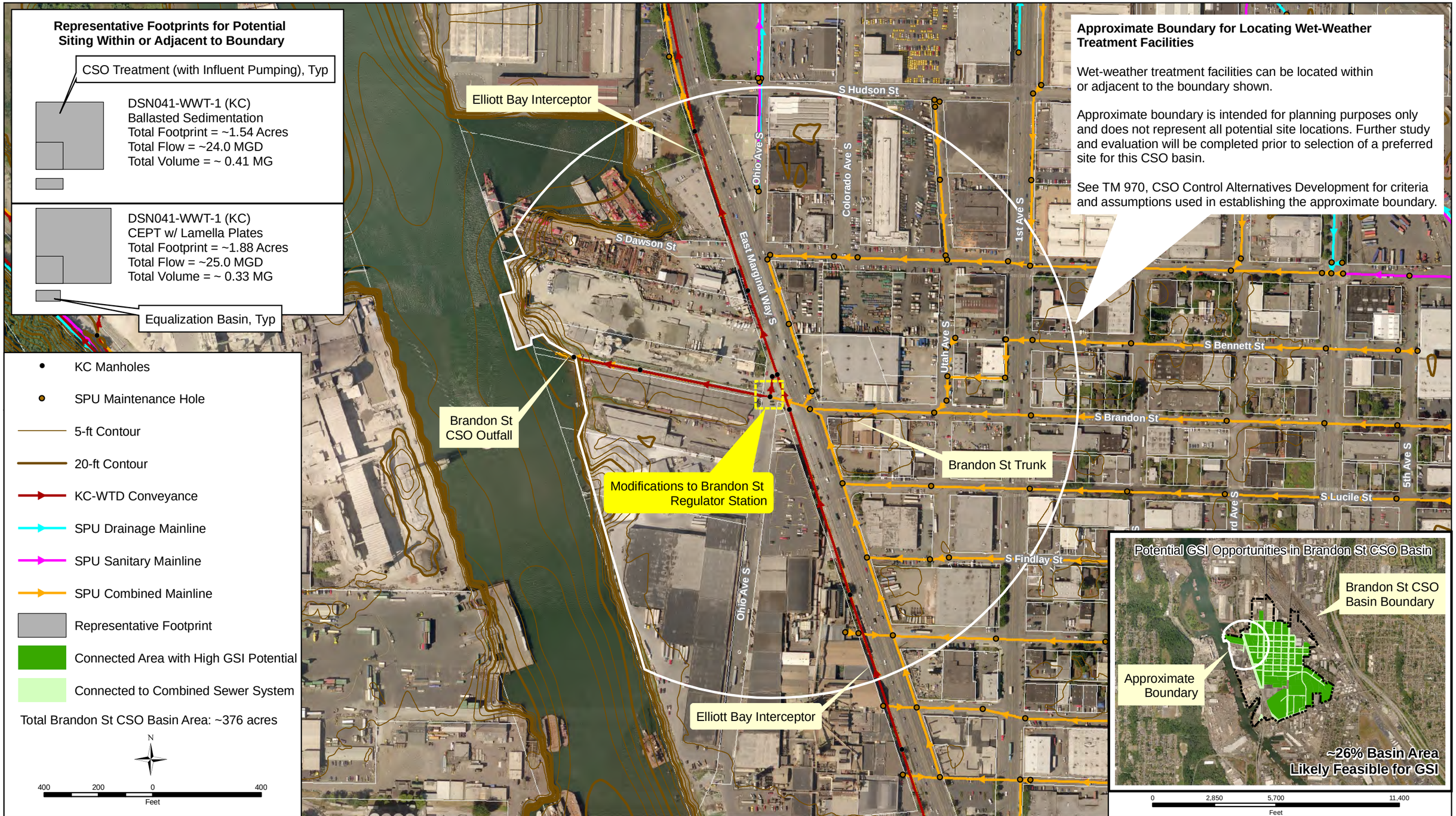
One regulator station will be required to divert King County flows from the Brandon St Regulator Station to the WWTF and equalization basin. For this planning phase, it is assumed that the diversion would occur at the Brandon St Regulator Station. Evaluation of whether flows can be diverted upstream of the regulator will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the WWTF and equalization basin via a 42-inch-diameter influent gravity sewer. The length of the gravity sewer will vary depending on the selected location of the WWTF, which will be evaluated during

preferred alternative development. The gravity sewer can be up to 1,130 feet long based on the criteria and assumptions listed in Section 6.1.

Treated CSOs would be conveyed to the Brandon St Regulator Station via a 36-inch-diameter effluent gravity sewer, up to approximately 1,130 feet in length. The length of the gravity sewer will vary depending on the selected location of the WWTF, which will be evaluated during preferred alternative development.

Treated and untreated CSOs would be conveyed via the existing CSO outfall from the Brandon St Regulator Station to the Brandon St Outfall Station. The flows would then be conveyed via the new extension of the CSO outfall from the Brandon St Outfall Station to the Lower Duwamish Waterway. The outfall extension is approximately 500 feet long assuming the discharge is located at the center of the Lower Duwamish Waterway[2]. For planning purposes, the new outfall extension will be 72 inches in diameter to match the existing CSO outfall capacity. The length of the CSO outfall extension will be modified depending on the selected location of the discharge, which will be evaluated during preferred alternative development.

[2] Preliminary outfall assumptions (see Appendix F.3 for WWTF design criteria) were used during the alternatives development and evaluation process. Refined outfall design concepts and cost estimates were prepared separately from this technical memorandum and are included in *Technical Memorandum 954.03, Preliminary CSO Outfall Concepts Analysis*.



King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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File Name:

Data Source:

Figure G.5.2-1

Brandon Street - DSN041-WWT-1 (KC)
Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN041-WWT-1 (KC)

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)
DSN041 Brandon Regulator	35.2

Escalation Assumptions

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

Total Project Cost for Ballasted Sedimentation, 2010 Dollars

Description	Total Costs (Brandon St)
24.0-MGD Ballasted Sedimentation Construction Cost =	$10,810,000
0.41-MG Equalization Basin Construction Cost =	$2,980,000
24.0-MGD Influent Pump Station Construction Cost =	$5,990,000
Solids Handling Facility Construction Cost =	$1,210,000
Grit Removal Facility Construction Cost =	$190,000
Modifications to Brandon St Regulator Construction Cost =	$490,000
Influent Gravity Sewer Construction Cost (1,130 LF of 42-inch-diameter pipe) =	$1,650,000
Effluent Gravity Sewer Construction Cost (1,130 LF of 36-inch-diameter pipe) =	$1,560,000
[3]Outfall Construction Cost (500 LF of 72-inch-diameter pipe) =	$2,160,000
SDOT Street Use Permit Fee Cost =	$200,000
Total Construction Cost =	$27,240,000
Sales Tax (10% of Construction Cost) =	$2,720,000
[1]Allied Costs (46.22% of Construction Cost) =	$12,590,000
Property Costs =	$7,680,000
Subtotal of Project Costs =	$50,230,000
[1]Construction Contingency (10% of Construction Cost) =	$2,720,000
[1, 2]Project Contingency =	$12,350,000
Total Project Cost for Ballasted Sedimentation, 2010 Dollars =	**$65,300,000**

[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]Placeholder Costs for CSO Outfall: Assume new CSO outfall extension at $60/in-dia/LF. This cost may be refined following the evaluation of wet-weather treatment facility CSO outfall options in the Duwamish River, which will include the preparation of the *CSO Treatment Plant Outfall Evaluation TM* .

Alternative DSN041-WWT-1 (KC)

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)
DSN041 Brandon Regulator	35.2

Escalation Assumptions

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

Total Project Cost for Chemically Enhanced Primary Treatment With Lamella Plates, 2010 Dollars

Description	Total Costs (Brandon St)
25.0-MGD CEPT with Lamella Construction Cost =	$9,390,000
0.33-MG Equalization Basin Construction Cost =	$2,640,000
25.0-MGD Influent Pump Station Construction Cost =	$6,200,000
Lamella Plates Construction Cost =	$530,000
Solids Handling Facility Construction Cost =	$250,000
Modifications to Brandon St Regulator Construction Cost =	$490,000
Influent Gravity Sewer Construction Cost (1,130 LF of 42-inch-diameter pipe) =	$1,650,000
Effluent Gravity Sewer Construction Cost (1,130 LF of 36-inch-diameter pipe) =	$1,560,000
[3]Outfall Construction Cost (500 LF of 72-inch-diameter pipe) =	$2,160,000
SDOT Street Use Permit Fee Cost =	$200,000
Total Construction Cost =	$25,070,000
Sales Tax (10% of Construction Cost) =	$2,510,000
[1]Allied Costs (46.22% of Construction Cost) =	$11,590,000
Property Costs =	$9,390,000
Subtotal of Project Costs =	$48,560,000
[1]Construction Contingency (10% of Construction Cost) =	$2,510,000
[1, 2]Project Contingency =	$12,060,000
Total Project Cost for CEPT with Lamella Plates, 2010 Dollars =	**$63,100,000**

[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]Placeholder Costs for CSO Outfall: Assume new CSO outfall extension at $60/in-dia/LF. This cost may be refined following the evaluation of wet-weather treatment facility CSO outfall options in the Duwamish River, which will include the preparation of the *CSO Treatment Plant Outfall Evaluation TM* .

WET-WEATHER TREATMENT FACILITY COSTS

Wet-Weather Treatment Facility - Design Flow Rate

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Ballasted Sedimentation Reduced CSO Peak Flow Rate[1] (MGD)	CEPT with Lamella Plates Reduced CSO Peak Flow Rate[1] (MGD)
DSN041 Brandon Regulator	35.2	24.0	25.0

[1]Reduction in peak flow rate due to incorporation of an equalization basin.

Wet-Weather Treatment Facility - Construction Costs (2010 Dollars)

Description	Ballasted Sedimentation	CEPT with Lamella Plates
Treatment Facility	$10,811,192	$9,391,919
Influent Pump Station	$5,993,159	$6,198,704
Solids Handling Facility	$1,211,812	$249,600
Grit Removal Facility	$186,262	$0
Lamella Plates	$0	$526,303
Regulator Station	$485,000	$485,000
Total Construction Costs	$18,687,424	$16,851,527

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EQUALIZATION BASIN FOR BALLASTED SEDIMENTATION - 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: 0.41 Mgal
Facility Footprint: 5500 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	501.00	SY	$43	$21,600
Dewatering	1	LS	$911,000	$911,000
Odor Control	1	LS	$93,400	$93,400
Effluent Pump Station	1	LS	$201,000	$201,000
Construction Cost	0.41	Mgal	4,000,000	$1,640,000
			Year 2008 Subtotal	$2,867,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$2,981,700

EQUALIZATION BASIN FOR CEPT WITH LAMELLA PLATES - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Equalization Basin_CEPT
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.).

Assumptions

Construction Year: 2010
Storage Capacity: 0.33 Mgal
Facility Footprint: 5000 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	367.00	SY	$43	$15,800
Dewatering	1	LS	$911,000	$911,000
Odor Control	1	LS	$93,400	$93,400
Effluent Pump Station	1	LS	$201,000	$1,320,000
Construction Cost	0.33	Mgal	4,000,000	$2,541,200
			Year 2008 Subtotal	$2,643,000

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

Construction Year 2010 Subtotal $2,643,000

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: 1130 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: 42 in.

Geometry

Outer Diameter	4.25	ft
Trench Width	8.03	ft
Excavation Depth	15.3	ft
Complete Surface Rest. Width	10	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	5,120.00	CY	$13	$66,600
Backfill	3,020.00	CY	$34	$103,000
Complete Pavement Restoration	1,260.00	SY	$86	$108,000
Overlay Pavement Restoration	4,270.00	SY	$28	$119,000
Trench Safety	34,500.00	SF	$17	$586,000
Spoil Load and Haul	5,120.00	CY	$16	$82,000
Pipe Unit Material Cost	1,130.00	lf	$86	$97,200
Pipe Installation	1,130.00	lf	$52	$58,800
Place Pipe Zone Fill	1,510.00	CY	$34	$51,200
Manholes	3	MH	$9,270	$29,200
Existing Utilities	1,130.00	lf	$120	$136,000
Dewatering	1,130.00	lf	$107	$121,000
Traffic Control	1,130.00	lf	$24	$27,100
			Year 2008 Subtotal	$1,580,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$1,650,000

Year 2010 Total: $1,650,000

EFFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Effluent 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: 1130 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: 36 in.

Geometry

Outer Diameter	3.67	ft
Trench Width	7.27	ft
Excavation Depth	14.7	ft
Complete Surface Rest. Width	9.27	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	4,460.00	CY	$13	$58,000
Backfill	2,740.00	CY	$34	$93,100
Complete Pavement Restoration	1,160.00	SY	$86	$100,000
Overlay Pavement Restoration	4,360.00	SY	$28	$122,000
Trench Safety	23,100.00	SF	$17	$563,000
Spoil Load and Haul	4,460.00	CY	$16	$71,400
Pipe Unit Material Cost	1,130.00	lf	$77	$87,000
Pipe Installation	1,130.00	lf	$45	$50,900
Place Pipe Zone Fill	1,280.00	CY	$34	$43,600
Manholes	3	MH	$9,720	$29,200
Existing Utilities	1,130.00	lf	$120	$136,000
Dewatering	1,130.00	lf	$107	$121,000
Traffic Control	1,130.00	lf	$24	$27,100
			Year 2008 Subtotal	$1,500,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$1,560,000

Year 2010 Total: $1,560,000

MODIFICATIONS TO BRANDON ST REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
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
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)
DSN041 Brandon Regulator	$114.18	$22.12

Land Costs for Ballasted Sedimentation, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Influent Pump Station, Equalization Basin, Grit Removal, CSO Treatment Process (Ballasted Sedimentation), Disinfection, Solids Handling Facility, Odor Control/Electrical/Controls/Generator Building , Restrooms, Site Buffer, etc.	67,255	$114.18	100%	$7,679,176
			Total Land Costs	$7,679,176

Land Costs for Chemically Enhanced Primary Treatment with Lamella Plates, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Influent Pump Station, Equalization Basin, CSO Treatment Process (CEPT with Lamella Plates), Chemical Storage and Feed System, Disinfection, Odor Control/Electrical/Controls/Generator Building , Restrooms, Site Buffer, etc.	81,862	$114.18	100%	$9,347,003
Additional Solids Handling Facility	356	$114.18	100%	$40,648
			Total Land Costs	$9,387,651

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 Brandon St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Gravity Sewer, First Phase of Construction	42	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer, Second Phase of Construction	42	130	44	5,720	12.1	2	$0.20	$1,144
Installation of Effluent Gravity Sewer, First Phase of Construction	36	1,000	22	22,000	93.3	10	$2.90	$63,800
Installation of Effluent Gravity Sewer, Second Phase of Construction	36	130	22	2,860	12.1	2	$0.20	$572
							Total SDOT Street Use Fee Estimation:	$199,616

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Operations and Maintenance Cost Estimate Summary

Basin Name: Brandon

Alternative Name: SEBI-Brandon-KC-WWTF (Ballasted w/ UV)

		Acres of Raingarden for GSI	**0.00**	
ENR 1994	5747	*Annual Overflow Vol (MG)*	**29.90**	
Current ENR	**8645.4**	*Annual Vol Capture*	**23.90**	
Power Cost (per kwh)	**0.065**	*Annual Events*	**16**	
Labor rate (loaded) /hr	**51.17**	*Stor Vol*	**0.41**	Equalization
SPU Water Cost $/CCF	**4.50**	*Peak Flow Rate*	**106.50**	
Carbon Cost/Lb	**2.00**	*Peak Flow Rate w/equal*	**24.00**	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$3,413			
Force Mains	$0			
Regulator/Flow Control Structures	$0			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$1,656			
Pump Stations	$17,692	$55,480	$30,055	
Rectangular Storage Facilities	$13,354	$3,896	$2,371	$7,674
High Rate Treatment	$290,607	$3,477	$0	$12,583
Additonal Secondary Treatment	NA	$19,257	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$326,721**	**$82,110**	**$32,427**	**$20,256**

Total Annual O&M

General	**$429,088**
Energy	**$32,427**
Total	**$461,515**

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WTD Business Case Evaluation Results

Brandon CSO Control Alternatives

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

Scenario Alternatives	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
1 Brandon WWTF	50	$65,300,000	$84,772,065	$0	$84,772,065	$2,803,381	$2,803,381

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

Scenario Alternatives	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
1 Brandon WWTF	50	$65,300,000	$57,338,785	$0	$57,338,785	$1,896,173	$1,896,173

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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Brandon St Site Alternative

DSN041-SEP-1 (KC) or SEBI-Brandon-KC-SEP

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DSN041-SEP-1 (KC) or SEBI-Brandon-KC-SEP

Alternative DSN041-SEP-1 (KC) controls King County's Brandon St CSOs by separating the combined sewer system (CSS) into separate systems to manage storm and sanitary flows. This alternative assumes full separation where the existing CSS becomes a separated storm sewer system, and a new sanitary sewer system is constructed. This alternative is an independent alternative which would control King County CSOs.

Design Criteria

- King County CSO Peak Flow Rate: 35.2 MGD
- Sanitary Peak Flow Rate (Peak DWF): 0.4 MGD[1]

Description

Alternative DSN041-SEP-1 (KC) consists of full separation of the Brandon St CSO Basin, approximately 288 acres of flat terrain in an industrial/commercial area. The alternative consists of converting the existing CSS to a separated storm sewer system and constructing a new separated sanitary sewer system. For planning-level purposes, this alternative has been developed assuming a vacuum sewer system as the new sanitary sewer system. However, the sanitary sewer system will be finalized during preferred alternative development. Options include conventional gravity sewers, vacuum sewers, grinder pump systems, and pump station systems. This alternative assumes that the existing Brandon St CSO Outfall would be converted to a storm outfall, eliminating the Brandon St CSO Outfall. See Section 6.1 and Appendix F.3 for more details about sewer separation and CSO control processes.

The main components of this alternative would include:

- New separated sanitary sewer system
    - A central vacuum station.
    - Approximately 250 vacuum valve pits (assumed one vacuum pit per parcel in the Brandon St CSO Basin).
    - Modifications to approximately 250 side sewer connections (assumed one side sewer connection per parcel in the Brandon St CSO Basin).
    - Up to approximately 27,200 ft of 4-inch-diameter[2] vacuum sewers to convey sanitary sewer flows into the Elliott Bay Interceptor (EBI). Area to be fully separated is shown in Figure G.5.2-2.
- Combined sewer system
    - Reuse existing CSS as new storm sewer system. Area to be fully separated is shown in Figure G.5.2-2.
- Stormwater Treatment

[1]Peak dry weather flow (DWF) based on flow monitoring of the Brandon Trunk in August 2009. Additional flow monitoring may be required to finalize design sanitary flow rate.
[2]Cost estimate of new sanitary sewer system assumed vacuum sewers that are 4 inches in diameter for planning purposes only. Diameters will be further evaluated during preferred alternative development.

- Stormwater discharges need to meet water quality standards under the City of Seattle's Drainage Code.
- Utilize on-site best management practices (BMPs) that include:
  - Bioretention,
  - Green roofs,
  - Permeable pavement, and
  - Filterra® units.

- Modifications to the Brandon St Regulator Station.

Sewer Separation

Alternative DSN041-SEP-1 (KC) consists of installing a new sanitary sewer system parallel to the existing combined sewer system that will discharge into the EBI. For planning-level purposes, it is assumed that the new separated sanitary sewer system would be a forced vacuum system.

Sanitary flows from each of the parcels would be routed via gravity to a vacuum valve and vault. A vacuum station, housing two or more vacuum pumps, would induce a negative pressure and draw from the vacuum sewers connected to each individual vacuum valve vault. The maximum expected lift is between approximately 30 and 40 feet.

For this alternative, the central vacuum station would be located adjacent to the EBI. As air is drawn through the system, sewer gasses are extracted; thus, odor control would be required to reduce odors.

Table 1 summarizes the main components assumed with the vacuum sewer system for this alternative in the Brandon St CSO Basin.

Table 1. Components for Vacuum Sewer Separation Process

- Up to approximately 250 vacuum valve pits (1 per parcel) included in the 8 blocks of project area.
- Side sewer connection/separation for up to 250 parcels.
- Up to approximately 27,200 ft of 4-inch-diameter vacuum sewers from the side sewers to the Central Vacuum Station.
- Central Vacuum Station, consisting of at least 3 vacuum pumps and a collection tank housed in a building.
- Ancillary Facilities: Generator and Odor control system

Flow Diversion and Discharge

A new discharge structure into the EBI will be required for this alternative. Sanitary sewer flows collected from the Brandon St CSO Basin area would discharge into a new discharge structure located adjacent to the EBI. Final location of the discharge structure will be evaluated during preferred alternative development. The Brandon St Regulator Station would be abandoned.

Storm sewer flows would be conveyed via the existing CSO outfall from the Brandon St CSO Outfall Station into the Lower Duwamish Waterway. For planning purposes, it is assumed no modifications to the existing outfall station and outfall would be required.

Stormwater Treatment

Sewer separation provides the ability to route sanitary flows to the EBI while stormwater continues to discharge into the Lower Duwamish Waterway. Sewer separation does not eliminate the contamination that is inherently associated with stormwater discharges, namely oil, grease, floatables, heavy metals, and organics. Regulatory requirements will require treatment for the stormwater discharges to satisfy water quality standards into the Lower Duwamish Waterway.

To satisfy water quality standards, impervious areas for each parcel and right-of-way would be routed to an appropriate BMP. For this alternative, the Brandon St CSO Basin was divided into units, and each parcel was evaluated for available area for BMPs and amount of impervious area.

For parcels with difficult siting or with contamination issues, Filterra® units were used to meet the water quality standards. Filterra® units are approved by the Washington Department of Ecology to treat stormwater. They meet or exceed water quality criteria for total suspended solids (TSS), heavy metals, and organics. Filterra® units are self-contained bioretention and are sized to treat runoff from a pre-determined area.

Since the objective of stormwater treatment is water quality, infiltration was not a requirement, and rain gardens and permeable pavement were sized to provide the maximum treatment and included underdrains.

Additional modeling would be needed to determine the overall pollutant loading reduction from this alternative.

Construction Assumptions

King County's Tabula cost estimating program, vendor quotes, and costs from similar project experience was used to develop a Class 5 estimate for this alternative. The attached documentation lists the construction assumptions used.

- New 4-inch-diameter vacuum sewers—Costs were estimated in the conveyance pipe costing tool of Tabula.
- Vacuum sewer system—A vendor quote for the proposed vacuum system was provided by Air-Vac.
- Side sewer connections—A unit cost per connection was derived from previous King County project experience and applied to this alternative.
- Stormwater treatment—Cost estimates for green stormwater infrastructure were used to estimate stormwater treatment costs. Sizing was determined using City of Seattle Pre-Sized Calculator for water quality. Filterra® costs and sizing were provided by a local distributor.

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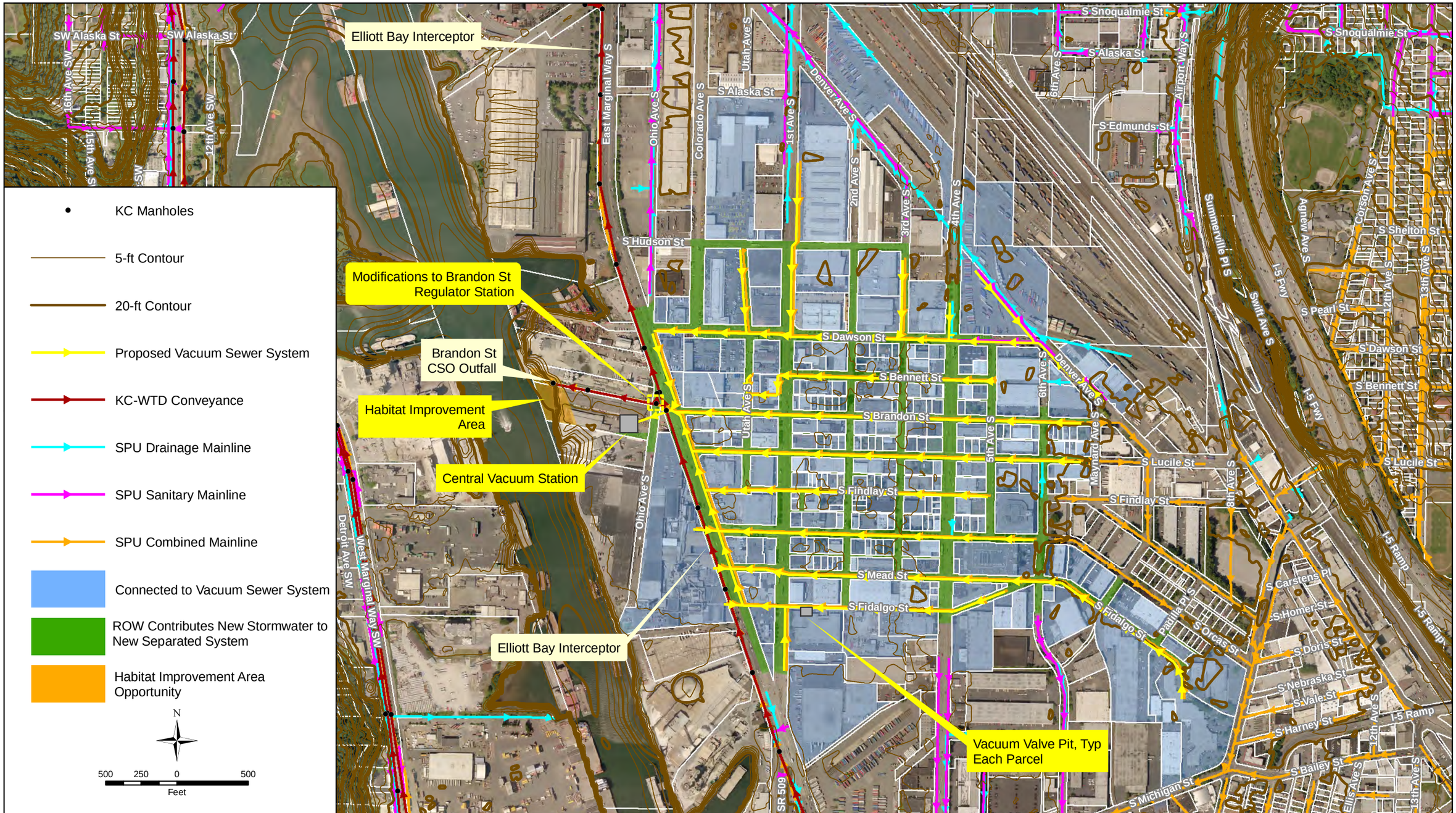

King County
Department of
Natural Resources and Parks
Wastewater Treatment Division

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File Name:

Data Source:

Figure G.5.2-2

Brandon Street - DSN041-SEP-1 (KC)
New Separated System

TM 970, CSO Control Alternatives Development

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Alternative DSN041-SEP-1 (KC)

Escalation Assumptions

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

Total Project Cost for Sewer Separation, 2010 Dollars

Description	Total Costs (Brandon)
Central Vacuum Station Construction Cost =	$2,030,000
[1,5] Vacuum Valve Pit Construction Cost (250 Parcels) =	$500,000
[2,5] Side Sewer Connection/Separation Cost (250 Parcels) =	$7,500,000
Modifications to Brandon Street Regulator Construction Cost =	$490,000
Vacuum Sewer Construction Cost (27,200 LF of 4-inch-diameter pipe) =	$6,040,000
[6]Storm Water Treatment Cost =	$17,210,000
SDOT Street Use Permit Fee Cost =	$420,000
Total Construction Cost =	$34,190,000
Sales Tax (10% of Construction Cost) =	$3,420,000
[3]Allied Costs (46.07% of Construction Cost) =	$15,750,000
Property Cost =	$1,780,000
Subtotal of Project Cost =	$55,140,000
[4] Construction Contingency (10% of Construction Cost) =	$3,420,000
[3, 4] Project Contingency =	$13,120,000
Total Project Cost for Sewer Separation, 2010 Dollars =	**$71,700,000**

[1] Total Vacuum Valve Pits Construction Cost = $2,000/pit * 1 pit/parcel * 250 parcels.

[2] Total Side Sewer Connection/Separation Cost = $ 30,000/parcel * 250 parcels (includes temporary easements)

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

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

[5]Number of parcels based on King County GIS.

[6]Storm Water Treatment Cost includes GSI improvements in streets, alleys, and parcels.

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CENTRAL VACUUM STATION

Assumptions
1) Information from AirVAC - Central vacuum system would consist of 3 - 25 hp pumps .
2) Station located abovegrade in a building and a 4000-gallon collection tank.

Central Vacuum Station

Description	Unit	Qty	Cost	Total	Source
Central Vacuum System	ea	1	$300,000	$300,000	AirVAC
Generator	ea	1	$250,000	$250,000	Engineer's Estimate
Building	sf	2500	$400	$1,000,000	Engineer's Estimate
Site/Civil	LS	1	$200,000	$200,000	Engineer's Estimate
Electrical/Instrumentation	LS	1	$275,000	$275,000	Engineer's Estimate
			Total Construction Costs	$ 2,025,000	

VACUUM SEWERS - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Vacuum Sewers
Printed date : 02/03/2011

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: 27200 ft
Conduit Type: Force Main
Depth of Cover: 4 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: Standard
Pipe Diameter: 8 in.

Geometry

Outer Diameter	0.754	ft
Trench Width	3.48	ft
Excavation Depth	5.75	ft
Complete Surface Rest. Width	5.48	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	20,200.00	CY	$13	$262,000
Backfill	10,500.00	CY	$34	$358,000
Complete Pavement Restoration	16,600.00	SY	$86	$1,420,000
Trench Safety	313,000.00	SF	$1	$166,000
Spoil Load and Haul	20,200.00	CY	$16	$323,000
Pipe Unit Material Cost	27,200.00	lf	$30	$816,000
Pipe Installation	27,200.00	lf	$22	$598,000
Place Pipe Zone Fill	9,210.00	CY	$34	$313,000
Existing Utilities	27,200.00	lf	$32	$870,000
Dewatering	27,200.00	lf	$80	$2,180,000
Traffic Control	27,200.00	lf	$16	$435,000
			Year 2008 Subtotal	$7,740,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$8,050,000
Construction Year 2010 Subtotal (1"-4" dia), Assumed as 75% of 8" dia force main costs.	$6,037,500

MODIFICATIONS TO BRANDON STREET REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
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
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)
DSN041 Brandon Regulator	$114.18	$22.12

Land Costs, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Central Vacuum Station	15,625	$114.18	100%	$1,784,063
			Total Land Costs	$1,784,063

SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.

Closure of construction area will occur in phases. Assumed construction phasing in:	2,000	ft segments
Assumed production rate during working days =	25	LF/d
Width is based on the trench width for 4" FM in Tabula.	3.5	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
Brandon Regulator Structure	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Vacuum Sewer, First Phase of Construction	4	2,000	3.5	7,000	112.0	12	$4.50	$31,500
Installation of Vacuum Sewer, Second Phase of Construction	4	2,000	3.5	7,000	112.0	12	$4.50	$31,500
Installation of Vacuum Sewer, Third Phase of Construction	4	2,000	3.5	7,000	112.0	12	$4.50	$31,500
Installation of Vacuum Sewer, Fourth Phase of Construction	4	2,000	3.5	7,000	112.0	12	$4.50	$31,500
Installation of Vacuum Sewer, Fifth Phase of Construction	4	2,000	3.5	7,000	112.0	12	$4.50	$31,500
Installation of Vacuum Sewer, Sixth Phase of Construction	4	2,000	3.5	7,000	112.0	12	$4.50	$31,500
Installation of Vacuum Sewer, Seventh Phase of Construction	4	2,000	3.5	7,000	112.0	12	$4.50	$31,500
Installation of Vacuum Sewer, Eigth Phase of Construction	4	2,000	3.5	7,000	112.0	12	$4.50	$31,500
Installation of Vacuum Sewer, Ninth Phase of Construction	4	2,000	3.5	7,000	112.0	12	$4.50	$31,500
Installation of Vacuum Sewer, Tenth Phase of Construction	4	2,000	3.5	7,000	112.0	12	$4.50	$31,500
Installation of Vacuum Sewer, Eleventh Phase of Construction	4	2,000	3.5	7,000	112.0	12	$4.50	$31,500
Installation of Vacuum Sewer, Twelvth Phase of Construction	4	2,000	3.5	7,000	112.0	12	$4.50	$31,500
Installation of Vacuum Sewer, Thirteenth Phase of Construction	4	2,000	3.5	7,000	112.0	12	$4.50	$31,500
Installation of Vacuum Sewer, Fourteenth Phase of Construction	4	1,200	3.5	4,200	67.2	7	$1.30	$5,460
							Total SDOT Street Use Fee Estimation:	$421,460

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Operations and Maintenance Cost Estimate Summary

Basin Name: Brandon

Alternative Name: SEBI-Brandon-KC-SEP

		Acres of Raingarden for GSI	**0.00**
ENR 1994	5747	*Annual Overflow Vol (MG)*	**29.90**
Current ENR	**8645.4**	*Annual Vol Captured*	
Power Cost (per kwh)	**0.065**	*Annual Events*	**16**
Labor rate (loaded) /hr	**51.17**	*Stor Vol*	
SPU Water Cost $/CCF	**4.50**	*Peak Flow Rate*	**106.50**
Carbon Cost/Lb	**2.00**	*Peak Flow Rate w/equal*	**24.00**

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	$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	$0	NA	NA
Vacume System	$9,000	$54,704	$5,260	
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$9,000**	**$54,704**	**$5,260**	**$0**

Total Annual O&M

General	**$63,704**
Energy	**$5,260**
Total	**$68,964**

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WTD Business Case Evaluation Results

Brandon CSO Control Alternatives

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

Scenario Alternatives	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
2 Brandon Separation	50	$71,700,000	$69,564,877	$0	$69,564,877	$2,300,485	$2,300,485

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

Scenario Alternatives	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
2 Brandon Separatio	50	$71,700,000	$56,316,492	$0	$56,316,492	$1,862,366	$1,862,366

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.5.3

Consolidated Alternatives – S Michigan St and Brandon St

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Consolidated Alternatives – SMichigan St and Brandon St

DSN039/041-WWT-1 (KC) or
SEBI-Cons Brandon-SMichigan-KC-WWTF
(New Conveyance)

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DSN039/041-WWT-1 (KC) or SEBI-Cons Brandon-S Michigan-KC-WWTF (New Conveyance)

Alternative DSN039/041-WWT-1 (KC) controls King County's S Michigan St and Brandon St CSOs by building an equalization basin and wet-weather treatment facility (WWTF) to store and treat CSOs prior to discharge into the Lower Duwamish Waterway. The WWTF would be located near the S Michigan St Regulator Station and designed to meet NPDES effluent water quality limits. This alternative is an independent alternative which would store or treat King County CSOs.

This alternative includes new conveyance to convey flows from the Brandon St and S Michigan St Regulator Stations to the WWTF.

Design Criteria

- Conveyance from S Michigan St Regulator Station to WWTF (Common to Both CSO Treatment Processes)
    - CSO Peak Flow Rate for Sizing Conveyance from Brandon St Regulator Station to Influent Pump Station, Equalization Basin and WWTF: 35.2 MGD (Brandon St CSOs)
    - CSO Peak Flow Rate for Sizing Conveyance from S Michigan St Regulator Station to Influent Pump Station, Equalization Basin, and WWTF: 66.1 MGD (S Michigan St CSOs)
- Ballasted Sedimentation
    - WWTF and Influent Pump Station Peak Design Flow Rate: 66.0 MGD
    - Equalization Basin Volume: 0.89 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to S Michigan St Regulator Station: 66.0 MGD
    - CSO Peak Flow Rate for Sizing New Outfall[1]: 66.0 MGD
- Chemically Enhanced Primary Treatment with Lamella Plates
    - WWTF and Influent Pump Station Peak Design Flow Rate: 68.0 MGD
    - Equalization Basin Volume: 0.72 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to CSO Outfall: 68.0 MGD
    - CSO Peak Flow Rate for Sizing New Outfall[1]: 68.0 MGD

Description

Alternative DSN039/041-WWT-1 (KC) consists of a WWTF to treat S Michigan St and Brandon St CSOs, which discharge into the Lower Duwamish Waterway. The WWTF includes an influent pump station, equalization basin, screening facility, CSO treatment process, and disinfection. Modifications to both the Brandon St and S Michigan St Regulator Stations would

[1] Untreated CSOs will discharge to existing CSO outfalls (Brandon St and S Michigan St CSO Outfalls).

be required for diversion of flows to the WWTF. Ancillary facilities include an odor control facility, electrical/controls building, and emergency generator. The CSO treatment process could be either a) Ballasted Sedimentation or b) Chemically Enhanced Primary Treatment (CEPT) with Lamella Plates. See Section 6.1 and Appendix F.3 for more details about the treatment facilities and CSO treatment processes.

This alternative assumes that the WWTF would be located within or adjacent to the approximate solid boundary shown in Figure G.5.3-1. The WWTF could be located anywhere between the Brandon St Regulator Station and S Michigan St Regulator Station (indicated as dashed boundary in Figure G.5.3-1); however, conveyance would need to be re-evaluated if WWTF moves from the assumed location (solid boundary). See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundaries. The main components of this alternative would include:

- Conveyance from Brandon St and S Michigan St Regulator Stations to WWTF (Common to Both CSO Treatment Processes)
    - Modifications to the Brandon St and S Michigan St Regulator Stations.
    - Approximately 4,000 ft of 42-inch-diameter influent gravity sewer from the Brandon St Regulator Station to the WWTF. The length depends on the location selected for the WWTF within or adjacent to the approximate solid boundary shown in Figure G.5.3-1.
    - Up to approximately 2,320 ft of 54-inch-diameter influent gravity sewer from the S Michigan St Regulator Station to the WWTF. The length depends on the location selected for the WWTF within or adjacent to the approximate solid boundary shown in Figure G.5.3-1.
- CSO Treatment Process (One of the Following)
    - Ballasted Sedimentation
        - 66.0-MGD WWTF.
        - 0.89-MG equalization basin.
        - 66.0-MGD influent pump station.
        - Up to approximately 2,320 ft of 54-inch-diameter effluent gravity sewer from the WWTF to the S Michigan St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate solid boundary shown in Figure G.5.3-1.
        - Approximately 1,150 ft of 54-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the S Michigan St Regulator Station to the center of the Lower Duwamish Waterway[2].
    - Chemically Enhanced Primary Treatment with Lamella Plates

[2] Preliminary outfall assumptions (see Appendix F.3 for WWTF design criteria) were used during the alternatives development and evaluation process. Refined outfall design concepts and cost estimates were prepared separately from this technical memorandum and are included in *Technical Memorandum 954.03, Preliminary CSO Outfall Concepts Analysis*.

- 68.0-MGD WWTF.
- 0.72-MG equalization basin.
- 68.0-MGD influent pump station.
- Up to approximately 2,320 ft of 54-inch-diameter effluent gravity sewer from the WWTF to the S Michigan St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate solid boundary shown in Figure G.5.3-1.
- Approximately 1,150 ft of 54-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the S Michigan St Regulator Station to the center of the Lower Duwamish Waterway[3].

Wet-Weather Treatment Facility

Two treatment technologies have been developed for use in the CSO treatment processes for this alternative based on the findings of the *Technical Memorandum 700, Treatment Technology Selection.* Table 1 summarizes the unit processes of the WWTF that are included for each CSO treatment process evaluated. See Section 6.1 and Appendix F.3 for more details about the treatment facilities and CSO treatment processes.

Table 1. Unit Process for CSO Treatment Processes

Ballasted Sedimentation	CEPT with Lamella Plates
• Influent Pump Station, • Fine Screening, • Grit Removal, • Ballasted Sedimentation System (including Chemical Feed System), • Solids Handling Facility, • Disinfection System, and • Facilities Building (odor control, electrical controls, standby generator).	• Influent Pump Station, • Coarse Screening, • CEPT System (including Chemical Feed System and Additional Depth for Solids Handling), • Solids Handling Facility, • Disinfection System, and • Facilities Building (odor control, electrical controls, standby generator).

Equalization Basin

The equalization basin allows for shaving peak flows to the WWTF. The shaving of peak flows results in a reduced design capacity requirement for the WWTF. In this alternative, CSOs would be pumped to the WWTF, and flows in excess of the hydraulic capacity of the WWTF would be diverted to the equalization basin prior to the WWTF. This operational mode ensures that CSOs

[3] Preliminary outfall assumptions (see Appendix F.3 for WWTF design criteria) were used during the alternatives development and evaluation process. Refined outfall design concepts and cost estimates were prepared separately from this technical memorandum and are included in *Technical Memorandum 954.03, Preliminary CSO Outfall Concepts Analysis*.

are being treated, and the equalization basin is used only during peak wet-weather events that exceed the WWTF design capacity.

An alternate operational mode includes routing all flows to the equalization basin prior to sending flows to the WWTF to minimize operational costs associated with the WWTF. However, the capacity of the WWTF would need to increase to handle higher peak wet-weather events.

Flow Diversion and Discharge

The WWTF and equalization basin is located near the S Michigan St Regulator Station and would store or treat King County CSOs diverted from the S Michigan St and Brandon St Regulator Stations.

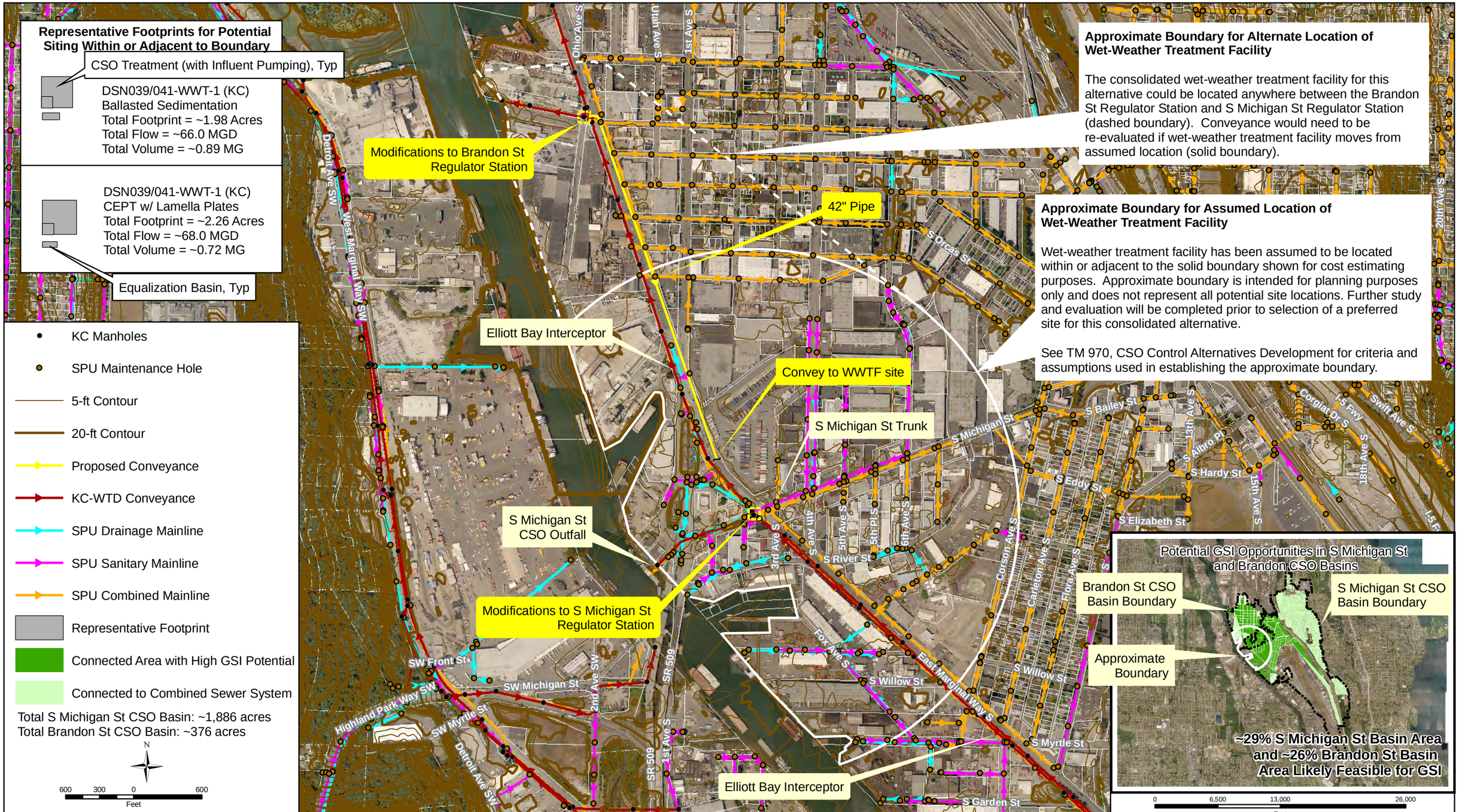
One regulator station will be required to divert King County flows (S Michigan St CSOs) from the S Michigan St Regulator Station to the WWTF and equalization basin. For this planning phase, it is assumed that the diversion would occur at the S Michigan St Regulator Station. Evaluation of whether flows can be diverted upstream of the regulator will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the WWTF and equalization basin via a 54-inch-diameter influent gravity sewer. The length of the gravity sewer will vary depending on the selected location of the WWTF, which will be evaluated during preferred alternative development. The gravity sewer can be up to 2,320 feet long based on the criteria and assumptions listed in Section 6.1.

Another regulator station will be required to divert King County flows (Brandon St CSOs) from the Brandon St Regulator Station to the WWTF. For this planning phase, it is assumed that the diversion would occur at the Brandon St Regulator Station, and flows would be conveyed to the WWTF via a 42-inch-diameter gravity sewer. The length of the gravity sewer will vary depending on the selected location of the WWTF, which will be evaluated during preferred alternative development. The gravity sewer is approximately 4,000 feet long based on the criteria and assumptions listed in Section 6.1.

Treated CSOs would be conveyed to the S Michigan St Regulator via a 54-inch-diameter effluent gravity sewer[4], up to approximately 2,320 feet in length. The length of the gravity sewer will vary depending on the selected location of the WWTF, which will be evaluated during preferred alternative development. The treated CSOs would then be conveyed by the new CSO outfall (approximately 1,150 feet of 54-inch-diameter pipe) from the S Michigan St Regulator Station to the center of the Lower Duwamish Waterway[5]. The length of the CSO outfall will be modified depending on the selected location of the discharge, which will be evaluated during preferred alternative development.

[4] The 54-inch-diameter effluent pipe would operate as a gravity sewer for the Ballasted Sedimentation alternative, but it would operate as a pressure sewer for the CEPT with Lamella Plates alternative at peak flow rates.

[5] Preliminary outfall assumptions (see Appendix F.3 for WWTF design criteria) were used during the alternatives development and evaluation process. Refined outfall design concepts and cost estimates were prepared separately from this technical memorandum and are included in *Technical Memorandum 954.03, Preliminary CSO Outfall Concepts Analysis*.



King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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File Name:

Data Source:

Figure G.5.3-1

S Michigan St and Brandon St - DSN039/041-WWT-1 (KC) (New Conveyance)
Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN039/041-WWT-1 (KC) (New Conveyance)

Percentage of Cost Attributed to S Michigan and Brandon CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs (%)
DSN039 Michigan Regulator	66.1	65.3%
DSN041 Brandon Regulator	35.2	34.7%

Escalation Assumptions

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

Total Project Cost for Ballasted Sedimentation, 2010 Dollars

Description	Total Costs	Costs Attributed to King County (S Michigan)[3]	Costs Attributed to King County (Brandon)[3]
66.0-MGD Ballasted Sedimentation Construction Cost =	$20,100,000	$13,120,000	$6,980,000
0.89-MG Equalization Basin Construction Cost =	$5,120,000	$3,340,000	$1,780,000
66.0-MGD Influent Pump Station Construction Cost =	$14,400,000	$9,400,000	$5,000,000
Solids Handling Facility Construction Cost =	$2,650,000	$1,730,000	$920,000
Grit Removal Facility Construction Cost =	$510,000	$330,000	$180,000
Modifications to Michigan Regulator Construction Cost =	$490,000	$490,000	$0
Modifications to Brandon Regulator Construction Cost =	$490,000	$0	$490,000
Influent Gravity Sewer Construction Cost (2,320 LF of 54-inch-diameter pipe) =	$4,140,000	$4,140,000	$0
Effluent Gravity Sewer Construction Cost (2,320 LF of 54-inch-diameter pipe) =	$4,140,000	$2,700,000	$1,440,000
Conveyance from Brandon Street Regulator to WWTF Construction Cost (4,000 LF of 42-inch-diameter pipe) =	$5,810,000	$0	$5,810,000
[4]Outfall Construction Cost (1,150 LF of 54-inch-diameter pipe) =	$3,730,000	$2,430,000	$1,300,000
SDOT Street Use Permit Fee Cost =	$1,040,000	$440,000	$610,000
Total Construction Cost =	$62,620,000	$38,120,000	$24,510,000
Sales Tax (10% of Construction Cost) =	$6,260,000	$3,810,000	$2,450,000
[1]Allied Costs (46.22% of Construction Cost) =	$28,940,000	$17,620,000	$11,330,000
Property Cost =	$9,650,000	$6,300,000	$3,350,000
Subtotal of Project Cost =	$107,470,000	$65,850,000	$41,640,000
[1]Construction Contingency (10% of Construction Cost) =	$6,260,000	$3,810,000	$2,450,000
[1, 2]Project Contingency =	$25,980,000	$15,950,000	$10,040,000
Total Project Cost for Ballasted Sedimentation, 2010 Dollars =	**$139,700,000**	**$85,600,000**	**$54,100,000**

[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]Placeholder Costs for CSO Outfall: Assume new CSO outfall at $60/in-dia/LF sized for treated CSOs only. This cost may be refined following the evaluation of wet-weather treatment facility CSO outfall options in the Duwamish River, which will include the preparation of the *CSO Treatment Plant Outfall Evaluation TM* .

Alternative DSN039/041-WWT-1 (KC) (New Conveyance)

Percentage of Cost Attributed to S Michigan and Brandon CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs (%)
DSN039 Michigan Regulator	66.1	65.3%
DSN041 Brandon Regulator	35.2	34.7%

Escalation Assumptions

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

Total Project Costs for Chemically Enhanced Primary Treatment with Lamella Plates, 2010 Dollars

Description	Total Costs	Costs Attributed to King County (S Michigan)[3]	Costs Attributed to King County (Brandon)[3]
68.0-MGD CEPT with Lamella Construction Cost =	$17,920,000	$11,690,000	$6,230,000
0.72-MG Equalization Basin Construction Cost =	$4,350,000	$2,840,000	$1,510,000
68.0-MGD Influent Pump Station Construction Cost =	$14,780,000	$9,640,000	$5,140,000
Lamella Plates Construction Cost =	$1,430,000	$930,000	$500,000
Solids Handling Facility Construction Cost =	$1,900,000	$1,240,000	$660,000
Modifications to Michigan Regulator Construction Cost =	$490,000	$490,000	$0
Modifications to Brandon Regulator Construction Cost =	$490,000	$0	$490,000
Influent Gravity Sewer Construction Cost (2,320 LF of 54-inch-diameter pipe) =	$4,140,000	$4,140,000	$0
Effluent Gravity Sewer Construction Cost (2,320 LF of 54-inch-diameter pipe) =	$4,140,000	$2,700,000	$1,440,000
Conveyance from Brandon Street Regulator to WWTF Construction Cost (4,000 LF of 42-inch-diameter pipe) =	$5,810,000	$0	$5,810,000
[4]Outfall Construction Cost (1,150 LF of 54-inch-diameter pipe) =	$3,730,000	$2,430,000	$1,300,000
SDOT Street Use Permit Fee Cost =	$1,040,000	$440,000	$610,000
Total Construction Cost =	$60,220,000	$36,540,000	$23,690,000
Sales Tax (10% of Construction Cost) =	$6,020,000	$3,650,000	$2,370,000
[1]Allied Costs (46.22% of Construction Cost) =	$27,830,000	$16,890,000	$10,950,000
Property Cost =	$11,330,000	$7,390,000	$3,940,000
Subtotal of Project Cost =	$105,400,000	$64,470,000	$40,950,000
[1]Construction Contingency (10% of Construction Cost) =	$6,020,000	$3,650,000	$2,370,000
[1, 2]Project Contingency =	$25,600,000	$15,690,000	$9,920,000
Total Project Cost for Chemically Enhanced Primary Treatment with Lamella Plates, 2010 Dollars =	**$137,000,000**	**$83,800,000**	**$53,200,000**

[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.

[4]Placeholder Costs for CSO Outfall: Assume new CSO outfall at $60/in-dia/LF sized for treated CSOs only. This cost may be refined following the evaluation of wet-weather treatment facility CSO outfall options in the Duwamish River, which will include the preparation of the *CSO Treatment Plant Outfall Evaluation TM* .

WET-WEATHER TREATMENT FACILITY COSTS

Wet-Weather Treatment Facility - Design Flow Rate

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Ballasted Sedimentation Reduced CSO Peak Flow Rate[1] (MGD)	CEPT with Lamella Plates Reduced CSO Peak Flow Rate[1] (MGD)
DSN039 Michigan Regulator	66.1	66.0	68.0
DSN041 Brandon Regulator	35.2		

[1]Reduction in peak flow rate due to incorporation of an equalization basin.

Wet-Weather Treatment Facility - Construction Costs (2010 Dollars)

Description	Ballasted Sedimentation	CEPT with Lamella Plates
Treatment Facility	$20,104,520	$17,924,237
Influent Pump Station	$14,396,100	$14,784,489
Solids Handling Facility	$2,651,317	$1,902,840
Grit Removal Facility	$512,219	$0
Lamella Plates	$0	$1,431,544
Regulator Station	$485,000	$485,000
Total Construction Costs	$38,149,156	$36,528,110

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EQUALIZATION BASIN FOR BALLASTED SEDIMENTATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility
Printed date : 12/14/2010

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: 0.89 Mgal
Facility Footprint: 11200 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	1,240.00	SY	$43	$53,500
Dewatering	1	LS	$947,000	$947,000
Odor Control	1	LS	$156,000	$156,000
Effluent Pump Station	1	LS	$213,000	$213,000
Construction Cost	0.9	Mgal	4,000,000	$3,560,000
			Year 2008 Subtotal	$4,930,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$5,120,000

EQUALIZATION BASIN FOR CEPT WITH LAMELLA PLATES - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Equalization Basin_CEPT
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.).

Assumptions

Construction Year: 2010
Storage Capacity: 0.72 Mgal
Facility Footprint: 8400 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	933.00	SY	$43	$40,100
Dewatering	1	LS	$931,000	$931,000
Odor Control	1	LS	$129,000	$129,000
Effluent Pump Station	1	LS	$208,000	$208,000
Construction Cost	0.7	Mgal	4,000,000	$2,880,000
			Year 2008 Subtotal	$4,190,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,350,000

MODIFICATIONS TO BRANDON ST REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Brandon Regulator Station
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
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 S MICHIGAN ST REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Michigan Regulator Station
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
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

INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe
Printed date : 12/14/2010

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: 2319 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: 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	13,800.00	CY	$13	$179,000
Backfill	7,500.00	CY	$34	$255,000
Complete Pavement Restoration	3,020.00	SY	$86	$259,000
Overlay Pavement Restoration	8,320.00	SY	$28	$23,000
Trench Safety	76,700.00	SF	$17	$1,300,000
Spoil Load and Haul	13,800.00	CY	$16	$221,000
Pipe Unit Material Cost	2,320.00	lf	$168	$390,000
Pipe Installation	2,320.00	lf	$70	$162,000
Place Pipe Zone Fill	4,210.00	CY	$34	$143,000
Manholes	5	MH	$15,400	$76,900
Existing Utilities	2,320.00	lf	$166	$385,000
Dewatering	2,320.00	lf	$127	$295,000
Traffic Control	2,320.00	lf	$36	$83,500
			Year 2008 Subtotal	$3,990,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,140,000

EFFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Effluent Pipe
Printed date : 12/14/2010

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: 2319 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: 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	13,800.00	CY	$13	$179,000
Backfill	7,500.00	CY	$34	$255,000
Complete Pavement Restoration	3,020.00	SY	$86	$259,000
Overlay Pavement Restoration	8,320.00	SY	$28	$233,000
Trench Safety	76,700.00	SF	$17	$1,300,000
Spoil Load and Haul	13,800.00	CY	$16	$221,000
Pipe Unit Material Cost	2,320.00	lf	$168	$390,000
Pipe Installation	2,320.00	lf	$70	$162,000
Place Pipe Zone Fill	4,210.00	CY	$34	$143,000
Manholes	5	MH	$15,400	$76,900
Existing Utilities	2,320.00	lf	$166	$385,000
Dewatering	2,320.00	lf	$127	$295,000
Traffic Control	2,320.00	lf	$36	$83,500
			Year 2008 Subtotal	$3,990,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,140,000

CONVEYANCE FROM BRANDON ST REGULATOR TO WWTF - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Brandon_Michigan Conveyance
Printed date : 01/03/2011

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: 4000 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: 42 in.

Geometry

Outer Diameter	4.25	ft
Trench Width	8.03	ft
Excavation Depth	15.3	ft
Complete Surface Rest. Width	10	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	18,100.00	CY	$13	$236,000
Backfill	10,700.00	CY	$34	$364,000
Complete Pavement Restoration	4,460.00	SY	$86	$383,000
Overlay Pavement Restoration	15,100.00	SY	$28	$423,000
Trench Safety	122,000.00	SF	$17	$2,070,000
Spoil Load and Haul	18,100.00	CY	$16	$290,000
Pipe Unit Material Cost	4,000.00	lf	$86	$344,000
Pipe Installation	4,000.00	lf	$52	$208,000
Place Pipe Zone Fill	5,330.00	CY	$34	$181,000
Manholes	8	MH	$9,720	$77,700
Existing Utilities	4,000.00	lf	$120	$480,000
Dewatering	4,000.00	lf	$107	$428,000
Traffic Control	4,000.00	lf	$24	$96,000
			Year 2008 Subtotal	$5,580,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$5,810,000

Year 2010 Total: $5,810,000

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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)
DSN039 Michigan Regulator	$111.86	$22.44

Land Costs for Ballasted Sedimentation, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Influent Pump Station, Equalization Basin, Grit Removal, CSO Treatment Process (Ballasted Sedimentation), Disinfection, Solids Handling Facility, Odor Control/Electrical/Controls/Generator Building , Restrooms, Site Buffer, etc.	86,311	$111.86	100%	$9,654,748
			Total Land Costs	$9,654,748

Land Costs for Chemically Enhanced Primary Treatment with Lamella Plates, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Influent Pump Station, Equalization Basin, CSO Treatment Process (CEPT with Lamella Plates), Chemical Storage and Feed System, Disinfection, Odor Control/Electrical/Controls/Generator Building , Restrooms, Site Buffer, etc.	98,560	$111.86	100%	$11,024,922
Additional Solids Handling Facility	2,700	$111.86	100%	$302,062
			Total Land Costs	$11,326,983

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 S Michigan St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Regulator Station Upgrade at Brandon St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Gravity Sewer from Brandon St Regulator Station to WWTF, First Phase of Construction	42	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from Brandon St Regulator Station to WWTF, Second Phase of Construction	42	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from Brandon St Regulator Station to WWTF, Third Phase of Construction	42	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from Brandon St Regulator Station to WWTF, Fourth Phase of Construction	42	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from S Michigan St Regulator Station to WWTF, First Phase of Construction	54	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from S Michigan St Regulator Station to WWTF, Second Phase of Construction	54	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from S Michigan St Regulator Station to WWTF, Third Phase of Construction	54	319	44	14,036	29.8	3	$0.30	$4,211
Installation of Effluent Gravity Sewer, First Phase of Construction	54	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Effluent Gravity Sewer, Second Phase of Construction	54	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Effluent Gravity Sewer, Third Phase of Construction	54	319	44	14,036	29.8	3	$0.30	$4,211
							Total SDOT Street Use Fee Estimation:	$1,042,222

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Operations and Maintenance Cost Estimate Summary

Basin Name: Brandon-S Michigan Consolidated (Conveyed)

Alternative Name: SEBI-Cons Brandon-SMichigan-KC-WWTF (Conveyance, Ballasted w/ UV)

		Acres of Raingarden for GSI	**0.00**	
ENR 1994	5747	*Annual Overflow Vol (MG)*	**121.20**	
Current ENR	**8645.4**	*Annual Vol Capture*	**102.10**	
Power Cost (per kwh)	**0.065**	*Annual Events*	**26.00**	
Labor rate (loaded) /hr	**51.17**	*Stor Vol*	**0.89**	equal
SPU Water Cost $/CCF	**4.50**	*Peak Flow Rate*	**268.00**	
Carbon Cost/Lb	**2.00**	*Peak Flow Rate w/Equal*	**66.00**	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$13,046			
Force Mains	$0			
Regulator/Flow Control Structures	$0			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$1,656			
Pump Stations	$20,726	$56,607	$52,960	
Rectangular Storage Facilities	$22,758	$12,687	$5,212	$16,658
High Rate Treatment	$380,410	$10,743	$0	$53,753
Additonal Secondary Treatment	NA	$82,264	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$438,596**	**$162,301**	**$58,172**	**$70,410**

Total Annual O&M

General	**$671,308**
Energy	**$58,172**
Total	**$729,480**

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WTD Business Case Evaluation Results

S Michigan-Brandon Consolidated WWTF CSO Control Alternativ

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							
1 Conv to Mich-Bran WWTF	50	$139,700,000	$167,506,416	$0	$167,506,416	$5,539,376	$5,539,376

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							
1 Conv to Mich-Bran WWTF	50	$139,700,000	$118,755,808	$0	$118,755,808	$3,927,211	$3,927,211

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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Consolidated Alternatives – SMichigan St and Brandon St

DSN039/041-WWT-1 (KC) or
SEBI-Cons Brandon-SMichigan-KC-WWTF
(EBI Modifications)

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DSN039/041-WWT-1 (KC) or SEBI-Cons Brandon-SMichigan-KC-WWTF (EBI Modifications)

Alternative DSN039/041-WWT-1 (KC) controls King County's S Michigan St and Brandon St CSOs by building an equalization basin and wet-weather treatment facility (WWTF) to store and treat CSOs prior to discharge into the Lower Duwamish Waterway. The WWTF would be located near the S Michigan St Regulator Station and designed to meet NPDES effluent water quality limits. This alternative is an independent alternative which would store or treat King County CSOs.

This alternative includes modifying the Elliott Bay Interceptor (EBI) with new structures to route flows from the EBI to the WWTF via the following:

- EBI Diversion Structure (located near the S Michigan St Regulator Station) - Diversion of flows from the EBI, upstream of the proposed WWTF location.
- EBI Gate and Bypass Structure (located near the Brandon St Regulator Station) - Backflowing of flows via the EBI, downstream of the proposed WWTF location from the Brandon St CSO Basin.

Design Criteria

- Conveyance Improvements and Structures for Diversion of Flows to the WWTF[1]
    - CSO Peak Flow Rate for Brandon St: 35.2 MGD (for sizing conveyance from Brandon St Regulator Station to EBI)
    - CSO Peak Flow Rate for Sizing Influent Pipe from EBI Diversion Structure to WWTF: 101.3 MGD (backflowing of flows from Brandon St CSO Basin and diversion of flows upstream of the EBI Diversion Structure from the East Marginal Pump Station)
    - CSO Peak Flow Rate for Sizing Conveyance from S Michigan St Regulator Station to Influent Pump Station, Equalization Basin, and WWTF: 66.1 MGD (S Michigan St CSOs)
- Ballasted Sedimentation
    - WWTF and Influent Pump Station Peak Design Flow Rate: 66.0 MGD
    - Equalization Basin Volume: 0.89 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to S Michigan St Regulator Station: 66.0 MGD
    - CSO Peak Flow Rate for Sizing New Outfall[2]: 66.0 MGD
- Chemically Enhanced Primary Treatment with Lamella Plates

[1] Diversion of flows from the East Marginal Pump Station to the WWTF will provide downstream system capacity in the EBI to allow a portion of the flows from the Brandon St CSO Basin to continue downstream in the EBI. The remaining flows from the Brandon St CSO Basin will backflow in the EBI to the WWTF located at the S Michigan St CSO Basin.

[2] Untreated CSOs will discharge to existing CSO outfalls (Brandon St and S Michigan St CSO Outfalls).

- WWTF and Influent Pump Station Peak Design Flow Rate: 68.0 MGD
- Equalization Basin Volume: 0.72 MG
- CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to CSO Outfall: 68.0 MGD
- CSO Peak Flow Rate for Sizing New Outfall[2]: 68.0 MGD

Description

Alternative DSN039/041-WWT-1 (KC) consists of a WWTF to control S Michigan St and Brandon St CSOs, which discharge into the Lower Duwamish Waterway. Flows from the East Marginal Pump Station, which enter the EBI upstream of the EBI Diversion Structure, would be diverted to the WWTF for treatment during wet-weather events. When the EBI gate at the EBI Gate and Bypass Structure (located near the Brandon St Regulator Station) is closed during wet-weather events, a portion of the flows from the Brandon St CSO Basin would backflow via the EBI to the EBI Diversion Structure where they would be diverted to the WWTF for treatment. The WWTF includes an influent pump station, equalization basin, screening facility, CSO treatment process, and disinfection. Modifications to both the Brandon St and S Michigan St Regulator Stations would be required for diversion of flows to the WWTF. Ancillary facilities include an odor control facility, electrical/controls building, and emergency generator. The CSO treatment process could be either a) Ballasted Sedimentation or b) Chemically Enhanced Primary Treatment (CEPT) with Lamella Plates. See Section 6.1 and Appendix F.3 for more details about the treatment facilities and CSO treatment processes.

This alternative assumes that the WWTF would be located within or adjacent to the approximate boundary shown in Figure G.5.3-2. 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:

- Conveyance Improvements and Structures for Diversion of Flows to the WWTF (Common to Both CSO Treatment Processes)
  - Modifications to the Brandon St and S Michigan St Regulator Stations.
  - EBI Gate and Bypass Structure near the Brandon St Regulator Station to house a gate that will allow flows from the Brandon St CSO Basin to backflow to the WWTF via the EBI.
  - Approximately 200 ft of 48-inch-diameter bypass pipe to allow flows to bypass the EBI gate (located in the EBI Gate and Bypass Structure) during construction, allow flow splitting upstream or downstream of the EBI gate, and serve as a relief point in the event of failure of the EBI gate.
  - EBI Diversion Structure (located near the S Michigan St Regulator Station) to divert flows from the Brandon St CSO Basin (backflow from closing of EBI gate) and upstream flows from the East Marginal Pump Station to the WWTF.
  - Approximately 2,320 ft of 48-inch-diameter influent gravity sewer to convey flows from the EBI Diversion Structure (located near the S Michigan St Regulator Station) to the WWTF. The length depends on the location selected

for the WWTF within or adjacent to the approximate boundary shown in Figure G.5.3-2.

  - Up to approximately 2,320 ft of 54-inch-diameter influent gravity sewer from the S Michigan St Regulator Station to the WWTF. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.5.3-2.

- CSO Treatment Process (One of the Following)
  - Ballasted Sedimentation
    - 66.0-MGD WWTF.
    - 0.89-MG equalization basin.
    - 66.0-MGD influent pump station.
    - Up to approximately 2,320 ft of 54-inch-diameter effluent gravity sewer from the WWTF to the S Michigan St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.5.3-2.
    - Approximately 1,150 ft of 54-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the S Michigan St Regulator Station to the center of the Lower Duwamish Waterway[3].
  - Chemically Enhanced Primary Treatment with Lamella Plates
    - 68.0-MGD WWTF.
    - 0.72-MG equalization basin.
    - 68.0-MGD influent pump station.
    - Up to approximately 2,320 ft of 54-inch-diameter effluent gravity sewer from the WWTF to the S Michigan St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.5.3-2.
    - Approximately 1,150 ft of 54-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the S Michigan St Regulator Station to the center of the Lower Duwamish Waterway[3].

Wet-Weather Treatment Facility

Two treatment technologies have been developed for use in the CSO treatment processes for this alternative based on the findings of the *Technical Memorandum 700, Treatment Technology Selection.* Table 1 summarizes the unit processes of the WWTF that are included for each CSO

[3] Preliminary outfall assumptions (see Appendix F.3 for WWTF design criteria) were used during the alternatives development and evaluation process. Refined outfall design concepts and cost estimates were prepared separately from this technical memorandum and are included in *Technical Memorandum 954.03, Preliminary CSO Outfall Concepts Analysis*.

treatment process evaluated. See Section 6.1 and Appendix F.3 for more details about the treatment facilities and CSO treatment processes.

Table 1. Unit Process for CSO Treatment Processes

Ballasted Sedimentation	CEPT with Lamella Plates
• Influent Pump Station, • Fine Screening, • Grit Removal, • Ballasted Sedimentation System (including Chemical Feed System), • Solids Handling Facility, • Disinfection System, and • Facilities Building (odor control, electrical controls, standby generator).	• Influent Pump Station, • Coarse Screening, • CEPT System (including Chemical Feed System and Additional Depth for Solids Handling), • Solids Handling Facility, • Disinfection System, and • Facilities Building (odor control, electrical controls, standby generator).

Equalization Basin

The equalization basin allows for shaving peak flows to the WWTF. The shaving of peak flows results in a reduced design capacity requirement for the WWTF. In this alternative, CSOs would be pumped to the WWTF, and flows in excess of the hydraulic capacity of the WWTF would be diverted to the equalization basin prior to the WWTF. This operational mode ensures that CSOs are being treated, and the equalization basin is used only during peak wet-weather events that exceed the WWTF design capacity.

An alternate operational mode includes routing all flows to the equalization basin prior to sending flows to the WWTF to minimize operational costs associated with the WWTF. However, the capacity of the WWTF would need to increase to handle higher peak wet-weather events.

Flow Diversion and Discharge

Modifications to the S Michigan St Regulator Station will be required to divert King County flows (S Michigan St CSOs) to the WWTF and equalization basin. For this planning phase, it is assumed that the diversion would occur at the S Michigan St Regulator Station. Evaluation of whether flows can be diverted upstream of the regulator will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the WWTF and equalization basin via a 54-inch-diameter influent gravity sewer. The length of the gravity sewer will vary depending on the selected location of the WWTF, which will be evaluated during preferred alternative development. The gravity sewer can be up to 2,320 feet long based on the criteria and assumptions listed in Section 6.1.

Additional flows to the WWTF would be routed via the EBI either from backflowing the EBI associated with closing the EBI gate or diverting upstream flows in the EBI directly to the WWTF. These flow diversions would provide available downstream system capacity in the EBI to control the Brandon St CSO Outfall. The following summarizes the flow scheme for routing flows from the EBI to the WWTF:

- Upstream Diversion of Flows. The East Marginal Pump Station flows (approximately 25 MGD[4]), would be routed to the EBI Diversion Structure (located near the S Michigan St Regulator Station) along the EBI and routed to the WWTF via approximately 2,320 ft of 48-inch-diameter influent gravity sewer[5].
- Backflowing of the EBI. Motorized gates will be installed in the EBI Gate and Bypass Structure (near the Brandon St Regulator Station) to control flows. Flows routed upstream of the gate from the Brandon St CSO Basin (only a portion of flows will be routed upstream) will backflow to the EBI Diversion Structure and then be routed to the WWTF via approximately 2,320 ft of 48-inch-diameter influent gravity sewer[5].

Treated CSOs would be conveyed to the S Michigan St Regulator via a 54-inch-diameter effluent gravity sewer[6], up to approximately 2,320 feet in length. The length of the gravity sewer will vary depending on the selected location of the WWTF, which will be evaluated during preferred alternative development. The treated CSOs would then be conveyed by the new CSO outfall (approximately 1,150 feet of 54-inch-diameter pipe) from the S Michigan St Regulator Station to the center of the Lower Duwamish Waterway[7]. The length of the CSO outfall will be modified depending on the selected location of the discharge, which will be evaluated during preferred alternative development.

[4] East Marginal Pump Station: maximum allowable pumped flow rate based on June 2010 modeling run.
[5] The total length of the influent gravity sewer will vary depending on the selected location of the WWTF, which will be evaluated during preferred alternative development.
[6] The 54-inch-diameter effluent pipe would operate as a gravity sewer for the Ballasted Sedimentation alternative, but it would operate as a pressure sewer for the CEPT with Lamella Plates alternative at peak flow rates.
[7] Preliminary outfall assumptions (see Appendix F.3 for WWTF design criteria) were used during the alternatives development and evaluation process. Refined outfall design concepts and cost estimates were prepared separately from this technical memorandum and are included in *Technical Memorandum 954.03, Preliminary CSO Outfall Concepts Analysis*.

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Approximate Boundary for Locating Wet-Weather Treatment Facilities

Wet-weather treatment facilities can be located within or adjacent to the boundary shown.

Approximate boundary is intended for planning purposes only and does not represent all potential site locations. Further study and evaluation will be completed prior to selection of a preferred site for this CSO basin.

See TM 970, CSO Control Alternatives Development for criteria and assumptions used in establishing the approximate boundary.

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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File Name:

Data Source:

Figure G.5.3-2

S Michigan St and Brandon St - DSN039/041-WWT-1 (KC) (EBI Modifications) Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN039/041-WWT-1 (KC) (EBI Modifications)

Percentage of Cost Attributed to S Michigan and Brandon CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs (%)
DSN039 Michigan Regulator	66.1	65.3%
DSN041 Brandon Regulator	35.2	34.7%

Escalation Assumptions

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

Total Project Cost for Ballasted Sedimentation, 2010 Dollars

Description	Total Costs	Costs Attributed to King County (S Michigan)[3]	Costs Attributed to King County (Brandon)[3]
66.0-MGD Ballasted Sedimentation Construction Cost =	$20,100,000	$13,120,000	$6,980,000
0.89-MG Equalization Basin Construction Cost =	$5,120,000	$3,340,000	$1,780,000
66.0-MGD Influent Pump Station Construction Cost =	$14,400,000	$9,400,000	$5,000,000
Solids Handling Facility Construction Cost =	$2,650,000	$1,730,000	$920,000
Grit Removal Facility Construction Cost =	$510,000	$330,000	$180,000
EBI Gate and Bypass Structure Construction Cost =	$2,640,000	$0	$2,640,000
Modifications to S Michigan St Regulator Construction Cost =	$490,000	$490,000	$0
Modifications to Brandon St Regulator Construction Cost =	$490,000	$0	$490,000
Connection to Brandon Trunk Construction Cost =	$490,000	$0	$490,000
EBI Diversion Structure (near Michigan St Regulator) Construction Cost =	$2,640,000	$0	$2,640,000
Bypass Pipe at EBI Gate and Bypass Structure Construction Cost (200 LF of 48-inch-diameter pipe) =	$330,000	$0	$330,000
Influent Gravity Sewer from S Michigan St Regulator to WWTF Construction Cost (2,320 LF of 54-inch-diameter pipe) =	$4,140,000	$4,140,000	$0
Influent Gravity Sewer from EBI Diversion Structure to WWTF Construction Cost (2,320 LF of 48-inch-diameter pipe) =	$3,770,000	$0	$3,770,000
Effluent Gravity Sewer Construction Cost (2,320 LF of 54-inch-diameter pipe) =	$4,140,000	$2,700,000	$1,440,000
[4]Outfall Construction Cost (1,150 LF of 54-inch-diameter pipe) =	$3,730,000	$2,430,000	$1,300,000
SDOT Street Use Permit Fee Cost =	$810,000	$440,000	$370,000
Total Construction Cost =	$66,450,000	$38,120,000	$28,330,000
Sales Tax (10% of Construction Cost) =	$6,650,000	$3,810,000	$2,830,000
[1]Allied Costs (46.22% of Construction Cost) =	$30,710,000	$17,620,000	$13,090,000
Property Cost =	$10,230,000	$6,300,000	$3,930,000
Subtotal of Project Cost =	$114,040,000	$65,850,000	$48,180,000
[1]Construction Contingency (10% of Construction Cost) =	$6,650,000	$3,810,000	$2,830,000
[1, 2]Project Contingency =	$27,560,000	$15,950,000	$11,620,000
Total Project Cost for Ballasted Sedimentation, 2010 Dollars =	**$148,300,000**	**$85,600,000**	**$62,600,000**

[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]Placeholder Costs for CSO Outfall: Assume new CSO outfall at $60/in-dia/LF sized for treated CSOs only. This cost may be refined following the evaluation of wet-weather treatment facility CSO outfall options in the Duwamish River, which will include the preparation of the *CSO Treatment Plant Outfall Evaluation TM* .

Alternative DSN039/041-WWT-1 (KC) (EBI Modifications)

Percentage of Cost Attributed to S Michigan and Brandon CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs (%)
DSN039 Michigan Regulator	66.1	65.3%
DSN041 Brandon Regulator	35.2	34.7%

Escalation Assumptions

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

Total Project Costs for Chemically Enhanced Primary Treatment with Lamella Plates, 2010 Dollars

Description	Total Costs	Costs Attributed to King County (S Michigan)[3]	Costs Attributed to King County (Brandon)[3]
68.0-MGD CEPT with Lamella Construction Cost =	$17,920,000	$11,690,000	$6,230,000
0.72-MG Equalization Basin Construction Cost =	$4,350,000	$2,840,000	$1,510,000
68.0-MGD Influent Pump Station Construction Cost =	$14,780,000	$9,640,000	$5,140,000
Lamella Plates Construction Cost =	$1,430,000	$930,000	$500,000
Solids Handling Facility Construction Cost =	$1,900,000	$1,240,000	$660,000
EBI Gate and Bypass Structure Construction Cost =	$2,640,000	$0	$2,640,000
Modifications to S Michigan St Regulator Construction Cost =	$490,000	$490,000	$0
Modifications to Brandon St Regulator Construction Cost =	$490,000	$0	$490,000
Connection to Brandon Trunk Construction Cost =	$490,000	$0	$490,000
EBI Diversion Structure (near Michigan St Regulator) Construction Cost =	$2,640,000	$0	$2,640,000
Bypass Pipe at EBI Gate and Bypass Structure Construction Cost (200 LF of 48-inch-diameter pipe) =	$330,000	$0	$330,000
Influent Gravity Sewer from S Michigan St Regulator to WWTF Construction Cost (2,320 LF of 54-inch-diameter pipe) =	$4,140,000	$4,140,000	$0
Influent Gravity Sewer from EBI Diversion Structure to WWTF Construction Cost (2,320 LF of 48-inch-diameter pipe) =	$3,770,000	$0	$3,770,000
Effluent Gravity Sewer Construction Cost (2,320 LF of 54-inch-diameter pipe) =	$4,140,000	$2,700,000	$1,440,000
[4]Outfall Construction Cost (1,150 LF of 54-inch-diameter pipe) =	$3,730,000	$2,430,000	$1,300,000
SDOT Street Use Permit Fee Cost =	$810,000	$440,000	$370,000
Total Construction Cost =	$64,050,000	$36,540,000	$27,510,000
Sales Tax (10% of Construction Cost) =	$6,410,000	$3,650,000	$2,750,000
[1]Allied Costs (46.22% of Construction Cost) =	$29,600,000	$16,890,000	$12,720,000
Property Cost =	$11,900,000	$7,390,000	$4,510,000
Subtotal of Project Cost =	$111,960,000	$64,470,000	$47,490,000
[1]Construction Contingency (10% of Construction Cost) =	$6,410,000	$3,650,000	$2,750,000
[1, 2]Project Contingency =	$27,180,000	$15,690,000	$11,500,000
Total Project Cost for Chemically Enhanced Primary Treatment with Lamella Plates, 2010 Dollars =	**$145,600,000**	**$83,800,000**	**$61,700,000**

[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)

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

[4]Placeholder Costs for CSO Outfall: Assume new CSO outfall at $60/in-dia/LF sized for treated CSOs only. This cost may be refined following the evaluation of wet-weather treatment facility CSO outfall options in the Duwamish River, which will include the preparation of the *CSO Treatment Plant Outfall Evaluation TM* .

WET-WEATHER TREATMENT FACILITY COSTS

Wet-Weather Treatment Facility - Design Flow Rate

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Ballasted Sedimentation Reduced CSO Peak Flow Rate[1] (MGD)	CEPT with Lamella Plates Reduced CSO Peak Flow Rate[1] (MGD)
DSN039 Michigan Regulator	66.1	66.0	68.0
DSN041 Brandon Regulator	35.2		

[1]Reduction in peak flow rate due to incorporation of an equalization basin.

Wet-Weather Treatment Facility - Construction Costs (2010 Dollars)

Description	Ballasted Sedimentation	CEPT with Lamella Plates
Treatment Facility	$20,104,520	$17,924,237
Influent Pump Station	$14,396,100	$14,784,489
Solids Handling Facility	$2,651,317	$1,902,840
Grit Removal Facility	$512,219	$0
Lamella Plates	$0	$1,431,544
Regulator Station	$485,000	$485,000
Total Construction Costs	$38,149,156	$36,528,110

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EQUALIZATION BASIN FOR BALLASTED SEDIMENTATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility
Printed date : 12/14/2010

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: 0.89 Mgal
Facility Footprint: 11200 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	1,240.00	SY	$43	$53,500
Dewatering	1	LS	$947,000	$947,000
Odor Control	1	LS	$156,000	$156,000
Effluent Pump Station	1	LS	$213,000	$213,000
Construction Cost	0.9	Mgal	4,000,000	$3,560,000
			Year 2008 Subtotal	$4,930,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$5,120,000

EQUALIZATION BASIN FOR CEPT WITH LAMELLA PLATES - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Equalization Basin_CEPT
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.).

Assumptions

Construction Year: 2010
Storage Capacity: 0.72 Mgal
Facility Footprint: 8400 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	933.00	SY	$43	$40,100
Dewatering	1	LS	$931,000	$931,000
Odor Control	1	LS	$129,000	$129,000
Effluent Pump Station	1	LS	$208,000	$208,000
Construction Cost	0.7	Mgal	4,000,000	$2,880,000
			Year 2008 Subtotal	$4,190,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,350,000

EBI GATE AND BYPASS STRUCTURE

DATE Feb-11

Item	Description	Quantity	Unit	Unit cost, $	Cost, $	Notes
DIVISION 3 - CONCRETE						
	Base Slab	261	CY	$600	$156,800	
	Walls	597	CY	$900	$537,333	
	Top Elevated Slab	84	CY	$1,000	$84,444	
	Beams	7	CY	$1,400	$9,333	
	Grout	9	CY	$300	$2,667	
DIVISION 5 - METALS						
	FRP Gratings	0	SF	$26	$0	No grating/handrails
	FRP Handrails	0	LNFT	$60	$0	Assumed in structure
	Alum Ladders	60	LNFT	$150	$9,000	
	Alum Ship Ladder	0	LNFT	$200	$0	
	Steel Misc Struc Shapes	3,000	LB	$4	$12,000	
	Alum Mus Struc Shapes	1,600	LB	$11	$17,600	
	Anchor Bolts	406	EA	$7	$2,841	
	Access Hatches (72"X48" Double Leaf)	3	EA	$4,000	$12,000	
	Sluice Gates (60")	2	EA	$90,000	$180,000	
	Temp Dams	2	EA	$5,000	$10,000	
DIVISION 31 - EARTHWORK, ETC						
	24" Dia Secant Pile	1,620	LF	$250	$405,000	
	Crane Mobilization (piles)	1	EA	$15,000	$15,000	
	Crane Rental	150	HR	$1,500	$225,000	
	Crane Crew	150	HR	$300	$45,000	
	Shoring	9240	SF	$60	$554,400	
	Excavation	2646	BCY	$35	$92,607	
	Spoil Load & Haul	3307	LCY	$16	$52,919	Unit cost based on Tabula
	Import Backfill	978	CY	$34	$33,244	Unit cost based on Tabula
	Dewatering	1	EA	$500,000	$500,000	
	AC surface removal	1111	SY	$30	$33,333	
	AC surface restoration	1111	SY	$86	$95,556	Unit cost based on Tabula
	AC overlay surface restoration	1500	SY	$28	$42,000	Unit cost based on Tabula
	Utility Relocation	1	LS	$200,000	$200,000	Unit cost based on Tabula
	Electrical/I&C	1	EA	499,212	$499,212	15% of subtotal
	Mobilization	1	EA	199,685	$199,685	6% of subtotal
	Temporary Traffic Control	1	EA	133,123	$133,123	4% of subtotal
	Temporary Erosion & Sed Control	1	EA	66,562	$66,562	2% of subtotal
	Subtotal				***$4,226,659***	(96" EBI)
	Scaled-Down Cost Based on Reduced Diameter of EBI at S Michigan and Brandon Compared to EBI at Kingdome				***$2,641,662***	(60" EBI)

Notes:

1. Costs do not include O&P
2. Soil conditions assumed to require piles for gravity/lateral support

EBI GATE AND BYPASS STRUCTURE (CONTINUED)

DATE Feb-11

Item	Description	Location		No.	L (ft)	H (ft)	W (ft)	Sum	Total	Unit
Concrete walls									597	CY
	Walls	Exterior longit		1.00	112.00	20.00	2.00	4,480.00		
		Exterior longit		1.00	56.00	20.00	4.00	4,480.00		
		Exterior transv		2.00	28.00	20.00	2.00	2,240.00		
		Interior		1.00	70.00	20.00	2.00	2,800.00		
		Misc fill at corners		1.00	10.00	20.00	10.00	2,000.00		
	weir	south end		1.00	20.00	6.00	1.00	120.00		
Concrete base mat									261.3	CY
	Slab	Bottom Matt		1.00	84.00	3.00	28.00	7,056.00		
Concrete elevated slabs									84	CY
	Elevated Slab	Wet Well Top Slab		1.00	84.00	1.00	28.00	2,352.00		
		Subtract Hatches		3.00	6.00	1.00	4.00	72.00		
Concrete elevated beams									7	CY
	Concrete Beam	Ea end interior wall		3.00	15.00	2.00	2.00	180.00		
Grout									9	CY
	Grout	Misc fill/transitions at invert		1.00	30.00	1.00	8.00	240.00		
Piles									1,620	LF
Augercast	24 inch diameter	base mat support		27.00	60.00			1,620.00		
Anchor bolts									406	lbs
	3/4"x min 5" embed	Miscellaneous		75.00			1.13	84.75		
	Adhesive Anchors	Ladders	3.00	6.00			1.13	20.34		
	3/4" x min 12" embe	gates	2.00	20.00			7.52	300.80		
	c.i.p. anchor bolts							-		
Embedded metal									11,411	lbs
	L3x3x1/4	Top Slab - Hatches		3.00	12.00	8.00	4.90	1,411.20		
Asphalt Pavement Removal									1,111	sy
	existing asphalt	over structure			200.00		50.00	10,000.00		
Asphalt Pavement Restoration									1,111	sy
	new asphalt	over structure			200.00		50.00	10,000.00		

EBI GATE AND BYPASS STRUCTURE (CONTINUED)

Tetra Tech
1420 Fifth Avenue, Suite 600
Seattle, WA 98101
206.883.9300

JOB TITLE	EBI Bypass Structure		
	Wet Well Steel Quantities		
JOB NO.	135-18300-10001	SHEET NO.	
CALCULATED BY	GCB/GMS	DATE	Feb-11
CHECKED BY	0	DATE	Feb-11

Item	Location	Description	No.	Length or Area (ft) or (ft^2)	Height or Width (ft)	Weight lb/ft or lb/ft^2	Sum	Total	unit
Light Structural Aluminum, < 20 lb/ft								1,600	lbs
	below grade	Miscellaneous		200.00		8.00	1600.00		
Light Structural Steel, < 20 lb/ft								3,000	lbs
	below grade	Miscellaneous		200.00		15.00	3000.00		
							-		
							-		
							-		
FRP gratings								-	ft^2
	none	none					-		
							-		
FRP Handrails c/w kick plates								-	ft
	none	none					-		
Aluminum ladders; w/o cage								60	ft
		below grade	3.00	20.00			60.00		
Aluminum Ship ladders								-	ft
	none	none					-		
Access Hatches								72	ft^2
	Top Elevated Slab	Access Hatch	3.00	6.00	4.00		72.00		
							-		
Shoring								9,240	ft^2
	Perimeter	Sheet pile	2.00	94.00	35.00		6,580.00		
			2.00	38.00	35.00		2,660.00		
								2,646	cy
Excavation									
	To 5 feet clear each side	Excavation		94.00	38.00	20.00	2,645.93		
								978	cy
Imported backfill									
	perimeter 5 foot wic spae	Backfill against structure	2.00	94.00	5.00	20.00	696.30		
			2.00	38.00	5.00	20.00	281.48		

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MODIFICATIONS TO S MICHIGAN ST REGULATOR - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Michigan Regulator Station
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
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 BRANDON ST REGULATOR - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Brandon Regulator Station
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
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

CONNECTION TO BRANDON TRUNK - 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

EBI DIVERSION STRUCTURE (ASSUME SAME AS EBI GATE STRUCTURE)

DATE Feb-11

Item	Description	Quantity	Unit	Unit cost, $	Cost, $	Notes
DIVISION 3 - CONCRETE						
	Base Slab	261	CY	$600	$156,800	
	Walls	597	CY	$900	$537,333	
	Top Elevated Slab	84	CY	$1,000	$84,444	
	Beams	7	CY	$1,400	$9,333	
	Grout	9	CY	$300	$2,667	
DIVISION 5 - METALS						
	FRP Gratings	0	SF	$26	$0	No grating/handrails
	FRP Handrails	0	LNFT	$60	$0	Assumed in structure
	Alum Ladders	60	LNFT	$150	$9,000	
	Alum Ship Ladder	0	LNFT	$200	$0	
	Steel Misc Struc Shapes	3,000	LB	$4	$12,000	
	Alum Mus Struc Shapes	1,600	LB	$11	$17,600	
	Anchor Bolts	406	EA	$7	$2,841	
	Access Hatches (72"X48" Double Leaf)	3	EA	$4,000	$12,000	
	Sluice Gates (60")	2	EA	$90,000	$180,000	
	Temp Dams	2	EA	$5,000	$10,000	
DIVISION 31 - EARTHWORK, ETC						
	24" Dia Secant Pile	1,620	LF	$250	$405,000	
	Crane Mobilization (piles)	1	EA	$15,000	$15,000	
	Crane Rental	150	HR	$1,500	$225,000	
	Crane Crew	150	HR	$300	$45,000	
	Shoring	9240	SF	$60	$554,400	
	Excavation	2646	BCY	$35	$92,607	
	Spoil Load & Haul	3307	LCY	$16	$52,919	Unit cost based on Tabula
	Import Backfill	978	CY	$34	$33,244	Unit cost based on Tabula
	Dewatering	1	EA	$500,000	$500,000	
	AC surface removal	1111	SY	$30	$33,333	
	AC surface restoration	1111	SY	$86	$95,556	Unit cost based on Tabula
	AC overlay surface restoration	1500	SY	$28	$42,000	Unit cost based on Tabula
	Utility Relocation	1	LS	$200,000	$200,000	Unit cost based on Tabula
	Electrical/I&C	1	EA	499,212	$499,212	15% of subtotal
	Mobilization	1	EA	199,685	$199,685	6% of subtotal
	Temporary Traffic Control	1	EA	133,123	$133,123	4% of subtotal
	Temporary Erosion & Sed Control	1	EA	66,562	$66,562	2% of subtotal
	Subtotal				***$4,226,659***	(96" EBI)
	Scaled-Down Cost Based on Reduced Diameter of EBI at S Michigan and Brandon Compared to EBI at Kingdome				***$2,641,662***	(60" EBI)

Notes:

1. Costs do not include O&P
2. Soil conditions assumed to require piles for gravity/lateral support

BYPASS PIPE AT EBI GATE AND BYPASS STRUCTURE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: EBI Diversion Bypass Pipe
Printed date : 02/03/2011

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: 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	1,030.00	CY	$13	$13,400
Backfill	586.00	CY	$34	$19,900
Complete Pavement Restoration	240.00	SY	$86	$20,600
Overlay Pavement Restoration	738.00	SY	$28	$20,700
Trench Safety	6,330.00	SF	$17	$108,000
Spoil Load and Haul	1,030.00	CY	$16	$16,500
Pipe Unit Material Cost	200.00	lf	$123	$24,600
Pipe Installation	200.00	lf	$60	$12,000
Place Pipe Zone Fill	309.00	CY	$34	$10,500
Manholes	1	MH	$12,600	$12,600
Existing Utilities	200.00	lf	$166	$33,200
Dewatering	200.00	lf	$107	$21,400
Traffic Control	200.00	lf	$36	$7,200
			Year 2008 Subtotal	$320,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$333,000

Year 2010 Total: $333,000

INFLUENT GRAVITY SEWER FROM S MICHIGAN ST REGULATOR TO WWTF - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe
Printed date : 12/14/2010

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: 2319 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: 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	13,800.00	CY	$13	$179,000
Backfill	7,500.00	CY	$34	$255,000
Complete Pavement Restoration	3,020.00	SY	$86	$259,000
Overlay Pavement Restoration	8,320.00	SY	$28	$23,000
Trench Safety	76,700.00	SF	$17	$1,300,000
Spoil Load and Haul	13,800.00	CY	$16	$221,000
Pipe Unit Material Cost	2,320.00	lf	$168	$390,000
Pipe Installation	2,320.00	lf	$70	$162,000
Place Pipe Zone Fill	4,210.00	CY	$34	$143,000
Manholes	5	MH	$15,400	$76,900
Existing Utilities	2,320.00	lf	$166	$385,000
Dewatering	2,320.00	lf	$127	$295,000
Traffic Control	2,320.00	lf	$36	$83,500
			Year 2008 Subtotal	$3,990,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,140,000

INFLUENT GRAVITY SEWER FROM EBI DIVERSION STRUCTURE TO WWTF - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: EBI Diversion to WWTF
Printed date : 02/03/2011

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: 2320 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	11,900.00	CY	$13	$155,000
Backfill	6,790.00	CY	$34	$231,000
Complete Pavement Restoration	2,780.00	SY	$86	$239,000
Overlay Pavement Restoration	8,560.00	SY	$28	$240,000
Trench Safety	73,500.00	SF	$17	$1,250,000
Spoil Load and Haul	11,900.00	CY	$16	$191,000
Pipe Unit Material Cost	2,320.00	lf	$123	$285,000
Pipe Installation	2,320.00	lf	$60	$139,000
Place Pipe Zone Fill	3,580.00	CY	$34	$122,000
Manholes	5	MH	$12,600	$62,800
Existing Utilities	2,320.00	lf	$166	$385,000
Dewatering	2,320.00	lf	$107	$248,000
Traffic Control	2,320.00	lf	$36	$83,500
			Year 2008 Subtotal	$3,630,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$3,770,000

EFFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Effluent Pipe
Printed date : 12/14/2010

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: 2319 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: 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	13,800.00	CY	$13	$179,000
Backfill	7,500.00	CY	$34	$255,000
Complete Pavement Restoration	3,020.00	SY	$86	$259,000
Overlay Pavement Restoration	8,320.00	SY	$28	$233,000
Trench Safety	76,700.00	SF	$17	$1,300,000
Spoil Load and Haul	13,800.00	CY	$16	$221,000
Pipe Unit Material Cost	2,320.00	lf	$168	$390,000
Pipe Installation	2,320.00	lf	$70	$162,000
Place Pipe Zone Fill	4,210.00	CY	$34	$143,000
Manholes	5	MH	$15,400	$76,900
Existing Utilities	2,320.00	lf	$166	$385,000
Dewatering	2,320.00	lf	$127	$295,000
Traffic Control	2,320.00	lf	$36	$83,500
			Year 2008 Subtotal	$3,990,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,140,000

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)
DSN041 Brandon Regulator	$114.18	$22.12
DSN039 Michigan Regulator	$111.86	$22.44

Land Costs for Ballasted Sedimentation, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Influent Pump Station, Equalization Basin, Grit Removal, CSO Treatment Process (Ballasted Sedimentation), Disinfection, Solids Handling Facility, Odor Control/Electrical/Controls/Generator Building , Restrooms, Site Buffer, etc.	86,311	$111.86	100%	$9,654,748
EBI Gate and Bypass Structure, located over EBI in vicinity of Brandon.	5,000	$114.18	100%	$570,900
			Total Land Costs	$10,225,648

Land Costs for Chemically Enhanced Primary Treatment with Lamella Plates, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Influent Pump Station, Equalization Basin, CSO Treatment Process (CEPT with Lamella Plates), Chemical Storage and Feed System, Disinfection, Odor Control/Electrical/Controls/Generator Building , Restrooms, Site Buffer, etc.	98,560	$111.86	100%	$11,024,922
EBI Gate and Bypass Structure, located over EBI in vicinity of Brandon.	5,000	$114.18	100%	$570,900
Additional Solids Handling Facility	2,700	$111.86	100%	$302,062
			Total Land Costs	$11,897,883

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
EBI Gate and Bypass Structure	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Connection to Brandon Trunk	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Regulator Station Upgrade at S Michigan St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Regulator Station Upgrade at Brandon St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500

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
EBI Diversion Structure (near Michigan St Regulator)	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Bypass Pipe at EBI Gate and Bypass Structure	48	200	44	8,800	18.7	2	$0.20	$1,760
Installation of Influent Gravity Sewer from EBI Diversion Structure to WWTF, First Phase of Construction	48	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from EBI Diversion Structure to WWTF, Second Phase of Construction	48	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from EBI Diversion Structure to WWTF, Third Phase of Construction	48	320	44	14,080	29.9	3	$0.30	$4,224
Installation of Influent Gravity Sewer from S Michigan St Regulator Station to WWTF, First Phase of Construction	54	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from S Michigan St Regulator Station to WWTF, Second Phase of Construction	54	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from S Michigan St Regulator Station to WWTF, Third Phase of Construction	54	320	44	14,080	29.9	3	$0.30	$4,224
Installation of Effluent Gravity Sewer, First Phase of Construction	54	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Effluent Gravity Sewer, Second Phase of Construction	54	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Effluent Gravity Sewer, Third Phase of Construction	54	320	44	14,080	29.9	3	$0.30	$4,224
							Total SDOT Street Use Fee Estimation:	$812,532

Operations and Maintenance Cost Estimate Summary

Basin Name: Brandon-S Michigan Consolidated (EBI)

Alternative Name: SEBI-Cons Brandon-SMichigan-KC-WWTF (Backflow, Ballasted w/ UV)

		Acres of Raingarden for GSI	**0.00**	
ENR 1994	5747	*Annual Overflow Vol (MG)*	**121.20**	
Current ENR	**8645.4**	*Annual Vol Capture*	**102.10**	
Power Cost (per kwh)	**0.065**	*Annual Events*	**26.00**	
Labor rate (loaded) /hr	**51.17**	*Stor Vol*	**0.89**	equal
SPU Water Cost $/CCF	**4.50**	*Peak Flow Rate*	**268.00**	
Carbon Cost/Lb	**2.00**	*Peak Flow Rate w/Equal*	**66.00**	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$10,812			
Force Mains	$0			
Regulator/Flow Control Structures	$76,917			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$1,656			
Pump Stations	$20,726	$56,607	$52,960	
Rectangular Storage Facilities	$22,758	$12,687	$5,212	$16,658
High Rate Treatment	$380,410	$10,743	$0	$53,753
Additonal Secondary Treatment	NA	$82,264	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$513,279**	**$162,301**	**$58,172**	**$70,410**

Total Annual O&M

General	**$745,990**
Energy	**$58,172**
Total	**$804,163**

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WTD Business Case Evaluation Results

S Michigan-Brandon Consolidated WWTF CSO Control Alternativ

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							
2 EBI Conv to Mich-Bran WWTF	50	$148,300,000	$179,417,608	$0	$179,417,608	$5,933,275	$5,933,275

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							
2 EBI Conv to Mich-Bran WWTF	50	$148,300,000	$126,518,231	$0	$126,518,231	$4,183,912	$4,183,912

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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