Appendix G.3

Middle EBI – Hanford #2, Lander St, Kingdome, and King St

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Appendix G.3.1

Hanford #2 Site Alternatives

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Hanford #2 Site Alternative

DSN032-WWT-1 (KC) or MEBI-Hanford-KC-WWTF

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DSN032-WWT-1 (KC) or MEBI-Hanford-KC-WWTF

Alternative DSN032-WWT-1 (KC) controls King County's Hanford #2 CSOs by building an equalization basin and wet-weather treatment facility (WWTF) to store and treat CSOs prior to discharge into the East Waterway (Duwamish River). The WWTF would be located near the Hanford 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 Hanford St Regulator Station to WWTF (Common to Both CSO Treatment Processes)
    - CSO Peak Flow Rate for Sizing Conveyance from Hanford St Regulator Station to Influent Pump Station, Equalization Basin, and WWTF: 94.9 MGD
- Ballasted Sedimentation
    - WWTF and Influent Pump Station Peak Design Flow Rate: 68.0 MGD
    - Equalization Basin Volume: 0.94 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Hanford St Regulator Station: 68.0 MGD
    - CSO Peak Flow Rate for Sizing Outfall: Capacity of Existing Hanford St CSO Outfall.
- Chemically Enhanced Primary Treatment with Lamella Plates
    - WWTF and Influent Pump Station Peak Design Flow Rate: 70.0 MGD
    - Equalization Basin Volume: 0.77 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Hanford St Regulator Station: 70.0 MGD
    - CSO Peak Flow Rate for Sizing Outfall: Capacity of Existing Hanford St CSO Outfall

Description

Alternative DSN032-WWT-1 (KC) consists of a WWTF to treat Hanford #2 CSOs, which discharge into the East Waterway (Duwamish River). The WWTF includes an influent pump station, equalization basin, screening facility, CSO treatment process, and disinfection. Modifications to the Hanford 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.3.1-1. 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 Hanford St Regulator Station to WWTF (Common to Both CSO Treatment Processes)
    - Modifications to the Hanford St Regulator Station.
    - Up to approximately 1,470 ft of 60-inch-diameter influent gravity sewer to convey Hanford #2 CSOs from the Hanford 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.3.1-1.
- CSO Treatment Processes (One of the Following)
    - Ballasted Sedimentation
        - 68.0-MGD WWTF.
        - 0.94-MG equalization basin.
        - 68.0-MGD influent pump station.
        - Up to approximately 1,470 ft of 54-inch-diameter effluent gravity sewer from the WWTF to the Hanford St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.3.1-1.
        - Approximately 700 ft of 48-inch-diameter pipe for the extension of the CSO outfall into the East Waterway (Duwamish River)[1].
    - Chemically Enhanced Primary Treatment with Lamella Plates
        - 70.0-MGD WWTF.
        - 0.77-MG equalization basin.
        - 70.0-MGD influent pump station.
        - Up to approximately 1,470 ft of 54-inch-diameter effluent gravity sewer from the WWTF to the Hanford St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.3.1-1.
        - Approximately 700 ft of 48-inch-diameter pipe for the extension of the CSO outfall into the East Waterway (Duwamish River)[1].

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 *Technical Memorandum 700, Treatment Technology Selection.* Table 1 summarizes the unit processes of the WWTF that are included for each CSO

[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*.

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 near the Hanford St Regulator Station and would store or treat King County CSOs diverted from the Hanford St Regulator Station.

One regulator station will be required to divert King County flows (Hanford #2 CSOs) from the Hanford St Regulator Station to the WWTF and equalization basin. For this planning phase, it is assumed that the diversion would occur at the Hanford 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 60-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 1,470 feet long based on the criteria and assumptions listed in Section 6.1.

Treated CSOs would be conveyed to the Hanford St Regulator Station via a 54-inch-diameter effluent gravity sewer, up to approximately 1,470 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 to the new extension of the CSO outfall to the East Waterway (Duwamish River). For planning purposes, the new outfall extension is approximately 700 feet long and is 48 inches in diameter to match the existing CSO outfall capacity and replace the existing submarine outfall[2]. 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*.

Representative Footprints for Potential Siting Within or Adjacent to Boundary

CSO Treatment (with Influent Pumping), Typ

DSN032-WWT-1 (KC)
Ballasted Sedimentation
Total Footprint = ~2.00 Acres
Total Flow = ~68.0 MGD
Total Volume = ~0.94 MG

DSN032-WWT-1 (KC)
CEPT w/ Lamella Plates
Total Footprint = ~2.29 Acres
Total Flow = ~70.0 MGD
Total Volume = ~0.77 MG

Equalization Basin, Typ

Lander St Regulator Station

Hanford #2 CSO Outfall

Modifications to Hanford St Regulator Station

Elliott Bay Interceptor

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.

- KC Manholes
- SPU Maintenance Hole
- 5-ft Contour
- 20-ft Contour
- KC-WTD Conveyance
- SPU Drainage Mainline
- SPU Sanitary Mainline
- SPU Combined Mainline
- Representative Footprint
- Connected Area with High GSI Potential
- Connected to Combined Sewer System

Total Hanford/Lander CSO Basin Area: ~3,469 acres

N

500 250 0 500
Feet

Potential GSI Opportunities in Hanford #2 CSO Basin

Hanford/Lander CSO Basin Boundary

Approximate Boundary

~19% Hanford/Lander Basin Area Likely Feasible for GSI

0 7,500 15,000 30,000
Feet

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

File Name:

Data Source:

Figure G.3.1-1

Hanford #2 - DSN032-WWT-1 (KC)
Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN032-WWT-1 (KC)

Escalation Assumptions

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

Total Project Cost for Ballasted Sedimentation, 2010 Dollars

Description	Total Costs (Hanford #2)
68.0-MGD Ballasted Sedimentation Construction Cost =	$20,520,000
0.94-MG Equalization Basin Construction Cost =	$5,350,000
68.0-MGD Influent Pump Station Construction Cost =	$14,780,000
Solids Handling Facility Construction Cost =	$2,720,000
Grit Removal Facility Construction Cost =	$530,000
Modifications to Hanford St Regulator Construction Cost =	$490,000
Influent Gravity Sewer Construction Cost (1,470 LF of 60-inch-diameter pipe) =	$2,970,000
Effluent Gravity Sewer Construction Cost (1,470 LF of 54-inch-diameter pipe) =	$2,620,000
[3]Outfall Construction Cost (700 LF of 48-inch-diameter pipe) =	$2,020,000
SDOT Street Use Permit Fee Cost =	$290,000
Total Construction Cost =	$52,290,000
Sales Tax (10% of Construction Cost) =	$5,230,000
[1]Allied Costs (46.22% of Construction Cost) =	$24,170,000
Property Cost =	$9,180,000
Subtotal of Project Cost =	$90,870,000
[1]Construction Contingency (10% of Construction Cost) =	$5,230,000
[1, 2]Project Contingency =	$22,030,000
Total Project Cost for Ballasted Sedimentation, 2010 Dollars =	**$118,100,000**

[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 replace submerged outfall with new CSO outfall extension at $60/in/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 DSN032-WWT-1 (KC)

Escalation Assumptions

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

Total Project Cost for CEPT with Lamella Plates, 2010 Dollars

Description	Total Costs (Hanford #2)
70-MGD CEPT with Lamella Construction Cost =	$18,290,000
0.77-MG Equalization Basin Construction Cost =	$4,580,000
70-MGD Influent Pump Station Construction Cost =	$15,170,000
Lamella Plates Construction Cost =	$1,470,000
Solids Handling Facility Construction Cost =	$2,090,000
Modifications to Hanford St Regulator Construction Cost =	$490,000
Influent Gravity Sewer Construction Cost (1,470 LF of 60-inch-diameter pipe) =	$2,970,000
Effluent Gravity Sewer Construction Cost (1,470 LF of 54-inch-diameter pipe) =	$2,620,000
[3]Outfall Construction Cost (700 LF of 48-inch-diameter pipe) =	$2,020,000
SDOT Street Use Permit Fee Cost =	$290,000
Total Construction Cost =	$49,990,000
Sales Tax (10% of Construction Cost) =	$5,000,000
[1]Allied Costs (46.22% of Construction Cost) =	$23,110,000
Property Cost =	$10,850,000
Subtotal of Project Cost =	$88,950,000
[1]Construction Contingency (10% of Construction Cost) =	$5,000,000
[1, 2]Project Contingency =	$21,690,000
Total Project Cost for CEPT with Lamella Plates, 2010 Dollars =	**$115,600,000**

[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]Placeholder Costs for CSO Outfall: Assume replace submerged outfall with new CSO outfall extension at $60/in/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)
DSN032 Hanford #2 Regulator	94.9	68	70

[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	$20,519,950	$18,292,256
Influent Pump Station	$14,784,489	$15,171,809
Solids Handling Facility	$2,719,865	$2,091,240
Grit Removal Facility	$527,741	$0
Lamella Plates	$0	$1,473,648
Regulator Station	$485,000	$485,000
Total Construction Costs	$39,037,044	$37,513,953

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EQUALIZATION BASIN FOR BALLASTED SEDIMENTATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Equalization Basin (Ballasted)
Printed date : 01/04/2011

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 0.94 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	$952,000	$952,000
Odor Control	1	LS	$164,000	$164,000
Effluent Pump Station	1	LS	$214,000	$214,000
Construction Cost	0.9	Mgal	4,000,000	$3,760,000
			Year 2008 Subtotal	$5,140,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$5,350,000			

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

Cost Calculations for Storage Facility: Equalization Basin (CEPT)
Printed date : 01/04/2011

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 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			

INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe
Printed date : 01/04/2011

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: 1470 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 60 in.

Geometry

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

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	9,750.00	CY	$13	$127,000
Backfill	5,130.00	CY	$34	$174,000
Complete Pavement Restoration	2,040.00	SY	$86	$175,000
Overlay Pavement Restoration	5,150.00	SY	$28	$144,000
Trench Safety	50,300.00	SF	$17	$856,000
Spoil Load and Haul	9,750.00	CY	$16	$156,000
Pipe Unit Material Cost	1,470.00	lf	$220	$323,000
Pipe Installation	1,470.00	lf	$81	$119,000
Place Pipe Zone Fill	3,020.00	CY	$34	$103,000
Manholes	3	MH	$15,400	$46,100
Existing Utilities	1,470.00	lf	$265	$390,000
Dewatering	1,470.00	lf	$127	$187,000
Traffic Control	1,470.00	lf	$36	$52,900
			Year 2008 Subtotal	$2,850,000

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

Year 2010 Total: $2,970,000

EFFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Effluent Pipe
Printed date : 01/04/2011

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: 1470 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	8,740.00	CY	$13	$114,000
Backfill	4,760.00	CY	$34	$162,000
Complete Pavement Restoration	1,910.00	SY	$86	$164,000
Overlay Pavement Restoration	5,270.00	SY	$28	$148,000
Trench Safety	48,600.00	SF	$17	$827,000
Spoil Load and Haul	8,740.00	CY	$16	$140,000
Pipe Unit Material Cost	1,470.00	lf	$168	$247,000
Pipe Installation	1,470.00	lf	$70	$103,000
Place Pipe Zone Fill	2,670.00	CY	$34	$90,800
Manholes	3	MH	$15,400	$46,100
Existing Utilities	1,470.00	lf	$166	$244,000
Dewatering	1,470.00	lf	$127	$187,000
Traffic Control	1,470.00	lf	$36	$52,900
			Year 2008 Subtotal	$2,520,000

Mobilization/Demobilization at 6%	1.06	
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98	
Effective Multiplier	1.04	
Construction Year 2010 Subtotal	$2,620,000	

Year 2010 Total: $2,620,000

MODIFICATIONS TO HANFORD ST REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 01/04/2011

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.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	180,000	180,000
Electrical/Instrumentation	1	LS	195,000	195,000
Architectural/Structural	1	LS	40,000	$40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	$1			
Construction Year 2010 Subtotal	$485,000			

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PROPERTY AND PERMITTING COSTS

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

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building ($/SF)	Average Cost per Square Foot for Industrial Land ($/SF)
DSN032 Hanford #2 Regulator	$105.60	$24.12

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.	86,946	$105.60	100%	$9,181,498
			Total Land Costs	$9,181,498

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.	99,779	$105.60	100%	$10,536,662
Additional Solids Handling Facility	2,968	$105.60	100%	$313,391
			Total Land Costs	$10,850,053

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 Hanford St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Gravity Sewer, First Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer, Second Phase of Construction	60	470	44	20,680	43.9	5	$0.70	$14,476
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	470	44	20,680	43.9	5	$0.70	$14,476
						Total SDOT Street Use Fee Estimation:		$290,652

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Operations and Maintenance Cost Estimate Summary

Basin Name: Hanford 2

Alternative Name: MEBI-Hanford-KC-WWTF (Ballasted w/ UV)

ENR 1994	5747	*Acres of Raingarden for GSI*	**0.00**	
Current ENR	**8645.4**	*Annual Overflow Vol (MG)*	**202.70**	
Power Cost (per kwh)	**0.065**	*Annual Vol Capture*	**179.30**	
Labor rate (loaded) /hr	**51.17**	*Annual Events*	**19**	
SPU Water Cost $/CCF	**4.50**	*Stor Vol*	**0.94**	equalization
Carbon Cost/Lb	**2.00**	*Peak Flow Rate*	**188.00**	
		Peak Flow Rate w/Eual	**68.00**	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$4,439			
Force Mains	$0			
Regulator/Flow Control Structures	$0			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$1,656			
Pump Stations	$20,870	$56,661	$53,853	
Rectangular Storage Facilities	$23,737	$10,273	$5,457	$17,594
High Rate Treatment	$290,607	$13,477	$0	$94,396
Additonal Secondary Treatment	NA	$144,465	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$341,310**	**$224,877**	**$59,310**	**$111,990**

Total Annual O&M

General	**$678,176**
Energy	**$59,310**
Total	**$737,486**

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WTD Business Case Evaluation Results

Hanford 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
MEBI-Hanford-KC-WWTF	50	$118,100,000	$148,095,651	$0	$148,095,651	$4,897,469	$4,897,469

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
MEBI-Hanford-KC-WWTF	50	$118,100,000	$102,226,845	$0	$102,226,845	$3,380,605	$3,380,605
		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.3.2

Lander St Site Alternatives

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Lander St Site Alternative

DSN030-WWT-1 (KC) or MEBI-Lander-KC-WWTF

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DSN030-WWT-1 (KC) or MEBI-Lander-KC-WWTF

Alternative DSN030-WWT-1 (KC) controls King County's Lander St CSOs by building an equalization basin and wet-weather treatment facility (WWTF) to store and treat CSOs prior to discharge into the East Waterway (Duwamish River). The WWTF would be located near the Lander 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 Lander St Regulator Station to WWTF (Common to Both CSO Treatment Processes)
    - CSO Peak Flow Rate for Sizing Conveyance from Lander Regulator Station to Influent Pump Station, Equalization Basin, and WWTF: 47.9 MGD
- Ballasted Sedimentation
    - WWTF and Influent Pump Station Peak Design Flow Rate: 23.0 MGD
    - Equalization Basin Volume: 0.79 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Lander St Regulator Station: 23.0 MGD
    - CSO Peak Flow Rate for Sizing Outfall: Capacity of Existing Lander St CSO Outfall.
- Chemically Enhanced Primary Treatment with Lamella Plates
    - WWTF and Influent Pump Station Peak Design Flow Rate: 24.0 MGD
    - Equalization Basin Volume: 0.71 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Lander St Regulator Station: 24.0 MGD
    - CSO Peak Flow Rate for Sizing Outfall: Capacity of Existing Lander CSO Outfall

Description

Alternative DSN030-WWT-1 (KC) consists of a WWTF to treat Lander CSOs, which discharge into the East Waterway (Duwamish River). The WWTF includes an influent pump station, equalization basin, screening facility, CSO treatment process, and disinfection. Modifications to the Lander 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.3.2-1. 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 Lander St Regulator Station to WWTF (Common to Both CSO Treatment Processes)
    - Modifications to the Lander St Regulator Station.
    - Up to approximately 1,970 ft of 48-inch-diameter influent gravity sewer to convey Lander St CSOs from the Lander 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.3.2-1.
- CSO Treatment Processes (One of the Following)
    - Ballasted Sedimentation
        - 23.0-MGD WWTF.
        - 0.79-MG equalization basin.
        - 23.0-MGD influent pump station.
        - Up to approximately 1,970 ft of 36-inch-diameter effluent gravity sewer from the WWTF to the Lander St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.3.2-1.
        - Approximately 500 ft of 96-inch-diameter pipe for the extension of the CSO outfall into the East Waterway (Duwamish River)[1].
    - Chemically Enhanced Primary Treatment with Lamella Plates
        - 24.0-MGD WWTF.
        - 0.71-MG equalization basin.
        - 24.0-MGD influent pump station.
        - Up to approximately 1,970 ft of 36-inch-diameter effluent gravity sewer from the WWTF to the Lander St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.3.2-1.
        - Approximately 500 ft of 96-inch-diameter pipe for the extension of the CSO outfall into the East Waterway (Duwamish River)[1].

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

[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*.

treatment process evaluated. See Section 6.1 and Appendix Figure G.3.2-1 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 near the Lander St Regulator Station and would store or treat King County CSOs diverted from the Lander St Regulator Station.

One regulator station will be required to divert King County flows (Lander CSOs) from the Lander St Regulator Station to the WWTF and equalization basin. For this planning phase, it is assumed that the diversion would occur at the Lander 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 48-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 1,970 feet long based on the criteria and assumptions listed in Section 6.1.

Treated CSOs would be conveyed to the Lander St Regulator Station via a 36-inch-diameter effluent gravity sewer, up to approximately 1,970 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 to the new extension of the CSO outfall to the East Waterway (Duwamish River). For planning purposes, the new outfall extension is approximately 500 feet long and is 96 inches in diameter to match the existing CSO outfall capacity[2]. 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*.

Representative Footprints for Potential Siting Within or Adjacent to Boundary

CSO Treatment (with Influent Pumping), Typ

DSN030-WWT-1 (KC)
Ballasted Sedimentation
Total Footprint = ~1.65 Acres
Total Flow = ~23.0 MGD
Total Volume = ~0.79 MG

DSN030-WWT-1 (KC)
CEPT w/ Lamella Plates
Total Footprint = ~1.95 Acres
Total Flow = ~24.0 MGD
Total Volume = ~0.71 MG

Equalization Basin, Typ

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.

Lander Street CSO Outfall

Elliott Bay Interceptor

Modifications to Lander St Regulator Station

Hanford #2 CSO Outfall

Hanford St Regulator Station

- KC Manholes
- SPU Maintenance Hole
- 5-ft Contour
- 20-ft Contour
- KC-WTD Conveyance
- SPU Drainage Mainline
- SPU Sanitary Mainline
- SPU Combined Mainline
- Representative Footprint
- Connected Area with High GSI Potential
- Connected to Combined Sewer System

Total Hanford/Lander CSO Basin Area: ~3,469 acres

N

600 300 0 600
Feet

Potential GSI Opportunities in Lander St CSO Basin

Hanford/Lander CSO Basin Boundary

Approximate Boundary

~19% Hanford/Lander Basin Area Likely Feasible for GSI

0 8,000 16,000 32,000
Feet

King County
Department of
Natural Resources and Parks
Wastewater Treatment Division

File Name:

Data Source:

Figure G.3.2-1

Lander - DSN030-WWT-1 (KC)
Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN030-WWT-1 (KC)

Escalation Assumptions

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

Total Project Cost for Ballasted Sedimentation, 2010 Dollars

Description	Total Costs (Lander)
23.0-MGD Ballasted Sedimentation Construction Cost =	$10,580,000
0.79-MG Equalization Basin Construction Cost =	$4,680,000
23.0-MGD Influent Pump Station Construction Cost =	$5,790,000
Solids Handling Facility Construction Cost =	$1,180,000
Grit Removal Facility Construction Cost =	$180,000
Modifications to Lander St Regulator Construction Cost =	$490,000
Influent Gravity Sewer Construction Cost (1,970 LF of 48-inch-diameter pipe) =	$3,200,000
Effluent Gravity Sewer Construction Cost (1,970 LF of 36-inch-diameter pipe) =	$2,570,000
[3]Outfall Construction Cost (500 LF of 96-inch-diameter pipe) =	$2,880,000
SDOT Street Use Permit Fee Cost =	$380,000
Total Construction Cost =	$31,930,000
Sales Tax (10% of Construction Cost) =	$3,190,000
[1]Allied Costs (46.22% of Construction Cost) =	$14,760,000
Property Cost =	$8,310,000
Subtotal of Project Cost =	$58,190,000
[1]Construction Contingency (10% of Construction Cost) =	$3,190,000
[1, 2]Project Contingency =	$14,270,000
Total Project Cost for Ballasted Sedimentation, 2010 Dollars =	**$75,700,000**

[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/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 DSN030-WWT-1 (KC)

Escalation Assumptions

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

Total Project Cost for CEPT with Lamella Plates, 2010 Dollars

Description	Total Costs (Lander)
24-MGD CEPT with Lamella Construction Cost =	$9,180,000
0.71-MG Equalization Basin Construction Cost =	$4,310,000
24-MGD Influent Pump Station Construction Cost =	$5,990,000
Lamella Plates Construction Cost =	$510,000
Solids Handling Facility Construction Cost =	$980,000
Modifications to Lander St Regulator Construction Cost =	$490,000
Influent Gravity Sewer Construction Cost (1,970 LF of 48-inch-diameter pipe) =	$3,200,000
Effluent Gravity Sewer Construction Cost (1,970 LF of 36-inch-diameter pipe) =	$2,570,000
[3]Outfall Construction Cost (500 LF of 96-inch-diameter pipe) =	$2,880,000
SDOT Street Use Permit Fee Cost =	$380,000
Total Construction Cost =	$30,490,000
Sales Tax (10% of Construction Cost) =	$3,050,000
[1]Allied Costs (46.22% of Construction Cost) =	$14,090,000
Property Cost =	$9,970,000
Subtotal of Project Cost =	$57,600,000
[1]Construction Contingency (10% of Construction Cost) =	$3,050,000
[1, 2]Project Contingency =	$14,230,000
Total Project Cost for CEPT with Lamella Plates, 2010 Dollars =	**$74,900,000**

[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/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)
DSN030 Lander Regulator	47.9	23	24

[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	$10,576,675	$9,179,397
Influent Pump Station	$5,787,347	$5,993,159
Solids Handling Facility	$1,177,538	$976,560
Grit Removal Facility	$178,501	$0
Lamella Plates	$0	$505,251
Regulator Station	$485,000	$485,000
Total Construction Costs	$18,205,061	$17,139,367

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EQUALIZATION BASIN FOR BALLASTED SEDIMENTATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Equalization Basin (Ballasted)
Printed date : 01/04/2011

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 0.79 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	$938,000	$938,000
Odor Control	1	LS	$140,000	$140,000
Effluent Pump Station	1	LS	$210,000	$210,000
Construction Cost	0.8	Mgal	4,000,000	$3,160,000
			Year 2008 Subtotal	$4,500,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$4,680,000			

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

Cost Calculations for Storage Facility: Equalization Basin (CEPT)
Printed date : 01/04/2011

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 0.71 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	$930,000	$930,000
Odor Control	1	LS	$127,000	$127,000
Effluent Pump Station	1	LS	$207,000	$207,000
Construction Cost	0.7	Mgal	4,000,000	$2,840,000
			Year 2008 Subtotal	$4,140,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$4,310,000			

INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe
Printed date : 01/04/2011

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: 1970 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	10,100.00	CY	$13	$132,000
Backfill	5,770.00	CY	$34	$196,000
Complete Pavement Restoration	2,360.00	SY	$86	$203,000
Overlay Pavement Restoration	7,270.00	SY	$28	$204,000
Trench Safety	62,400.00	SF	$17	$1,060,000
Spoil Load and Haul	10,100.00	CY	$16	$162,000
Pipe Unit Material Cost	1,970.00	lf	$123	$242,000
Pipe Installation	1,970.00	lf	$60	$118,000
Place Pipe Zone Fill	3,040.00	CY	$34	$103,000
Manholes	4	MH	$12,600	$50,200
Existing Utilities	1,970.00	lf	$166	$327,000
Dewatering	1,970.00	lf	$107	$211,000
Traffic Control	1,970.00	lf	$36	$70,900
			Year 2008 Subtotal	$3,080,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$3,200,000

Year 2010 Total: $3,200,000

EFFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Effluent Pipe
Printed date : 01/04/2011

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: 1970 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 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	7,780.00	CY	$13	$101,000
Backfill	4,770.00	CY	$34	$162,000
Complete Pavement Restoration	2,030.00	SY	$86	$174,000
Overlay Pavement Restoration	2,790.00	SY	$28	$78,000
Trench Safety	57,800.00	SF	$17	$982,000
Spoil Load and Haul	7,780.00	CY	$16	$124,000
Pipe Unit Material Cost	1,970.00	lf	$77	$152,000
Pipe Installation	1,970.00	lf	$45	$88,700
Place Pipe Zone Fill	2,230.00	CY	$34	$76,000
Manholes	4	MH	$9,720	$38,900
Existing Utilities	1,970.00	lf	$120	$236,000
Dewatering	1,970.00	lf	$107	$211,000
Traffic Control	1,970.00	lf	$24	$47,300
			Year 2008 Subtotal	$2,470,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$2,570,000

Year 2010 Total: $2,570,000

MODIFICATIONS TO LANDER ST REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 01/04/2011

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.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	180,000	180,000
Electrical/Instrumentation	1	LS	195,000	195,000
Architectural/Structural	1	LS	40,000	$40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	$1			
Construction Year 2010 Subtotal	$485,000			

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PROPERTY AND PERMITTING COSTS

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

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building ($/SF)	Average Cost per Square Foot for Industrial Land ($/SF)
DSN030 Lander Regulator	$115.46	$24.12

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.	71,937	$115.46	100%	$8,305,846
			Total Land Costs	$8,305,846

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.	84,952	$115.46	100%	$9,808,558
Additional Solids Handling Facility	1,390	$115.46	100%	$160,522
			Total Land Costs	$9,969,080

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 Lander St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Gravity Sewer, First Phase of Construction	48	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer, Second Phase of Construction	48	970	44	42,680	90.5	10	$2.90	$123,772
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	970	22	21,340	90.5	10	$2.90	$61,886
						Total SDOT Street Use Fee Estimation:		$383,558

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Operations and Maintenance Cost Estimate Summary

Basin Name: Lander 2

Alternative Name: MEBI-Lander-KC-WWTF (Ballasted w/ UV)

ENR 1994	5747
Current ENR	**8654.4**
Power Cost (per kwh)	**0.065**
Labor rate (loaded) /hr	**51.17**
SPU Water Cost $/CCF	**4.50**
Carbon Cost/Lb	**2.00**

Acres of Raingarden for GSI	**0.00**	
Annual Overflow Vol (MG)	**92.50**	
Annual Vol Capture	**83.60**	
Annual Events	**20**	
Stor Vol	**0.79**	equalization
Peak Flow Rate	**188.00**	
Peak Flow Rate w/Equal	**23.00**	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$2,220			
Force Mains	$0			
Regulator/Flow Control Structures	$0			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$1,656			
Pump Stations	$17,620	$55,454	$29,348	
Rectangular Storage Facilities	$20,799	$9,009	$4,592	$14,786
High Rate Treatment	$290,607	$5,305	$0	$44,013
Additonal Secondary Treatment	NA	$0	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$332,901**	**$69,767**	**$33,940**	**$58,799**

Total Annual O&M

General	**$461,467**
Energy	**$33,940**
Total	**$495,407**

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WTD Business Case Evaluation Results

Lander 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
MEBI-Lander-KC-WWTF	50	$75,700,000	$82,443,205	$0	$82,443,205	$2,726,367	$2,726,367

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
MEBI-Lander-KC-WWTF	50	$75,700,000	$64,313,961	$0	$64,313,961	$2,126,839	$2,126,839
		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.3.3

Kingdome Site Alternatives

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Kingdome Site Alternative

DSN029-WWT-1 (KC) or MEBI-Kingdome-KC-WWTF

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DSN029-WWT-1 (KC) or MEBI-Kingdome-KC-WWTF

Alternative DSN029-WWT-1 (KC) controls King County's Kingdome CSOs by building an equalization basin and wet-weather treatment facility (WWTF) to store and treat CSOs prior to discharge into Elliott Bay. The WWTF would be located near the Kingdome 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 Kingdome Regulator Station to WWTF (Common to Both CSO Treatment Processes)
    - CSO Peak Flow Rate for Sizing Conveyance from Kingdome Regulator Station to Influent Pump Station, Equalization Basin, and WWTF: 87.0 MGD
- Ballasted Sedimentation
    - WWTF and Influent Pump Station Peak Design Flow Rate: 48.0 MGD
    - Equalization Basin Volume: 0.87 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Kingdome Regulator Station: 48.0 MGD
    - CSO Peak Flow Rate for Sizing Outfall: Capacity of Existing Kingdome CSO Outfall.
- Chemically Enhanced Primary Treatment with Lamella Plates
    - WWTF and Influent Pump Station Peak Design Flow Rate: 49.0 MGD
    - Equalization Basin Volume: 0.79 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Kingdome Regulator Station: 49.0 MGD
    - CSO Peak Flow Rate for Sizing Outfall: Capacity of Existing Kingdome CSO Outfall

Description

Alternative DSN029-WWT-1 (KC) consists of a WWTF to treat Kingdome CSOs, which discharge into Elliott Bay. The WWTF includes an influent pump station, equalization basin, screening facility, CSO treatment process, and disinfection. Modifications to the Kingdome 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.3.3-1. See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundary.

The main components of this alternative would include:

- Conveyance from Kingdome Regulator Station to WWTF (Common to Both CSO Treatment Processes)
    - Modifications to the Kingdome Regulator Station.
    - Up to approximately 1,570 ft of 54-inch-diameter influent gravity sewer to convey Kingdome CSOs from the Kingdome 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.3.3-1.
- CSO Treatment Processes (One of the Following)
    - Ballasted Sedimentation
        - 48.0-MGD WWTF.
        - 0.87-MG equalization basin.
        - 48.0-MGD influent pump station.
        - Up to approximately 1,570 ft of 48-inch-diameter effluent gravity sewer from the WWTF to the Kingdome Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.3.3-1.
        - Approximately 1,500 ft of 72-inch-diameter pipe for the extension of the CSO outfall into Elliott Bay[1].
    - Chemically Enhanced Primary Treatment with Lamella Plates
        - 49.0-MGD WWTF.
        - 0.79-MG equalization basin.
        - 49.0-MGD influent pump station.
        - Up to approximately 1,570 ft of 48-inch-diameter effluent gravity sewer from the WWTF to the Kingdome Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.3.3-1.
        - Approximately 1,500 ft of 72-inch-diameter pipe for the extension of the CSO outfall into Elliott Bay[1].

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

[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*.

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 near the Kingdome Regulator Station and would store or treat King County CSOs diverted from the Kingdome Regulator Station.

One regulator station will be required to divert King County flows (Kingdome CSOs) from the Kingdome Regulator Station to the WWTF and equalization basin. For this planning phase, it is assumed that the diversion would occur at the Kingdome 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 1,570 feet long based on the criteria and assumptions listed in Section 6.1.

Treated CSOs would be conveyed to the Kingdome Regulator Station via a 48-inch-diameter effluent gravity sewer, up to approximately 1,570 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 to the new extension of the CSO outfall to Elliott Bay. For planning purposes, the new outfall extension is approximately 1,500 feet long and is 72 inches in diameter to match the existing CSO outfall capacity[2]. 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*.

Representative Footprints for Potential Siting Within or Adjacent to Boundary

CSO Treatment (with Influent Pumping), Typ

DSN029-WWT-1 (KC)
Ballasted Sedimentation
Total Footprint = ~1.85 Acres
Total Flow = ~48.0 MGD
Total Volume = 0.87 MG

DSN029-WWT-1 (KC)
CEPT w/ Lamella Plates
Total Footprint = ~2.18 Acres
Total Flow = ~49.0 MGD
Total Volume = 0.79 MG

Equalization Basin, Typ

- KC Manholes
- SPU Maintenance Hole
- 5-ft Contour
- 20-ft Contour
- KC-WTD Conveyance
- SPU Drainage Mainline
- SPU Sanitary Mainline
- SPU Combined Mainline
- Representative Footprint
- Connected Area with High GSI Potential
- Connected to Combined Sewer System

Total Kingdome CSO Basin Area: ~915 acres

N

600 300 0 600
Feet

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.

Kingdome CSO Outfall

Modifications to Kingdome Regulator Station

Connecticut Street Trunk

Elliott Bay Interceptor

S King St
S Dearborn St
S Royal Brougham Way
S Atlantic St
Edgar Martinez Dr S
S Massachusetts St
S Vermont St
S Plummer St
Alaskan Way S
Alaska Fwy
Alaskan Viaduct Ramp
Occidental Ave S
1st Ave S
Colorado Ave S
Utah Ave S
3rd Ave S
4th Ave S
Atlantic Ramp
Ryerson Base A Rd
SR 519 Ramp
I-90 Ramp
Maynard Ave S
7th Ave S
8th Ave S
9th Ave S
I-90 Fwy
I-90/I-5 Ramp
I-5 Fwy
Airport Way S

Potential GSI Opportunities in Kingdome CSO Basin

Kingdome CSO Basin Boundary

Approximate Boundary

~0% Basin Area Likely Feasible for GSI

0 3,700 7,400 14,800
Feet

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

File Name:

Data Source:

Figure G.3.3-1

Kingdome - DSN029-WWT-1 (KC)
Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN029-WWT-1 (KC)

Escalation Assumptions

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

Total Project Cost for Ballasted Sedimentation, 2010 Dollars

Description	Total Costs (Kingdome)
48.0-MGD Ballasted Sedimentation Construction Cost =	$16,250,000
0.87-MG Equalization Basin Construction Cost =	$5,040,000
48.0-MGD Influent Pump Station Construction Cost =	$10,850,000
Solids Handling Facility Construction Cost =	$2,030,000
Grit Removal Facility Construction Cost =	$370,000
Modifications to Kingdome Regulator Construction Cost =	$490,000
Influent Gravity Sewer Construction Cost (1,570 LF of 54-inch-diameter pipe) =	$2,820,000
Effluent Gravity Sewer Construction Cost (1,570 LF of 48-inch-diameter pipe) =	$2,560,000
[3]Outfall Construction Cost (1,500 LF of 72-inch-diameter pipe) =	$6,480,000
SDOT Street Use Permit Fee Cost =	$310,000
Total Construction Cost =	$47,200,000
Sales Tax (10% of Construction Cost) =	$4,720,000
[1]Allied Costs (46.22% of Construction Cost) =	$21,820,000
Property Cost =	$9,510,000
Subtotal of Project Cost =	$83,250,000
[1]Construction Contingency (10% of Construction Cost) =	$4,720,000
[1, 2]Project Contingency =	$20,260,000
Total Project Cost for Ballasted Sedimentation, 2010 Dollars =	**$108,200,000**

[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]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 DSN029-WWT-1 (KC)

Escalation Assumptions

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

Total Project Cost for CEPT with Lamella Plates, 2010 Dollars

Description	Total Costs (Kingdome)
49-MGD CEPT with Lamella Construction Cost =	$14,300,000
0.79-MG Equalization Basin Construction Cost =	$4,680,000
49-MGD Influent Pump Station Construction Cost =	$11,050,000
Lamella Plates Construction Cost =	$1,030,000
Solids Handling Facility Construction Cost =	$1,920,000
Modifications to Kingdome Regulator Construction Cost =	$490,000
Influent Gravity Sewer Construction Cost (1,570 LF of 54-inch-diameter pipe) =	$2,820,000
Effluent Gravity Sewer Construction Cost (1,570 LF of 48-inch-diameter pipe) =	$2,560,000
[3]Outfall Construction Cost (1,500 LF of 72-inch-diameter pipe) =	$6,480,000
SDOT Street Use Permit Fee Cost =	$310,000
Total Construction Cost =	$45,640,000
Sales Tax (10% of Construction Cost) =	$4,560,000
[1]Allied Costs (46.22% of Construction Cost) =	$21,090,000
Property Costs =	$11,510,000
Subtotal of Project Costs =	$82,800,000
[1]Construction Contingency (10% of Construction Cost) =	$4,560,000
[1, 2]Project Contingency =	$20,280,000
Total Project Cost for CEPT with Lamella Plates, 2010 Dollars =	**$107,600,000**

[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]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)	Reduced CSO Peak Flow Rate[1] (MGD)	CEPT with Lamella Plates Reduced CSO Peak Flow Rate[1] (MGD)
DSN029 Kingdome Regulator	87.0	48	49
Total Wet-Weather Treatment Facility Design Capacity		**48**	**49**

[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	$16,254,747	$14,300,232
Influent Pump Station	$10,852,529	$11,051,664
Solids Handling Facility	$2,034,386	$1,915,400
Grit Removal Facility	$372,523	$0
Lamella Plates	$0	$1,031,554
Regulator Station	$485,000	$485,000
Total Construction Costs	$29,999,185	$28,783,850

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EQUALIZATION BASIN FOR BALLASTED SEDIMENTATION - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 0.87 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	$945,000	$945,000
Odor Control	1	LS	$153,000	$153,000
Effluent Pump Station	1	LS	$212,000	$212,000
Construction Cost	0.9	Mgal	4,000,000	$3,480,000
			Year 2008 Subtotal	$4,840,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$5,040,000			

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

Cost Calculations for Storage Facility: Equalization Basin (CEPT)
Printed date : 12/28/2010

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: 0.79 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	$938,000	$938,000
Odor Control	1	LS	$140,000	$140,000
Effluent Pump Station	1	LS	$210,000	$210,000
Construction Cost	0.8	Mgal	4,000,000	$3,160,000
			Year 2008 Subtotal	$4,500,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$4,680,000			

MODIFICATIONS TO KINGDOME 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 : 12/17/2010

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: 1570 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	9,330.00	CY	$13	$121,000
Backfill	5,080.00	CY	$34	$173,000
Complete Pavement Restoration	2,040.00	SY	$86	$176,000
Overlay Pavement Restoration	5,630.00	SY	$28	$158,000
Trench Safety	51,900.00	SF	$17	$883,000
Spoil Load and Haul	9,330.00	CY	$16	$149,000
Pipe Unit Material Cost	1,570.00	lf	$168	$264,000
Pipe Installation	1,570.00	lf	$70	$110,000
Place Pipe Zone Fill	2,850.00	CY	$34	$97,000
Manholes	4	MH	$15,400	$61,500
Existing Utilities	1,570.00	lf	$166	$261,000
Dewatering	1,570.00	lf	$127	$199,000
Traffic Control	1,570.00	lf	$36	$56,500
			Year 2008 Subtotal	$2,710,000

Mobilization/Demobilization at 6%	1.06	
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98	
Effective Multiplier	1.04	
Construction Year 2010 Subtotal	$2,820,000	

Year 2010 Total: $2,820,000

EFFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Effluent Pipe
Printed date : 12/17/2010

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: 1570 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	8,090.00	CY	$13	$105,000
Backfill	4,600.00	CY	$34	$156,000
Complete Pavement Restoration	1,880.00	SY	$86	$162,000
Overlay Pavement Restoration	5,790.00	SY	$28	$162,000
Trench Safety	49,700.00	SF	$17	$845,000
Spoil Load and Haul	8,090.00	CY	$16	$129,000
Pipe Unit Material Cost	1,570.00	lf	$123	$193,000
Pipe Installation	1,570.00	lf	$60	$94,200
Place Pipe Zone Fill	2,420.00	CY	$34	$82,400
Manholes	4	MH	$12,600	$50,200
Existing Utilities	1,570.00	lf	$166	$261,000
Dewatering	1,570.00	lf	$107	$168,000
Traffic Control	1,570.00	lf	$36	$56,500
			Year 2008 Subtotal	$2,470,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$2,560,000

Year 2010 Total: $2,560,000

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)
DSN029 Kingdome Regulator	$118.02	$24.12

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.	80,587	$118.02	100%	$9,510,878
			Total Land Costs	$9,510,878

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.	94,784	$118.02	100%	$11,186,408
Additional Solids Handling Facility	2,718	$118.02	100%	$320,799
			Total Land Costs	$11,507,207

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	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	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 Kingdome 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	570	44	25,080	53.2	6	$0.90	$22,572
Installation of Effluent Gravity Sewer, First Phase of Construction	48	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Effluent Gravity Sewer, Second Phase of Construction	48	570	44	25,080	53.2	6	$0.90	$22,572
						Total SDOT Street Use Fee Estimation:		$306,844

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Operations and Maintenance Cost Estimate Summary

Basin Name: Kingdome

Alternative Name: MEBI-Kingdome-KC-WWTF (Ballasted w/ UV)

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

Acres of Raingarden for GSI	**0.00**	
Annual Overflow Vol (MG)	**195.10**	
Annual Vol Capture	**180.50**	
Annual Events	**24**	
Stor Vol	**0.87**	equalization
Peak Flow Rate	**227.40**	
Peak Flow Rate w/Equal	**48.00**	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$4,741			
Force Mains	$0			
Regulator/Flow Control Structures	$0			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$1,656			
Pump Stations	$19,498	$56,151	$44,824	
Rectangular Storage Facilities	$22,366	$11,575	$5,082	$16,283
High Rate Treatment	$290,607	$11,266	$0	$95,028
Additonal Secondary Treatment	NA	$145,432	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$338,868**	**$224,425**	**$49,907**	**$111,311**

Total Annual O&M

General	**$674,604**
Energy	**$49,907**
Total	**$724,511**

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WTD Business Case Evaluation Results

Kingdome WWT 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
MEBI-Kingdome-KC-WWTF	50	$108,200,000	$138,304,993	$0	$138,304,993	$4,573,696	$4,573,696

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
MEBI-Kingdome-KC-WWTF	50	$108,200,000	$94,398,543	$0	$94,398,543	$3,121,725	$3,121,725
		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.3.4

King St Site Alternatives

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King St Site Alternative

DSN028-STOR-1 (KC) or MEBI-King-KC-STOR

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DSN028-STOR-1 (KC) or MEBI-King-KC-STOR

Alternative DSN028-STOR-1 (KC) controls King County's King St CSOs by building a storage tank near the King St Regulator Station. This alternative is an independent alternative and only controls King County CSOs.

Design Criteria

- King County Storage Volume Requirement: 2.63 MG (King St)
- King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 56.0 MGD (King St)
- Storage tank is required to drain within 12 hours of event.

Description

Alternative DSN028-STOR-1 (KC) consists of a storage tank to control King County King St CSOs. A CSO control volume of approximately 2.63 MG is required to reduce overflows at the King St CSO Outfall to an average of one untreated discharge per year. Storage of this volume could be provided with an offline storage tank located within or adjacent to the approximate boundary shown in Figure G.3.4-1. See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundary.

The main components of this alternative would include:

- 2.63-MG offline storage tank with pumps to empty the storage tank.
- Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
- Modifications to King St Regulator Station.
- Up to approximately 740 ft of 18-inch-diameter force main, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.3.4-1.
- Up to approximately 1,480 ft of 48-inch-diameter influent gravity sewer, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.3.4-1.

Storage Tank

The CSO control volume for King County could be stored in a buried, rectangular structure, approximately 250 feet long and 90 feet wide with a sidewater depth of approximately 20 feet.

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

Facilities Building(s)

Facilities building(s) would be located above or below ground level and would contain an odor control system, electrical controls, and a standby generator. The actual contents of the building(s) will be determined during preferred alternative development. The representative footprint shown in Figure G.3.4-1 for this alternative locates the facilities buildings adjacent to the storage tank for conservative purposes; however, the facilities buildings could be located above the storage tank to minimize space requirements.

Flow Diversion and Discharge

One regulator station will be required to divert King County flows from the King St Regulator Station to the storage tank. For this planning phase, it is assumed that the diversion would occur at the King St Regulator Station. Evaluation of whether flows can be diverted upstream of the King St Regulator Station will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the storage tank via a 48-inch-diameter influent gravity sewer. The length of the influent gravity sewer will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development. The influent gravity sewer can be up to 1,480 feet long based on the criteria and assumptions listed in Section 6.1.

After a wet-weather event, the chambers inside the storage tank would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County Elliott Bay Interceptor through a 18-inch-diameter force main that is up to approximately 740 feet in length. The length of the force main will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development.

Construction Assumptions

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

Representative Footprints for Potential Siting Within or Adjacent to Boundary

Storage Tank — DSN028-STOR-1 (KC)
Footprint = ~0.78 Acres
Volume = ~2.6 MG

Storage Tank — DSN028-STOR-2 (KC & SPU)
Footprint = ~0.91 Acres
Volume = ~3.3 MG

Electrical/Controls Building, Typ

Odor Control Building, Typ

- KC Manholes
- SPU Maintenance Hole
- 5-ft Contour
- 20-ft Contour
- KC-WTD Conveyance
- SPU Drainage Mainline
- SPU Sanitary Mainline
- SPU Combined Mainline
- Representative Footprint
- Connected Area with High GSI Potential
- Connected to Combined Sewer System

Total King Street CSO Basin Area: ~366 acres

N

400 200 0 400
Feet

Approximate Boundary for Locating CSO Storage Tank

CSO storage tank 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.

Elliott Bay Interceptor
Yesler Way
Western Ave
S Washington St
The Benson Line
Occidental Ave Walk
S Main St
3rd Ave S
2nd Ave S
4th Ave S
Transit Tunnel AcRd
S Jackson St
2nd Ave Ext S
King Street Trunk
King Street CSO Outfall
Occidental Ave S
S King St
1st Ave S
Pedestrian Walk
Intl District Sta AcRd
5th Ave S
6th Ave S
Weller St Walk
S Weller St
Modifications to King Street Regulator Station
Alaskan Viaduct Ramp
Alaskan Way S
S Dearborn St
Railroad Way S
Alaska Fwy
Alaska Fwy
Occidental Ave S
QWEST

Potential GSI Opportunities in King St CSO Basin

Approximate Boundary

King St CSO Basin Boundary

~0% Basin Area Likely Feasible for GSI

0 2,500 5,000 10,000
Feet

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

File Name:

Data Source:

Figure G.3.4-1

King Street Storage Alternatives
Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN028-STOR-1 (KC)

Escalation Assumptions

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

Total Project Cost, 2010 Dollars

Description	Total Costs (King Street)
2.63-MG Storage Tank Construction Cost =	$13,000,000
Influent Gravity Sewer Construction Cost (1,480 LF of 48-inch-diameter pipe) =	$2,410,000
Force Main Construction Cost (740 LF of 18-inch-diameter pipe) =	$360,000
Modifications to King Street Regulator Construction Cost =	$490,000
SDOT Street Use Permit Fee Cost =	$170,000
Total Construction Cost =	$16,430,000
Sales Tax (10% of Construction Cost) =	$1,640,000
[1]Allied Costs (46.07% of Construction Cost) =	$7,570,000
Property Cost =	$4,140,000
Subtotal of Project Cost =	$29,780,000
[1]Construction Contingency (10% of Construction Cost) =	$1,640,000
[1, 2]Project Contingency =	$7,290,000
Total Project Cost, 2010 Dollars =	**$38,700,000**

[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)

STORAGE TANK - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 2.63 Mgal
Facility Footprint: 34025 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	3,780.00	SY	$43	$163,000
Dewatering	1	LS	$1,110,000	$1,110,000
Odor Control	1	LS	$434,000	$434,000
Effluent Pump Station	1	LS	$258,000	$258,000
Construction Cost	2.6	Mgal	4,000,000	$10,500,000
			Year 2008 Subtotal	$12,500,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$13,000,000			

INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Gravity)
Printed date : 11/05/2010

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: 1480 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 48 in.

Geometry

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

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	7,620.00	CY	$13	$99,100
Backfill	4,330.00	CY	$34	$147,000
Complete Pavement Restoration	1,770.00	SY	$86	$153,000
Overlay Pavement Restoration	5,460.00	SY	$28	$153,000
Trench Safety	46,900.00	SF	$17	$797,000
Spoil Load and Haul	7,620.00	CY	$16	$122,000
Pipe Unit Material Cost	1,480.00	lf	$123	$182,000
Pipe Installation	1,480.00	lf	$60	$88,800
Place Pipe Zone Fill	2,280.00	CY	$34	$77,700
Manholes	3	MH	$12,600	$37,700
Existing Utilities	1,480.00	lf	$166	$246,000
Dewatering	1,480.00	lf	$107	$158,000
Traffic Control	1,480.00	lf	$36	$53,300
			Year 2008 Subtotal	$2,310,000

Mobilization/Demobilization at 6%	1.06	
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98	
Effective Multiplier	1.04	
Construction Year 2010 Subtotal	$2,410,000	

Year 2010 Total: $2,410,000

FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Force Main
Printed date : 11/05/2010

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: 740 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Standard
Pipe Diameter: 18 in.

Geometry

Outer Diameter	1.63	ft
Trench Width	4.61	ft
Excavation Depth	8.63	ft
Complete Surface Rest. Width	6.61	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,090.00	CY	$13	$14,200
Backfill	632	CY	$34	$21,500
Complete Pavement Restoration	544	SY	$86	$46,800
Overlay Pavement Restoration	1,270.00	SY	$28	$35,400
Trench Safety	12,800.00	SF	$1	$6,770
Spoil Load and Haul	1,090.00	CY	$16	$17,400
Pipe Unit Material Cost	740	lf	$82	$60,700
Pipe Installation	740	lf	$29	$21,500
Place Pipe Zone Fill	401	CY	$34	$13,600
Existing Utilities	740	lf	$42	$31,100
Dewatering	740	lf	$87	$64,400
Traffic Control	740	lf	$16	$11,800
			Year 2008 Subtotal	$345,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$359,000

Year 2010 Total: $359,000

MODIFICATIONS TO KING STREET REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

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

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

Year 2010 Total: $485,000

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PROPERTY AND PERMITTING COSTS

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

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building ($/SF)	Average Cost per Square Foot for Industrial Land ($/SF)
DSN028 King Street Regulator	$121.71	$24.12

Land Costs, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Storage Tank	26,000	$121.71	100%	$3,164,460
Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.)	8,025	$121.71	100%	$976,723
			Total Land Costs	$4,141,183

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 King St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Gravity Sewer, First Phase of Construction	48	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer, Second Phase of Construction	48	480	44	21,120	44.8	5	$0.70	$14,784
Installation of Force Main	18	740	22	16,280	69.1	7	$1.30	$21,164
						Total SDOT Street Use Fee Estimation:		$170,048

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Operations and Maintenance Cost Estimate Summary

Basin Name: King

Alternative Name: MEBI-King-KC-STOR

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

Acres of Raingarden for GSI	**0.00**
Annual Overflow Vol (MG)	**9.10**
Annual Vol Capture	**6.20**
Annual Events	**7**
Stor Vol	**2.63**
Peak Flow Rate	**56.00**
Peak Flow Rate w/Equal	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$2,235			
Force Mains	$27			
Regulator/Flow Control Structures	$38,459			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$0			
Pump Stations	$0	$0	$0	
Rectangular Storage Facilities	$38,823	$8,938	$9,778	$32,005
High Rate Treatment	$0	$0	$0	$0
Additonal Secondary Treatment	NA	$4,072	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$79,543**	**$13,010**	**$9,778**	**$32,005**

Total Annual O&M

General	**$124,558**
Energy	**$9,778**
Total	**$134,337**

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WTD Business Case Evaluation Results

King Street Ind Storage CSO Control

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
MEBI-King-KC-STOR	50	$38,700,000	$42,764,052	$0	$42,764,052	$1,414,192	$1,414,192

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
MEBI-King-KC-STOR	50	$38,700,000	$31,870,170	$0	$31,870,170	$1,053,935	$1,053,935
		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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King St Site Alternative

DSN028-STOR-2 (KC & SPU) or MEBI-King-Collab-STOR

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DSN028-STOR-2 (KC & SPU) or MEBI-King-Collab-STOR

Alternative DSN028-STOR-2 (KC & SPU) controls King County's King St CSOs and SPU's Vine, Madison, University, and Washington CSOs by building a storage tank near the King St Regulator Station. This alternative is a collaborative alternative that was developed by King County.

Design Criteria

- King County Storage Volume Requirement: 2.63 MG (King St)
- SPU Storage Volume Requirement: 0.65 MG[1] (Vine, Madison, University, and Washington)
- King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 56.0 MGD (King St)
- SPU CSO Peak Flow Rate for Sizing Conveyance to Storage: Flow rate needs to be provided by SPU for the following SPU CSO basins: Vine St, Madison St, University St, and Washington St[1]
- Storage tank is required to drain within 12 hours of event.

Description

Alternative DSN028-STOR-2 (KC & SPU) consists of a joint storage tank to control King County King St CSOs and SPU Vine, Madison, University, and Washington CSOs. A CSO control volume of approximately 2.63 MG is required to reduce overflows at the King St CSO Outfall to an average of one untreated discharge per year. A total maximum storage volume of 3.28 MG[1] is required to control all five CSO outfalls. Storage of this volume could be provided with an offline storage tank located within or adjacent to the approximate boundary shown in Figure G.3.4-1. See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundary. This alternative does not include the conveyance components and costs associated with SPU conveying flows to the King St Regulator Station.

The main components of this alternative would include:

- 3.28-MG offline storage tank with pumps to empty the storage tank.
- Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
- Modifications to King St Regulator Station.
- Up to approximately 740 ft of 20-inch-diameter force main, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.3.4-1.
- Up to approximately 1,480 ft of 54-inch-diameter influent gravity sewer, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.3.4-1.

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

Storage Tank

The CSO control volumes for King County and SPU could be stored in a buried, rectangular structure, approximately 270 feet long and 100 feet wide with a sidewater depth of approximately 20 feet.

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

Facilities Building(s)

Facilities building(s) would be located above or below ground level and would contain an odor control system, electrical controls, and a standby generator. The actual contents of the building(s) will be determined during preferred alternative development. The representative footprint shown in Figure G.3.4-1 for this alternative locates the facilities buildings adjacent to the storage tank for conservative purposes; however, the facilities buildings could be located above the storage tank to minimize space requirements.

Flow Diversion and Discharge

One regulator station will be required to divert King County and SPU flows from the King St Regulator Station to the storage tank. For this planning phase, it is assumed that the diversion would occur at the King St Regulator Station. Evaluation of whether flows can be diverted upstream of the King St Regulator Station will be completed during preferred alternative development. Diverted King County and SPU flow would discharge to the location of the storage tank via a 54-inch-diameter influent gravity sewer. The length of the influent gravity sewer will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development. The influent gravity sewer can be up to 1,480 feet long based on the criteria and assumptions listed in Section 6.1.

After a wet-weather event, the chambers inside the storage tank would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County Elliott Bay Interceptor through a 20-inch-diameter force main that is up to approximately 740 feet in length. The length of the force main will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development.

Construction Assumptions

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

Alternative DSN028-STOR-2 (KC & SPU)

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

Agency	Volume (MG)	Percentage of Costs (%)
King County	2.63	80.2%
SPU	0.65	19.8%

Escalation Assumptions

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

Total Project Cost, 2010 Dollars

Description	Total Costs (King County & SPU)	Costs Attributed to King County (King Street)[3]	Costs Attributed to SPU[3, 4]
3.28-MG Storage Tank Construction Cost =	$15,900,000	$12,750,000	$3,150,000
Influent Gravity Sewer Construction Cost (1,480 LF of 54-inch-diameter pipe) =	$2,640,000	$2,120,000	$520,000
Force Main Construction Cost (740 LF of 20-inch-diameter pipe) =	$390,000	$310,000	$80,000
Modifications to King Street Regulator Construction Cost =	$490,000	$390,000	$100,000
SDOT Street Use Permit Fee Cost =	$170,000	$140,000	$30,000
Total Construction Cost =	$19,590,000	$15,710,000	$3,880,000
Sales Tax (10% of Construction Cost) =	$1,960,000	$1,570,000	$390,000
[1]Allied Costs (46.07% of Construction Cost) =	$9,030,000	$7,240,000	$1,790,000
Property Cost =	$4,810,000	$3,860,000	$950,000
Subtotal of Project Cost =	$35,390,000	$28,380,000	$7,010,000
[1]Construction Contingency (10% of Construction Cost) =	$1,960,000	$1,570,000	$390,000
[1, 2]Project Contingency =	$8,660,000	$6,940,000	$1,720,000
Total Project Cost, 2010 Dollars =	**$46,000,000**	**$36,900,000**	**$9,100,000**

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

STORAGE TANK - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 3.28 Mgal
Facility Footprint: 39560 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	4,400.00	SY	$43	$189,000
Dewatering	1	LS	$1,180,000	$1,180,000
Odor Control	1	LS	$538,000	$538,000
Effluent Pump Station	1	LS	$274,000	$274,000
Construction Cost	3.3	Mgal	4,000,000	$13,100,000
			Year 2008 Subtotal	$15,300,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$15,900,000			

INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Length: 1480 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	8,800.00	CY	$13	$114,000
Backfill	4,790.00	CY	$34	$163,000
Complete Pavement Restoration	1,920.00	SY	$86	$166,000
Overlay Pavement Restoration	5,310.00	SY	$28	$149,000
Trench Safety	49,000.00	SF	$17	$832,000
Spoil Load and Haul	8,800.00	CY	$16	$141,000
Pipe Unit Material Cost	1,480.00	lf	$168	$249,000
Pipe Installation	1,480.00	lf	$70	$104,000
Place Pipe Zone Fill	2,690.00	CY	$34	$91,400
Manholes	3	MH	$15,400	$46,100
Existing Utilities	1,480.00	lf	$166	$246,000
Dewatering	1,480.00	lf	$127	$188,000
Traffic Control	1,480.00	lf	$36	$53,300
			Year 2008 Subtotal	$2,540,000

Mobilization/Demobilization at 6%	1.06	
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98	
Effective Multiplier	1.04	
Construction Year 2010 Subtotal	$2,640,000	

Year 2010 Total: $2,640,000

FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Force Main
Printed date : 11/04/2010

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

Geometry

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

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,170.00	CY	$13	$15,200
Backfill	663	CY	$34	$22,600
Complete Pavement Restoration	562	SY	$86	$48,400
Overlay Pavement Restoration	1,250.00	SY	$28	$34,900
Trench Safety	13,000.00	SF	$1	$6,900
Spoil Load and Haul	1,170.00	CY	$16	$18,700
Pipe Unit Material Cost	740	lf	$91	$67,300
Pipe Installation	740	lf	$30	$22,200
Place Pipe Zone Fill	434	CY	$34	$14,800
Existing Utilities	740	lf	$58	$42,900
Dewatering	740	lf	$87	$64,400
Traffic Control	740	lf	$16	$11,800
			Year 2008 Subtotal	$370,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$385,000

Year 2010 Total: $385,000

MODIFICATIONS TO KING STREET REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1			
Effective Multiplier	0.98			
Construction Year 2010 Subtotal	$485,000			

Year 2010 Total: $485,000

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PROPERTY AND PERMITTING COSTS

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

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building ($/SF)	Average Cost per Square Foot for Industrial Land ($/SF)
DSN028 King Street Regulator	$121.71	$24.12

Land Costs, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption ($/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs ($)
Storage Tank	30,800	$121.71	100%	$3,748,668
Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.)	8,760	$121.71	100%	$1,066,180
			Total Land Costs	$4,814,848

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 King 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	480	44	21,120	44.8	5	$0.70	$14,784
Installation of Force Main	20	740	22	16,280	69.1	7	$1.30	$21,164
						Total SDOT Street Use Fee Estimation:		$170,048

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Appendix G.3.5

Consolidated Alternatives – King St and Kingdome

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Consolidated Alternatives – King St and Kingdome

DSN028/029-WWT-1 (KC) or
MEBI-Cons Kingdome-King-KC-WWTF

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DSN028/029-WWT-1 (KC) or MEBI-Cons Kingdome-King-KC-WWTF

Alternative DSN028/029-WWT-1 (KC) controls King County's King St and Kingdome CSOs by building an equalization basin and wet-weather treatment facility (WWTF) to store and treat CSOs prior to discharge into Elliott Bay. The WWTF would be located near the Kingdome 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 King St and Kingdome Regulator Stations to WWTF (Common to Both CSO Treatment Processes)
    - CSO Peak Flow Rate for Sizing Conveyance from King St Regulator Station to Influent Pump Station, Equalization Basin, and WWTF: 29.6 MGD (King St CSOs)
    - CSO Peak Flow Rate for Sizing Conveyance from Kingdome Regulator Station to Influent Pump Station, Equalization Basin, and WWTF: 87.0 MGD (Kingdome CSOs)
- Ballasted Sedimentation
    - WWTF and Influent Pump Station Peak Design Flow Rate: 56.0 MGD
    - Equalization Basin Volume: 1.45 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Kingdome Regulator Station: 56.0 MGD
    - CSO Peak Flow Rate for Sizing New Outfall[1]: 56.0 MGD
- Chemically Enhanced Primary Treatment with Lamella Plates
    - WWTF and Influent Pump Station Peak Design Flow Rate: 58.0 MGD
    - Equalization Basin Volume: 1.28 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Kingdome Regulator Station: 58.0 MGD
    - CSO Peak Flow Rate for Sizing New Outfall[1]: 58.0 MGD

Description

Alternative DSN028/029-WWT-1 (KC) consists of a WWTF to treat King St and Kingdome CSOs, which discharge into Elliott Bay. The WWTF includes an influent pump station, equalization basin, screening facility, CSO treatment process, and disinfection. Modifications to the King St and Kingdome 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.

[1] Untreated CSOs will discharge to existing CSO outfalls (King St and Kingdome CSO Outfalls).

This alternative assumes that the WWTF would be located within or adjacent to the approximate solid boundary shown in Figure G.3.5-1. The WWTF could be located anywhere between the King St Regulator Station and Kingdome Regulator Station (indicated as dashed boundary in Figure G.3.5-1); 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 King St and Kingdome Regulator Stations to WWTF (Common to Both CSO Treatment Processes)
    - Modifications to the King St and Kingdome Regulator Stations.
    - Approximately 2,400 ft of 36-inch-diameter influent gravity sewer to convey King St CSOs from the King 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.3.5-1.
    - Up to approximately 1,570 ft of 54-inch-diameter influent gravity sewer to convey Kingdome CSOs from the Kingdome 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.3.5-1.
- CSO Treatment Process (One of the Following)
    - Ballasted Sedimentation
        - 56.0-MGD WWTF.
        - 1.45-MG equalization basin.
        - 56.0-MGD influent pump station.
        - Up to approximately 1,570 ft of 48-inch-diameter effluent gravity sewer from the WWTF to the Kingdome Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate solid boundary shown in Figure G.3.5-1.
        - Approximately 3,000 ft of 48-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the Kingdome Regulator Station to Elliott Bay[2].
    - Chemically Enhanced Primary Treatment with Lamella Plates
        - 58.0-MGD WWTF.
        - 1.28-MG equalization basin.
        - 58.0-MGD influent pump station.

[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*.

- Up to approximately 1,570 ft of 48-inch-diameter effluent gravity sewer from the WWTF to the Kingdome Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate solid boundary shown in Figure G.3.5-1.
- Approximately 3,000 ft of 48-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the Kingdome Regulator Station to Elliott Bay[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 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.

[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*.

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 Kingdome Regulator Station and would store or treat King County CSOs diverted from the King St and Kingdome Regulator Stations.

One regulator station will be required to divert King County flows (Kingdome CSOs) from the Kingdome Regulator Station to the WWTF and equalization basin. For this planning phase, it is assumed that the diversion would occur at the Kingdome 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 facilities, which will be evaluated during preferred alternative development. The gravity sewer can be up to 1,570 feet long based on the criteria and assumptions listed in Section 6.1.

An additional regulator station will be required to divert King County flows (King St CSOs) from the King St Regulator Station to the WWTF. For this planning phase, it is assumed that the diversion would occur at the King St Regulator Station. Flows would be conveyed to the WWTF via approximately 2,400 ft of 36-inch-diameter influent gravity sewer. The total length of the gravity sewer will vary depending on the selected location of the facilities, which will be evaluated during preferred alternative development.

Treated CSOs would be conveyed to the Kingdome Regulator Station via a 48-inch-diameter effluent gravity sewer, up to approximately 1,570 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 3,000 feet of 48-inch-diameter pipe) from the Kingdome Regulator Station to Elliott Bay[4]. 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] 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*.

Representative Footprints for Potential Siting Within or Adjacent to Boundary

CSO Treatment (with Influent Pumping), Typ

DSN028/029-WWT-1 (KC)
Ballasted Sedimentation
Total Footprint = ~2.00 Acres
Total Flow = ~56.0 MGD
Total Volume = ~1.45 MG

DSN028/029-WWT-1 (KC)
CEPT w/ Lamella Plates
Total Footprint = ~2.33 Acres
Total Flow = ~58.0 MGD
Total Volume = ~1.28 MG

Equalization Basin, Typ

- KC Manholes
- SPU Maintenance Hole
- 5-ft Contour
- 20-ft Contour
- Proposed Conveyance
- KC-WTD Conveyance
- SPU Drainage Mainline
- SPU Sanitary Mainline
- SPU Combined Mainline
- Representative Footprint
- Connected Area with High GSI Potential
- Connected to Combined Sewer System

N

600 300 0 600
Feet

Modifications to King Street Regulator Station

36" Pipe

Convey to WWTF site

Kingdome CSO Outfall

Modifications to Kingdome Regulator Station

Connecticut Street Trunk

Elliott Bay Interceptor

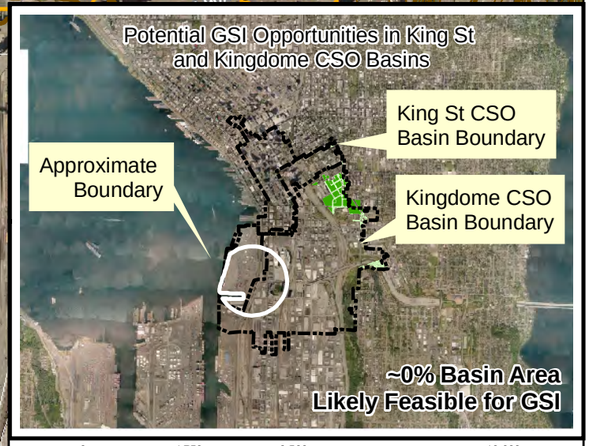
Approximate Boundary for Alternate Location of Wet-Weather Treatment Facility

The consolidated wet-weather treatment facility for this alternative could be located anywhere between the King St Regulator Station and Kingdome Regulator Station (dashed boundary). Conveyance would need to be re-evaluated if wet-weather treatment facility moves from assumed location (solid boundary).

Approximate Boundary for Assumed Location of Wet-Weather Treatment Facility

Wet-weather treatment facility has been assumed to be located within or adjacent to the solid boundary shown for cost estimating purposes. 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 consolidated alternative.

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

File Name:

Data Source:

Figure G.3.5-1

King Street and Kingdome - DSN028/029-WWT-1 (KC) Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN028/029-WWT-1 (KC)

Percentage of Cost Attributed to King Street and Kingdome CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs (%)
DSN028 King Street Regulator	29.6	25.4%
DSN029 Kingdome Regulator	87.0	74.6%

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 Street[3]	Costs Attributed to Kingdome[3]
56-MGD Ballasted Sedimentation Construction Cost =	$17,990,000	$4,570,000	$13,420,000
1.45-MG Equalization Basin Construction Cost =	$7,640,000	$1,940,000	$5,700,000
56-MGD Influent Pump Station Construction Cost =	$12,440,000	$3,160,000	$9,280,000
Solids Handling Facility Construction Cost =	$2,310,000	$590,000	$1,720,000
Grit Removal Facility Construction Cost =	$430,000	$110,000	$320,000
Modifications to King Street Regulator Construction Cost =	$490,000	$490,000	$0
Modifications to Kingdome Regulator Construction Cost =	$490,000	$0	$490,000
Influent Gravity Sewer Construction Cost, from King St Regulator to WWTF (2,400 LF of 36-inch-diameter pipe) =	$3,130,000	$3,130,000	$0
Influent Gravity Sewer Construction Cost from Kingdome Regulator to WWTF (1,570 LF of 54-inch-diameter pipe) =	$2,820,000	$0	$2,820,000
Effluent Gravity Sewer Construction Cost (1,570 LF of 48-inch-diameter pipe) =	$2,560,000	$650,000	$1,910,000
[4]Outfall Construction Cost (3,000 LF of 48-inch-diameter pipe) =	$8,640,000	$2,190,000	$6,450,000
SDOT Street Use Permit Fee Cost =	$450,000	$180,000	$270,000
Total Construction Cost =	$59,390,000	$17,010,000	$42,380,000
Sales Tax (10% of Construction Cost) =	$5,940,000	$1,700,000	$4,240,000
[1]Allied Costs (46.22% of Construction Cost) =	$27,450,000	$7,860,000	$19,590,000
Property Cost =	$10,380,000	$2,640,000	$7,740,000
Subtotal of Project Cost =	$103,160,000	$29,210,000	$73,950,000
[1]Construction Contingency (10% of Construction Cost) =	$5,940,000	$1,700,000	$4,240,000
[1, 2]Project Contingency =	$25,010,000	$7,060,000	$17,950,000
Total Project Cost for Ballasted Sedimentation, 2010 Dollars =	**$134,100,000**	**$38,000,000**	**$96,100,000**

[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 DSN028/029-WWT-1 (KC)

Percentage of Cost Attributed to King Street and Kingdome CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs (%)
DSN028 King Street Regulator	29.6	25.4%
DSN029 Kingdome Regulator	87.0	74.6%

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	Costs Attributed to King Street[3]	Costs Attributed to Kingdome[3]
58-MGD CEPT with Lamella Construction Cost =	$16,050,000	$4,070,000	$11,980,000
1.28-MG Equalization Basin Construction Cost =	$6,880,000	$1,750,000	$5,130,000
58-MGD Influent Pump Station Construction Cost =	$12,830,000	$3,260,000	$9,570,000
Lamella Plates Construction Cost =	$1,220,000	$310,000	$910,000
Solids Handling Facility Construction Cost =	$1,480,000	$380,000	$1,100,000
Modifications to King Street Regulator Construction Cost =	$490,000	$490,000	$0
Modifications to Kingdome Regulator Construction Cost =	$490,000	$0	$490,000
Influent Gravity Sewer Construction Cost, from King St Regulator to WWTF (2,400 LF of 36-inch-diameter pipe) =	$3,130,000	$3,130,000	$0
Influent Gravity Sewer Construction Cost from Kingdome Regulator to WWTF (1,570 LF of 54-inch-diameter pipe) =	$2,820,000	$0	$2,820,000
Effluent Gravity Sewer Construction Cost (1,570 LF of 48-inch-diameter pipe) =	$2,560,000	$650,000	$1,910,000
[4]Outfall Construction Cost (3,000 LF of 48-inch-diameter pipe) =	$8,640,000	$2,190,000	$6,450,000
SDOT Street Use Permit Fee Cost =	$450,000	$180,000	$270,000
Total Construction Cost =	$57,040,000	$16,410,000	$40,630,000
Sales Tax (10% of Construction Cost) =	$5,700,000	$1,640,000	$4,060,000
[1]Allied Costs (46.22% of Construction Cost) =	$26,360,000	$7,580,000	$18,780,000
Property Cost =	$12,220,000	$3,100,000	$9,120,000
Subtotal of Project Cost =	$101,320,000	$28,730,000	$72,590,000
[1]Construction Contingency (10% of Construction Cost) =	$5,700,000	$1,640,000	$4,060,000
[1, 2]Project Contingency =	$24,700,000	$6,980,000	$17,720,000
Total Project Cost for CEPT with Lamella Plates, 2010 Dollars =	**$131,700,000**	**$37,400,000**	**$94,400,000**

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

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

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

[4]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)
DSN028 King Street Regulator	29.6	56	58
DSN029 Kingdome Regulator	87.0		

[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	$17,990,402	$16,045,699
Influent Pump Station	$12,438,133	$12,831,863
Solids Handling Facility	$2,308,577	$1,483,620
Grit Removal Facility	$434,610	$0
Lamella Plates	$0	$1,221,023
Regulator Station	$485,000	$485,000
Total Construction Costs	$33,656,722	$32,067,205

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EQUALIZATION BASIN FOR BALLASTED SEDIMENTATION - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 1.45 Mgal
Facility Footprint: 16000 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	1,780.00	SY	$43	$76,400
Dewatering	1	LS	$1,000,000	$1,000,000
Odor Control	1	LS	$245,000	$245,000
Effluent Pump Station	1	LS	$228,000	$228,000
Construction Cost	1.4	Mgal	4,000,000	$5,800,000
			Year 2008 Subtotal	$7,350,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$7,640,000			

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

Cost Calculations for Storage Facility: Equalization Basin_CEPT
Printed date : 12/28/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 1.28 Mgal
Facility Footprint: 14400 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	1,600.00	SY	$43	$68,800
Dewatering	1	LS	$984,000	$984,000
Odor Control	1	LS	$218,000	$218,000
Effluent Pump Station	1	LS	$224,000	$224,000
Construction Cost	1.3	Mgal	4,000,000	$5,120,000
			Year 2008 Subtotal	$6,610,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$6,880,000			

MODIFICATIONS TO KING ST REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1			
Effective Multiplier	0.98			
Construction Year 2010 Subtotal	$485,000			

Year 2010 Total: $485,000

MODIFICATIONS TO KINGDOME REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

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

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

Year 2010 Total: $485,000

CONVEYANCE FROM KING STREET TO WWTF - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Conveyance (King St to Kingdome)
Printed date : 12/20/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Length: 2400 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 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	9,470.00	CY	$13	$123,000
Backfill	5,810.00	CY	$34	$198,000
Complete Pavement Restoration	2,470.00	SY	$86	$213,000
Overlay Pavement Restoration	3,400.00	SY	$28	$95,100
Trench Safety	70,400.00	SF	$17	$1,200,000
Spoil Load and Haul	9,470.00	CY	$16	$152,000
Pipe Unit Material Cost	2,400.00	lf	$77	$185,000
Pipe Installation	2,400.00	lf	$45	$108,000
Place Pipe Zone Fill	2,720.00	CY	$34	$92,500
Manholes	5	MH	$9,720	$48,600
Existing Utilities	2,400.00	lf	$120	$288,000
Dewatering	2,400.00	lf	$107	$257,000
Traffic Control	2,400.00	lf	$24	$57,600
			Year 2008 Subtotal	$3,010,000

Mobilization/Demobilization at 6%	1.06	
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98	
Effective Multiplier	1.04	
Construction Year 2010 Subtotal	$3,130,000	

Year 2010 Total: $3,130,000

CONVEYANCE FROM KINGDOME TO WWTF - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Kingdome to WWTF)
Printed date : 12/21/2010

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: 1570 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	9,330.00	CY	$13	$121,000
Backfill	5,080.00	CY	$34	$173,000
Complete Pavement Restoration	2,040.00	SY	$86	$176,000
Overlay Pavement Restoration	5,630.00	SY	$28	$158,000
Trench Safety	51,900.00	SF	$17	$883,000
Spoil Load and Haul	9,330.00	CY	$16	$149,000
Pipe Unit Material Cost	1,570.00	lf	$168	$264,000
Pipe Installation	1,570.00	lf	$70	$110,000
Place Pipe Zone Fill	2,850.00	CY	$34	$97,000
Manholes	4	MH	$15,400	$61,500
Existing Utilities	1,570.00	lf	$166	$261,000
Dewatering	1,570.00	lf	$127	$199,000
Traffic Control	1,570.00	lf	$36	$56,500
			Year 2008 Subtotal	$2,710,000

Mobilization/Demobilization at 6%	1.06	
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98	
Effective Multiplier	1.04	
Construction Year 2010 Subtotal	$2,820,000	

Year 2010 Total: $2,820,000

EFFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Effluent Pipe
Printed date : 12/01/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Length: 1570 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	8,090.00	CY	$13	$105,000
Backfill	4,600.00	CY	$34	$156,000
Complete Pavement Restoration	1,880.00	SY	$86	$162,000
Overlay Pavement Restoration	5,790.00	SY	$28	$162,000
Trench Safety	49,700.00	SF	$17	$845,000
Spoil Load and Haul	8,090.00	CY	$16	$129,000
Pipe Unit Material Cost	1,570.00	lf	$123	$193,000
Pipe Installation	1,570.00	lf	$60	$94,200
Place Pipe Zone Fill	2,420.00	CY	$34	$82,400
Manholes	4	MH	$12,600	$50,200
Existing Utilities	1,570.00	lf	$166	$261,000
Dewatering	1,570.00	lf	$107	$168,000
Traffic Control	1,570.00	lf	$36	$56,500
			Year 2008 Subtotal	$2,470,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$2,560,000

Year 2010 Total: $2,560,000

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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)
DSN029 Kingdome Regulator	$118.02	$24.12

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.	87,931	$118.02	100%	$10,377,617
			Total Land Costs	$10,377,617

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.	101,468	$118.02	100%	$11,975,253
Additional Solids Handling Facility	2,112	$118.02	100%	$249,277
			Total Land Costs	$12,224,530

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 King St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Regulator Station Upgrade at Kingdome Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Gravity Sewer from King St Regulator Station to WWTF, First Phase of Construction	36	1,000	22	22,000	93.3	10	$2.90	$63,800
Installation of Influent Gravity Sewer from King St Regulator Station to WWTF, Second Phase of Construction	36	1,000	22	22,000	93.3	10	$2.90	$63,800
Installation of Influent Gravity Sewer from King St Regulator Station to WWTF, Third Phase of Construction	36	400	22	8,800	37.3	4	$0.50	$4,400
Installation of Influent Gravity Sewer from Kingdome 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 Kingdome Regulator Station to WWTF, Second Phase of Construction	54	570	44	25,080	53.2	6	$0.90	$22,572
Installation of Effluent Gravity Sewer, First Phase of Construction	48	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Effluent Gravity Sewer, Second Phase of Construction	48	570	44	25,080	53.2	6	$0.90	$22,572
						Total SDOT Street Use Fee Estimation:		$445,344

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Operations and Maintenance Cost Estimate Summary

Basin Name: King-Kingdome Consolidated

Alternative Name: MEBI-Cons Kingdome-King-KC-WWTF (Ballasted w/ UV)

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

Acres of Raingarden for GSI	**0.00**	
Annual Overflow Vol (MG)	**204.20**	
Annual Vol Capture	**186.70**	
Annual Events	**24**	
Stor Vol	**1.45**	equalization
Peak Flow Rate	**283.40**	
Peak Flow Rate w/equal	**56.00**	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$12,895			
Force Mains	$0			
Regulator/Flow Control Structures	$0			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$1,656			
Pump Stations	$20,003	$56,339	$48,305	
Rectangular Storage Facilities	$33,729	$19,292	$8,471	$27,139
High Rate Treatment	$380,410	$12,368	$0	$98,292
Additonal Secondary Treatment	NA	$150,428	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$448,694**	**$238,426**	**$56,775**	**$125,431**

Total Annual O&M

General	**$812,551**
Energy	**$56,775**
Total	**$869,326**

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WTD Business Case Evaluation Results

King-Kingdome CSO Control Alternative

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							
MEBI-Cons Kingdome-King-KC-WWTF	50	$134,100,000	$169,874,355	$0	$169,874,355	$5,617,683	$5,617,683

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							
MEBI-Cons Kingdome-King-KC-WWTF	50	$134,100,000	$116,560,763	$0	$116,560,763	$3,854,622	$3,854,622

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.3.6

Consolidated Alternatives – Hanford #2 and Lander St

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Consolidated Alternatives – Hanford #2 and Lander St

DSN030/032-WWT-1 (KC) or
MEBI-Cons Hanford-Lander-KC-WWTF

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DSN030/032-WWT-1 (KC) or MEBI-Cons Hanford-Lander-KC-WWTF

Alternative DSN030/032-WWT-1 (KC) controls King County's Lander St and Hanford #2 CSOs by building an equalization basin and wet-weather treatment facility (WWTF) to store and treat CSOs prior to discharge into the East Waterway (Duwamish River). The WWTF would be located near the Hanford 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 Lander St and Hanford St Regulator Stations to WWTF (Common to Both CSO Treatment Processes)
    - CSO Peak Flow Rate for Sizing Conveyance from Lander St Regulator Station to Influent Pump Station, Equalization Basin, and WWTF: 47.9 MGD (Lander St CSOs)
    - CSO Peak Flow Rate for Sizing Conveyance from Hanford St Regulator Station to Influent Pump Station, Equalization Basin, and WWTF: 94.9 MGD (Hanford #2 CSOs)
- Ballasted Sedimentation
    - WWTF and Influent Pump Station Peak Design Flow Rate: 94.0 MGD
    - Equalization Basin Volume: 0.97 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Hanford St Regulator Station: 94.0 MGD
    - CSO Peak Flow Rate for Sizing New Outfall[1]: 94.0 MGD
- Chemically Enhanced Primary Treatment with Lamella Plates
    - WWTF and Influent Pump Station Peak Design Flow Rate: 96.0 MGD
    - Equalization Basin Volume: 0.82 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Hanford St Regulator Station: 96.0 MGD
    - CSO Peak Flow Rate for Sizing New Outfall[1]: 96.0 MGD

Description

Alternative DSN030/032-WWT-1 (KC) consists of a WWTF to treat Lander St and Hanford St CSOs, which discharge into the East Waterway (Duwamish River). The WWTF includes an influent pump station, equalization basin, screening facility, CSO treatment process, and disinfection. Modifications to the Lander St and Hanford 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

[1] Untreated CSOs will discharge to existing CSO outfalls (Lander St and Hanford St CSO Outfalls).

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.3.6-1. The WWTF could be located anywhere between the Lander St Regulator Station and Hanford St Regulator Station (indicated as dashed boundary in Figure G.3.6-1); 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 Lander St and Hanford St Regulator Stations to WWTF (Common to Both CSO Treatment Processes)
    - Modifications to the Lander St and Hanford St Regulator Stations.
    - Approximately 2,500 ft of 54-inch-diameter influent gravity sewer to convey Lander St CSOs from the Lander 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.3.6-1.
    - Up to approximately 1,370 ft of 60-inch-diameter influent gravity sewer to convey Hanford #2 CSOs from the Hanford 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.3.6-1.
- CSO Treatment Process (One of the Following)
    - Ballasted Sedimentation
        - 94.0-MGD WWTF.
        - 0.97-MG equalization basin.
        - 94.0-MGD influent pump station.
        - Up to approximately 1,370 ft of 60-inch-diameter effluent gravity sewer from the WWTF to the Hanford 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.3.6-1.
        - Approximately 1,400 ft of 60-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the Hanford St Regulator Station to the East Waterway (Duwamish River)[2].
    - Chemically Enhanced Primary Treatment with Lamella Plates
        - 96.0-MGD WWTF.

[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*.

- 0.82-MG equalization basin.
- 96.0-MGD influent pump station.
- Up to approximately 1,370 ft of 60-inch-diameter effluent gravity sewer from the WWTF to the Hanford 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.3.6-1.
- Approximately 1,500 ft of 60-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the Hanford St Regulator Station to the East Waterway (Duwamish River)[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 are being treated, and the equalization basin is used only during peak wet-weather events that exceed the WWTF design capacity.

[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*.

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 Hanford St Regulator Station and would store or treat King County CSOs diverted from the Lander St and Hanford St Regulator Stations.

One regulator station will be required to divert King County flows (Hanford #2 CSOs) from the Hanford St Regulator Station to the WWTF and equalization basin. For this planning phase, it is assumed that the diversion would occur at the Hanford 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 60-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 1,370 feet long based on the criteria and assumptions listed in Section 6.1.

An additional regulator station will be required to divert King County flows (Lander St CSOs) from the Lander St Regulator Station to the WWTF. For this planning phase, it is assumed that the diversion would occur at the Lander St Regulator Station. Flows would be conveyed to the WWTF via approximately 2,500 ft of 54-inch-diameter influent gravity sewer. The total length of the gravity sewer will vary depending on the selected location of the WWTF, which will be evaluated during preferred alternative development.

Treated CSOs would be conveyed to the Hanford St Regulator Station via a 60-inch-diameter effluent gravity sewer, up to approximately 1,370 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 1,500 feet of 60-inch-diameter pipe) from the Hanford St Regulator Station to the East Waterway (Duwamish River)[4]. 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] 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*.

Representative Footprints for Potential Siting Within or Adjacent to Boundary

CSO Treatment (with Influent Pumping), Typ

DSN030/032-WWT-1 (KC)
Ballasted Sedimentation
Total Footprint = ~2.19 Acres
Total Flow = ~94.0 MGD
Total Volume = ~0.97 MG

DSN030/032-WWT-1 (KC)
CEPT w/ Lamella Plates
Total Footprint = ~2.51 Acres
Total Flow = ~96.0 MGD
Total Volume = ~0.82 MG

Equalization Basin, Typ

- KC Manholes
- SPU Maintenance Hole
- 5-ft Contour
- 20-ft Contour
- Proposed Conveyance
- KC-WTD Conveyance
- SPU Drainage Mainline
- SPU Sanitary Mainline
- SPU Combined Mainline
- Representative Footprint
- Connected Area with High GSI Potential
- Connected to Combined Sewer System

Total Hanford/Lander CSO Basin Area: ~3,469 acres

N

740 370 0 740
Feet

Modifications to Lander St Regulator Station

Lander St CSO Outfall

Hanford #2 CSO Outfall

Modifications to Hanford St Regulator Station

Convey to WWTF site

54" Pipe

Elliott Bay Interceptor

Approximate Boundary

Approximate Boundary for Alternate Location of Wet-Weather Treatment Facility

The consolidated wet-weather treatment facility for this alternative could be located anywhere between the Lander St Regulator Station and Hanford St Regulator Station (dashed boundary). Conveyance would need to be re-evaluated if wet-weather treatment facility moves from assumed location (solid boundary).

Approximate Boundary for Assumed Location of Wet-Weather Treatment Facility

Wet-weather treatment facility has been assumed to be located within or adjacent to the solid boundary shown for cost estimating purposes. 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 consolidated alternative.

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

Potential GSI Opportunities in Hanford #2 and Lander CSO Basins

Hanford/Lander CSO Basin Boundary

~19% Hanford/Lander Basin Area Likely Feasible for GSI

0 8,000 16,000 32,000
Feet

SW Lander St
Alaska Fwy
Utah Ave S
S Forest St
I-5 Ramp
S Stevens St
S Hanford St
4th Ave S
S Hinds St
Spokane St
S Spokane St
U-Turn
East Marginal Way S
1st Ave S
2nd Ave S
West Seattle Fwy

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

File Name:

Data Source:

Figure G.3.6-1

Lander and Hanford #2 - DSN030/032-WWT-1 (KC)
Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN030/032-WWT-1 (KC)

Percentage of Cost Attributed to Hanford #2 and Lander CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs (%)
DSN030 Lander Regulator	47.9	33.5%
DSN032 Hanford #2 Regulator	94.9	66.5%

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 Lander[3]	Costs Attributed to Hanford #2[3]
94-MGD Ballasted Sedimentation Construction Cost =	$25,700,000	$8,620,000	$17,080,000
0.97-MG Equalization Basin Construction Cost =	$5,480,000	$1,840,000	$3,640,000
94-MGD Influent Pump Station Construction Cost =	$19,740,000	$6,620,000	$13,120,000
Solids Handling Facility Construction Cost =	$3,610,000	$1,210,000	$2,400,000
Grit Removal Facility Construction Cost =	$730,000	$240,000	$490,000
Modifications to Lander St Regulator Construction Cost =	$490,000	$490,000	$0
Modifications to Hanford St Regulator Construction Cost =	$490,000	$0	$490,000
Influent Gravity Sewer Construction Cost, from Lander St Regulator to WWTF (2,500 LF of 54-inch-diameter pipe) =	$4,460,000	$4,460,000	$0
Influent Gravity Sewer Construction Cost from Hanford St Regulator to WWTF (1,370 LF of 60-inch-diameter pipe) =	$2,770,000	$0	$2,770,000
Effluent Gravity Sewer Construction Cost (1,370 LF of 60-inch-diameter pipe) =	$2,770,000	$930,000	$1,840,000
[4]Outfall Construction Cost (1,500 LF of 60-inch-diameter pipe) =	$5,400,000	$1,810,000	$3,590,000
SDOT Street Use Permit Fee Cost =	$560,000	$320,000	$230,000
Total Construction Cost =	$72,200,000	$26,540,000	$45,650,000
Sales Tax (10% of Construction Cost) =	$7,220,000	$2,650,000	$4,570,000
[1]Allied Costs (46.22% of Construction Cost) =	$33,370,000	$12,270,000	$21,100,000
Property Cost =	$10,050,000	$3,370,000	$6,680,000
Subtotal of Project Cost =	$122,840,000	$44,830,000	$78,000,000
[1]Construction Contingency (10% of Construction Cost) =	$7,220,000	$2,650,000	$4,570,000
[1, 2]Project Contingency =	$29,630,000	$10,800,000	$18,830,000
Total Project Cost for Ballasted Sedimentation, 2010 Dollars =	**$159,700,000**	**$58,300,000**	**$101,400,000**

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

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

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

[4]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 DSN030/032-WWT-1 (KC)

Percentage of Cost Attributed to Lander and Hanford #2 CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs (%)
DSN030 Lander Regulator	47.9	33.5%
DSN032 Hanford #2 Regulator	94.9	66.5%

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	Costs Attributed to Lander[3]	Costs Attributed to Hanford #2[3]
96-MGD CEPT with Lamella Construction Cost =	$22,840,000	$7,660,000	$15,180,000
0.82-MG Equalization Basin Construction Cost =	$4,810,000	$1,610,000	$3,200,000
96-MGD Influent Pump Station Construction Cost =	$20,110,000	$6,750,000	$13,360,000
Lamella Plates Construction Cost =	$2,020,000	$680,000	$1,340,000
Solids Handling Facility Construction Cost =	$3,030,000	$1,020,000	$2,010,000
Modifications to Lander St Regulator Construction Cost =	$490,000	$490,000	$0
Modifications to Hanford St Regulator Construction Cost =	$490,000	$0	$490,000
Influent Gravity Sewer Construction Cost, from Lander Regulator to WWTF (2,500 LF of 54-inch-diameter pipe) =	$4,460,000	$4,460,000	$0
Influent Gravity Sewer Construction Cost from Hanford St Regulator to WWTF (1,370 LF of 60-inch-diameter pipe) =	$2,770,000	$0	$2,770,000
Effluent Gravity Sewer Construction Cost (1,370 LF of 60-inch-diameter pipe) =	$2,770,000	$930,000	$1,840,000
[4]Outfall Construction Cost (1,500 LF of 60-inch-diameter pipe) =	$5,400,000	$1,810,000	$3,590,000
SDOT Street Use Permit Fee Cost =	$560,000	$320,000	$230,000
Total Construction Cost =	$69,750,000	$25,730,000	$44,010,000
Sales Tax (10% of Construction Cost) =	$6,980,000	$2,570,000	$4,400,000
[1]Allied Costs (46.22% of Construction Cost) =	$32,240,000	$11,890,000	$20,340,000
Property Cost =	$12,000,000	$4,030,000	$7,970,000
Subtotal of Project Costs =	$120,970,000	$44,220,000	$76,720,000
[1]Construction Contingency (10% of Construction Cost) =	$6,980,000	$2,570,000	$4,400,000
[1, 2]Project Contingency =	$29,310,000	$10,700,000	$18,620,000
Total Project Cost for CEPT with Lamella Plates, 2010 Dollars =	**$157,300,000**	**$57,500,000**	**$99,700,000**

[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)
DSN030 Lander Regulator	47.9	94	96
DSN032 Hanford #2 Regulator	94.9		

[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	$25,696,274	$22,843,269
Influent Pump Station	$19,736,322	$20,109,754
Solids Handling Facility	$3,610,987	$3,026,960
Grit Removal Facility	$729,525	$0
Lamella Plates	$0	$2,021,004
Regulator Station	$485,000	$485,000
Total Construction Costs	$50,258,108	$48,485,987

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EQUALIZATION BASIN FOR BALLASTED SEDIMENTATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Equalization Basin_Ballasted
Printed date : 01/04/2011

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 0.97 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	$955,000	$955,000
Odor Control	1	LS	$169,000	$169,000
Effluent Pump Station	1	LS	$215,000	$215,000
Construction Cost	1	Mgal	4,000,000	$3,880,000
			Year 2008 Subtotal	$5,270,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$5,480,000			

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

Cost Calculations for Storage Facility: Equalization Basin_CEPT
Printed date : 01/04/2011

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 0.82 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	$941,000	$941,000
Odor Control	1	LS	$145,000	$145,000
Effluent Pump Station	1	LS	$211,000	$211,000
Construction Cost	0.8	Mgal	4,000,000	$3,280,000
			Year 2008 Subtotal	$4,630,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$4,810,000			

CONVEYANCE FROM LANDER TO WWTF - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Lander to WWTF)
Printed date : 01/17/2011

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: 2500 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	14,900.00	CY	$13	$193,000
Backfill	8,090.00	CY	$34	$275,000
Complete Pavement Restoration	3,250.00	SY	$86	$280,000
Overlay Pavement Restoration	8,970.00	SY	$28	$251,000
Trench Safety	82,700.00	SF	$17	$1,410,000
Spoil Load and Haul	14,900.00	CY	$16	$238,000
Pipe Unit Material Cost	2,500.00	lf	$168	$420,000
Pipe Installation	2,500.00	lf	$70	$175,000
Place Pipe Zone Fill	4,540.00	CY	$34	$154,000
Manholes	5	MH	$15,400	$76,900
Existing Utilities	2,500.00	lf	$166	$415,000
Dewatering	2,500.00	lf	$127	$318,000
Traffic Control	2,500.00	lf	$36	$90,000
			Year 2008 Subtotal	$4,290,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,460,000

Year 2010 Total: $4,460,000

CONVEYANCE FROM HANFORD #2 TO WWTF - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Hanford #2 to WWTF)
Printed date : 01/17/2011

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: 1370 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 60 in.

Geometry

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

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	9,090.00	CY	$13	$118,000
Backfill	4,780.00	CY	$34	$162,000
Complete Pavement Restoration	1,900.00	SY	$86	$163,000
Overlay Pavement Restoration	4,800.00	SY	$28	$134,000
Trench Safety	46,900.00	SF	$17	$798,000
Spoil Load and Haul	9,090.00	CY	$16	$145,000
Pipe Unit Material Cost	1,370.00	lf	$220	$301,000
Pipe Installation	1,370.00	lf	$81	$111,000
Place Pipe Zone Fill	2,820.00	CY	$34	$95,800
Manholes	3	MH	$15,400	$46,100
Existing Utilities	1,370.00	lf	$265	$363,000
Dewatering	1,370.00	lf	$127	$174,000
Traffic Control	1,370.00	lf	$36	$49,300
			Year 2008 Subtotal	$2,660,000

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

Year 2010 Total: $2,770,000

EFFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Effluent Pipe
Printed date : 01/04/2011

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: 1370 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 60 in.

Geometry

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

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	9,090.00	CY	$13	$118,000
Backfill	4,780.00	CY	$34	$162,000
Complete Pavement Restoration	1,900.00	SY	$86	$163,000
Overlay Pavement Restoration	4,800.00	SY	$28	$134,000
Trench Safety	46,900.00	SF	$17	$798,000
Spoil Load and Haul	9,090.00	CY	$16	$145,000
Pipe Unit Material Cost	1,370.00	lf	$220	$301,000
Pipe Installation	1,370.00	lf	$81	$111,000
Place Pipe Zone Fill	2,820.00	CY	$34	$95,800
Manholes	3	MH	$15,400	$46,100
Existing Utilities	1,370.00	lf	$265	$363,000
Dewatering	1,370.00	lf	$127	$174,000
Traffic Control	1,370.00	lf	$36	$49,300
			Year 2008 Subtotal	$2,660,000

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

Year 2010 Total: $2,770,000

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MODIFICATIONS TO LANDER ST REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 01/04/2011

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.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	180,000	180,000
Electrical/Instrumentation	1	LS	195,000	195,000
Architectural/Structural	1	LS	40,000	$40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	$1			
Construction Year 2010 Subtotal	$485,000			

MODIFICATIONS TO HANFORD ST REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 01/04/2011

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.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	180,000	180,000
Electrical/Instrumentation	1	LS	195,000	195,000
Architectural/Structural	1	LS	40,000	$40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	$1			
Construction Year 2010 Subtotal	$485,000			

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)
DSN032 Hanford #2 Regulator	$105.60	$24.12

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.	95,214	$105.60	100%	$10,054,598
			Total Land Costs	$10,054,598

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.	109,320	$105.60	100%	$11,544,192
Additional Solids Handling Facility	4,296	$105.60	100%	$453,617
			Total Land Costs	$11,997,809

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 Lander St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Regulator Station Upgrade at Hanford St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Influent Gravity Sewer from Lander 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 Lander 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 Lander St Regulator Station to WWTF, Third Phase of Construction	54	500	44	22,000	46.7	5	$0.70	$15,400
Installation of Influent Gravity Sewer from Hanford St Regulator Station to WWTF, First Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from Hanford St Regulator Station to WWTF, Second Phase of Construction	60	370	44	16,280	34.5	4	$0.50	$8,140
Installation of Effluent Gravity Sewer, First Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Effluent Gravity Sewer, Second Phase of Construction	60	370	44	16,280	34.5	4	$0.50	$8,140
						Total SDOT Street Use Fee Estimation:		$555,080

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Operations and Maintenance Cost Estimate Summary

Basin Name: Hanford-Lander Consolidated

Alternative Name: MEBI-Cons Hanford-Lander-KC-WWTF (Ballasted w/ UV)

		Acres of Raingarden for GSI	**0.00**	
ENR 1994	5747	*Annual Overflow Vol (MG)*	**295.30**	
Current ENR	**8645.4**	*Annual Vol Capture*	**266.80**	
Power Cost (per kwh)	**0.065**	*Annual Events*	**20**	
Labor rate (loaded) /hr	**51.17**	*Stor Vol*	**0.97**	equalization
SPU Water Cost $/CCF	**4.50**	*Peak Flow Rate*	**512.60**	
Carbon Cost/Lb	**2.00**	*Peak Flow Rate w/Equal*	**94.00**	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$7,912			
Force Mains	$0			
Regulator/Flow Control Structures	$0			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$1,656			
Pump Stations	$22,748	$57,358	$64,559	
Rectangular Storage Facilities	$24,325	$11,062	$5,638	$18,155
High Rate Treatment	$380,410	$19,246	$0	$140,462
Additonal Secondary Treatment	NA	$214,966	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$437,052**	**$302,632**	**$70,197**	**$158,618**

Total Annual O&M

General	**$898,301**
Energy	**$70,197**
Total	**$968,499**

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WTD Business Case Evaluation Results

Hanford-Lander 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							
MEBI-Cons Hanford-Lander-KC-WWTF	50	$159,700,000	$198,716,484	$0	$198,716,484	$6,571,482	$6,571,482

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							
MEBI-Cons Hanford-Lander-KC-WWTF	50	$159,700,000	$137,799,250	$0	$137,799,250	$4,556,971	$4,556,971

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.3.7

Consolidated Alternatives – Hanford #2, Lander, and Kingdome

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Consolidated Alternatives – Hanford #2, Lander St, and Kingdome

DSN029/030/032-WWT-1 (KC) or
MEBI-Cons Hanford-Lander-Kingdome-KC-WWTF

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DSN029/030/032-WWT-1 (KC) or MEBI-Cons Hanford-Lander-Kingdome-KC-WWTF

Alternative DSN029/030/032-WWT-1 (KC) controls King County's Kingdome, Lander St, and Hanford #2 CSOs by building an equalization basin and wet-weather treatment facility (WWTF) to store and treat CSOs prior to discharge into the East Waterway (Duwamish River). The WWTF would be located near the Hanford 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 Kingdome, Lander St, and Hanford St Regulator Stations to WWTF (Common to Both CSO Treatment Processes)
    - CSO Peak Flow Rate for Sizing Conveyance from Kingdome Regulator Station to Lander St Regulator Station: 87.0 MGD (Kingdome CSOs)
    - CSO Peak Flow Rate for Sizing Conveyance from Lander St Regulator Station to Lander St Connection at East Marginal Way South: 47.9 MGD (Lander St CSOs)
    - CSO Peak Flow Rate for Sizing Conveyance from Lander St Connection at East Marginal Way South to Influent Pump Station, Equalization Basin, and WWTF: 134.9 MGD (Kingdome and Lander St CSOs)
    - CSO Peak Flow Rate for Sizing Conveyance from Hanford St Regulator Station to Influent Pump Station, Equalization Basin, and WWTF: 94.9 MGD (Hanford #2 CSOs)
- Ballasted Sedimentation
    - WWTF and Influent Pump Station Peak Design Flow Rate: 139.0 MGD
    - Equalization Basin Volume: 1.57 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to the Hanford St Regulator Station: 139.0 MGD
    - CSO Peak Flow Rate for Sizing New Outfall[1]: 139.0 MGD
- Chemically Enhanced Primary Treatment with Lamella Plates
    - WWTF and Influent Pump Station Peak Design Flow Rate: 142.0 MGD
    - Equalization Basin Volume: 1.36 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Hanford St Regulator Station: 142.0 MGD
    - CSO Peak Flow Rate for Sizing New Outfall[1]: 142.0 MGD

[1] Untreated CSOs will discharge to existing CSO outfalls (King St, Kingdome, Lander St, and Hanford #2 CSO Outfalls).

Description

Alternative DSN029/030/032-WWT-1 (KC) consists of a WWTF to treat Kingdome, Lander St, and Hanford #2 CSOs, which discharge into the East Waterway. The WWTF includes an influent pump station, equalization basin, screening facility, CSO treatment process, and disinfection. Modifications to the Kingdome, Lander St, and Hanford 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 solid boundary shown in Figure G.3.7-1. The WWTF could be located anywhere between the Kingdome Regulator Station and Hanford St Regulator Station (indicated as dashed boundary in Figure G.3.7-1); 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 Kingdome, Lander St, and Hanford St Regulator Stations to WWTF (Common to Both CSO Treatment Processes)
    - Modifications to the Kingdome, Lander St, and Hanford St Regulator Stations.
    - Approximately 4,800 ft of 72-inch-diameter gravity sewer to convey Kingdome CSOs from the Kingdome Regulator Station to the Lander St Connection at East Marginal Way South.
    - Approximately 900 ft of 42-inch-diameter gravity sewer to convey Lander St CSOs from the Lander St Regulator Station to the Lander St Connection at East Marginal Way South.
    - Approximately 1,500 ft of 78-inch-diameter influent gravity sewer to convey Kingdome and Lander St CSOs from the Lander St Connection at East Marginal Way South 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.3.7-1.
    - Up to approximately 1,890 ft of 60-inch-diameter influent gravity sewer to convey Hanford #2 CSOs from the Hanford 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.3.7-1.
- CSO Treatment Process (One of the Following)
    - Ballasted Sedimentation
        - 139.0-MGD WWTF.
        - 1.57-MG equalization basin.
        - 139.0-MGD influent pump station.

- Up to approximately 1,890 ft of 72-inch-diameter effluent gravity sewer from the WWTF to the Hanford 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.3.7-1.
- Approximately 1,500 ft of 72-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the Hanford St Regulator Station to the center of the East Waterway[2].

o Chemically Enhanced Primary Treatment with Lamella Plates

- 142.0-MGD WWTF.
- 1.36-MG equalization basin.
- 142.0-MGD influent pump station.
- Up to approximately 1,890 ft of 72-inch-diameter effluent gravity sewer from the WWTF to the Hanford 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.3.7-1.
- Approximately 1,500 ft of 72-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the Hanford St Regulator Station to the center of the East Waterway[2].

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	• 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,

[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*.

Ballasted Sedimentation	CEPT with Lamella Plates
• Facilities Building (odor control, electrical controls, standby generator).	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 near the Hanford St Regulator Station and would store or treat King County CSOs diverted from the Kingdome, Lander St, and Hanford St Regulator Stations.

One regulator station will be required to divert King County flows (Hanford #2 CSOs) from the Hanford St Regulator Station to the WWTF and equalization basin. For this planning phase, it is assumed that the diversion would occur at the Hanford 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 60-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 1,890 feet long based on the criteria and assumptions listed in Section 6.1.

Two additional regulator stations will be required to divert King County flows from the Kingdome and Lander St Regulator Stations to the WWTF. For this planning phase, it is assumed that the diversions would occur at the existing regulator stations. Flows would be conveyed to the WWTF via approximately 900 ft of 42-inch-diameter gravity sewer, 4,800 ft of 72-inch-diameter gravity sewer, and 1,500 ft of 78-inch-diameter gravity sewer. The total length of the gravity sewers will vary depending on the selected location of the WWTF, which will be evaluated during preferred alternative development.

Treated CSOs would be conveyed to the Hanford St Regulator Station via a 72-inch-diameter effluent gravity sewer, up to approximately 1,890 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 1,500 feet of 72-inch-diameter pipe) from the Hanford St Regulator

Station to the center of the East Waterway[3]. 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.

[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*.

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Representative Footprints for Potential Siting Within or Adjacent to Boundary

CSO Treatment (with Influent Pumping), Typ

DSN029/030/032-WWT-1 (KC)
Ballasted Sedimentation
Total Footprint = ~2.62 Acres
Total Flow = ~139.0 MGD
Total Volume = ~1.57 MG

DSN029/030/032-WWT-1 (KC)
CEPT w/ Lamella Plates
Total Footprint = ~2.94 Acres
Total Flow = ~142.0 MGD
Total Volume = ~1.36 MG

Equalization Basin, Typ

Modifications to Kingdome Regulator Station

Elliott Bay Interceptor

Kingdome CSO Outfall

72" Pipe

42" Pipe

Lander St CSO Outfall

Modifications to Lander St Regulator Station

78" Pipe

Hanford #2 CSO Outfall

Convey to WWTF site

Modifications to Hanford St Regulator Station

Approximate Boundary for Alternate Location of Wet-Weather Treatment Facility

The consolidated wet-weather treatment facility for this alternative could be located anywhere between the Kingdome Regulator Station and Hanford St Regulator Station (dashed boundary). Conveyance would need to be re-evaluated if wet-weather treatment facility moves from assumed location (solid boundary).

Approximate Boundary for Assumed Location of Wet-Weather Treatment Facility

Wet-weather treatment facility has been assumed to be located within or adjacent to the solid boundary shown for cost estimating purposes. 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 consolidated alternative.

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

- KC Manholes
- 20-ft Contour
- Proposed Conveyance
- KC-WTD Conveyance
- Representative Footprint
- Connected Area with High GSI Potential
- Connected to Combined Sewer System

Total Hanford/Lander CSO Basin Area: ~3,469 acres

N

1,600 800 0 1,600
Feet

Potential GSI Opportunities in Hanford #2, Lander, and Kingdome CSO Basins

Hanford/Lander CSO Basin Boundary

Kingdome CSO Basin Boundary

Approximate Boundary

~19% Hanford/Lander Basin Area Likely Feasible for GSI

0 8,750 17,500 35,000
Feet

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

File Name:

Data Source:

Figure G.3.7-1

Kingdome, Lander, and Hanford #2 - DSN029/030/032-WWT-1 (KC) Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN029/030/032-WWT-1 (KC)

Percentage of Cost Attributed to Hanford #2, Lander, and Kingdome CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs[a] (%)	Percentage of Costs[b] (%)
DSN029 Kingdome	87.0	64.5%	37.9%
DSN030 Lander Street Regulator	47.9	35.5%	20.8%
DSN032 Hanford #2 Regulator	94.9	NA	41.3%

[a]Percentages used to allocate costs of conveyance from Lander St Regulator to WWTF (conveyance of Kingdome and Lander St CSOs).
[b]Percentages used to allocate costs for the majority of components.

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 Kingdome[3]	Costs Attributed to Lander[3]	Costs Attributed to Hanford #2[3]
139-MGD Ballasted Sedimentation Construction Cost =	$33,670,000	$12,750,000	$7,020,000	$13,900,000
1.57-MG Equalization Basin Construction Cost =	$8,180,000	$3,100,000	$1,710,000	$3,380,000
139-MGD Influent Pump Station Construction Cost =	$40,800,000	$15,450,000	$8,500,000	$16,850,000
Solids Handling Facility Construction Cost =	$5,150,000	$1,950,000	$1,070,000	$2,130,000
Grit Removal Facility Construction Cost =	$1,080,000	$410,000	$230,000	$450,000
Modifications to Kingdome Regulator Construction Cost =	$490,000	$490,000	$0	$0
Modifications to Lander Street Regulator Construction Cost =	$490,000	$0	$490,000	$0
Modifications to Hanford Street Regulator Construction Cost =	$490,000	$0	$0	$490,000
Conveyance from Kingdome to Lander St Connection at E Marginal Way S Construction Cost (4,800 LF of 72-inch-diameter pipe) =	$11,800,000	$11,800,000	$0	$0
Conveyance from Lander St Regulator to New Pipe at E Marginal Way S Construction Cost (900 LF of 42-inch-diameter pipe) =	$1,510,000	$0	$1,510,000	$0
Conveyance from Lander St Regulator to WWTF Construction Cost (1,500 LF of 78-inch-diameter pipe) =	$4,600,000	$2,970,000	$1,630,000	$0
Influent Gravity Sewer from Hanford St Regulator to WWTF Construction Cost (1,890 LF of 60-inch-diameter pipe) =	$3,810,000	$0	$0	$3,810,000
Effluent Gravity Sewer Construction Cost (1,890 LF of 72-inch-diameter pipe) =	$4,620,000	$1,750,000	$960,000	$1,910,000
[4]Outfall Construction Cost (1,500 LF of 72-inch-diameter pipe) =	$6,480,000	$2,450,000	$1,350,000	$2,680,000
SDOT Street Use Permit Fee Cost =	$1,150,000	$750,000	$100,000	$300,000
Total Construction Cost =	$124,320,000	$53,870,000	$24,570,000	$45,900,000
Sales Tax (10% of Construction Cost) =	$12,430,000	$5,390,000	$2,460,000	$4,590,000
[1]Allied Costs (46.22% of Construction Cost) =	$57,460,000	$24,900,000	$11,360,000	$21,210,000
Property Cost =	$12,070,000	$4,570,000	$2,520,000	$4,980,000
Subtotal of Project Cost =	$206,280,000	$88,730,000	$40,910,000	$76,680,000
[1]Construction Contingency (10% of Construction Cost) =	$12,430,000	$5,390,000	$2,460,000	$4,590,000
[1, 2]Project Contingency =	$49,450,000	$21,230,000	$9,810,000	$18,410,000
Total Project Cost for Ballasted Sedimentation, 2010 Dollars =	**$268,200,000**	**$115,400,000**	**$53,200,000**	**$99,700,000**

[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* .

Alternative DSN029/030/032-WWT-1 (KC)

Percentage of Cost Attributed to Hanford #2, Lander, and Kingdome CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs[a] (%)	Percentage of Costs[b] (%)
DSN029 Kingdome	87.0	64.5%	37.9%
DSN030 Lander Street Regulator	47.9	35.5%	20.8%
DSN032 Hanford #2 Regulator	94.9	NA	41.3%

[a]Percentages used to allocate costs of conveyance from Lander St Regulator to WWTF (conveyance of Kingdome and Lander St CSOs).
[b]Percentages used to allocate costs for the majority of components.

Escalation Assumptions

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

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

Description	Total Costs	Costs Attributed to Kingdome[3]	Costs Attributed to Lander[3]	Costs Attributed to Hanford #2[3]
142-MGD CEPT with Lamella Construction Cost =	$29,830,000	$11,290,000	$6,220,000	$12,320,000
1.36-MG Equalization Basin Construction Cost =	$7,240,000	$2,741,000	$1,509,000	$2,990,000
142-MGD Influent Pump Station Construction Cost =	$41,600,000	$15,750,000	$8,670,000	$17,180,000
Lamella Plates Construction Cost =	$2,989,000	$1,132,000	$623,000	$1,234,000
Solids Handling Facility Construction Cost =	$4,840,000	$1,832,000	$1,009,000	$1,999,000
Modifications to Kingdome Regulator Construction Cost =	$490,000	$490,000	$0	$0
Modifications to Lander Street Regulator Construction Cost =	$490,000	$0	$490,000	$0
Modifications to Hanford Street Regulator Construction Cost =	$490,000	$0	$0	$490,000
Conveyance from Kingdome to Lander St Connection at E Marginal Way S Construction Cost (4,800 LF of 72-inch-diameter pipe) =	$11,800,000	$11,800,000	$0	$0
Conveyance from Lander St Regulator to New Pipe at E Marginal Way S Construction Cost (900 LF of 42-inch-diameter pipe) =	$1,510,000	$0	$1,510,000	$0
Conveyance from Lander St Regulator to WWTF Construction Cost (1,500 LF of 78-inch-diameter pipe) =	$4,600,000	$2,970,000	$1,630,000	$0
Influent Gravity Sewer from Hanford St Regulator to WWTF Construction Cost (1,890 LF of 60-inch-diameter pipe) =	$3,810,000	$0	$0	$3,810,000
Effluent Gravity Sewer Construction Cost (1,890 LF of 72-inch-diameter pipe) =	$4,620,000	$1,750,000	$960,000	$1,910,000
[4]Outfall Construction Cost (1,500 LF of 72-inch-diameter pipe) =	$6,480,000	$2,450,000	$1,350,000	$2,680,000
SDOT Street Use Permit Fee Cost =	$1,150,000	$750,000	$140,000	$300,000
Total Construction Cost =	$121,940,000	$52,960,000	$24,110,000	$44,910,000
Sales Tax (10% of Construction Cost) =	$12,190,000	$5,300,000	$2,410,000	$4,490,000
[1]Allied Costs (46.22% of Construction Cost) =	$56,360,000	$24,480,000	$11,140,000	$20,760,000
Property Cost =	$14,370,000	$5,440,000	$3,000,000	$5,930,000
Subtotal of Project Cost =	$204,860,000	$88,180,000	$40,660,000	$76,090,000
[1]Construction Contingency (10% of Construction Cost) =	$12,190,000	$5,300,000	$2,410,000	$4,490,000
[1, 2]Project Contingency =	$49,270,000	$21,150,000	$9,790,000	$18,340,000
Total Project Cost for CEPT with Lamella Plates, 2010 Dollars =	**$266,300,000**	**$114,600,000**	**$52,900,000**	**$98,900,000**

[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)
DSN029 Kingdome	87.0	139	142
DSN030 Lander Street Regulator	47.9		
DSN032 Hanford #2 Regulator	94.9		

[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	$33,671,046	$29,833,997
Solids Handling Facility	$5,153,314	$4,840,000
Grit Removal Facility	$1,078,765	$0
Lamella Plates	$0	$2,989,401
Total Construction Costs	$39,903,124	$37,663,398

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EQUALIZATION BASIN FOR BALLASTED SEDIMENTATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Equalization Basin_Ballasted
Printed date : 12/27/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 1.57 Mgal
Facility Footprint: 16000 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	1,780.00	SY	$43	$76,400
Dewatering	1	LS	$1,010,000	$1,010,000
Odor Control	1	LS	$265,000	$265,000
Effluent Pump Station	1	LS	$231,000	$231,000
Construction Cost	1.6	Mgal	4,000,000	$6,280,000
			Year 2008 Subtotal	$7,860,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$8,180,000			

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

Cost Calculations for Storage Facility: Equalization Basin_CEPT
Printed date : 12/28/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 1.36 Mgal
Facility Footprint: 15200 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	1,690.00	SY	$43	$72,600
Dewatering	1	LS	$991,000	$991,000
Odor Control	1	LS	$231,000	$231,000
Effluent Pump Station	1	LS	$226,000	$226,000
Construction Cost	1.4	Mgal	4,000,000	$5,440,000
			Year 2008 Subtotal	$6,960,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$7,240,000			

INFLUENT PUMP STATION FOR BALLASTED SEDIMENTATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pump Station: Influent Pump Station_Ballasted
Printed date : 12/27/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Capacity: 139 mgd
Total Dynamic Head: 50 ft
Excavation Depth: 40 ft

Calculated Parameters

Required Pump Power	2,390	Hp
Base Architectural/Structural Unit Cost	113,000	$/mgd
Architectural/Structural Unit Cost Adjustment	89,100	$/mgd
Base Mechanical Unit Cost	37,200	$/mgd
Mechanical Unit Cost Adjustment	-11,200.00	$/mgd

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	6,590,000	$6,590,000
Electrical/Instrumentation	1	LS	3,250,000	3,250,000
Architectural/Structural	139	mgd	202,000	28,100,000
Mechanical	139	mgd	26,100	3,620,000
			Year 2008 Subtotal	$41,600,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$40,800,000

Year 2010 Total: $40,800,000

INFLUENT PUMP STATION FOR CEPT WITH LAMELLA PLATES - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pump Station: Influent Pump Station_CEPT
Printed date : 12/28/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Capacity: 142 mgd
Total Dynamic Head: 50 ft
Excavation Depth: 40 ft

Calculated Parameters

Required Pump Power	2,440	Hp
Base Architectural/Structural Unit Cost	113,000	$/mgd
Architectural/Structural Unit Cost Adjustment	89,100	$/mgd
Base Mechanical Unit Cost	37,000	$/mgd
Mechanical Unit Cost Adjustment	-11,100.00	$/mgd

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	6,710,000	$6,710,000
Electrical/Instrumentation	1	LS	3,300,000	3,300,000
Architectural/Structural	142	mgd	202,000	28,700,000
Mechanical	142	mgd	25,900	3,680,000
			Year 2008 Subtotal	$42,400,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$41,600,000

Year 2010 Total: $41,600,000

MODIFICATIONS TO KINGDOME REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1			
Effective Multiplier	0.98			
Construction Year 2010 Subtotal	$485,000			

Year 2010 Total: $485,000

MODIFICATIONS TO LANDER ST REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1			
Effective Multiplier	0.98			
Construction Year 2010 Subtotal	$485,000			

Year 2010 Total: $485,000

MODIFICATIONS TO HANFORD ST REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1			
Effective Multiplier	0.98			
Construction Year 2010 Subtotal	$485,000			

Year 2010 Total: $485,000

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CONVEYANCE FROM KINGDOME TO LANDER STREET REGULATOR - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Conveyance (Kingdome to Lander)
Printed date : 12/17/2010

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: 4800 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: 72 in.

Geometry

Outer Diameter	7.29	ft
Trench Width	12	ft
Excavation Depth	18.3	ft
Complete Surface Rest. Width	14	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	39,000.00	CY	$13	$506,000
Backfill	19,200.00	CY	$34	$652,000
Complete Pavement Restoration	7,460.00	SY	$86	$641,000
Overlay Pavement Restoration	16,000.00	SY	$28	$448,000
Trench Safety	176,000.00	SF	$17	$2,990,000
Spoil Load and Haul	39,000.00	CY	$16	$623,000
Pipe Unit Material Cost	4,800.00	lf	$346	$1,660,000
Pipe Installation	4,800.00	lf	$109	$523,000
Place Pipe Zone Fill	12,400.00	CY	$34	$420,000
Manholes	10	MH	$17,700	$177,000
Existing Utilities	4,800.00	lf	$360	$1,730,000
Dewatering	4,800.00	lf	$147	$706,000
Traffic Control	4,800.00	lf	$50	$240,000
			Year 2008 Subtotal	$11,300,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$11,800,000

Year 2010 Total: $11,800,000

CONVEYANCE FROM LANDER ST REGULATOR TO NEW CONVEYANCE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Conveyance (Lander Regulator to New Pipe)
Printed date : 02/15/2011

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: 900 ft
Conduit Type: Gravity
Depth of Cover: 14 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	19.3	ft
Complete Surface Rest. Width	10	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	5,150.00	CY	$13	$66,900
Backfill	3,480.00	CY	$34	$118,000
Complete Pavement Restoration	1,000.00	SY	$86	$86,200
Overlay Pavement Restoration	3,400.00	SY	$28	$95,100
Trench Safety	34,700.00	SF	$17	$589,000
Spoil Load and Haul	5,150.00	CY	$16	$82,400
Pipe Unit Material Cost	900.00	lf	$86	$77,400
Pipe Installation	900.00	lf	$52	$46,800
Place Pipe Zone Fill	1,200.00	CY	$34	$40,800
Manholes	2	MH	$10,800	$21,600
Existing Utilities	900.00	lf	$120	$108,000
Dewatering	900.00	lf	$107	$96,300
Traffic Control	900.00	lf	$24	$21,600
			Year 2008 Subtotal	$1,450,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$1,510,000

Year 2010 Total: $1,510,000

CONVEYANCE FROM LANDER STREET REGULATOR TO WWTF - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Conveyance (Lander to WWTF)
Printed date : 12/29/2010

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: 1500 ft
Conduit Type: Gravity
Depth of Cover: 17 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: 78 in.

Geometry

Outer Diameter	7.75	ft
Trench Width	12.6	ft
Excavation Depth	25.8	ft
Complete Surface Rest. Width	14.6	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	18,000.00	CY	$13	$234,000
Backfill	11,200.00	CY	$34	$380,000
Complete Pavement Restoration	2,430.00	SY	$86	$209,000
Overlay Pavement Restoration	4,900.00	SY	$28	$137,000
Trench Safety	77,300.00	SF	$17	$1,310,000
Spoil Load and Haul	18,000.00	CY	$16	$288,000
Pipe Unit Material Cost	1,500.00	lf	$414	$621,000
Pipe Installation	1,500.00	lf	$126	$189,000
Place Pipe Zone Fill	4,190.00	CY	$34	$142,000
Manholes	3	MH	$26,800	$80,300
Existing Utilities	1,500.00	lf	$360	$540,000
Dewatering	1,500.00	lf	$147	$221,000
Traffic Control	1,500.00	lf	$50	$75,000
			Year 2008 Subtotal	$4,430,000

Mobilization/Demobilization at 6%	1.06	
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98	
Effective Multiplier	1.04	
Construction Year 2010 Subtotal	$4,600,000	

Year 2010 Total: $4,600,000

INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe
Printed date : 12/17/2010

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: 1887 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 60 in.

Geometry

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

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	12,500.00	CY	$13	$163,000
Backfill	6,580.00	CY	$34	$224,000
Complete Pavement Restoration	2,610.00	SY	$86	$225,000
Overlay Pavement Restoration	6,610.00	SY	$28	$185,000
Trench Safety	64,600.00	SF	$17	$1,100,000
Spoil Load and Haul	12,500.00	CY	$16	$200,000
Pipe Unit Material Cost	1,890.00	lf	$220	$415,000
Pipe Installation	1,890.00	lf	$81	$153,000
Place Pipe Zone Fill	3,880.00	CY	$34	$132,000
Manholes	4	MH	$15,400	$61,500
Existing Utilities	1,890.00	lf	$265	$500,000
Dewatering	1,890.00	lf	$127	$240,000
Traffic Control	1,890.00	lf	$36	$67,900
			Year 2008 Subtotal	$3,660,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$3,810,000

Year 2010 Total: $3,810,000

EFFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Effluent Pipe
Printed date : 12/17/2010

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: 1887 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: 72 in.

Geometry

Outer Diameter	7.29	ft
Trench Width	12	ft
Excavation Depth	18.3	ft
Complete Surface Rest. Width	14	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	15,300.00	CY	$13	$199,000
Backfill	7,530.00	CY	$34	$256,000
Complete Pavement Restoration	2,930.00	SY	$86	$252,000
Overlay Pavement Restoration	6,290.00	SY	$28	$176,000
Trench Safety	69,000.00	SF	$17	$1,170,000
Spoil Load and Haul	15,300.00	CY	$16	$245,000
Pipe Unit Material Cost	1,890.00	lf	$346	$653,000
Pipe Installation	1,890.00	lf	$109	$206,000
Place Pipe Zone Fill	4,860.00	CY	$34	$165,000
Manholes	4	MH	$17,700	$70,800
Existing Utilities	1,890.00	lf	$360	$679,000
Dewatering	1,890.00	lf	$147	$277,000
Traffic Control	1,890.00	lf	$50	$94,400
			Year 2008 Subtotal	$4,450,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,620,000

Year 2010 Total: $4,620,000

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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)
DSN032 Hanford #2	$105.60	$24.12

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.	114,324	$105.60	100%	$12,072,614
			Total Land Costs	$12,072,614

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.	128,247	$105.60	100%	$13,542,883
Additional Solids Handling Facility	7,860	$105.60	100%	$830,062
			Total Land Costs	$14,372,945

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	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	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
Modifications to Kingdome Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Modifications to Lander St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Modifications to Hanford St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Conveyance Pipe from Kingdome to Lander St Regulator Stations, First Phase of Construction	72	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Conveyance Pipe from Kingdome to Lander St Regulator Stations, Second Phase of Construction	72	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Conveyance Pipe from Kingdome to Lander St Regulator Stations, Third Phase of Construction	72	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Conveyance Pipe from Kingdome to Lander St Regulator Stations, Fourth Phase of Construction	72	1,000	44	44,000	93.3	10	$2.90	$127,600

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
Installation of Conveyance Pipe from Kingdome to Lander St Regulator Stations, Fifth Phase of Construction	72	800	44	35,200	74.7	8	$1.70	$59,840
Installation of Influent Gravity Sewer from Lander St Regulator Station to WWTF, First Phase of Construction	78	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from Lander St Regulator Station to WWTF, Second Phase of Construction	78	500	44	22,000	46.7	5	$0.70	$15,400
Installation of Influent Gravity Sewer from Hanford St Regulator Station to WWTF, First Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from Hanford St Regulator Station to WWTF, Second Phase of Construction	60	887	44	39,028	82.8	9	$2.10	$81,959
Installation of Effluent Gravity Sewer, First Phase of Construction	72	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Effluent Gravity Sewer, Second Phase of Construction	72	887	44	39,028	82.8	9	$2.10	$81,959
							Total SDOT Street Use Fee Estimation:	$1,151,858

Operations and Maintenance Cost Estimate Summary

Basin Name: **Hanford-Lander-Kingdome**
Conveyed - ballasted & UV

Alternative Name: **MEBI-Cons Hanford-Lander-Kingdome-KC-WWTF**

		Acres of Raingarden for GSI	**0.00**	
		Annual Overflow Vol (MG)	**490.40**	
ENR 1994	5747			
Current ENR	**8645.4**	*Annual Vol Capture*	**451.00**	
Power Cost (per kwh)	**0.065**	*Annual Events*	**24**	
Labor rate (loaded) /hr	**51.17**	*Stor Vol*	**1.57**	Equalization
SPU Water Cost $/CCF	**4.50**	*Peak Flow Rate*	**740.00**	No SPU
		Peak Flow Rate w/Equal	**139.00**	
Carbon Cost/Lb	**2.00**			

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$15,221			
Force Mains	$0			
Regulator/Flow Control Structures	$38,459			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$1,656			
Pump Stations	$16,317	$58,566	$80,370	
Rectangular Storage Facilities	$87,213	$55,613	$24,419	$78,235
High Rate Treatment	$380,410	$30,295	$0	$237,438
Additonal Secondary Treatment	NA	$363,379	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$539,276**	**$507,853**	**$104,789**	**$315,674**

Total Annual O&M

General	**$1,362,803**
Energy	**$104,789**
Total	**$1,467,592**

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WTD Business Case Evaluation Results

Hanford-Lander-Kingdome 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							
MEBI-Cons Hanford-Lander-Kingdome-KC-WWTF	50	$268,200,000	$325,188,675	$0	$325,188,675	$10,753,871	$10,753,871

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							
MEBI-Cons Hanford-Lander-Kingdome-KC-WWTF	50	$268,200,000	$229,009,025	$0	$229,009,025	$7,573,245	$7,573,245

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.3.8

Consolidated Alternatives – Hanford #2, Lander St, Kingdome, and King St

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Consolidated Alternatives – Hanford #2, Lander St, Kingdome, and King St

DSN028/029/030/032-WWT-1 (KC) or
MEBI-Cons Hanford-Lander-King-Kingdome-KC-WWTF
(New Conveyance)

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DSN028/029/030/032-WWT-1 (KC) or MEBI-Cons Hanford-Lander-King-Kingdome-KC-WWTF (New Conveyance)

Alternative DSN028/029/030/032-WWT-1 (KC) controls King County's King St, Kingdome, Lander St, and Hanford #2 CSOs by building an equalization basin and wet-weather treatment facility (WWTF) to store and treat CSOs prior to discharge into the East Waterway (Duwamish River). The WWTF would be located near the Hanford 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 King St, Kingdome, Lander St, and Hanford St Regulator Stations to the WWTF.

Design Criteria

- Conveyance from King St, Kingdome, Lander St, and Hanford St Regulator Stations to WWTF (Common to Both CSO Treatment Processes)
    - CSO Peak Flow Rate for Sizing Conveyance from King St Regulator Station to Kingdome Regulator Station: 29.6 MGD (King St CSOs)
    - CSO Peak Flow Rate for Sizing Conveyance from Kingdome Regulator Station to Lander St Connection at East Marginal Way South: 116.6 MGD (King St and Kingdome CSOs)
    - CSO Peak Flow Rate for Sizing Conveyance from Lander St Regulator Station to Lander St Connection at East Marginal Way South: 47.9 MGD (Lander St CSOs)
    - CSO Peak Flow Rate for Sizing Conveyance from Lander St Connection at East Marginal Way South to Influent Pump Station, Equalization Basin, and WWTF: 164.5 MGD (King St, Kingdome, and Lander St CSOs)
    - CSO Peak Flow Rate for Sizing Conveyance from Hanford St Regulator Station to Influent Pump Station, Equalization Basin, and WWTF: 94.9 MGD (Hanford #2 CSOs)
- Ballasted Sedimentation
    - WWTF and Influent Pump Station Peak Design Flow Rate: 151.0 MGD
    - Equalization Basin Volume: 1.71 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Hanford St Regulator Station: 151.0 MGD
    - CSO Peak Flow Rate for Sizing New Outfall[1]: 151.0 MGD
- Chemically Enhanced Primary Treatment with Lamella Plates
    - WWTF and Influent Pump Station Peak Design Flow Rate: 155.0 MGD
    - Equalization Basin Volume: 1.43 MG

[1] Untreated CSOs will discharge to existing CSO outfalls (King St, Kingdome, Lander St, and Hanford #2 CSO Outfalls).

- CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Hanford St Regulator Station: 155.0 MGD
- CSO Peak Flow Rate for Sizing New Outfall[1]: 155.0 MGD

Description

Alternative DSN028/029/030/032-WWT-1 (KC) consists of a WWTF to treat King St, Kingdome, Lander St, and Hanford #2 CSOs, which discharge into the East Waterway. The WWTF includes an influent pump station, equalization basin, screening facility, CSO treatment process, and disinfection. Modifications to the King St, Kingdome, Lander St, and Hanford 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 solid boundary shown in Figure G.3.8-1. The WWTF could be located anywhere between the King St Regulator Station and Hanford St Regulator Station (indicated as dashed boundary in Figure G.3.8-1); 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 King St, Kingdome, Lander St, and Hanford St Regulator Stations to WWTF (Common to Both CSO Treatment Processes)
  - Modifications to the King St, Kingdome, Lander St, and Hanford St Regulator Stations.
  - Approximately 2,400 ft of 48-inch-diameter gravity sewer to convey King St CSOs from the King St Regulator Station to the Kingdome Regulator Station.
  - Approximately 4,800 ft of 72-inch-diameter gravity sewer to convey King St and Kingdome CSOs from the Kingdome Regulator Station to the Lander St Connection at East Marginal Way South.
  - Approximately 900 ft of 42-inch-diameter gravity sewer to convey Lander St CSOs from the Lander St Regulator Station to the Lander St Connection at East Marginal Way South.
  - Approximately 1,500 ft of 84-inch-diameter influent gravity sewer to convey King St, Kingdome, and Lander St CSOs from the Lander St Connection at East Marginal Way South 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.3.8-1.
  - Up to approximately 1,890 ft of 60-inch-diameter influent gravity sewer to convey Hanford #2 CSOs from the Hanford 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.3.8-1.

- CSO Treatment Process (One of the Following)
    - Ballasted Sedimentation
        - 151.0-MGD WWTF.
        - 1.71-MG equalization basin.
        - 151.0-MGD influent pump station.
        - Up to approximately 1,890 ft of 72-inch-diameter effluent gravity sewer from the WWTF to the Hanford 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.3.8-1.
        - Approximately 1,500 ft of 72-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the Hanford St Regulator Station to the center of the East Waterway[2].
    - Chemically Enhanced Primary Treatment with Lamella Plates
        - 155.0-MGD WWTF.
        - 1.43-MG equalization basin.
        - 155.0-MGD influent pump station.
        - Up to approximately 1,890 ft of 72-inch-diameter effluent gravity sewer from the WWTF to the Hanford 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.3.8-1.
        - Approximately 1,500 ft of 72-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the Hanford St Regulator Station to the center of the East Waterway[2].

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,	• Influent Pump Station, • Coarse Screening,

[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*.

Ballasted Sedimentation	CEPT with Lamella Plates
• Grit Removal, • Ballasted Sedimentation System (including Chemical Feed System), • Solids Handling Facility, • Disinfection System, and • Facilities Building (odor control, electrical controls, standby generator).	• 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 near the Hanford St Regulator Station and would store or treat King County CSOs diverted from the King St, Kingdome, Lander St, and Hanford St Regulator Stations.

One regulator station will be required to divert King County flows (Hanford #2 CSOs) from the Hanford St Regulator Station to the WWTF and equalization basin. For this planning phase, it is assumed that the diversion would occur at the Hanford 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 60-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 1,890 feet long based on the criteria and assumptions listed in Section 6.1.

Three additional regulator stations will be required to divert King County flows from the King St, Kingdome, and Lander St Regulator Stations to the WWTF. For this planning phase, it is assumed that the diversions would occur at the existing regulator stations. Flows would be conveyed to the WWTF via approximately 900 ft of 42-inch-diameter gravity sewer, 2,400 ft of 48-inch-diameter gravity sewer, 4,800 ft of 72-inch-diameter gravity sewer, and 1,500 ft of 84-inch-diameter gravity sewer. The total length of the gravity sewers will vary depending on the selected location of the WWTF, which will be evaluated during preferred alternative development.

Treated CSOs would be conveyed to the Hanford St Regulator Station via a 72-inch-diameter effluent gravity sewer[3], up to approximately 1,890 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 1,500 feet of 72-inch-diameter pipe) from the Hanford St Regulator Station to the center of the East Waterway[4]. 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.

[3] The 72-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.
[4] 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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Representative Footprints for Potential Siting Within or Adjacent to Boundary

CSO Treatment (with Influent Pumping), Typ

DSN028/029/030/032-WWT-1 (KC)
Ballasted Sedimentation
Total Footprint = ~2.80 Acres
Total Flow = ~151.0 MGD
Total Volume = ~1.71 MG

DSN028/029/030/032-WWT-1 (KC)
CEPT w/ Lamella Plates
Total Footprint = ~3.04 Acres
Total Flow = ~155.0 MGD
Total Volume = ~1.43 MG

Equalization Basin, Typ

- KC Manholes
- 20-ft Contour
- Proposed Conveyance
- KC-WTD Conveyance
- Representative Footprint
- Connected Area with High GSI Potential
- Connected to Combined Sewer System

Total Hanford/Lander CSO Basin Area: ~3,469 acres

N

1,600 800 0 1,600
Feet

Modifications to King St Regulator Station
48" Pipe
Kingdome CSO Outfall
Modifications to Kingdome Regulator Station
72" Pipe
Lander St CSO Outfall
42" Pipe
Modifications to Lander St Regulator Station
Hanford #2 CSO Outfall
84" Pipe
Modifications to Hanford St Regulator Station
Convey to WWTF site.
Elliott Bay Interceptor
King St CSO Basin Boundary
Kingdome CSO Basin Boundary
Approximate Boundary

Approximate Boundary for Alternate Location of Wet-Weather Treatment Facility

The consolidated wet-weather treatment facility for this alternative could be located anywhere between the King St Regulator Station and Hanford St Regulator Station (dashed boundary). Conveyance would need to be re-evaluated if wet-weather treatment facility moves from assumed location (solid boundary).

Approximate Boundary for Assumed Location of Wet-Weather Treatment Facility

Wet-weather treatment facility has been assumed to be located within or adjacent to the solid boundary shown for cost estimating purposes.

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 consolidated alternative.

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

Potential GSI Opportunities in Hanford #2, Lander, King St, and Kingdome CSO Basins

Hanford/Lander CSO Basin Boundary

~19% Hanford/Lander Basin Area Likely Feasible for GSI

0 8,750 17,500 35,000
Feet

Water Taxi Route
The Benson Line
S Main St
6th Ave S
25th Ave S
12th Ave S
I-90 Fwy
S Bush Pl
S Norman St
I-5 Fwy
13th Ave SW
Harbor Ave SW
SW Lander St
16th Ave SW
S Forest St
Airport Way S
I-5 Ramp
Chelan Ave SW
Klickitat Ave SW
SW Spokane St
Terminal 25 Rd
SR 99 Ramp
Alaska Fwy
S Spokane St
1st Ave S
I-5 Fwy
SW Manning St

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

File Name:

Data Source:

Figure G.3.8-1

King St, Kingdome, Lander, and Hanford #2 - DSN028/029/030/032-WWT-1 (KC) (New Conveyance) Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

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Alternative DSN028/029/030/032-WWT-1 (KC) (New Conveyance)

Percentage of Cost Attributed to Hanford #2, Lander, Kingdome, and King Street CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs[a] (%)	Percentage of Costs[b] (%)	Percentage of Costs[c] (%)
DSN028 King Street Regulator	29.6	25.4%	18.0%	11.4%
DSN029 Kingdome	87.0	74.6%	52.9%	33.5%
DSN030 Lander Street Regulator	47.9	NA	29.1%	18.5%
DSN032 Hanford #2 Regulator	94.9	NA	NA	36.6%

[a]Percentages used to allocate costs of conveyance from Kingdome Regulator to Lander St Regulator (conveyance of King St and Kingdome CSOs).
[b]Percentages used to allocate costs of conveyance from Lander St Regulator to WWTF (conveyance of King St, Kingdome, and Lander St CSOs).
[c]Percentages used to allocate costs for the majority of components.

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 Street[3]	Costs Attributed to Kingdome[3]	Costs Attributed to Lander[3]	Costs Attributed to Hanford #2[3]
151-MGD Ballasted Sedimentation Construction Cost =	$35,590,000	$4,060,000	$11,940,000	$6,570,000	$13,020,000
1.71-MG Equalization Basin Construction Cost =	$8,820,000	$1,006,000	$2,958,000	$1,629,000	$3,227,000
151-MGD Influent Pump Station Construction Cost =	$43,900,000	$5,010,000	$14,720,000	$8,110,000	$16,060,000
Solids Handling Facility Construction Cost =	$5,560,000	$634,000	$1,865,000	$1,027,000	$2,034,000
Grit Removal Facility Construction Cost =	$1,170,000	$130,000	$390,000	$220,000	$430,000
Modifications to King Street Regulator Construction Cost =	$490,000	$490,000	$0	$0	$0
Modifications to Kingdome Regulator Construction Cost =	$490,000	$0	$490,000	$0	$0
Modifications to Lander Street Regulator Construction Cost =	$490,000	$0	$0	$490,000	$0
Modifications to Hanford Street Regulator Construction Cost =	$490,000	$0	$0	$0	$490,000
Conveyance from King Street to Kingdome Regulator Construction Cost (2,400 LF of 48-inch-diameter pipe) =	$3,900,000	$3,900,000	$0	$0	$0
Conveyance from Kingdome to Lander St Connection at E Marginal Way S Construction Cost (4,800 LF of 72-inch-diameter pipe) =	$11,800,000	$3,000,000	$8,800,000	$0	$0
Conveyance from Lander St Regulator to New Pipe at E Marginal Way S Construction Cost (900 LF of 42-inch-diameter pipe) =	$1,510,000	$0	$0	$1,510,000	$0
Conveyance from Lander St Regulator to WWTF Construction Cost (1,500 LF of 84-inch-diameter pipe) =	$5,600,000	$1,010,000	$2,960,000	$1,630,000	$0
Influent Gravity Sewer from Hanford St Regulator to WWTF Construction Cost (1,890 LF of 60-inch-diameter pipe) =	$3,810,000	$0	$0	$0	$3,810,000
Effluent Gravity Sewer Construction Cost (1,890 LF of 72-inch-diameter pipe) =	$4,620,000	$530,000	$1,550,000	$850,000	$1,690,000
[4]Outfall Construction Cost (1,500 LF of 72-inch-diameter pipe) =	$6,480,000	$740,000	$2,170,000	$1,200,000	$2,370,000
SDOT Street Use Permit Fee Cost =	$1,420,000	$460,000	$580,000	$90,000	$290,000
Total Construction Cost =	$136,140,000	$20,970,000	$48,420,000	$23,330,000	$43,420,000
Sales Tax (10% of Construction Cost) =	$13,610,000	$2,100,000	$4,840,000	$2,330,000	$4,340,000
[1]Allied Costs (46.22% of Construction Cost) =	$62,920,000	$9,690,000	$22,380,000	$10,780,000	$20,070,000
Property Cost =	$12,880,000	$1,470,000	$4,320,000	$2,380,000	$4,710,000
Subtotal of Project Cost =	$225,550,000	$34,230,000	$79,960,000	$38,820,000	$72,540,000
[1]Construction Contingency (10% of Construction Cost) =	$13,610,000	$2,100,000	$4,840,000	$2,330,000	$4,340,000
[1, 2]Project Contingency =	$54,060,000	$8,169,000	$19,148,000	$9,316,000	$17,422,000
Total Project Cost for Ballasted Sedimentation, 2010 Dollars =	**$293,200,000**	**$44,500,000**	**$103,900,000**	**$50,500,000**	**$94,300,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.
[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)
[3]Allocation of costs is pending confirmation from management.
[4]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 DSN028/029/030/032-WWT-1 (KC) (New Conveyance)

Percentage of Cost Attributed to Hanford #2, Lander, Kingdome, and King Street CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs[a] (%)	Percentage of Costs[b] (%)	Percentage of Costs[c] (%)
DSN028 King Street Regulator	29.6	25.4%	18.0%	11.4%
DSN029 Kingdome	87.0	74.6%	52.9%	33.5%
DSN030 Lander Street Regulator	47.9	NA	29.1%	18.5%
DSN032 Hanford #2 Regulator	94.9	NA	NA	36.6%

[a]Percentages used to allocate costs of conveyance from Kingdome Regulator to Lander St Regulator (conveyance of King St and Kingdome CSOs).
[b]Percentages used to allocate costs of conveyance from Lander St Regulator to WWTF (conveyance of King St, Kingdome, and Lander St CSOs).
[c]Percentages used to allocate costs for the majority of components.

Escalation Assumptions

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

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

Description	Total Costs	Costs Attributed to King Street[3]	Costs Attributed to Kingdome[3]	Costs Attributed to Lander[3]	Costs Attributed to Hanford #2[3]
155-MGD CEPT with Lamella Construction Cost =	$31,560,000	$3,600,000	$10,580,000	$5,830,000	$11,550,000
1.43-MG Equalization Basin Construction Cost =	$7,550,000	$862,000	$2,532,000	$1,394,000	$2,762,000
155-MGD Influent Pump Station Construction Cost =	$45,000,000	$5,130,000	$15,090,000	$8,310,000	$16,460,000
Lamella Plates Construction Cost =	$3,260,000	$370,000	$1,090,000	$600,000	$1,190,000
Solids Handling Facility Construction Cost =	$4,440,000	$510,000	$1,490,000	$820,000	$1,620,000
Modifications to King Street Regulator Construction Cost =	$490,000	$490,000	$0	$0	$0
Modifications to Kingdome Regulator Construction Cost =	$490,000	$0	$490,000	$0	$0
Modifications to Lander Street Regulator Construction Cost =	$490,000	$0	$0	$490,000	$0
Modifications to Hanford Street Regulator Construction Cost =	$490,000	$0	$0	$0	$490,000
Conveyance from King Street to Kingdome Regulator Construction Cost (2,400 LF of 48-inch-diameter pipe) =	$3,900,000	$3,900,000	$0	$0	$0
Conveyance from Kingdome to Lander St Connection at E Marginal Way S Construction Cost (4,800 LF of 72-inch-diameter pipe) =	$11,800,000	$3,000,000	$8,800,000	$0	$0
Conveyance from Lander St Regulator to New Pipe at E Marginal Way S Construction Cost (900 LF of 42-inch-diameter pipe) =	$1,510,000	$0	$0	$1,510,000	$0
Conveyance from Lander St Regulator to WWTF Construction Cost (1,500 LF of 84-inch-diameter pipe) =	$5,600,000	$1,010,000	$2,960,000	$1,630,000	$0
Influent Gravity Sewer from Hanford St Regulator to WWTF Construction Cost (1,890 LF of 60-inch-diameter pipe) =	$3,810,000	$0	$0	$0	$3,810,000
Effluent Gravity Sewer Construction Cost (1,890 LF of 72-inch-diameter pipe) =	$4,620,000	$530,000	$1,550,000	$850,000	$1,690,000
[4]Outfall Construction Cost (1,500 LF of 72-inch-diameter pipe) =	$6,480,000	$740,000	$2,170,000	$1,200,000	$2,370,000
SDOT Street Use Permit Fee Cost =	$1,420,000	$460,000	$580,000	$90,000	$290,000
Total Construction Cost =	$132,910,000	$20,600,000	$47,330,000	$22,720,000	$42,230,000
Sales Tax (10% of Construction Cost) =	$13,290,000	$2,060,000	$4,730,000	$2,270,000	$4,220,000
[1]Allied Costs (46.22% of Construction Cost) =	$61,430,000	$9,520,000	$21,880,000	$10,500,000	$19,520,000
Property Cost =	$14,710,000	$1,680,000	$4,930,000	$2,720,000	$5,380,000
Subtotal of Project Cost =	$222,340,000	$33,860,000	$78,870,000	$38,210,000	$71,350,000
[1]Construction Contingency (10% of Construction Cost) =	$13,290,000	$2,060,000	$4,730,000	$2,270,000	$4,220,000
[1, 2]Project Contingency =	$53,410,000	$8,100,000	$18,930,000	$9,190,000	$17,190,000
Total Project Cost for CEPT with Lamella Plates, 2010 Dollars =	**$289,000,000**	**$44,000,000**	**$102,500,000**	**$49,700,000**	**$92,800,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.
[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)
[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)
DSN028 King Street Regulator	29.6	151	155
DSN029 Kingdome	87.0		
DSN030 Lander Street Regulator	47.9		
DSN032 Hanford #2 Regulator	94.9		

[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	$35,586,938	$31,563,913
Solids Handling Facility	$5,564,601	$4,440,000
Grit Removal Facility	$1,171,896	$0
Lamella Plates	$0	$3,263,079
Total Construction Costs	$42,323,435	$39,266,992

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EQUALIZATION BASIN FOR BALLASTED SEDIMENTATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Equalization Basin
Printed date : 12/17/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 1.71 Mgal
Facility Footprint: 19800 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	2,200.00	SY	$43	$94,600
Dewatering	1	LS	$1,020,000	$1,020,000
Odor Control	1	LS	$287,000	$287,000
Effluent Pump Station	1	LS	$235,000	$235,000
Construction Cost	1.7	Mgal	4,000,000	$6,840,000
			Year 2008 Subtotal	$8,480,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$8,820,000			

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

Cost Calculations for Storage Facility: Equalization Basin_CEPT
Printed date : 12/28/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 1.43 Mgal
Facility Footprint: 15200 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	1,690.00	SY	$43	$72,600
Dewatering	1	LS	$998,000	$998,000
Odor Control	1	LS	$242,000	$242,000
Effluent Pump Station	1	LS	$228,000	$228,000
Construction Cost	1.4	Mgal	4,000,000	$5,720,000
			Year 2008 Subtotal	$7,260,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$7,550,000			

INFLUENT PUMP STATION FOR BALLASTED SEDIMENTATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pump Station: Influent Pump Station
Printed date : 12/17/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Capacity: 151 mgd
Total Dynamic Head: 50 ft
Excavation Depth: 40 ft

Calculated Parameters

Required Pump Power	2,600	Hp
Base Architectural/Structural Unit Cost	112,000	$/mgd
Architectural/Structural Unit Cost Adjustment	89,100	$/mgd
Base Mechanical Unit Cost	36,400	$/mgd
Mechanical Unit Cost Adjustment	-10,900.00	$/mgd

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	7,090,000	$7,090,000
Electrical/Instrumentation	1	LS	3,450,000	3,450,000
Architectural/Structural	151	mgd	201,000	30,400,000
Mechanical	151	mgd	25,500	3,840,000
			Year 2008 Subtotal	$44,800,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$43,900,000

Year 2010 Total: $43,900,000

INFLUENT PUMP STATION FOR CEPT WITH LAMELLA PLATES - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pump Station: Influent Pump Station_CEPT
Printed date : 12/28/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Capacity: 155 mgd
Total Dynamic Head: 50 ft
Excavation Depth: 40 ft

Calculated Parameters

Required Pump Power	2,670	Hp
Base Architectural/Structural Unit Cost	112,000	$/mgd
Architectural/Structural Unit Cost Adjustment	89,100	$/mgd
Base Mechanical Unit Cost	36,100	$/mgd
Mechanical Unit Cost Adjustment	-10,800.00	$/mgd

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	7,260,000	$7,260,000
Electrical/Instrumentation	1	LS	3,510,000	3,510,000
Architectural/Structural	155	mgd	201,000	31,200,000
Mechanical	155	mgd	25,300	3,920,000
			Year 2008 Subtotal	$45,900,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$45,000,000

Year 2010 Total: $45,000,000

MODIFICATIONS TO REGULATOR STATIONS - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

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

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

Year 2010 Total: $485,000

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CONVEYANCE FROM KING STREET TO KINGDOME REGULATOR - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Conveyance (King St to Kingdome)
Printed date : 12/17/2010

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: 2400 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	12,400.00	CY	$13	$161,000
Backfill	7,030.00	CY	$34	$239,000
Complete Pavement Restoration	2,880.00	SY	$86	$247,000
Overlay Pavement Restoration	8,860.00	SY	$28	$248,000
Trench Safety	76,000.00	SF	$17	$1,290,000
Spoil Load and Haul	12,400.00	CY	$16	$198,000
Pipe Unit Material Cost	2,400.00	lf	$123	$295,000
Pipe Installation	2,400.00	lf	$60	$144,000
Place Pipe Zone Fill	3,700.00	CY	$34	$126,000
Manholes	5	MH	$12,600	$62,800
Existing Utilities	2,400.00	lf	$166	$398,000
Dewatering	2,400.00	lf	$107	$257,000
Traffic Control	2,400.00	lf	$36	$86,400
			Year 2008 Subtotal	$3,750,000

Mobilization/Demobilization at 6%	1.06	
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98	
Effective Multiplier	1.04	
Construction Year 2010 Subtotal	$3,900,000	

Year 2010 Total: $3,900,000

CONVEYANCE FROM KINGDOME TO LANDER STREET CONNECTION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Conveyance (Kingdome to Lander)
Printed date : 12/17/2010

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: 4800 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: 72 in.

Geometry

Outer Diameter	7.29	ft
Trench Width	12	ft
Excavation Depth	18.3	ft
Complete Surface Rest. Width	14	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	39,000.00	CY	$13	$506,000
Backfill	19,200.00	CY	$34	$652,000
Complete Pavement Restoration	7,460.00	SY	$86	$641,000
Overlay Pavement Restoration	16,000.00	SY	$28	$448,000
Trench Safety	176,000.00	SF	$17	$2,990,000
Spoil Load and Haul	39,000.00	CY	$16	$623,000
Pipe Unit Material Cost	4,800.00	lf	$346	$1,660,000
Pipe Installation	4,800.00	lf	$109	$523,000
Place Pipe Zone Fill	12,400.00	CY	$34	$420,000
Manholes	10	MH	$17,700	$177,000
Existing Utilities	4,800.00	lf	$360	$1,730,000
Dewatering	4,800.00	lf	$147	$706,000
Traffic Control	4,800.00	lf	$50	$240,000
			Year 2008 Subtotal	$11,300,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$11,800,000

Year 2010 Total: $11,800,000

CONVEYANCE FROM LANDER ST REGULATOR TO NEW CONVEYANCE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Conveyance (Lander Regulator to New Pipe)
Printed date : 02/15/2011

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: 900 ft
Conduit Type: Gravity
Depth of Cover: 14 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	19.3	ft
Complete Surface Rest. Width	10	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	5,150.00	CY	$13	$66,900
Backfill	3,480.00	CY	$34	$118,000
Complete Pavement Restoration	1,000.00	SY	$86	$86,200
Overlay Pavement Restoration	3,400.00	SY	$28	$95,100
Trench Safety	34,700.00	SF	$17	$589,000
Spoil Load and Haul	5,150.00	CY	$16	$82,400
Pipe Unit Material Cost	900.00	lf	$86	$77,400
Pipe Installation	900.00	lf	$52	$46,800
Place Pipe Zone Fill	1,200.00	CY	$34	$40,800
Manholes	2	MH	$10,800	$21,600
Existing Utilities	900.00	lf	$120	$108,000
Dewatering	900.00	lf	$107	$96,300
Traffic Control	900.00	lf	$24	$21,600
			Year 2008 Subtotal	$1,450,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$1,510,000

Year 2010 Total: $1,510,000

CONVEYANCE FROM LANDER STREET REGULATOR TO WWTF - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Conveyance (Lander to WWTF)
Printed date : 12/29/2010

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: 1500 ft
Conduit Type: Gravity
Depth of Cover: 17 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 84 in.

Geometry

Outer Diameter	8.33	ft
Trench Width	13.3	ft
Excavation Depth	26.3	ft
Complete Surface Rest. Width	15.3	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	19,500.00	CY	$13	$254,000
Backfill	11,900.00	CY	$34	$403,000
Complete Pavement Restoration	2,560.00	SY	$86	$220,000
Overlay Pavement Restoration	4,780.00	SY	$28	$134,000
Trench Safety	79,000.00	SF	$17	$1,340,000
Spoil Load and Haul	19,500.00	CY	$16	$312,000
Pipe Unit Material Cost	1,500.00	lf	$490	$735,000
Pipe Installation	1,500.00	lf	$146	$219,000
Place Pipe Zone Fill	4,620.00	CY	$34	$157,000
Manholes	3	MH	$51,600	$155,000
Existing Utilities	1,500.00	lf	$773	$1,160,000
Dewatering	1,500.00	lf	$147	$221,000
Traffic Control	1,500.00	lf	$50	$75,000
			Year 2008 Subtotal	$5,390,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$5,600,000

Year 2010 Total: $5,600,000

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

Cost Calculations for Pipe: Influent Pipe
Printed date : 12/17/2010

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: 1887 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 60 in.

Geometry

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

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	12,500.00	CY	$13	$163,000
Backfill	6,580.00	CY	$34	$224,000
Complete Pavement Restoration	2,610.00	SY	$86	$225,000
Overlay Pavement Restoration	6,610.00	SY	$28	$185,000
Trench Safety	64,600.00	SF	$17	$1,100,000
Spoil Load and Haul	12,500.00	CY	$16	$200,000
Pipe Unit Material Cost	1,890.00	lf	$220	$415,000
Pipe Installation	1,890.00	lf	$81	$153,000
Place Pipe Zone Fill	3,880.00	CY	$34	$132,000
Manholes	4	MH	$15,400	$61,500
Existing Utilities	1,890.00	lf	$265	$500,000
Dewatering	1,890.00	lf	$127	$240,000
Traffic Control	1,890.00	lf	$36	$67,900
			Year 2008 Subtotal	$3,660,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$3,810,000

Year 2010 Total: $3,810,000

EFFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Effluent Pipe
Printed date : 12/17/2010

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: 1887 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: 72 in.

Geometry

Outer Diameter	7.29	ft
Trench Width	12	ft
Excavation Depth	18.3	ft
Complete Surface Rest. Width	14	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	15,300.00	CY	$13	$199,000
Backfill	7,530.00	CY	$34	$256,000
Complete Pavement Restoration	2,930.00	SY	$86	$252,000
Overlay Pavement Restoration	6,290.00	SY	$28	$176,000
Trench Safety	69,000.00	SF	$17	$1,170,000
Spoil Load and Haul	15,300.00	CY	$16	$245,000
Pipe Unit Material Cost	1,890.00	lf	$346	$653,000
Pipe Installation	1,890.00	lf	$109	$206,000
Place Pipe Zone Fill	4,860.00	CY	$34	$165,000
Manholes	4	MH	$17,700	$70,800
Existing Utilities	1,890.00	lf	$360	$679,000
Dewatering	1,890.00	lf	$147	$277,000
Traffic Control	1,890.00	lf	$50	$94,400
			Year 2008 Subtotal	$4,450,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,620,000

Year 2010 Total: $4,620,000

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)
DSN032 Hanford #2	$105.60	$24.12

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.	121,939	$105.60	100%	$12,876,758
			Total Land Costs	$12,876,758

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.	132,268	$105.60	100%	$13,967,501
Additional Solids Handling Facility	7,014	$105.60	100%	$740,656
			Total Land Costs	$14,708,157

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
Modifications to King St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Modifications to Kingdome Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Modifications to Lander St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Modifications to Hanford St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Conveyance Pipe from King St to Kingdome Regulator Stations, First Phase of Construction	48	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Conveyance Pipe from King St to Kingdome Regulator Stations, Second Phase of Construction	48	1,000	44	44,000	93.3	10	$2.90	$127,600

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
Installation of Conveyance Pipe from King St to Kingdome Regulator Stations, Third Phase of Construction	48	400	44	17,600	37.3	4	$0.50	$8,800
Installation of Conveyance Pipe from Kingdome to Lander St Regulator Stations, First Phase of Construction	72	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Conveyance Pipe from Kingdome to Lander St Regulator Stations, Second Phase of Construction	72	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Conveyance Pipe from Kingdome to Lander St Regulator Stations, Third Phase of Construction	72	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Conveyance Pipe from Kingdome to Lander St Regulator Stations, Fourth Phase of Construction	72	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Conveyance Pipe from Kingdome to Lander St Regulator Stations, Fifth Phase of Construction	72	800	44	35,200	74.7	8	$1.70	$59,840
Installation of Influent Gravity Sewer from Lander St Regulator Station to WWTF, First Phase of Construction	84	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from Lander St Regulator Station to WWTF, Second Phase of Construction	84	500	44	22,000	46.7	5	$0.70	$15,400
Installation of Influent Gravity Sewer from Hanford St Regulator Station to WWTF, First Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from Hanford St Regulator Station to WWTF, Second Phase of Construction	60	887	44	39,028	82.8	9	$2.10	$81,959
Installation of Effluent Gravity Sewer, First Phase of Construction	72	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Effluent Gravity Sewer, Second Phase of Construction	72	887	44	39,028	82.8	9	$2.10	$81,959
						Total SDOT Street Use Fee Estimation:		$1,422,358

Operations and Maintenance Cost Estimate Summary

Basin Name: **HLKK**

Alternative Name: **MEBI-Cons Hanford-Lander-King-Kingdome-KC-WWTF (Conveyance, Ballasted w/ UV)**

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

Acres of Raingarden for GSI	**0.00**	
Annual Overflow Vol (MG)	**499.50**	need spu
Annual Vol Capture	**457.50**	
Annual Events	**24**	
Stor Vol	**1.71**	equal
Peak Flow Rate	**259.40**	
Peak Flow Rate w/equal	**151.00**	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$20,204			
Force Mains	$0			
Regulator/Flow Control Structures	$0			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$1,656			
Pump Stations	$26,865	$58,888	$84,185	
Rectangular Storage Facilities	$63,876	$0	$0	$0
High Rate Treatment	$380,410	$31,856	$0	$240,861
Additonal Secondary Treatment	NA	$368,616	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$493,011**	**$459,360**	**$84,185**	**$240,861**

Total Annual O&M

General	**$1,193,232**
Energy	**$84,185**
Total	**$1,277,416**

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WTD Business Case Evaluation Results

Project Name: Hanford-Lander-King-Kingdome WWT - New Conveyance

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							
HLKK Convey	50	$293,200,000	$337,937,237	$0	$337,937,237	$11,175,462	$11,175,462

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							
HLKK Convey	50	$293,200,000	$245,395,020	$0	$245,395,020	$8,115,124	$8,115,124

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 – Hanford #2, Lander St, Kingdome, and King St

DSN028/029/030/032-WWT-1 (KC) or
MEBI-Cons Hanford-Lander-King-Kingdome-KC-WWTF
(EBI Modifications)

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DSN028/029/030/032-WWT-1 (KC) or MEBI-Cons Hanford-Lander-King-Kingdome-KC-WWTF (EBI Modifications)

Alternative DSN028/029/030/032-WWT-1 (KC) controls King County's King St, Kingdome, Lander St, and Hanford #2 CSOs by building an equalization basin and wet-weather treatment facility (WWTF) to store and treat CSOs prior to discharge into the East Waterway (Duwamish River). The WWTF would be located near the Hanford 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 Hanford St Regulator Station) - Diversion of flows from the EBI, upstream of the proposed WWTF location.
- EBI Gate and Bypass Structure (located near the Kingdome Regulator Station) - Backflowing of flows via the EBI, downstream of the proposed WWTF location from the Kingdome and Lander St CSO Basins.

Design Criteria

- Conveyance Improvements and Structures for Diversion of Flows to the WWTF[1]
    - CSO Peak Flow Rate for Kingdome: 87.0 MGD (for sizing conveyance from Kingdome Regulator Station to EBI)
    - CSO Peak Flow Rate for Lander St: 47.9 MGD (for sizing conveyance from Lander St Regulator Station to EBI)
    - CSO Peak Flow Rate for Sizing Influent Pipe from EBI Diversion Structure to WWTF: 164.5 MGD (backflowing of flows from Kingdome and Lander St CSO Basins and diversion of flows upstream of the EBI Diversion Structure from the West Seattle Pump Station and Duwamish Pump Station)
    - CSO Peak Flow Rate for Sizing Conveyance from Hanford St Regulator Station to Influent Pump Station, Equalization Basin, and WWTF: 94.9 MGD (Hanford #2 CSOs)
- Ballasted Sedimentation
    - WWTF and Influent Pump Station Peak Design Flow Rate: 151.0 MGD
    - Equalization Basin Volume: 1.71 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Hanford St Regulator Station: 151.0 MGD
    - CSO Peak Flow Rate for Sizing New Outfall[2]: 151.0 MGD

[1] Diversion of flows from the EBI, upstream of the proposed WWTF location and backflowing of flows from the Kingdome and Lander St CSO Basins, will provide downstream system capacity in the EBI to control the King St CSO Outfall (CSO Peak Flow Rate of approximately 29.0 MGD).

- Chemically Enhanced Primary Treatment with Lamella Plates
    - WWTF and Influent Pump Station Peak Design Flow Rate: 155.0 MGD
    - Equalization Basin Volume: 1.43 MG
    - CSO Peak Flow Rate for Sizing Effluent Conveyance from WWTF to Hanford St Regulator Station: 155.0 MGD
    - CSO Peak Flow Rate for Sizing New Outfall[2]: 155.0 MGD

Description

Alternative DSN028/029/030/032-WWT-1 (KC) consists of a WWTF to control King St, Kingdome, Lander St, and Hanford #2 CSOs, which discharge into the East Waterway. Flows from the West Seattle Pump Station and Duwamish 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 Kingdome Regulator Station) is closed during wet-weather events, flows from the Kingdome and Lander St CSO Basins would backflow via the EBI to the EBI Diversion Structure where they would be diverted to the WWTF for treatment. These diversions will provide capacity in the EBI to control the King St CSO Outfall. The WWTF includes an influent pump station, equalization basin, screening facility, CSO treatment process, and disinfection. A new EBI Gate and Bypass Structure (located near the Kingdome Regulator Station), a new EBI Diversion Structure (located near the Hanford St Regulator Station), and modifications to the Lander St and Hanford 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.3.8-2. 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 Lander St and Kingdome Regulator Stations.
    - EBI Gate and Bypass Structure near the Kingdome Regulator Station to house a gate that will allow flows from the Kingdome and Lander St CSO Basins to backflow to the WWTF via the EBI.
    - Approximately 300 ft of 60-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.

[2] Untreated CSOs will discharge to existing CSO outfalls (King St, Kingdome, Lander St, and Hanford #2 CSO Outfalls).

- Approximately 50 ft of 42-inch-diameter gravity sewer to upgrade the existing connection from the Lander St Regulator Station to the EBI.
- EBI Diversion Structure (located near the Hanford St Regulator Station) to divert flows from the Kingdome and Lander St CSO Basins (backflow from closing of EBI gate) and upstream flows from the Duwamish Pump Station and West Seattle Pump Station to the WWTF.
- Approximately 1,000 ft of 78-inch-diameter influent gravity sewer to convey flows from the EBI Diversion Structure (located near the Hanford 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.3.8-2.
- Modifications to the Hanford St Regulator Station.
- Up to approximately 1,890 ft of 60-inch-diameter influent gravity sewer to convey Hanford #2 CSOs from the Hanford 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.3.8-2.

- CSO Treatment Process (One of the Following)
  - Ballasted Sedimentation
    - 151.0-MGD WWTF.
    - 1.71-MG equalization basin.
    - 151.0-MGD influent pump station.
    - Up to approximately 1,890 ft of 72-inch-diameter effluent gravity sewer from the WWTF to the Hanford St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.3.8-2.
    - Approximately 1,500 ft of 72-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the Hanford St Regulator Station to the center of the East Waterway[3].
  - Chemically Enhanced Primary Treatment with Lamella Plates
    - 155.0-MGD WWTF.
    - 1.43-MG equalization basin.
    - 155.0-MGD influent pump station.
    - Up to approximately 1,890 ft of 72-inch-diameter effluent gravity sewer from the WWTF to the Hanford St Regulator Station. The length depends on the location selected for the WWTF within or adjacent to the approximate boundary shown in Figure G.3.8-2.

[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*.

- Approximately 1,500 ft of 72-inch-diameter pipe for the CSO outfall. The alternative assumes a new CSO outfall would convey treated CSOs from the Hanford St Regulator Station to the center of the East Waterway[4].

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

Modifications to the Hanford St Regulator Station will be required to divert King County flows (Hanford #2 CSOs) to the WWTF and equalization basin. For this planning phase, it is assumed

[4] 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*.

that the diversion would occur at the Hanford 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 60-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 1,890 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 King St CSO Outfall. The following summarizes the flow scheme for routing flows from the EBI to the WWTF:

- Upstream Diversion of Flows. The Duwamish Pump Station flows (approximately 88 MGD[5]), West Seattle Pump Station flows (approximately 19 MGD[5]), and local inflows (approximately 9 MGD[5]) would be routed to the EBI Diversion Structure (located near the Hanford St Regulator Station) along the EBI and routed to the WWTF via approximately 1,000 ft of 78-inch-diameter influent gravity sewer[6].
- Backflowing of the EBI. Motorized gates will be installed in the EBI Gate and Bypass Structure (near the Kingdome Regulator Station) to control flows. Flows routed upstream of the gate (from the Kingdome and Lander St CSO Basins) will backflow to the EBI Diversion Structure and then be routed to the WWTF via approximately 1,000 ft of 78-inch-diameter influent gravity sewer[6].

Modifications to the Lander St Regulator Station will be required to divert King County flows from the Lander St Regulator Station to the EBI to backflow to the WWTF.

Treated CSOs would be conveyed to the Hanford St Regulator Station via a 72-inch-diameter effluent gravity sewer[7], up to approximately 1,890 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 1,500 feet of 72-inch-diameter pipe) from the Hanford St Regulator Station to the center of the East Waterway[8]. 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.

[5] Duwamish Pump Station: 1-year pumped flow rate, West Seattle Pump Station: maximum allowable pumped flow rate, Local Inflows: 1-year peak flow rate from June 2010 modeling run.

[6] 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.

[7] The 72-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.

[8] 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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Representative Footprints for Potential Siting Within or Adjacent to Boundary

CSO Treatment (with Influent Pumping), Typ

DSN028/029/030/032-WWT-1 (KC)
Ballasted Sedimentation
Total Footprint = ~2.80 Acres
Total Flow = ~151.0 MGD
Total Volume = ~1.71 MG

DSN028/029/030/032-WWT-1 (KC)
CEPT w/ Lamella Plates
Total Footprint = ~3.04 Acres
Total Flow = ~155.0 MGD
Total Volume = ~1.43 MG

Equalization Basin, Typ

King St Regulator Station

Kingdome Regulator Station

Modifications to Lander St Regulator Station

Hanford #2 CSO Outfall

Modifications to Hanford St Regulator Station

Elliott Bay Interceptor

EBI Diversion to WWTF

EBI Gates and Bypass Structure

60" Bypass

Modifications to Existing Structures

- KC Manholes
- SPU Maintenance Hole
- 20-ft Contour
- KC-WTD Conveyance
- SPU Drainage Mainline
- SPU Sanitary Mainline
- SPU Combined Mainline
- Representative Footprint
- Connected Area with High GSI Potential
- Connected to Combined Sewer System

Total Hanford/Lander CSO Basin Area: ~3,469 acres

N

1,600 800 0 1,600
Feet

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.

Potential GSI Opportunities in Hanford #2, Lander, King St, and Kingdome CSO Basins

Hanford/Lander CSO Basin Boundary

Approximate Boundary

~19% Hanford/Lander Basin Area Likely Feasible for GSI

0 8,750 17,500 35,000
Feet

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

File Name:

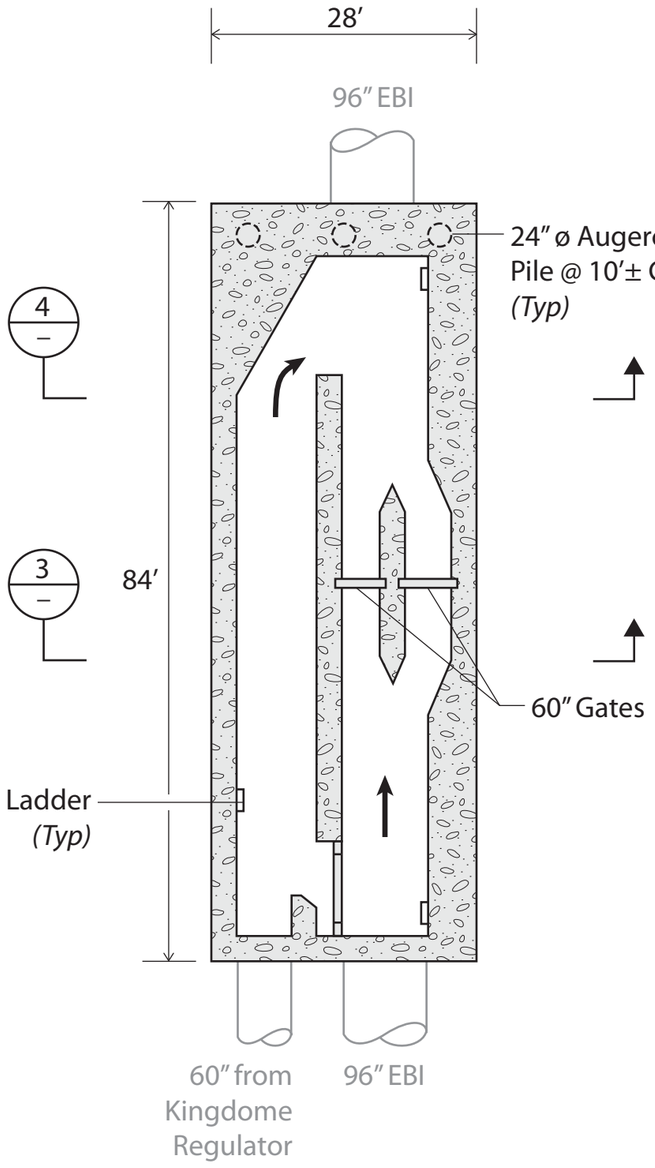
Data Source:

Figure G.3.8-2

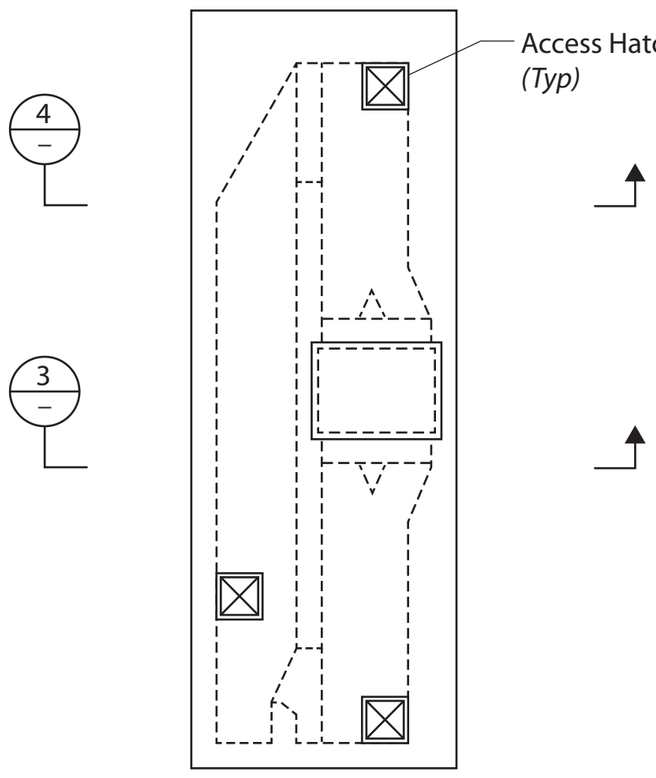
King St, Kingdome, Lander, and Hanford #2 - DSN028/029/030/032-WWT-1 (KC) (EBI Modifications) Potential Site Boundary and Representative Footprints

TM 970, CSO Control Alternatives Development

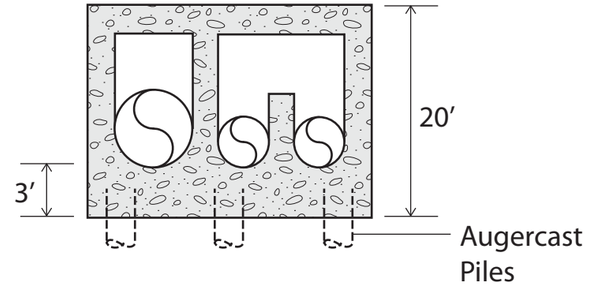
EBI GATE AND BYPASS STRUCTURE



Bottom Plan 1
No Scale



Top Plan 2
No Scale



Section 3
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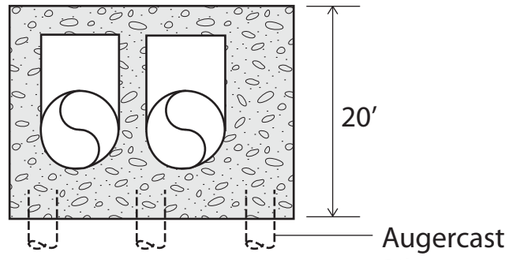

Section 4
No Scale

Alternative DSN028/029/030/032-WWT-1 (KC) (EBI Modifications)

Percentage of Cost Attributed to Hanford #2, Lander, Kingdome, and King Street CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs[a] (%)	Percentage of Costs[b] (%)
DSN028 King Street Regulator	29.6	18.0%	11.4%
DSN029 Kingdome	87.0	52.9%	33.5%
DSN030 Lander Street Regulator	47.9	29.1%	18.5%
DSN032 Hanford #2 Regulator	94.9	NA	36.6%

[a]Percentages used to allocate shared costs to control King Street, Kingdome, and Lander St CSOs.

[b]Percentages used to allocate shared costs to control King Street, Kingdome, Lander St, and Hanford #2 CSOs.

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 Street[3]	Costs Attributed to Kingdome[3]	Costs Attributed to Lander[3]	Costs Attributed to Hanford #2[3]
151-MGD Ballasted Sedimentation Construction Cost =	$35,590,000	$4,060,000	$11,940,000	$6,570,000	$13,020,000
1.71-MG Equalization Basin Construction Cost =	$8,820,000	$1,006,000	$2,958,000	$1,629,000	$3,227,000
151-MGD Influent Pump Station Construction Cost =	$43,900,000	$5,010,000	$14,720,000	$8,110,000	$16,060,000
Solids Handling Facility Construction Cost =	$5,560,000	$634,000	$1,865,000	$1,027,000	$2,034,000
Grit Removal Facility Construction Cost =	$1,170,000	$130,000	$390,000	$220,000	$430,000
EBI Gate and Bypass Structure Construction Cost =	$4,230,000	$760,000	$2,240,000	$1,230,000	$0
Connection to Kingdome Trunk Construction Cost =	$490,000	$0	$490,000	$0	$0
Rebuilding of Existing Regulator (North of Kingdome Trunk) Construction Cost =	$490,000	$0	$490,000	$0	$0
Modifications to Lander Street Regulator Construction Cost =	$490,000	$0	$0	$490,000	$0
Lander Street Connection to EBI Construction Cost =	$490,000	$0	$0	$490,000	$0
Modifications to Hanford Street Regulator Construction Cost =	$490,000	$0	$0	$0	$490,000
EBI Diversion Structure (near Hanford St Regulator) Construction Cost =	$4,230,000	$760,000	$2,240,000	$1,230,000	$0
Bypass Pipe at EBI Gate and Bypass Structure Construction Cost (300 LF of 60-inch-diameter pipe) =	$610,000	$0	$610,000	$0	$0
Upsize Existing Pipe from Lander St Regulator to EBI Construction Cost (50 LF of 42-inch-diameter pipe) =	$80,000	$0	$0	$80,000	$0
Influent Gravity Sewer from EBI Diversion Structure to WWTF Construction Cost (1,000 LF of 78-inch-diameter pipe) =	$2,590,000	$470,000	$1,370,000	$750,000	$0
Influent Gravity Sewer from Hanford St Regulator to WWTF Construction Cost (1,890 LF of 60-inch-diameter pipe) =	$3,810,000	$0	$0	$0	$3,810,000
Effluent Gravity Sewer Construction Cost (1,890 LF of 72-inch-diameter pipe) =	$4,620,000	$530,000	$1,550,000	$850,000	$1,690,000
[4]Outfall Construction Cost (1,500 LF of 72-inch-diameter pipe) =	$6,480,000	$740,000	$2,170,000	$1,200,000	$2,370,000
SDOT Street Use Permit Fee Cost =	$600,000	$50,000	$160,000	$90,000	$290,000
Total Construction Cost =	$124,740,000	$14,150,000	$43,190,000	$23,970,000	$43,420,000
Sales Tax (10% of Construction Cost) =	$12,470,000	$1,420,000	$4,320,000	$2,400,000	$4,340,000
[1]Allied Costs (46.22% of Construction Cost) =	$57,650,000	$6,540,000	$19,960,000	$11,080,000	$20,070,000
Property Cost =	$13,470,000	$1,580,000	$4,630,000	$2,550,000	$4,710,000
Subtotal of Project Cost =	$208,330,000	$23,690,000	$72,100,000	$40,000,000	$72,540,000
[1]Construction Contingency (10% of Construction Cost) =	$12,470,000	$1,420,000	$4,320,000	$2,400,000	$4,340,000
[1, 2]Project Contingency =	$50,030,000	$5,687,000	$17,310,000	$9,600,000	$17,422,000
Total Project Cost for Ballasted Sedimentation, 2010 Dollars =	**$270,800,000**	**$30,800,000**	**$93,700,000**	**$52,000,000**	**$94,300,000**

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

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

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

[4]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 DSN028/029/030/032-WWT-1 (KC) (EBI Modifications)

Percentage of Cost Attributed to Hanford #2, Lander, Kingdome, and King Street CSOs, Based on Peak Flow Rates[3]

Uncontrolled CSO Basin	2010 CSO Peak 1-Year Flow Rate (MGD)	Percentage of Costs[a] (%)	Percentage of Costs[b] (%)
DSN028 King Street Regulator	29.6	18.0%	11.4%
DSN029 Kingdome	87.0	52.9%	33.5%
DSN030 Lander Street Regulator	47.9	29.1%	18.5%
DSN032 Hanford #2 Regulator	94.9	NA	36.6%

[a]Percentages used to allocate shared costs to control King Street, Kingdome, and Lander St CSOs.
[b]Percentages used to allocate shared costs to control King Street, Kingdome, Lander St, and Hanford #2 CSOs.

Escalation Assumptions

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

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

Description	Total Costs	Costs Attributed to King Street[3]	Costs Attributed to Kingdome[3]	Costs Attributed to Lander[3]	Costs Attributed to Hanford #2[3]
155-MGD CEPT with Lamella Construction Cost =	$31,560,000	$3,600,000	$10,580,000	$5,830,000	$11,550,000
1.43-MG Equalization Basin Construction Cost =	$7,550,000	$862,000	$2,532,000	$1,394,000	$2,762,000
155-MGD Influent Pump Station Construction Cost =	$45,000,000	$5,130,000	$15,090,000	$8,310,000	$16,460,000
Lamella Plates Construction Cost =	$3,260,000	$370,000	$1,090,000	$600,000	$1,190,000
Solids Handling Facility Construction Cost =	$4,440,000	$510,000	$1,490,000	$820,000	$1,620,000
EBI Gate and Bypass Structure Construction Cost =	$4,230,000	$760,000	$2,240,000	$1,230,000	$0
Connection to Kingdome Trunk Construction Cost =	$490,000	$0	$490,000	$0	$0
Rebuilding of Existing Regulator (North of Kingdome Trunk) Construction Cost =	$490,000	$0	$490,000	$0	$0
Modifications to Lander Street Regulator Construction Cost =	$490,000	$0	$0	$490,000	$0
Lander Street Connection to EBI Construction Cost =	$490,000	$0	$0	$490,000	$0
Modifications to Hanford Street Regulator Construction Cost =	$490,000	$0	$0	$0	$490,000
EBI Diversion Structure (near Hanford St Regulator) Construction Cost =	$4,230,000	$760,000	$2,240,000	$1,230,000	$0
Bypass Pipe at EBI Gate and Bypass Structure Construction Cost (300 LF of 60-inch-diameter pipe) =	$610,000	$0	$610,000	$0	$0
Upsize Existing Pipe from Lander St Regulator to EBI Construction Cost (50 LF of 42-inch-diameter pipe) =	$80,000	$0	$0	$80,000	$0
Influent Gravity Sewer from EBI Diversion Structure to WWTF Construction Cost (1,000 LF of 78-inch-diameter pipe) =	$2,590,000	$470,000	$1,370,000	$750,000	$0
Influent Gravity Sewer from Hanford St Regulator to WWTF Construction Cost (1,890 LF of 60-inch-diameter pipe) =	$3,810,000	$0	$0	$0	$3,810,000
Effluent Gravity Sewer Construction Cost (1,890 LF of 72-inch-diameter pipe) =	$4,620,000	$530,000	$1,550,000	$850,000	$1,690,000
[4]Outfall Construction Cost (1,500 LF of 72-inch-diameter pipe) =	$6,480,000	$740,000	$2,170,000	$1,200,000	$2,370,000
SDOT Street Use Permit Fee Cost =	$600,000	$50,000	$160,000	$90,000	$290,000
Total Construction Cost =	$121,510,000	$13,780,000	$42,100,000	$23,360,000	$42,230,000
Sales Tax (10% of Construction Cost) =	$12,150,000	$1,380,000	$4,210,000	$2,340,000	$4,220,000
[1]Allied Costs (46.22% of Construction Cost) =	$56,160,000	$6,370,000	$19,460,000	$10,800,000	$19,520,000
Property Cost =	$15,300,000	$1,780,000	$5,250,000	$2,890,000	$5,380,000
Subtotal of Project Cost =	$205,120,000	$23,310,000	$71,020,000	$39,390,000	$71,350,000
[1]Construction Contingency (10% of Construction Cost) =	$12,150,000	$1,380,000	$4,210,000	$2,340,000	$4,220,000
[1, 2]Project Contingency =	$49,390,000	$5,610,000	$17,100,000	$9,480,000	$17,190,000
Total Project Cost for CEPT with Lamella Plates, 2010 Dollars =	**$266,700,000**	**$30,300,000**	**$92,300,000**	**$51,200,000**	**$92,800,000**

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.
[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)
[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)
DSN028 King Street Regulator	29.6	151	155
DSN029 Kingdome	87.0		
DSN030 Lander Street Regulator	47.9		
DSN032 Hanford #2 Regulator	94.9		

[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	$35,586,938	$31,563,913
Solids Handling Facility	$5,564,601	$4,440,000
Grit Removal Facility	$1,171,896	$0
Lamella Plates	$0	$3,263,079
Total Construction Costs	$42,323,435	$39,266,992

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EQUALIZATION BASIN FOR BALLASTED SEDIMENTATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Equalization Basin
Printed date : 12/17/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 1.71 Mgal
Facility Footprint: 19800 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	2,200.00	SY	$43	$94,600
Dewatering	1	LS	$1,020,000	$1,020,000
Odor Control	1	LS	$287,000	$287,000
Effluent Pump Station	1	LS	$235,000	$235,000
Construction Cost	1.7	Mgal	4,000,000	$6,840,000
			Year 2008 Subtotal	$8,480,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$8,820,000			

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

Cost Calculations for Storage Facility: Equalization Basin_CEPT
Printed date : 12/28/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Storage Capacity: 1.43 Mgal
Facility Footprint: 15200 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	1,690.00	SY	$43	$72,600
Dewatering	1	LS	$998,000	$998,000
Odor Control	1	LS	$242,000	$242,000
Effluent Pump Station	1	LS	$228,000	$228,000
Construction Cost	1.4	Mgal	4,000,000	$5,720,000
			Year 2008 Subtotal	$7,260,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal	$7,550,000			

INFLUENT PUMP STATION FOR BALLASTED SEDIMENTATION - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pump Station: Influent Pump Station
Printed date : 12/17/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Capacity: 151 mgd
Total Dynamic Head: 50 ft
Excavation Depth: 40 ft

Calculated Parameters

Required Pump Power	2,600	Hp
Base Architectural/Structural Unit Cost	112,000	$/mgd
Architectural/Structural Unit Cost Adjustment	89,100	$/mgd
Base Mechanical Unit Cost	36,400	$/mgd
Mechanical Unit Cost Adjustment	-10,900.00	$/mgd

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	7,090,000	$7,090,000
Electrical/Instrumentation	1	LS	3,450,000	3,450,000
Architectural/Structural	151	mgd	201,000	30,400,000
Mechanical	151	mgd	25,500	3,840,000
			Year 2008 Subtotal	$44,800,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$43,900,000

Year 2010 Total: $43,900,000

INFLUENT PUMP STATION FOR CEPT WITH LAMELLA PLATES - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pump Station: Influent Pump Station_CEPT
Printed date : 12/28/2010

Project year: 2010

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

Assumptions

Construction Year: 2010
Capacity: 155 mgd
Total Dynamic Head: 50 ft
Excavation Depth: 40 ft

Calculated Parameters

Required Pump Power	2,670	Hp
Base Architectural/Structural Unit Cost	112,000	$/mgd
Architectural/Structural Unit Cost Adjustment	89,100	$/mgd
Base Mechanical Unit Cost	36,100	$/mgd
Mechanical Unit Cost Adjustment	-10,800.00	$/mgd

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	7,260,000	$7,260,000
Electrical/Instrumentation	1	LS	3,510,000	3,510,000
Architectural/Structural	155	mgd	201,000	31,200,000
Mechanical	155	mgd	25,300	3,920,000
			Year 2008 Subtotal	$45,900,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1
Effective Multiplier	0.98
Construction Year 2010 Subtotal	$45,000,000

Year 2010 Total: $45,000,000

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***	

Notes:

1. Soil conditions assumed to require piles for gravity/lateral support

EBI GATE AND BYPASS STRUCTURE (CONTINUED)

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

JOB TITLE EBI Bypass Structure
Concrete Quantities
JOB NO. 135-2749-10001 **SHEET NO.**
CALCULATED BY GCB/GMS **DATE** Feb-10
CHECKED BY **DATE** Feb-10

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-10
CHECKED BY 0 DATE Feb-10

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	Backfill against structure	2.00	94.00	5.00	20.00	696.30		
	spae		2.00	38.00	5.00	20.00	281.48		

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CONNECTION TO KINGDOME 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

REBUILDING OF EXISTING REGULATOR AT KINGDOME - 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

MODIFICATIONS TO LANDER ST REGULATOR - 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

LANDER ST CONNECTION TO EBI - 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

MODIFICATIONS TO HANFORD ST REGULATOR - OUTPUT FROM TABULA 3.1.2

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

Project year: 2010

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

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1	LS	$180,000	$180,000
Electrical/Instrumentation	1	LS	195,000	$195,000
Architectural/Structural	1	LS	40,000	40,000
Mechanical	1	LS	80,000	80,000
			Year 2008 Subtotal	$495,000
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	$1			
Effective Multiplier	0.98			
Construction Year 2010 Subtotal	$485,000			

Year 2010 Total: $485,000

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EBI DIVERSION STRUCTURE (ASSUME SAME AS EBI GATE STRUCTURE)

DATE Feb-10

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***	

Notes:

1. 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: Backflow EBI_Bypass Pipe at Kingdome
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: 300 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: King County Average
Trench Safety: Special Shoring
Pipe Diameter: 60 in.

Geometry

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

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,990.00	CY	$13	$25,900
Backfill	1,050.00	CY	$34	$35,600
Complete Pavement Restoration	415.00	SY	$86	$35,700
Overlay Pavement Restoration	1,050.00	SY	$28	$29,400
Trench Safety	10,300.00	SF	$17	$175,000
Spoil Load and Haul	1,990.00	CY	$16	$31,900
Pipe Unit Material Cost	300.00	lf	$220	$66,000
Pipe Installation	300.00	lf	$81	$24,300
Place Pipe Zone Fill	617.00	CY	$34	$21,000
Manholes	1	MH	$15,400	$15,400
Existing Utilities	300.00	lf	$265	$79,500
Dewatering	300.00	lf	$127	$38,100
Traffic Control	300.00	lf	$36	$10,800
			Year 2008 Subtotal	$588,000

Mobilization/Demobilization at 6%	1.06	
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98	
Effective Multiplier	1.04	
Construction Year 2010 Subtotal	$611,000	

Year 2010 Total: $611,000

UPSIZE PIPE FROM LANDER ST REGULATOR TO EBI - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Lander St Diversion Pipe to EBI
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: 50 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: King County Average
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	227.00	CY	$13	$2,950
Backfill	134.00	CY	$34	$4,550
Complete Pavement Restoration	55.70	SY	$86	$4,790
Overlay Pavement Restoration	189.00	SY	$28	$5,290
Trench Safety	1,530.00	SF	$17	$25,900
Spoil Load and Haul	227.00	CY	$16	$3,630
Pipe Unit Material Cost	50.00	lf	$86	$4,300
Pipe Installation	50.00	lf	$52	$2,600
Place Pipe Zone Fill	66.60	CY	$34	$2,270
Manholes	1	MH	$9,720	$9,720
Existing Utilities	50.00	lf	$120	$6,000
Dewatering	50.00	lf	$107	$5,350
Traffic Control	50.00	lf	$24	$1,200
			Year 2008 Subtotal	$78,600

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$81,700

Year 2010 Total: $81,700

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

Cost Calculations for Pipe: Backflow EBI_Diversion from EBI 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: 1000 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: King County Average
Trench Safety: Special Shoring
Pipe Diameter: 78 in.

Geometry

Outer Diameter	7.75	ft
Trench Width	12.6	ft
Excavation Depth	18.8	ft
Complete Surface Rest. Width	14.6	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	8,730.00	CY	$13	$114,000
Backfill	4,190.00	CY	$34	$143,000
Complete Pavement Restoration	1,620.00	SY	$86	$139,000
Overlay Pavement Restoration	3,270.00	SY	$28	$91,500
Trench Safety	37,500.00	SF	$17	$638,000
Spoil Load and Haul	8,730.00	CY	$16	$140,000
Pipe Unit Material Cost	1,000.00	lf	$414	$414,000
Pipe Installation	1,000.00	lf	$126	$126,000
Place Pipe Zone Fill	2,790.00	CY	$34	$95,000
Manholes	2	MH	$20,000	$40,000
Existing Utilities	1,000.00	lf	$360	$360,000
Dewatering	1,000.00	lf	$147	$147,000
Traffic Control	1,000.00	lf	$50	$50,000
			Year 2008 Subtotal	$2,500,000

Mobilization/Demobilization at 6%	1.06	
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98	
Effective Multiplier	1.04	
Construction Year 2010 Subtotal	$2,590,000	

Year 2010 Total: $2,590,000

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

Cost Calculations for Pipe: Influent Pipe
Printed date : 12/17/2010

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: 1887 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 60 in.

Geometry

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

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	12,500.00	CY	$13	$163,000
Backfill	6,580.00	CY	$34	$224,000
Complete Pavement Restoration	2,610.00	SY	$86	$225,000
Overlay Pavement Restoration	6,610.00	SY	$28	$185,000
Trench Safety	64,600.00	SF	$17	$1,100,000
Spoil Load and Haul	12,500.00	CY	$16	$200,000
Pipe Unit Material Cost	1,890.00	lf	$220	$415,000
Pipe Installation	1,890.00	lf	$81	$153,000
Place Pipe Zone Fill	3,880.00	CY	$34	$132,000
Manholes	4	MH	$15,400	$61,500
Existing Utilities	1,890.00	lf	$265	$500,000
Dewatering	1,890.00	lf	$127	$240,000
Traffic Control	1,890.00	lf	$36	$67,900
			Year 2008 Subtotal	$3,660,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$3,810,000

Year 2010 Total: $3,810,000

EFFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Effluent Pipe
Printed date : 12/17/2010

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: 1887 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: 72 in.

Geometry

Outer Diameter	7.29	ft
Trench Width	12	ft
Excavation Depth	18.3	ft
Complete Surface Rest. Width	14	ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	15,300.00	CY	$13	$199,000
Backfill	7,530.00	CY	$34	$256,000
Complete Pavement Restoration	2,930.00	SY	$86	$252,000
Overlay Pavement Restoration	6,290.00	SY	$28	$176,000
Trench Safety	69,000.00	SF	$17	$1,170,000
Spoil Load and Haul	15,300.00	CY	$16	$245,000
Pipe Unit Material Cost	1,890.00	lf	$346	$653,000
Pipe Installation	1,890.00	lf	$109	$206,000
Place Pipe Zone Fill	4,860.00	CY	$34	$165,000
Manholes	4	MH	$17,700	$70,800
Existing Utilities	1,890.00	lf	$360	$679,000
Dewatering	1,890.00	lf	$147	$277,000
Traffic Control	1,890.00	lf	$50	$94,400
			Year 2008 Subtotal	$4,450,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$4,620,000

Year 2010 Total: $4,620,000

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)
DSN029 Kingdome Regulator	$118.02	$24.12
DSN032 Hanford #2	$105.60	$24.12

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.	121,939	$105.60	100%	$12,876,758
EBI Gate and Bypass Structure, located over EBI in vicinity of Kingome.	5,000	$118.02	100%	$590,100
			Total Land Costs	$13,466,858

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.	132,268	$105.60	100%	$13,967,501
EBI Gate and Bypass Structure, located over EBI in vicinity of Kingome.	5,000	$118.02	100%	$590,100
Additional Solids Handling Facility	7,014	$105.60	100%	$740,656
			Total Land Costs	$15,298,257

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 Kingdome Trunk	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Rebuilding of Existing Regulator (North of Kingdome Trunk)	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Lander Street Connection to EBI	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Regulator Station Upgrade at Lander St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
EBI Diversion Structure (near Hanford St Regulator)	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Regulator Station Upgrade at Hanford St Regulator Station	NA	NA	NA	5,000	60.2	7	$1.30	$6,500
Installation of Bypass Pipe at EBI Gate and Bypass Structure	60	300	44	13,200	28.0	3	$0.30	$3,960
Installation of New Pipe from Lander St Regulator to EBI	42	50	44	2,200	4.7	1	$0.10	$220
Installation of Influent Gravity Sewer from EBI Diversion Structure to WWTF	78	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from Hanford St Regulator Station to WWTF, First Phase of Construction	60	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Influent Gravity Sewer from Hanford St Regulator Station to WWTF, Second Phase of Construction	60	887	44	39,028	82.8	9	$2.10	$81,959
Installation of Effluent Gravity Sewer, First Phase of Construction	72	1,000	44	44,000	93.3	10	$2.90	$127,600
Installation of Effluent Gravity Sewer, Second Phase of Construction	72	887	44	39,028	82.8	9	$2.10	$81,959
						Total SDOT Street Use Fee Estimation:		$596,398

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Operations and Maintenance Cost Estimate Summary

Basin Name: **HLKK**

Alternative Name: **MEBI-Cons Hanford-Lander-King-Kingdome-KC-WWTF (Backflow, Ballasted w/ UV)**

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

Acres of Raingarden for GSI	**0.00**	
Annual Overflow Vol (MG)	**499.50**	
Annual Vol Capture	**449.60**	
Annual Events	**24**	
Stor Vol	**1.71**	equal
Peak Flow Rate	**259.40**	
Peak Flow Rate w/Equal	**151.00**	

Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	$7,746			
Force Mains	$0			
Regulator/Flow Control Structures	$269,211			
Deep/Shallow Tunnels	$0			
Off-Line Storage Pipes	$0			
River Outfalls	$1,656			
Pump Stations	$26,865	$58,888	$84,185	
Rectangular Storage Facilities	$9,073	$22,751	$9,990	$32,005
High Rate Treatment	$380,410	$31,600	$0	$236,701
Additonal Secondary Treatment	NA	$362,251	NA	NA
Green Stormwater Infrastructure	$0			
Annual Cost Subtotals:	**$694,961**	**$475,489**	**$94,174**	**$268,707**

Total Annual O&M

General	**$1,439,157**
Energy	**$94,174**
Total	**$1,533,331**

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WTD Business Case Evaluation Results

Project Name: Hanford-Lander-King-Kingdome WWTF

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							
Backflow	50	$270,800,000	$331,108,103	$0	$331,108,103	$10,949,625	$10,949,625

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							
Backflow	50	$270,800,000	$232,010,630	$0	$232,010,630	$7,672,507	$7,672,507

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

Notes:

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

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

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

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

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