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Appendix G.6

# West Duwamish – W Michigan St and Terminal 115

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Appendix G.6.1

# W Michigan St Site Alternatives

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## W Michigan St Site Alternative

DSN042-STOR-1 (KC) or WDUW-WMichigan-KC-STOR

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## DSN042-STOR-1 (KC) or WDUW-WMichigan-KC-STOR

Alternative DSN042-STOR-1 (KC) controls King County's West Michigan St CSOs by building a storage pipe on the west side of the Duwamish River. This alternative is an independent alternative and only controls King County CSOs.

### Design Criteria

- King County Storage Volume Requirement: 0.27 MG (West Michigan St)
- King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 3.63 MGD (West Michigan St)
- Storage pipe is required to drain within 12 hours of event.

### Description

Alternative DSN042-STOR-1 (KC) consists of a storage pipe to control King County West Michigan St CSOs. A CSO control volume of approximately 0.27 MG is required to reduce overflows at the West Michigan St CSO Outfall to an average of one untreated discharge per year. Storage of this volume could be provided with an offline storage pipe located in rights of way or existing easements immediately adjacent to the selected diversion point on the West Duwamish Interceptor, thereby minimizing conveyance to storage (see Figure G.6.1-1).

The main components of this alternative would include:

- 0.27-MG offline storage pipe with pumps to empty the storage pipe.
- Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
- A regulator station (diversion structure).
- Approximately 100 ft of 8-inch-diameter force main, depending on the location selected for the diversion point and offline storage pipe.
- Approximately 100 ft of 18-inch-diameter influent gravity sewer, depending on the location selected for the diversion point and offline storage pipe.

### Storage Pipe

The CSO control volume for King County could be stored in a buried 12-ft-diameter pipe, approximately 340 feet long. For storage of this volume, it may be more cost-effective to install a smaller-diameter pipe, and the sizing of the storage pipe will be refined during preferred alternative development.

Flows would enter the storage pipe during a wet-weather event. The storage pipe may be configured with equipment for flushing and self-cleaning and cast-in-place access and flushing structures located at the upstream and downstream ends of the storage pipe. A valve vault could house control valves and a common header for the drain pumping system. Control of odors and sediment in the storage pipe 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. This alternative assumes that private property would be acquired for the facilities building.

### Flow Diversion and Discharge

It is assumed that the storage pipe can be located in rights of way or existing easements immediately adjacent to the diversion point for this alternative. Further study and evaluation will be completed prior to selection of a preferred location for the diversion point and storage pipe along the West Duwamish Interceptor.

One regulator station will be required to divert King County flows (W Michigan St CSOs) from the West Duwamish Interceptor to the offline storage pipe. Diverted King County flow would discharge to the location of the storage pipe via an 18-inch-diameter influent gravity sewer. For this alternative, it is assumed that the influent gravity sewer is approximately 100 feet in length; however, the length of the influent gravity sewer will vary depending on the selected location of the diversion point and storage pipe, which will be evaluated during preferred alternative development.

After a wet-weather event, the storage pipe would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County West Duwamish Interceptor through an 8-inch-diameter force main that is assumed to be approximately 100 feet in length. However, the length of the force main will vary depending on the selected location of the diversion point and storage pipe, which will be evaluated during preferred alternative development.

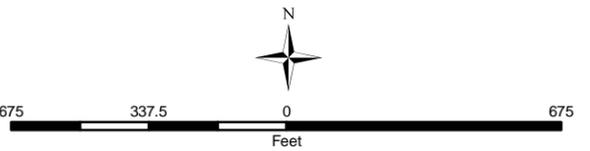
### Construction Assumptions

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 Length of Storage Pipe**  
 DSN042-STOR-1 (KC)  
 Length of 12-ft-Diameter Storage Pipe = ~340 ft  
 Volume = ~0.27 MG

**Locating CSO Storage Pipe**  
 For storage pipe alternatives, it is assumed that the storage pipe can be located in rights of way or existing easements immediately adjacent to the diversion point, thereby minimizing conveyance to storage.  
 Further study and evaluation will be completed prior to selection of a preferred location for the diversion point and storage pipe.

- KC Manholes
  - SPU Maintenance Hole
  - 5-ft Contour
  - 20-ft Contour
  - KC-WTD Conveyance
  - SPU Drainage Mainline
  - SPU Sanitary Mainline
  - SPU Combined Mainline
  - Rights of Way
  - Connected Area with High GSI Potential
  - Connected to Combined Sewer System
- Total W Michigan St CSO Basin Area: ~203 acres

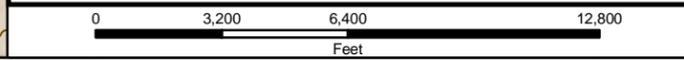


West Michigan St Regulator Station

West Duwamish Interceptor

West Michigan St CSO Outfall

Potential GSI Opportunities in W Michigan St CSO Basin



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## Alternative DSN042-STOR-1 (KC)

### Escalation Assumptions

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

### Total Project Cost, 2010 Dollars

Description	Total Costs (W Michigan St)
0.27-MG Storage Pipe Construction Cost =	\$2,270,000
Odor Control and Effluent Pump Station for Storage Pipe Construction Cost =	\$160,000
Flushing System for Storage Pipe Construction Cost =	\$100,000
Influent Gravity Sewer Construction Cost (100 LF of 18-inch-diameter pipe) =	\$100,000
Force Main Construction Cost (100 LF of 8-inch-diameter pipe) =	\$40,000
Regulator Construction Cost =	\$490,000
SDOT Street Use Permit Fee Cost =	\$20,000
Total Construction Cost =	\$3,180,000
Sales Tax (10% of Construction Cost) =	\$320,000
<sup>1</sup> Allied Costs (54.92% of Construction Cost) =	\$1,750,000
Property Cost =	\$200,000
Subtotal of Project Cost =	\$5,450,000
<sup>1</sup> Construction Contingency (10% of Construction Cost) =	\$320,000
<sup>1,2</sup> Project Contingency =	\$1,320,000
<b>Total Project Cost, 2010 Dollars =</b>	<b>\$7,100,000</b>

<sup>1</sup> King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

<sup>2</sup>Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

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## STORAGE PIPE - OUTPUT FROM TABULA 3.1.2

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Cost Calculations for Pipe: Storage Pipe  
 Printed date : 01/28/2011

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: 340 ft  
 Conduit Type: Gravity  
 Depth of Cover: 15 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: 144 in.

### Geometry

Outer Diameter	14 ft
Trench Width	20.7 ft
Excavation Depth	30 ft
Complete Surface Rest. Width	22.7 ft

### Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	7,820.00	CY	13	102,000
Backfill	3,650.00	CY	34	124,000
Complete Pavement Restoration	858	SY	86	73,800
Overlay Pavement Restoration	805	SY	28	22,500
Trench Safety	20,400.00	SF	17	347,000
Spoil Load and Haul	7,820.00	CY	16	125,000
Pipe Unit Material Cost	340	lf	1,590	540,000
Pipe Installation	340	lf	646	220,000
Place Pipe Zone Fill	2,230.00	CY	34	75,900
Manholes	1	MH	47,600	47,600
Existing Utilities	340	lf	1,190	405,000
Dewatering	340	lf	200	68,000
Traffic Control	340	lf	100	34,000
			Year 2008 Subtotal	\$2,180,000
Mobilization/Demobilization at 6%		1.06		
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)		0.98		
Effective Multiplier		1.04		
Construction Year 2010 Subtotal				\$2,270,000

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**STORAGE PIPE, ODOR CONTROL & EFFLUENT PS - OUTPUT FROM TABULA 3.1.2**

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Cost Calculations for Storage Facility: Storage Facility

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: 0.5 Mgal  
 Facility Footprint: 6705 SF  
 Land Acquisition: None  
 Surface Restoration: Pavement  
 Dewatering: Significant  
 Construction Method: PreCast  
 Outflow Operations: Pump  
 Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	745.00	SY	\$43	\$32,000
Dewatering	1	LS	\$911,000	\$911,000
Odor Control	1	LS	\$93,400	\$93,400
Effluent Pump Station	1	LS	\$201,000	\$201,000
Construction Cost	0.5	Mgal	2,500,000	\$1,250,000
			Year 2008 Subtotal	\$2,490,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal (0.5 MG)			\$2,590,000	
Construction Year 2010, Odor Control and Effluent Pump Station - for 0.27 MG pipe			\$158,976	

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**INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2**

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Cost Calculations for Pipe: Influent Pipe (Gravity)  
 Printed date : 01/28/2011

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: 100 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: 18 in.

Geometry

Outer Diameter	1.92 ft
Trench Width	4.99 ft
Excavation Depth	12.9 ft
Complete Surface Rest. Width	6.99 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	239.00	CY	\$13	\$3,100
Backfill	166.00	CY	\$34	\$5,660
Complete Pavement Restoration	77.70	SY	\$86	\$6,680
Overlay Pavement Restoration	167.00	SY	\$28	\$4,670
Trench Safety	2,580.00	SF	\$17	\$43,900
Spoil Load and Haul	239.00	CY	\$16	\$3,820
Pipe Unit Material Cost	100.00	If	\$24	\$2,400
Pipe Installation	100.00	If	\$29	\$2,900
Place Pipe Zone Fill	61.70	CY	\$34	\$2,100
Manholes	1	MH	\$8,330	\$8,330
Existing Utilities	100.00	If	\$42	\$4,200
Dewatering	100.00	If	\$87	\$8,700
Traffic Control	100.00	If	\$16	\$1,600
			<b>Year 2008 Subtotal</b>	<b>\$98,100</b>
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal				<b>\$102,000</b>

**Year 2010 Total: \$102,000**

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## FORCE MAIN - OUTPUT FROM TABULA 3.1.2

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Cost Calculations for Pipe: Force Main  
 Printed date : 01/28/2011

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: 100 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: 8 in.

### Geometry

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

### Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	100.00	CY	\$13	\$1,300
Backfill	64.50	CY	\$34	\$2,190
Complete Pavement Restoration	60.90	SY	\$86	\$5,240
Overlay Pavement Restoration	184.00	SY	\$28	\$5,140
Trench Safety	1,550.00	SF	\$1	\$822
Spoil Load and Haul	100.00	CY	\$16	\$1,600
Pipe Unit Material Cost	100.00	lf	\$30	\$3,000
Pipe Installation	100.00	lf	\$22	\$2,200
Place Pipe Zone Fill	33.80	CY	\$34	\$1,150
Existing Utilities	100.00	lf	\$32	\$3,200
Dewatering	100.00	lf	\$80	\$8,000
Traffic Control	100.00	lf	\$16	\$1,600
			Year 2008 Subtotal	\$35,400
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal			\$36,800	

Year 2010 Total: \$36,800

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## REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

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Cost Calculations for Regulator Station: Regulator 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  
Above Grade Structure: Yes

### Unit Costs (Basis 2008)

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

Year 2010 Total: \$485,000

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PROPERTY AND PERMITTING COSTS

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

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building (\$/SF)	Average Cost per Square Foot for Industrial Land (\$/SF)
DSN042 West Michigan Regulator	\$111.67	\$23.19

**Land Costs, 2010 Dollars**

Description	Footprint (SF)	Land Cost Assumption (\$/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs (\$)
Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.)	1,750	\$111.67	100%	\$195,423
<b>Total Land Costs</b>				<b>\$195,423</b>

**SDOT Street Use Permit Fee Assumptions**

Construction is located on arterial.

Closure of construction area will occur in phases for conveyance. Assumed construction phasing in:

Assumed production rate for conveyance pipe and force main during working days =

For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula.

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.

Assumed production rate of storage pipe during working days =

1,000 ft segments

15 LF/d

22 ft

44 ft

8 LF/d

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 W Michigan St Regulator Station	NA	NA	NA	5,000	60.2	7	\$1.30	\$6,500
Installation of Influent Gravity Sewer	18	100	22	2,200	9.3	1	\$0.10	\$220
Installation of Force Main	8	100	22	2,200	9.3	1	\$0.10	\$220
Installation of Storage Pipe	144	340	44	14,960	59.5	6	\$0.90	\$13,464
<b>Total SDOT Street Use Fee Estimation:</b>								<b>\$20,404</b>

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## Operations and Maintenance Cost Estimate Summary

**Basin Name:** West Michigan

**Alternative Name:** WDUW-WMichigan-KC-STOR

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

Acres of Raingarden for GSI	<b>0.00</b>
Annual Overflow Vol (MG)	<b>1.10</b>
Annual Vol Capture	<b>0.40</b>
Annual Events	<b>3</b>
Stor Vol	<b>0.27</b>
Peak Flow Rate	<b>3.60</b>
Peak Flow Rate w/Equal	<b>0.00</b>

### Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	\$151			
Force Mains	\$4			
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	\$10,611	\$898	\$1,536	\$5,053
High Rate Treatment	\$0	\$0	\$0	\$0
Additional Secondary Treatment	NA	\$263	NA	NA
Green Stormwater Infrastructure	\$0			

<b>Annual Cost Subtotals:</b>	<b>\$49,225</b>	<b>\$1,161</b>	<b>\$1,536</b>	<b>\$5,053</b>
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#### Total Annual O&M

General	\$55,439
Energy	\$1,536
<b>Total</b>	<b>\$56,975</b>

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# WTD BUSINESS CASE EVALUATION RESULTS

## West Michigan CSO Control

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

Scenario	Lifetime	Initial Capital Outlay	Total Project Life Costs (2)	Total Project Life Benefits	Net Project Life Costs	Average Project Annual Cost	Annual Costs over(under) Status quo
<b>Alternatives</b>							
WDUW-WMichigan- KC-STOR	50	\$7,100,000	\$9,582,170	\$0	\$9,582,170	\$316,879	\$316,879

### 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
<b>Alternatives</b>							
WDUW-WMichigan- KC-STOR	50	\$7,100,000	\$6,337,478	\$0	\$6,337,478	\$209,578	\$209,578

First Year of Construction	2010	Additional inflation rate > 3%	1.00%
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**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.6.2

# Terminal 115 Site Alternatives

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# Terminal 115 Site Alternative

DSN038-STOR-1 (KC) or WDUW-Term 115-KC-STOR

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## DSN038-STOR-1 (KC) or WDUW-Term 115-KC-STOR

Alternative DSN038-STOR-1 (KC) controls King County's Terminal 115 CSOs by building a storage pipe on the west side of the Duwamish River. This alternative is an independent alternative and only controls King County CSOs.

### Design Criteria

- King County Storage Volume Requirement: 0.05 MG (Terminal 115)
- King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 4.6 MGD (Terminal 115)
- Storage pipe is required to drain within 12 hours of event.

### Description

Alternative DSN038-STOR-1 (KC) consists of a storage pipe to control King County Terminal 115 CSOs. A CSO control volume of approximately 0.05 MG is required to reduce overflows at the Terminal 115 CSO Outfall to an average of one untreated discharge per year. Storage of this volume could be provided with an offline storage pipe located in rights of way or existing easements immediately adjacent to the selected diversion point on the West Duwamish Interceptor, thereby minimizing conveyance to storage (see Figure G.6.2-1).

The main components of this alternative would include:

- 0.05-MG offline storage pipe with pumps to empty the storage pipe.
- Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
- A regulator station (diversion structure).
- Approximately 100 ft of 8-inch-diameter force main, depending on the location selected for the diversion point and offline storage pipe.
- Approximately 100 ft of 21-inch-diameter influent gravity sewer, depending on the location selected for the diversion point and offline storage pipe.

### Storage Pipe

The CSO control volume for King County could be stored in a buried 12-ft-diameter pipe, approximately 65 feet long. For storage of this volume, it may be more cost-effective to install a smaller-diameter pipe, and the sizing of the storage pipe will be refined during preferred alternative development.

Flows would enter the storage pipe during a wet-weather event. The storage pipe may be configured with equipment for flushing and self-cleaning and cast-in-place access and flushing structures located at the upstream and downstream ends of the storage pipe. A valve vault could house control valves and a common header for the drain pumping system. Control of odors and sediment in the storage pipe 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. This alternative assumes that private property would be acquired for the facilities building.

### Flow Diversion and Discharge

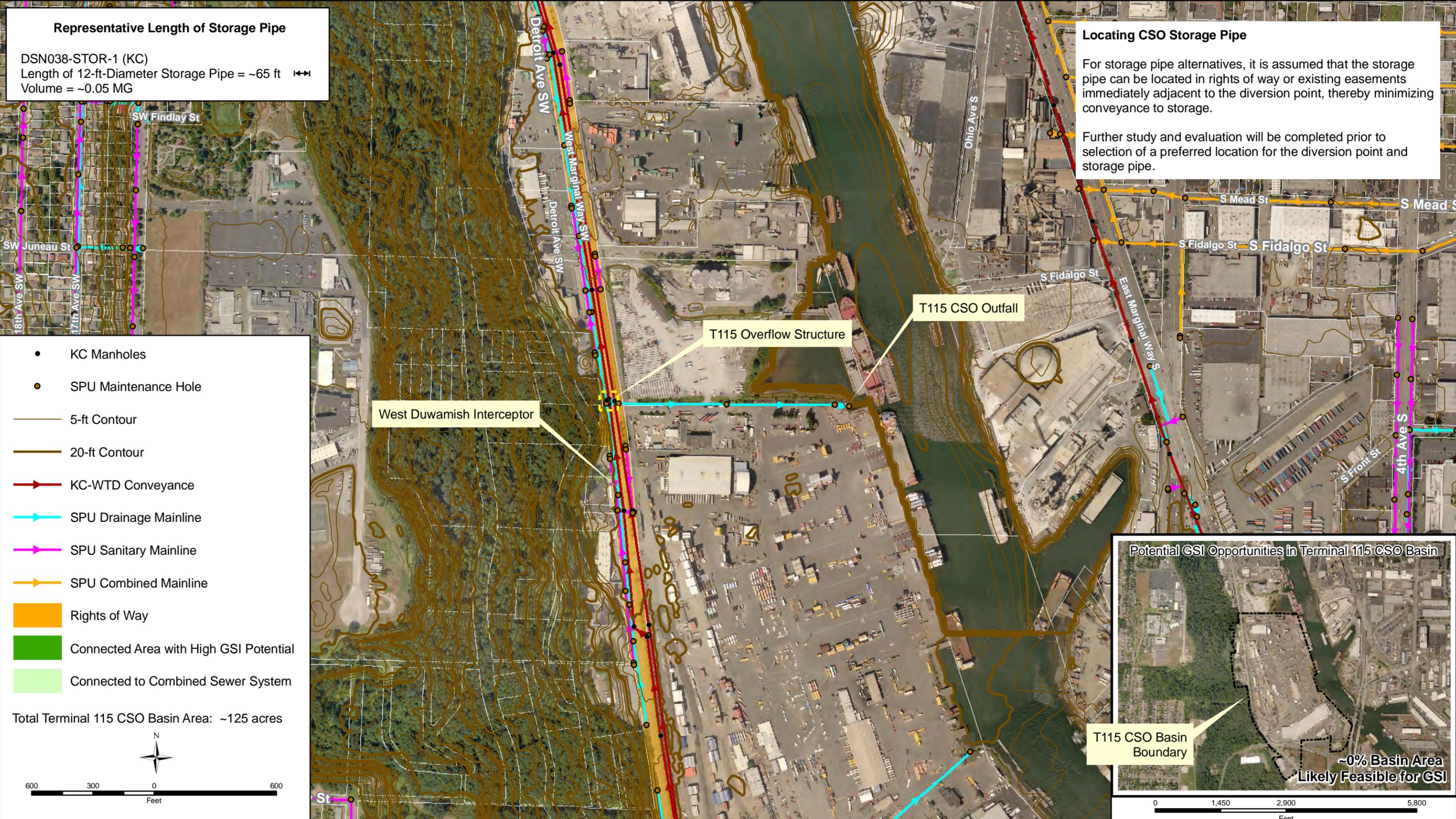
It is assumed that the storage pipe can be located in rights of way or existing easements immediately adjacent to the diversion point for this alternative. Further study and evaluation will be completed prior to selection of a preferred location for the diversion point and storage pipe along the West Duwamish Interceptor.

One regulator station will be required to divert King County flows (Terminal 115 CSOs) from the West Duwamish Interceptor to the storage pipe. Diverted King County flow would discharge to the location of the storage pipe via a 21-inch-diameter influent gravity sewer. For this alternative, it is assumed that the influent gravity sewer is approximately 100 feet in length; however, the length of the influent gravity sewer will vary depending on the selected location of the diversion point and storage pipe, which will be evaluated during preferred alternative development.

After a wet-weather event, the storage pipe would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County West Duwamish Interceptor through an 8-inch-diameter force main that is assumed to be approximately 100 feet in length. However, the length of the force main will vary depending on the selected location of the diversion point and storage pipe, which will be evaluated during preferred alternative development.

### Construction Assumptions

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



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## Alternative DSN038-STOR-1 (KC)

### Escalation Assumptions

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

### Total Project Cost, 2010 Dollars

Description	Total Costs (Terminal 115)
0.05-MG Storage Pipe Construction Cost =	\$470,000
Odor Control and Effluent Pump Station for Storage Pipe Construction Cost =	\$30,000
Flushing System for Storage Pipe Construction Cost =	\$100,000
Influent Gravity Sewer Construction Cost (100 LF of 21-inch-diameter pipe) =	\$110,000
Force Main Construction Cost (100 LF of 8-inch-diameter pipe) =	\$40,000
Regulator Construction Cost =	\$490,000
SDOT Street Use Permit Fee Cost =	\$10,000
Total Construction Cost =	\$1,250,000
Sales Tax (10% of Construction Cost) =	\$130,000
<sup>1</sup> Allied Costs (54.92% of Construction Cost) =	\$690,000
Property Cost =	\$190,000
Subtotal of Project Cost =	\$2,260,000
<sup>1</sup> Construction Contingency (10% of Construction Cost) =	\$130,000
<sup>1,2</sup> Project Contingency =	\$550,000
<b>Total Project Cost, 2010 Dollars =</b>	<b>\$2,900,000</b>

<sup>1</sup> King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

<sup>2</sup>Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

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## STORAGE PIPE - OUTPUT FROM TABULA 3.1.2

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Cost Calculations for Pipe: Storage Pipe

Printed date : 01/28/2011

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: 65 ft  
 Conduit Type: Gravity  
 Depth of Cover: 15 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: 144 in.

### Geometry

Outer Diameter	14 ft
Trench Width	20.7 ft
Excavation Depth	30 ft
Complete Surface Rest. Width	22.7 ft

### Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,500.00	CY	\$13	\$19,400
Backfill	698.00	CY	\$34	\$23,700
Complete Pavement Restoration	164.00	SY	\$86	\$14,100
Overlay Pavement Restoration	154.00	SY	\$28	\$4,310
Trench Safety	3,900.00	SF	\$17	\$66,300
Spoil Load and Haul	1,500.00	CY	\$16	\$23,900
Pipe Unit Material Cost	65.00	lf	\$1,590	\$103,000
Pipe Installation	65.00	lf	\$646	\$42,000
Place Pipe Zone Fill	427.00	CY	\$34	\$14,500
Manholes	1	MH	\$47,600	\$47,600
Existing Utilities	65.00	lf	\$1,190	\$77,400
Dewatering	65.00	lf	\$200	\$13,000
Traffic Control	65.00	lf	\$100	\$6,500
			Year 2008 Subtotal	\$456,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal				\$474,000

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**STORAGE PIPE, ODOR CONTROL AND EFFLUENT PS - OUTPUT FROM TABULA 3.1.2**

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Cost Calculations for Storage Facility: Storage Facility

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: 0.5 Mgal  
 Facility Footprint: 3405 SF  
 Land Acquisition: None  
 Surface Restoration: Pavement  
 Dewatering: Significant  
 Construction Method: PreCast  
 Outflow Operations: Pump  
 Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	378.00	SY	\$43	\$16,300
Dewatering	1	LS	\$911,000	\$911,000
Odor Control	1	LS	\$93,400	\$93,400
Effluent Pump Station	1	LS	\$201,000	\$201,000
Construction Cost	0.5	Mgal	2,500,000	\$1,250,000
			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 (0.5 MG)			\$2,570,000	
Construction Year 2010, Odor Control and Effluent Pump Station - for 0.05 MG pipe			\$29,440	

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## INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

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Cost Calculations for Pipe: Inflow Pipe (Gravity)

Printed date : 01/28/2011

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: 100 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: 21 in.

### Geometry

Outer Diameter	2.21 ft
Trench Width	5.37 ft
Excavation Depth	13.2 ft
Complete Surface Rest. Width	7.37 ft

### Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	263.00	CY	\$13	\$3,420
Backfill	179.00	CY	\$34	\$6,090
Complete Pavement Restoration	81.90	SY	\$86	\$7,040
Overlay Pavement Restoration	163.00	SY	\$28	\$4,550
Trench Safety	2,640.00	SF	\$17	\$44,900
Spoil Load and Haul	263.00	CY	\$16	\$4,200
Pipe Unit Material Cost	100.00	If	\$31	\$3,100
Pipe Installation	100.00	If	\$31	\$3,100
Place Pipe Zone Fill	69.50	CY	\$34	\$2,360
Manholes	1	MH	\$8,330	\$8,330
Existing Utilities	100.00	If	\$58	\$5,800
Dewatering	100.00	If	\$87	\$8,700
Traffic Control	100.00	If	\$16	\$1,600
			Year 2008 Subtotal	\$103,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal			\$107,000	

Year 2010 Total: \$107,000

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## FORCE MAIN - OUTPUT FROM TABULA 3.1.2

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Cost Calculations for Pipe: Force Main

Printed date : 01/28/2011

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: 100 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: 8 in.

### Geometry

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

### Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	100.00	CY	\$13	\$1,300
Backfill	64.50	CY	\$34	\$2,190
Complete Pavement Restoration	60.90	SY	\$86	\$5,240
Overlay Pavement Restoration	184.00	SY	\$28	\$5,140
Trench Safety	1,550.00	SF	\$1	\$822
Spoil Load and Haul	100.00	CY	\$16	\$1,600
Pipe Unit Material Cost	100.00	lf	\$30	\$3,000
Pipe Installation	100.00	lf	\$22	\$2,200
Place Pipe Zone Fill	33.80	CY	\$34	\$1,150
Existing Utilities	100.00	lf	\$32	\$3,200
Dewatering	100.00	lf	\$80	\$8,000
Traffic Control	100.00	lf	\$16	\$1,600
			Year 2008 Subtotal	\$35,400
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal			\$36,800	

Year 2010 Total: \$36,800

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## REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

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Cost Calculations for Regulator Station: Regulator 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  
Above Grade Structure: Yes

### Unit Costs (Basis 2008)

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

Year 2010 Total: \$485,000

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PROPERTY AND PERMITTING COSTS

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

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building (\$/SF)	Average Cost per Square Foot for Industrial Land (\$/SF)
DSN038 Terminal 115 Overflow	\$107.77	\$23.19

**Land Costs, 2010 Dollars**

Description	Footprint (SF)	Land Cost Assumption (\$/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs (\$)
Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.)	1,750	\$107.77	100%	\$188,598
<b>Total Land Costs</b>				<b>\$188,598</b>

**SDOT Street Use Permit Fee Assumptions**

Construction is located on arterial.

Closure of construction area will occur in phases for influent pipe and force main. Assumed construction phasing in:

Assumed production rate for conveyance pipe during working days =

For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula.

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.

Assumed production rate of storage pipe during working days =

1,000 ft segments

15 LF/d

22 ft

44 ft

8 LF/d

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 Terminal 115 Overflow Structure	NA	NA	NA	5,000	60.2	7	\$1.30	\$6,500
Installation of Influent Gravity Sewer	21	100	22	2,200	9.3	1	\$0.10	\$220
Installation of Force Main	8	100	22	2,200	9.3	1	\$0.10	\$220
Installation of Storage Pipe	144	65	44	2,860	11.4	2	\$0.20	\$572

**Total SDOT Street Use Fee Estimation: \$7,512**

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## Operations and Maintenance Cost Estimate Summary

**Basin Name:** T-115

**Alternative Name:** WDUW-Term 115-KC-STOR

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

Acres of Raingarden for GSI	0.00
Annual Overflow Vol (MG)	3.50
Annual Vol Capture	1.10
Annual Events	3
Stor Vol	0.05
Peak Flow Rate ENR 1994	4.60 5747

### Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	\$151			
Force Mains	\$4			
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	\$6,301	\$166	\$284	\$936
High Rate Treatment	\$0	\$0	\$0	\$0
Additonal Secondary Treatment	NA	\$722	NA	NA
Green Stormwater Infrastructure	\$0	NA	NA	NA

<b>Annual Cost Subtotals:</b>	<b>\$44,915</b>	<b>\$889</b>	<b>\$284</b>	<b>\$936</b>
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#### Total Annual O&M

<b>General</b>	<b>\$46,739</b>
<b>Energy</b>	<b>\$284</b>
<b>Total</b>	<b>\$47,024</b>

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# WTD BUSINESS CASE EVALUATION RESULTS

## Terminal 115 CSO Control

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

Scenario	Lifetime	Initial Capital Outlay	Total Project Life Costs (2)	Total Project Life Benefits	Net Project Life Costs	Average Project Annual Cost	Annual Costs over(under) Status quo
<b>Alternatives</b>							
<b>1 Storage Pipe Alt</b>	50	\$2,900,000	\$5,189,715	\$0	\$5,189,715	\$171,622	\$171,622

### 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
<b>Alternatives</b>							
<b>1 Storage Pipe Alt</b>	50	\$2,900,000	\$2,948,919	\$0	\$2,948,919	\$97,520	\$97,520

First Year of Construction	2010	Additional inflation rate > 3%	1.00%
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**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.6.3

# Consolidated Alternatives – W Michigan St and Terminal 115

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# Consolidated Alternatives – WMichigan St and Terminal 115

DSN038/042-STOR-1 (KC) or  
WDUW-Cons WMichigan-Term 115-KC-STOR

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## DSN038/042-STOR-1 (KC) or WDUW-Cons WMichigan-Term 115-KC-STOR

Alternative DSN038/042-STOR-1 (KC) controls King County's Terminal 115 and West Michigan St CSOs by building a storage pipe on the west side of the Duwamish River. This alternative is an independent alternative and only controls King County CSOs.

### Design Criteria

- King County Storage Volume Requirement: 0.32 MG (Terminal 115 and West Michigan St)
- King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 8.23 MGD (Terminal 115 and West Michigan St)
- CSO Peak Flow Rate for Sizing Conveyance from West Michigan St Regulator Station to Terminal 115 Overflow Structure: 3.63 MGD (West Michigan St CSOs)
- Storage pipe is required to drain within 12 hours of event.

### Description

Alternative DSN038/042-STOR-1 (KC) consists of a storage pipe to control King County Terminal 115 and West Michigan St CSOs. A CSO control volume of approximately 0.32 MG is required to reduce overflows at the Terminal 115 and W Michigan St CSO Outfalls to an average of one untreated discharge per year. Storage of this volume could be provided with an offline storage pipe located in rights of way or existing easements immediately adjacent to the selected diversion point on the West Duwamish Interceptor (diversion point assumed as Terminal 115 Overflow Structure for this alternative), thereby minimizing conveyance to storage (see Figure G.6.3-1).

The main components of this alternative would include:

- 0.32 -MG offline storage pipe with pumps to empty the storage pipe.
- Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
- Modifications to the Terminal 115 Overflow Structure and West Michigan St Regulator Station.
- Approximately 100 ft of 8-inch-diameter force main, depending on the location selected for the diversion point and offline storage pipe.
- Approximately 100 ft of 30-inch-diameter influent gravity sewer, depending on the location selected for the diversion point and offline storage pipe.
- Approximately 2,800 ft of 18-inch-diameter gravity sewer to convey flows from the West Michigan St Regulator Station to the Terminal 115 Overflow Structure as shown in Figure G.6.3-1.

## Storage Pipe

The CSO control volume for King County could be stored in a buried 12-ft-diameter pipe, approximately 400 feet long. For storage of this volume, it may be more cost-effective to install a smaller-diameter pipe, and the sizing of the storage pipe will be refined during preferred alternative development.

Flows would enter the storage pipe during a wet-weather event. The storage pipe may be configured with equipment for flushing and self-cleaning and cast-in-place access and flushing structures located at the upstream and downstream ends of the storage pipe. A valve vault could house control valves and a common header for the drain pumping system. Control of odors and sediment in the storage pipe 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. This alternative assumes that private property would be acquired for the facilities building.

## Flow Diversion and Discharge

It is assumed that the storage pipe can be located in rights of way or existing easements immediately adjacent to the diversion point (assumed as Terminal 115 Overflow Structure for this alternative). Further study and evaluation will be completed prior to selection of a preferred location for the diversion point and storage pipe along the West Duwamish Interceptor.

One regulator station will be required to divert King County flows (Terminal 115 and W Michigan St CSOs) from the Terminal 115 Overflow Structure to the storage pipe. For this planning phase, it is assumed that the diversion would occur at the Terminal 115 Overflow Structure. Evaluation of whether flows can be diverted upstream or downstream of the Terminal 115 Overflow Structure will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the storage pipe via a 30-inch-diameter influent gravity sewer. For this alternative, it is assumed that the influent gravity sewer is approximately 100 feet in length; however, the length of the influent gravity sewer will vary depending on the selected location of the diversion point and storage pipe, which will be evaluated during preferred alternative development.

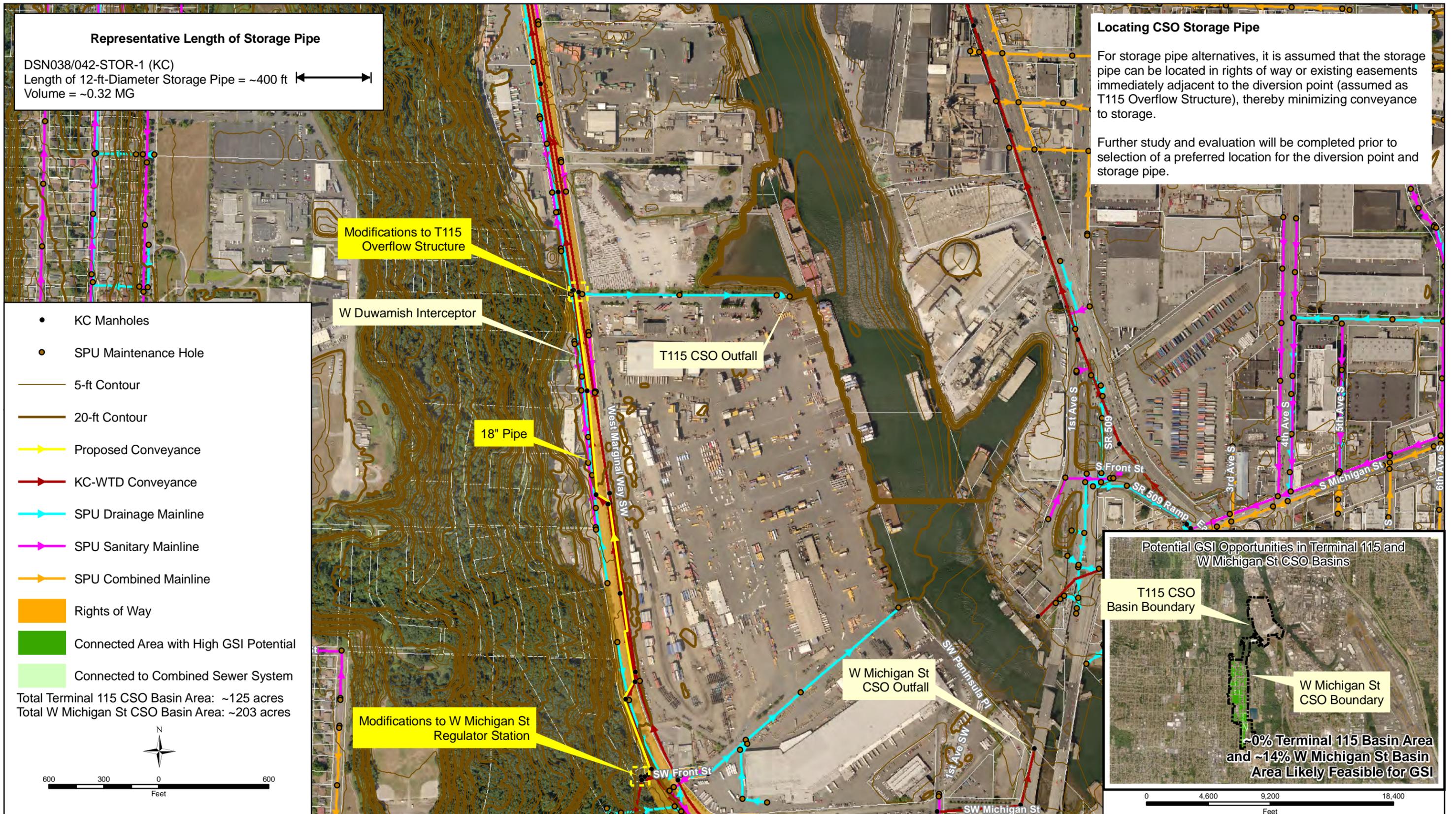
An additional regulator station will be required to divert King County flows (W Michigan St CSOs) from the W Michigan St Regulator Station to the Terminal 115 Overflow Structure. For this planning phase, it is assumed that the diversion would occur at the W Michigan St Regulator Station. Flows would be conveyed to the Terminal 115 Overflow Structure via approximately 2,800 ft of 18-inch-diameter gravity sewer.

After a wet-weather event, the storage pipe would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County West Duwamish Interceptor through an 8-inch-diameter force main that is assumed to be approximately 100 feet in length. However, the length of the force main will vary depending on the selected location of the diversion point and storage pipe, which will be evaluated during preferred alternative development.

## Construction Assumptions

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

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## Alternative DSN038/042-STOR-1 (KC)

### Percentage of Cost Attributed to Terminal 115 and W Michigan St CSOs, Based on Volume<sup>3</sup>

Uncontrolled CSO Basin	2010 CSO Storage Volume (gallons)	Percentage of Costs (%)
DSN038 Terminal 115 Regulator	50,000	15.6%
DSN042 W Michigan St Regulator	270,000	84.4%

### Escalation Assumptions

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

### Total Project Cost, 2010 Dollars

Description	Total Costs (King County)	Costs Attributed to Terminal 115 <sup>3</sup>	Costs Attributed to W Michigan St <sup>3</sup>
0.32-MG Storage Pipe Construction Cost =	\$2,660,000	\$420,000	\$2,240,000
Odor Control and Effluent Pump Station for Storage Pipe Construction Cost =	\$190,000	\$30,000	\$160,000
Flushing System for Storage Pipe Construction Cost =	\$100,000	\$20,000	\$80,000
Influent Gravity Sewer Construction Cost (100 LF of 30-inch-diameter pipe) =	\$120,000	\$20,000	\$100,000
Force Main Construction Cost (100 LF of 8-inch-diameter pipe) =	\$40,000	\$10,000	\$30,000
Conveyance from W Michigan St Regulator to T115 Overflow Structure Construction Cost (2,800 LF of 18-inch-diameter pipe) =	\$2,660,000	\$0	\$2,660,000
Modifications to W Michigan St Regulator Station Construction Cost =	\$490,000	\$0	\$490,000
Modifications to Terminal 115 Overflow Structure Construction Cost =	\$490,000	\$80,000	\$410,000
SDOT Street Use Permit Fee Cost =	\$190,000	\$10,000	\$180,000
<b>Total Construction Cost =</b>	<b>\$6,940,000</b>	<b>\$590,000</b>	<b>\$6,350,000</b>
Sales Tax (10% of Construction Cost) =	\$690,000	\$60,000	\$640,000
<sup>1</sup> Allied Costs (50.97% of Construction Cost) =	\$3,540,000	\$300,000	\$3,240,000
Property Cost =	\$190,000	\$30,000	\$160,000
<b>Subtotal of Project Cost =</b>	<b>\$11,360,000</b>	<b>\$980,000</b>	<b>\$10,390,000</b>
<sup>1</sup> Construction Contingency (10% of Construction Cost) =	\$690,000	\$60,000	\$640,000
<sup>1, 2</sup> Project Contingency =	\$2,720,000	\$230,000	\$2,480,000
<b>Total Project Cost, 2010 Dollars =</b>	<b>\$14,800,000</b>	<b>\$1,300,000</b>	<b>\$13,500,000</b>

<sup>1</sup> King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost

<sup>2</sup> Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

<sup>3</sup> Allocation of costs is pending confirmation from management.

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## STORAGE PIPE - OUTPUT FROM TABULA 3.1.2

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Cost Calculations for Pipe: Storage Pipe

Printed date : 01/28/2011

Project year: 2010

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

### Assumptions

Construction Year: 2010  
 Length: 400 ft  
 Conduit Type: Gravity  
 Depth of Cover: 15 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: 144 in.

### Geometry

Outer Diameter	14 ft
Trench Width	20.7 ft
Excavation Depth	30 ft
Complete Surface Rest. Width	22.7 ft

### Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	9,200.00	CY	\$13	\$120,000
Backfill	4,290.00	CY	\$34	\$146,000
Complete Pavement Restoration	1,010.00	SY	\$86	\$86,800
Overlay Pavement Restoration	947.00	SY	\$28	\$26,500
Trench Safety	24,000.00	SF	\$17	\$408,000
Spoil Load and Haul	9,200.00	CY	\$16	\$147,000
Pipe Unit Material Cost	400.00	lf	\$1,590	\$635,000
Pipe Installation	400.00	lf	\$646	\$258,000
Place Pipe Zone Fill	2,630.00	CY	\$34	\$89,300
Manholes	1	MH	\$47,600	\$47,600
Existing Utilities	400.00	lf	\$1,190	\$476,000
Dewatering	400.00	lf	\$200	\$80,000
Traffic Control	400.00	lf	\$100	\$40,000
			Year 2008 Subtotal	\$2,560,000

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

Construction Year 2010 Subtotal	\$2,660,000
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**STORAGE PIPE, ODOR CONTROL AND EFFLUENT PS - OUTPUT FROM TABULA 3.1.2**

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Cost Calculations for Storage Facility: Storage Facility  
 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: 0.5 Mgal  
 Facility Footprint: 7425 SF  
 Land Acquisition: None  
 Surface Restoration: Pavement  
 Dewatering: Significant  
 Construction Method: PreCast  
 Outflow Operations: Pump  
 Odor Control: true

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Surface Restoration	825.00	SY	\$43	\$35,500
Dewatering	1	LS	\$911,000	\$911,000
Odor Control	1	LS	\$93,400	\$93,400
Effluent Pump Station	1	LS	\$201,000	\$201,000
Construction Cost	0.5	Mgal	2,500,000	\$1,250,000
			Year 2008 Subtotal	\$2,490,000

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

Construction Year 2010 Subtotal (0.5 MG) \$2,590,000

Construction Year 2010, Odor Control and Effluent Pump Station - for 0.32 MG pipe	\$188,416
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**INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2**

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Cost Calculations for Pipe: Influent Pipe (Gravity)  
 Printed date : 01/28/2011

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: 100 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: 30 in.

Geometry

Outer Diameter	3.08 ft
Trench Width	6.51 ft
Excavation Depth	14.1 ft
Complete Surface Rest. Width	8.51 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	339.00	CY	\$13	\$4,410
Backfill	217.00	CY	\$34	\$7,380
Complete Pavement Restoration	94.50	SY	\$86	\$8,130
Overlay Pavement Restoration	150.00	SY	\$28	\$4,200
Trench Safety	2,820.00	SF	\$17	\$47,900
Spoil Load and Haul	339.00	CY	\$16	\$5,430
Pipe Unit Material Cost	100.00	If	\$51	\$5,100
Pipe Installation	100.00	If	\$38	\$3,800
Place Pipe Zone Fill	94.90	CY	\$34	\$3,230
Manholes	1	MH	\$9,720	\$9,720
Existing Utilities	100.00	If	\$58	\$5,800
Dewatering	100.00	If	\$100	\$10,000
Traffic Control	100.00	If	\$24	\$2,400
			<b>Year 2008 Subtotal</b>	<b>\$117,000</b>
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal				<b>\$122,000</b>

**Year 2010 Total: \$122,000**

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**FORCE MAIN - OUTPUT FROM TABULA 3.1.2**

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Cost Calculations for Pipe: Force Main  
 Printed date : 01/28/2011

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: 100 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: 8 in.

Geometry

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

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	100.00	CY	\$13	\$1,300
Backfill	64.50	CY	\$34	\$2,190
Complete Pavement Restoration	60.90	SY	\$86	\$5,240
Overlay Pavement Restoration	184.00	SY	\$28	\$5,140
Trench Safety	1,550.00	SF	\$1	\$822
Spoil Load and Haul	100.00	CY	\$16	\$1,600
Pipe Unit Material Cost	100.00	lf	\$30	\$3,000
Pipe Installation	100.00	lf	\$22	\$2,200
Place Pipe Zone Fill	33.80	CY	\$34	\$1,150
Existing Utilities	100.00	lf	\$32	\$3,200
Dewatering	100.00	lf	\$80	\$8,000
Traffic Control	100.00	lf	\$16	\$1,600
			Year 2008 Subtotal	\$35,400
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal			\$36,800	

Year 2010 Total: \$36,800

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**CONVEYANCE FROM W MICHIGAN ST TO T115 - OUTPUT FROM TABULA 3.1.2**

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Cost Calculations for Pipe: Conveyance from W Michigan Regulator to T115 Overflow Structure  
 Printed date : 01/12/2011

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: 2800 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: 18 in.

Geometry

Outer Diameter	1.92 ft
Trench Width	4.99 ft
Excavation Depth	12.9 ft
Complete Surface Rest. Width	6.99 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	6,690.00	CY	\$13	\$86,900
Backfill	4,660.00	CY	\$34	\$158,000
Complete Pavement Restoration	2,180.00	SY	\$86	\$187,000
Overlay Pavement Restoration	4,670.00	SY	\$28	\$131,000
Trench Safety	72,300.00	SF	\$17	\$1,230,000
Spoil Load and Haul	6,690.00	CY	\$16	\$107,000
Pipe Unit Material Cost	2,800.00	lf	\$24	\$67,200
Pipe Installation	2,800.00	lf	\$29	\$81,200
Place Pipe Zone Fill	1,730.00	CY	\$34	\$58,800
Manholes	6.00	MH	\$8,330	\$50,000
Existing Utilities	2,800.00	lf	\$42	\$118,000
Dewatering	2,800.00	lf	\$87	\$244,000
Traffic Control	2,800.00	lf	16	\$44,800
			Year 2008 Subtotal	\$2,560,000
Mobilization/Demobilization at 6%	1.06			
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98			
Effective Multiplier	1.04			
Construction Year 2010 Subtotal				\$2,660,000

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## MODIFICATIONS TO W MICHIGAN ST REGULATOR STATION - OUTPUT FROM TABULA 3.1.2

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Cost Calculations for Regulator Station: Regulator 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  
Above Grade Structure: Yes

### Unit Costs (Basis 2008)

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

Year 2010 Total: \$485,000

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## MODIFICATIONS TO TERMINAL 115 OVERFLOW STRUCTURE - OUTPUT FROM TABULA 3.1.2

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Cost Calculations for Regulator Station: Regulator 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  
Above Grade Structure: Yes

### Unit Costs (Basis 2008)

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

Year 2010 Total: \$485,000

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PROPERTY AND PERMITTING COSTS

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

Uncontrolled CSO Basin	Average Cost per Square Foot for Industrial Land and Building (\$/SF)	Average Cost per Square Foot for Industrial Land (\$/SF)
DSN038 Terminal 115 Overflow	\$107.77	\$23.19

Land Costs, 2010 Dollars

Description	Footprint (SF)	Land Cost Assumption (\$/SF)	Assumed Percentage of Market Value (%)	Estimated Land Costs (\$)
Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.)	1,750	\$107.77	100%	\$188,598
<b>Total Land Costs</b>				<b>\$188,598</b>

SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.

Closure of construction area will occur in phases for conveyance. Assumed construction phasing in:

Assumed production rate for conveyance pipe and force main during working days =

For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula.

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.

Assumed production rate of storage pipe during working days =

1,000 ft segments

15 LF/d

22 ft

44 ft

8 LF/d

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 W Michigan St Regulator Station	NA	NA	NA	5,000	60.2	7	\$1.30	\$6,500
Regulator Station Upgrade at Terminal 115 Overflow Structure	NA	NA	NA	5,000	60.2	7	\$1.30	\$6,500
Installation of Conveyance from W Michigan St Regulator Station to Terminal 115 Overflow Structure, First Phase of Construction	18	1,000	22	22,000	93.3	10	\$2.90	\$63,800
Installation of Conveyance from W Michigan St Regulator Station to Terminal 115 Overflow Structure, Second Phase of Construction	18	1,000	22	22,000	93.3	10	\$2.90	\$63,800
Installation of Conveyance from W Michigan St Regulator Station to Terminal 115 Overflow Structure, Third Phase of Construction	18	800	22	17,600	74.7	8	\$1.70	\$29,920
Installation of Influent Gravity Sewer	30	100	22	2,200	9.3	1	\$0.10	\$220
Installation of Force Main	8	100	22	2,200	9.3	1	\$0.10	\$220
Installation of Storage Pipe	144	400	44	17,600	70.0	7	\$1.30	\$22,880
<b>Total SDOT Street Use Fee Estimation:</b>								<b>\$193,840</b>

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## Operations and Maintenance Cost Estimate Summary

**Basin Name: West Michigan & T-115**

**Alternative Name: WDUW-Cons WMichigan-Term 115-KC-STOR**

		<i>Acres of Raingarden for GSI</i>	<b>0.00</b>
		<i>Annual Overflow Vol (MG)</i>	<b>1.10</b>
<i>Current ENR</i>	<b>8645.4</b>	<i>Annual Vol Capture</i>	<b>0.40</b>
<i>Power Cost (per kwh)</i>	<b>0.065</b>	<i>Annual Events</i>	<b>3</b>
<i>Labor rate (loaded) /hr</i>	<b>51.17</b>	<i>Stor Vol</i>	<b>0.32</b>
<i>SPU Water Cost \$/CCF</i>	<b>4.50</b>	<i>Peak Flow Rate ENR 1994</i>	<b>8.20 5747</b>
<i>Carbon Cost/Lb</i>	<b>2.00</b>		

### Annual Costs

Components	Annual Maintenance & Inspection Cost	Annual Operation Cost	Annual Energy Cost	Annual Chemical Cost
Gravity Sewer/Combined Sewers	\$4,379			
Force Mains	\$4			
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	\$11,591	\$1,064	\$1,821	\$5,989
High Rate Treatment	\$0	\$0	\$0	\$0
Additional Secondary Treatment	NA	\$263	NA	NA
Green Stormwater Infrastructure	\$0			
<b>Annual Cost Subtotals:</b>	<b>\$54,432</b>	<b>\$1,327</b>	<b>\$1,821</b>	<b>\$5,989</b>
<b>Total Annual O&amp;M</b>				
			<b>\$61,749</b>	
			<b>\$1,821</b>	
			<b>\$63,569</b>	

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# WTD BUSINESS CASE EVALUATION RESULTS

## West Michigan - T115 CSO Control

### Lower Bound Discount Rate (WTD Borrowing Cost) <sup>(1)</sup>

Scenario	Lifetime	Initial Capital Outlay	Total Project Life Costs <sup>(2)</sup>	Total Project Life Benefits	Net Project Life Costs	Average Project Annual Cost	Annual Costs over(under) Status quo
<b>Alternatives</b>							
<b>WDUW-Cons</b>							
<b>WMichigan-Term</b>	50	\$14,800,000	\$17,009,248	\$0	\$17,009,248	\$562,490	\$562,490
<b>115-KC-STOR</b>							

### Upper Bound Discount Rate (OMB, Private Rate of Return) <sup>(3)</sup>

Scenario	Lifetime	Initial Capital Outlay	Total Project Life Costs <sup>(2)</sup>	Total Project Life Benefits	Net Project Life Costs	Average Project Annual Cost	Annual Costs over(under) Status quo
<b>Alternatives</b>							
<b>WDUW-Cons</b>							
<b>WMichigan-Term</b>	50	\$14,800,000	\$12,373,092	\$0	\$12,373,092	\$409,174	\$409,174
<b>115-KC-STOR</b>							

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