
CHAPTER EP-2
**IMPACTS AND MITIGATION MEASURES FOR
REVISED SERVICE STRATEGIES 1, 2 AND 4**

In addition to the Executive's Preferred Plan (which is based on Service Strategy 3), Service Strategies 1, 2 and 4 have also been revised to reflect the need to convey and treat a smaller quantity of wastewater in the future than was previously projected (see discussion of revised population and flow estimates in Foreword). Some key facilities considered in the revised Service Strategies 1, 2 and 4 are smaller than those previously described in Part II of this FEIS (Part II is directly derived from the Draft EIS). For example, under revised SS4, the ultimate planned capacity of the East Treatment Plant would be 154 mgd rather than 235 mgd as described in the *Draft RWSP* and DEIS.

Reduced flow projections have also eliminated the need for some facilities. For example, it is no longer necessary under any service strategy to construct a second interceptor, parallel to the existing East Side Interceptor (ESI). The third leg of the existing outfall for the East Treatment Plant has also been eliminated. Peak flow discharge at this treatment plant can now be handled by storing the flows temporarily in large tanks and using the outfall into the Green River to discharge secondary treated effluent during peak flow conditions (approximately once every two years).

These service strategy revisions have all resulted in projected environmental impacts that are of the same or less magnitude than those described in Part II of this FEIS. At the end of this chapter, these impacts are discussed and compared in Table EP2-9 for each element of the environment and for each revised service strategy. Figure EP2-1 compares discharge rates from King County outfalls for the revised strategies in 2030. In addition, Table EP2-4 compares the costs of the revised service strategies, Table EP2-5 provides volumes of excavated materials for construction of various types of facilities, Table EP2-6 provides operational trips for treatment plants, and Tables EP2-7 and EP2-8 provide construction transportation impact summaries for treatment plants and major conveyance facilities, respectively.

The CSO control program has been revised to achieve an average of one discharge event per year by 2030. This is 13 years earlier than previously considered and would benefit water quality for Puget Sound beaches, the Ship Canal, and the Duwamish River sooner than discussed in the Draft EIS. It would also reduce the accumulation of pollutants in sediments near outfall locations resulting in less potential for cumulative impacts to water quality and marine biota.

All environmental impacts of the revised service strategies fall within the range of those previously discussed in the Draft EIS and presented in Part II of this FEIS. Chapter 4 of Part II of the FEIS provides information on the "Affected Environment". Chapters 5 through 8 discuss operational impacts common to all service strategies and impacts and mitigation measures for each Service Strategy as described in the *Draft RWSP*.

Chapter 9 of Part II of this FEIS describes impacts and mitigation measures related to reclaimed water applications. Chapter 10 covers biosolids recycling program impacts and mitigation measures.

Chapter 11 of Part II of this FEIS contains the discussion of “Construction Impacts and Mitigation Measures”. This information is applicable to all service strategies.

Finally, Chapter 12 of Part II of this FEIS provides a description of the service strategy options that were considered as described in the *Draft RWSP*. Some of these options have been retained as part of the EPP (see Chapter EP-1).

SUMMARY OF KEY FEATURES OF REVISED SERVICE STRATEGY 1

Key Components of this Strategy:

- Maintain the existing two-treatment-plant system (West and East Plants)
- Expand East Treatment Plant in increments:
 - Plant capacity of 135 mgd (2013)
 - Plant capacity of 154 mgd (2021)
- Expand West Treatment Plant to planned capacity of 159 mgd (2029)
- Construct a new parallel Kenmore interceptor (2010)
- Construct 5-million gallons of storage to reduce ETS peak flows (2016)
- Implement CSO program to achieve one overflow event per year per outfall by 2030
- Implement I/I incentives/surcharge program
- Biosolids:
 - Produce Class B biosolids at all three plants
 - Explore alternative technologies to improve biosolids quality and marketability
- Water Reuse:
 - Research new applications for reclaimed water
 - Allow flexibility to produce and distribute reclaimed water at all treatment plants

The important features of revised Service Strategy 1 are shown in Figure EP2-2. Table EP2-1 shows the chronological sequence of projects under this service strategy.

Service Strategy 1 splits the northern flows between the two existing treatment plants, first expanding the East Treatment Plant (by 2010 and again by 2021) and then the West Treatment Plant (by 2029).

There are some differences between the revised Service Strategy 1 described here and Service Strategy 1 as presented in the draft RWSP and Part II of this FEIS (chapters 3 and 5). In the revised SS1, the West Treatment Plant is expanded to 159 mgd in 2029 rather than in 2020. The planned capacity of the East Treatment Plant is now less than was previously described. Under the revised strategy, it is only expanded to 154 mgd in 2021 rather than to 235 mgd in 2040 as described in Part II of this FEIS.

Because of the smaller planned capacity at the East Treatment Plant, it is no longer necessary to construct a third outfall at Duwamish Head to discharge peak flows. Additionally, a small storage tank would need to be constructed: 5 mg rather than the 20 mg described in Part II of the FEIS.

As with all revised service strategies (and the EPP) the CSO program achieves an average of one overflow event per outfall per year earlier than is described in Part II of this FEIS. All revised service strategies also include implementation of an I/I incentives and surcharge program.

SUMMARY OF KEY FEATURES OF REVISED SERVICE STRATEGY 2

Key Components of this Strategy:

- Create a new three-treatment plant system (comprised of West Plant, East Plant, and a new North Plant)
- Expand West Treatment Plant to planned capacity of 159 mgd (2013)
- Construct a new parallel Kenmore interceptor (2009)
- Construct a new 27 mgd North Plant (2024)
- Construct a conveyance system to carry influent to the North Plant and an outfall from the North Plant to Puget Sound (2024)
- Expand East Treatment Plant to 127 mgd (2029)
- Implement CSO program to achieve one overflow event per year per outfall by 2030
- Implement I/I incentives/surcharge program.
- Biosolids: Same as for SS1
- Water Reuse: Same as for SS1, but also adds greater flexibility to build smaller “satellite” treatment plants if circumstances warrant (as for EPP)

The important features of Service Strategy 2 are shown in Figure EP2-3. Table EP2-2 shows the chronological sequence of projects under this service strategy.

Revised Service Strategy 2 splits the northern flows between the West Treatment Plant and a new treatment plant in north King or south Snohomish County. The flows are first sent to the West Treatment Plant. Until a new treatment plant is constructed, all northern flows would be conveyed through the Kenmore Interceptor, requiring a parallel interceptor to be constructed.

The West Treatment Plant is expanded to planned capacity of 159 mgd but this would occur in 2013 rather than 2010. The Kenmore parallel would be constructed by 2009.

The East Treatment Plant is smaller than previously discussed but the additional capacity is needed earlier under revised Service Strategy 2. Under revised SS2, it is expanded to 127 mgd in 2029.

A new 27 mgd North Plant would be constructed by the year 2024. This is smaller than the 65 mgd plant described in Part II of the FEIS.

**Table EP2-2. Service Strategy 2
List of Capital Facilities (by year required on-line)**

1996	2000	2005	2010	2015	2020	2025	2030	2040
Treatment Plant Projects								
						*Increase West Point Capacity to 159 MGD (2013)		
							*Construct 27 MGD North End Plant (2024)	
							*NEP Outfall (2024)	
							*Increase East Plant to 127 MGD (2029)	
Conveyance Projects								
◆	ESI-11 – Wilburton Siphon (1998)							
	◆	Reuse Projects (1999)						
		◆	ESI-1 (2000)					
		◆	Trunk Improvements (1990-2000)					
		◆	Increase York PS capacity to 68 MGD (2000)					
			◆	I&I Reduction Program – Project (2003)				
				◆	Auburn Interceptor 1,2,3 (2004)			
					◆	Trunk Improvements (2001-2010)		
						◆ Off-line storage at North Creek (2005)		
						◆ Tunnel Kenmore to Matthew’s Park PS (2009)		
							◆ Increase Kenmore PS capacity to 35 MGD (2010)	
							◆ PS at end of Tunnel (2010)	
							◆ Trunk Improvements (2011-2020)	
							◆ Convey N. Creek PS flows to Kenmore (2017)	
							◆ Modify N. Creek PS to pump to Kenmore (2017)	
							◆ Modify York PS to pump 35 MGD north (2017)	
							◆ Auburn Interceptor Storage (2020)	
							◆ Tunnel from NEP to Puget Sound (2024)	
							◆ Forcemain from Kenmore PS to NEP (2024)	
							◆ PS at Kenmore to pump to NEP (2024)	
							◆ Trunk Improvements (2021-2030)	
							◆ Trunk Improvements >2031	
CSO Projects								
★	Harbor (1998)							
		★	Denny Way (2006)					
			★	MLK Way (2008)				
				★	Henderson (2009)			
					★	Norfolk (2009)		
						★ S. Magnolia (2010)		
						★ SW Alaska St. (2010)		
						★ Murray (2010)		
						★ Barton (2011)		
						★ North Beach (2011)		
						★ University Montlake (2015)		
						★ Hanford (2017)		
						★ West Point (2018)		
						★ Lander (2019)		
						★ Michigan (2022)		
						★ Brandon (2022)		
						★ Chelan (2024)		
						★ Connecticut (2026)		
						★ King Street (2026)		
						★ Hanford @ Rainier (2026)		
						★ 8 th Avenue S. (2027)		
						★ W. Michigan (2027)		
						★ Terminal 115 (2027)		
						★ 3 rd West (2029)		
						★ Ballard (2029)		
						★ 11 th Ave (2030)		

SUMMARY OF KEY FEATURES OF REVISED SERVICE STRATEGY 4

Key Components of this Strategy:

- Maintain the existing two-treatment-plant system (West and East Plants)
- Expand West Plant to planned capacity of 159 mgd (2013)
- Expand East Plant in increments:
 - Plant capacity of 135 mgd (2024)
 - Plant capacity of 154 mgd (2037)
- Construct Kenmore-to-Duwamish deep tunnel for CSOs and wastewater in increments (2025)
- Implement CSO program to achieve one overflow event per outfall per year by 2030.
- Implement I/I incentives/surcharge program.
- Biosolids (Same as for SS1)
- Water Reuse (Same as for SS1)

The important features of Service Strategy 4 are shown in Figure EP2-4. Table EP2-3 shows the chronological sequence of projects under this service strategy.

Revised Service Strategy 4 splits the northern flows between the two existing treatment plants. However, flows that exceed the capacity of the existing Kenmore and Eastside Interceptors are conveyed south through a new deep tunnel underneath the City of Seattle. Eventually, the tunnel would be operated to optimize efficiency by routing variable flows to the East and West Treatment Plants.

The main differences between Service Strategy 4 in the draft RWSP and the revised Service Strategy 4 are the length and diameters of the tunnel. The length was initially proposed to be 18 miles. Under revised SS4 it would be about 15 miles. The initial diameters were 18 feet and 29 feet (for different segments). Under revised SS4 the diameters would be 12 feet and 19 feet.

Under revised service strategy 4, the planned capacity of the East Plant is smaller. It is expanded to an ultimate planned capacity of 154 mgd rather than 235 mgd.

**Table EP2-3. Service Strategy 4
List of Capital Facilities (by year required on-line)**

1996	2000	2005	2010	2015	2020	2025	2030	2040
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Treatment Plant Projects

*Increase West Point Capacity to 159 MGD (2013)

*Increase East Plant Capacity to 135 MGD

(2024)

*Increase East Plant capacity to 154 MGD (2037)

Conveyance Projects

◆ESI-11 – Wilburton Siphon (1998)

◆Reuse Projects (1999)

◆ESI-1 (2000)

◆Trunk Improvements (1990-2000)

◆Increase York PS capacity to 68 MGD (2000)

◆I&I Reduction Programs (2003)

◆Auburn Interceptor Sections 1,2,3 (2004)

◆Trunk Improvements 2001-2010

◆North end of Kenmore to Thornton Creek Tunnel (2005)

◆Thornton Crk to University Tunnel (2013)

◆Trunk Improvements 2011-2020

◆Convey N. Creek PS flows to Kenmore (2017)

◆Modify York PS to pump 35 MGD north (2017)

◆Auburn Interceptor Storage (2020)

◆Off-line storage at Sunset Tunnel (2020)

◆Trunk Improvements 2021-2030

◆ETS Storage (2030)

◆Trunk

Improvements

(2031+)

CSO Projects

★Harbor (1998)

★Denny Way (2006)

★MLK Way (2008)

★Henderson (2009)

★Norfolk (2009)

★U+M to Kenmore Tunnel (2010)

★ S. Magnolia (2013)

★SW Alaska (2014)

★Murray (2015)

★Barton (2016)

★North Beach (2017)

★Ballard (2017)

★11th Avenue West (2019)

★West Point Improvements (2020)

★Chelan (2021)

★3rd W. Tunnel (2025)

★3rd W. Pump Station to WP (2025)

★Hanford, Lander, Connecticut, King to tunnel (2025)

★Michigan+Brandon to tunnel (2028)

★8th Ave. S (2029)

★W. Michigan (2029)

★Terminal 115 (2030)

★Hanford @ Rainier (2030)

1996	2000	2005	2010	2015	2020	2025	2030	2040
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ALTERNATIVE PHASING OF SERVICE STRATEGY 3

The County evaluated different facility phasing for Service Strategy 3 to attempt to optimize the overall cost, rate impact and benefits of the strategy. The facility phasing under so-called “Strategy 3B” reversed the order of treatment plant capacity additions so that the East Plant would be expanded before the North Plant was built. To control sewer backups in the northend, an additional parallel interceptor between Kenmore and Mathews Beach Park would also be needed, and the ultimate size of the East Plant would increase while the North Plant size decreased.

Although “3B” afforded potential near term cost savings, it was not carried forward because, relative to “3A”, it has greater environmental impacts and less flexibility in the near term.

REVISED SERVICE STRATEGY COSTS

Table EP2-4A shows the net present value of each system strategy through 2050. Table EP2-4B compares the monthly rate impacts of the service strategies.

TABLE EP2-4A
Revised Strategy Costs (in \$million)

Service Strategy	2030	2050
Executive's Preferred Plan	1,086	1,252
Revised System Strategy 1	789	881
Revised System Strategy 2	1,027	1,149
Revised System Strategy 4	1,218	1,335

All costs shown in 1998 net present value through 2050.

Table EP2-4B
Comparison of Levelized (average) Monthly Rate Impacts,^a
1998 to 2030 (in 1998 dollars)

Rates	Service Strategy			
	1	2	3	4
Current	19.10	19.10	19.10	19.10
Average, 1998-2030	17.65	18.23	18.97	19.25
Maximum	19.94	19.96	21.46	21.55
Minimum	14.59	15.95	16.01	17.09

^a Dollars/month for a single-family residence

Table EP2-5
Approximate Areas Disturbed and Volumes of Excavated Material ⁽¹⁾
Construction Impact Summary

Type of Facility	Executives Preferred Plan		Service Strategy 1		Service Strategy 2		Service Strategy 4	
	Area Disturbed (acres)	Volume Excavated (cubic yards) ⁽²⁾	Area Disturbed (acres)	Volume Excavated (cubic yards)	Area Disturbed (acres)	Volume Excavated (cubic yards)	Area Disturbed (acres)	Volume Excavated (cubic yards)
Treatment Plants	28	1,000,000	17	880,000	20	860,000	17	880,000
Major Conveyances ⁽³⁾	17	670,000	10	330,000	17	650,000	11	1,200,000
CSO Projects	9	1,000,000	5	1,600,000	12	940,000	1	1,600,000
Total	54	2,670,000	32	2,810,000	49	2,450,000	29	3,680,000

Notes: (1) Numbers for “areas disturbed” and “volumes excavated” are rounded.
(2) “Volumes excavated” include estimated volumes of preload material (East Plant) and a 30% swell factor.
(3) Major conveyances correspond to those listed in Table EP2-8.

**Table EP2-6
Operational Trips (1)
Service Strategies 1, 2, and 4**

VEHICLE TYPE	FACILITY						
	West Plant		East Plant				North Plant ⁽²⁾
	Existing, Average/Day (133 mgd)	(159 mgd)	Existing, Average/Day (115 mgd)	(127 mgd)	(135 mgd)	(154 mgd)	(27 mgd)
CARS	320/day	380/day	330/day	375/day	385/day	440/day	65/day
TRUCKS	35/day	40/day	65/day ⁽⁴⁾	75/day	75/day	85/day	7/day
BIOSOLIDS TRUCKS ⁽³⁾ (7 days a week)	12/day (6 loads)	Maximum of (13 loads)	10-12/day (5-6 loads)	12/day (6 loads)	12-14/day (6-7 loads)	14-16/day (7-8 loads)	2-4/day (1-2 loads)
<u>Chlorine</u> RAILROAD CARS	-----	-----	7/year	8/year	8/year	10/year	NA ⁽⁵⁾

Notes: (1) Trips are one-way; figures are rounded. "One-way" is defined as a single direction trip to a single destination.
(2) Projected North Plant trips are based on existing West Plant trips to reflect most recent traffic volume data.
(3) Biosolids truck trips are one-way. Final conditions to the Shoreline Substantial Development Permit for upgrade to secondary treatment at West Point state that "the number of loaded sludge trucks shall not exceed 13 per day on average over a year period (January through December)." Thirteen truck loads per day equals 26 one-way truck trips as defined in Note (1).
(4) East Plant truck trip numbers include septage trucks which are not processed at the West Plant.
(5) Data not available.

**Table EP2-7
Treatment Plants
Construction Transportation Impact Summary**

Facility	Potentially Affected Roadways ⁽¹⁾	Excavation Volumes ⁽²⁾ (cubic yards)	Total One-Way ⁽³⁾ Haul Truck Trips (16 cy/load)	Maximum Daily Haul Truck Trips (16 cy /load)	Total Construction ⁽⁴⁾ Related Trips (average/maximum per day)
West Plant (133 mgd to 159 mgd)	<ul style="list-style-type: none"> • 15th Ave W • W Dravus St • 20 Ave W • Gilman Ave W • W Government Wy • Discovery Pk/Fort Lawton roadways 	100,000	13,000	150-200	150-200/300-350
East Plant (115 mgd to 135 mgd)	<ul style="list-style-type: none"> • SW 7th St • Longacres Drive SW • Monster Rd SW • Oaksdale Ave SW • SW Grady Wy 	300,000	38,000	125-150	100-150/200-250
East Plant (135 mgd to 154 mgd))	Same as East Plant (115 to 135 mgd)	280,000	35,000	125-150	100-150/200-250
East Plant (115 mgd to 127 mgd)	Same as East Plant (115 to 135 mgd)	220,000	28,000	90-115	80-125/150-200
North End Plant (0 mgd to 27 mgd)	Dependent on location.	300,000	38,000	150-200	150-250/300-350
North End Plant (0 mgd to 18 mgd)	Dependent on location.	200,000	25,000	100-150	100-150/200-250
North End Plant (18 mgd to 36 mgd)	Dependent on location.	150,000	19,000	100-150	100-150/200-250
North End Plant (36 mgd to 54 mgd))	Dependent on location.	150,000	19,000	100-150	100-150/200-250
Notes: (1) Roadways listed are major and/or principal affected roadways. (2) Excavation volumes include estimates for pre-load material (East Plant) and a 30% swell factor; numbers are rounded. (3) A one-way truck trip is defined as a single direction trip to a single destination; numbers are rounded. (4) Construction related trips include haul truck, delivery, inspection, and worker trips.					

**Table EP2-8
Major Conveyance Facilities
Construction Transportation Impact Summary**

Conveyance	Potential Affected Roadways ⁽¹⁾	Excavation Volumes ⁽²⁾ (cubic yards)	Total One-Way ⁽³⁾ Haul Truck Trips (16 cy/load)	Average Daily ⁽⁴⁾ Haul Truck Trips (16 cy /load)	Total Construction ⁽⁵⁾ Related trips (Average/day)
Auburn Interceptor (Sections 1, 2, 3)	<ul style="list-style-type: none"> • SR 167 • SR 516 • SR 181 • S 228th St • James St • W Meeker St • S 277th St • 37th St NW • 29 St NW 	121,000	15,000	50-100	100-150
Tunnel (Kenmore to Mathews Beach Park)	<ul style="list-style-type: none"> • SR 522 • NE 175th St • 61st Ave NE • Sand Pt Wy NE 	147,000	18,000	50-100	100-150
New Kenmore Pump Station (PS) to North End Plant (NEP).	Dependent on NEP location.	112,000	14,000	50-100	100-150
NEP Tunnel (NEP to Puget Sound)	Dependent on NEP location.	173,000	22,000	50-100	100-150
NEP Outfall	Dependent on NEP location.	22,000	3,000	50-100	100-150
Kenmore PS to North Creek PS	<ul style="list-style-type: none"> • I-405 • SR 522 • North Creek Pkwy • NE 195th St • NE 175th St • 68th Ave NE 	61,000 - 96,000 (dependent on Service Strategy)	8,000 - 12,000	50-100	100-150
Deep Tunnel (Kenmore/Duwamish)	<ul style="list-style-type: none"> • I-90 • I-5 • SR 522 • SR 520 • SR 99 • SR 167 	983,000	123,000	50-100	100-150
<p>Notes: (1) Roadways listed are major and/or principal affected roadways. (2) Excavation volumes are rounded to the nearest thousand and include a 30% swell factor; numbers are rounded. (3) A one way trip is defined as a single direction trip to a single destination; numbers are rounded. (4) Numbers for daily truck trips are based on a single construction site. (5) Construction related truck trips include haul truck, delivery, inspection, and worker trips.</p>					

