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

Design Criteria

SPU Storage Volume requirements:

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

King County Storage Volume requirements:

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

Description

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

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

The main components of this alternative include:

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

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

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

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

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

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

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

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

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

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

- One drop structure to connect to Fremont Siphon

Tunnel

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

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

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

Facilities Building

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

Flow Diversion and Discharge

Madison Park Basin: NPDES025

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

Montlake Basins: NPDES020 and NPDES140

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

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

Montlake Regulator

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

North Lake Union Basin: NPDES018

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

University Regulator Diversion

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

Portage Bay/Lake Union Basin: NPDES138

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

Fremont/Wallingford: NPDES147 and NPDES174

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

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

3rd Avenue West Regulator

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

11th Avenue Northwest Regulator

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

Construction Assumptions

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