West Point Treatment Plant

Ongoing Marine Water Quality Monitoring

King County
Department of
Natural Resources and Parks
Water and Land Resources Division

Water Quality Report – Update June 9th, 2017

OVERVIEW

As part of a long-term program, King County monitors water quality at 12 offshore and 20 beach locations (see Figure 1) to provide an understanding of water quality within the Puget Sound Central Basin, including at all treatment plant outfalls. The West Point Treatment Plant main outfall is the site labeled KSSK02 on the map, located 3,600 ft. offshore at approximately 230-ft deep. The county maintains a long-term dataset, over 50 years at some locations, which provides insight into natural variation. This monitoring program and dataset form the basis from which water quality conditions can be assessed that may be affected by the West Point wastewater discharge during its period of reduced treatment.

As of May 10th, repairs at West Point were completed to ensure that quality of secondary treated effluent will consistently meet all permit requirements for discharge to Puget Sound. King County will return to a twice-per-month monitoring frequency at all offshore stations, the EBO station will no longer be sampled, and beach station monitoring will return to a monthly frequency.

At the offshore sampling stations, dissolved oxygen, temperature, salinity, density (calculated), chlorophyll, and light intensity and transmission are measured throughout the entire water column from surface to bottom every two weeks. Additionally, nutrients, fecal indicator bacteria (FIB), suspended solids, and chlorophyll are measured at specific depths at each site, and phytoplankton composition and abundance are assessed at a subset of sites. Beach locations are monitored monthly for nutrients, FIB, temperature, and salinity.

Additional Monitoring: During the time treatment was reduced at the West Point plant through June 9th, the sampling frequency at a subset of four offshore long-term monitoring stations was increased to weekly. A new site was added at the emergency bypass outfall (EBO) and is also sampled weekly. This frequency and variety of biological, chemical, and physical conditions can capture some impacts on ecosystem functions. From April 10th through June 9th, bacteria concentrations at a subset of six beach sampling stations were being monitored weekly. As of April 11th, a Submersible Ultraviolet Nitrate Analyzer (SUNA) sensor loaned to King County from the Washington State Dept. of Ecology has been used to support monitoring efforts. The SUNA sensor adds rapid measurements of nitrate and provides more information on variability from the surface to bottom.

Overall, the County's monitoring is sufficient to evaluate the most relevant water quality conditions that have the potential to result in any acute adverse effects to Puget Sound aquatic life.

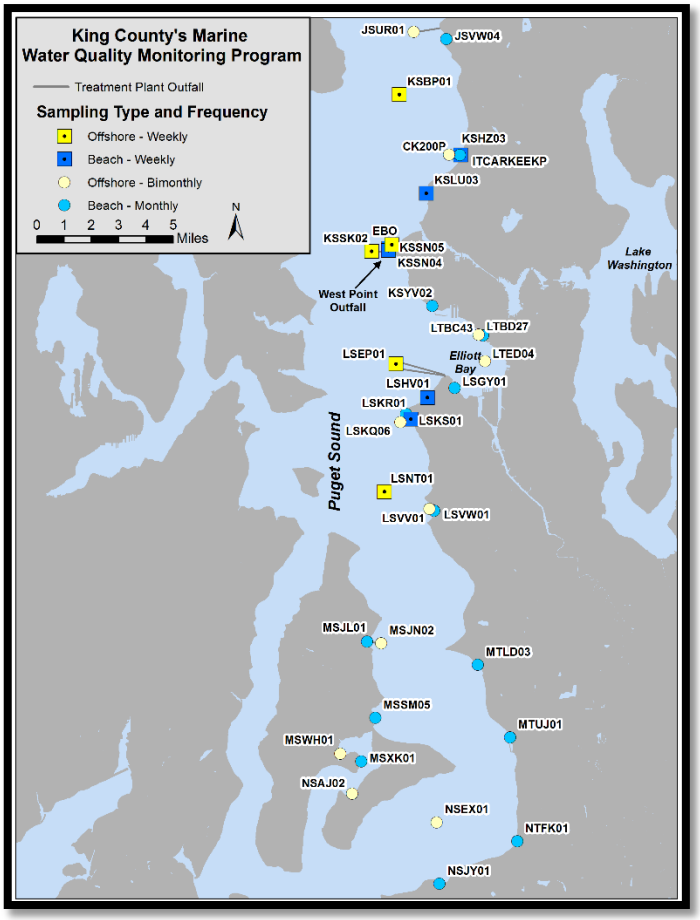

Figure 1. Map of King County's marine water quality monitoring stations.

The most recent data results available from the May 15th-16th and May 24th (offshore) and May 17th, 22nd, and 30th (beach) sampling events are summarized below for three key water quality indicators. More data results are available in the appendix.

BACTERIA

Fecal coliforms, along with *Enterococcus*, are types of indicator bacteria that King County routinely monitor at freshwater and marine beaches, as well as offshore. These bacteria are found in the intestinal tracts and feces of humans and other warm-blooded animals, and can make their way into our waterways through various pathways. Although these bacteria are typically not pathogenic, they are important to monitor as an indicator that pathogens that make people sick may be present.

The State of Washington has a two part standard to protect human primary contact recreation and shellfish consumption in marine waters. The standard includes a 14 colony forming unit (CFU)/100 mL geometric mean average and a 43 CFU/100 mL peak concentration (the peak concentration is not to be exceeded in greater than 10% of samples). These standards are used for comparing data from multiple samples at a station rather than a single sample.

Comparing recent individual samples to the bacteria standards indicates that concentrations of fecal coliforms from both surface waters (Figure 2) and at depth at all offshore stations, including KSSK02 off of West Point, were low and all below the geometric mean standard and the peak standard during both sampling events in late May. Despite no fecal coliform detections at the West Point outfall site, *Enterococcus* concentrations were elevated at the two deepest depths on May 15th. The reason for the discrepancy between fecal coliform and *Enterococcus* levels is unknown; however, the latter is capable of surviving longer in the marine environment. For data on subsurface and *Enterococcus* bacteria concentrations, see Appendix Table A-2.

Concentrations of bacteria at the subset of six beach stations sampled weekly, which includes beaches near West Point, were all below the state's peak water quality standard. However, some sample values at stations KSLU03 (Golden Gardens), KSSN05 (West Point South Beach), and LSKS01 (Alki – Richey Viewpoint) were above the geometric mean criteria once (KSLU03 & KSSN05) or twice (LSKS01) (see Appendix Figure A-8). Fecal coliform concentrations at KSLU03 and *Enterococcus* values at ITCARKEEKP (Carkeek Park) were slightly elevated, while all others were within the historical range for May (Appendix Table A-2).

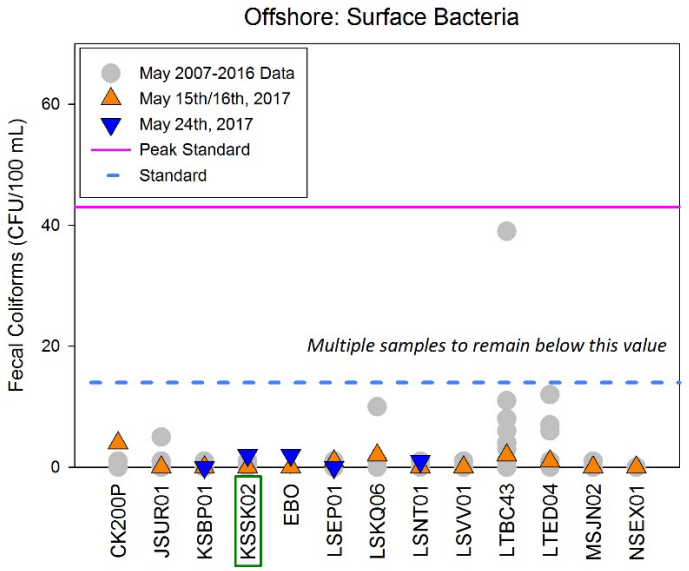

Figure 2. Bacteria (fecal coliforms) levels of single samples collected near surface (1 meter) at offshore stations in Central Puget Sound during the late May 2017 sampling events are illustrated with historical bacteria levels. Note: station KSSK02, West Point outfall, highlighted.

NUTRIENTS

Nutrients, such as nitrogen compounds (ammonia and nitrate) and orthophosphate, are essential elements for aquatic plants and algae. Silica is a micronutrient needed by some algae and other organisms for skeletal growth. However, excess nutrients can cause a sudden increase in aquatic plants that can lead to unfavorable conditions. High ammonia concentrations can be toxic to aquatic organisms, including fish.

All ammonia values in offshore waters in mid-to-late May were below the lowest (chronic) water quality criterion, which is based upon temperature, salinity, and pH factors (anticipated to be about 2.2 mg/L for May conditions). Ammonia values at the deepest depth at the South Plant outfall station (LSEP01) were elevated for both sampling weeks compared to historical values (Figure 3). An elevated value at the South Plant outfall was also observed on April 18th, but subsequent results until May 16th were within the typical range. These elevated ammonia results are likely a consequence of South Plant treating additional solids from the West Point plant and slightly higher ammonia levels in the effluent. Surface ammonia levels, including at the West Point and South Plant outfalls, were low (Appendix, Figure A-6).

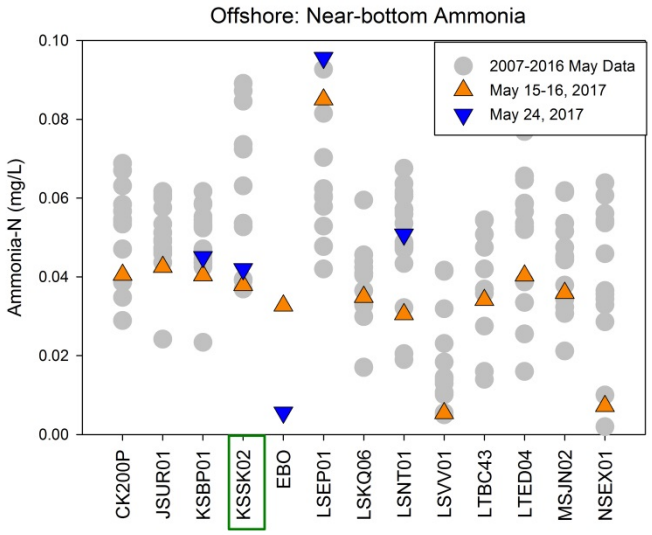

Figure 3. Ammonia levels collected at the deepest depth at offshore stations during the second half of May are shown with historical levels. Note: station KSSK02, the West Point outfall, is highlighted. The Emergency Bypass Station (EBO) was not routinely sampled prior to this event, so recent data cannot be compared to prior years.

Nitrate + nitrite, orthophosphate, and silica at offshore stations for all depths except the surface were within normal seasonal ranges for all sites. However, similar to early May, nitrate/nitrite and silica surface water values were either lower than normal or near the low range for historical values due to the regularly-occurring spring phytoplankton bloom that began in mid-April. Surface nutrients were especially low on May 24th. Phytoplankton (microalgae) take up nutrients for growth, such as nitrate and silica, which lowers levels in the water when the bloom is large. The bloom was evident throughout the Central Basin (but smaller in Elliott Bay) in mid-to-late May as indicated by high chlorophyll-*a* values (Appendix, Figure A-6). The results of the SUNA sensor (Appendix Figures A-1 to A-5) also show low nitrate at the surface.

Nitrate/nitrite levels at beach stations were all within the normal seasonal range on May 17th and ammonia levels were either within the normal seasonal range or slightly lower than normal for a few sites (Appendix, Figure A-9 and A-10).

DISSOLVED OXYGEN

Dissolved oxygen is important for marine life, and can control the presence or absence of species. Aquatic life requires a certain amount of oxygen dissolved in the water to live, and different species have different tolerances. Waters with high dissolved oxygen are considered healthy for sustaining many species.

Plants and algae produce oxygen during the day. In deep waters, it can be too dark for plant growth and is separated from surface mixing with air, so processes like decomposition by bacteria can result in low dissolved oxygen. Human inputs of organic materials and decay of sinking algae at depth may decrease oxygen levels. Also, deep waters from the Pacific Ocean enter Puget Sound and can result in naturally occurring low oxygen levels.

The State of Washington dissolved oxygen standard to protect aquatic life depends on the designated waterbody use. For Central Puget Sound, the one-day minimum dissolved oxygen standard is 7 mg/L for waters of extraordinary quality. At the dissolved oxygen level of 5 mg/L, biological stress can be induced on marine life. If dissolved oxygen levels fall below 3 mg/L, then this can displace or potentially result in death of some marine species.

The most recent data from late May show healthy near-bottom oxygen levels for all offshore sites across Central Puget Sound (Figure 4), continuing typical spring conditions observed since April.

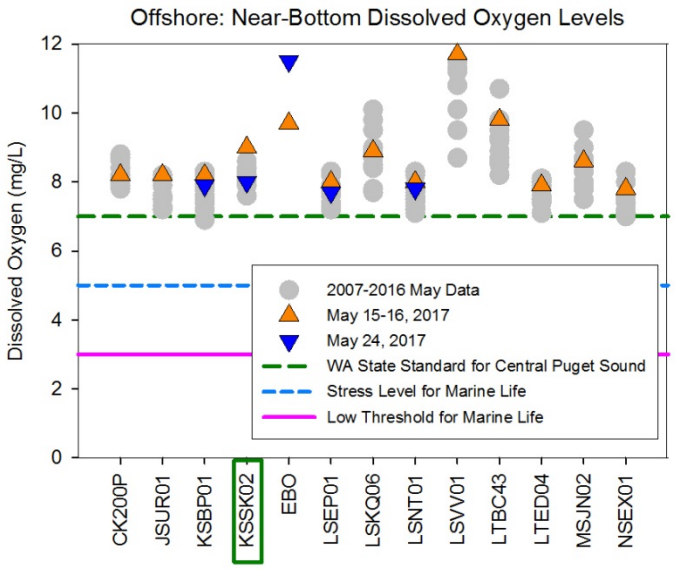

Figure 4. In Puget Sound, the lowest dissolved oxygen levels are typically found near the seafloor, so near-bottom oxygen levels are shown by site on top of historical oxygen conditions for the second half of May. Note: station KSSK02, West Point outfall, highlighted in green. The EBO site, Emergency Bypass Outfall, was added recently, so no historical data are available.

From the surface to bottom of the water column, dissolved oxygen levels were above the state water quality standard. On May 24th, oxygen levels were particularly high at the surface as a result of rising spring phytoplankton growth and oxygen production across all

sites (Appendix Figures A-1 to A-5). This is related to warmer surface water temperatures and lower salinities from rain and river run-off that in turn create stronger separation of surface water layers from deep, concentrating phytoplankton in the surface layers (see Appendix A-7 for more discussion).

SUMMARY

Water sample results collected between May 15th and May 30th, 2017 are summarized below. Additional results are provided in the Appendix.

- Concentrations of fecal coliforms in surface waters at offshore stations were below the geometric mean reference water quality standards as well as the peak standard in late May.
- *Enterococcus* concentrations deep at the West Point outfall station were higher than at other offshore stations despite no untreated discharges occurring during that time. The reason for the discrepancy of concentrations of the two bacteria types is unknown.
- Beach bacteria concentrations were typical at four of the six stations monitored weekly during the last three weeks of May. However, fecal coliform concentrations at Golden Gardens, and *Enterococcus* concentrations at Carkeek Park were slightly elevated above normal. Some sample values were above the geometric mean water quality criterion at three stations (Golden Gardens, West Point South, and Alki – Richey Viewpoint), but not the peak water quality criterion.
- All ammonia levels were below the lowest (chronic) water quality criterion.
- Surface ammonia levels were low and within normal ranges at all sites and depths. Near-bottom ammonia levels at the South Plant outfall were elevated for both sampling weeks in mid-to-late May.
- Nitrate/nitrite, orthophosphate, and silica results were within expected seasonal values for offshore waters at all depths except the surface.
- Low nitrate/nitrite and silica levels at the surface in addition to high chlorophyll-*a* values indicate the continuance of the regularly-occurring spring phytoplankton bloom which began in mid- April.
- Near-bottom dissolved oxygen values were at healthy levels and all sites were above the state water quality standard across all depths.
- Higher dissolved oxygen levels were observed in late May in surface and shallow waters, reflecting the growth of phytoplankton and other algae which produce oxygen. This shows a continuing of typical spring conditions since April.

One example of zooplankton (Megalops, which is a larval development stage of crabs) found in May from zooplankton net tows in Puget Sound, pictured under a microscope, roughly the size of a grain of rice. These young crabs float and live in the water column until they settle out. They typically feed on phytoplankton and smaller zooplankton. (Source: Lyndsey Swanson)

FOR MORE INFORMATION

- **King County Marine & Sediment Assessment Group:** http://green2.kingcounty.gov/marine
- **Download Water Column Data:** http://green2.kingcounty.gov/marine/Download
- **West Point Marine Monitoring:** http://www.kingcounty.gov/depts/dnrp/wtd/system/west/west-point-restoration/marine-monitoring.aspx
- **Wastewater Incidence Response:** http://kingcounty.gov/depts/dnrp/wtd/response/incident-response.aspx