Regional Waterbody Summary
Lower Passaic River and Newark Bay

The Silicon Valley of the 1800s, the Lower Passaic River flows through the historic industrial heartland of New Jersey. From the Dundee Island Dam, the tidal Passaic River flows south to Newark Bay, where its waters mix with those of three other major waterbodies: the Arthur Kill, Kill van Kull, and the Hackensack River. The entire watershed includes portions of Essex, Passaic, Hudson, Bergen, and Union Counties. While the shorelines still harbor major industrial uses, including the port and related facilities in Newark and Elizabeth, there are some important public access points such as Newark's Riverfront Park, and Stephen Gregg Park in Bayonne.

Major factors impacting water quality in this region include chemical leaks and spills, CSOs, contaminated sediments, industrial post source discharge, landfills, municipal discharge and sewage, unpermitted discharges, and urban runoff. The Lower Passaic River, designated as a Superfund site, has borne a heavy burden of pollution from a century of industrialization and manufacturing that has left layers of dioxin (including 2,3,7,8-TCDD), PCBs, arsenic, benzo[a]pyrene (PAHs), dieldrin, heptachlor epoxide, chlordane, and DDT in the waterbody and in fish tissue. In addition to these impairments, the Lower Passaic River and Newark Bay are also affected by floatables, low levels of dissolved oxygen, high phosphorus levels, total suspended solids, and pH levels. The EPA currently reports that aquatic life, fish consumption, public bathing, recreation, and shellfishing are impaired throughout the region. TMDLs are needed for all aforementioned causes of impairment.

Waterbody	Water Class NJAC 7: 9B-1.14(d)(1)	Water Quality Criteria: Pathogenic Bacteria (cfus/100mL)	Water Quality Criteria: Dissolved Oxygen (mg/L)
Upper Passaic River	FW2-NT: Fishing, Fish Propagation, and Bathing	*E. Coli:* Monthly GM ≤ 126 and a single sample max > 235	Never < 4.0 at any time
			24-hour average ≥ 5.0
Passaic River	Class SE2: Fishing and Fish Propagation	Fecal Coliform: Monthly GM ≤ 770	Never < 4.0
Lower Passaic River and Newark Bay	Class SE3: Fishing and Fish Migration	Fecal Coliform: Monthly GM ≤ 1,500	Never < 3.0

Water Quality Monitoring in the Harbor Estuary

This regional waterbody summary, prepared by the New York-New Jersey Harbor and Estuary Program (HEP) and partners, provides a brief analysis of select water quality data to illustrate the progress toward achieving the fishable and swimmable goals of the Clean Water Act in the Lower Passaic River and Newark Bay. It is a companion to HEP's 2021 *Harbor-Wide Water Quality Monitoring Report* (available at www.hudsonriver.org/harborwidewqreport-2021), which presents water quality data collected from 2010 to 2017 from both New York and New Jersey across all 10 different regions of the Harbor Estuary. The full report analyzes four water quality parameters against federal recreational water quality recommendations and guidance documents as well as state water quality standards and criteria, and discusses achievements to date and efforts still needed to achieve fishable and swimmable waters.

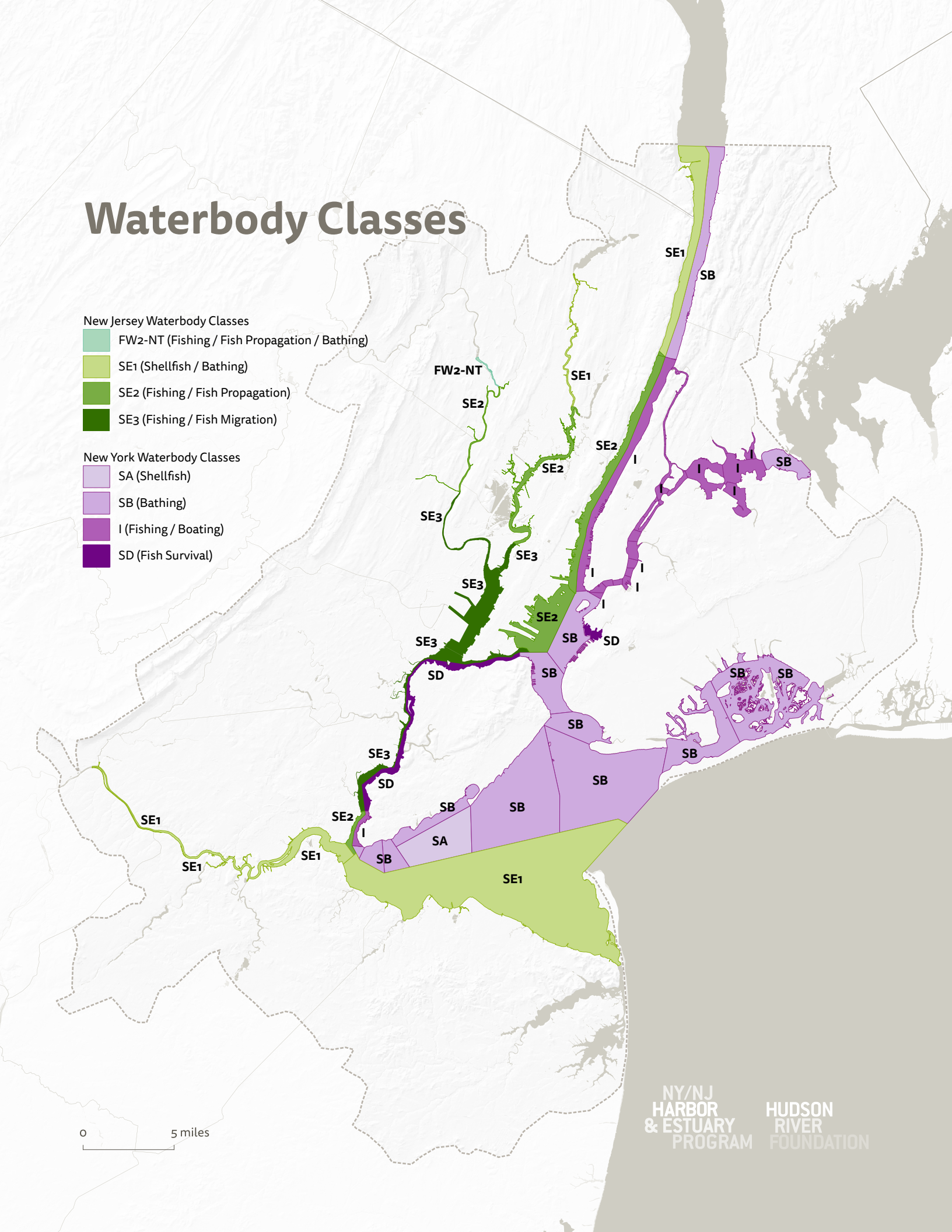
This regional waterbody summary describes water quality and key challenges and opportunities for improvement relative to New York's and/or New Jersey's state standards and criteria as of 2020 for pathogenic bacteria (e.g. fecal coliform, *Enterococci*, and *E. coli*) and dissolved oxygen. In the case where multiple water quality standards and criteria are used in a regional waterbody, the highest criteria that is supportive of primary or secondary contact is displayed as the threshold. For swimmable waters, pathogen levels must meet a state's criteria and designated use (i.e., supporting secondary or primary contact recreation). The potential future standard of *Enterococcus* is also discussed where applicable. For fishable waters, dissolved oxygen levels must meet and/or exceed the state's criteria and levels of total nitrogen and chlorophyll-*a* must show at least fair conditions to support aquatic life. Potential investments and opportunities for improvement are showcased, including the National Pollutant Discharge Elimination System (NPDES) and Long Terms Control Plan (LTCP) permits used by the states of New York and New Jersey to reduce pollution and ensure designated uses of each waterbody are met. Total Maximum Daily Loads (TMDLs) are another tool used by the states and EPA to determine the amount of a pollutant that a waterway can take in and still meet their designated uses and water quality criteria.

Data presented were collected primarily between June 1 and September 30, and compiled from two comparable harbor surveys conducted by the New York City Department of Environmental Protection (NYCDEP) and by the New Jersey Harbor Dischargers Group (NJHDG). As available, select secondary data sources were used to complement results from these two primary data sources. More information on data analysis methods can be found in the full report.

The full report and this regional waterbody summary does not serve to replace New York's or New Jersey's Integrated Water Quality Reports, nor are they meant to be used for compliance purposes. Proposed rulemaking to amend standards and/or criteria introduced by the states are also not explored in this report.

Photo: Rob Buchanan, Billion Oyster Project

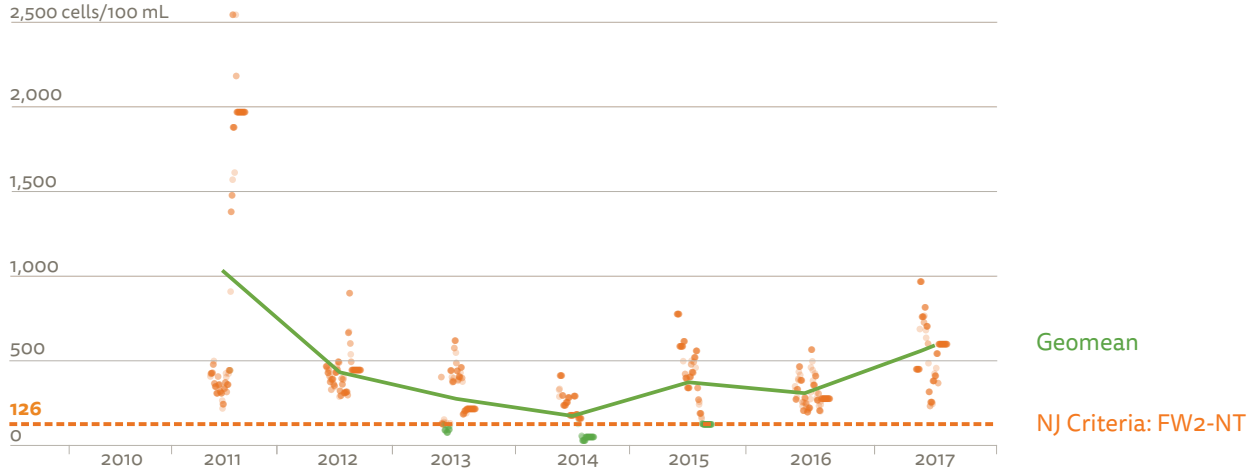
Waterbody Classes



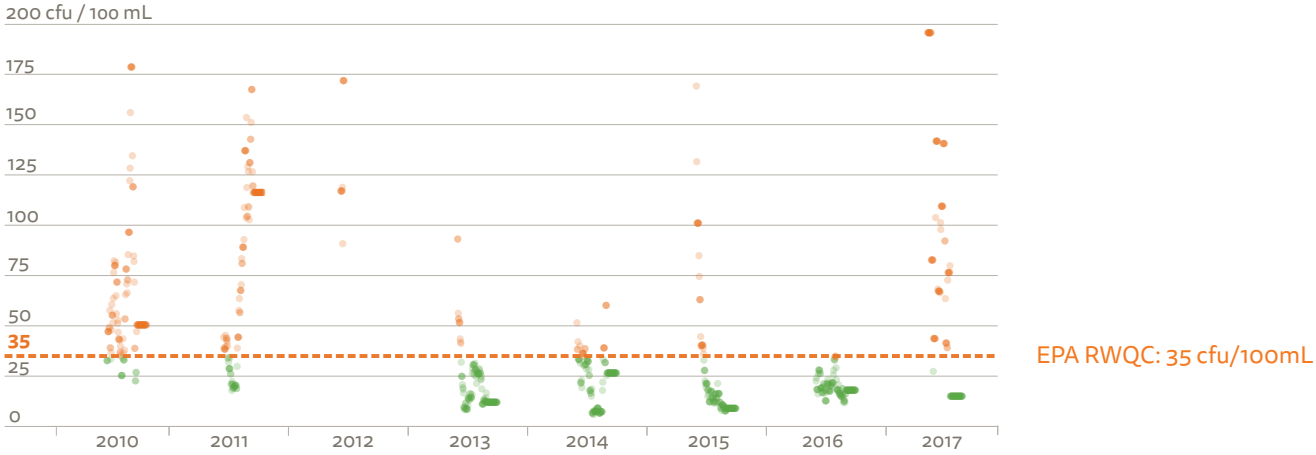
Pathogens

The presence of pathogenic bacteria can limit recreational use of these waterways. While sampling data show some improvement, additional efforts are needed to reduce pathogenic bacteria in the Lower Passaic River and Newark Bay to support primary contact recreation. The geometric means of samples from the region show non-compliance for *Enterococcus* and *Escherichia coli*, commonly referred to as *E. coli*, used to measure pathogenic bacteria in freshwater systems. *E. coli* summer discrete measurements ranged from 29 cfu/100mL to 2,544 cfu/100mL over the eight-year period. With an average of 56 discrete samples per recreational season (June-September) per year, the average geomean value for *E. coli* in this region is 399 cfu/100mL. Samples tested for *Enterococci* show inconsistencies over time and were found to be in compliance during 2016. *Enterococcus* summer geometric means ranged from 6 cfu/100mL to 222 cfu/100mL over the same periods. Out of over 100 samples, the average geomean of *Enterococcus* for this region is 51 cfu/100mL and 30% of discrete samples exceeded the single sample maximum (> 130 cfus/100mL) of the criterion.

E. Coli, Surface Summer Mean and Discrete Samples



Enterococcus, 30 Day Moving Geomean



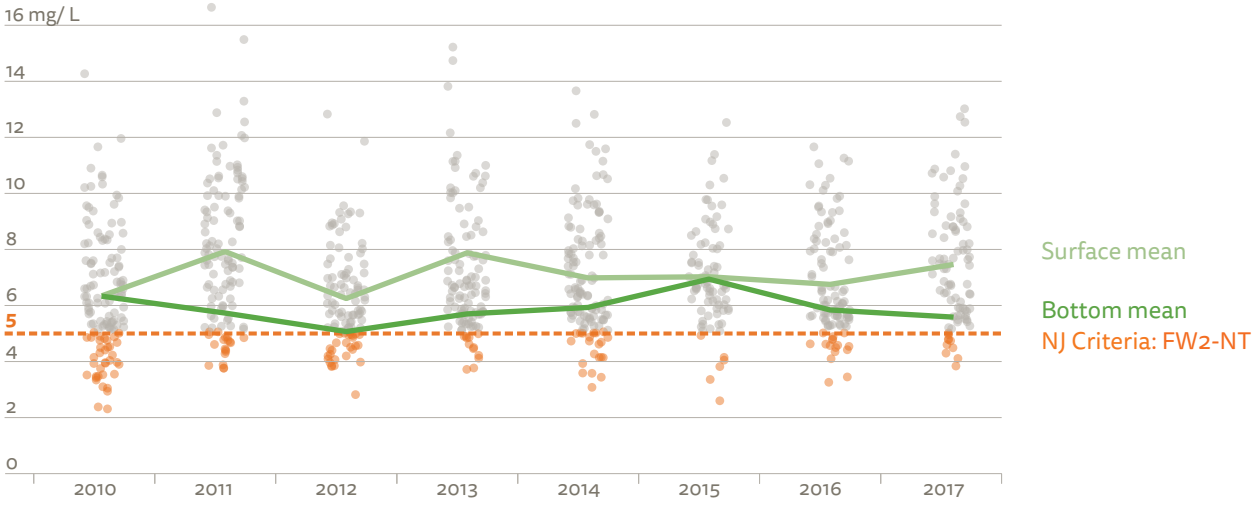
Dissolved Oxygen

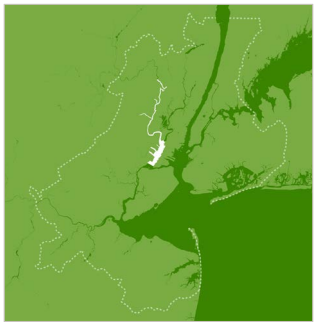
Dissolved oxygen (DO) is a critical measure of habitat quality for fish and other wildlife. It is measured at the surface, where sunlight can penetrate to generate photosynthesis, as well as at the bottom, where sunlight is less available. In general, bottom DO concentrations are consistently lower than surface DO concentrations. Compliance with DO criteria has varied throughout the eight-year period. The Lower Passaic River and Newark Bay have been in compliance with the criteria throughout the eight-year period, though daily values have fluctuated below 4 mg/L. The percent of time DO samples were less than 4 mg/L was between 2-14% for surface DO and 0-15% for bottom DO. The percent of time DO samples were less than 5 mg/L has been between 7.7-22% for surface DO and 3-48% for bottom DO.

The data presented are from the Long-term Ambient Water Quality Monitoring of the New Jersey Portion of the New York/New Jersey Harbor Waters discrete sampling program, conducted by the NJHDG. The Hudson River Environmental Conditions Observing System (HRECOS) has a continuous monitoring station located in the Newark Bay that is operated and maintained by the Passaic Valley Sewerage Commission (PVSC). The HRECOS station was installed in 2014 in Newark Bay near the confluence with the Passaic River and collects data every 15 minutes year round. Results from the two data sources do show inconsistencies, with the HRECOS data being more severe. For example, in 2016, the percent of bottom DO samples that were less than 4.0 mg/L at the NJHDG stations was 3%, while the HRECOS stations for the same period was 8%.

2016	NJHDG	HRECOS
Average (mg/L)	5.84	4.99
% < 4.0 mg/L	3	7.9
% < 5.0 mg/L	16.4	52.2
Discrete Minimum Sample (mg/L)	3.56	2.74

Dissolved Oxygen, Summer Mean, Surface and Bottom

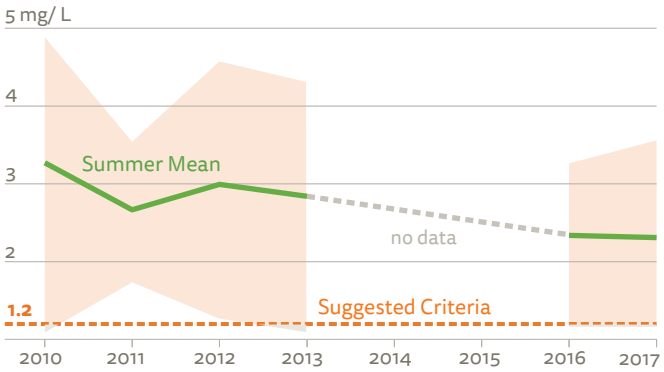




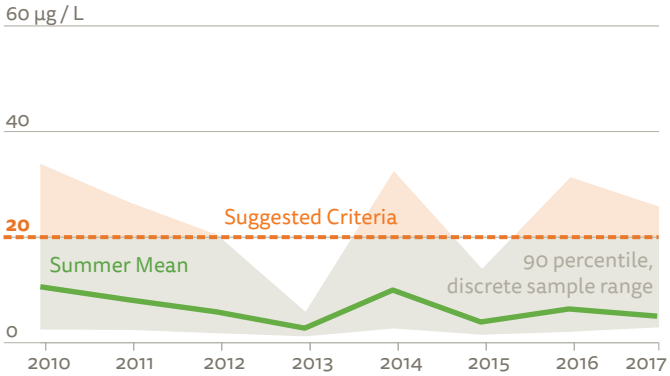
Other Water Quality Parameters

While pathogenic bacteria and dissolved oxygen are the primary criteria used to set water quality standards in New Jersey, measurement of total nitrogen and chlorophyll-*a* provide additional information as to possible causes of low DO as well as the presence of photosynthetic algae and algal blooms. Between 2010 and 2017, the summer means for total nitrogen ranged between 2.35 and 3.27 mg/L, though daily values fluctuated over time and data were not available between 2013 and 2015. Total nitrogen levels between 0.4 and 1.2 mg/L is considered indicative of fair conditions, and water quality would improve with nitrogen levels equal to or below 0.4 mg/L. Chlorophyll-*a* in this region shows daily fluctuation over the eight-year period. Concentrations of 5 µg/L or below support healthier habitats for fish survival and propagation, while concentrations at or above 20 µg/L increase algal growth.

Total Nitrogen, Summer Mean



Chlorophyll-*a*, 90th Percentile Surface



Investments and Opportunities for Improvement

EPA and New Jersey have identified CSOs as a key source of pathogenic bacteria (and other pollutants) that limit recreational use. Eight of New Jersey's 25 CSO permit holders are located in this region, and each is responsible for producing a Long Term Control Plan (LTCP) intended to reduce the number of CSOs. New Jersey LTCPs, submitted to the state in 2020, have a long term (20-40 year) implementation process. New Jersey municipalities' planned investments through the LTCPs range from $16.2 million to upwards of $1.8 billion per each of the CSO permit holders in the region (NJDEP, 2020). Potential investments in chemical disinfection of discharge using Peracetic acid (PAA), storage tunnels or tanks, and green infrastructure should result in significant improvements to water quality in the region. In addition, MS4 permits in the region address stormwater quality issues related to new development, redevelopment and existing development.

With the implementation of LTCPs and efforts to prevent pollution through the MS4 permits, reduction in pathogens is anticipated, specifically *E.coli* and *enterococci*, and nutrients. New Jersey CSO permittees are required to consider green infrastructure as a CSO alternative. Green infrastructure projects such as the conversion of impervious surface into rain gardens will also improve levels of nutrient loading and total suspended solids by managing stormwater runoff in the region. To improve water quality for fish propagation and survival as well as reduce the occurrence of algal blooms, further efforts are needed to mitigate nutrients such as nitrogen and chlorophyll-*a* in this region. Under the EPA Superfund Program, efforts to remediate the lower 8.3 miles of the Passaic River, from Newark Bay to the Newark/Belleville border, will remove 3.5 million cubic yards of toxic sediment (NJDEP, 2020). What will become the largest environmental dredging project in the history of the federal Superfund program, the cleanup will provide opportunities to create, enhance, and restore habitat and improve water quality.