HHPC
Hempstead
Harbor
Protection
Committee
Long Island, New York

2020
Water-Quality Report
Hempstead Harbor
(Full Report, Including Appendices)

prepared by

COALITION TO SAVE HEMPSTEAD HARBOR
EST. 1986

FUSS & O NEILL

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EST. 1986

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Cover photos:

Rainbow over Tappen Marina - Carol DiPaolo
Masked Monitoring - Doug Brown
Osprey Nest on the Glen Cove Breakwater - Carol DiPaolo
Seed Clams at Tappen Marina - Carol DiPaolo

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Acknowledgments

Environmental restoration and conservation require dedication, passion, patience, broad-based community support, and collaboration, as well as large infusions of technical expertise and funding. We therefore gratefully acknowledge the financial support and participation of all who have partnered with us to protect our local environment.

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- The Long Island Regional Planning Council/Long Island Nitrogen Action Plan
- The Glenwood/Glen Head Civic Association
- The United Civic Council of Glen Head and Glenwood Landing

NFWF

LONG ISLAND SOUND FUTURES FUND

15 YEARS OF CONSERVATION SUCCESS

LONG ISLAND SOUND FUTURES FUND

2005-2020

IMPACT

450 Grants awarded

$63 MILLION Conservation impact of grants and matching contributions

773 Acres of coastal habitat restored

3 MILLION People aware and engaged

200 MILLION Gallons of stormwater pollution prevented

PROGRAM PRIORITIES

CLEAN WATERS AND HEALTHY WATERSHEDS
Improve water quality by reducing pollution from land and waters draining into Long Island Sound

THRIVING HABITATS AND ABUNDANT WILDLIFE
Protect and restore the sound's ecological balance to benefit people and wildlife

SUSTAINABLE AND RESILIENT COMMUNITIES
Support informed and engaged communities that use, appreciate, and help restore the sound, and improve community resilience and sustainability

SOUND SCIENCE AND INCLUSIVE MANAGEMENT
Support inclusive, adaptive, innovative and accountable management of Long Island Sound

The LIS Sound Futures Fund has been a critical source of funding for Hempstead Harbor's water-monitoring program; above are from the 15th anniversary brochure cover and p. 9

Introduction

About 40 years ago, the view of Hempstead Harbor was much different from what it is today. The harbor was suffering from air, water, and land-based problems that resulted from past industrial activities along its shores. These problems were the impetus for the formation of a citizens' activist group in 1986, the Coalition to Save Hempstead Harbor. CSHH established Hempstead Harbor's **Citizens Water-Monitoring Program** in 1992 and initially funded the program through membership support, grants from local foundations and businesses, and volunteer services. The program became widely recognized by other groups around Hempstead Harbor and Long Island Sound and quickly was able to garner support from local municipalities and government agencies.

As the program continued, positive changes were occurring not only on the landscape around the harbor, but also on the political landscape, as citizens and government learned to work collaboratively to achieve environmental goals. In 2006, the Hempstead Harbor Protection Committee, a municipal organization formed in 1995, was able to step up to fund the harbor's water-monitoring program through a Long Island Sound Study grant administered by the National Fish and Wildlife Foundation. The grant enabled the completion of an EPA-approved **Quality Assurance Project Plan** (QAPP) in 2006, which further enhanced the credibility of the monitoring program and enabled the HHPC to obtain future federal funds for the program. The QAPP was updated and approved by EPA in 2011 and 2014, and a new QAPP was completed and certified in 2019. An updated QAPP was approved in 2020.

During 2007, a copy of the QAPP, water-quality data, and other information from the water-monitoring program was requested for two separate shellfish-related projects. The information was used to help fill out the New York State Department of Environmental Conservation’s (DEC’s) data on the level of pathogens in Hempstead Harbor and to determine whether the harbor could be opened to shellfish harvesting in the near term.

The results of the DEC's rigorous water-quality testing showed that dramatic water-quality improvements had been achieved in Hempstead Harbor. On June 1, 2011, the efforts of all parties that worked for years to improve conditions in the harbor culminated in the **reopening of 2,500 acres of shellfish beds for harvesting** in the northern portion of the harbor–a success story that has been highlighted all around Long Island Sound and beyond.

Initiation of the Monitoring Program

By 1990, there had been a history of chronic sewage spills from the failing wastewater treatment plants that were sited along Hempstead Harbor’s shoreline. These spills along with cutbacks in Nassau County Department of Health's water-quality monitoring program were the factors that motivated CSHH to create a citizens water-monitoring program for Hempstead Harbor. The program was intended as a springboard for public education and outreach, to foster increased awareness of environmental issues, and to encourage public participation in local conservation efforts.

In the early 1990s, at the same time that CSHH developed the water-quality monitoring program for Hempstead Harbor, concerns about the health of Long Island Sound gained increased attention. CSHH recognized that the priorities established under the Long Island Sound Study's **Comprehensive Conservation and Management Plan** (CCMP) (1994) were the same priorities that had to be addressed for Hempstead Harbor, perhaps to a different extent. These priorities were low dissolved oxygen (hypoxia), toxic-substance contamination, pathogen contamination, habitat degradation, and floatable debris. Therefore, at the start, Hempstead Harbor's water-quality monitoring program included dissolved oxygen as a critical monitoring parameter.

CSHH worked hard to develop a credible water-testing program that could be relied on to indicate the health of the harbor. However, the primary purpose in establishing the program was to encourage all who live, work, and enjoy recreational activities around Hempstead Harbor to renew their interest in the harbor, as well as in Long Island Sound, and to participate in restoration efforts. An important component of the program since its start has been to involve citizens in observing changing conditions around the harbor and notifying CSHH as well as appropriate municipal and environmental agencies of any unusual events affecting the harbor.

Program Expansion

Over the years, the scope of the water-monitoring program has expanded, as has the network of partners that have supported it. The number of testing parameters and stations has increased.

Scudder's Pond in 2020 (l) and coir banks for stream and upper-pond restoration in 2014 (r) (photos by Michelle Lapinel McAllister, 7/20/20, and Carol DiPaolo, 3/11/14, respectively)

As described in later sections of this report, Scudder's Pond had been identified as a major contributor of bacteria to Hempstead Harbor through stormwater runoff. In 2009, in anticipation of restoration work planned for the pond to mitigate the effects of stormwater runoff, two new monitoring stations were established. The stations are located at the weir that drains water from the pond directly to the harbor and at the outfall across the road that carries pond water as well as runoff from the larger area around the pond. At the same time, a new station was also established at the powerhouse drain outfall, which had been identified as the second largest contributor of bacteria to the harbor.

The years of monitoring these stations established a baseline of bacteria levels that occur from May to November. In 2013, the program was expanded to include winter monitoring (November to May) of the pond and powerhouse outfalls. Monitoring these outfalls during the winter has helped understand what happens to bacteria levels during the coldest months of the year. We were also able to examine changes in bacteria levels as construction work at the pond proceeded and following the completion of the restoration in June 2014. Although weekly winter monitoring for Scudder's Pond ended in April 2016, samples are collected periodically to check on conditions as we continue the winter monitoring focusing on the powerhouse drain outfall.

In 2015, three new stations were established in the outer harbor for the regular monitoring season. These stations are located within the area of the certified shellfish beds of Hempstead Harbor and are important for obtaining more detailed information on water-quality conditions in this section of the harbor.

Municipal Watershed-Based Management

As CSHH continued its monitoring efforts, the nine municipalities that share jurisdiction over Hempstead Harbor recognized they also shared the harbor's water-quality problems but did not, individually, have the resources to tackle large harbor issues. It became increasingly evident that they needed a mechanism to overcome the complexities of municipal boundaries and facilitate a more coordinated government approach to water-quality problems. In 1995, the Hempstead Harbor Protection Committee was created and became Long Island's first watershed-based intermunicipal organization, specifically formed to protect and improve the water quality of Hempstead Harbor. CSHH became the first environmental organization to join the committee–as a nonvoting member and technical adviser.

HHPC first focused on abatement of stormwater runoff as it developed a comprehensive Hempstead Harbor Water-Quality Improvement Plan (1998). CSHH implemented the plan's water-quality monitoring component. Also, in recognition of the need to balance the diverse uses of Hempstead Harbor, the HHPC secured a grant to prepare the Harbor Management Plan for Hempstead Harbor (2004), which was adopted by all nine HHPC municipalities.

CSHH and HHPC Profiles and Activities

The Coalition to Save Hempstead Harbor and the Hempstead Harbor Protection Committee continue to work closely together on improving Hempstead Harbor's water quality. Each organization has offered separate and valuable contributions to improving conditions around the harbor. At the same time, the two organizations illustrate the great successes that can result from creating valuable partnerships that can pool resources and maximize results to benefit the environment and local communities.

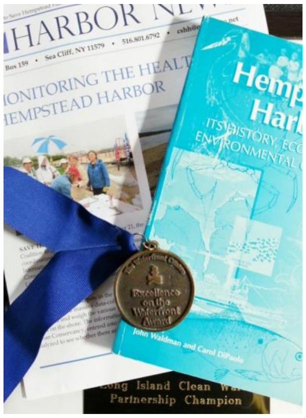
CSHH

CSHH's mission, to identify and eliminate environmental threats to Hempstead Harbor and surrounding communities, is longstanding. When CSHH first formed in 1986, it was in response to reports of continued degradation of Hempstead Harbor on a number of fronts. CSHH joined with other community members and successfully prevented a new mass-burn incinerator from being built on the harbor's western shore and shut down a failing incinerator that was operating on its eastern shore. CSHH sponsored the development of a townwide recycling plan for the Town of North Hempstead, offering a solution to problems of solid-waste management, and became a critical watchdog for the harbor as remediation plans were formulated to clean up contaminated sites.

As CSHH developed its Citizens Water-Monitoring Program, it also participated in the meetings and hearings that led to the completion of the Long Island Sound Study's Comprehensive Conservation and Management Plan (1994). More recently, CSHH participated in the meetings leading up to the 2015 revision and update of that plan. (CSHH has been a member of the Long Island Sound Study's Citizens Advisory Committee since 1992 and served for three years as chair of its Communications Subcommittee; CSHH is currently a member of the Long Island Sound Study's Water Quality Monitoring Workgroup.)

During the early years of the Hempstead Harbor monitoring program (1996), CSHH initiated the creation of a soundwide network of environmental organizations and agencies who were conducting water-monitoring programs. This first Long Island Sound Water-Monitoring Work Group provided a forum for reviewing current testing parameters, methodologies, and equipment used by members and for examining testing results in a broader context. Among the work group's achievements was completion of the **Long Island Sound Mapping Project** (July 1998), which mapped sites monitored around Long Island Sound and identified the agencies and other organizations responsible for testing at those sites. The project was funded through a grant awarded to CSHH, on behalf of the work group, by EPA/Long Island Sound Study.

In 1998, CSHH published ***Hempstead Harbor: Its History, Ecology, and Environmental Challenges***. The book supports the goals of the water-monitoring program, encouraging community members to learn about Hempstead Harbor's importance as a habitat for marine life and other species. It also describes the critical relationship between the ecology of the harbor and sound and the quality of life (and economy) of surrounding communities.



In 2000, CSHH became a partner in **EPA's Environmental Monitoring for Public Awareness and Community Tracking** (EMPACT) program. CSHH worked with the Marine Sciences Department of the University of Connecticut to maintain a telemetry link at the EMPACT Web site at www.MYSound.uconn.edu, so that water-quality data from Hempstead Harbor could be viewed on the Web. (In 2005, the program was discontinued due to logistical problems and lack of funding.)

In 2001, CSHH received the prestigious **Clearwater Award**, announced by The Waterfront Center, a Washington, DC-based educational organization with worldwide membership. CSHH was commended for the scope of its activities in working to improve conditions in and around Hempstead Harbor. Particularly noted were CSHH's book (mentioned above) and the expansion of its water-monitoring program.

In 2002, CSHH was asked by the US EPA Long Island Sound Study Office to plan and coordinate a **Stormwater Workshop** to help prepare Long Island communities to meet the requirements of the EPA Phase II Stormwater Regulations. CSHH received a grant to host the workshop, which was cosponsored by the EPA Long Island Sound Office, Long Island Sound Study, and the New York Sea Grant Program.

In 2009, CSHH initiated a community work group to focus on development of a townwide land-preservation plan. A first step toward a broader land-use preservation plan was to determine the feasibility of a watershed-protection overlay district for Hempstead Harbor. The scope of the Glenwood Road/Powerhouse Drain Stormwater Pollution Abatement Plan (HHPC, 2013) was expanded to include this element. Also in 2009, CSHH became a member of the newly formed **Long Island Sound/New York State Sentinel Site Work Group** (a bistate–New York and Connecticut–approach to understanding climate-change indicators for Long Island Sound and selecting appropriate sites to measure them).

In 2013, CSHH was invited to participate in a project that would establish a report-card system to communicate the health of Long Island Sound. Hempstead Harbor and Norwalk Harbor were to have the first embayment report cards, serving as pilot projects to help launch a **soundwide report-card system**; both harbors have longstanding and credible water-quality monitoring programs and availability of long-term water-quality data.

Since 2016, CSHH has participated in the **Unified Water Study (UWS) for Long Island Sound embayments**. The goal of the study is to standardize testing parameters and operating procedures among groups monitoring bays and harbors around Long Island Sound so that a report card can be developed comparing ecological conditions in those bays. CSHH conducts the biweekly UWS program in Hempstead Harbor separate from the harbor's weekly core monitoring program.

In early 2018, CSHH was awarded a grant by Patagonia to spearhead a **habitat restoration project in Glenwood Landing** to raise community awareness of stormwater runoff problems that contribute bacteria and nitrogen to Hempstead Harbor. Local homeowners participating in the program reserved portions of their property to be planted with native plants to improve soil conditions and reduce runoff. This project concluded in 2020. Also in

2018, the New York State Outdoor Education Association (NYSOEA) recognized CSHH for its long-standing dedication to the ecological health of Hempstead Harbor and Long Island Sound, and CSHH became one of the recipients of **NYSOEA's Environmental Impact Award**.

In 2019, CSHH was awarded a grant from the Nassau County Soil and Water Conservation District (NCSWCD) for the **Tappen Marina monitoring program** in anticipation of a pilot project to raise seed clams in the marina. A second grant was awarded to CSHH in 2020 to continue the marina monitoring program. In July 2020, Town of Oyster Bay staff placed seed clams in floating upweller systems in the marina for the first aquaculture project in Hempstead Harbor.

CSHH continues to work with other environmental groups and agencies around Hempstead Harbor and Long Island Sound. CSHH has served on **advisory committees** formed to develop local revitalization plans for harbor communities (e.g., Glen Cove Creek Reclamation Committee, Glenwood Landing Steering Committee, Roslyn Waterfront Committee, Glen Cove Waterfront Citizens' Planning Committee, and Glen Cove Master Plan Task Force); **review committees** for restoration-plan proposals (e.g., Scudder's Pond Restoration Program and Glenwood Road/Powerhouse Drain Stormwater Pollution Abatement Plan); and **technical work groups** (e.g., Long Island Nitrogen Action Plan, Long Island Sound Nitrogen Reduction Study, and Long Island Pathogen TMDL Work Group).

In addition, CSHH sponsors several shoreline cleanups each season. In April 2011, CSHH organized an **emergency cleanup of plastic disks** accidentally released from an aeration tank at the Mamaroneck sewage treatment plant. The cleanup resulted in the collection of over 27,000 disks from five beaches around Hempstead Harbor and helped convince Westchester County to send crews to continue cleanup efforts (disks are still found occasionally during beach cleanups). In September 2019, CSHH coordinated local activities as part of the **International Coastal Cleanup**, as it has for all but two years since 1992. In 2020, because of COVID-19 risks, official International Coastal Cleanup events were cancelled. CSHH instead sponsored a month-long **harborwide "Clean-a-Thon"** and encouraged participation by individuals, families, and small groups of local residents.

HHPC

The idea for addressing Hempstead Harbor's water-quality issues on a harborwide basis was conceived in the mid-1990s by NYS Comptroller Tom DiNapoli (then-NYS Assemblyman) and former Sea Cliff Mayor Ted Blackburn.

In 1995, funds were sought and received from the NYS Department of State, and the Hempstead Harbor Protection Committee (HHPC) (Long Island's first inter-municipal watershed organization) was born. The funds were used to hire a part-time director and to hire coastal experts to prepare an in-depth **Hempstead Harbor Water Quality Improvement Plan** (completed in 1998). Each of the nine municipalities signed an intermunicipal agreement to work cooperatively and to contribute financially to the HHPC.

HHPC's municipal members include Nassau County, the Towns of Oyster Bay and North Hempstead, the City of Glen Cove, and the Villages of Sea Cliff, Roslyn Harbor, Roslyn, Flower Hill, and Sands Point. The committee accomplishes its mission to protect and improve the harbor’s water quality through planning studies, capital-improvement projects, educational outreach, water-quality monitoring, information and technology sharing, development of model ordinances, coordination of enforcement, and working with other governmental agencies as well as environmental, educational, community, and business groups. HHPC’s executive director serves on the Long Island Sound Study’s Citizens Advisory Committee, the Board of Directors of the Nassau County Soil and Water Conservation District, and on the Board of Directors of Friends of Cedarmere, Friends of the Bay, and the Oyster Bay/Cold Spring Harbor Protection Committee. These ties and cooperative effort save each municipality expenses and provide a coordinated approach to solving harbor problems and a year-round focus on harbor issues.

The HHPC prepared the **Scudder’s Pond Subwatershed Plan** (2006) and had secured nearly $2.5 million toward the implementation of its recommendations, which began in November 2013 and was completed in June 2014. This subwatershed (located in Sea Cliff) had been identified as one of the most significant contributors of bacteria-laden stormwater runoff to the harbor. A similar study, the **Glenwood Road/Powerhouse Drain Pollution Abatement Plan** for the subwatershed in Glenwood Landing, was completed in December 2013.

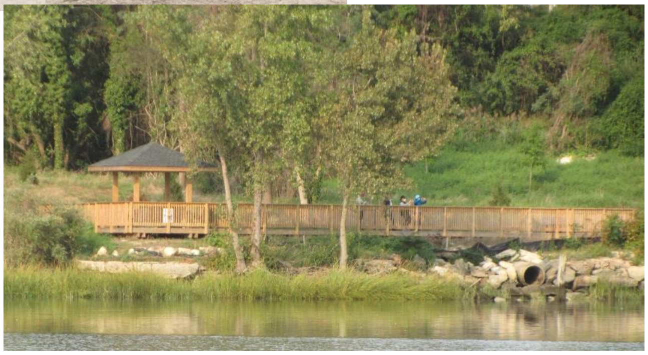
In 2007, HHPC applied for federal **No Discharge Zone (NDZ)** designation for Hempstead Harbor; the US EPA approved the application on November 6, 2008. The NDZ designation affords the harbor the necessary legal basis to restrict boaters from discharging their wastes into the harbor and strengthens avenues for enforcement. On September 6, 2011, New York State, following Connecticut's example, banned vessel sewage discharges from its portion of Long Island Sound, including all harbors and bays, making the entire sound a no-discharge zone.

The HHPC has also established a website (www.HempsteadHarbor.org) and a Facebook page to serve as harbor resources. Other efforts have included the production of professional coastal interpretive signage; the production of a series of three television programs; the purchase of a portable display unit that is used at area fairs, festivals, libraries, and town and village halls; the installation of pet-waste stations around the harbor; and intermunicipal cleanups of debris in the harbor.

The HHPC was instrumental in expanding the harbor’s designation as a NYS Significant Coastal Fish and Wildlife Habitat Area to encompass the entire harbor. It has also played a role in having harbor trails and land acquisition added to the state’s Open Space Plan; having the harbor designated by the Long Island Sound Study as an inaugural “Long Island Sound Stewardship Site"; and having the harbor designated as part of Audubon New York’s “Important Bird Areas of New York State.” The HHPC has been a great success and has spawned the creation of other intermunicipal efforts, including the Manhasset Bay Protection Committee, the Oyster Bay/Cold Spring Harbor Protection Committee, the

Northport Water Quality Protection Committee, and the Peconic Estuary Protection Committee.

Starting point of the Hempstead Harbor shoreline trail (l) and extension of the trail south along the western shoreline (below) (photos by Carol DiPaolo, 5/20/15 and 9/16/20)



Since 1995, the HHPC has received over 25 grants, which have covered much of the committee's costs. The balance of the HHPC's budget (including monetary matches for the grants) is made up of annual dues received from the nine member municipalities. The HHPC has taken over financial responsibility for the core monitoring program by obtaining grants to cover various elements of the program and contributing a portion of committee dues to make up any shortfalls that may occur with grant funding.

In 2012, the HHPC received an Environmental Quality Award from the US EPA Region 2 for its efforts in improving water quality in Hempstead Harbor to the point where 2,500 acres of the harbor were reopened to shellfish harvesting for the first time in 45 years. Since the water-quality standards to support shellfish harvesting are the highest of all water-quality standards, this achievement demonstrated the water-quality improvements that the HHPC was created to seek. In so doing, Hempstead Harbor also became the first major water body in New York State to achieve this status in several decades. The HHPC continues to work with others to achieve this for the remaining portions of the harbor.

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1 Harbor Overview

Hempstead Harbor lies along the north shore of Long Island, bordering the western portion of Long Island Sound, between Manhasset Bay to the west and Oyster Bay to the east. The V-shaped harbor is about 5 miles long from mouth to head, and its shoreline extends about 14 miles from Prospect Point on the west at its mouth to Matinecock Point on the east. For the most part, the harbor presents a beautiful water body that is quiet and uncrowded, though it has widely mixed uses.

Industrial or commercial enterprises were historically concentrated in four areas along the harbor's shoreline. They remain currently, to a much lesser degree, in three areas of the harbor. The former industrial sites degraded the harbor's shorelines, wetlands, and water quality with the effects of oil and sewage spills, toxic contamination, stormwater runoff, air pollution, and industrial discharges. The worst of these effects were noted in the mid-1980s.

Powerhouse drain (CSHH #14A) at low tide (l) and view looking north west beyond adjacent fuel terminal dock (r) (photos by Michelle Lapinel McAllister, 3/20/20 and 5/27/20, respectively)

Efforts to restore the harbor resulted in the closure of a landfill, two incinerators, and a sewage treatment plant (STP). Dramatic changes around the harbor have resulted in improved water quality.

One sewage treatment plant (in Glen Cove) remains and in 2003 was upgraded, using a biological process to remove nitrogen from its discharge. In late 2006, an ultraviolet (UV) light disinfection system was installed to replace the chlorination system. In June 2009, after a backup generator was installed at the STP to make the UV system fully operational, the chlorine vats were emptied and CSHH ceased chlorine testing at the STP outfall, CSHH #8. The replacement of the chlorination system with the UV disinfection system offers a significant benefit for water quality because it removes the risks posed by chlorine by-products, which can have an adverse impact on marine life. (In 2008, Nassau County purchased the plant from the City of Glen Cove; in August 2020, Suez North America began operation of the Glen Cove plant and the two other county-owned plants.)

The remediation of some hazardous waste sites has been completed, while cleanup efforts are ongoing for others.

Wetland-restoration planting at Bar Beach lagoon in 2003 (above, l) and in 2005 (above, r) (photos by Kevin Braun) and view of west shore and construction of the Town of North Hempstead trail (r) (photo by Carol DiPaolo, 6/17/20)

Wetland restoration projects have been expanded on the western shore of the harbor, south of the former Bar Beach Park, which is now part of the larger North Hempstead Beach Park. (In September 2007, Nassau County transferred ownership of the Hempstead Harbor Beach Park to the Town of North Hempstead, which merged it with the adjacent town-owned Bar Beach Park; in May 2008, the combined beaches were renamed North Hempstead Beach Park.) In 2015, the section of the trail along the western shore just south of the former Bar Beach was completed. In 2019, work began to extend the trail, and at completion in 2020 the trail was nearly two miles long.

Despite the harbor's impaired condition during the 1980s, in 1987 New York State designated Hempstead Harbor a **Significant Coastal Fish and Wildlife Habitat** area, which included the upper portion of Hempstead Harbor, from Mott Point on the west to the Glen Cove breakwater on the east. Over the last 30 years, the harbor's ecosystem has vastly improved, containing a diversity of marine life and water birds. Wetland grasses have recovered a large portion of the lower harbor south of the North Hempstead Beach Park, once again providing a nursery and healthy habitat for marine species and bird populations. Reflecting Hempstead Harbor's dramatic turnaround, its designation as a Significant Coastal Fish and Wildlife Habitat was modified in October 2005 to include the lower portion of the harbor, extending south to the Roslyn viaduct.

By 2009, water quality had improved so dramatically in Hempstead Harbor that the results of water-quality testing undertaken by the NYS Department of Environmental Conservation (DEC) indicated that a portion of the outer harbor could be certified for shellfish harvesting. (The harbor had been restricted for shellfish harvesting for over 40 years.) The testing and regulatory process was completed in 2011, and on June 1, 2011, 2,500 acres of shellfish beds that form a band across the outer harbor were officially reopened for harvesting.

Today, Hempstead Harbor continues to support many diverse uses and activities. Fuel is transported to the Glenwood Landing terminal (Global Partners LP) that is adjacent to a power plant that has operated since the early 1900s. Farther north, tugboats tow barges to and from a sand and gravel transfer station on the western shore of the harbor and into Glen Cove Creek, which flows from the harbor's eastern shore. In contrast to these commercial uses, the recreational uses continue to flourish and expand as the harbor's water quality improves. Marinas and yacht, sailing, rowing, and fishing clubs, which are concentrated in the middle portion of the harbor, are thriving. Town, city, village, and small private beaches are also located along the harbor's shore. As the harbor environment has continued to improve, there has been increased pressure to develop properties along the shoreline, which in time could exacerbate the problems that are currently being mitigated.

Above, RXR residential development under construction along the north side of Glen Cove Creek; at left, Glen Harbor residential development in Glenwood Landing (photos by Carol DiPaolo, 6/3/20)

These diverse and often competing interests must be balanced in planning for the future of Hempstead Harbor. The Harbor Management Plan for Hempstead Harbor (Hempstead Harbor Protection Committee, 2004) offers a comprehensive strategy for the municipalities that share jurisdiction over Hempstead Harbor to "work cooperatively to address issues related to the wise use and protection of the harbor's surface waters, natural resources, underwater lands, and shorefront." Environmental challenges and priorities that remain for the harbor include stormwater runoff abatement; reductions in bacteria and nitrogen levels; prevention of inappropriate land use and development, particularly along the shore; and continued remediation of contamination from former industrial activities.

2 Methods

It is difficult to draw direct relationships among all the variables that affect water quality, and this is the challenge presented every year in attempting to analyze the past season's water-quality data. The graphs presented in this report compare seasonal and long-term averages for various water-quality parameters at different testing stations. The data collected over the years are a critical resource as we look for trends that point to the health of the harbor.

Assessing the health of Hempstead Harbor is complicated. There are many variables affecting water quality. Some things are within our control–such as nitrogen discharges and other pollution from both point and nonpoint sources; other things, are not–such as rainfall and temperature. However, all of these factors have critical relationships that have an impact on the ecological health and human use of our waters, including swimming, fishing, and other recreational pursuits.

The data collected through the water-monitoring program help us understand the interrelationships that occur in Hempstead Harbor. This information enables us to work with others in addressing harborwide and soundwide issues, so that we can plan and implement best management practices to assure a healthy environment for the future.

2.1 Quality Assurance Plans

The first Quality Assurance Project Plan (QAPP) for the Hempstead Harbor Water-Quality Monitoring Program was completed in 2006. The QAPP documents the testing methods and quality assurance and quality control (QA/QC) procedures CSHH has implemented in the program. QAPP revisions were approved by the US Environmental Protection Agency (EPA), Region 2, to reflect changes in the program in 2011 and 2014. A new QAPP was completed and approved in early 2019. The QAPP was again updated and approved in 2020.

The EPA approval of the QAPP broadens the use of the program's data by outside organizations, enables the program to receive federal funding for future monitoring efforts, reiterates CSHH's ongoing commitment to provide high-quality monitoring data for Hempstead Harbor, and demonstrates the reliability of the data presented in this and previous water-quality reports.

CSHH also completed data usability assessment reports (DUARs) for 2017-2019 data, which were accepted by NYS DEC. A data assessment report for 2020 data is included at Appendix G.

2.2 Core Program

The core monitoring program for Hempstead Harbor encompasses weekly testing from May through October at stations established in the upper and lower harbor and in Glen Cove Creek. Also included are several shoreline stations; a few of these are part of the winter monitoring program, which currently focuses on the Powerhouse Drain Subwatershed.

The principal CSHH stations that are sampled weekly during the regular monitoring season for all program parameters are located between the former Bar Beach (now part of the 36.2-acre North Hempstead Beach Park) and Long Island Sound, as well as in Glen Cove Creek. Lower-harbor stations and others located close to the shoreline can be accessed only during high tide. See *Figures 1-2* for core-program station locations; see *Table 1* for the latitude/longitude points for the monitoring stations. Note that five core-program stations correspond to stations established for the Unified Water Study (UWS) for Long Island Sound embayments, as described at *Section 2.3*, and these are indicated in *Table 1*.

2.2.1 Monitoring Adjustments Due to COVID-19

A number of adjustments were made to the 2020 core monitoring program as a result of the risks presented by COVID-19 and the guidelines issued at the time to minimize those risks. Although the program started up as scheduled in mid-May for collection of shoreline samples at CSHH #14A, #15A, and #15B, in-harbor sampling was postponed to June 3.

To comply with social distancing and other Center for Disease Control guidelines, the number of crew members on each boat used was reduced. However, in order to complete planned monitoring tasks, two boats were required for monitoring every other week. A three-person crew on one boat conducted vertical profiles of the water column, while crew in a nearby boat picked up samples for both bacteria and nitrogen at designated stations. On alternating weeks, one boat and crew picked up bacteria samples only. This schedule was in place through July 8. On July 15, we reverted to our usual schedule and crew, conducting weekly vertical profiles of the water column, collecting weekly bacterial samples, and collecting biweekly nitrogen samples.

Water monitoring during COVID: Mark Ring (foreground), Michelle Lapinel McAllister, and Elaine Neice (l); Michelle Lapinel McAllister, Carol DiPaolo, and Mark Ring (r) (photos (l) by Carol DiPaolo, 6/3/20, and (r) by Doug Brown, 8/7/20)

Also, because of concerns about the potential risk of the aerosolized spread of COVID through wastewater, collection of bacterial samples and other testing was suspended at the Glen Cove sewage treatment plant outfall (CSHH #8) and adjacent stations (CSHH #9-#11) from the beginning of the season through early August. Testing and water-sample collection resumed at these stations on August 7, following interim guidance issued by the World Health Organization on July 29 that concluded there was minimal risk of contracting COVID through aerosolized wastewater discharges ("Water, sanitation, hygiene, and waste management for SARS-CoV-2, the virus that causes COVID-19," July 29, 2020).

2.2.2 Station Locations

Below is a list of CSHH stations for the core monitoring program.

Upper-harbor monitoring stations also include those by outfalls in Glen Cove Creek and near Scudder's Pond:

- CSHH #1, at Beacon 11 (between Tappen Beach Marina on the east shore and North Hempstead Beach Park on the west shore)
- CSHH #2, at Bell Buoy 6 (a stationary marker near the harbor mouth, east of Mott Point)
- CSHH #3, at the red channel marker C-1, at the mouth of Glen Cove Creek, between the Hempstead Harbor Club and Sea Cliff Beach
- CSHH #8, at the Glen Cove sewage treatment plant outfall pipe
- CSHH #9, outfall about 10 ft west of CSHH #8
- CSHH #10, outfall about 20 ft west of CSHH #8, at the end of the seawall
- CSHH #11, about 50 ft east of CSHH #8
- CSHH #12, about 100 ft east of CSHH #8, in the middle of the creek, north of the bend in the south seawall
- CSHH #13, 60 ft from the Mill Pond cement weir at the head of Glen Cove Creek

Aerial view of upper harbor, eastern shore, from right to left: Glen Cove Creek, Garvies Point, Morgan Park, Crescent Beach, and Matinecock Point in Glen Cove (photo by David North, 7/13/19)

- CSHH #15, about 50 yds from Scudder's Pond outfall, at northwest corner of the Tappen Beach pool area
- CSHH #15A, at the Scudder’s Pond/Littleworth Lane outfall, north of the Tappen Beach pool area
- CSHH #15B, at the Scudder’s Pond weir on the east side of Shore Road
- CSHH #16, a central point in the outer harbor (corresponds with DEC shellfish monitoring station #24)
- CSHH #17, outside Crescent Beach restricted shellfish area across from white beach house
- CSHH #17A, within the Crescent Beach restricted area across from the stream that runs alongside the beach

Lower-harbor stations (except for CSHH #14A, which is tested from shore) are often inaccessible during low tides and are monitored less frequently:

- CSHH #4, north of the sand spit at North Hempstead Beach Park (south section)
- CSHH #5, at Mott’s Cove
- CSHH #6, at a point east of the site of the former Town of North Hempstead incinerator, now the waste-transfer station
- CSHH #7, at the southernmost section of the harbor, on the east shore just before the walkway for Bryant Landing buildings (208 senior residential units) and just north of the Roslyn viaduct. (The former marker for this station was a portion of an old oil dock, which was removed during the construction of Bryant Landing buildings.)
- CSHH #14, about 50 yds from powerhouse outfall
- CSHH #14A, directly from the powerhouse outfall (may be mixed with harbor water)

Aerial view of lower harbor, looking south; Town of Oyster Bay’s Tappen Beach on eastern shore and Town of North Hempstead Beach Park north of the sandspit on western shore (photo by David North, 7/13/19)

Figure 1
Core-Program Station Locations

Figure 2
Station Locations for Harbor Sections and Glen Cove Creek

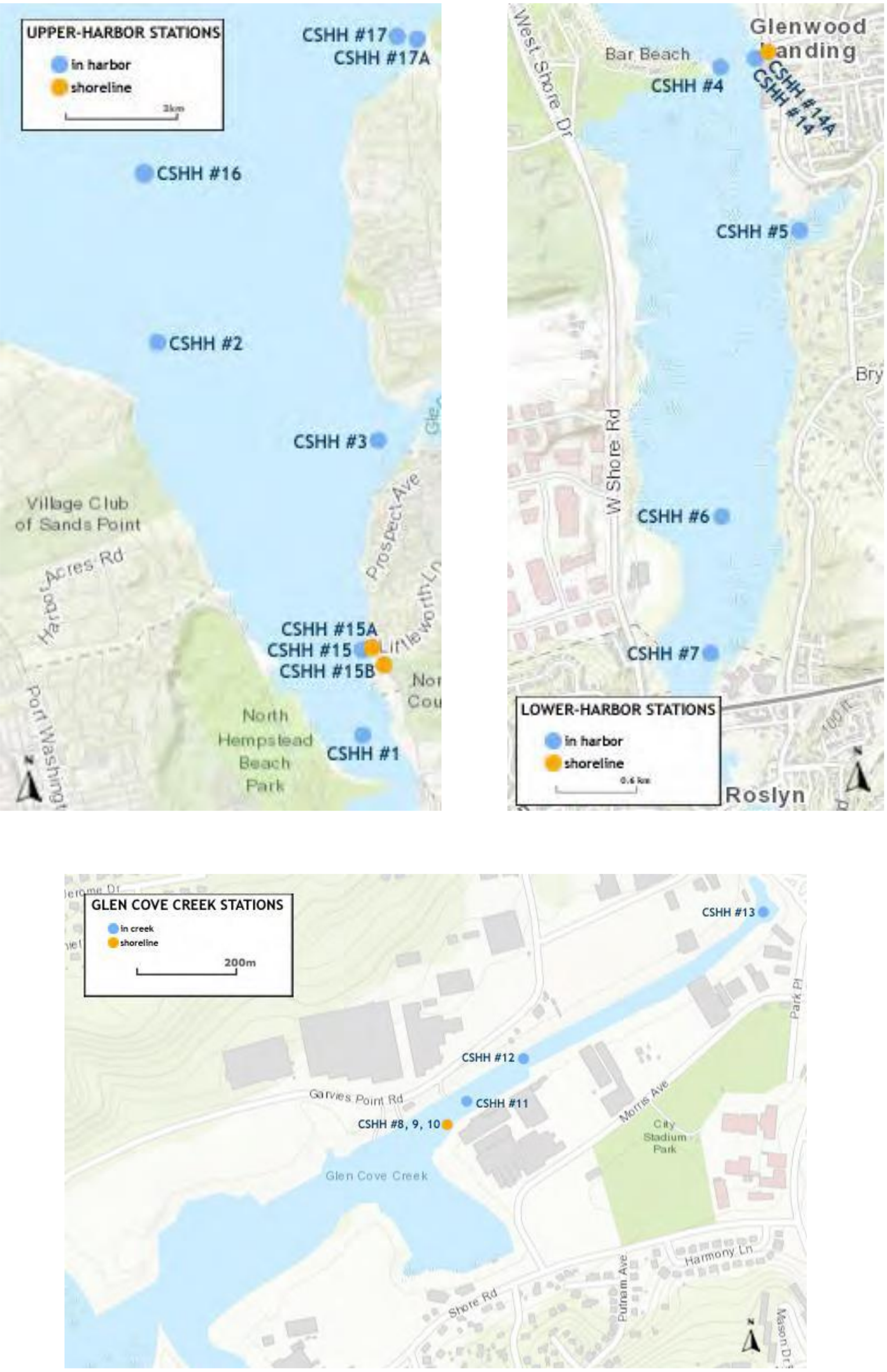


Table 1
Latitude/Longitude Points for Monitoring Stations (NAD 83 Datum)

Station ID	Latitude N	Longitude W
Upper-Harbor Stations		
CSHH #1, Beacon 11 (Corresponds to UWS station HEM-M-01)	40.83189	073.65353
CSHH #2, Bell 6 (Corresponds to UWS station HEM-0-04)	40.86099	073.67362
CSHH #3, red channel marker (Corresponds to UWS station HEM-M-03)	40.85373	073.65202
CSHH #8, adjacent to STP outfall pipe	40.85849	073.64204
CSHH #9, 10 ft west of #8	40.85850	073.64195
CSHH #10, 20 ft west of #8	40.85846	073.64198
CSHH #11, 50 ft east of #8	40.85852	073.64141
CSHH #12, 100 ft east of #8	40.85947	073.64054
CSHH #13, 60 ft from Mill Pond weir	40.86165	073.63583
CSHH #15, about 50 yds from Scudder's Pond outfall, north of Tappen Beach pool area	40.83820	073.65355
CSHH #15A, at outfall north of Tappen Beach pool	40.83837	073.65263
CSHH #15B, at Scudder's Pond weir	40.83709	073.65144
CSHH #16, north of Bell 6 (Corresponds to UWS station HEM-0-05)	40.87349	073.67493
CSHH #17, just outside the Crescent Beach restricted shellfish area (Corresponds to UWS station HEM-0-06)	40.88365	073.65016
CSHH #17A, inside Crescent Beach restricted shellfish area, just off shoreline	40.88343	073.64819
Lower-Harbor Stations		
CSHH #4, east of North Hempstead Beach Park (formerly Bar Beach) near sand spit	40.82815	073.65015
CSHH #5, Mott's Cove	40.82197	073.64619
CSHH #6, east of Port Washington transfer station	40.81114	073.65008
CSHH #7, west of Bryant Landing (formerly site of oil dock)	40.80596	073.65065
CSHH #14, about 50 yds from Powerhouse Drain outfall	40.82848	073.64840
CSHH #14A, at Powerhouse Drain outfall	40.82872	073.64776

2.2.3 Station Expansion

At the end of the 2004 monitoring season, CSHH #9, #10, #11, and #12 were added in the vicinity of the Glen Cove sewage treatment plant outfall (CSHH #8) (in Glen Cove Creek) specifically to provide additional samples for bacteria analysis by the Nassau County Department of Health (NCDH). These stations were added to track the frequency and source of unusual dry- and wet-weather flows that were noticed at discharge points west of the STP outfall and that, on testing, indicated high levels of bacteria; the four stations became a permanent part of the program in 2005.

CSHH #13 was also established to monitor bacteria levels at the head of the creek and became a permanent part of the program in 2007. In 2008, CSHH #13 was set at 60 feet west of the Mill Pond weir to avoid shifting the sampling location as access to the weir varied due to tidal cycles. Samples collected at CSHH #13 can help indicate whether the restoration of Mill Pond is curtailing bacteria inputs to Glen Cove Creek and indicates the effect of fresh water from the large outfall that drains Cedar Swamp Creek. (Construction on the north side of Glen Cove Creek and the increased number of barges near the head of the creek in 2018-2020 sometimes impaired access to CSHH #13.)

In 2009, the water-monitoring program was temporarily expanded to incorporate areas previously tested by the NYS Department of Environmental Conservation. Thirteen of the stations that were set up in 1988 as sampling points for DEC's shellfish growing area (SGA) #50 were reestablished, and five new stations were added. CSHH collected samples once or twice a week (depending on tidal cycles), and the samples were delivered to the DEC lab for analysis. The purpose of this sampling was to determine whether these areas of the harbor could be reopened for shellfish harvesting in addition to the areas in the outer harbor that were already being slated for reopening (in 2011). Unfortunately, the test results showed that all but two of the stations failed DEC shellfish standards on a regular basis. The stations that were monitored by CSHH in 2009 will not be monitored again for DEC until there are further water-quality improvements in areas of the mid- and lower harbor.

CSHH continues to collect samples at stations #14, #14A (established in 2010), #15, #15A, and #15B for bacteria analysis by the NCDH (using water-quality standards for bathing beaches) as an alternative way to monitor discharges from the powerhouse drain (#14 and #14A) and Scudder's Pond (#15 and #15A and B). Both subwatersheds were identified as the largest contributors of bacteria to Hempstead Harbor, and remediation plans were developed for both areas and implemented for Scudder's Pond (pond restoration was completed in June 2014). The samples collected established a benchmark of bacteria levels prior to restoration of the pond and allowed for comparison of levels during and following completion of restoration work. Similarly, samples collected from #14A, the large outfall at the bottom of Glenwood Road, have helped establish conditions prior to any construction or other measures that will be implemented to diminish stormwater runoff in this area.

In 2015, CSHH stations #16, #17, and #17A were added to the monitoring program to further evaluate the water quality in the outer harbor within the recertified shellfish harvesting area and in the restricted area just offshore of Crescent Beach.

CSHH #17A is offshore of the stream that flows alongside Crescent Beach and meanders into Hempstead Harbor (photo by Carol DiPaolo, 8/7/20)

2.2.4 Frequency of Testing and Testing Parameters

Testing for the core Hempstead Harbor monitoring program is conducted weekly from May through October, generally on the same day of the week and at the same time, starting at approximately 7 AM and typically continuing for five hours.

Beginning in 2013, weekly collection of water samples during the winter (November through April) was added to the monitoring program for CSHH #15A (outfall that drains from Scudder's Pond and Littleworth Lane, north of Tappen Beach pool), #15B (Scudder's Pond weir), and #14A (powerhouse outfall). The water samples are delivered to Nassau County Department of Health for bacteria analysis (fecal coliform and enterococci). This component of the monitoring program corresponded with the start of the restoration work (November 2013) at Scudder's Pond. (Phragmites removal, dredging of the pond bottom, installation of a new storm-water basin at Littleworth Lane to curtail future sedimentation of the pond, and planting of native plants were included in the restoration work, and the anticipated result was to diminish bacteria loading to Hempstead Harbor.) The winter monitoring continues; in 2020, winter testing was conducted biweekly for bacteria and nitrogen. Beginning in 2018, winter sample collection was focused primarily on conditions at the powerhouse drain subwatershed; samples from Scudder's Pond outfalls are collected periodically or after a heavy rain or snowfall.

For the regular monitoring season, CSHH collects water samples and conducts water-quality tests with the assistance of volunteers as well as municipal staff for boat transportation to sampling sites. Water samples are collected (weather and tidal cycles permitting) from up to 21 testing stations for bacterial analysis by the NCDH. In addition, tests for dissolved oxygen (DO), salinity, water temperature, pH, and turbidity are conducted weekly at CSHH #1-3, #8, #13, and #16-17 and less frequently at CSHH #4-7, #14 and #15, where access is limited by tidal cycles. Samples were collected for nitrite and nitrate analysis until 2016 when the facility used for the lab analysis closed. However, samples continued to be collected for onboard ammonia testing. In 2018, sample collection for nitrogen resumed, and samples were delivered to Pace Analytical Laboratory for analysis of nitrite, nitrate, and ammonia (onboard ammonia testing was eliminated). Starting in 2019, nitrogen samples were collected during the regular monitoring season on a biweekly basis and delivered to Pace Analytical Laboratory for analysis of nitrite, nitrate, ammonia, and total Kjeldahl nitrogen. A listing of core-program testing parameters, sampling locations, and analyses performed is presented in *Table 2*.

Physical observations are recorded regarding weather conditions, wind direction and velocity, water surface, air temperature, floatables, and wildlife and human activities. Whenever possible, floatable debris is retrieved and brought back to shore for disposal.

Dissolved oxygen (DO), salinity, water temperature, and pH are recorded with an electronic meter. In 2017-2020, a Eureka Manta+ 35 multiparameter meter, which was provided to groups participating in the Unified Water Study for Long Island Sound Embayments (see *Section 2.4*), was used by CSHH also for the core Hempstead Harbor monitoring program. (The YSI ProPlus meter, used previously starting in 2014, is maintained as a backup instrument.) For the core program, the electronic meter is used starting at 0.5 meter and at 1-meter increments thereafter. A sample of bottom water is tested for DO using the Winkler titration method at the first station that is monitored for the day (typically, CSHH #1) as a quality-assurance check of the electronic meter. A quality-assurance check is also performed for pH using a LaMotte wide-range indicator test kit that uses a color comparator.

CSHH water-monitoring crew members, left to right, Mark Ring, Carol DiPaolo, and Michelle Lapinel McAllister (photos by Michelle Lapinel McAllister (l) and Carol DiPaolo (r), 8/19/20)

In 2017-2020, the Eureka Manta+ 35 was also used to measure turbidity (the LaMotte 2020e portable turbidity meter, which had been used previously, is maintained as a backup instrument). The Eureka Manta+ 35 also measures chlorophyll a (Chl a), which is not a parameter required for the core Hempstead Harbor monitoring program but is a “Tier 1” parameter for the UWS. Because the same multiparameter meter is maintained and calibrated for both programs and monitoring events for the programs occur on consecutive days, Chl a levels are recorded for the core monitoring program as merely a frame of reference (see *Section 3.6*).

Table 2
CSHH Monitoring-Program Parameters

Parameter	Location	Analyzer or Method	Location of Analysis
Dissolved Oxygen	Vertical profiles starting at half meter below surface and then 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
Dissolved Oxygen	One location for electronic meter validation	LaMotte 5860-01 (Winkler titration)	Field
Water Temperature	Vertical profiles starting at half meter below surface and then 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
Water Temperature	One station for electronic meter validation	Calibrated thermometer	Field
Air Temperature	One measurement at each station during monitoring	Calibrated electronic thermometer	Field
Salinity	Vertical profiles starting at half meter below surface and then 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
pH	Vertical profiles starting at half meter below surface and then 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
pH	One station for electronic meter validation	LaMotte 5858-01 test kit	Field
Turbidity	Vertical profiles starting at half meter below surface and then 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
Clarity	CSHH #1-8, 13, 14, 15, 16, and 17	LaMotte Secchi disk	Field
Chlorophyll a	Vertical profiles starting at half meter below surface and then 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
Fecal Coliform	Grab sample at half-meter depth or from outfall flow at CSHH #1-14, 14A, 15, 15A, 15B, 16-17, and 17A	Membrane filter, SM 9222 D-2006	Nassau County Department of Health
Enterococci	Grab sample at half-meter depth or from outfall flow at CSHH #1-14, 14A, 15, 15A, 15B, 16-17, and 17A	Membrane filter, EPA 1600	Nassau County Department of Health
Total Kjeldahl Nitrogen	Grab sample at half meter depth at CSHH #1, 3, 6-8, 12-13, and 16 and just below surface or from outfall flow at 14A, 15A	EPA 351.2	Pace Analytical Services, LLC
Ammonia	Grab sample at half meter depth at CSHH #1, 3, 6-8, 12-13, and 16 and just below surface or from outfall flow at 14A, 15A	EPA 350.1, Rev. 2.0 SM22 4500	Pace Analytical Services, LLC
Nitrate	Grab sample at half meter depth at CSHH #1, 3, 6-8, 12-13, and 16 and just below surface or from outfall flow at 14A, 15A	EPA 353.2 Rev.2.0	Pace Analytical Services, LLC
Nitrite	Grab sample at half meter depth at CSHH #1, 3, 6-8, 12-13, and 16 and just below surface or from outfall flow at 14A, 15A	EPA 353.2 Rev.2.0	Pace Analytical Services, LLC
Precipitation	Village of Sea Cliff	Visually read rain gauge	Field

2.3 Tappen Marina Monitoring

The marina at Harry Tappen Beach Park is one of three marinas for which the Town of Oyster Bay constructed and installed floating upweller systems (FLUPSYs) to raise clams and oysters. The project was initially undertaken in partnership with Cornell Cooperative Extension Suffolk County. The two other marinas involved in the project are the Theodore Roosevelt Memorial Park marina and the TOBAY marina on the south shore. The Tappen Marina FLUPSYs represent the first-ever aquaculture project for Hempstead Harbor.

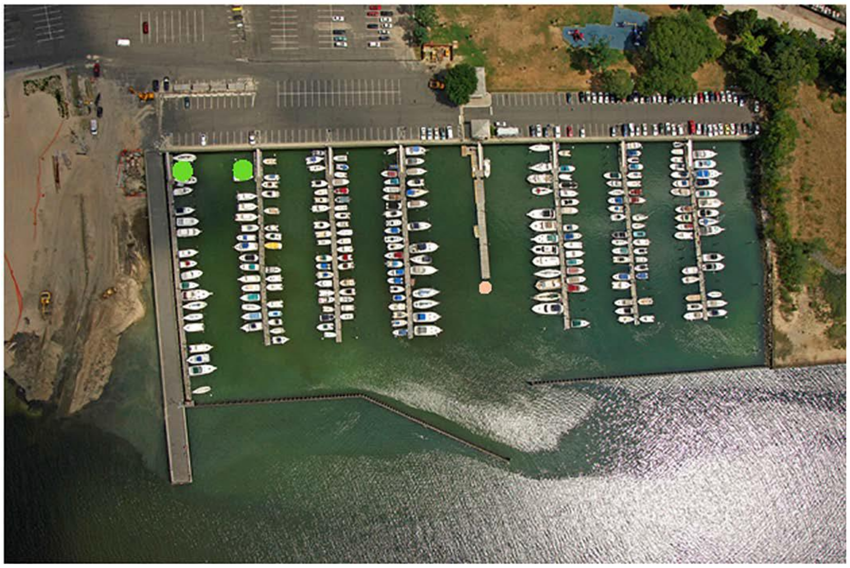
In 2019, the Coalition to Save Hempstead Harbor proposed a monitoring program for Tappen Marina (east shore of Hempstead Harbor) to gather baseline data for water-quality conditions in the marina and to determine whether discernible changes in water quality occur while seed clams are growing in the marina. Nassau County Soil & Water Conservation District (NCSWCD) awarded a grant to CSHH to conduct the monitoring program. The program was to be coordinated with the Town of Oyster Bay's installation of six floating upweller systems (FLUPSYs) and seed clams (about one million clams per each unit) at two locations in Tappen Marina. Although CSHH's testing program began in May and concluded at the end of October, due to an unexpected shortage of seed clams, the FLUPSYs were never installed at the marina.

In 2020, despite the COVID-19 shutdown, monitoring of Tappen Marina continued through the season as scheduled (under a second grant awarded by NCSWCD). The Town of Oyster Bay installed four FLUPSYs in the marina on May 22; 2 million seed clams arrived on July 31, 2020, and were distributed among 36 barrels in three of the four FLUPSYs. COVID challenges reduced the number of FLUPSYs and seed clams in Tappen Marina from what had originally been planned.

2.3.1 Marina Station Locations

Sampling sites selected in 2019 and 2020 were modified to accommodate changes to the Town of Oyster Bay's plans regarding the number and location of FLUPSYs and clams installed in Tappen Marina. When the Tappen Marina Monitoring Program was conceived for the 2019 season, two stations were selected because of the prospective location of FLUPSYs—CSHH #18 and #20. A third station was selected as a control station because of its proximity to the entrance to the marina from the open harbor—CSHH #19. In the end, as mentioned above, the FLUPSYs and the clams were not placed in Tappen Marina in 2019, although the CSHH monitoring program continued as planned and provided baseline information about water-quality conditions in the marina.

For 2020, changes in station locations from 2019 were needed to accommodate logistical issues within the marina. CSHH #19, at the end of the service dock, remained the "control" station; it is located closest to where the water from Hempstead Harbor flows in and out of the marina (at the end of the main/service dock). CSHH #18 (located at S dock) was tested again for the 2020 season. Testing at CSHH #20 was discontinued, and testing was conducted instead at new station CSHH #21 (located at R dock).



Aerial photo of Tappen Marina; green dots mark location of CSHH #18 (corner) and #21, and the orange dot marks the location of CSHH #19

2.3.2 Marina Testing Parameters

Weekly testing was conducted at all marina stations for water temperature, salinity, dissolved oxygen, pH, and turbidity using a Eureka Manta+ 35; a Secchi disk was used to test for water clarity. In addition, water samples were collected weekly for bacteria analysis (fecal coliform and enterococci) by the Nassau County Department of Health. Biweekly water samples were collected for nitrogen analysis (nitrite, nitrate, ammonia, and total Kjeldahl nitrogen) by Pace Analytical Services, LLC.

Although the FLUPSYs and seed clams were not installed at Tappen Marina in 2019, our monitoring program provided invaluable water-quality information and a solid benchmark for comparing 2019 conditions with those of the 2020 season. Below, the focus is on selected water-quality parameters that are critical for shellfish growth or for observing the impact shellfish may have on water quality in a shellfish-growing area.

Appendix E includes 2020 monitoring data for the three Tappen Marina monitoring stations. Also included in the appendix are graphs comparing testing results among stations and between the two marina testing seasons.

Dissolved oxygen. Dissolved oxygen is a significant parameter when looking at marine health because it is the amount of oxygen that is available to marine life and can affect their growth and reproductive systems. (See also *Section 3.1*.)

In 2020, all Tappen Marina stations had similar DO levels. There were no anoxic events (DO at or below 1 ppm) in Tappen Marina; there were, however, hypoxic events (DO at or below 3.0 ppm). Hypoxia was observed at CSHH #21 on 7/22, 8/12, and 9/9/20 and at CSHH #18 and CSHH #19 on 9/9/20. CSHH #19 had slightly higher levels of DO for both

2020 and 2019 than did CSHH #1 (an in-harbor station located at Beacon 11, the navigational light between Tappen Marina and the Town of North Hempstead Beach Park). CSHH #1 had a total of four hypoxic events during the 2020 season, occurring on the three dates mentioned above for CSHH #21, as well as on 7/8.

pH. Average pH for Hempstead Harbor is approximately 7.7. (See also *Section 3.4.*) Generally, pH levels at the bottom are more acidic than at the surface. Although the pattern of more acidic conditions at the bottom applied for CSHH #21 and #19, a difference was noted at CSHH #18, where throughout the 2020 season surface levels were more acidic than bottom levels. Though CSHH #18 was monitored less frequently in 2019 (because of changes to prospective FLUPSY locations), the pattern was similar, i.e., pH was lower at CSHH #18 compared with other marina stations.

The 2020 pH data was important with respect to the growth rate of the seed clams in Tappen Marina. Throughout the season, we consulted with Town of Oyster Bay staff who maintained the FLUPSYs and tracked the growth rates of the seed clams. The seed clams started out in Tappen Marina at 2.31 mm. By August 12, it was clear that the clams at CSHH #18 (the S-dock location) were not growing at the same rate as the clams in the other FLUPSYs. On August 12, the clams in FLUPSY 3 (at S dock) measured 3.46 mm, and the clams in FLUPSYs 1 and 2 (at R dock) measured 3.65 mm and 3.88 mm (respectively).

Sorting seed clams at R dock (l) and monitoring conditons at S dock (r)
(photos by Carol DiPaolo, 10/7/20 and 6/10/20, respectively)

A review of the data collected at all marina stations pointed to pH levels as causing the difference in the seed-clam growth rate—pH was more acidic at CSHH #18. The exact cause of the pronounced acidity at this location is not certain. One possibility is that dead fish and other organic matter tended to accumulate in this corner of the marina, and the decomposition process can create more acidic conditions and therefore lower pH.

At the end of the 2020 monitoring season, following nearly two weeks of successive rain events in October, the most significant drop in pH occurred at CSHH #18—to 5.20-5.70—while pH at CSHH #21 and #19 dropped to 7.3 and 7.4, respectively. Again because of the configuration of the marina and the corner location of CSHH #18, that area may be more susceptible to the collection and then decomposition of organic matter. Stormwater runoff and related discharges to the marina may have exacerbated those conditions.

The important takeaway is that the data collected at the marina was used in real time to direct the location of the FLUPSYs and help improve the growth rate of the seed clams. The FLUPSY at CSHH # 18 was moved on August 12 to the adjacent R-dock and remained there for the rest of the season. The growth rate of the clams in that FLUPSY (FLUPSY #3) caught up with that of the other clams in FLUPSYs #1 and #2 (also located at R dock).

Water Clarity. Water clarity is measured using a Secchi disk. (See also *Section 3.5.)* Ideal water clarity in the open waters of Long Island Sound is considered to be at a minimum Secchi depth of 2.4 m. Water clarity decreases with the more suspended particles there are, such as sediment or phytoplankton.

The best Secchi-disk depth for Tappen Marina stations in 2020 was at CSHH #19—1.75 m on 10/22/20. The worst Secchi-disk depth was at CSHH #18—0.25 m on 7/15/20. In general, water clarity in Tappen Marina was worse is 2020 compared with 2019. Persistent algal blooms and increased construction activity around Hempstead Harbor in 2020 may have contributed to poorer water clarity.

Bacteria. Fecal coliform is the indicator bacteria used currently by New York State as the standard for determining shellfish-bed closures. It was also previously used as a swimming standard to determine beach closures when levels exceeded the threshold of 1,000 CFU/100ml. (Enterococci is the indicator bacteria currently used as a beach standard by New York State, and, therefore, by Nassau County Department of Health (NCDH) as well; the exceedance threshold is 104 CFU/100ml.) (See also *Section 3.8.*)

NCDH performs the bacteria analysis of the water samples we collect at Tappen Marina and Hempstead Harbor and provides both enterococci and fecal coliform levels (even though county beach data is reported for enterococci only). For the most part, bacteria levels for Tappen Marina reflect in-harbor conditions.

There were no exceedances for fecal coliform in the 2020 season, same as in the previous year. However, all three marina stations had an enterococci exceedance on 9/30/20, and CSHH #18 had an additional exceedance earlier in the season on 6/3/20. Comparatively, there had been only one event in 2019 where there was an exceedance in enterococci seen across stations, which occurred on 10/23/19. Exceedances in bacteria levels across all stations at Tappen Marina for both 2020 and 2019 corresponded with rainfall greater than a half an inch within the previous 48 hours.

Nitrogen. Monitoring for nitrogen is important because excess nitrogen in water can spur the growth of algal cells and leads to algae blooms, which in turn depletes dissolved oxygen in the water as the algal cells decompose. (See also *Section 3.7.*)

Nitrite was not detected at any of the Tappen Marina stations during the 2020 season (this was the case also in 2019). In general, total nitrogen (the sum of total organic nitrogen and total inorganic nitrogen) was slightly higher at CSHH #18 than at CSHH #21 and #19. Whenever there was a peak in total nitrogen levels (exceeding 1.0 mg/l), all stations showed elevated levels of total nitrogen. The first peak occurred on 7/1/20 at stations CSHH #18 and

#19, and total nitrogen was elevated but not as high at CSHH #21. For CSHH #18, total nitrogen comprised mainly nitrate and ammonia. For CSHH #19, there was an even distribution of organic nitrogen, ammonia, and nitrate, with ammonia being the highest component. The next peaks occurred on 8/26, 9/23, and 10/7/20. On each of the three dates, total nitrogen was primarily made up of total organic nitrogen.

2.4 Unified Water Study

In 2016-2020, the Coalition to Save Hempstead Harbor participated in the *Unified Water Study: Long Island Sound Embayment Research* (UWS), funded by the federal EPA's Long Island Sound Study and administered by Save the Sound. The UWS is an ecological study of Long Island Sound bays in both Connecticut and New York. It is intended to engage citizen scientists in water monitoring by using uniform equipment and methodologies to collect biweekly samples from May through October. In 2020, 22 groups monitored 38 bays, ranging geographically from Queens, NY, to Stonington, CT.

Although CSHH conducts monitoring for the UWS as a separate program from the core monitoring program for Hempstead Harbor, to the extent possible CSHH has aligned testing equipment and methodologies for both programs. For example, the same multiparameter meter is used and maintained as per UWS standard operating procedures to measure parameters that are common to both programs (e.g., water temperature, salinity, dissolved oxygen, and turbidity).

2.4.1 UWS Station Locations

In 2017, five CSHH/Hempstead Harbor core monitoring program stations were selected as to be included in the UWS study and are coded as "HEM" for that study. In 2018, a sixth station was added (which does not correspond with a core monitoring program station), and all UWS stations were renumbered as follows:

- HEM-M-01, same as CSHH #1
- HEM-M-02 (new for 2018)
- HEM-M-03, same as CSHH #3
- HEM-0-04, same as CSHH #2
- HEM-0-05, same as CSHH #16
- HEM-0-06, same as CSHH #17.

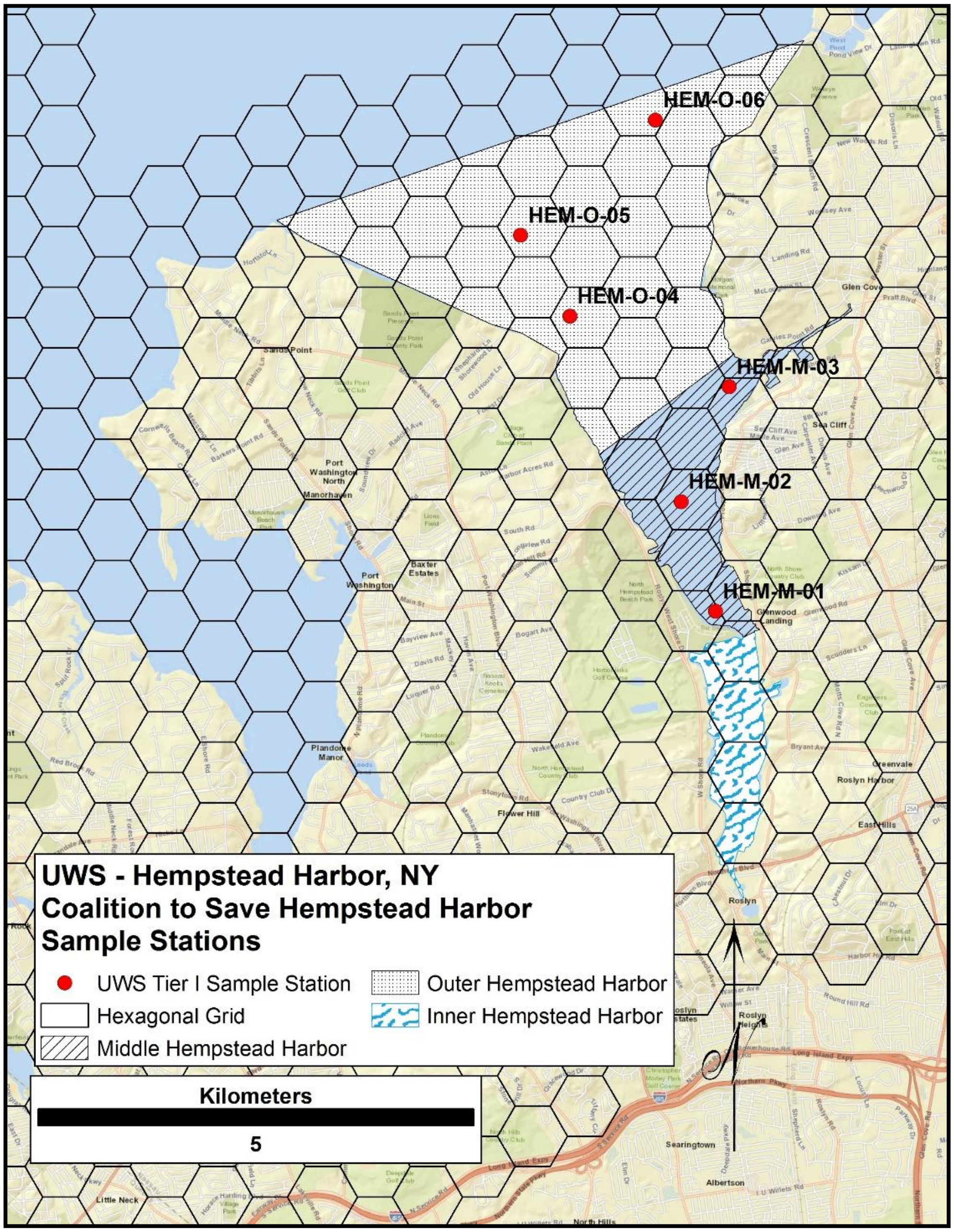
See *Figure 3* for a hexagonal grid showing the location of UWS stations.

2.4.2 UWS Testing Parameters

As mentioned above, UWS monitoring is conducted on a biweekly basis, from May through October. As per UWS protocols, sampling must be completed within three hours of sunrise and so generally begins at approximately 6 AM.

For the UWS, the Eureka Manta+ 35 is used by most participating groups to measure "Tier 1" parameters: water temperature, specific conductivity (salinity), dissolved oxygen, chlorophyll a, and turbidity. UWS protocols specify collecting data at half a meter below surface and at half a meter off the bottom for stations that have a total depth of fewer than 10 meters; for deeper stations, data is recorded at mid-depth as well. At the end of each survey, four chlorophyll filtrations were performed along with taking meter readings from the same water that is filtered, and two of the filters were sent to the Interstate Environmental Commission's laboratory for analysis (see also *Section 3.6*).

Figure 3
Location of Hempstead Harbor UWS Stations Sampled in 2019-2020



Credit: Hexagonal grid provided by Peter Linderoth, Save the Sound

The program also includes a qualitative macrophyte (aquatic plant, or seaweed) assessment that must be conducted on three days (ideally a week apart) from July 15 to August 7, within three hours of low tide. The assessment may be from a soft shoreline or from a submerged area (from a dock or boat). For Hempstead Harbor, CSHH selected unraked areas of three beaches: Sea Cliff Beach, Harry Tappen Beach, and North Hempstead Beach Park. A photo assessment was completed for each area, and seaweed was categorized by color and general growth type (e.g., sheet, twig-like, or hair-like).

View looking north from Town of North Hempstead Beach Park (l), close-up of red and green seaweed north of Tappen Pool (c), and east of Sea Cliff Beach (r) (photos by Michelle Lapinel McAllister, 7/15 and 7/24/20)

The 2018-2019 results from the UWS monitoring for all bays were included in the 2020 Long Island Sound Report Card. (See https://www.savethesound.org/wp-content/uploads/2020/10/2020_Save_the_Sound_LIS_Report_Card_FINAL.pdf.) This was the first time that the Long Island Sound Report Card included information and grades on the surrounding bays and bay segments along with segments of the sound, i.e., from west to east, Western Narrows, Eastern Narrows, Western Basin, and Eastern Basin. Hempstead Harbor is included in the Eastern Narrows segment of the sound, which received an overall "C" grade. Despite enormous improvements in water quality for Hempstead Harbor over the last 35 years, the two segments of the harbor that were graded for the report card, "Middle Hempstead Harbor" and "Outer Hempstead Harbor," received grades of "D" and "C+," respectively. Hempstead Harbor's lowest scores were for levels of DO and chlorophyll.

Data from the UWS sampling for Hempstead Harbor are included in *Appendix F*.

3 Monitoring Results

This section summarizes results of the CSHH water-monitoring program. Where possible, data from the CSHH program from 1995-2020 are compared with 2020 data. *Appendices A, B, C, D, E,* and *F* include graphs and tables constructed with the data collected during this period.

3.1 Dissolved Oxygen

Dissolved oxygen (DO), the form of oxygen that marine life needs to survive, is an important indicator of the health of our Long Island Sound estuary. Hypoxia (low oxygen) and anoxia (no oxygen) are water-quality problems that commonly occur during the summer in Hempstead Harbor and in other areas in and around Long Island Sound, particularly in the western sound. DO is indirectly affected by nutrient enrichment, particularly nitrogen, which can enter Hempstead Harbor through stormwater runoff, discharges from sewage treatment plants, or leaching from failing septic systems. Nitrogen accelerates the growth of phytoplankton or algae and increases the density of organisms that grow. The increased number and growth rate cause frequent or prolonged "blooms." When the cells in the plankton blooms die off, the decomposition process depletes dissolved oxygen that fish, shellfish, and other aquatic organisms need to survive. The larvae of these organisms are often especially sensitive to low DO concentrations. In addition to these direct effects of low DO levels, indirect effects can also occur. Low DO levels can cause some bacteria to produce hydrogen sulfide, which is a gas that can be toxic to fish.

Key Findings – Dissolved Oxygen

- Healthy DO levels (greater than 5.0 ppm) were observed in 82.7% of all surface and bottom measurements taken in 2020, considerably higher than the 59.1% of healthy DO levels observed in 2019.
- For bottom DO levels (which are most crucial to bottom-dwelling marine life), hypoxic conditions were observed in 10.5% of all measurements taken in 2020. Hypoxic conditions were observed at stations CSHH #1, CSHH #2, CSHH #3, CSHH #16, and CSHH #17.
- There were considerably fewer bottom hypoxic events in 2020 (10.5%) than there were in 2019 (when 20.2% of samples were hypoxic).
- The long-term percentage of bottom hypoxic events (2004-2020) is 13.1% compared with the 2020 average of 10.5%.
- Looking at DO levels at the surface in 2020, no hypoxic conditions were found, compared with 2.5% of readings in 2019.
- Hypoxic conditions in 2020 occurred from mid-July through mid-September. This was within approximately the same time frame in which hypoxic conditions were observed in 2019.
- In 2020, there were no anoxic readings (less than 1.0 ppm); there were six in 2019.
- Stations CSHH #2 and CSHH #16 had the highest number of hypoxic readings in 2020.

Although many algal species produce oxygen during their growth stage through photosynthesis, algal mortality and subsequent decay generally influence DO levels more strongly, especially later in the summer when more organic matter is decaying and rates of photosynthesis are declining. Therefore, productive aquatic ecosystems with larger nutrient loads are more prone to low

DO levels. The impact of temperature and salinity on DO levels in these ecosystems is generally of secondary importance. Typically, as temperature and salinity increase, the dissolved oxygen concentration decreases. Because the majority of organic-matter decay occurs at the estuary bottom, DO levels tend to be higher at the surface and lower at the bottom of the water column. Density-dependent stratification, such as elevated salinity levels at the harbor bottom, inhibits mixing and exaggerates the difference between surface and bottom DO levels.

Prior to 2008, DO levels above 5.0 ppm were considered healthy; DO levels below 5.0 ppm were considered to cause various adverse impacts (related to growth, reproduction, and survival of organisms). The severity of impacts, and threshold DO levels where impacts occur, are strongly species dependent, (e.g., bottom-dwelling marine species would be more affected by low DO than species that can move more easily to higher-oxygen areas.)

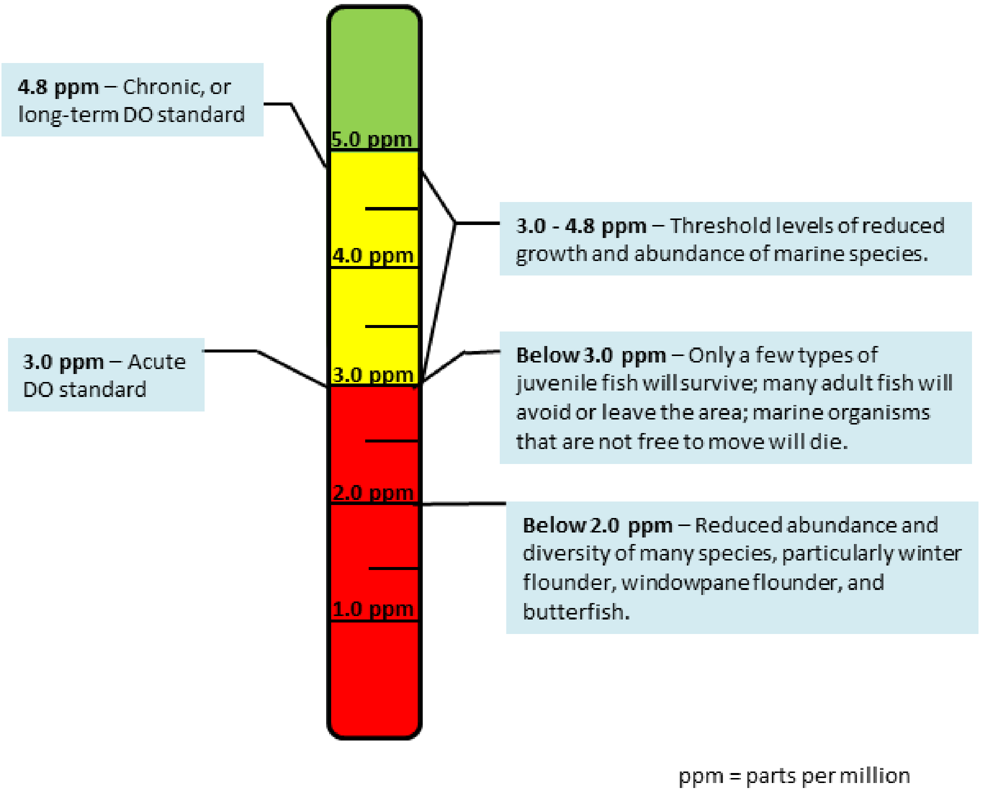
A revised dissolved oxygen standard was implemented by the NYS DEC on February 16, 2008. For estuarine waters such as Hempstead Harbor, the chronic, or long-term, DO standard is 4.8 ppm. This means DO levels of 4.8 ppm and above are considered to be protective of most marine aquatic species. The acute DO standard is 3.0 ppm, which means that if DO concentrations fall below 3.0 ppm, conditions are considered hypoxic; under hypoxic conditions, most juvenile fish will not be able to survive, many adult fish will avoid or leave the area, and species that cannot leave the area will die. For DO concentrations that are equal to or greater than 3.0 ppm and less than 4.8 ppm, the growth and abundance of certain marine species will be affected. The impact of hypoxia on marine life depends on the duration and area over which low DO levels occur; water temperature, salinity, and distribution and behavioral patterns of resident species also play a role in how marine organisms react to hypoxic conditions.

Bunker finning in the fog (photo by Carol DiPaolo, 10/22/20)

However, states often interpret effects of environmental conditions on marine life differently; for example, Connecticut's DO standard was 5.0 ppm through 2010 (it was changed to 4.8 ppm in 2011), and it specified maximum periods for which exposure to low DO is allowed. These standards are similar to the New York standards, although not completely consistent.

Percent saturation of dissolved oxygen is also monitored in Hempstead Harbor. Percent saturation is a measure of the amount of oxygen currently dissolved in water compared with the amount that can be dissolved in the water, and it is influenced by variability in water temperature and salinity. In a marine system such as Hempstead Harbor, which has abundant nutrients and organisms, dissolved oxygen levels near the surface can be oversaturated during the day (greater than 100%) due to photosynthesis by algae, and undersaturated at night (50% or lower) due to decomposition of dead organic matter (respiration).

Figure 4
DO Standards and Effects of Depleted DO on Marine Life



This report evaluates DO measurements collected at the bottom of Hempstead Harbor, which are considered critical because bottom-dwelling marine life have more difficulty than other marine species in trying to escape low DO conditions. Hypoxic conditions (low DO, interpreted to be less than 3.0 ppm in this report) and anoxic conditions (no DO, which, for purposes of this report, is less than 1.0 ppm) have been implicated in fish kills in Hempstead Harbor, particularly of Atlantic menhaden (commonly known as bunker) but also of juvenile flounder and other species.

No fish kills occurred during 2001 through 2004 despite extended periods of hypoxia. A clam kill occurred in 2005 south of Bar Beach, near CSHH #5, but this kill reportedly resulted from lunar/tidal effects and not hypoxia. A small, localized fish kill occurred in August 2006 from an unusual condition off of Morgan Beach–low DO and hydrogen sulfide produced by sulfur bacteria present in the decomposition of algal cells. No fish kills in

Hempstead Harbor were observed or reported in 2007-2014. Two limited bunker kills occurred late in the season in 2015 when DO levels had increased−in October and November–and corresponded with the large bunker populations that remained in the harbor through the beginning of January 2016. No fish kills were reported in Hempstead Harbor from 2017-2018. In 2019, following rising air temperatures, significant rain events, and bottom DO levels becoming hypoxic and/or anoxic, a limited fish kill occurred in Hempstead Harbor and other bays in the western sound, affecting mostly bunker. Although a limited and scattered fish kill occurred over several months in 2020 affecting the bunker population, it was later discovered that a virus was implicated soundwide. (See also *Section 4.5*.)

Lower DO levels may be the result of a variety of factors, including anthropogenic influences such as nutrient enrichment from wastewater-treatment-plant discharges, overuse of fertilizers in home gardening and golf-course maintenance, and residual oxygen demand in bottom sediments from past industrial activities. Changes in air and water temperature and the physical nature and chemistry of the water can also influence DO levels, although typical effects are relatively minor (see *Sections 3.2 and 3.3*). It is also possible that differences in wind patterns could affect vertical mixing within the water column, resulting in a well-mixed water column during some years, and a more stratified water column in others.

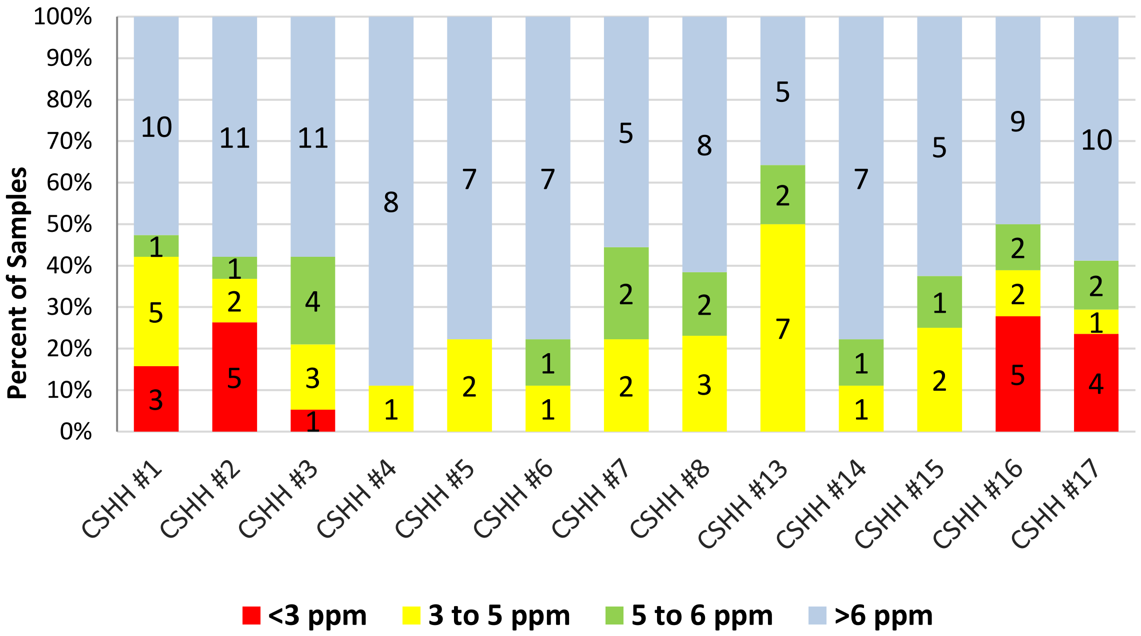
Of the 13 stations where bottom dissolved oxygen was measured in 2020, stations CSHH #1, CSHH #2, CSHH #3, CSHH #16, and CSHH #17 had measurements indicative of hypoxic conditions. There is no discernible spatial pattern to the distribution of hypoxic conditions; stations with the highest percentage of hypoxic observations were spread throughout the harbor. This suggests that both the lower and outer harbor experience similar fluctuations in DO, and more locally specific factors are likely the driver behind hypoxic conditions. Also note that, while there were no hypoxic conditions observed at the lower harbor stations in 2020, these stations were only visited during two of the seven weeks in which hypoxic conditions were recorded elsewhere in the harbor. Overall in 2020 across all monitoring stations, 10.5% of all bottom readings exhibited hypoxic conditions (where DO < 3.0 ppm; *Figure 5*), 18.6% of observations fell in the 3.0-5.0 ppm range, 11.0% fell in the 5.0-6.0 ppm range, and 59.9% of observations showed bottom DO levels above 6.0 ppm.

The percentage of bottom DO measurements with hypoxic conditions in 2020 (10.5% or 18 measurements for bottom) was considerably lower than 2019 (20.2%). It is the seventh lowest percentage of hypoxic conditions for bottom DO measurements observed in the past 17 years of monitoring. There were no surface DO measurements with hypoxic conditions in 2020, significantly lower than in 2019 (when 2.5% of surface measurements were hypoxic) (*Figure 6*).

Anoxic conditions (< 1 ppm) were not observed at any stations during the 2020 monitoring season, whereas they were observed six times during the 2019 monitoring season across two different sampling events and five separate stations.

Figure 5
2020 Bottom Dissolved Oxygen for Stations in Hempstead Harbor

Each vertical bar represents one of CSHH's monitoring sites. Colored bars indicate percentage of all samples taken at a location that fall into each of the four color-coded categories. Numbers inside the bars indicate the number of observations (sample size) within each bar segment. Red bars are representative of hypoxic conditions (DO below 3 ppm); DO between 3 and 5 is considered marginal, and DO above 5 ppm is considered a healthy condition.



The hypoxic conditions recorded in 2020 occurred from about mid-July through mid-September. This is generally consistent with periods of higher air and water temperatures when the solubility of oxygen in water decreases. The period of hypoxic and anoxic conditions may lengthen in the future based on climate projections for warmer overall air temperatures. A comparison of the number of days and months in which hypoxic conditions are observed may be a useful indicator of changing temperature conditions.

There are no obvious temporal trends in bottom DO levels over the period of record (1995 to present). At most locations, average bottom DO fluctuates between 4 ppm and 7 ppm; the overall average bottom DO reading over time for all stations has been 5.68 ppm (7.46 ppm for surface DO). Station CSHH #13, located at the head of Glen Cove Creek, has been the most obvious outlier, with lower than typical DO levels in recent years (*Figure 7*); however, in 2020, DO levels at CSHH #13 were more similar to those seen at other stations in Glen Cove Creek.

Figure 6
Percent of Observations with Hypoxic Conditions Over Time

Monitoring-season averages are shown for both bottom dissolved oxygen and surface dissolved oxygen.

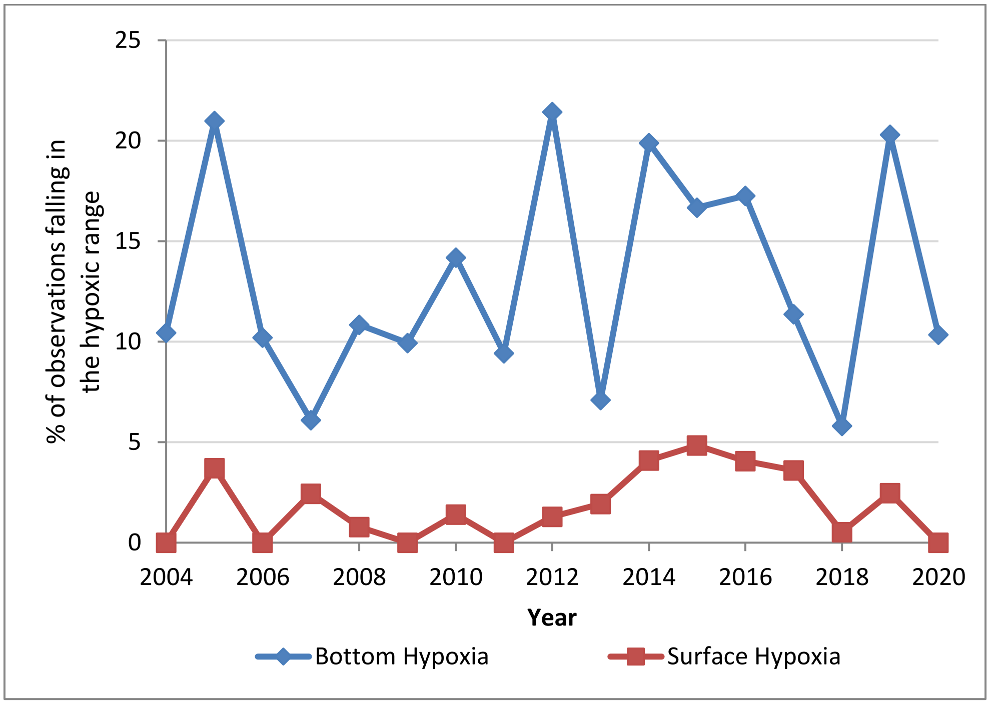
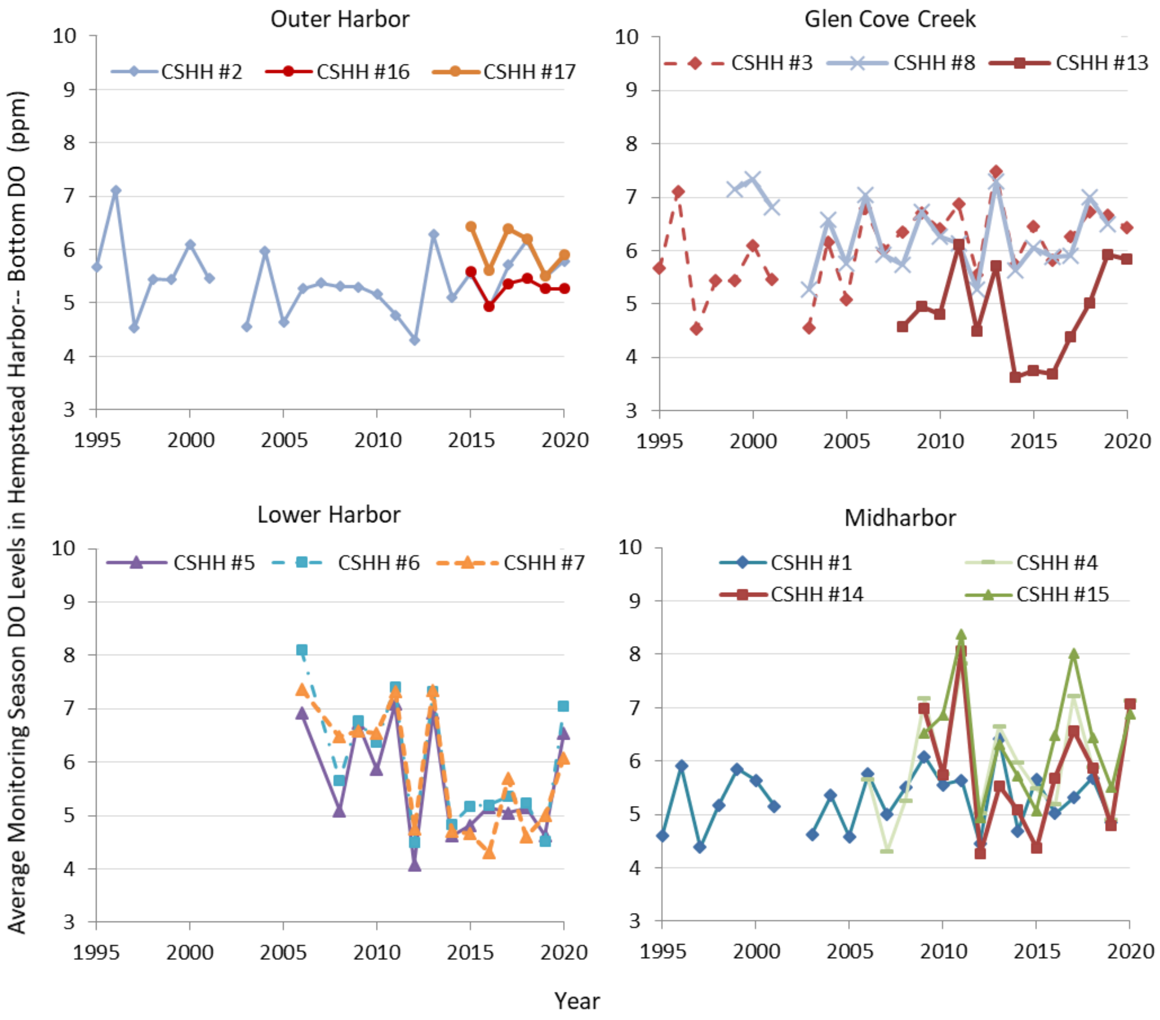


Figure 7
Average Monitoring-Season DO Levels in Hempstead Harbor

Monitoring-season averages are depicted for each station since 1995 (or since inception of data collection for that station). Stations are grouped according to their proximity to one another and loosely by region of the harbor, to allow for inspection of spatial patterns. Within each grouping, each station is represented with a unique color and symbol. Connected dots indicate the approximate trajectory of a given station's measurements over time.



3.2 Temperature

Key Findings – Temperature

- Water and air temperatures are least variable at CSHH stations in the outer harbor and within the area of Glen Cove Creek and most variable in the lower harbor. It should be noted that lower harbor stations are visited less frequently due to tide, which may contribute to these greater variations.
- Average water temperature at CSHH stations in 2020 was 4.5% (0.90°C) warmer than the long-term average (1995 to present).
- Average 2020 air temperature at CSHH stations was 2.93% (0.63°C) cooler than the long-term average (1995 to present).

Water temperature is monitored to record seasonal and annual changes of temperature within the harbor and to determine whether temperature could be affecting marine life, especially organisms in the harbor that are in the southernmost limit of their habitat. As stated by the Long Island Sound Resource Center (referencing a 2010 report by J. O'Donnell), a warming trend has been observed in Long Island Sound (about 1.8°F [1°C] warmer per century), when temperatures are averaged throughout the sound. A difference has also been observed between the western and eastern portions of the sound: the western portion, influenced most by fresh water inputs, is cooler than the eastern portion, influenced most by ocean water. The water temperature effects of climate change are not discernible in Hempstead Harbor probably because the shallower water and tidal flushing are affected most by the cooler water of western Long Island Sound.

Water temperature is also used to determine the percent saturation of DO within the harbor. As described previously, percent saturation is a measure of the amount of oxygen currently dissolved in water compared with the amount that can be dissolved in the water. Percent saturation is strongly influenced by temperature: the lower the temperature, the higher the DO level must be to reach 100% saturation, and vice versa. For example, at 32ºF (0ºC), DO reaches 100% saturation concentration in water when it is present at a level of 14.6 ppm, whereas at 68ºF (20ºC), 100% DO saturation concentration is reached at 9.2 ppm, and at 77ºF (25ºC), it is reached at 8.3 ppm.

Additionally, temperature monitoring tells us whether the water column is stratified or well mixed. Stratification is a naturally occurring condition whereby water at the surface is warmer while water at the bottom stays cold. Because the colder water is denser, it stays at the bottom and cannot mix easily with the warmer water. This colder water becomes isolated from the surface where the majority of oxygen transfer occurs, which prevents replacement of DO lost through consumption by organisms. Hempstead Harbor does not generally exhibit pronounced stratification, because the harbor is relatively shallow and strongly influenced by tides; vertical mixing continues through much of the season.

See *Figure 8* for average annual water temperature for each monitoring location for the period of record. Many factors affect water temperature, but it is representative more of conditions that occur over several days and is not heavily influenced by daily variation in air temperature.

Average water temperatures tend to be least variable in the outer harbor and the area around and within the mouth of Glen Cove Creek and most variable in the lower harbor (*Figure 8*). Station CSHH #1, in the middle section of the harbor, appears to have a more stable average temperature than the surrounding stations. Lower harbor stations are visited less frequently due to tide, which may contribute to these greater variations. Overall, 2020 surface water temperature averaged 21.13ºC, and average bottom water temperature was 20.53ºC. The long-term average water temperature over all years since 1995 is 19.93ºC; 2020 average water temperature was 20.83ºC, or 4.52% higher than the long-term average. Surface and bottom water temperatures differed from one another in 2020, with bottom temperatures 0.60ºC cooler, on average, than their surface water counterparts. This difference between surface and bottom temperature is expected and has occurred for every monitoring season since 2004. A statistical analysis was applied to the temperature difference using a paired t-test (i.e., pairing differences in testing results on the same date and at the same station to determine the probability that the result occurred by chance). The analysis indicated there was only a small probability of this occurring by chance (<0.01%). (See *Appendix A* for additional water temperature monitoring data.)

Air temperature affects aquatic temperature, which affects both DO concentrations and biological activity within an aquatic system. Because CSHH records temperature data only during monitoring events, temperature more strongly indicates the time of day that CSHH monitored a certain location. However, because monitoring events began at similar times each season and have similar durations, changes in temperature averaged between sites during a season could be indicative of annual variability in weather conditions.

Figure 9 presents average monitoring-season air temperatures recorded at all stations since 1995. As with water temperature, air temperature is least variable in the outer harbor and the area around and within the mouth of Glen Cove Creek, where average monitoring season temperatures have stayed within a narrow 4ºC window from approximately 20ºC to 24ºC (*Figure 9)*. Average air temperatures in the lower harbor and midharbor have been much more variable, ranging from about 14.5ºC to almost 26ºC. Note, however, that because lower harbor stations are visited less frequently, the averages may appear more variable since individual monitoring events will have more influence. In 2020, for example, lower harbor stations were not visited at all between 7/29 and 9/16, which skewed their average temperatures lower than those of outer harbor and Glen Cove Creek stations. As was seen with water temperature, within the midharbor group, station CSHH #1 is less variable than nearby stations; its pattern is more similar to that of the outer harbor and stations within and near Glen Cove Creek. The 2004 monitoring season was the coolest on record, with an average temperature of 19.5ºC recorded at the three stations included in the study at that time. Conversely, 2001 was on average the hottest monitoring season at 23.0ºC. In 2020, average air temperature across all stations was 20.8ºC. The long-term average air temperature across all years since 1995 is 21.5ºC. Average 2020 air temperature was 2.93% (0.7ºC) cooler than the long-term average.

Figure 8
Average Water Temperature Recorded During Seasonal Monitoring Events

Monitoring-season averages are depicted for each station since 1995 (or since inception of data collection for that station). Stations are grouped according to their proximity to one another and loosely by region of the harbor, to allow for inspection of spatial patterns. Within each grouping, each station is represented with a unique color and symbol. Connected dots indicate the approximate trajectory of a given station's measurements over time.

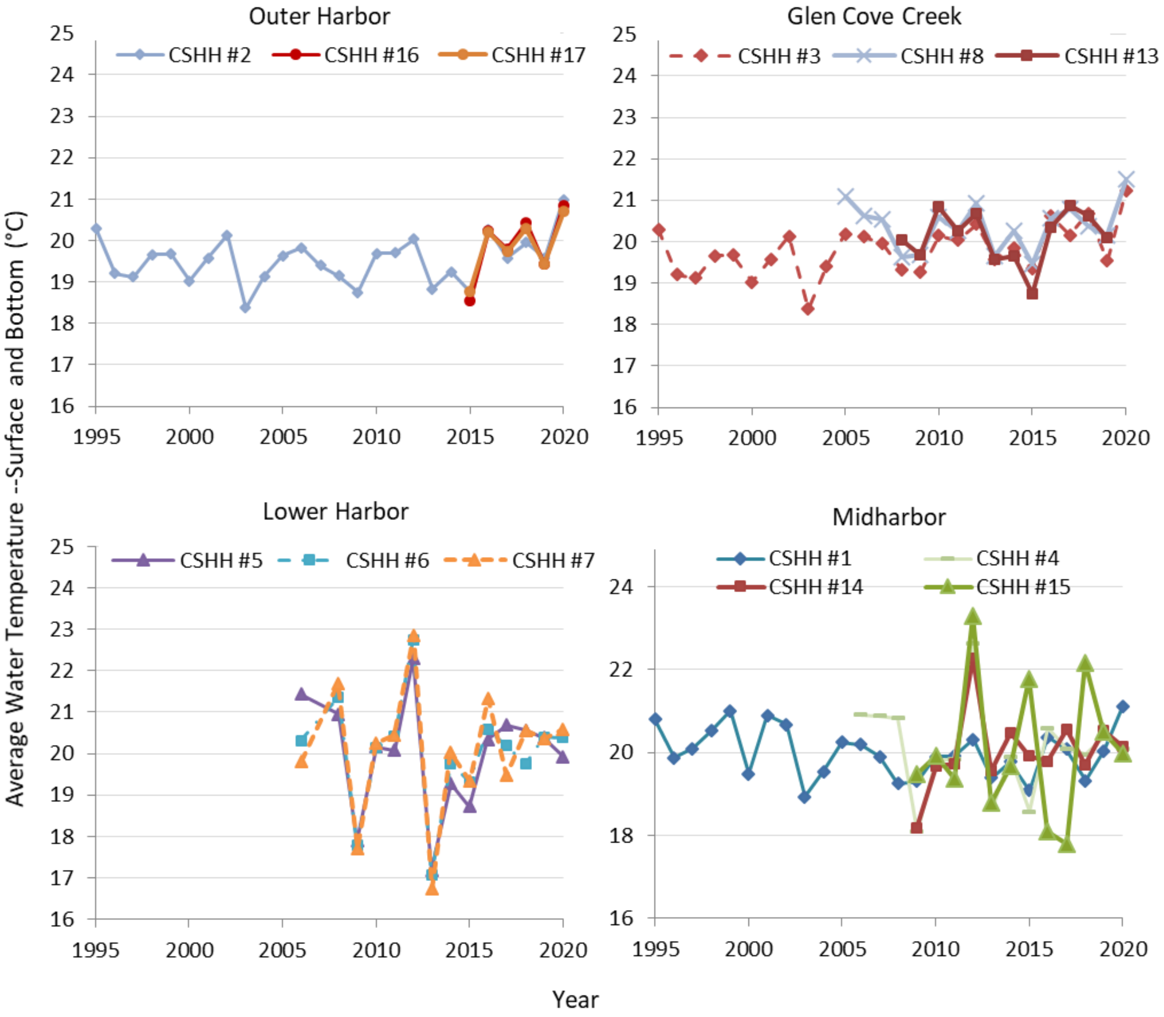
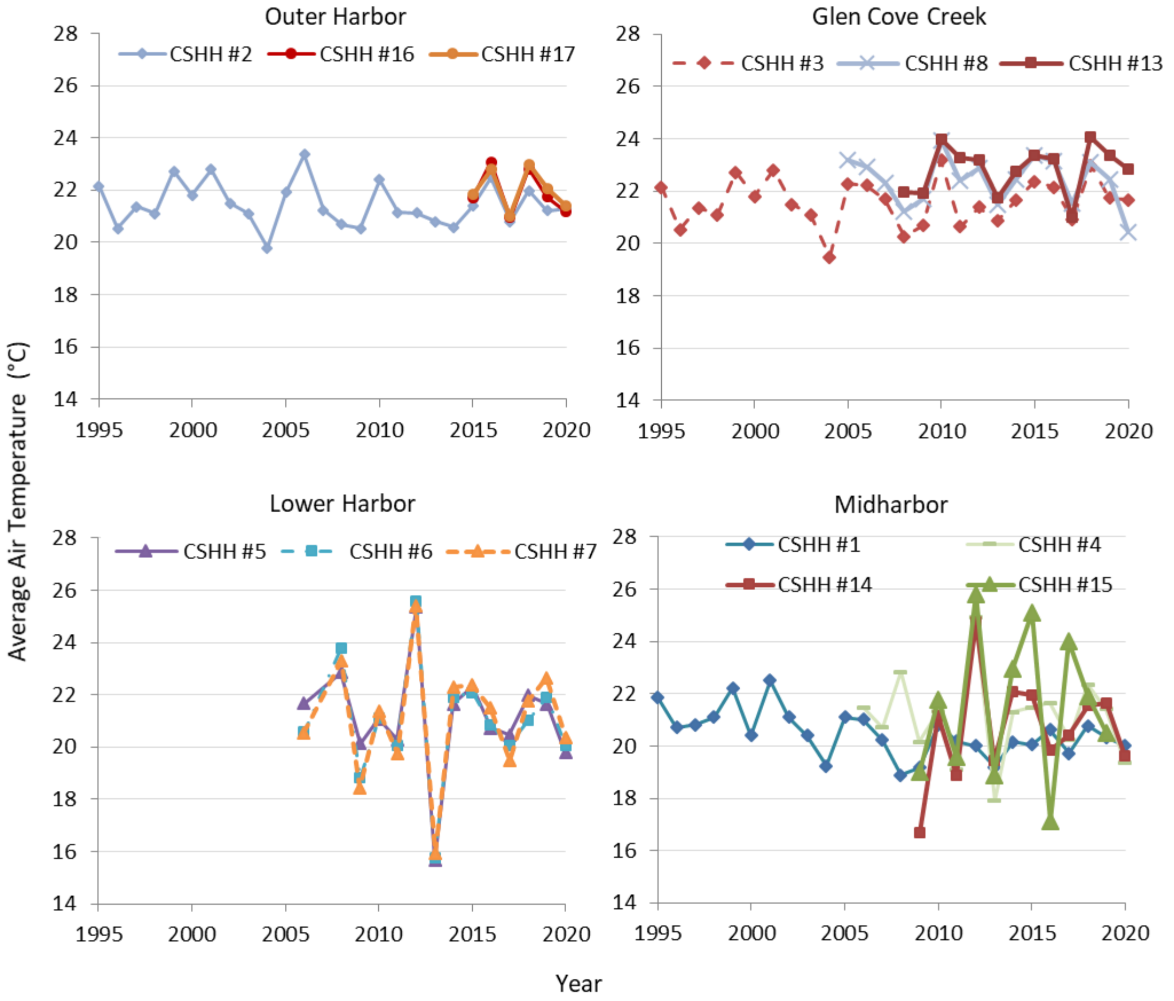


Figure 9
Average Air Temperature Recorded During Seasonal Monitoring Events

Monitoring-season averages are depicted for each station since 1995 (or since inception of data collection for that station). Stations are grouped according to their proximity to one another and loosely by region of the harbor, to allow for inspection of spatial patterns. Within each grouping, each station is represented with a unique color and symbol. Connected dots indicate the approximate trajectory of a given station's measurements over time. (An outlier for CSHH #15 in 2017 has been removed—the unusually low "average" temperature of 8.8ºC was a result of having only one observation at the station, in mid-October.)



3.3 Salinity

Monitoring salinity assists in determining whether the harbor is being influenced by tidal water or, instead, by freshwater from the watershed (i.e., from streams, stormwater, wastewater, or other discharges). Like temperature, salinity is an indicator of the water's oxygen-holding capacity and whether the water column is stratified.

Salinity affects DO levels; there is lower DO saturation in salt water than in fresh water. For example, the saturation level of dissolved oxygen at 25 ppt salinity is equal to approximately 85% of the saturation level of dissolved oxygen for freshwater. In Long Island Sound, salinity generally ranges between 21 ppt and 28 ppt (as compared with the typical salinity level of 32-38 ppt in the open ocean). Salinity levels within an estuary are generally affected by proximity to freshwater inflows, such as rivers or discharges from sewage treatment plants, and through direct precipitation and runoff.

Key Findings – Salinity

- At 25.82 ppt, the average salinity level across all stations in 2020 was 1.88% higher than the long-term average (2004 to present).
- In 2020, the average salinity was 4.42% higher compared with that of 2019.
- Stations CSHH #8 and #13 show stronger correlations between rainfall and average salinity than the other stations.
- Compared with 2019, there was a stronger relationship between lower salinity and rainfall at stations close to shore; this relationship is presumed to reflect the localized influence of stormwater runoff on near-shore salinity and overall water quality.
- The highest salinity for 2020 was 28.09 ppt (surface) and 28.21 ppt (bottom), whereas the lowest salinity was 18.06 ppt (surface) and 23.75 ppt (bottom).

Figure 10 presents average annual salinity levels at all monitoring stations for the period of record. Salinity levels in Hempstead Harbor generally vary less than in Long Island Sound. During the 2020 testing season, salinity readings at the Hempstead Harbor monitoring stations (including those near freshwater outflows) ranged from 18.06 ppt to 28.21 ppt.

Additionally, salinity levels measured at the bottom of the harbor are generally higher than those near the surface, because high-salinity water is denser and tends to sink. As expected, in 2020, statistical analysis performed via a paired t-test (described in *Section 3.2)* indicates that surface and bottom salinity values were significantly different from one another (p-value < 0.0001), with surface salinity levels 0.73 ppt lower on average than bottom salinity levels. This further suggests that slight stratification is occurring in the harbor.

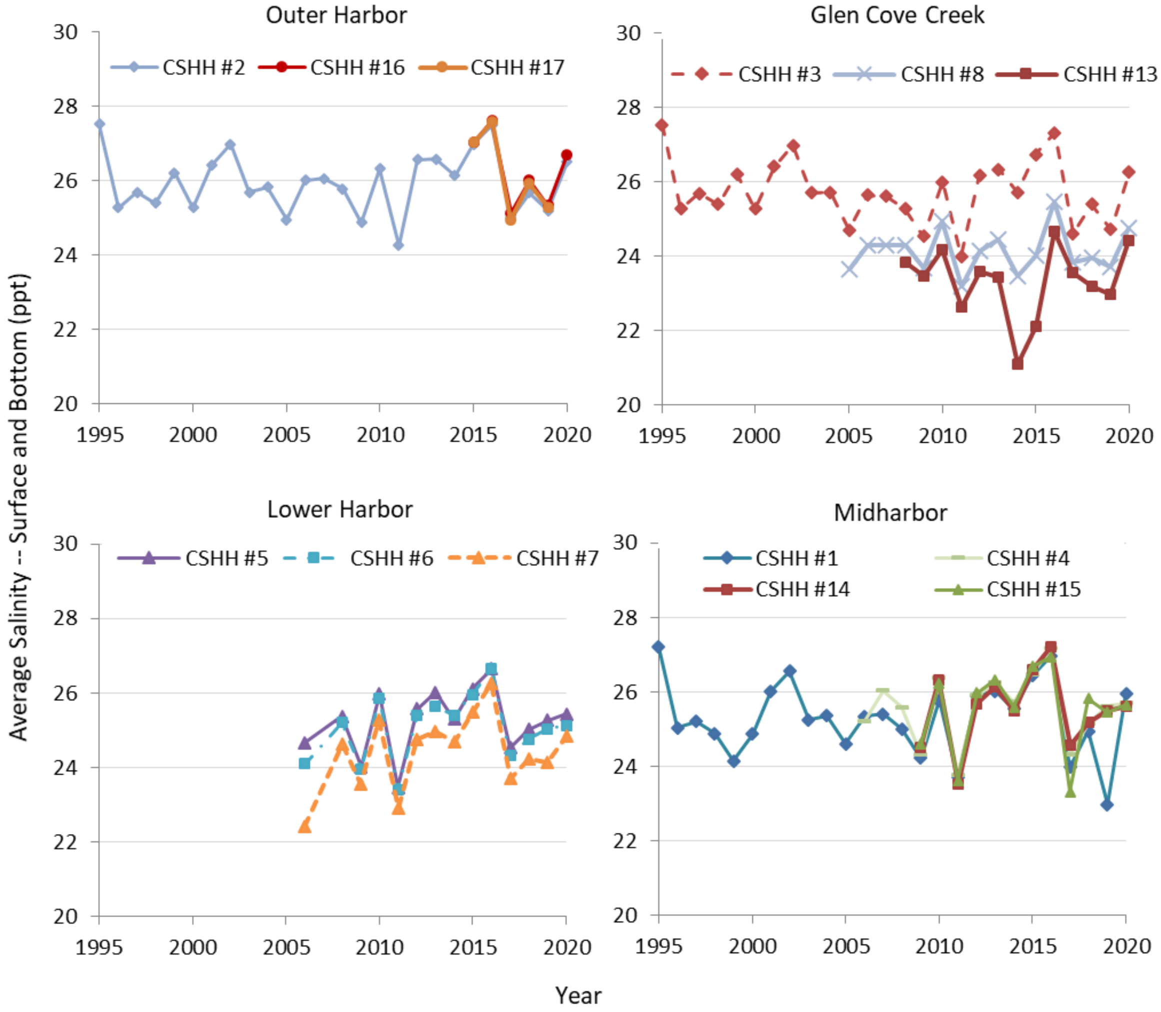
The long-term average salinity level within the harbor during the monitoring season since 1995 is 25.35 ppt, with annual averages ranging from a low of 23.5 ppt in 2011 to a high of 27.43 ppt in 1995. Average salinity level across all stations in 2020 was 25.82, 1.88% higher than the long-term average.

As with several other indicators, the stations within or near Glen Cove Creek seem to follow a different pattern from that of many of the other stations (this is particularly true of CSHH

#13 and CSHH #8, because CSHH #13 is near a large outfall that drains stormwater and freshwater from Cedar Swamp Creek, and CSHH #8 is below the large outfall for the Glen Cove STP; see *Figure 10*). Station CSHH #13's 2020 average (24.43 ppt) was 5.38% lower than the overall 2020 average salinity; CSHH #8 (24.77 ppt) was 4.06% lower than the overall 2020 average. See *Appendix A* for additional salinity data results.

Figure 10
Measured Average Salinity in Hempstead Harbor

Monitoring-season averages are depicted for each station since 1995 (or since inception of data collection for that station). Stations are grouped according to their proximity to one another and loosely by region of the harbor, to allow for inspection of spatial patterns. Within each grouping, each station is represented with a unique color and symbol. Connected dots indicate the approximate trajectory of a given station's measurements over time.



Taken as a whole, the 2020 monitoring season data indicate a weak relationship between salinity and precipitation. The relationship for the data as a whole is similar when salinity is compared either with the previous day's rainfall (24-hour rainfall) or with the previous two day's rainfall (48-hour rainfall). However, two stations demonstrate stronger dilution effects from precipitation than the others. Approximately 50% (R^2=0.498) of the variation in salinity at station CSHH #8, and approximately 60% (R^2=0.590) of the variation in salinity at station CSHH #13 can be explained by differences in previous day's rainfall, with higher rainfall amounts correlating to lower salinity. These two stations have consistently exhibited stronger dilution effects than the other stations, although in 2019 the effect was less pronounced than in 2018 and 2020. (In statistics, R^2 is a measure of the percentage of variation in the data that can be attributed to a given modeled relationship.) As seen in previous years, these relationships typically become weaker when salinity is compared with 48-hour rainfall rather than 24-hour rainfall.

Collectively, these results suggest that near-shore salinity is influenced by contributions of stormwater runoff and other freshwater inputs from the harbor watershed. Those stations showing the strongest dilution effects are located in Glen Cove Creek (stations CSHH #8 and CSHH #13), with additional stations close to shore in the lower harbor and midharbor indicating dilution effects as well.

3.4 pH

Figure 11 presents averaged surface and bottom pH for all monitoring stations from years 2007-2020.

Monitoring pH (a measure of acidity or alkalinity) helps in following trends in aquatic life and water chemistry. Carbon dioxide (CO_2) released by bacteria respiration and uptake via plant photosynthesis affect aquatic pH over short periods (hours to days), whereas the increase in atmospheric CO2 may affect aquatic pH over decades. Also, recent research has linked the combination of both low pH and low DO levels with having a more detrimental impact on marine life than low DO alone. [See *Gobler, C.J., et al. (8 January 2014). Hypoxia and acidification have additive and synergistic negative effects on the growth, survival, and metamorphosis of early life stage bivalves. Retrieved from* [http://www.plosone.org/article/info:doi /10.1371/journal.pone.0083648](http://www.plosone.org/article/info:doi/10.1371/journal.pone.0083648).]

Key Findings – pH

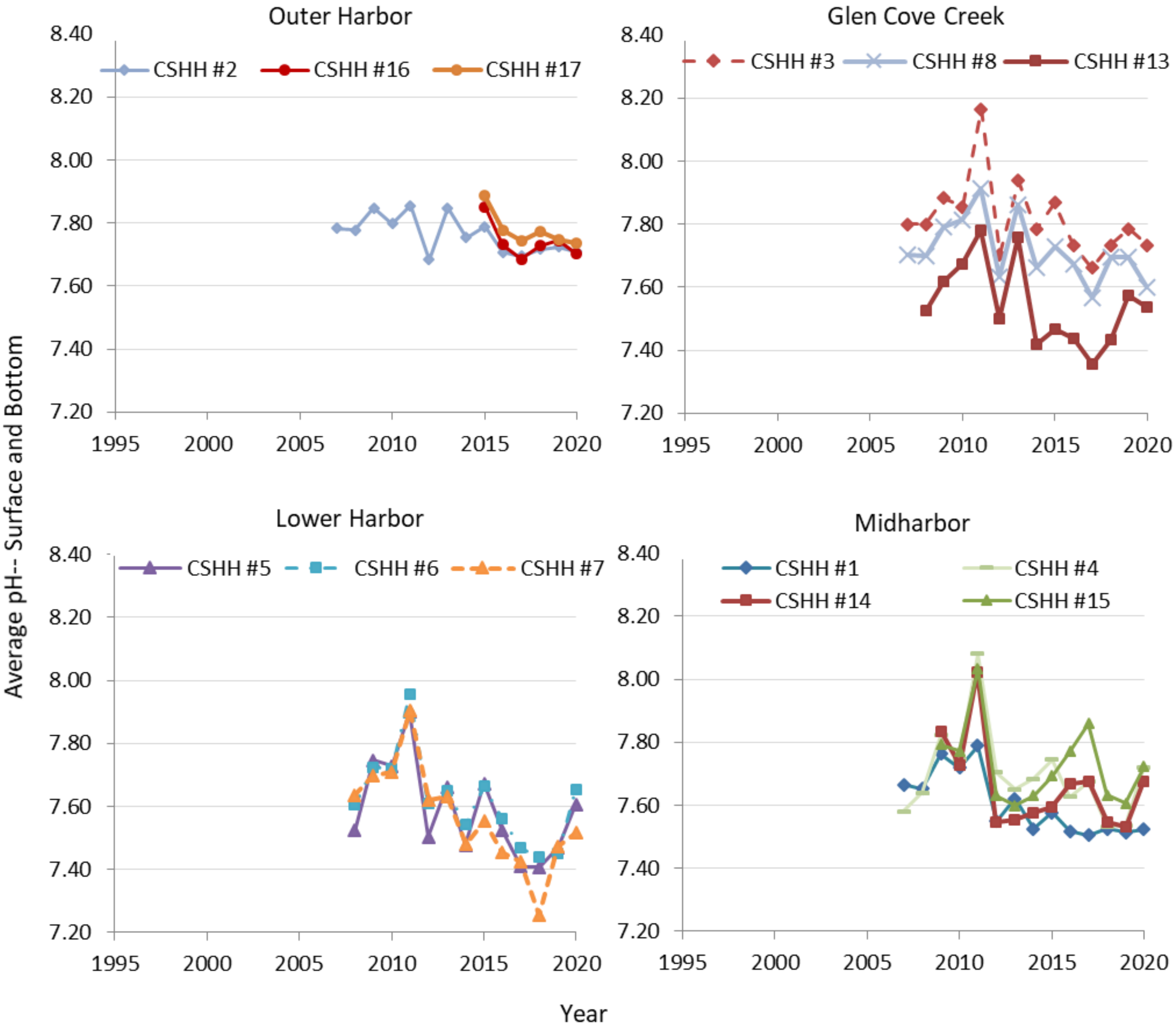
- 2020 average pH levels were lower (more acidic) than the long-term average (since 2007); lower by 0.47% at the surface and 0.64% at the bottom.
- Overall, after decreasing (i.e., becoming more acidic) over seasons 2004-2018, average pH increased (turned slightly more alkaline) in 2019 and 2020.
- CSHH #4, CSHH #5, CSHH #6, and CSHH#14 showed the largest increases in average pH in 2020.
- In 2020, the highest pH readings were 8.43 (surface) and 8.11 (bottom); the lowest readings of 6.92 (surface) and 7.08 (bottom).

Average pH levels in Hempstead Harbor in 2020 were 7.73 for surface pH and 7.57 for bottom pH. These averages are identical to those seen in 2019, and approximately 0.47% below and 0.64% below the long-term averages of 7.77 and 7.62, respectively. Overall, average pH across all monitoring stations has been decreasing (i.e., becoming more acidic) since 2011, when it reached a high of 8.00 for surface pH and 7.83 for bottom pH, although there was a slight increase in surface pH and bottom pH in 2019 and 2020 compared with pH levels in the previous couple of years. This overall pattern is seen for most individual stations as well. The largest increases in pH (becoming more alkaline) from the 2019 to the 2020 monitoring season were observed at CSHH #4 (2.4% increase from 2019) and CSHH

#6 (2.8% increase from 2019). CSHH #5 and CSHH #14 also showed increases in average pH, at a 1.87% increase since 2019 and a 1.99% increase, respectively.

Figure 11
Measured Average pH in Hempstead Harbor During Seasonal Monitoring Events

Monitoring-season averages for combined surface and bottom pH are depicted for each station since 2007 (or since inception of data collection for that station). Stations are grouped according to their proximity to one another and loosely by region of the harbor, to allow for inspection of spatial patterns. Within each grouping, each station is represented with a unique color and symbol. Connected dots indicate the approximate trajectory of a given station's measurements over time.



3.5 Water Clarity/Turbidity

In general, turbidity is a measure of water clarity. Suspended solids, dissolved organic matter, and plankton can cause increases in turbidity or the cloudiness of the water and may vary due to natural events such as tidal flux, rainfall, seasonal algal blooms, and ice melt. Human activities that cause eutrophication (excess nutrients) and sediment loading (e.g., from construction-site runoff) also increase turbidity.

Key Findings – Water Clarity/Turbidity

- 2020 Secchi-disk readings indicated a decline in water clarity compared with those of 2019, but a slight improvement over typical harbor conditions.
- The lowest and highest Secchi-disk readings in 2020 across all stations were 0.1 m and 2.5 m, respectively.
- Average surface turbidity readings in 2020 were 5.34% lower than the long-term average (2008 to present) at a sampling depth of one-half meter.
- In 2020, the highest average turbidity was seen at stations CSHH #5, CSHH #6, and CSHH #7.

3.5.1 Secchi-Disk Measurements

Water clarity is commonly monitored through the use of a Secchi disk–a white (or white and black) plastic disk that is lowered into the water to determine the lowest depth at which ambient light can penetrate the water column. In most nutrient-rich waters, such as Hempstead Harbor and Long Island Sound, the depth at which the Secchi disk is visible is limited by the amount of plankton, algae, or other suspended matter in the water (these give the harbor its usual green to brown color). Secchi readings are typically 1 to 2 meters for Hempstead Harbor but can range from 0.25 to 3 meters during the monitoring season. For 2020, the range of Secchi readings (0.1 to 2.5 meters) for the monitoring season indicates lesser water clarity over typical readings. However, the 0.1 m reading is an anomaly and does not represent conditions across all stations. Moreover, the average Secchi reading in 2020 across all stations was 1.25 meters, 12.8% shallower than the 2019 average of 1.43 meters but 3.3% deeper than the long term-average of 1.21 meters (from 2008 to present). These findings indicate decreased water clarity in 2020 compared with that in 2019, but somewhat greater water clarity relative to the long-term average.

3.5.2 Turbidity-Meter Measurements

Although research related to the effect of turbidity on the marine environment is limited, there has been increased recognition of its significance and the need to standardize measurements of turbidity levels. For example, excessive increases in turbidity may cause harm to fish growth and survival as well as affect gill function in both naturally low and highly turbid waters.

The US EPA’s Quality Criteria for Water 1986 report stated that turbidity could affect both freshwater and marine species of fish in the following ways:

1. Kill the fish or reduce their growth rate, resistance to disease, etc.
2. Prevent the successful development of fish eggs and larvae
3. Modify natural movements and migrations of fish
4. Reduce the abundance of food available to the fish

Elevated turbidity is generally harmful in most aquatic environments and for most species. Although some species may benefit (e.g., small increases in turbidity may afford some species increased camouflage), this increased advantage would be at the expense of other species (e.g., larger predators) and may upset the ecological balance.

It is thought that the effect of additional turbidity from human-generated sources on water bodies depends on the determined "background" turbidity level of the water body (see Johnson and Hines 1999; Meager 2005). (At this time, regulatory agencies have not articulated a background turbidity level for Hempstead Harbor and Long Island Sound.)

In New York, the water-quality standard for marine waters is that there shall be "no increase that will cause a substantial visible contrast to natural conditions."

Because of the previously cited significance of turbidity on the marine environment, turbidity sampling was initiated for Hempstead Harbor stations in July 2008. At each station monitored, turbidity is measured in nephelometric turbidity units (NTUs). (Prior to 2017, a LaMotte 2020e meter was used to measure turbidity, requiring grab samples, which were collected generally at two depths–at a half meter below the surface and at Secchi-disk depth; since 2017, a multiparameter meter has been used for a vertical profile of the water column.)

Given that the Secchi-disk depth decreases as the water sampled gets harder to see through, it follows that turbidity measurements should generally be inversely related. Measures of conditions at Hempstead Harbor stations clearly indicate an inverse relationship; that is, the greater the number for the depth at which the Secchi disk could be seen below the surface (the greater the transparency), the lower the number measured by the meter in NTUs (the lower the turbidity). For example, on July 1, 2020, Secchi disk depth was at an all-time low of 0.1 m, whereas the turbidity reading at a half meter below the surface was 5.29 NTU; the chlorophyll a reading was 80.85 ug/L, and a rusty-colored algal bloom was evident.

Secchi depth, at CSHH #6, was at an all-time low of 0.1 m (photo by Carol DiPaolo, 7/1/20)

In 2020, turbidity readings ranged from 0.76 to 17.12 NTUs at the sampling depth of one-half meter, compared with a range from 0.55 to 18.97 NTUs in 2019. The average reading at the sampling depth of one-half meter in 2020 was of 2.88 NTUs (nearly the same as in 2019) and the median was 2.57 NTUs. The 2020 average turbidity at a sampling depth of one-half meter was 5.34% lower than the long-term average (from 2008 to present) for the harbor. The highest average turbidity at the sampling depth of one-meter in 2020 was seen at stations CSHH #5 (average turbidity 4.93 NTUs), CSHH #6 (average turbidity 4.90 NTUs), and CSHH #7 (average turbidity 6.06 NTUs). The overall range of readings since 2008 (when turbidity monitoring began) is -2.34 to 62.79 NTUs. See *Appendix A* for additional turbidity data.

3.6 Chlorophyll

Chlorophyll is a photosynthetic pigment that causes the green color in algae and other plants. Chlorophyll a (Chl a) is the most abundant form of chlorophyll (others include type b, c, and d). Chlorophyll is essential to the process of photosynthesis, when energy from the sun converts carbon dioxide and water into oxygen and organic compounds. The concentration of chlorophyll present in water is directly related to the amount of suspended phytoplankton (a subset of algae) living in it. Chlorophyll is also present in cyanobacteria, often called “blue-green algae” although they are bacteria, not algae. Phytoplankton can be used as an indicator organism to determine the health of a water body, and measuring chlorophyll is a direct way of tracking algal growth. Excessive concentrations of algae, typically accompanied by high concentrations of nutrients (e.g., nitrogen), can cause the water to have a green, brown, or red appearance and decrease the overall clarity. Significant concentrations of algae are considered a “bloom” and can cause the depletion of dissolved oxygen and may cause fish kills. In addition to being simply aesthetically unpleasing because of discoloration of the water, some species of algae and cyanobacteria produce toxins that affect fish, shellfish, humans, livestock, and wildlife.

The Long Island Sound Water Quality Monitoring Program (CT DEEP) reported that between 1991 and 2011 Long Island Sound had an average Chl a of 13.4 µg/L.

Chlorophyll a has been measured as part of the CSHH monitoring program since July 2016, when a FluoroSense handheld fluorometer was used. The process to determine Chl a generally requires a field reading and then filtering a representative sample, collected during the monitoring event, to extract algae. This filter is analyzed by a laboratory with a calibrated fluorometer or spectrophotometer to determine the correlation between the extracted concentration and value recorded in the field. This correlation is then applied to all field readings for that monitoring event. In the case of the 2016 data, field readings were recorded, but filtrations were completed for only two monitoring events, and so the data are considered incomplete. In 2017 to present, Chl a field readings were recorded for the core monitoring program and used only as a frame of reference. For the UWS, field readings were recorded and four filtrations were completed for each monitoring event (two of the four filters were used as backup and not analyzed). The data were corrected following the completion of the lab analysis of the filters. The UWS Chl a field readings are included in *Appendix F.*

3.7 Nitrogen

Ammonia, nitrate, and nitrite are three nitrogen-based compounds that are commonly present in marine waters. Other nitrogen-based compounds include organic nitrogen and nitrogen gas.

Key Findings – Nitrogen

- In 2020, total nitrogen was highest at outfall locations (in Glen Cove Creek and those associated with Scudder's Pond and the Powerhouse Drain) as compared with in-harbor stations. This was the case in 2019 as well.
- From 2018 through 2020, nitrate was the largest component of total inorganic nitrogen samples.
- In 2020, station CSHH #13 had the highest total organic nitrogen samples of all stations sampled (7.0 mg/L). Station CSHH #14A had the highest ammonia, nitrite, nitrate, and total nitrogen values of all stations sampled (1.6 mg/L, 0.14 mg/L, 11.6 mg/L, and 14.4 mg/L, respectively).

3.7.1 The Nitrogen Cycle

Nitrogen is generally made available to a marine ecosystem from the atmosphere (called fixation) and from the watershed. Nitrogen fixation is usually a smaller source of nitrogen than the watershed sources. Inputs of nitrogen from the watershed are in the form of **ammonia** (NH_3), **nitrite** (NO_2), or **nitrate** (NO_3). (*Figure 12* presents a diagram of the nitrogen cycle in the water environment.)

Ammonia and nitrate generally originate from fertilizer and human or animal wastes that can end up in water bodies from old or failing septic systems, wastewater treatment plants and from stormwater runoff. Nitrate is also a product of properly functioning treatment plants, which convert ammonia to nitrate.

Ammonia and nitrate are important for organisms, which require nitrogen for growth and reproduction. Nitrogen forms amino acids, proteins, urea, and other compounds that are needed for life. These forms of nitrogen are referred to as organic nitrogen.

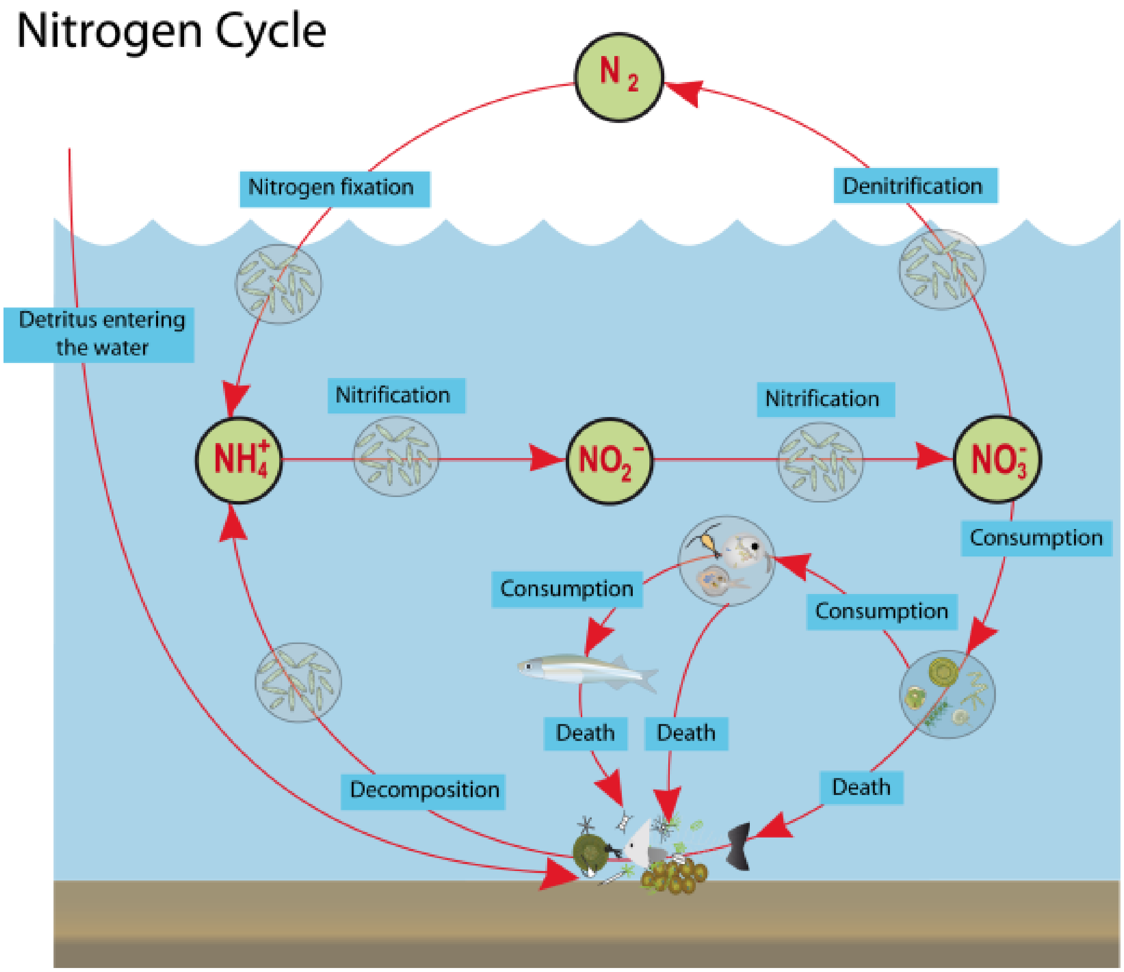
Ammonia has two forms of interest to water-quality concerns; there is the un-ionized form of ammonia, NH_3, which in excess is toxic to fish (both freshwater and marine) or in the ionized form **ammonium** (NH_4^+), which is innocuous. The relative concentration of each form is pH and temperature dependent (and to a small extent the fraction of un-ionized ammonia is inversely related to salinity). Higher pH and temperature are associated with increased levels of the more toxic, free ammonia (NH_3). pH has the largest effect on increasing ammonia toxicity.

Many forms of organic nitrogen are quickly converted to ammonia in water. One form of ammonia can form a gas and be released into the atmosphere.

Ammonia can also be converted to nitrite in the presence of oxygen as part of the nitrification process, but as more oxygen is added, nitrite (which is highly unstable) quickly transforms to nitrate. When anoxic conditions form, certain bacteria convert nitrate into **nitrogen gas** (N_2), which is released to the atmosphere.

Sewage treatment plants can be upgraded to provide biological nutrient (nitrogen) removal. The Glen Cove sewage treatment plant was upgraded to do so. Older wastewater treatment plants blow oxygen into the wastewater to promote the growth of microorganisms, which decay carbon-based waste rapidly and produce carbon dioxide. Ammonia is converted into nitrate as a byproduct. Treatment plants with nitrogen removal upgrades have an anoxic zone in the wastewater treatment tanks and circulate wastewater that has been treated with oxygen already. Highly specialized bacteria remove the oxygen from the nitrate, releasing nitrogen gas and removing the nitrogen from the wastewater stream.

Figure 12
Nitrogen in Marine Environments
(Graphic from Sea Grant, University of Rhode Island, at https://seagrant.gso.uri.edu/nitrogen-cycle-lie/)
Note: N_2 is nitrogen gas; $NH_4^{(+)}$ is ammonium; $NO_2^{(-)}$ is nitrite; $NO_3^{(-)}$ is nitrate.



3.7.2 Nitrogen Monitoring by CSHH

From 2004 through September 2016, CSHH collected samples weekly at CSHH #1-3, #8, #13, #16, and #17 and, when tidal and weather conditions allow, at CSHH #4-7, #14, and #15 to test for ammonia, nitrite, and nitrate. In 2004-2006, the samples that were sent to the town lab for ammonia analysis produced results that indicated interferences (possibly from the saltwater, turbidity, or water color), so ammonia testing was conducted in the field using a LaMotte test kit. Through September 2016, nitrite and nitrate samples continued to be analyzed at the Town of Oyster Bay lab, by Lockwood, Kessler and Bartlett, Inc., using an electronic Hach kit. Beginning in 2012, only the salicylate method was used in the field for ammonia testing (rather than both the Nessler and salicylate methods as was used previously). In October 2016, closure of the town lab and the absence of resources necessary to go to another facility for sample analysis prevented further nitrite and nitrate testing through 2017. Ammonia samples continued to be tested in the field. Beginning in 2018, water samples were collected weekly at CSHH #1-3, #8, #13, #14A, #15A, #15B, #16, and #17 and, when tidal conditions allowed, at CSHH #4-7, #14, and #15; samples were delivered to Pace Analytical Services, LLC for analysis of nitrite, nitrate, and ammonia (onboard testing for ammonia was suspended). Starting in 2019, water samples for nitrogen analysis, including total Kjeldahl nitrogen, were collected biweekly at 10 stations: CSHH #1, #3, #6-8, #12-13, #14A, #15A, and #16 (with access to #6 and #7 being tide dependent).

It is important to understand how the various forms of nitrogen are related and reported. Total Nitrogen (TN) comprises inorganic nitrogen and organic nitrogen. Total inorganic nitrogen (TIN) is the sum of nitrate (NO_3), nitrite (NO_2), and ammonia (NH_3) in both its dissolved and undissolved forms. Organic nitrogen refers to the nitrogen in organic compounds, such as amino acids and urea. Total Kjeldahl nitrogen (TKN), an analytical nitrogen parameter, is the sum of organic nitrogen and ammonia.

Dissolved inorganic nitrogen (DIN) consists of NO_3, NO_2, and NH_3 in the form most readily available to phytoplankton. As a result, it often controls the formation of algal blooms and is used by US EPA as an indicator of estuarine water quality (*U.S. Environmental Protection Agency. Office of Water and Office of Research and Development. (2015). National Coastal Condition Assessment 2010 (EPA 841-R-15-006). Washington, DC. December 2015. http://www.epa.gov/national-aquatic-resource-surveys/ncca*). In the most recent National Coastal Condition Assessment, the US EPA identifies DIN as an indicator of nutrient enrichment and estuarine water quality and states that DIN concentrations >0.5 mg/L are considered an indicator of poor water quality. Currently, CSHH does not test specifically for DIN, however CSHH does calculate TIN. If TIN (which includes DIN) is less than 0.5 mg/L, this would indicate that DIN must also be below this 0.5 mg/L threshold. However, most of CSHH's TIN measurements are above this threshold, which may indicate elevated DIN levels, but not definitively.

For 2020, CSHH #14A had the highest average TIN level across all stations (5.1 mg/L). Average TIN levels ranged from 0.14 mg/L to 5.1 mg/L. CSHH #1, #3, and #6 had the lowest average TIN levels (0.21 mg/L, 0.14 mg/L, and 0.32 mg/L, respectively). At CSHH #1, #3, and #6, TIN concentrations <0.5 mg/L (which indicate that DIN must also be less than 0.5 mg/L), indicate good to fair estuarine water quality at these locations in terms of this parameter.

The tidal indicator protocol established by the Mid-Atlantic Tributary Assessment Coalitions (*Wicks 2011, as cited in Taillie et al 2020. Water quality gradients and trends in New York Harbor. (2020). Regional Studies in Marine Science, Vol. 33, 2020, 100922.*) identifies the following indicator thresholds for total nitrogen levels: >1.2 mg/L are considered very poor (a failing score); 0.8-1.2 mg/L is considered poor; 0.6-0.8 mg/L is considered marginal; 0.4-0.6 mg/L is considered fair; and <0.4 mg/L is considered good (a passing score). In 2020, CSHH #14A had the highest average TN level across all stations (5.8 mg/L). Average TN ranged from 0.41 mg/L to 5.8 mg/L, and the average TN readings for stations CSHH #8, #12, #13, #14A, #15A, and #15B were all above the 1.2 mg/L threshold indicative of poor water quality based on this protocol. CSHH #6 had the lowest average total nitrogen (0.41 mg/L), which equates to a water quality rating of "fair." All measured stations had at least one reading over the course of the season that was at or above the 1.2 mg/L threshold.

The presence of ammonia in the harbor can indicate nutrient enrichment. High levels of ammonia are usually only detected when wastewater systems, including septic tanks, cesspools, and publicly owned treatment works (POTWs), are malfunctioning and discharging to the harbor. CSHH monitors the outflow of the Glen Cove sewage treatment plant (CSHH #8), which is likely to have some detectable amounts of ammonia (see *Appendix D*).

Elevated ammonia levels can also be present in the harbor from stormwater discharges or may even indicate a large presence of fish. This was likely the case in 2016-2018, when ammonia was detected at all stations and seemed to coincide with a large presence of Atlantic menhaden throughout the harbor. In 2020, ammonia was again detected at all sampled stations, with levels ranging from 0.10 mg/L to 1.60 mg/L. CSHH #14A had the highest average ammonia level across all stations (0.65 mg/L). Averages for each station ranged from 0.01 mg/L to 0.65 m/L. CSHH #3, #15A, and #16 had the lowest average ammonia levels (0.06 mg/L, 0.07 mg/L, and 0.01 mg/L, respectively). At these stations, between 50% (CSHH #3 and CSHH #15A) and 91% (CSHH #16) of readings were below detection limits for ammonia.

Nitrate and nitrite occur in later stages of the nitrogen cycle and are normally present in the estuary. However, high concentrations indicate enrichment problems and can also be used to anticipate algal blooms and hypoxia. Of the regularly monitored stations, average nitrate levels across monitoring dates at each station ranged from 0.06 mg/L to 4.8 mg/L, with a high of 11.6 mg/L observed at CSHH #14A on 10/7/20. CSHH #14A had the highest average nitrate level (4.8 mg/L), followed by CSHH #15A (3.2 mg/L). CSHH #1, #3, and #16 had among the lowest average nitrate readings, ranging from 0.06 mg/L to 0.08 mg/L. Similarly, at these three stations, 73%, 55%, and 50% of nitrate readings were below detectable limits, respectively. CSHH #16 also had a high occurrence of readings under detectable limits (73%), although a maximum nitrate reading of 6.6 mg/L on 10/7/20 raised the station's average total nitrate level across all sampling dates.

Nitrogen contamination can potentially pose problems for drinking water quality. Nitrogen contamination of groundwater has the highest potential for health impacts in places like Long Island, where drinking water comes solely from groundwater. Excess nitrate levels present in drinking water due to contamination from fertilizers, septic systems, and manure can lead to "blue-baby" syndrome in infants.

Following years of studies and modeling around Long Island Sound, nitrogen discharge limitations were imposed on sewage treatment plants all around the sound to reduce nitrogen outputs to help reduce algal blooms and the frequency and duration of low oxygen levels throughout the sound. However, reducing stormwater inputs is more complicated because the sources of nitrogen and other pollutants are so diffuse.

The consistently high levels of nitrogen indicators at CSHH #14A, the Powerhouse Drain outfall, may be expected given that this station receives considerable stormwater runoff that may be contaminated by nutrient-heavy sources (fertilizer, pet waste, etc.). The lowest levels of nitrogen indicators were seen at stations CSHH #1, #3, #6, and #7. CSHH #1 and #3 had the lowest average levels of ammonia, total inorganic nitrogen, and nitrate. Stations CSHH #6 and CSHH #7 had the lowest average total nitrogen. All four of these stations were below detection levels for nitrite on all sampling dates in 2020.

It is also worth noting that there were persistent algal blooms in the lower harbor around stations CSHH #6 and CSHH #7 in 2020. While algal blooms are typically (and correctly) associated with high nutrient levels, it is not unexpected to see lower nutrient levels observed in the vicinity of ongoing algal blooms because the blooms consume nutrients, therefore reducing their concentrations in the surrounding waters.

Plots showing nitrogen data from 2018-2020 are included in *Appendix D*. Nitrogen data collected in earlier years is no longer presented because these data cannot be meaningfully compared with the more recent data due to the changes in methodology discussed above. Historically, there was little variability in most locations from 2006-2009 but significant variability from 2012-2020. These earlier data are available in prior years' reports.

3.8 Bacteria

For Hempstead Harbor, Nassau County Department of Health (NCDH) and New York State Department of Environmental Conservation are the agencies that have jurisdiction in opening or closing swimming beaches and shellfish beds, respectively. Both agencies use ***fecal indicator bacteria levels*** and other factors to determine whether beaches or shellfish beds require temporary or extended closures.

Fecal coliform and **enterococci bacteria** are the types that are measured and used as indicators for water-quality standards. They are typically found in human and warm-blooded animals and are, therefore, used as the indicators of fecal contamination and the potential for the existence of other organisms that may have an adverse impact on human health. **Total coliform bacteria** are widely present in the environment, whereas **fecal coliform** is most commonly found in the intestines of warm-blooded animals (such as birds), and **enterococci** are most prevalent in the human digestive system.

3.8.1 Beach-Closure Standards

In October 2000, Congress enacted the Beaches Environmental Assessment and Coastal Act of 2000 (BEACH Act), which gave US EPA the authority to set and impose water-quality standards for coastal beaches throughout the United States and compelled all states to adopt new criteria for determining beach closures by April 2004.

In response, New York State instituted revised beach-closure standards on June 23, 2004, presented in NYCRR Title 10, Section 6-2.15. The standards for marine water include the following thresholds:

1. Based on a single sample, the upper value for the density of bacteria shall be:
    a. 1,000 fecal coliform bacteria per 100 ml; or
    b. 104 enterococci per 100 ml.
2. Based on the mean of the logarithms of the results of the total number of samples collected in a 30-day period, the upper value for the density of bacteria shall be:
    a. 2,400 total coliform bacteria per 100 ml; or
    b. 200 fecal coliform bacteria per 100 ml; or
    c. 35 enterococci per 100 ml.

Although coliform and enterococci are present in the human intestine and also in the intestines of warm-blooded animals, EPA considers the enterococcal standard to be more closely correlated with human gastrointestinal illnesses and, therefore, more protective of human health.

Key Findings – Bacteria

- Among area beaches, Crescent Beach had the highest average fecal indicator bacteria levels in 2020, whereas Tappen Beach had the lowest.
- Beaches were preemptively closed due to precipitation on 10 rain dates.
- Bacteria levels (for the indicator bacteria--fecal coliform and enterococci) at the outer-harbor stations are always lower than near-shore stations, because they are less influenced by stormwater and other discharges from shore.
- Bacteria levels continued to decline generally at Scudder's Pond outfalls for both summer and winter testing, although there was a slight variation between the two indicator bacteria in 2020 as compared with 2019. During summer testing, there was a slight increase in fecal coliform exceedances at both stations with a decrease in enterococci exceedances at #15A and #15B compared with the previous summer season. There was a slight increase in winter fecal coliform exceedances at both stations in 2020, with a decrease in enterococci exceedances at #15A and #15B compared with 2019 enterococci levels.
- The outfall for the Powerhouse Drain continued to have consistently high levels of bacteria for samples taken directly from the discharge. Fecal coliform exceedances decreased in the regular monitoring season (compared with previous year) and increased for the winter season. Enterococci increased for both the regular and winter season testing when compared with the previous year.
- As in previous years, some of the highest bacteria levels were recorded at stations near outfalls in Glen Cove Creek. However, the number of exceedances in bacteria levels (using swimming standards) were still higher in 2020 at the Powerhouse Drain than at areas in Glen Cove Creek.
- Results from winter monitoring have shown that bacteria levels for samples collected in cold weather are not always lower than for samples collected during the summer season. It could be due to slower decay rates due to UV and temperature conditions.

In 2008, enterococcus became the sole indicator organism recommended by the EPA and required by the New York State Sanitary Code for Bathing Beaches (Subpart 6-2) for evaluating the microbiological quality of saline recreational beach water. NCDH, therefore, discontinued analyzing beach water samples for fecal coliform.

On July 31, 2014, EPA issued an updated version of its National Beach Guidance and Required Performance Criteria for Grants. Key changes in the 2014 Beach Guidance include:

- Updating the science on pathogens, fecal indicator bacteria (FIB), and health concerns
- Updating the science on beach water-quality monitoring
- Providing guidance on when to issue or remove a notification
- Describing new beach notification and communication tools, such as social media, e-mail, and text messages
- Adding new performance criterion

The guidance was partially implemented, most notably with regard to communication and notification of precautionary administrative beach closures. In 2015, NCDH started issuing “advisories” to close beaches rather than administrative or preemptive closures when rainfall exceeds a half inch in a 24-hour period (see more below).

3.8.2 Beach Monitoring for Bacteria Levels

Each beach season, samples for bacteria testing are collected twice a week by the Nassau County Department of Health at beaches around the harbor. These bacteria samples are analyzed at the NCDH laboratory in conformance with beach-closure standards that were implemented in 2004. (Although, NCDH discontinued the analysis of fecal coliform for beach closures in 2008, it continued both fecal coliform and enterococci analyses for the midharbor samples collected by CSHH to allow for more consistency in the comparison of data.)

During the 1980s, chronic raw sewage spills into Hempstead Harbor caused elevated levels of bacteria, affecting shellfish beds and recreational use of the harbor. Between 1986 and 1990, beaches around Hempstead Harbor were closed an average of eight days each beach season due to high coliform counts. Beach closures dropped off significantly during the early years of CSHH's monitoring program, and, for beach seasons 1994-1999, there were no beach closures due to high bacteria levels.

However, in 2000, NCDH initiated a preemptive (or administrative) beach-closure program. This means that in addition to closing beaches based on high bacteria sample results, NCDH closes beaches as a precautionary measure following rain events that exceed a threshold level and duration of precipitation. That threshold is established at the beginning of each season based on previous sample results, but typically, the threshold is ½ inch or more of rain in a 24-hour period. Therefore, even though water quality has improved remarkably, beach closures started to increase because of the preemptive closures. The 2015 change to advisories, left the actual closures up to the local municipal jurisdictions, amounting to the same result—beach closures following a half an inch of rain within 24 hours.

In 2020, area beaches were closed as a precautionary measure on 10 days. The dates of closure included 5/23, 5/24, 7/10, 7/11, 7/23, 7/31, 8/14, 8/18, 9/4, and 9/10. These same beaches were closed preemptively for 2 days (5/26, 5/27) due to a sewage spill in Port Washington on 5/26. Sea Cliff Beach was also closed 4 days due to elevated bacteria levels (9/19-9/22). (Note that in calculating the total number of days that beaches are closed for each season, NCDH totals the number of days that each beach is closed, even if several beaches around the harbor are closed for the same rain event. Also, the beach at the Village Club of Sands Point is considered "nonoperational" and so is not closed preemptively or otherwise.)

NCDH continues to monitor Crescent Beach in Glen Cove, which has been closed since 2009 due to a known source of high bacteria from the stream that runs alongside the beach and into the harbor. (The high bacteria levels were thought to be caused by failing septic systems upland of the beach. However, in 2018, additional tests, including DNA/source tracking, were conducted that pointed to wildlife as the source of the bacteria. In August 2018, DEC stated that the tests "confirmed that there is no direct or indirect discharge from septic systems along the stream corridor." However, DEC stated that it will continue its investigation to see whether faulty septic systems near Crescent Beach or other locations may be leaking waste that travels through groundwater into the stream. More testing was planned along with a feasibility study for addressing the issue through different treatment technologies.)

Monthly average beach data are presented in *Table 3*.

3.8.2.1 Comparing Bacteria Data for Beaches

Variability in bacteria concentrations from samples collected at individual beaches on a particular day is presented in the data contained in *Appendix C*. Although rainfall can increase bacteria in a water body, it is difficult to see clear and consistent influences from rainfall when rainfall dates are plotted against bacteria counts. It is also important to note that changes in government regulations, testing protocols, and methodologies for sample analysis make it difficult to compare water-quality conditions relating to bacteria levels over time. For example, the method used for enterococci analysis by the NCDH laboratory changed from the 2004 to 2005 monitoring seasons, making comparisons between data from the two years difficult.

In 2020, monthly average bacteria results for enterococci at area beaches ranged from 0.10 CFU (colony forming units)/100 ml at Village Club of Sands Point and Sea Cliff Beaches in May to 172.07 CFU/100 ml at Crescent Beach in August. Overall, in 2020, Crescent Beach had the highest average bacteria levels, whereas Tappen Beach had the lowest (see *Table 3* below; see *Appendix C* comparing previous years).

Table 3
Monthly Average for Beach Enterococci Data for 2020

	Units in CFU/100 ml*	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	--	--	--	--	--	--	--
May	Enterococci	0.10	17.03	10.40	2.03	0.10	1.05	1.70
June	Enterococci	14.79	4.38	4.79	8.79	13.02	9.59	69.27
July	Enterococci	106.46	13.24	6.90	15.56	10.68	28.94	16.64
August	Enterococci	21.22	31.01	84.63	6.02	3.01	17.32	172.07
September	Enterococci	12.00	19.00	21.00	26.00	96.28	1.55	10.35
*Season Averages**	*Enterococci*	*48.38*	*15.89*	*27.19*	*9.85*	*18.41*	*16.15*	*71.87*

**The New York State standard sets the upper limits of enterococci at 104 colony forming units (CFU) per 100 milliliters of water for a single sample and 35 CFU for the 30-day logarithmic average; the units in the table above are calculated as an arithmetic average.*

3.8.3 Monitoring CSHH Stations for Bacteria Levels

CSHH collects samples for bacteria analysis at 21 CSHH monitoring stations in Hempstead Harbor (15 stations on a weekly basis and others depending on tidal conditions). Five of these (CSHH #9-13) started as temporary sites but became part of the regular sampling program to test for the presence of bacteria from discharge pipes in Glen Cove Creek in the vicinity of the STP.

Other areas of concern that CSHH regularly monitors for bacteria levels are those draining Scudder's Pond (CSHH #15A and #15B) and the outfall at the bottom of Glenwood Road and Shore Road (CSHH #14A) that drains what is referred to as the powerhouse drain subwatershed. As previously stated, these stations have been monitored since 2009 during the regular monitoring season but were the focus of the Hempstead Harbor winter monitoring program starting in 2013 through present.

In 2015, three new stations—CSHH #16, #17, and #17A—were added to assess the water quality in the certified shellfishing area located in the outer harbor as well as near and in the restricted area off of Crescent Beach. Results from bacteria samples taken at these stations supplement the samples collected by NYS DEC and NCDH.

Regarding the outfall pipes monitored in Glen Cove Creek, there have been unusual and recurring discharges of brown flow from CSHH #9 and white milky flow from CSHH #10 observed and reported over several years at these outfalls, which are near the Glen Cove sewage treatment plant. Unusual discharges were noted in 2004-2006 and were brought to the attention of Glen Cove city officials, NCDH, HHPC, Nassau County Department of Public Works (NCDPW), and NYS DEC. In 2006, representatives from Glen Cove, the city's consultants, and CSHH arranged a boat trip to view the discharge pipes along the creek. Also in 2006, Glen Cove received a NY Department of State grant to map and source the outfalls along both the north and south sides of the creek. As several water samples from the area continued to show high levels of fecal coliform and enterococci, further investigation was needed. In 2007, a follow-up meeting prompted further testing by NCDPW and NCDH, but there were no definitive answers as to the source of the bacteria. In 2008, NCDPW further investigated the discharge pipe at CSHH #10 using a camera, and NCDH did dye testing at a possible source, but efforts by both county departments and the City of Glen Cove provided inconclusive results.

In 2015, NCDH further investigated possible sources of the white flow observed repeatedly from CSHH #10. The milky discharge was observed in 2017-2020. In 2018, additional tests were performed on samples collected from the white discharge; results showed high levels of calcium carbonate, magnesium, and water hardness, but the source of the discharge remains inconclusive.

Outfalls in Glen Cove Creek: brown discharge from CSHH #9 (l); milky white discharge from CSHH #10 (r) (photos by Carol DiPaolo, 8/19/20 and 9/23/20, respectively)

In 2019, samples collected from the white flow from CSHH #10 and brown discharges from CSHH #9 were tested for bacteria. The brown discharges occurred on three dates in June and had elevated bacteria levels. This was reported to Glen Cove and Nassau County DPW. NCDPW traced the source to a dumpster at the Glen Cove transfer station filled with dog waste that was leaching into a storm drain that led to the outfall pipe. Glen Cove DPW took measures to remedy the problem. Discharges from both CSHH #9 and #10 were observed in 2020. Because of the brown discharges that continued to be observed at CSHH #9 (on August 12 and19 and October 28), a meeting and a walk-through of areas around the STP were held with representatives of Suez, the operator of the STP. NCDPW sent a camera through the pipe in November to see whether there were any breaks in the line, and no breaks or infiltration from other sources were found.

3.8.3.1 Comparing Bacteria Data for CSHH Stations

The time series plots in *Appendix B* also show bacteria results for CSHH monitoring stations. Stations CSHH #2, #16, and #17 are located in the outer harbor and are thus less influenced by discharges from the watershed, which are likely the largest source of bacteria to the harbor. These stations typically show lower bacteria levels than at other stations, and that pattern held true in 2020. As in previous years, some of the highest bacteria levels in 2020 were recorded at stations CSHH #9, #10, and #11, all within Glen Cove Creek.

Similar to 2019, for a few of the sampling events, concentrations of the two indicator organisms–fecal coliform and enterococci–were often noticeably different with low concentrations of one organism and high concentrations of the other (this has been noted in past monitoring seasons as well). Although this difference in the behavior of the two indicator organisms is counterintuitive because one would expect that all indicators of fecal pollution should behave similarly, it is not uncommon. Scientific studies have found that though fecal coliform and enterococci are both used as fecal indicator organisms they are not highly correlated to each other. Both parameters indicate contamination, but the lack of correlation between the two may be related to bacteria source, differing decay rates for the two species, and possibly a differing potential for regrowth in the watershed.

Southern view of Scudder's Pond (l) and Powerhouse Drain (r) (photos by Michelle Lapinel McAllister, 4/30/20 and 5/27/20, respectively)

The Hempstead Harbor water-monitoring program has established levels of bacteria at various in-harbor and shoreline stations and stations in Glen Cove Creek during the regular season. The winter monitoring, which specifically targeted Scudder's Pond (CSHH #15A and #15B) and the powerhouse drain subwatershed (CSHH #14A), now has eight years of data for comparison of bacteria levels. The Hempstead Harbor monitoring program is one of the few programs, if not the only program, testing for bacteria in the winter.

The results of the analysis for winter water samples showed that the bacteria levels did not decline significantly solely as a result of the colder temperatures during the first winter season. Although there was some expectation that bacteria levels would decrease in the colder temperatures, there are factors that may have contributed to the continued higher numbers during the winter: lower temperatures and UV conditions during winter months promote slower decay and longer survival rates of the bacteria species.

Although the powerhouse drain subwatershed outfall experienced a decline in exceedances in winter 2018/2019, exceedances increased in summer 2019 and winter 2019/2020. Furthermore, lower levels of bacteria were observed at this station from March 23 through April 30, 2020; initially, it was thought that the lower bacteria levels may have resulted from the New York State stay-at-home order (for March 13-June 24, 2020) and the subsequent change in local water-usage schedules during the COVID-19 pandemic. Alternatively, it was thought that the decrease in bacteria levels may have been related to the installation (February 12-13, 2020) of 37 storm-drain filters in roads that are off of Glenwood Road. It later seemed that bacteria levels were not affected by either the COVID stay-at-home schedules or the new storm drain filters.

Summer exceedances for the powerhouse drain outfall decreased between 2019 and 2020 for fecal coliform although they increased for enterococci. Winter exceedances for the outfall increased for both fecal coliform and enterococci from 2020 to 2021.

Exceedances at the Scudder’s Pond stations decreased from the previous sampling year for enterococci, and exceedances in fecal coliform increased from the previous monitoring season. Overall, the data indicate improvements in conditions at the Scudder’s Pond outfall as a result of the restoration.

3.8.4 Shellfish Pathogen TMDLs

Shellfish beds in most areas around western Long Island Sound have been restricted or closed to harvesting for between 40 and 70 years. In 2011, shellfish beds in the northern section of Hempstead Harbor were reopened because of water-quality improvements. However, a large area of the harbor remains restricted from shellfish harvesting. Pathogen contamination is the main concern with shellfish beds because of the risk to humans who consume shellfish contaminated by harmful bacteria or viruses present in the water. Fecal coliform is the indicator organism that is used to determine whether certain water bodies are safe for shellfish harvesting. It is associated with human and animal waste and is used to indicate the presence of other more harmful bacteria, similar to the processes used to measure water quality for beaches (see the Beach-Closure Standards in *Section 3.8.1* above).

In August 2007, DEC announced the release of a report on “Shellfish Pathogen TMDLs for 27 303(d)-listed Waters” (including Hempstead Harbor). Under Section 303(d) of the federal Clean Water Act, states are required to develop plans to decrease the total maximum daily loads (TMDLs) of all pollutants that cause violations of water-quality standards. The DEC had listed 71 “Class SA” water bodies as being pathogen impaired, which therefore made them impaired for shellfishing. Class SA is the highest classification given to marine and estuarine waters and is applied to waters that are considered to have ecological, social, scenic, economic, or recreational importance. Class SA waters are offered the highest level

Table 4
Stations Exceeding Bacteria Standards[1]—Summer and Winter Monitoring

CSHH Stations	**#15A[2]**		**#15B[7]**		**#14A[2]**	
% of CFU[3] Exceedances	**FC[4]**	**ENT[5]**	**FC**	**ENT**	**FC**	**ENT**
5/5/13-11/13/13	17%	45%	29%	69%	32%	68%
11/18/13-5/14/14	13%	58%	13%	58%	50%	85%
Scudder's Pond Restoration Completed June 2014						
5/21/14-11/5/14	8%	36%	20%	28%	25%	100%
11/13/14-4/29/15	8%	33%	10%	30%	--[6]	--[6]
5/7/15-11/4/15	23%	31%	19%	23%	60%	64%
11/11/15-4/27/16	20%	15%	15%	10%	68%	89%
5/1/16-10/26/16	0%	29%	0%	24%	92%	69%
11/9/16-4/26/17	0%	23%	23%	15%	50%	75%
5/10/17-10/27/17	0%	26%	0%	17%	4%	67%
11/1/17-5/4/18	25%	38%	25%	25%	44%	59%
5/23/18-10/31/18	14%	26%	21%	25%	27%	65%
11/8/18-4/25/19	0%	0%	0%	0%	58%	17%
5/15/19-10-30/19	4%	29%	0%	33%	13%	58%
11/6/19-4/30/20	0%	38%	0%	38%	23%	46%
5/20/20-10/28/20	9%	26%	13%	25%	4%	74%
11/12/20-4/14/21	14%	29%	17%	33%	33%	67%
Average–Summer Post-Restoration	8%	29%	10%	25%	32%	71%
Average–Winter Post-Restoration	11%	29%	12%	21%	43%	53%

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[1] For purposes of comparison, thresholds for fecal coliform and enterococci for beach-closure standards are used here.

[2] Percent of exceedances may not reflect the monitoring events when samples are collected during high tide and the discharge is mixed with harbor water and, thus, diluted.

[3] CFU: colony-forming units

[4] FC: fecal coliform

[5] ENT: enterococci

[6] Only one sample collected during this period.

[7] Starting in summer 2019 season, only monthly testing at CSHH #15B.

of protection and must, by law, be suitable for recreation in and on the water, fishing, aquaculture, propagation and harvesting of shellfish, and as habitat for fish and other marine life.

The TMDL report called for a 95% load reduction, which contradicted DEC test results that showed that a portion of the harbor's shellfish beds could be reopened. At an October 16, 2008 meeting, DEC stated that the ultimate objective of the TMDL is to open the harbor to shellfishing, and, therefore, in the event that the entire area of Hempstead Harbor’s Class SA waters is opened, the TMDL would be satisfied and no additional remedial actions (other than monitoring) would be required. However, there may be a portion of the harbor’s SA waters that will not be reopened–even in the long term. Therefore, efforts to reduce bacteria will be required along with continued monitoring.

In 2018, DEC rescinded the pathogen TMDLs and in December 2018 created a pathogen TMDL workgroup to discuss formulation of new TMDLs and ways to prioritize the waterbodies around the state that would be addressed first in this new effort. CSHH and HHPC are members of this workgroup.

3.8.5 Monitoring Shellfish Growing Area

In 2009, in an attempt to assess water quality and determine whether opening mid- and lower sections of the harbor to shellfish harvesting should be pursued, CSHH partnered with DEC to collect water samples. Thirteen of the 19 stations sampled were the same stations established by DEC in 1988 for shellfish growing area (SGA) #50. The samples were delivered to the DEC lab in East Setauket, where they were analyzed for fecal coliform. The results showed that the sampling stations exceeded single-sample standards (49 FC/100ml) 37% of the time with DEC #13 (outside of Glen Cove Marina in Glen Cove Creek) exceeding at the highest rate, 53%.

Before this type of testing can be initiated once again, there would have to be some indication of additional water-quality improvements, e.g., from structural changes completed around the harbor to reduce runoff and bacteria loading.

3.8.6 Certified Shellfish Beds in Outer Harbor

On June 1, 2011, 2,500 acres of recertified shellfish beds were opened in the outer section of Hempstead Harbor. This followed five years of rigorous water-quality testing, as well as testing of samples of hard-shell clams from the area. For the first time in more than 40 years, clams, oysters, mussels, and scallops could be taken from this area by both commercial and recreational clammers, consistent with the size and quantity limits set for state waters.

One of the buoys marking the closed area around Crescent Beach (l) and a posting for the area closed to shellfishing at Tappen Marina (r) (photos by Jim Moriarty and Carol DiPaolo, 6/15/11 and 9/21/11, respectively)

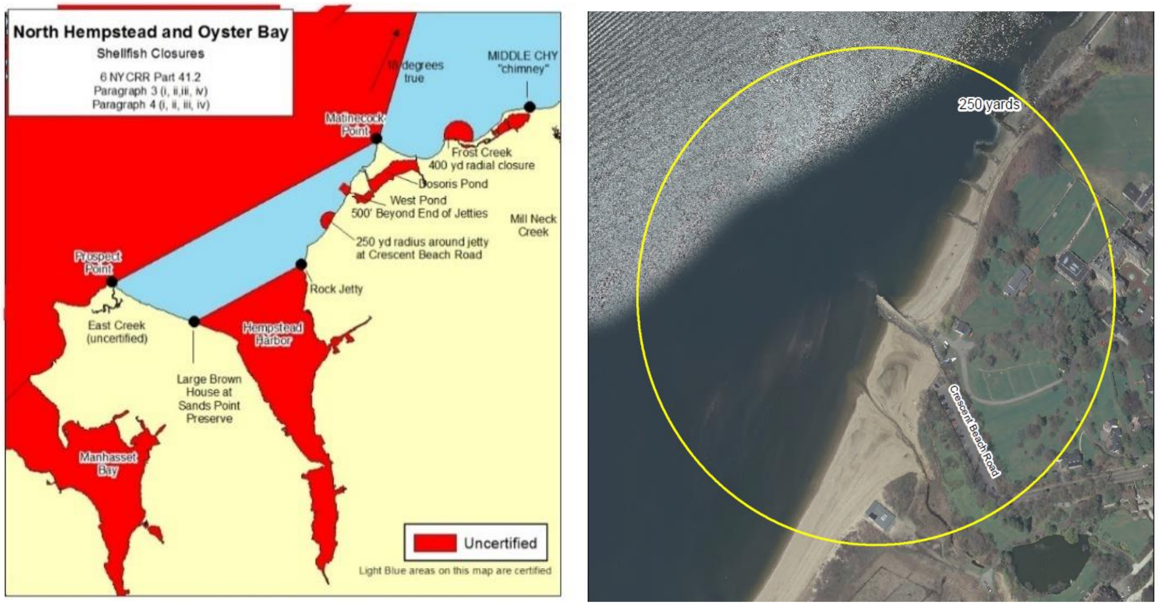
The rest of the harbor and East Creek, West Pond, and Dosoris Pond, which empty into the outer harbor, remain closed to shellfishing. A small semicircular area around Crescent Beach is also closed to shellfishing. (Crescent Beach has been closed for swimming since 2009; see *Section 3.8.2*.) In May 2018, approximately eight acres outside the mouth of West Pond, on the eastern shoreline of outer Hempstead Harbor, was reclassified as uncertified (closed) for shellfish harvesting because of an increase in bacteria levels. See *Figure 13*.

Signs have been posted along the shoreline in areas that remain uncertified. Three buoy markers delineate the 250-yard radius around Crescent Beach that remains closed to shellfishing.

The DEC continues to monitor the water quality of the reopened shellfish area and make necessary changes to the area's classification as conditions warrant. DEC follows a protocol for temporarily closing certified shellfish beds after a threshold amount (3 inches) and duration of rainfall, similar to NCDH's protocol for closing beaches, to protect against health risks associated with high bacteria levels caused by stormwater runoff. In 2019, the shellfish beds in Hempstead Harbor and other bays along Long Island's north shore were closed on July 23 and reopened on July 27 due to heavy rainfall on July 22-23, 2019. There were no closures of Hempstead Harbor certified shellfish beds in 2020. Information about shellfish-bed closures is disseminated through a prerecorded phone message at 631-444-0480, the DEC website (http://www.dec.ny.gov/outdoor/7765. html), and through press releases to local media outlets.

Figure 13

NYS DEC's 2018 Map of Hempstead Harbor Uncertified Shellfishing Areas and Aerial View of the Crescent Beach Closure Line



3.8.7 Bacteria Source Tracking

Because water quality has greatly improved over the years, increasing numbers of water birds are now seen on and around the harbor, and there is a question as to whether the birds are a significant factor in bacterial levels in Hempstead Harbor. Bacteroides analysis, along with other types of monitoring, would help answer that question so that appropriate strategies could be formulated.

In March 2010, CSHH and HHPC developed a proposal to expand the water-monitoring program to include bacteria source tracking at midharbor stations as well as at specific outfalls that are suspected of contributing high levels of bacteria to Hempstead Harbor. The goal of the proposal was to determine whether most of the bacteria entering the harbor are primarily from human or nonhuman sources through specialized genetic testing using a bacteroides marker. Unfortunately, funding was not available for the proposal.

In 2018, US EPA along with US Geological Survey and NYS DEC began using new methods of source tracking for several areas around Hempstead Harbor, including Crescent Beach (see *Section 3.8.2*).

3.9 Precipitation

Precipitation affects Hempstead Harbor water quality directly on the harbor's surface and through stormwater runoff. Both of these inputs can reduce the harbor's salinity. Direct precipitation tends to also dilute the quantity of pollutants within the harbor, although it can carry airborne pollutants. Stormwater runoff increases pollutant loads by washing bacteria, chemicals, and nutrients that have accumulated on the ground surface in the watershed into the harbor.

View from lower Hempstead Harbor looking north (photo by Carol DiPaolo, 7/15/20)

CSHH collects precipitation data using a rain gauge located in Sea Cliff (note that 25.4 mm is equivalent to approximately 1 inch). *Table 5* presents monthly total precipitation for the months of June through October from 1997 through 2020.

Total precipitation measured during June through October 2020 (594.62 mm, or 23.4 inches) was 25.0 mm (1.0 inches) or 4.0% lower than the average total precipitation during the previous 23 monitoring seasons (619.6 mm, or 24.4 inches). Typically, the distribution of precipitation varies from month to month. In 2020, June was the driest month (46.48 mm), whereas October was the wettest month of the monitoring season (175.77 mm). There were 10 precipitation events during the monitoring season that produced over 25 mm of rain (35.56 mm on 3/23, 47.24 mm on 4/13, 43.43 mm on 7/10, 36.32 mm on 7/31, 36.58 mm on 8/13, 29.97 mm on 9/3, 44.96 mm on 9/10, 31.75 mm on 10/12, 46.48 mm on 10/16, and 37.08 mm on 10/29). Precipitation on these dates may have influenced water quality measurements occurring on or shortly after those days.

Links between precipitation and salinity are described above in *Section 3.3*.

The strongest relationships between precipitation (indicated by previous day's rain) and bacteria were seen at stations CSHH #3, CSHH #5, and CSHH #14, where bacteria increased with increasing precipitation.

Table 5
Monthly Rainfall Totals for the 1997-2020 Monitoring Seasons, in mm

	June	July	August	September	October	Total
2020	46.48	141.99	116.33	114.05	175.77	594.62
2019	92.20	212.09	130.05	9.14	156.97	600.45
2018	75.95	103.89	147.32	158.75	112.27	598.18
2017	124.7	118.4	131.6	64.8	145.5	585.0
2016	36.6	134.1	141.9	75.9	147.1	535.6
2015	130.3	75.7	76.2	75.2	156.5	513.9
2014	81	78.5	93.5	59.5	112	424.5
2013	235	69	59	75.5	8.5	447
2012	175.5	140.5	140.5	117.5	92.5	666.5
2011	127.5	48.5	381.5	163	122	842.5
2010	50.5	103.5	61.5	97	146	458.5
2009	294	150.5	83	69	175	771.5
2008	79.5	91	205.5	177.5	118	671.5
2007	159.5	198.5	132.5	36.5	136	663
2006	262	148	89	105	166.5	770.5
2005	45	81	41	28.5	460.5	656
2004	95	214	91	310.5	40	750.5
2003	291.5	87	88	194.5	134	795
2002	180.5	22.5	175.5	116.5 (9/15-30)	180	675+
2001	167	70.5	165	94	19.5	516
2000	146	159	158	125	6	594
1999	31	21	135	323	92	602
1998	191	59	145	90	97	582
1997	47	232	141	84	27 (10/1-15)	531+

4 Observations

The 2020 water-monitoring season for the Hempstead Harbor core program began on June 3 and extended through October 28 (monitoring for the Unified Water Study began on June 23 and extended through October 15); winter monitoring of shoreline outfalls ran from November 12, 2020, through April 14, 2021. As mentioned earlier in this report (*Section 2.2.1*), the 2020 monitoring schedule was adjusted to reflect safety recommendations for COVID-19.

During all monitoring surveys, wildlife observations are noted. These observations along with information from formal fish surveys and studies help fill out the picture of the health of the harbor's habitat. Local residents also play an important role in providing information on what they see throughout the year not only in and on the water, but also close to the harbor’s shores.

4.1 Biological Monitoring Report and Impact of Powerhouse Substation Removal

In 2015, the old brick powerhouse building (which had been part of the Glenwood Landing power plant operation since the early 1900s) was demolished, following the dismantling of the adjacent Substation 3 (in 2013). The substation operated at minimum capacity as a “peaking plant” and was the subject of a marine-life monitoring report–the Glenwood Power Station Entrainment and Impingement Monitoring Report (by ASA Analysis & Communication, Inc., September 2005). The power station monitoring report has been referenced in the Hempstead Harbor annual water-monitoring reports since 2005 because it provides a baseline of marine species that live in the harbor. Thirty-four types of fish and several other marine animals were found in the samples collected for that report.

In June 2012, LIPA and National Grid released the Environmental Impact Statement (EIS) for the demolition of the peaking plant (see http://www.hempsteadharbor.org/applications/DocumentLibraryManager/HHPCupload/Glenwood_EIA_Final%20June%202012%20.pdf).

Site of the former brick powerhouse building (photo by Michelle Lapinel McAllister, 5/27/20)

The EIS projected that the demolition of the plant would provide water-quality improvements: elimination of the thermal discharge from the plant, preservation of 11 to 18.5 million gallons annually of freshwater that no longer had to be pumped from on-site wells and the municipal system, and an estimated 5,300 fish and 190 million fish eggs, larvae, and early juveniles would no longer be destroyed annually in the plant's intake system. It's possible that the increase in fish populations noted over the last few years is a result of this change in Hempstead Harbor.

4.2 A Study of Striped Bass in NYS Marine District

Seine surveys for the NYS DEC's striped-bass study have been conducted in western Long Island bays since 1984 and in the Hudson River since 1979. Every year, the DEC prepares a report on the previous season's surveys entitled "A Study of the Striped Bass in the Marine District of New York State."

Although the study first found that striped bass spent their first year of life in the lower Hudson River, over recent years the nursery for young-of-the-year striped bass has expanded to bays around western Long Island. Although the purpose of the study is to examine the striped bass that have migrated out of the Hudson River as one- and two-year-old fish, the report provides important information on other species as well.

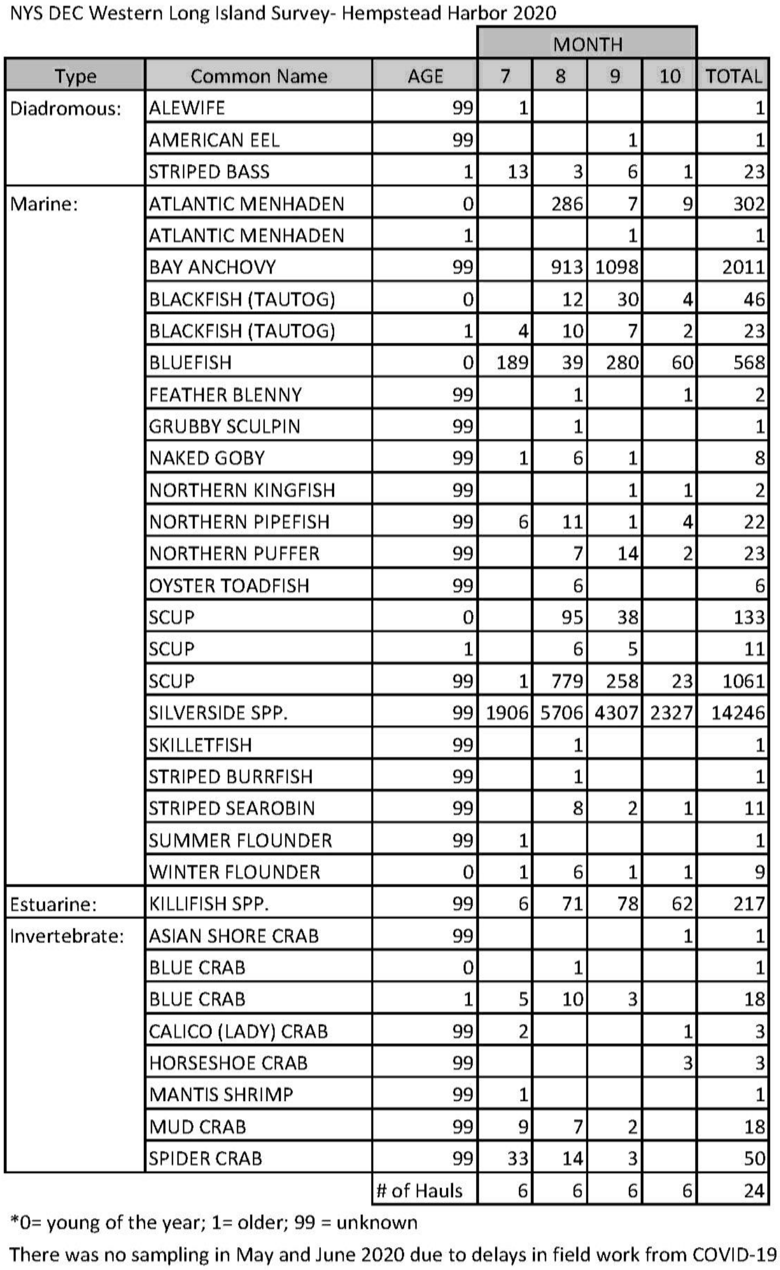
Most of the seining for western Long Island occurs in Jamaica, Little Neck, and Manhasset Bays, but Hempstead Harbor, Cold Spring Harbor, and Oyster Bay are also surveyed. The crew seines at six stations in Hempstead Harbor monthly, May through October. The catch totals for the harbor included in *Table 6* were provided by Caitlin Craig, marine biologist at the NYS DEC Bureau of Marine Resources, Diadromous Fisheries Unit.

The numbers for many of the fish caught in Hempstead Harbor seines were up from 2013 (the year that the power plant substation that was located along the shore of the lower harbor was dismantled; see the previous section on the Glenwood power station monitoring report). Most significantly, the Atlantic menhaden (young of the year), which were not included in the 2013 seine catch, were up to a stunning count of 203,932 in 2015. In 2017-2019, the "bunker" totals were 12,086, 3,165, and 1,386, respectively.

Significant seine catches in Hempstead Harbor for 2019 included those for sand lance (321, up from 34 in 2018) and scup (porgies) (7,305, up from 1,130 in 2018). Unusual catches in 2019 included two hogchokers (small flat fish) (never before caught in Hempstead Harbor for the DEC time series) and two smooth dogfish (only the fourth time these have been caught in the seine survey).

Note that in 2020 no seining was conducted in May and June because of COVID-19 delays. Therefore, the total catches and the number of species represented in Table 6 for the entire season are reduced from previous years' seasonal totals.

Table 6
NYS DEC Western Long Island Beach-Seine Survey for Hempstead Harbor 2020



NYS DEC Western Long Island Survey- Hempstead Harbor 2020

			MONTH				
Type	Common Name	AGE	7	8	9	10	TOTAL
Diadromous:	ALEWIFE	99	1				1
	AMERICAN EEL	99			1		1
	STRIPED BASS	1	13	3	6	1	23
Marine:	ATLANTIC MENHADEN	0		286	7	9	302
	ATLANTIC MENHADEN	1			1		1
	BAY ANCHOVY	99		913	1098		2011
	BLACKFISH (TAUTOG)	0		12	30	4	46
	BLACKFISH (TAUTOG)	1	4	10	7	2	23
	BLUEFISH	0	189	39	280	60	568
	FEATHER BLENNY	99		1		1	2
	GRUBBY SCULPIN	99		1			1
	NAKED GOBY	99	1	6	1		8
	NORTHERN KINGFISH	99			1	1	2
	NORTHERN PIPEFISH	99	6	11	1	4	22
	NORTHERN PUFFER	99		7	14	2	23
	OYSTER TOADFISH	99		6			6
	SCUP	0		95	38		133
	SCUP	1		6	5		11
	SCUP	99	1	779	258	23	1061
	SILVERSIDE SPP.	99	1906	5706	4307	2327	14246
	SKILLETFISH	99		1			1
	STRIPED BURRFISH	99		1			1
	STRIPED SEAROBIN	99		8	2	1	11
	SUMMER FLOUNDER	99	1				1
	WINTER FLOUNDER	0	1	6	1	1	9
Estuarine:	KILLIFISH SPP.	99	6	71	78	62	217
Invertebrate:	ASIAN SHORE CRAB	99				1	1
	BLUE CRAB	0		1			1
	BLUE CRAB	1	5	10	3		18
	CALICO (LADY) CRAB	99	2			1	3
	HORSESHOE CRAB	99				3	3
	MANTIS SHRIMP	99	1				1
	MUD CRAB	99	9	7	2		18
	SPIDER CRAB	99	33	14	3		50
		# of Hauls	6	6	6	6	24

*0= young of the year; 1= older; 99 = unknown

There was no sampling in May and June 2020 due to delays in field work from COVID-19

4.3 Shellfish Surveys and Reports

As mentioned in *Section 3.8.6*, June 1, 2011, marked the first time in over 40 years that the shellfish beds in the northern section of Hempstead Harbor were reopened for harvesting. The 2,500 acres of recertified shellfish beds extend in a wide strip from the east to west shore of the harbor. The recertification of the beds is important not only because this area is now productive for both commercial and recreational harvesting, but also because this is the best indicator of the dramatic water-quality improvements that have been made in Hempstead Harbor.

A recreational clammer in 2018 (l) and sorted clams from Hempstead Harbor on opening day of the shellfish area (r) (photos by Carol DiPaolo, 9/14/18 and 6/1/11, respectively)

The southern boundary of the recertified area extends from a rock jetty north of the Legend Yacht and Beach Club community (the site of the former Lowe estate) on the east shore to the large "brown house with chimneys" on the west shore (noted on navigational charts), which is Falaise, part of the Sands Point Preserve. (All areas south of this line remain closed to shellfishing.) The northern boundary of the recertified area runs from Matinecock Point on the east shore to Prospect Point on the west shore. However, Dosoris Pond, West Pond, and a semicircular area extending 250 yards off of Crescent Beach on the east shore remain closed to shellfishing. (See *Figure 13*.)

Shellfishing is historically significant for Hempstead Harbor, because it was an important commercial endeavor from about the first quarter of the nineteenth century into the first quarter of the twentieth century. Clams and oysters were shipped regularly from Hempstead Harbor to New York City, until restrictions were imposed because of dwindling resources. By 1928, the lower portion of the harbor was closed to shellfishing because of increasing levels of bacteria in the water (as was the case for most bays in western Long Island Sound and other New York waters). For a time, clam dredgers were harvesting clams in Hempstead Harbor and then transporting them to the Peconic Bay, where they were transplanted and remained for several weeks for purification so they could be sold commercially.

By the late 1990s, clams, oysters, and mussels were abundant throughout the harbor, and because of improved water quality, it seemed time to pursue one of our longstanding goals of reopening the harbor's shellfish beds. But the long, complex process of recertifying shellfish beds required tremendous collaboration as well as adherence to strict protocols for water-quality testing and retesting.

In 1998, CSHH initiated the first step and worked with the Interstate Environmental Commission, DEC, Town of North Hempstead (TNH), and local baymen to conduct a **hard-clam density survey** to determine the extent and condition of the clam population; the survey showed a healthy population of hard clams. From 2004 through 2008, DEC collected water samples from Hempstead Harbor. Several samples of the shellfish from the harbor were collected and tested for chemical contamination, but the results from those analyses were not completed and released until 2010.

Falaise, "the brown house with chimneys," marks the western point of the southern boundary of the certified shellfish beds in Hempstead Harbor (photo by Carol DiPaolo, 10/31/18)

On September 28, 2009, DEC-Bureau of Marine Resources (BMR) in conjunction with the US Food and Drug Administration (FDA) conducted a **hydrographic dye study** in Glen Cove Creek and Hempstead Harbor to test the dilution, dispersion, and time of travel of the sewage effluent discharged by the Glen Cove STP. A shoreline survey of the harbor was completed in the autumn of 2010, and at that point everything was lined up for the reopening of the shellfish beds in Hempstead Harbor in 2011.

4.3.1 Shellfish Landings

According to the DEC annual shellfish landings report, the 2014 haul of hard clams from Hempstead Harbor totaled 17,424 bushels. That represented the second largest harvest of hard clams for that year out of all of the harvest areas around Long Island, with an economic value of over $1.36 million. See https://www.dec.ny.gov/outdoor/103483.html#12836 for shellfish areas. Subsequent landing reports showed a substantial decrease in the hard-clam haul for Hempstead Harbor. The 2019 landings report showed the hard-clam haul for the harbor at 7,356 bushels, representing an economic value of $638,646; this put Hempstead Harbor in sixth place for the number of hard clams hauled from 30 growing areas around

Long Island. The 2019 soft-clam haul (39 bushels) and oyster haul (28 bushels) from the harbor were down from 2017-18.

In 2020, the hard-clam haul was up near the 2014 high—at 12,389 bushels of hard clams for a value of $1.01 million; this put Hempstead Harbor in third place for the number of hard clams hauled out of 30 growing areas around Long Island. The soft-clam haul (3 bushels) and oyster haul (18 bushels) represented a further decrease from previous years. While Hempstead Harbor's haul of hard clams increased significantly in 2020, numbers of hard clams, soft clams, and oysters dramatically decreased for Oyster Bay and Huntington Bay.

4.3.2 Monitoring Clamming Activities

In the first few weeks after the opening of the shellfish beds in Hempstead Harbor, large numbers of clam boats could be seen daily, clustered in essentially the same northeast area of the recertified beds; they were loaded with large mesh bags of clams. CSHH began incorporating a trip to the area during weekly monitoring surveys to record the number of boats harvesting clams throughout the season. Most of the commercial clammers work the area near Matinecock Point, and fewer are near Crescent Beach. In 2020, we observed 6 or fewer clam boats on most monitoring dates; on four dates there were 8-13 clammers (6/25, 7/1, 7/15, and 7/29). The number of clammers in Hempstead Harbor varies with weather and water-quality conditions in other bays further east; if shellfish beds in eastern bays are closed, we notice more clammers in Hempstead Harbor. It is odd that we observed fewer clammers than is previous years (possibly because of COVID-19), but the haul for hard clams in 2020 was near the 2014 peak.

4.3.3 Shellfish-Seeding Projects

The first shellfish-seeding project for Hempstead Harbor was conducted on October 9, 2007, as a joint initiative that included Nassau County, the TNH, TOBAY, Cornell Cooperative Extension, Frank M. Flower & Sons Oyster Company, as well as HHPC and CSHH, and was intended to add biomass to the harbor using a resource that could help improve water quality–each adult clam and oyster can filter 1 to 2.5 gallons of water per hour, with daily estimates (for oysters) of 30 to 60 gallons. A little neck clam can filter about 4.5 gallons per day, and an adult hard clam can filter about 24 gallons per day.

The shellfish stock for the seeding project came from Cornell Cooperative Extension and Frank M. Flower & Sons Oyster Company, and included more than 1.3 million seeds, consisting of two types of hard-shell clams (*Mercenaria mercenaria* and *M. mercenaria notata*) and oysters. (The *M. mercenaria notata* has markings that are different from the northern quahog stock normally found in Hempstead Harbor, which would later help in gauging the survival rate of the seeds.)

On October 15, 2009, Nassau County conducted the second shellfish seeding in Hempstead Harbor, which included 1.1 million clams and oysters. Funding for the 2009 shellfish-seeding operation was provided by the Long Island Sound Study, through the Long Island Sound Futures Fund.

Following the opening of the shellfish beds in Hempstead Harbor in 2011, the prospect of reseeding the beds was raised as a measure of sustainability, but finding the necessary funding for such a project is problematic. The Tappen Marina aquaculture project described at *Section 2.3* may eventually provide the stock of clams needed for seeding Hempstead Harbor.

4.3.4 Surveys to Assess Survival of Seed Clams and Oysters

In late summer 2008, CSHH requested a permit from DEC to conduct a shellfish-density survey in the area of the 2007 seeding project in Hempstead Harbor to gauge the survival rate of the seeds. We selected seven of the GPS points previously recorded for raking. The area seeded in 2007 included a transition from thick, muddy bottom to a harder, sandier bottom.

In the areas of thick, black mud (the deeper-water stations), we did not find hard-shelled clams and oysters; instead, we found an abundance of the very small surf clams referred to as "duck feed." As the bottom transitioned to sand closer to shore, we found a variety of clam sizes, from littlenecks to chowder, and the largest number in one raking included 10 clams. We also found a variety of other clams, some crabs, 4 small mantis shrimp, small snails, oyster drills, and broken shells of oysters, clams, and crepidula (slipper shells). A few seed clams of both types of clams used in the seeding project–*Mercenaria mercenaria* and *M. mercenaria notata*–were found, but they seemed to be naturally occurring because they were too small to have been from the 2007 seeding project.

In autumn 2008, the Town of Oyster Bay and the HHPC coordinated a broader shellfish population density survey, including 61 stations in Hempstead Harbor.

In preparation for Nassau County's 2009 shellfish seeding in Hempstead Harbor, Cornell Cooperative Extension, Marine Division, staffers Matthew Sclafani, Neal Stark, and Gregg Rivara completed a Sediment Suitability Assessment of Hempstead Harbor for Nassau County's Shellfish Restoration Program (October 14, 2009). The assessment helped determine suitable sites to plant seed clams and oysters in the area off of Morgan Park. The team chose a scuba survey to evaluate the bottom and delineate the boundaries between mud and harder-type of bottom such as sand and sand-mud-shell mixes.

During the sediment assessment, a natural population of predominately hard clams (*Mercenaria mercenaria*) was observed in the central and southern area of the survey. They were also present in the northern survey area but not as frequently. (The report stated that these observations validate the effort to enhance shellfish in this area because the area currently supports shellfish.)

Also during the sediment assessment, the team observed and collected clam shells of the *notata* variety, which they felt were most likely from the 2007 seed plantings and originated from Frank M. Flower's and Son shellfish stock. *Notata* clams are not common in the area (typically < 1% frequency) and are easy to distinguish from the white clam variety by the dark zig-zag striped patterns on the shell. The average size of the 10 *notata* shells the Cornell team found was 27 mm. (The *notata* were between 8-12 mm at the time of the 2007 planting.)

In October 2013, a shellfish-density survey was conducted by the Town of Oyster Bay over a two-week period and replicated the 2008 survey. The survey involved collecting 120 bottom grab samples at the same 61 stations used in the 2008 survey. The findings in the survey report (July 9, 2014) included the following: (1) hard clams in the harbor were widespread and fairly abundant; (2) although clam density was lower than in the 2008 survey, it had not changed significantly; (3) the density of seed clams decreased and represented a smaller percentage of the overall clam population; (4) the density of the clam population in the certified area of the harbor is less than what it was in 2008 but not by a statistically significant amount; (5) overall, the size of the clams were larger than in the 2008 survey and this could be because commercial harvesting focuses on the smaller little neck clams. A cautionary note concerned the decline in seed clams; a decline over several consecutive years could indicate an overall decline in the resource. Further studies would be needed to determine whether the 2013 seed-clam decline was an anomaly or part of an ongoing condition.

4.3.5 Mussel-Watch Project

As part of the Long Island Sound Study's indicators program, blue mussels were collected in November 2011 to continue previous efforts through the National Oceanic and Atmospheric Administration's (NOAA) Mussel Watch project to measure levels of contaminants in local blue mussels. A site in Hempstead Harbor off of the Village Club of Sands Point (formerly the IBM Country Club/Guggenheim Estate), was used as part of NOAA's National Status and Trends Mussel Watch program since 1986. Data from a 2000 mussel collection showed abundant blue mussels at the site with a dramatic decrease in contaminant levels for a variety of heavy metals, pesticides, and hydrocarbons. Prior to the November mussel collection, CSHH visited the site to determine access to and the density of the current mussel population. The site seemed to have a healthy population of mussels, despite reports from local residents that the mussel beds had shrunk after Tropical Storm Irene hit in late August 2011.

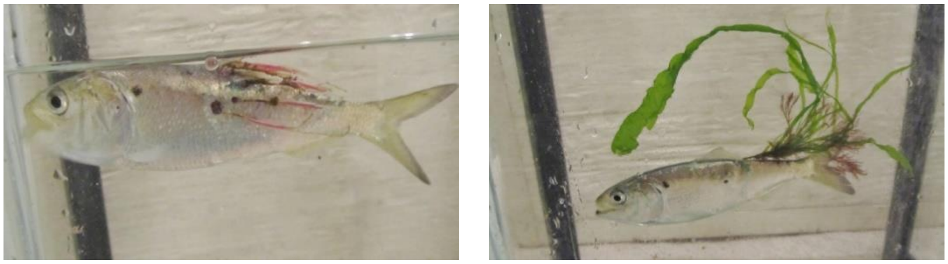
Ribbed-mussel colonies on the eastern shore of Hempstead Harbor (l), in a close-up of mussels around spartina roots in the cove south of Bar Beach (c), and along the shore in Mott's Cove (photos by Carol DiPaolo, 3/30/12, 7/15/17, and 3/11/19)

In March 2012, CSHH helped locate potential sites to collect **ribbed mussels** in Hempstead Harbor in preparation for another NOAA mussel-collection program. Ribbed mussels were present on the eastern shore of Hempstead Harbor, just south of Rum Point (north of the Tappen Beach park and pool). They continue to be densely packed around spartina roots in that area but are also present in Mott's Cove and on the western shore below the Bar Beach sand spit.

4.4 'Saladbacks'–A Local Phenomenon

"Saladbacks" is the term that local resident and aquatic conservation biologist John Waldman used to describe the unusual looking Atlantic menhaden (bunker) he first observed in December 2015. The mild autumn temperatures that year seemed to have kept the large population of bunker in the harbor much later than usual, and in mid-December John noted that many of the bunker he saw had parasitic copepods streaming off of them along with red algae and ulva that seem to be directly attached to the parasites. He saw them again in the same area on December 24, despite the drop in the temperature.

On January 4, 2016, although most of the fish had left Glen Cove Creek, a large number of bunker swam between the bulkhead and the dock near the STP outfall. Large adult fish were swimming with juveniles that were about 5-6 inches long; the juveniles had red and green algae attached to them. Both groups also had parasitic copepods attached to them.



Peanut bunker with parasitic copepods (l) and a "saladback" bunker (r) with algae attached to the copepods (photos by John Waldman, 12/15/15)

Photos and descriptions of the saladbacks were sent to a wide group of scientists, and the consensus was that this was a very unusual phenomenon. CSHH arranged to meet NYS DEC staffers at the dock on Glen Cove Creek on January 8, 2016, and they were able to collect a few fish with a drop net.

John Waldman netted about a hundred juvenile bunker over the course of two weeks from mid-December 2015 to January 2016. Below is his description of these fish.

> *Some of the specimens appeared normal. Others had one or more, red, tubular creatures attached to their bodies, heads, and even their mouths; a commonly seen parasite known as anchor worms. What was remarkable was that many had masses of algae growing off of the parasites' bodies.*

Saladbacks have been seen in Hempstead Harbor every year since that first observation in 2015, except for 2018, but in smaller numbers. In 2016, a few fish with algae streaming from them were seen in at Tappen Marina in May and in Glen Cove Creek in early June. In 2017, a large population of bunker was present throughout the harbor and stayed through November, however only a few juvenile menhaden (4-5 inches long) observed in Glen Cove Creek on June 1 had algae attached to them. On the last day of the 2019 monitoring (October 30), about two dozen bunker observed in Tappen Marina and a dozen in Glen Cove Creek had algae attached to them. In 2020, a lone bunker was observed at the head of Glen Cove Creek with algae attached to it. Also, at the end of the monitoring season, large schools of bunker were seen throughout the harbor and in Tappen Marina, where about 20% of adult-sized bunker had parasitic copepods attached to them; seven of those that could be seen near the surface had algae attached to the copepods.

(See also, Waldman, J., "A Novel Three-Way Interaction Among a Fish, Algae, and a Parasitic Copepod," Ecology, 98(12), 2017, pp. 3219–3220.)

4.5 Monthly Field Observations and Recreational-Fishing Reports

Even before our regular monitoring season begins, we receive reports about observations around the harbor. Starting off our 2020 reports (January 27), Paul Boehm reported hearing great horned owls calling to one another during the night in Sea Cliff—and it was likely a mating call; others in the area reported hearing them as well. Sanjay Jain, on March 4, reported what he was seeing in Roslyn Harbor, during a winter of very little snow:

> *The eagles have been a constant presence and have been reinforcing their nest on a regular basis. Some juvenile/adolescent eagles have been showing up every now and then as well. I had seen a seal floating around about 4-5 weeks ago. This was the second time I had seen that; once was a year or two ago. Greater scaup, lesser scaup, and buffleheads have been a frequent presence. There have been various other waterfowl that show up every now and then, but I am not sure of their identity.*

John Waldman reported catching his first striper of the year in Hempstead Harbor on March 17 and stated that it was "… some two weeks earlier than I ever have seen them in western Long Island Sound." He attributed the early appearance of striped bass to the extremely warm winter.

On March 26, we had the first reports that the ospreys had returned, although there was evidence that they were back at least a week or two before that, as nests from the previous year suddenly appeared to be larger and/or reinforced. (The first report of the 2019 ospreys' return was on March 17.)

Brants in clear water off of rocks near Sea Cliff Beach (photo by Nicole Ecker, 4/4/20)

On April 4, Lisa Cashman reported that a friend had sent a photo of unusually clear conditions off of Sea Cliff Beach:

> *My friend sent me this picture from the harbor today. She said the water was so clear she could see the [brants] feet moving below. I've heard that a larger than usual group of swans have been around too. They were wondering if this is "normal" for this time of year, or is there a tiny upside to less cars/air pollution and lord knows what else from the shutdown?*

May

Weekly surveys normally begin by mid-May, but the start of the 2020 monitoring season for the core program in Hempstead Harbor was delayed until June because of COVID-19. Still, local reporters kept us informed of what they were observing in or near the harbor. On May 15, local resident Moira Citko, after hearing a thud in her yard and discovering that a fish had dropped in via special delivery, wondered how far a bird could carry a fish. On the same day, Karen Papasergiou reported seeing a brown pelican while she and her husband, Serge, were sailing off of Sands Point. Also on May 15, *Newsday* reported that a 14-ft minke whale was discovered on a private beach in Oyster Bay; the whale was in poor health and had to be euthanized.

Fish delivery in Sea Cliff (photo by Moira Citko, 5/15/20)

June

The 2020 core monitoring season began on June 3, and during the four water-monitoring surveys for the month (June 3, 10, 17, and 25), an abnormal amount of turbidity and discoloration was noted throughout the harbor and Glen Cove Creek. Algal blooms were in process that ranged from green to brown and were combined with vegetation, seaweed, pollen slicks, and more floatable debris than usual, particularly following a heavy rainfall on June 6. We received reports about these conditions from local residents as well.

The sandspit off the southern section of the North Hempstead Beach Park is a favorite gathering place for birds (photo by Carol DiPaolo, 6/17/20)

During monitoring dates in June, brants, cormorants, Canada geese, a great blue heron, great and snowy egrets, killdeer, mallards, mute swans, ospreys, and terns were seen in various parts of the harbor. The osprey population continues to increase around Hempstead Harbor, with 12 nests in view around the shoreline.

Large schools of Atlantic menhaden (bunker) were seen throughout the harbor in June. However, on June 25, 11 dead bunker were seen in Tappen Marina (there were no hypoxic events in Hempstead Harbor until July 15). Although dead bunker had not been seen anywhere else in the harbor on that date, this seemed to be the beginning of a slow die-off affecting only bunker that lasted throughout the season and into the winter months. Similar die-offs occurred around Long Island Sound and other parts of the east coast, and it was ultimately concluded that a virus was the cause.

There was a surprising increase in reports of larger animals observed around the harbor's shores. A deer was seen on Bay Avenue in Sea Cliff. Groundhogs and muskrats were obsrved in Roslyn Harbor.

A deer (l) taking a leisurely walk on Bay Avenue, Sea Cliff (photo by Maddy Wadolowski, 6/28/20); groundhog (r) in a yard in Roslyn Harbor (photo by David North, 7/21/20)

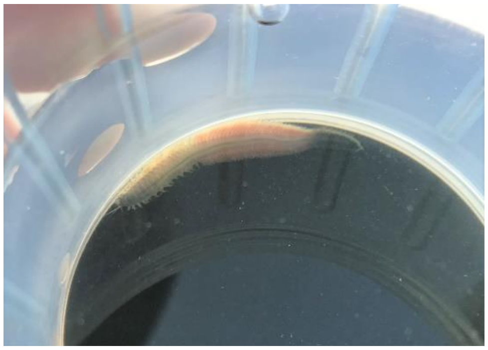
July

Weekly monitoring surveys were conducted on July 1, 8, 15, 22, and 29. The usual birds seen in the harbor at this time of year were observed on July monitoring dates, including cormorants, mallards, egrets (great and snowy), Canada geese, blue herons, ospreys, swans, and terns. A belted kingfisher was seen, and, on surveys that included lower-harbor stations (7/1, 7/15, and 7/29), two adult bald eagles and two juvenile bald eagles were seen perched in trees along the eastern shore. As is usually the case in July, large numbers of Canada geese and goslings and swans and cygnets were seen throughout the harbor.

A thick cloud of larval shrimp-like organisms observed in Tappen Marina (l); these were later identified as mysid shrimp—see closeup (r) (photos by Michelle Lapinel McAllister, 7/8/20)

On July 8, an unusual "bloom" of tiny shrimp (later identified by John Waldman and Gillian Stewart as mysid shrimp) was observed in Tappen Marina.

In Hempstead Harbor, usually in early to mid-July, the reproductive stages of sandworms called epitokes can be seen swarming near the surface in different areas of the harbor. The epitokes can appear greenish or tan with a red, and look very different from the adult sandworms that are used for fishing bate. On July 21, epitokes were observed near CSHH #1 (Beacon 11).



An epitoke at bottom rim of jar (photo by Michelle Lapinel McAllister, 7/21/20)

Blue-claw crabs made a relatively early appearance in July, and were observed in Tappen Marina on July 8, 15, and 22 and also on the bulkhead near CSHH #10 in Glen Gove Creek on July 8.

Schools of bunker were seen throughout the harbor on July monitoring dates. Two dead bunker were seen in Glen Cove Creek and one in Tappen Marina on July 22.

A robust brown algal bloom that started in mid-June persisted through July, particularly in the lower harbor and in some other isolated areas, including Tappen Marina. The bloom was so thick in areas that record-low Secchi depths (low water clarity) were recorded—as was the case on July 1 in the lower harbor (CSHH #6), where the Secchi depth was recorded at 0.1 m. The algal blooms along with the heat created a situation similar to what occurred in summer 2019—low oxygen levels in some areas of the harbor. However, most hypoxic events in 2020 fell between July 15 and August 12 and were concentrated at stations CSHH #2, #16, and #17—stations closest to Long Island Sound.

On July 6, the weir at Scudder's Pond collapsed, and the pond drained out into the harbor through the outfall at CSHH #15A, north of Tappen Beach Pool. On the high tide, water from the harbor partially refilled the pond. The first temporary fix didn't work, so with the help of volunteers, the base of the weir was cleared and sandbags were set down to fill the gap at the bottom of the weir. A permanent fix was planned but has not been installed to date. Prior to the collapse of the pond weir, a number of people could be seen fishing in the pond from the railing along Shore Road, catching carp and white perch.

August

Monitoring was conducted on five dates in August (August 5, 7, 12, 19, and 26); because of scheduling constraints, shoreline sampling was coupled with Tappen Marina testing on August 5, whereas in-harbor testing occurred on August 7. August 7 was the first day of resuming sample collection and testing at CSHH #8-11, following release of a report by the World Health Organization that determined there was little risk of COVID-19 infection from the aerosolized spray from STP discharges/outflows.

On August monitoring dates, we saw the usual birds of Hempstead Harbor: cormorants (34 seen on 8/19 and observed one that caught a fish), belted kingfishers, mallards, great egrets, Canada geese (65 counted on 8/12), blue herons, ospreys (frequently observed catching fish), mute swans, terns, and two bald eagles—one of which was flying over Tappen Marina with an eel in its talons (on 8/26).

Great blue heron (l) (photo by Ken Neice, 8/8/20), great egret (c), and swans and cygnet (r)
(photos by Carol DiPaolo, 8/19 and 8/7/20, respectively)

Blue-claw crabs were observed on all August monitoring dates on the bulkhead below the Cove Restaurant (up to 16 counted on August 7) and near the STP in Glen Cove Creek and also on the bulkhead at Tappen Marina.

One comb jelly was seen on August 26 at Tappen Marina. (We saw comb jellies—sea walnuts—for the first time during the season at Tappen Marina on May 20, 2020.)

There were reports that small bluefish were in areas of the harbor in mid-August. Large schools of adult bunker and baitfish were seen on all in-harbor monitoring dates in August. A few dead bunker were seen on three monitoring dates (up to 5 in Tappen Marina on 8/12 and up to 7 in Glen Cove Creek on 8/19) This corresponded with bottom hypoxia at CSHH #21 in Tappen Marina on 8/12 of 2.90 ppm, but there were no bottom hypoxic events on monitoring dates in Glen Cove Creek in 2020.

DEC's August seining in Hempstead Harbor reflected the greater fish diversity and activity that usually occurs in August, including 286 young-of-the year bunker, 913 bay anchovies, 880 scup, 39 young-of-the-year bluefish, 22 black fish, and 5,706 silversides. Two unusual fish included in the seine for Hempstead Harbor were 1 skilletfish and 1 striped burrfish.

On August 15, John Waldman reported:

> *My son Steve was paddle boarding between Sea Cliff Beach and Morgan Park on Tuesday* [August 11] *and saw a pair of rays come near the surface. He said they were 2-1/2 - 3 feet wide. I'm guessing cownose rays, which are invading our waters with warming.*

On two occasions in August, a brown discharge was observed from CSHH #9 in Glen Cove Creek (on 8/12 and 8/19) and corresponded with high bacteria levels in water samples collected from this station.

September

Weekly surveys were conducted on September 3, 9, 16, and 23. On 9/30, only shoreline sample collection was conducted. Hazy conditions were observed on 9/16 caused by west coast wildfire smoke. A working barge and crane that were positioned in Glen Cove Creek in August were present on all September monitoring dates, and were used to drop sand along the north bulkhead; on 9/9 this prevented access to CSHH #13. The large dilapidated barge that had been pushed to the sandbar at the head of the creek continued to release rust and large and small foam pieces.

The usual variety of birds was seen on each monitoring date, including cormorants (up to 91 counted on 9/16, when surveys were conducted in both the upper and lower harbor), mallards, great egrets (up to 17 counted on 9/16), Canada geese (up to 73 counted on 9/3), great blue herons, ospreys (up to 7 counted on 9/16), and mute swans (up to 15 counted on 9/16), and terns.

Bunker and baitfish were seen throughout the harbor on each of the monitoring dates. On 9/9, Paul Boehm caught 2 sea robins and a snapper while ferrying the monitoring crew to testing stations.

Sea robin (l) and snapper (r) caught and released by Paul Boehm during water-monitoring survey (photos by Carol DiPaolo, 9/9/20)

Blue-claw crabs were observed on all monitoring dates in September. One Asian shore crab (an invasive species) was seen on 9/3 and 9/16. A few comb jellies (sea walnuts) were seen on 9/3 and 9/9. The September DEC seining in Hempstead Harbor had notable catches of bay anchovies (1,098), black fish (37), young-of-the-year blue fish (280), scup (301), and silversides (4,307).

Elaine Neice relayed a report from a beachgoer at Sea Cliff Beach who said he was at Manorhaven Beach Park, Manhasset Bay, on 9/10 and saw 25-30 stingrays.

Dissolved oxygen levels popped up to healthy numbers at all but two in-harbor stations (CSHH #2, on 9/3, and CSHH #1, on 9/9). Water color judged to be normal on all survey dates. A few dead bunker were seen on 9/3 (2 in Tappen Marina, when marina stations had low DO, and 1 in Glen Cove Creek) and on 9/9 (7 in Tappen Marina); in each case the fish were in bad condition and seemed to be old kill or possibly from a bait release.

On September 23, water below the discharge from CSHH #8 was discolored brown with high turbidity, but the bacteria sample collected from that station had low bacteria results.

October

Weekly surveys were conducted on October 1, 7, 14, 22, and 28; on October 21, shoreline sample collection alone was conducted because the high winds necessitated postponing the in-harbor monitoring until the next day. On October 22, monitoring began in a thick fog, with virtually no visibility until 9:30 am. There was significant bird activity through the end of the month with sightings of the usual species seen around the harbor: cormorants, mallards, great egrets (up to 15 observed on 10/1, during a survey of both the lower and upper harbor), snowy egrets, Canada geese (44 counted in Scudder's Pond on 10/14), great blue herons, belted kingfishers, ospreys, swans, terns, and bald eagles (on four of the five monitoring dates, both adults and juveniles). On October 21, one of three cormorants observed at Tappen Marina caught a bunker and swallowed it whole.

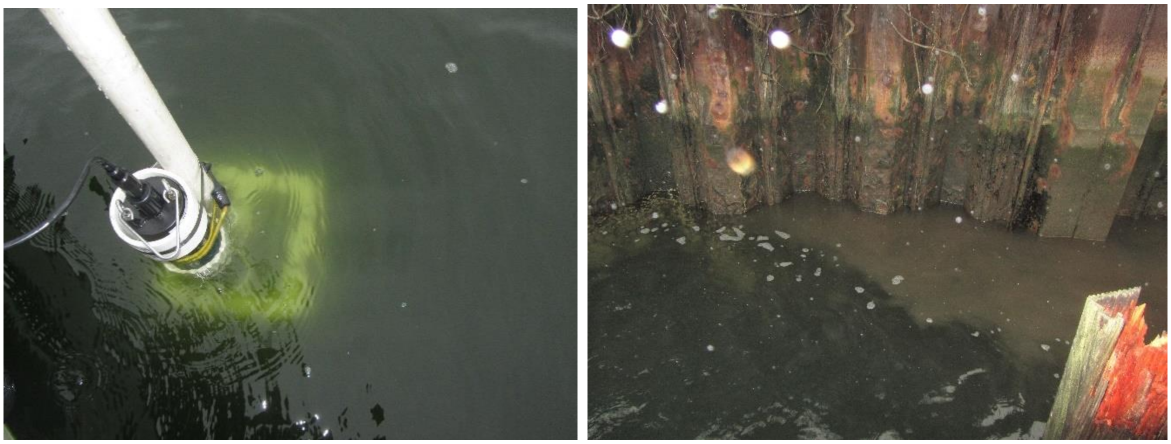
More comb jellies (sea walnuts) were observed on October monitoring dates than had been seen during the rest of the season. Bunker were seen throughout the harbor on four out of the five in-harbor monitoring dates. A small striped bass was caught at the end of a dock in Tappen Marina on October 1. A large school of bunker was also seen in Tappen Marina on 10/21; 20% of that school had parasitic copepods attached to them, and seven of those viewed near the surface also had algae attached. Bluefish were evident throughout the harbor on 10/28. Blue-claw crabs were seen 10/1 and 10/7.

A few dead bunker were seen on each of the monitoring dates in October, with the highest number observed in Glen Cove Creek (about 2 dozen) floating on an outgoing tide on October 22.

On October 15, Michelle Capobianco reported seeing a sand shark (smooth dogfish) (about 3' long) on the beach near the Sea Cliff Yacht Club pier. It was alive, brought in with a high tide, and hopefully made it back into the water.

Sand shark on beach near the Sea Cliff Yacht Club pier
(photo by Michelle Capobianco, 10/15/20)

Water color was judged to be normal on all of the October monitoring dates, but an area around CSHH #15 (just north of the rocks at Tappen Beach Pool) was abnormally green on October 28. On the same day, a brown flow was observed from the submerged outfall at CSHH #9.



Platform with Eureka Manta+ 35 meter lowered below the surface at CSHH #15 in green water (l); brown discharge from submerged pipe at CSHH #9 (r) (photos by Carol DiPaolo, 10/28/20)

November – December

Although our weekly water-monitoring surveys ended October 28, our fish and wildlife reporters kept us informed through the rest of the year with their harbor observations. All of our volunteer reporters were critical to keeping us informed of what was a long-term and widespread die-off of bunker that occurred through the autumn and winter months.

On November 3, Skip Dommin reported on conditions at Tappen Beach:

> *With yesterday's (11-2-2020) 50-mph wind gusts making it feel more like 30ºF rather than 40ºF, Tappen Beach was pretty desolate other than a flock of ring-billed gulls and one loner great black-backed gull…. These guys are tough!*

Gulls on Tappen Beach (photo by Skip Dommin, 11/2/20)

On November 21, Alex Greenberg reported seeing a seal off of Sea Cliff Beach. (Sanjay Jain had reported seeing a seal in the lower harbor in early February 2020.)

Seal off of Sea Cliff Beach (a still shot from a video by Alex Greenberg, 11/21/20)

On November 29, we received reports of dead bunker showing up on local beaches—Sea Cliff and Tappen—and gulls feasting on them (about 50 dead bunker on the shoreline from the Sea Cliff Yacht Club through Sea Cliff Beach). There had also been Facebook reports of fish kills further east on the north shore—as far as the North Fork. On November 30, with high tide and winds, there was no evidence of the dead fish that were observed the day before.

Because of mild weather conditions in October, large schools of very large bunker stayed in the harbor beyond the usual time you'd expect to see them (this happened a few years ago as well, and some stayed through the winter). On an off-season (11/21/20) boat trip through Glen Cove Creek, the bunker schools were particularly thick in Glen Cove Creek. A couple of bunker near the surface displayed unusual whirling behavior, rolling horizontally.

On November 30, Skip Dommin reported on his observations during the Thanksgiving holiday:

> *I walked Tappan Beach and the sidewalk along the entire length of the sea wall heading north to Sea Cliff midday on Thanksgiving, Saturday morning, Sunday morning, and this morning. I saw no evidence of fish kill and, in fact, I was amazed how clear and free of debris the water was along the shoreline. I also saw large flocks of Ring-billed gulls but no feeding-frenzy activity (most were snoozing in the Tappan parking lot!). A couple of cormorants were spotted right off the shoreline this morning diving to what appeared to be a school of fish.*

On November 30, Sebastian Li reported:

> *I've observed from my deck bunker swimming erratically like we observed in the creek. The water is so clear that I can see large schools of bunker deep in the water.*
>
> *Periodic sea gull action going for peanut bunker being forced to the surface by stripers and blues. Nothing compared to last year when the entire harbor was filled with gulls feeding.*

Two of several photos taken along the shoreline north of Tappen Beach
(photos by Sebastian Li, 11/25/20)

On December 1, Tom Lake sent this report from Justin Hayes (naturalist-educator), recounting his observation from Hudson River Park (river mile 2):

> *We received reports yesterday (11/30) of "several large swathes of dead, silvery fish" floating at the surface with some, still alive, circling and exhibiting erratic behaviors. These are likely the menhaden that many others around NYC and up the Hudson have been observing. Interestingly enough, water quality data from our nearby HRECOS station does not suggest hypoxia or temperature swings, so it is unknown what is causing the fish kills so late in the season."*

Interestingly, in looking back at old records, we found that December 7, 2015, observations included notes about large schools of bunker in the harbor at that time as well—with some dead fish showing up in Glen Cove Creek and along the shoreline. A lot of the fish had parasitic copepods on them. It was also the first year John Waldman had noticed that a lot of the copepods had algae attached to them. (See *Section 4.4*.)

In the large school of adult fish observed in Glen Cove Creek on November 21, 2020, some bunker had copepods attached to them, but what was most notable was that a couple of fish separated from the rest of the school displayed erratic behavior. Instead of just rolling over and "flashing" as they do in the school, they were near the surface and rolling or whirling repeatedly horizontally. This was noted a couple of times over the course of the regular monitoring season as well, and seemed similar to the "whirling disease" that occurred in bunker a few years ago in Manhasset Bay and off of Mamaroneck; the whirling behavior at that time was different—the fish were near the surface and spinning vertically. A virus was implicated in the fish kills that occurred at that time.

Although some of the dead fish seen along the shoreline had bite marks, according to Sebastian Li, most that had any marks on them seemed to have been pecked at by the gulls (rather than having been preyed on by larger fish). Many of the dead bunker had no marks on them, and there were fish in various states of decomposition.

On December 9, Skip Dommin reported on more dead bunker along the shoreline:

> *I have been taking regular walks the last couple of weeks along the Tappan bulkheads…. This morning (12/9/20) was the first where I noticed any noticeable quantity of dead bunker—maybe 40 to 50, well spaced-out… in sand in front of the bulkheads. Most were not scavenged by gulls.*

On December 10, Sebastian Li counted 103 dead bunker on the shoreline between the Tappen Beach pool and the area north of Rum Point.

Speculation continued regarding the causes of the bunker die-off, which was observed throughout Long Island Sound. Fish samples were collected by NYS DEC and CT DEEP, and it wasn't until the spring of 2021 that reports were issued that a virus was implicated in the die-off.

The last reports of the season were observations of bald eagles and migratory birds. On December 30, Skip Dommin reported seeing winter visitors to Hempstead Harbor:

> *I just wanted to forward some photos of some very special winter visitors: common merganser (female), common loon (non-breeding plumage instead of the black that we usually see in their northern resident territory), and a male and female pair of bufflehead ducks. All the more reason to protect our harbor for not only local residents, but migratory wildlife as well! ...the photos were taken 200-300 yards off shoreline. All of these photos were taken within the last few days. I am also keeping an eye out for that juvenile bald eagle I spotted in a tree eating a fish across from Tappen Beach a couple of weeks ago.*

Buffleheads (l), common loon (c), and merganser (r) (photos by Skip Dommin, 12/28 and 12/30/20)

4.6 Crustaceans

An assortment of crustaceans can be seen around Hempstead Harbor. This group of marine organisms is characterized by, among other things, a segmented body, paired appendages, and a hard external skeleton that has to be shed to accommodate growth. Crabs, lobsters, shrimp, and barnacles are examples of this group of marine creatures. We mention a variety of crabs that are either seen during weekly sampling or caught during the DEC seining that is conducted around the harbor; the crabs include blue-claw, lady (or pink calico), green, spider, mud, fiddler, and Asian shore crabs. Some are walking crabs, and others are swimmers, like the blue-claw crabs, which have back legs that are shaped like paddles. The Asian shore crab is an invasive species that started showing up around Long Island Sound in the late 1990s; it can tolerate a wide range of salinity and may be pushing out native species.

Lady/calico crab (l), blue-claw crab (m), and spider crab (r) (photos by Michelle Lapinel McAllister, 7/27/17, and Carol DiPaolo, 8/26/20, 7/24/19, respectively)

Blue-claw crabs have always been present in Hempstead Harbor, particularly in the lower harbor, but they appeared in remarkable numbers in 2007. We didn't see blue crabs in 2008 or 2009, and the 2009 DEC seines recorded only two blue crabs–one in July and one in October. Blue crabs returned in large numbers in 2010, but the population did not match the quantity recorded in 2007. No blue crabs were observed during the 2011-2012 monitoring dates, but the DEC seine crew for the striped-bass survey caught four in 2011 and seven in 2012. In 2013, we saw one blue crab, and the DEC seine catch for Hempstead Harbor included one in May and one in July. In 2014-2016, no blue crabs were noted on monitoring dates, but two were caught in the 2015 Hempstead Harbor DEC seine hauls. In 2017-2020, blue-claw crabs were present in greater numbers and were seen in local marinas and on bulkheads and beaches. In 2020, blue crabs were in caught in DEC seines in July-September.

Horseshoe crabs mating (photo by John Waldman, 6/3/18)

Although **horseshoe crabs** are included in the group of crustaceans seen around the harbor, they are not true crabs but are more closely related to spiders. They are noted mostly during the spring mating season and in the fall when the beaches are covered with molted shells.

The ubiquitous **acorn barnacle** is so plentiful that it is overlooked in weekly monitoring reports. These barnacles take up residence on rocks, bulkheads, pilings, docks, and boat bottoms all around the harbor.

A rarely seen crustacean in Hempstead Harbor and Long Island Sound is the mantis shrimp. That's because mantis shrimp hide at the bottom in rock formations or burrow several feet into the bottom of the harbor or sound. They have been nicknamed thumb-splitters because of their strong front claws, and they should be approached cautiously. We saw one many years ago (1996) during a low DO event that drove mantis shrimp and other bottom-dwelling creatures to the surface for air. In 2007, four small mantis shrimp were raked from the bottom during a shellfish survey, and a large one was brought up from a November 2013 shellfish survey. Increasingly, mantis shrimp have been found in the bellies of striped bass caught by local fishermen.

Mantis shrimp found in a striped bass (photo by Peter Emmerich, 6/6/14)

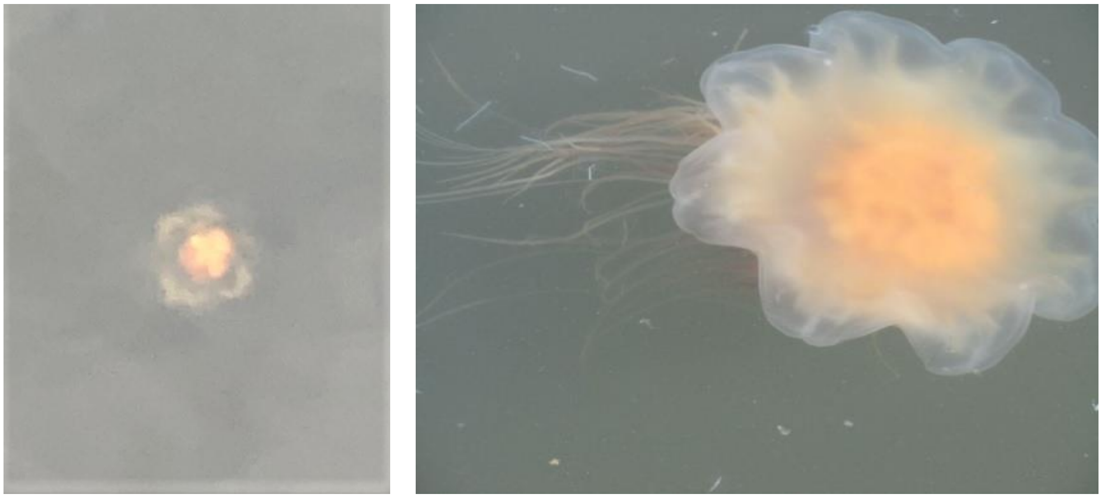
On August 24, 2016, numerous tiny crabs (about 0.7 cm) were observed in the water column at one of the outer-harbor stations (CSHH #16). Samples were collected, and an attempt was made to preserve the crabs, which seemed to include two larval stages. The crabs had prominent front claws that were very long compared with the rest of the body. We later identified the crabs as long-claw porcelain crabs, megalops stage; this was confirmed by a marine-invertebrates expert, David Lindeman. Although porcelain crabs are found along the Atlantic coast, this sighting in Hempstead Harbor was considered very unusual.

4.7 Jellies

Two types of **comb jellies** (which are classified separately from the stinging-celled jellyfish) are seen in Hempstead Harbor: the larger egg-shaped sea walnuts and the tiny, rounder sea gooseberries. The **sea walnuts** have lobes that are rimmed with short comb-like appendages that are phosphorescent. They can be seen at night glowing as the water is moved around them, as in the wake of a boat. **Sea gooseberries** have a pair of tail-like appendages that can be seen when they are up close to the surface. Comb jellies do not sting.

Comb jellies had usually appeared in large numbers in Hempstead Harbor in late June and through mid-October. In 2011, they were noted a little earlier in the season (in May) and were seen during monitoring dates for the last time on October 6. In 2012, we observed only a few comb jellies on only two monitoring dates. The comb jellies were noted throughout the entire season in 2013 and from July through September in 2014. In 2015, no comb jellies were observed on monitoring dates, and only a few were observed on a few monitoring dates in 2016-2020. In 2020, a few comb jellies were observed on May 20 and August 26 at Tappen Marina; they were present on two monitoring dates in September and again on four monitoring dates in October, but only in relatively few numbers. The decrease in comb jellies observed in Hempstead Harbor and Long Island Sound seems to correspond with the increased presence of Atlantic menhaden, which may be feeding on young comb jellies.

Two types of tentacled jellyfish that may be seen in the harbor are the **lion's mane jellyfish**, with long tentacles that sting, and the round, bell-shaped **moon jellyfish** that has short tentacles around its rim that do not produce a stinging sensation**.** Moon jellies are easily identified by the four, whitish, horseshoe-shaped gonads on the top of the bell. Both types of jellyfish are usually observed earlier in the season in Hempstead Harbor. In 2013, we saw both lion's mane jellyfish and moon jellies in Hempstead Harbor; mixed among these, were hundreds of unfamiliar jellies that were later identified as **salps**. No lion's mane or moon jellyfish were observed on monitoring dates in 2016; in 2017, only one moon jelly was seen by the STP in Glen Cove Creek. In 2018 and 2019, however, we received numerous reports of lion's mane jellies in the harbor early in the season—in April and early May. Reports of lion's mane jellies were received in April 2020. Most of those that are observed in Hempstead Harbor are relatively small and orange-colored, rather than purplish brown.



Lion's mane jellyfish in the harbor (l) and in Tappen Marina (r); the thin white lines visible in the photo at right are the internal structures in barrel-shaped salps (photos by Karen Papasergiou, 4/25/20, and Carol DiPaolo, 5/22/13, respectively)

4.8 Birds

Since the inception of the monitoring program, we have seen an increase in the variety of birds that have become residents or regular visitors to Hempstead Harbor. **Belted kingfishers, blue herons, cormorants, gulls, mallards, Canada geese, snowy and great egrets, ospreys, swans, terns,** and most recently, **bald eagles** are generally observed throughout the season, along with the usual swallows, pigeons, crows, and other land-based birds that are frequently seen along the shores of the harbor but not counted or specifically noted on data sheets during monitoring. Increasingly, red-winged blackbirds are noticed around the edges of Scudder's Pond and grassy areas on top of the bulkhead near the head of Glen Cove Creek.

Each year we see new, young members of the harbor's duck, Canada goose, and mute swan populations. Although the adult Canada goose population remains high, we have seen fewer numbers of young birds over the last few years. The mute swan population in Hempstead

Harbor has varied from a high of more than 50 swans observed in October 2010 to only a dozen observed at a time on monitoring dates from 2011-2017. The population began to increase again in 2018 with up to 55 swans counted on in August 2019 and up to 37 counted on June 17, 2020.

Mute swan interested in water monitoring
(photo by Carol DiPaolo, 9/23/20)

Observed less frequently during monitoring are **brants**, **green herons, black-crowned night herons, plover-type birds,** and **hawks** or **falcons**. Sightings of these are included on weekly data sheets and also noted in the monthly field observations at *Section 4.5*.

A belted kingfisher—stunned after flying into a glass door—(l), terns on a buoy (c), and two great blue herons separated by a great egret (r) (photos by Carol DiPaolo, 5/3, 6/26, and 8/28/19)

Osprey nest on navigational light at Glen Cove breakwater (photo by Carol DiPaolo, 9/3/20)

Osprey populations**,** once threatened because of the effects of widely used pesticides that were banned in the 1970s, have made a remarkable comeback to Hempstead Harbor and Long Island Sound. These beautiful "fish hawks" can be seen diving for prey in harbor waters. As the harbor's ecosystem improved, the ospreys and other water birds have been able to find plenty of food for them to thrive. The ospreys migrate long distances (to South America), in the fall and return in March–generally to the same nesting places they had been to previously.

Osprey nests have been visible from our monitoring stations in Hempstead Harbor for more than 20 years.

Since 2010, there have been some changes and increases in nesting sites. By 2019, there was a noticeable increase in the osprey population, and despite additions of nesting platforms around the harbor, ospreys have built nests on top of cell towers, other electrical equipment, and even construction cranes. We have also seen nests on top of duck blinds and abandoned boats. Currently, 12 osprey nests are within easy view around the harbor’s shoreline. One of the oldest nesting sites in Hempstead Harbor is Beacon 11, the navigational light between Tappen Beach Marina and Town of North Hempstead Beach Park.

Since about 2004, **peregrine falcons**, a protected species, have been sighted near the Glenwood Landing power plant. On October 28, 2009, and October 10, 2012, peregrine falcons were seen in the vicinity of the old brick powerhouse building that was slated for demolition in 2014. In May 2014, the falcons decided to build a nest in one of the white stacks on top of the brick building, despite the noise and demolition work that was going on. In July 2016, a peregrine falcon was seen near the site of the old power plant. In 2019, there was a sighting of what seemed to be a peregrine falcon in the same vicinity.

Although **red-tailed hawks** are seen often in wooded areas around Hempstead Harbor, we see them only occasionally during water sampling. However, on November 3, 2010, three red-tailed hawks with striking coloration circled over the head of Glen Cove Creek and were seen in that location again on June 4 and 8, 2014. On a winter monitoring date (January 19, 2018), a red-tailed hawk made an appearance over the Tappen Beach parking lot—along with an adult bald eagle. On October 11, 2019, two red-tailed hawks were seen near Tappen Beach pool.

In May 2008, we had our first sighting of a **turkey vulture** flying over Glen Cove Creek. Since then, they have been seen frequently throughout the year near the eastern shore of the harbor, flying over East Hills, Greenvale, Roslyn Harbor, Mott's Cove, and Sea Cliff. In 2015, we saw turkey vultures flying over the harbor on monitoring dates in August and September; on September 25, we were amazed to see nine turkey vultures flying near the western shore of the lower harbor near CSHH #6. In August 2016, we saw three turkey vultures flying over the lower harbor. None were seen on survey dates in 2017-2020, but

Red-tailed hawk flying over Glen Cove Creek (l) (11/3/10) and osprey in flight (c) (9/11/10) (photos by Jim Moriarty; turkey-vulture photo (r) posted at en.wikipedia.org/wiki/Turkey Vulture, retrieved 6/17/12, showing the bird's distinctive two-tone feather pattern underneath its wings) they are seen frequently throughout the year over harbor communities. During the last week of June 2018, five large turkey vultures were seen flying over Shore Road and Safe Harbor Marina (formerly Brewer Marina). There have been some unusual visitors over the years as well, such as a **great horned owl** that was rescued from the water at the Glen Cove Marina in Glen Cove Creek on August 9, 2009. During 2011, there were also some unexpected visitors: on April 9, two **northern gannets** were seen on Tappen Beach; on August 28, a **south polar skua** (a dark, gull-like bird), showed up on Sea Cliff Beach, brought in with the hurricane winds; and in mid-December, a **brown pelican** was seen off of Sands Point at the Execution Rocks Lighthouse. In 2017, we saw **black skimmers** for the first time during a monitoring date, and then had a report of a skimmer doing some nighttime fishing in Tappen Marina in 2018. Also in 2018, we received our first report of a **black vulture** (a southern variety) flying off of Sea Cliff Beach and two pairs of **long-tailed ducks** swimming near the same area in the harbor. Over recent years, we have received increasing reports of gannets diving into the harbor for food.

Bald eagles have been moving toward western Long Island Sound over recent years, and we started receiving regular reports of them around Hempstead Harbor in 2015 during the monitoring season. A Roslyn Harbor resident saw an immature bald eagle perched in a tree on his property in December 2015 and also in April 2017 (it takes about four years for bald eagles to mature into their distinctive white and brown-black coloration). A mature pair of bald eagles was seen in this area on February 20, 2017. In 2018 it was confirmed that there was a pair of bald eagles nesting in a large tree along the shoreline in Roslyn Harbor and at least one chick was in the nest on May 28, 2018. In 2019 and 2020, we continued to see adult and immature bald eagles throughout the year around Hempstead Harbor. In 2020, two juvenile and two adult bald eagles were present in the lower harbor; there were sightings of one or more of these on most monitoring dates that included lower-harbor surveys.

Adult bald eagle with eel (l) and juvenile bald eagle (r) along shoreline of upper harbor (photos by Sanjay Jain and Cindy Ash, 3/13/19 and 12/27/20, respectively)

4.9 Diamondback Terrapins and Other Turtles

Kemp's Ridley turtle found on Tappen Beach (photos by Mary Ann Maier, 12/11/19)

Diamondback terrapins are the only turtle found in estuarine waters and generally grow to about 10 inches long. In spring of 2005, diamondbacks were observed in large numbers in the lower harbor, near the Roslyn viaduct. Diamondbacks typically converge by the hundreds in one area in the spring and mate for several weeks. Information about their presence in Hempstead Harbor was used to support efforts to extend the harbor's designation as a "significant coastal fish and wildlife habitat" to include the area south to the Roslyn viaduct.

In 2006, dramatic changes occurred in the area near the viaduct with the construction of the large buildings at Bryant Landing and the new viaduct (which was completed in 2011). Although there were no diamondback sightings reported for the lower harbor since 2006, they had been seen in other parts of the harbor since then, particularly around what is now Safe Harbor Marina (formerly Brewer Marina) and the Sea Isle sand spit.

A diamondback terrapin below the outfall north of Tappen Beach pool (photos by Carol DiPaolo, 6/27/12)

In June 2008, the DEC seine crew caught an adult diamondback terrapin (255 mm across and 275 mm long–about 11 inches long–which is longer than the average size recorded) near the sandbar at the southern end of the North Hempstead Beach Park. On July 11 and August 19, 2009, a diamondback turtle was seen in Brewer Marina. In 2010, a large (about a foot long) diamondback was seen swimming also in Brewer Marina, near the Sea Isle sandspit. The diamondback pictured above was seen on June 27, 2012, north of the Tappen Beach pool and was more than a foot long. The last report received of a diamondback terrapin sighting in Hempstead Harbor was at Safe Harbor Marina on June 17, 2014.

Occasionally, large sea turtles have made their way into Long Island Sound and have been spotted in local bays. On August 2, 2011, a large sea turtle was seen at the Shelter Bay Yacht Club in Manhasset Bay. On October 24, 2011, Paul Boehm, who was fishing for black fish about a half a mile north of the Glen Cove breakwater, reported that he had seen a sea turtle, which he identified from photos as being a **Kemp's ridley turtle.** On August 13, 2015, a large sea turtle was seen in Long Island Sound near Hempstead Harbor. In 2019, a dead ridley turtle washed up on the beach near Tappen Marina.

We also often see snapping turtles (a fresh water species) in Scudder's Pond and other ponds around the harbor. In June 2019, a Scudder's Pond turtle chose to make a nest on nearby property. The homeowners were happy to protect the 36 turtle eggs that hatched on August 30; the tiny snapping turtles were then released to Scudder's Pond.

4.10 Algal Blooms

The color and turbidity of water within Hempstead Harbor vary by season. Hempstead Harbor Secchi-disk depths (an indicator of light penetration into the water column and therefore water clarity) in the harbor most often range from 0.5 m to 3.0 m, with the higher numbers in the range generally recorded in spring and autumn. Lower Secchi-disk depths along with supersaturated DO levels are strong indicators of the presence of algal blooms. Algae absorb more light and are present in greater quantities than other particulate material and give off oxygen in the growth phase. The dominant type of algae present in the harbor gives the water its color, which is typically brown or green.

There have been instances in previous seasons when algal blooms have caused unusual coloration or conditions in parts of Hempstead Harbor. In 2010, an unusual red-brown water color was observed on three occasions in Hempstead Harbor. On August 31, 2010, the water in sections of Tappen Marina had turned red; a water sample we collected and that was analyzed by the NCDH contained a mix of dinoflagellates, some that could cause red coloration along with other types of algae, none of which were toxin producers. The most dominant species was *Prorocentrum micans*, followed by *Prorocentrum triestinum*, *Gyrodinium* sp., and *Scripsiella trochoidea*.

Discolored water sample from algal bloom in Glen Cove Creek (l); boat wake discolored from algal bloom in lower harbor (r) (photos by Elaine Neice, 6/17/20, and Carol DiPaolo, 7/1/20, respectively)

In 2019, brown and green algal blooms were noted in July and September. In 2020, brown and green algal blooms were considered probable in May at Tappen Marina (with abnormal coloring on 5/27/20). On in-harbor monitoring dates in June through July 2020, algal blooms were considered probable, although water color was judged to be a normal brown or green color, a determination that is typically made at the first in-harbor sampling station, CSHH #1. However, there were instances during the 2020 regular monitoring season where patches of abnormal brown or green coloration were noted along with increased turbidity in other parts of the harbor—as occurred on 7/1/20 at CSHH #6 (abnormal rusty brown color), in Tappen Marina (abnormal brown), and Glen Cove Creek (abnormal brown) and on 7/15/20 at CSHH #7 (abnormal brown).

In addition, pollen slicks, which are commonly seen on the harbor's surface in spring, can change the appearance of the water surface and color. The slicks are usually lighter in color when first formed and then, as the organic matter within the slick decays, turn a darker brown. A pollen slick may also be mixed with algal cells.

Pollen slick–not sludge–in Hempstead Harbor (l); duckweed on surface of Scudder's Pond (photos by Carol DiPaolo, 5/7/15, and 7/19/20, respectively)

In May 2015, for example, the decaying pollen mixed with algae cells and created a mat on the water surface that prompted some local residents to report the appearance as "sludge" or sewage. This occurred in many areas around Long Island Sound. On May 7, 2015 (the first monitoring date for that season), we observed these conditions in Hempstead Harbor and collected a water sample for bacteria analysis; lab results confirmed that no sewage was mixed in the mat that had formed on the water surface. A noticeable pollen slick occurred in 2018, but pollen slicks in 2019 and 2020 were less widespread.

A mix of algal cells with other vegetation at Scudder's Pond often creates a mat at the surface that generally persists through the warmer months. Most often duckweed growth accelerates and covers the pond and moves from side to side as the wind changes.

Excess amounts of nitrogen released from failing septic systems, over fertilization of lawns and gardens, and other sources, have been implicated in causing more frequent and longer-lasting algal blooms in waters around Long Island and other areas. These blooms can affect other marine species through light reduction and oxygen depletion. Some types of algae contain biotoxins, and if the algal cells are present in high densities, these harmful algal blooms (HABs) may cause a risk to human health through consumption of shellfish taken from affected areas.

Excess nitrogen can also fuel the growth of larger aquatic plants called macroalgae, macrophytes, or, more commonly, seaweed. An overabundance of seaweed can further reduce light penetration, deplete oxygen, make it difficult for some species of marine life to thrive, and create aesthetic issues for beaches.

Green, red, and brown seaweeds in Hempstead Harbor (photos by Michelle Lapinel McAllister, 7/24/20)

In some bays, seaweeds can create deep mats on bay bottoms. In Hempstead Harbor, the seaweed is generally present in smaller amounts, sparsely covering portions of the shoreline at low tide or collecting around rocks or jetties. Seaweed may be observed in greater amounts after high winds and rain storms both on the surface of the water and on the shoreline during a receding tide. Common seaweeds found around Hempstead Harbor include red hornweed *(Agardhiella subulata*), Irish moss (Chondrus crispus), rockweed (*Fucus distichus)*, and sea lettuce (*Ulva lactuca).*

Appendix A

2020 CSHH Field-Monitoring Data

Red numbers indicate that the readings were unusually low or high but reflect station conditions.

Green lines indicate replicate surveys.

Purple lines indicate survey using YSI Pro Plus and LaMotte 2020e turbidity meter. Depth between sensor at bottom reading to sea floor is 0.15 m.

Blue lines indicate data supplemented by UWS data due to sampling restrictions for core program as a result of COVID-19.

*Sonde surface levels are taken at a half meter below the surface.

**Bottom levels are read by the sonde depth sensor, which is 0.3 m off the harbor floor.

***Total depth accounts for the 0.3 m distance between the Eureka sonde depth sensor and the harbor floor.

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chlor a (ug/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #1 - Beacon 11																
10/28/20	15.96	16.64	26.38	27.26	8.51	6.86	7.56	7.52	12.0	1.5	32.12	19.88	1.73	2.62	5.13	9:05
10/28/20	15.88	16.64	26.31	27.26	6.96	6.80	7.43	7.46	N/A	N/A	33.29	17.88	1.71	1.42	5.33	N/A
10/22/20	17.17	17.17	26.66	26.69	6.54	6.36	6.93	7.24	18.6	1.5	15.32	12.64	2.48	3.34	3.57	8:00
10/22/20	17.17	17.17	26.58	26.64	6.34	6.31	7.28	7.34	N/A	N/A	13.47	15.16	2.47	3.32	3.52	N/A
10/14/20	16.68	16.73	25.98	26.06	8.77	7.90	7.77	7.70	11.2	1.5	19.12	21.07	3.58	2.72	4.24	7:44
10/14/20	16.73	16.73	25.99	26.05	7.91	7.83	7.53	7.41	N/A	N/A	20.94	23.12	3.62	3.17	4.24	7:48
10/7/20	18.78	18.80	26.09	26.08	8.08	7.47	7.76	7.65	16.8	1.25	20.04	28.00	3.29	3.00	2.59	7:44
10/7/20	18.79	18.79	26.04	26.01	7.44	7.45	7.63	7.62	N/A	N/A	19.70	31.64	3.35	3.76	2.61	N/A
10/1/20	19.97	20.46	26.38	26.98	7.06	6.96	7.16	7.26	17.3	1.5	26.62	32.15	3.12	3.09	3.29	7:58
10/1/20	19.98	20.46	26.28	26.91	7.09	6.96	7.24	7.33	N/A	N/A	35.64	33.69	2.52	3.36	3.31	N/A
9/23/20	17.98	17.92	25.47	25.52	7.69	7.67	7.63	7.63	15.9	1.25	24.54	27.98	2.73	2.98	3.97	8:04
9/23/20	17.84	17.91	25.43	25.49	7.68	7.68	7.61	7.63	N/A	N/A	22.40	25.89	2.72	3.38	3.95	N/A
9/16/20	21.34	21.35	26.23	26.20	7.29	7.10	7.67	7.50	14.6	1.0	40.68	40.55	3.26	3.48	4.26	7:44
9/16/20	21.33	21.36	26.15	26.21	7.09	7.11	7.45	7.45	N/A	N/A	50.64	53.12	3.27	3.66	4.26	N/A
9/9/20	23.9	23.6	26.48	27.14	4.58	2.84	7.65	7.53	21.1	1.75	N/A	N/A	3.21	2.98	5.15	8:01
9/9/20	23.8	23.6	26.40	27.13	4.70	2.66	7.62	7.52	N/A	N/A	N/A	N/A	N/A	N/A	5.15	N/A

2020 CSHH Field-Monitoring Data

Date	**Water Temp (°C)**		**Salinity (ppt)**		**DO (ppm)**		**pH**		**Air Temp**	**Secchi**	**Chlor a (ug/l)**		**Turbidity (NTU)**		**Depth(m)**	**Time**
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	**(°C)**	**(m)**	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #1 - Beacon 11 (*continued*)																
9/3/20	23.46	23.51	26.55	26.76	3.32	3.16	7.35	7.34	23.7	1.25	20.05	18.32	3.45	4.08	3.08	7:35
9/3/20	23.45	23.51	26.54	26.74	3.27	3.14	7.34	7.34	N/A	N/A	19.82	19.77	3.40	3.80	3.09	N/A
8/26/20	25.10	25.27	26.01	26.07	8.50	8.21	8.00	7.90	22.1	1.2	46.48	49.63	2.81	3.45	5.03	7:50
8/26/20	25.06	25.15	25.93	25.96	8.39	8.29	7.92	7.89	N/A	N/A	47.42	50.38	3.09	4.16	5.07	N/A
8/19/20	23.85	23.76	25.49	25.71	4.50	3.24	7.36	7.26	20.5	1.0	48.53	16.43	3.49	5.80	3.13	7:51
8/19/20	23.84	23.75	25.33	25.72	3.89	3.56	7.30	7.27	N/A	N/A	67.00	15.59	3.57	5.70	3.15	N/A
8/12/20	24.14	23.51	26.17	26.54	4.02	2.25	7.34	7.18	25.6	1.25	28.46	20.61	1.98	3.10	3.55	7:48
8/12/20	24.24	23.51	26.16	26.53	3.23	2.98	7.30	7.22	N/A	N/A	21.46	14.37	1.91	2.59	3.74	N/A
8/7/20	23.45	23.22	25.82	26.45	4.47	3.47	6.92	7.08	23.0	1.0	42.62	19.50	3.36	4.40	3.24	9:42
8/7/20	23.45	23.28	25.85	26.41	3.43	3.63	7.13	7.14	N/A	N/A	45.94	23.71	3.76	4.98	3.18	N/A
7/29/20	25.69	24.56	25.69	26.06	6.74	4.04	7.73	7.42	25.3	1.0	52.52	36.66	2.90	2.88	4.34	8:55
7/29/20	25.72	24.37	25.64	26.10	5.13	3.65	7.67	7.38	N/A	N/A	53.72	25.96	2.68	4.18	4.98	N/A
7/22/20	24.45	24.03	25.15	25.47	3.00	2.79	7.26	7.25	25.0	1.2	30.04	17.70	4.14	5.47	2.98	7:37
7/22/20	24.51	23.95	25.01	25.58	3.05	2.92	7.27	7.26	N/A	N/A	31.38	14.59	3.97	4.72	3.02	N/A
7/15/20	25.23	24.30	24.89	25.46	8.71	5.87	8.04	7.70	24.8	0.75	46.40	16.49	3.76	12.03	4.87	7:42
7/15/20	25.23	24.28	25.85	25.45	7.06	5.82	8.00	7.71	N/A	N/A	50.81	15.90	3.72	9.64	4.88	N/A
7/8/20	21.54	21.42	25.37	25.58	2.98	2.84	N/A	N/A	N/A	N/A	68.09	56.42	2.98	2.79	3.48	6:55
7/1/20	21.40	18.58	24.94	25.86	7.24	3.31	7.66	7.32	22.8	1.1	80.54	21.08	3.01	1.00	5.19	7:41
7/1/20	21.26	18.72	24.97	25.81	4.72	4.11	7.52	7.37	N/A	N/A	77.35	26.19	2.81	1.10	5.22	N/A
6/23/20	20.51	19.98	24.97	25.36	6.74	6.67	N/A	N/A	N/A	N/A	92.25	78.53	3.36	2.84	3.33	6:37
6/17/20	18.95	17.23	24.75	25.33	7.89	6.20	7.90	7.67	18.6	0.8	39.82	37.32	3.12	2.74	4.32	7:26
6/17/20	19.04	17.24	24.66	25.36	7.13	6.29	7.89	7.68	N/A	N/A	39.74	39.64	3.06	3.12	4.38	N/A
6/3/20	17.64	16.08	24.42	25.15	8.87	6.93	8.15	7.90	21.1	1.25	29.25	15.58	2.60	3.87	4.73	7:44
6/3/20	17.63	16.07	24.51	25.22	8.36	7.27	8.15	7.90	N/A	N/A	32.17	14.75	2.32	3.79	4.73	N/A

2020 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chlor a (ug/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #2 - Bell Marker 6																
10/28/20	16.10	16.78	27.42	27.99	8.80	7.75	7.78	7.63	12.8	1.75	52.43	12.48	0.98	4.71	10.31	11:08
10/22/20	17.35	17.08	26.73	27.18	8.99	7.64	7.70	7.61	19.0	1.75	20.16	11.20	0.80	1.17	8.29	10:00
10/14/20	17.66	17.69	27.09	27.18	8.05	7.67	7.75	7.68	14.8	2.25	8.86	12.05	1.34	4.34	10.26	9:42
10/7/20	19.25	19.33	27.06	27.04	8.83	9.15	7.93	7.89	17.7	1.75	41.61	54.18	1.00	1.02	8.37	8:11
10/1/20	20.36	20.36	27.23	27.11	7.59	7.45	7.59	7.55	17.9	2.0	23.58	23.48	1.08	1.15	9.02	8:23
9/23/20	19.38	19.35	26.64	26.65	7.92	7.57	7.73	7.69	17.7	2.25	16.62	16.49	0.97	1.58	9.05	8:37
9/16/20	22.10	22.18	26.81	26.84	7.70	6.32	7.78	7.59	19.2	1.25	25.71	14.85	2.12	3.23	9.13	9:55
9/9/20	23.7	23.4	27.06	27.14	6.60	4.89	7.95	7.71	21.8	1.25	N/A	N/A	1.42	2.72	6.65	8:30
9/3/20	23.47	23.14	27.16	27.42	5.57	2.83	7.56	7.38	24.2	1.25	22.62	11.12	1.85	4.16	8.44	7:56
8/26/20	24.75	24.35	26.37	26.35	7.68	6.96	7.83	7.71	22.3	1.25	20.58	16.48	2.78	3.61	8.70	8:20
8/19/20	24.11	23.89	26.41	26.52	8.57	7.13	7.87	7.68	21.7	1.0	41.73	32.71	1.77	3.66	9.51	9:42
8/12/20	24.78	22.37	26.24	26.81	6.89	2.49	7.70	7.40	27.0	1.5	27.59	6.60	1.25	1.91	9.61	8:11
8/7/20	23.46	22.22	26.49	26.85	7.58	2.86	7.63	7.18	22.7	1.3	44.95	8.86	1.70	2.24	7.44	10:06
7/29/20	25.84	21.05	25.00	26.75	9.01	1.59	8.06	7.24	26.8	1.25	23.23	8.31	1.58	1.71	8.78	9:25
7/22/20	23.70	20.99	25.68	26.22	4.10	1.16	7.40	7.15	26.7	1.5	48.30	8.49	2.93	1.06	7.39	7:58
7/15/20	25.30	21.73	25.46	25.96	8.80	3.66	8.18	7.50	23.4	1.25	26.36	28.88	2.20	2.44	6.47	10:00
7/8/20	21.45	19.61	25.91	26.16	6.42	4.96	N/A	N/A	N/A	N/A	23.46	66.50	1.49	3.30	7.77	7:36
7/1/20	21.76	18.73	25.27	26.04	9.37	5.73	7.99	7.62	23.9	1.25	32.67	11.56	2.63	1.19	9.25	9:43
6/23/20	20.06	17.42	25.46	25.79	8.22	7.61	N/A	N/A	N/A	N/A	12.61	27.84	0.75	1.16	6.37	7:21
6/17/20	18.84	17.42	25.31	25.41	9.47	8.67	8.11	7.90	20.1	2.0	6.73	12.58	0.84	1.32	7.92	9:30
6/3/20	17.85	15.69	25.06	25.39	9.14	8.41	8.25	8.05	25.1	1.9	12.74	13.39	1.12	1.91	10.10	9:47

2020 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chlor a (ug/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #16 - Outer Harbor, Midway E/W Shore and N/S Boundary of Shellfish Harvesting Area																
10/28/20	16.17	16.82	27.59	28.10	8.59	7.55	7.78	7.65	12.7	1.5	42.93	11.00	0.92	1.60	10.63	11:30
10/22/20	17.38	17.02	26.92	27.22	9.46	7.57	7.76	7.62	19.3	2.0	29.74	10.78	0.76	1.61	8.81	10:20
10/14/20	17.72	17.89	27.20	27.32	8.11	7.56	7.73	7.67	15.1	2.25	7.16	7.55	1.31	2.66	10.94	10:00
10/7/20	19.33	19.49	27.05	27.16	8.99	8.68	7.96	7.89	17.7	1.75	38.18	47.47	1.08	1.71	9.01	8:28
10/1/20	20.23	20.25	27.16	27.22	7.58	7.01	7.60	7.53	18.3	2.5	21.13	15.44	1.42	1.27	9.70	8:42
9/23/20	19.77	19.70	26.81	26.82	7.62	7.52	7.70	7.69	18.3	2.25	9.52	13.30	1.05	1.63	9.26	9:07
9/16/20	22.46	22.51	26.90	26.94	6.94	6.23	7.69	7.64	19.5	1.5	12.61	13.54	1.50	2.60	11.10	10:10
9/9/20	23.9	23.3	27.10	27.27	7.37	5.04	8.01	7.59	22.4	1.25	N/A	N/A	1.20	1.63	9.40	8:52
9/3/20	23.42	23.12	27.21	27.46	6.60	3.73	7.67	7.43	24.0	1.5	25.47	11.61	1.42	4.81	8.75	8:16
8/26/20	24.58	24.14	26.46	26.58	8.15	5.28	7.85	7.51	21.1	1.3	30.89	23.54	1.79	6.19	10.01	8:41
8/19/20	23.94	23.75	26.36	26.69	8.59	6.30	7.90	7.66	21.1	1.0	49.12	26.71	1.78	4.87	10.50	9:57
8/12/20	24.69	21.32	26.44	27.12	7.40	2.24	7.74	7.20	26.4	1.75	22.97	4.30	1.06	1.78	10.14	8:26
8/7/20	23.46	22.15	26.60	26.89	8.31	2.83	7.74	7.19	23.0	1.25	38.43	9.39	1.78	3.71	8.86	10:22
7/29/20	25.71	20.15	26.20	26.98	10.82	1.36	8.25	7.23	27.3	0.8	74.67	11.65	2.74	0.86	10.20	9:38
7/22/20	24.34	20.82	25.54	26.24	6.45	1.68	7.74	7.19	25.6	1.3	27.03	6.48	1.92	1.18	8.40	8:11
7/15/20	24.10	20.41	25.64	26.26	10.15	2.52	8.24	7.41	22.6	1.5	22.44	13.64	1.88	3.93	9.93	10:23
7/8/20	21.28	19.46	26.03	26.26	7.48	6.54	N/A	N/A	N/A	N/A	23.31	32.40	0.90	2.39	8.89	7:50
7/1/20	20.91	17.02	25.94	26.29	8.58	4.52	8.01	7.52	26.6	1.75	25.33	8.17	1.45	3.97	10.69	9:57
6/23/20	20.81	16.16	25.47	25.88	8.49	7.09	N/A	N/A	N/A	N/A	10.31	15.51	0.74	2.74	8.69	7:35
6/17/20	18.31	N/A†	25.47	N/A†	8.56	N/A†	7.99	N/A†	19.3	2.0	7.81	N/A†	0.80	N/A†	N/A†	9:50
6/3/20	17.49	14.35	25.11	25.67	10.28	7.20	8.30	7.89	21.7	2.0	12.45	9.76	1.04	2.67	10.84	10:01

† did not sample bottom depth b/c of high waves

2020 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chlor a (ug/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #17 - Outer Harbor, Just Outside Restricted Crescent Beach Boundary																
10/28/20	16.70	16.93	28.09	28.21	7.76	7.20	7.70	7.62	12.6	1.75	13.42	5.65	1.34	1.93	6.40	11:52
10/22/20	17.40	17.14	26.93	27.26	9.71	7.98	7.82	7.62	19.8	1.75	39.40	6.94	0.84	1.41	5.52	10:42
10/14/20	17.66	17.62	27.22	27.19	7.77	7.47	7.68	7.66	15.4	2.5	5.11	6.82	1.34	3.01	6.68	10:22
10/7/20	19.26	19.26	27.03	27.00	9.55	9.44	8.01	7.99	18.2	1.5	38.16	39.77	1.57	1.18	4.40	8:47
10/1/20	20.22	20.17	27.18	27.18	7.66	7.25	7.62	7.57	18.5	2.25	22.50	18.57	1.13	1.23	6.52	9:10
9/23/20	19.06	19.07	26.63	26.66	8.04	7.95	7.77	7.76	18.7	2.0	13.53	18.44	1.35	1.18	5.58	9:28
9/16/20	22.49	22.15	26.98	26.96	7.08	6.34	7.72	7.63	19.8	1.5	11.99	6.97	1.39	1.97	6.90	10:33
9/9/20	23.8	23.6	27.16	27.23	6.59	5.07	7.96	7.79	22.8	1.25	N/A	N/A	1.15	2.44	5.95	9:20
9/3/20	23.58	23.57	27.26	27.23	6.28	5.68	7.65	7.61	24.3	1.5	20.20	21.14	2.04	1.79	4.35	8:35
8/26/20	24.71	24.46	26.49	26.61	8.08	7.06	7.86	7.68	20.6	1.5	23.46	23.47	1.81	3.13	7.24	9:03
8/19/20	Trip abandoned due to approaching thunderstorm.															
8/12/20	25.03	21.33	26.45	27.15	7.81	2.67	7.82	7.22	26.4	1.8	19.56	3.98	1.06	2.67	7.45	8:43
8/7/20	23.21	23.02	26.81	26.85	7.76	6.38	7.70	7.54	23.4	1.5	23.34	21.32	1.28	3.25	6.74	10:47
7/29/20	24.62	20.69	26.40	26.86	9.45	2.05	8.08	7.28	28.1	1.5	21.86	7.10	1.45	1.57	6.66	10:07
7/22/20	24.36	21.24	25.85	26.23	8.12	2.56	7.95	7.28	25.9	1.75	18.29	7.42	1.53	1.52	6.21	8:26
7/15/20	23.69	19.83	25.74	26.40	9.48	2.43	8.12	7.36	22.8	1.75	12.36	9.98	1.75	2.65	7.17	10:50
7/8/20	21.11	20.70	25.95	26.01	6.17	6.09	N/A	N/A	N/A	N/A	13.90	16.25	1.53	2.36	4.50	8:11
7/8/20	21.10	20.53	26.00	26.09	6.06	5.71	N/A	N/A	N/A	N/A	16.89	13.68	1.16	1.22	4.53	8:15
7/1/20	20.61	17.81	25.90	26.22	8.68	4.75	7.98	7.55	26.7	1.5	22.76	10.42	1.04	3.86	7.97	10:16
6/23/20	21.03	17.54	25.50	25.80	8.99	8.34	N/A	N/A	N/A	N/A	11.50	15.23	0.80	2.11	6.36	7:50
6/23/20	21.12	17.59	25.52	25.88	9.19	8.03	N/A	N/A	N/A	N/A	11.83	12.55	0.77	2.39	6.31	7:53
6/17/20	18.64	N/A†	25.43	N/A†	8.73	N/A†	8.02	N/A†	19.2	2.0	6.27	N/A†	1.16	N/A†	N/A†	10:13
6/3/20	17.53	14.98	25.18	25.54	10.31	8.04	8.28	7.94	22.2	2.0	3.22	6.85	1.06	1.96	8.38	10:20
† did not sample bottom depth b/c of high waves																

2020 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chlor a (ug/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #3 - Glen Cove Creek, Red Marker																
10/28/20	16.47	16.84	27.17	27.87	8.59	7.32	7.70	7.62	12.5	2.0	13.15	9.54	1.17	2.05	5.02	12:15
10/22/20	17.25	17.08	26.60	27.04	8.01	7.93	7.57	7.58	18.6	1.5	40.67	15.50	1.46	1.57	3.85	8:56
10/14/20	17.25	17.37	26.61	26.88	8.71	8.28	7.86	7.78	16.4	2.0	13.09	13.26	1.37	1.33	5.44	10:44
10/7/20	19.09	19.08	26.22	26.61	8.96	8.34	8.02	7.86	18.3	1.5	36.98	36.27	1.79	2.51	3.58	9:06
10/1/20	20.18	20.22	26.71	26.79	8.32	8.04	7.67	7.59	18.5	1.5	43.07	34.53	1.48	1.49	4.75	9:25
9/23/20	19.22	18.86	26.11	26.38	7.85	8.06	7.74	7.78	19.7	1.5	10.15	24.73	1.76	1.85	3.65	9:53
9/16/20	22.01	21.76	26.71	26.77	7.71	6.50	7.77	7.63	20.1	1.0	22.41	20.29	1.52	3.72	5.72	10:53
9/9/20	24.2	24.0	26.36	26.97	6.35	5.29	7.93	7.81	23.1	1.1	N/A	N/A	2.10	2.09	3.95	9:50
9/3/20	23.72	23.31	27.05	27.37	6.46	3.79	7.65	7.42	24.1	1.25	37.91	12.79	2.37	3.36	3.71	9:02
8/26/20	25.36	24.96	25.86	26.43	8.62	8.31	7.98	7.88	21.6	1.2	28.66	30.36	2.45	2.94	4.25	9:30
8/19/20	24.19	24.54	25.89	26.23	7.64	7.72	7.70	7.76	21.7	1.0	41.38	36.78	2.15	2.27	3.58	8:17
8/12/20	24.71	23.42	26.10	26.58	6.79	3.96	7.62	7.29	26.4	1.0	59.21	41.32	1.98	2.44	4.54	9:05
8/7/20	23.68	22.76	26.27	26.81	7.58	4.05	7.63	7.27	23.7	1.0	46.19	13.02	2.23	2.22	4.19	11:10
7/29/20	26.16	23.18	25.53	26.47	9.02	5.66	8.00	7.55	26.5	1.25	39.99	9.18	2.03	3.13	4.55	10:18
7/22/20	24.40	23.50	25.63	25.80	6.20	5.06	7.68	7.49	26.7	1.25	26.89	15.70	2.31	2.77	3.27	8:53
7/15/20	25.27	21.52	24.72	26.06	8.13	1.69	8.03	7.32	24.1	1.5	14.02	22.03	2.00	2.06	4.43	11:15
7/8/20	21.76	21.08	24.93	25.93	5.88	5.40	N/A	N/A	N/A	N/A	33.09	27.05	1.91	1.70	3.66	7:23
7/1/20	22.03	18.32	25.15	25.95	8.24	5.25	7.94	7.48	24.4	1.25	9.63	14.18	2.10	1.54	5.15	10:41
6/23/20	21.40	19.88	25.25	25.50	9.18	8.38	N/A	N/A	N/A	N/A	21.65	38.60	1.08	1.62	3.46	7:03
6/17/20	18.55	17.17	24.74	25.46	9.26	7.34	8.05	7.79	21.7	1.75	7.27	17.59	1.54	1.71	5.28	10:33
6/3/20	18.60	16.05	24.69	25.31	11.71	9.49	8.43	7.98	23.7	1.3	38.04	15.30	1.77	1.51	5.57	10:47

2020 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chlor a (ug/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #8 - Glen Cove Sewage Treatment Plant Outfall																
10/28/20	16.68	16.50	26.56	27.21	7.87	7.23	7.61	7.61	12.8	1.75	11.34	9.83	2.18	1.26	2.79	12:35
10/22/20	17.07	17.14	26.00	26.50	7.52	6.65	7.44	7.46	18.8	1.25	9.21	11.34	3.55	3.23	1.39	9:25
10/14/20	18.01	17.44	21.68	26.53	7.74	6.71	7.62	7.67	17.0	1.5	9.37	16.58	4.16	2.28	3.17	11:10
10/7/20	19.28	19.31	22.79	24.91	8.60	8.27	7.84	7.80	18.8	0.8	40.59	28.66	4.89	4.90	1.33	9:26
10/1/20	20.51	20.37	18.34	26.25	8.46	7.42	7.54	7.53	18.7	1.0	51.72	30.68	2.96	3.00	2.76	9:43
9/23/20	19.53	19.44	24.33	26.21	7.70	6.91	7.70	7.66	19.9	1.25	18.13	19.80	10.09	1.79	1.54	10:23
9/16/20	22.07	21.84	25.42	26.51	7.13	6.08	7.63	7.60	21.2	1.0	25.77	26.59	2.32	2.61	3.43	11:15
9/9/20	24.2	24.2	20.96	26.58	5.79	4.85	7.79	7.79	22.6	1.1	N/A	N/A	1.91	1.91	1.35	10:18
9/3/20	23.84	23.82	24.11	26.59	5.67	4.67	7.48	7.44	24.3	0.75	38.79	23.14	3.66	2.75	1.92	9:30
8/26/20	25.96	25.63	24.35	25.93	8.51	6.90	7.97	7.66	21.1	0.75	77.99	26.37	3.01	4.31	1.81	9:55
8/19/20	24.05	24.07	20.57	25.72	6.38	4.45	7.52	7.35	20.7	1.0	33.46	25.24	3.08	4.23	1.71	8:38
8/12/20	25.14	24.87	23.26	26.00	6.91	5.73	7.54	7.40	26.4	1.0	82.82	33.80	3.58	3.27	2.08	9:27
8/7/20	24.13	23.81	24.58	26.25	7.10	5.92	7.52	7.41	23.2	1.0	45.64	33.87	2.92	3.06	2.24	11:42
Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.																
CSHH #13 - 60' West of the Mill Pond Weir																
10/28/20	16.64	16.71	26.03	27.13	7.87	5.86	7.49	7.48	12.6	0.75	10.57	8.50	3.72	2.71	2.50	12:58
10/22/20	Access blocked by barge.															
10/14/20	17.56	18.19	21.65	26.53	5.70	4.70	7.35	7.43	17.1	1.5	8.42	8.44	2.56	3.39	2.80	11:31
10/7/20	18.86	19.02	21.80	23.75	8.25	8.16	7.66	7.68	19.9	1.0	58.56	31.45	3.10	4.57	1.08	9:48
10/1/20	19.54	20.66	18.06	26.27	8.55	5.02	7.49	7.27	20.1	1.0	105.13	18.30	3.71	3.75	2.70	10:02
9/23/20	19.29	19.57	24.07	25.83	6.72	6.16	7.50	7.43	21.4	1.0	13.00	11.94	3.18	3.31	1.30	10:49
9/16/20	Ran out of time for profile. Bacteria sample pickup only.															
9/9/20	Access blocked by barge.															

2020 CSHH Field-Monitoring Data

Date	**Water Temp (°C)**		**Salinity (ppt)**		**DO (ppm)**		**pH**		**Air Temp**	**Secchi**	**Chlor a (ug/l)**		**Turbidity (NTU)**		**Depth(m)**	**Time**
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	**(°C)**	**(m)**	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #13 - 60' West of the Mill Pond Weir (*continued*)																
9/3/20	23.60	23.82	24.04	25.84	5.13	4.65	7.49	7.44	25.1	1.25	46.87	19.48	1.96	2.55	1.80	9:55
8/26/20	25.49	25.76	24.98	25.82	6.55	4.57	7.54	7.47	22.7	0.8	36.64	20.55	3.37	5.33	1.45	10:26
8/19/20	24.04	24.16	24.28	25.22	4.47	4.00	7.28	7.26	21.8	0.5	45.76	29.21	4.24	3.63	2.14	9:22
8/12/20	24.62	24.89	23.26	25.86	6.36	4.74	7.47	7.31	28.5	1.0	87.69	34.94	3.45	3.36	1.74	9:46
8/7/20	23.91	23.76	24.65	26.25	6.82	4.84	7.43	7.22	26.1	1.0	57.49	18.32	2.75	4.37	2.40	12:10
7/29/20	25.49	25.34	24.34	25.54	7.20	3.82	7.61	7.36	31.3	0.75	34.14	19.43	3.36	3.79	1.94	10:46
7/22/20	24.82	25.25	22.24	25.03	9.40	7.58	7.89	7.60	28.3	1.0	56.02	18.92	3.51	4.58	1.75	9:18
7/15/20	Ran out of time for profile/sample.															
7/1/20	Blocked off by barge and crane.															
6/17/20	19.54	18.36	24.47	24.94	10.62	7.46	8.04	7.55	21.3	0.3	127.79	20.26	3.91	4.06	2.64	11:01
6/3/20	18.76	18.58	21.90	24.14	11.04	10.15	8.17	8.11	23.8	1.1	58.91	48.73	2.64	3.57	2.98	11:12
CSHH #14 - 50 yds from Powerhouse Drain																
10/28/20	16.16	16.50	26.48	26.93	7.18	6.84	7.51	7.51	12.5	1.25	39.43	25.32	1.90	1.61	2.56	9:42
10/14/20	16.52	16.54	25.84	25.86	7.86	7.64	7.69	7.67	13.2	1.25	18.20	16.69	3.38	3.54	2.44	8:18
10/1/20	20.39	20.43	26.48	26.91	7.47	7.44	7.57	7.56	21.4	1.25	20.33	23.02	2.68	1.94	2.34	10:48
9/16/20	21.03	21.04	26.00	26.01	7.00	7.01	7.50	7.51	14.7	1.0	39.68	48.99	4.66	4.68	3.83	8:14
7/29/20	26.00	25.08	25.40	25.69	5.74	4.79	7.55	7.44	27.3	0.75	100.08	28.92	4.82	2.74	2.40	8:37
7/15/20	25.44	25.36	24.95	25.07	7.80	7.85	7.95	7.91	24.7	0.75	47.33	26.43	4.40	5.13	2.12	9:20
7/1/20	21.03	20.44	25.12	25.27	6.60	5.99	7.60	7.50	21.8	0.75	73.45	29.05	2.93	2.01	2.51	9:05
6/17/20	18.77	17.27	24.66	25.31	8.17	7.35	7.86	7.71	20.0	0.8	61.99	48.64	3.65	2.61	2.07	7:53
6/3/20	17.41	17.26	24.43	24.52	8.64	8.70	8.08	8.05	21.0	1.25	28.93	38.90	2.90	2.88	2.49	8:21

2020 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chlor a (ug/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #15 - 50 yds from Scudder's Pond Outfall, North of Tappen Pool																
10/28/20	16.18	16.60	26.97	27.53	7.64	7.00	7.59	7.52	12.8	0.75	74.31	16.24	2.36	1.99	2.66	10:53
10/14/20	16.74	16.94	25.93	26.45	8.06	7.93	7.74	7.77	13.9	1.5	10.83	17.78	2.98	1.74	2.89	9:28
10/1/20	19.84	19.82	26.12	26.17	8.12	8.00	7.57	7.57	19.6	1.25	28.73	36.48	2.44	2.53	2.18	10:25
9/16/20	Ran out of time for survey.															
7/29/20	25.83	24.97	25.59	25.96	7.04	4.61	7.79	7.43	26.7	1.0	51.39	39.59	2.90	3.27	2.63	9:12
7/15/20	25.16	24.31	25.06	25.50	7.26	3.93	7.91	7.54	23.6	1.1	20.03	17.61	4.25	4.78	2.70	9:42
7/1/20	21.27	19.65	24.88	25.59	6.82	5.56	7.56	7.42	22.0	1.2	16.28	13.99	2.45	1.49	2.31	9:25
6/17/20	18.78	17.79	24.78	25.28	8.67	7.58	8.01	7.76	20.6	1.0	44.58	75.73	8.80	6.55	2.49	9:17
6/3/20	18.75	17.15	24.09	24.58	10.23	10.43	8.31	8.07	24.8	1.0	42.40	39.32	2.78	4.54	2.51	11:37
CSHH #4 - Bar Beach Spit																
10/28/20	16.05	16.22	26.46	26.58	8.05	7.30	7.57	7.56	12.2	1.25	51.33	72.49	2.12	2.06	2.55	9:29
10/14/20	16.79	16.81	25.87	25.89	7.91	7.62	7.70	7.69	12.3	1.0	20.61	20.75	3.69	4.20	1.86	8:07
10/1/20	20.32	20.31	26.67	26.69	8.40	8.46	7.67	7.67	20.4	1.5	30.53	36.44	1.61	1.75	2.36	10:37
9/16/20	21.15	21.18	26.04	26.04	7.63	7.27	7.66	7.65	15.7	1.0	45.99	52.09	3.72	3.91	1.63	8:25
7/29/20	25.57	24.95	25.58	25.74	5.88	3.60	7.52	7.37	26.4	1.2	37.86	30.89	3.23	3.10	2.41	8:44
7/15/20	25.16	25.05	25.15	25.28	7.95	6.94	7.88	7.81	25.2	0.8	22.56	12.75	5.71	5.37	1.84	9:11
7/1/20	21.47	20.02	25.10	25.44	7.85	6.65	7.81	7.53	22.2	0.5	105.36	31.16	3.69	1.67	2.65	9:15
6/17/20	18.12	18.12	25.12	25.11	7.82	7.68	7.85	7.84	19.1	1.1	27.60	34.57	2.60	2.24	1.22	7:44
6/3/20	17.34	16.92	24.82	24.98	8.74	8.69	8.12	8.07	20.6	1.5	32.51	21.25	2.18	2.74	5.24	8:09

2020 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chlor a (ug/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #5 - Mott's Cove																
10/28/20	16.31	16.46	26.51	26.81	7.38	6.87	7.52	7.50	12.5	1.25	33.55	14.38	2.58	1.61	2.24	9:54
10/14/20	16.32	16.61	25.02	25.67	7.57	7.26	7.59	7.61	12.7	1.25	16.02	16.01	3.40	4.31	2.22	8:32
10/1/20	20.07	20.26	25.91	26.38	7.51	7.41	7.51	7.52	21.5	1.25	25.68	24.33	3.65	1.87	2.14	11:00
9/16/20	20.95	21.01	25.69	25.78	6.98	6.77	7.59	7.58	16.0	0.75	34.26	36.25	4.47	4.28	1.65	8:42
7/29/20	25.30	25.20	25.32	25.47	5.41	4.38	7.45	7.38	26.3	0.7	54.39	29.89	3.70	3.46	2.11	8:20
7/15/20	25.21	25.11	24.66	24.90	6.89	6.65	7.75	7.74	24.7	0.8	28.56	18.36	17.12	12.58	1.92	8:57
7/1/20	20.45	19.55	24.87	25.39	6.33	4.99	7.45	7.35	22.6	1.0	38.69	15.58	2.93	2.71	2.20	8:52
6/17/20	18.16	17.66	24.69	25.17	7.53	6.41	7.74	7.69	20.4	0.8	72.37	54.11	4.16	4.65	1.84	8:12
6/3/20	17.19	16.79	24.57	24.88	8.42	8.18	7.99	7.96	21.4	1.0	46.60	18.78	2.38	3.04	2.22	8:37
CSHH #6 - East of Former Incinerator Site																
10/28/20	15.91	16.14	25.69	26.28	7.68	6.79	7.47	7.47	12.5	1.25	33.00	9.93	3.58	4.40	2.51	10:09
10/14/20	16.08	16.39	24.41	25.33	7.04	7.10	7.51	7.57	13.9	1.25	15.31	12.24	5.38	5.25	2.50	8:49
10/1/20	20.21	20.13	25.94	26.04	7.80	7.43	7.57	7.51	21.0	1.1	16.03	19.08	4.47	4.05	2.45	11:16
9/16/20	20.91	21.04	25.66	25.87	7.25	6.78	7.61	7.61	17.7	0.8	35.32	37.71	4.66	4.53	2.15	9:05
7/29/20	26.42	25.70	25.18	25.51	4.53	3.98	7.37	7.36	25.2	0.6	64.04	33.52	3.98	4.15	2.40	8:07
7/15/20	25.91	25.62	24.03	24.79	9.32	9.18	8.05	7.88	26.0	0.4	134.76	17.16	7.79	10.19	2.21	8:40
7/1/20	22.06	20.75	24.62	25.16	8.04	5.14	7.60	7.36	22.3	0.1	80.85	9.72	5.29	6.00	2.44	8:32
6/17/20	19.45	18.89	24.42	24.75	8.21	8.27	7.90	7.83	20.0	0.6	74.15	43.29	5.27	5.28	2.12	8:29
6/3/20	17.92	17.44	24.21	24.53	8.75	8.75	8.08	8.04	22.0	1.0	52.55	23.61	3.72	3.91	2.57	8:55

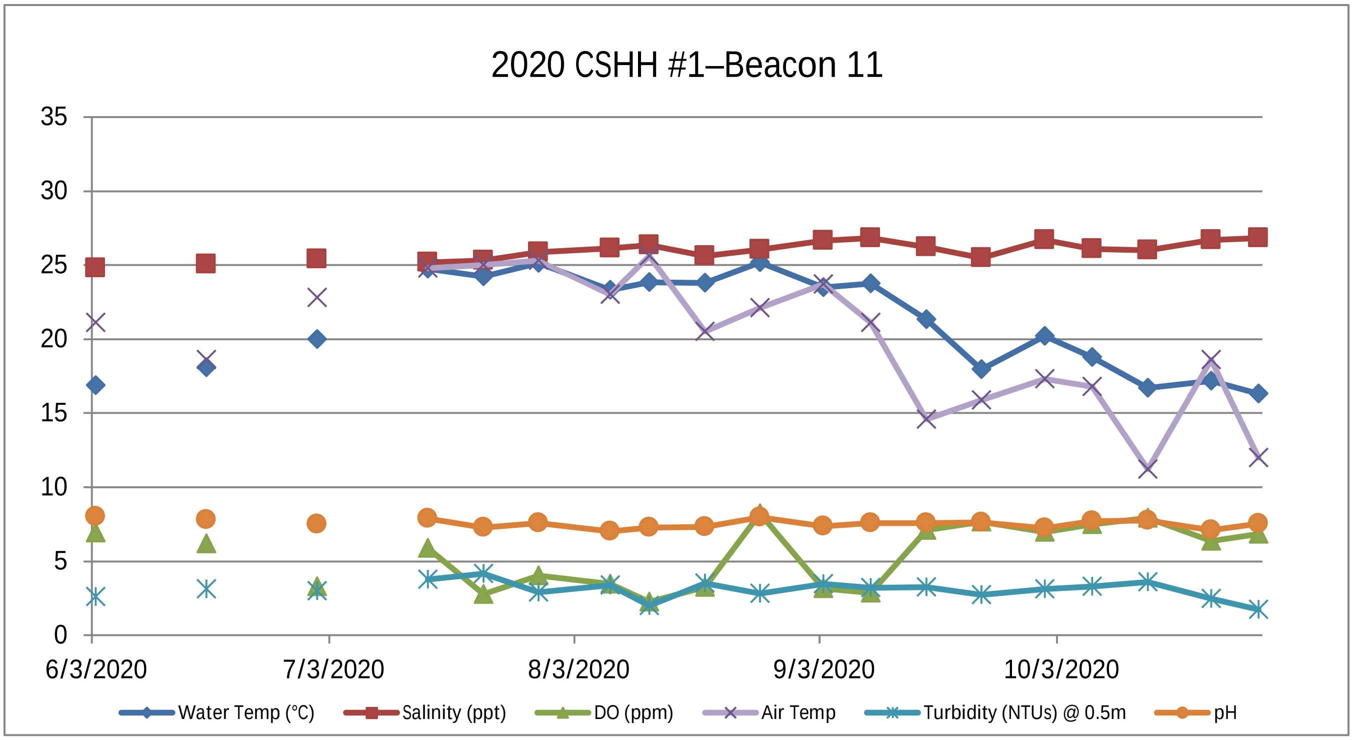
2020 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chlor a (ug/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #7 - West of Bryant Landing (formerly site of oil dock)																
10/28/20	15.46	15.94	25.04	26.05	6.30	5.68	7.30	7.31	12.8	0.8	17.54	4.22	4.70	2.47	1.67	10:23
10/14/20	15.99	16.36	23.56	24.57	7.02	6.38	7.44	7.43	13.5	0.5	9.19	7.19	6.30	6.64	1.71	9:02
10/1/20	20.18	20.31	25.65	25.87	6.57	6.63	7.39	7.45	20.9	0.75	14.47	15.45	5.14	4.79	1.74	11:27
9/16/20	20.84	20.94	25.57	25.60	5.92	5.82	7.50	7.49	18.1	0.6	33.72	30.00	7.28	8.59	1.59	9:18
7/29/20	26.51	26.47	24.97	25.25	4.33	3.67	7.34	7.28	25.3	0.75	47.78	34.71	5.69	4.72	1.72	7:56
7/15/20	25.80	25.98	23.41	24.11	6.81	6.17	7.72	7.60	24.5	0.3	33.64	13.76	7.48	8.53	1.48	8:25
7/1/20	22.42	22.38	24.02	24.46	5.46	4.44	7.36	7.30	23.0	0.7	42.47	11.77	4.82	5.56	1.73	8:21
6/17/20	19.44	19.55	23.36	24.03	7.62	7.07	7.67	7.64	20.0	0.3	48.55	48.76	9.93	14.19	1.42	8:40
6/3/20	18.05	17.90	24.23	27.51	8.47	8.81	8.06	8.05	25.0	1.0	25.41	23.77	3.24	3.38	1.80	9:12

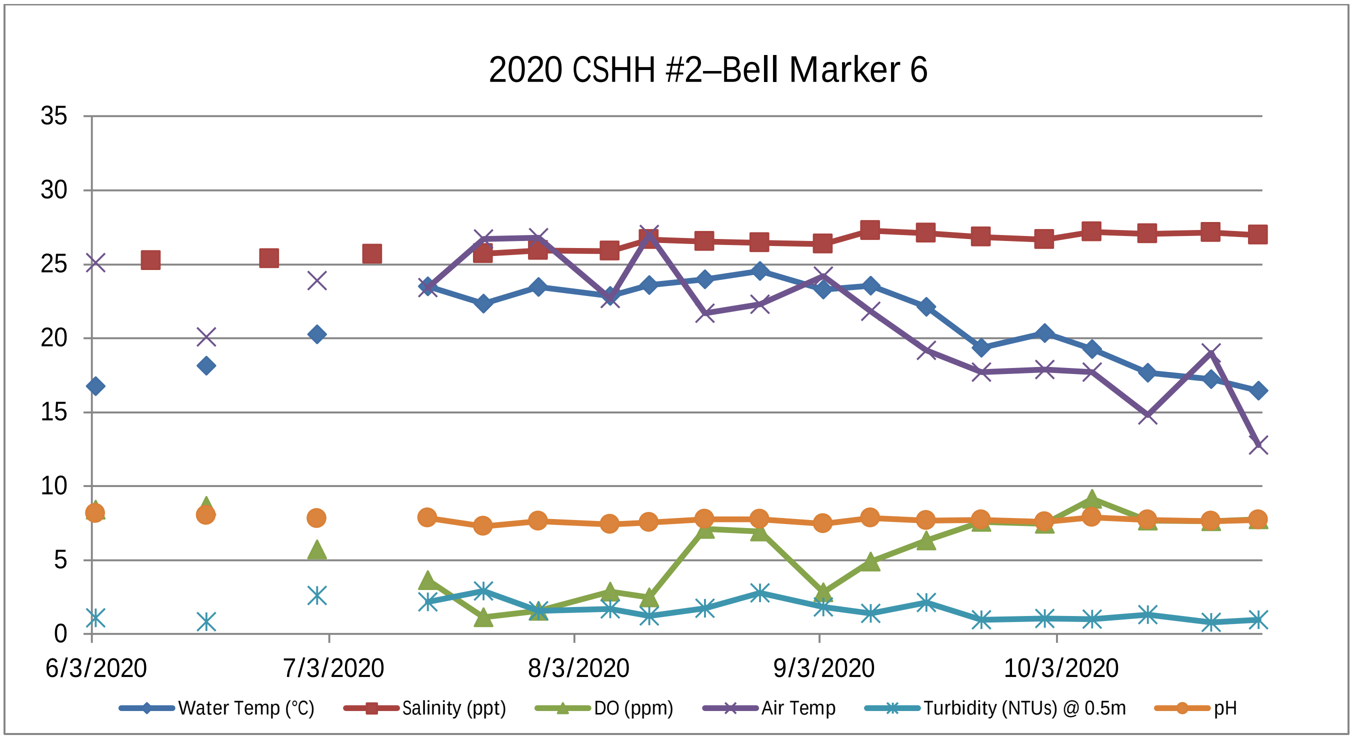
2020 Weekly Graphs for Water-Quality Parameters

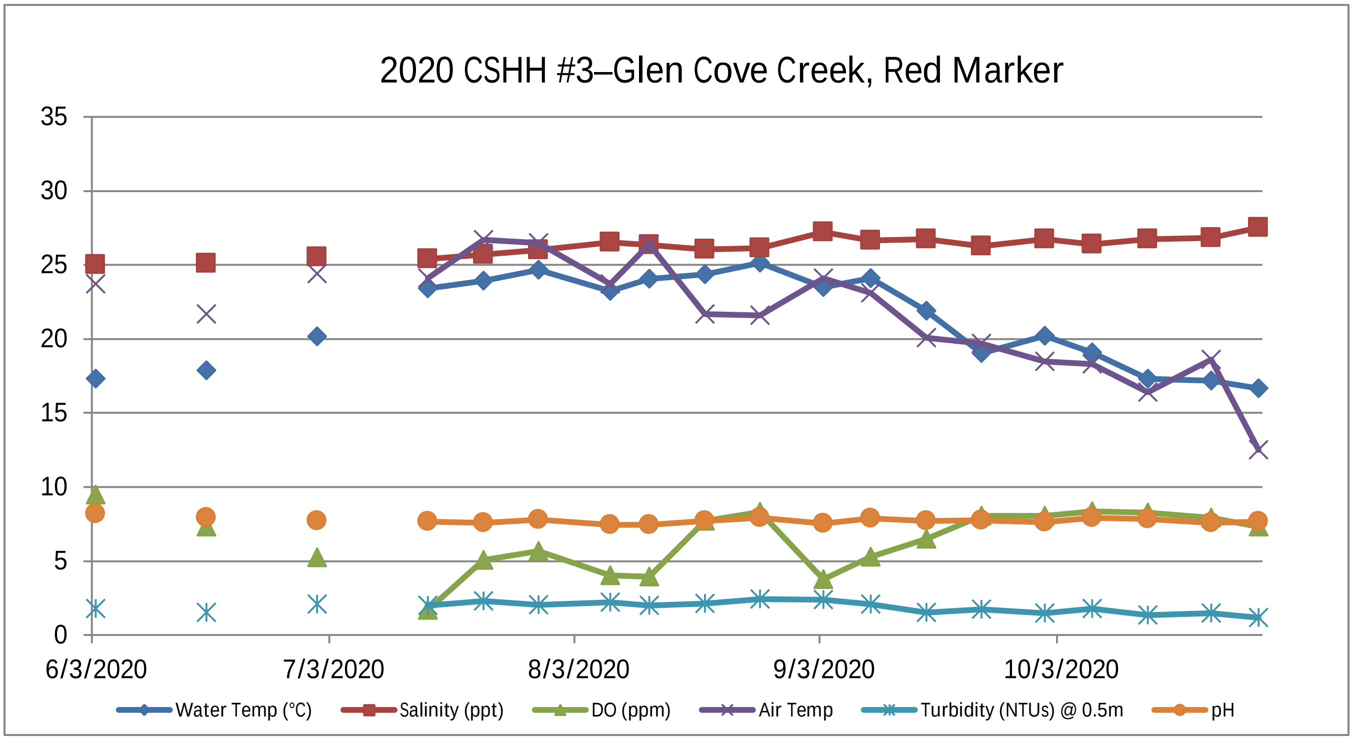
Note: The values graphed below are:

- Water Temperature: the average of the surface and bottom water temperature measurement for that sampling date
- Salinity: the average of the surface and bottom salinity measurement for that sampling date
- DO: the average of the surface and bottom dissolved oxygen measurement for that sampling date
- Air Temp: the measured air temperature at each of the stations on that sampling date
- Turbidity: the turbidity measured at 0.5 meter below the water surface on that sampling date
- pH: the average of the surface and bottom pH measurement for that sampling date

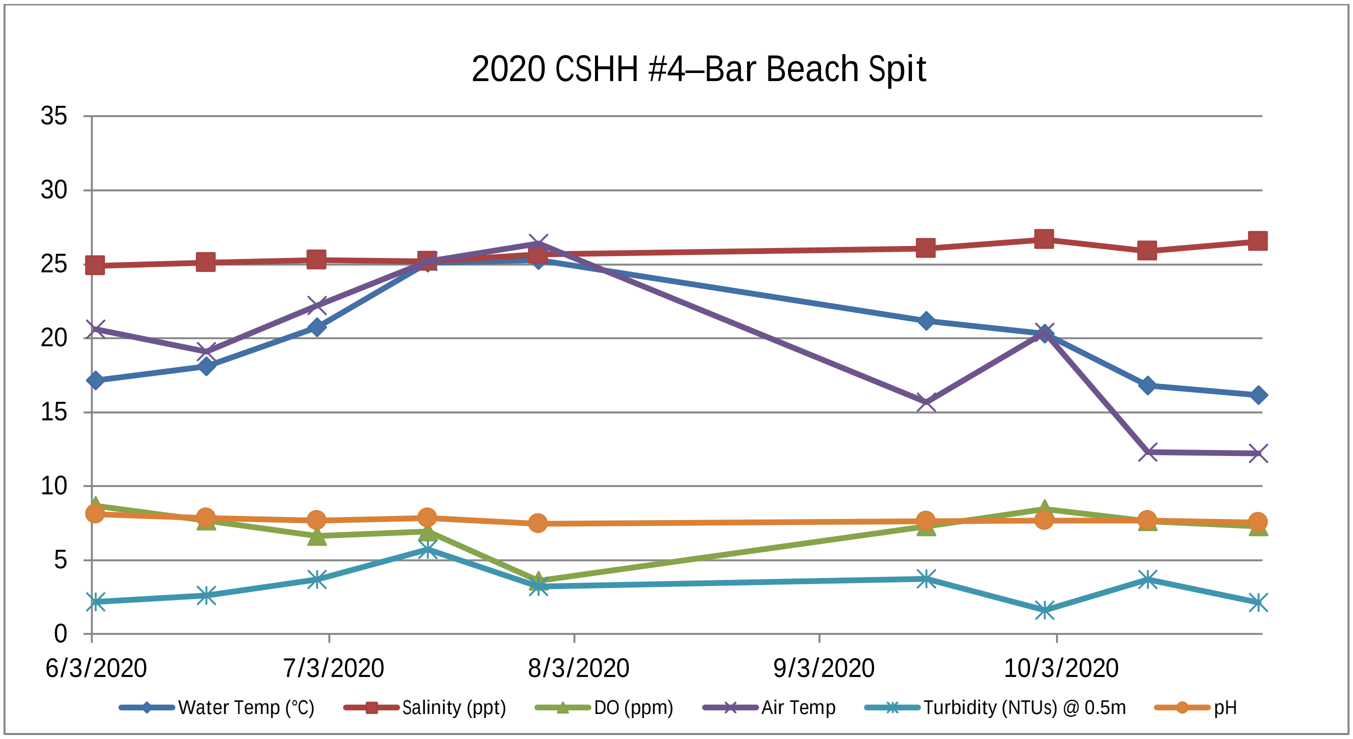


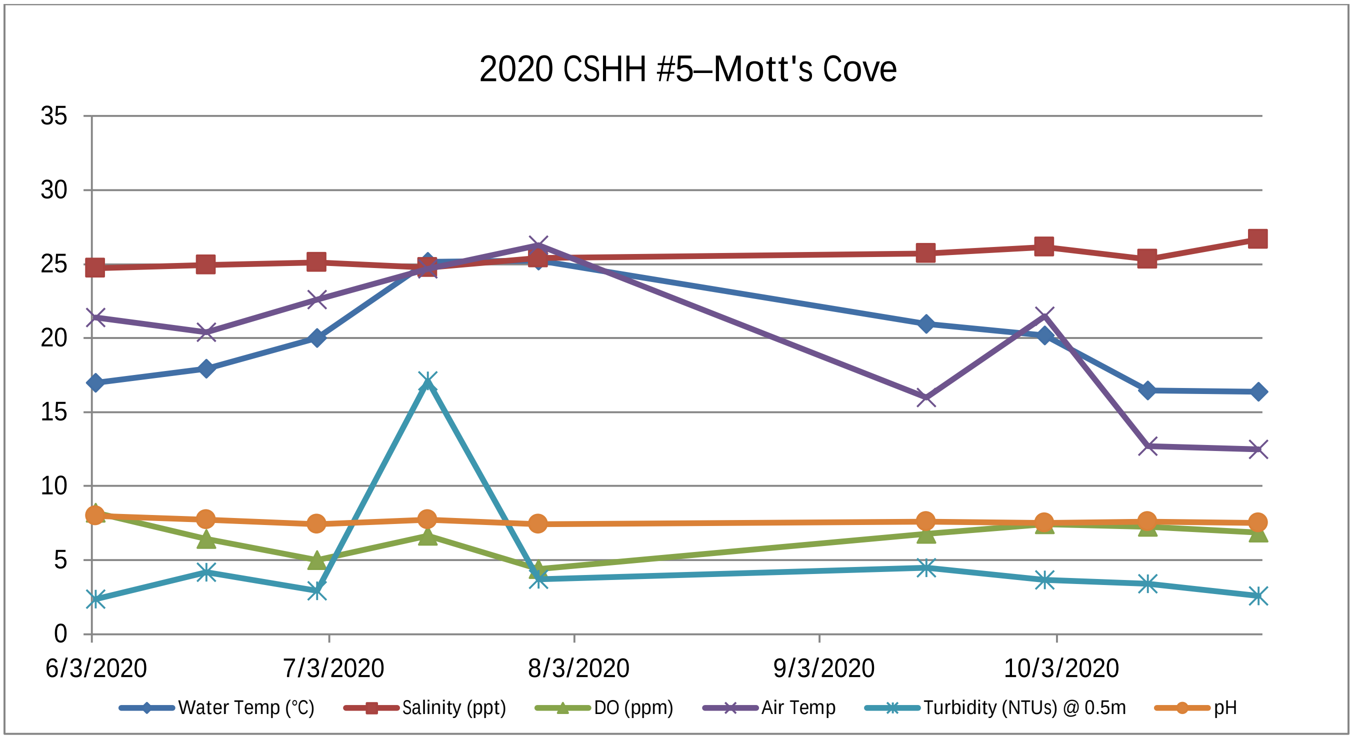
2020 Weekly Graphs for Water-Quality Parameters



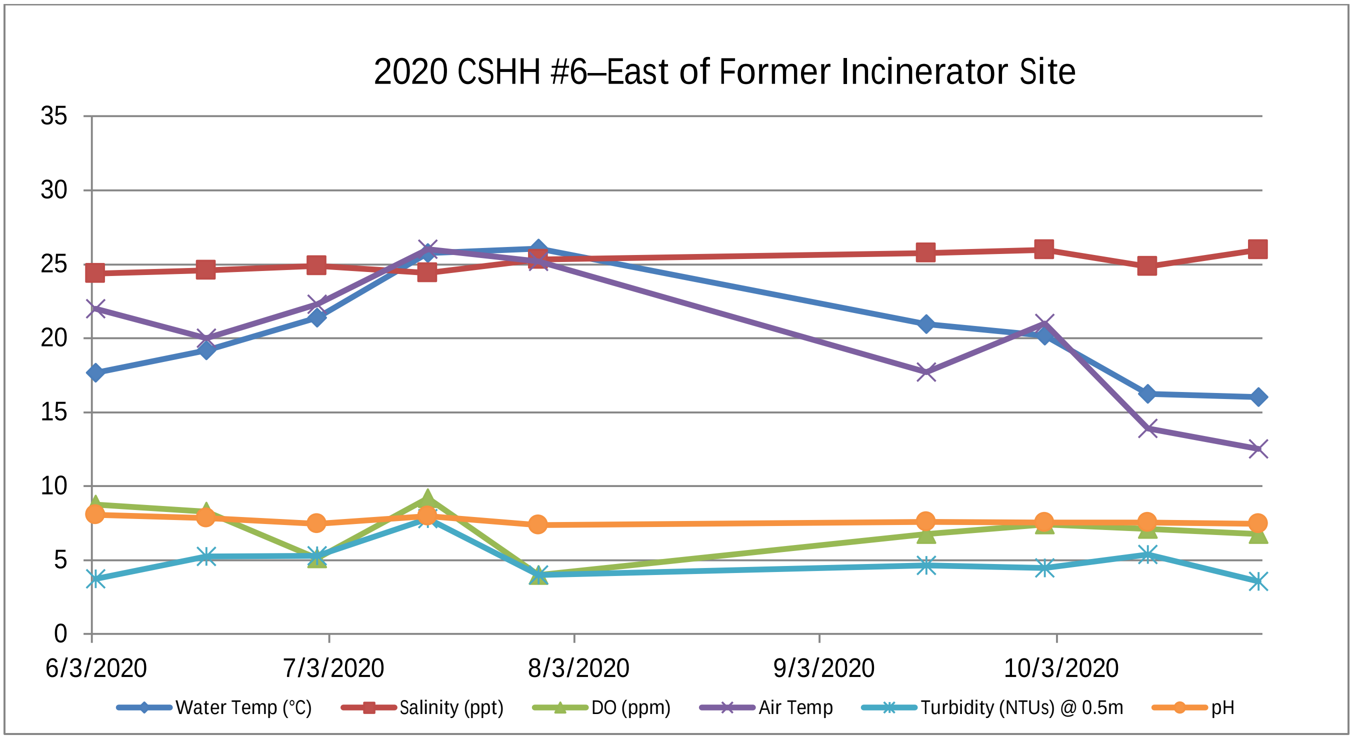


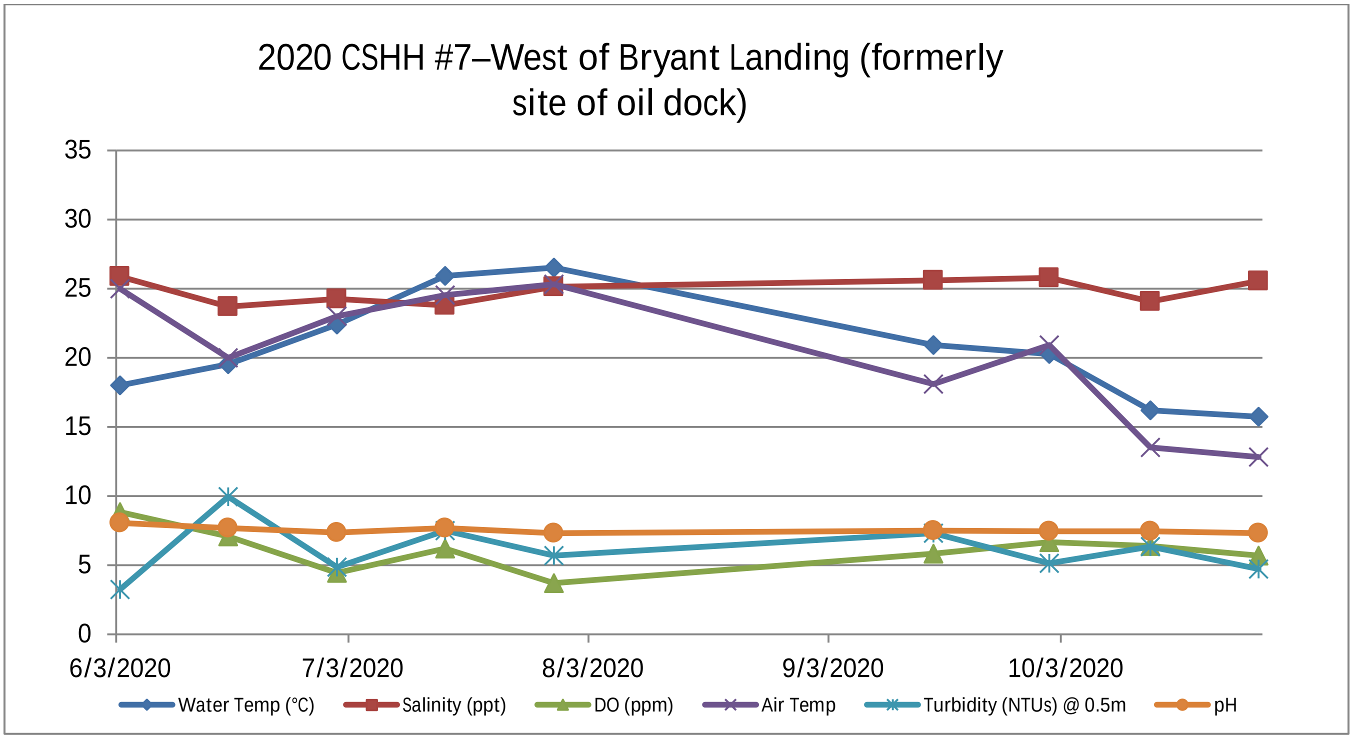
2020 Weekly Graphs for Water-Quality Parameters



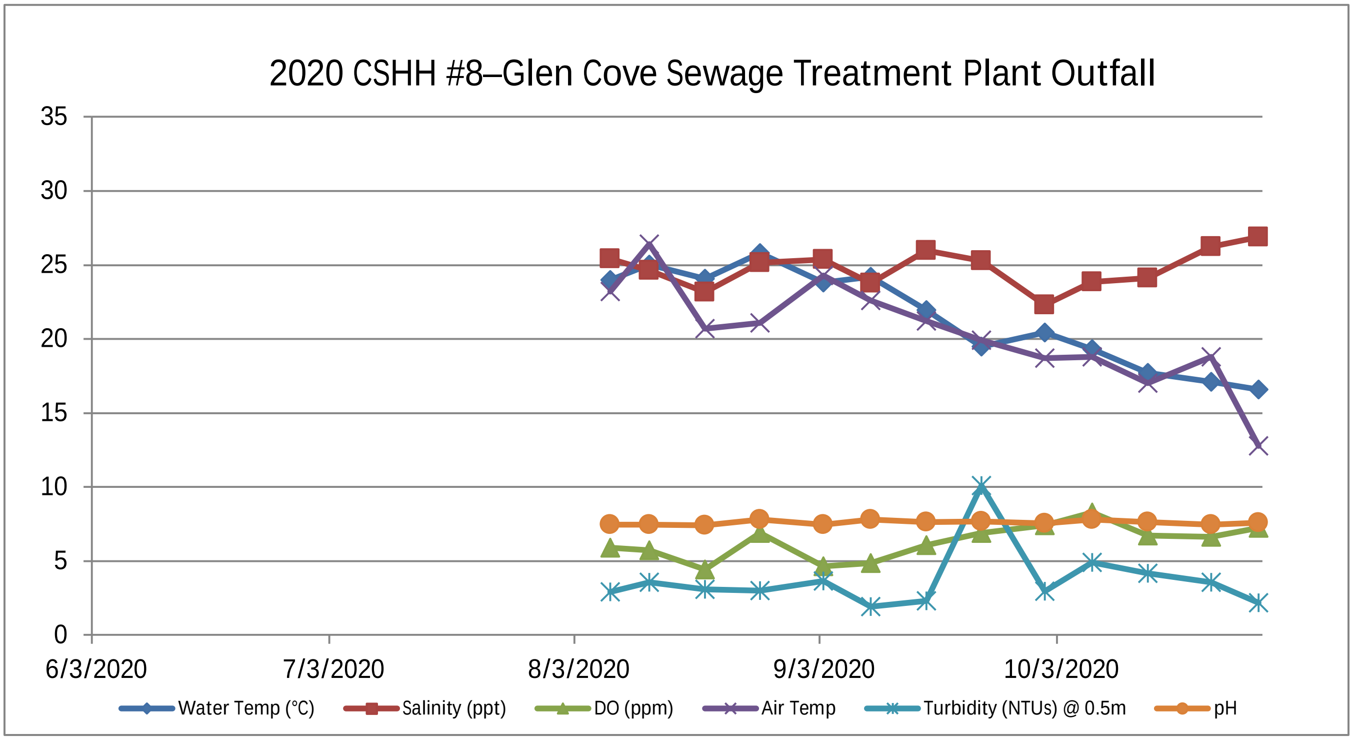


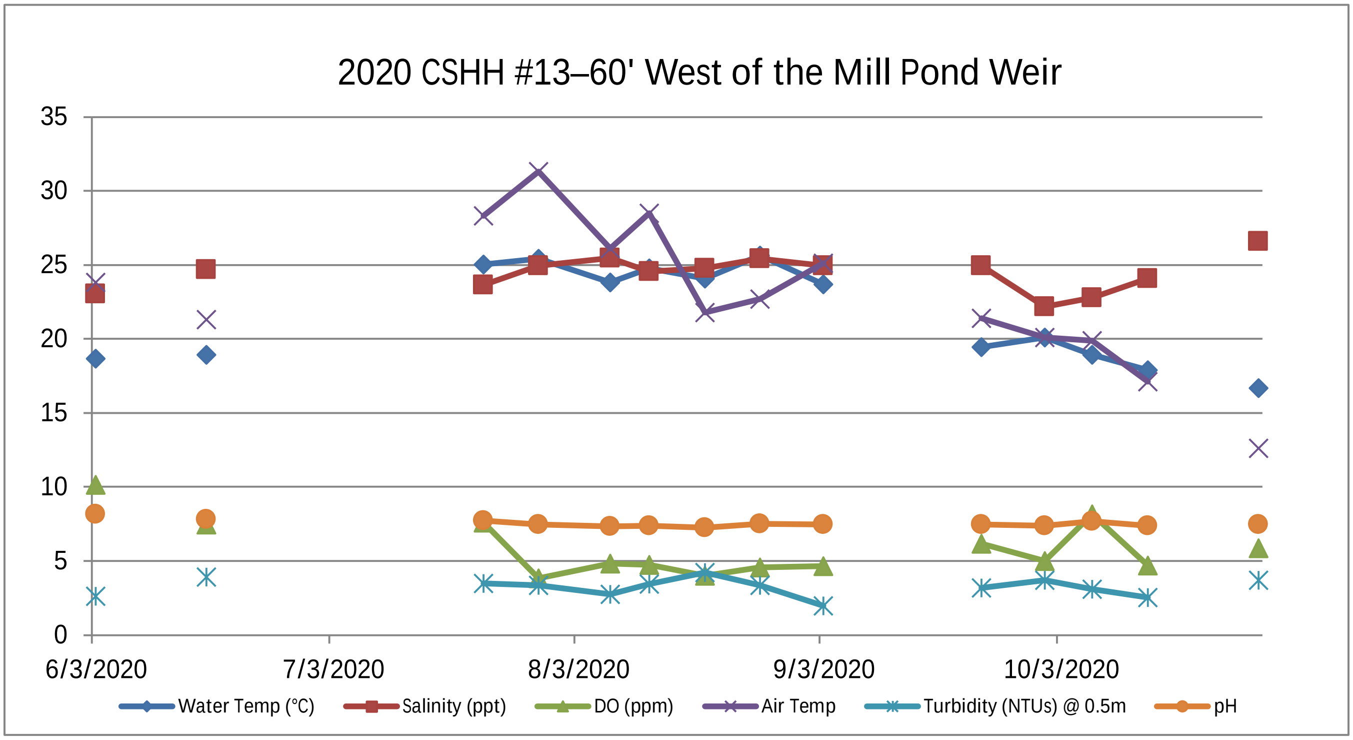
2020 Weekly Graphs for Water-Quality Parameters



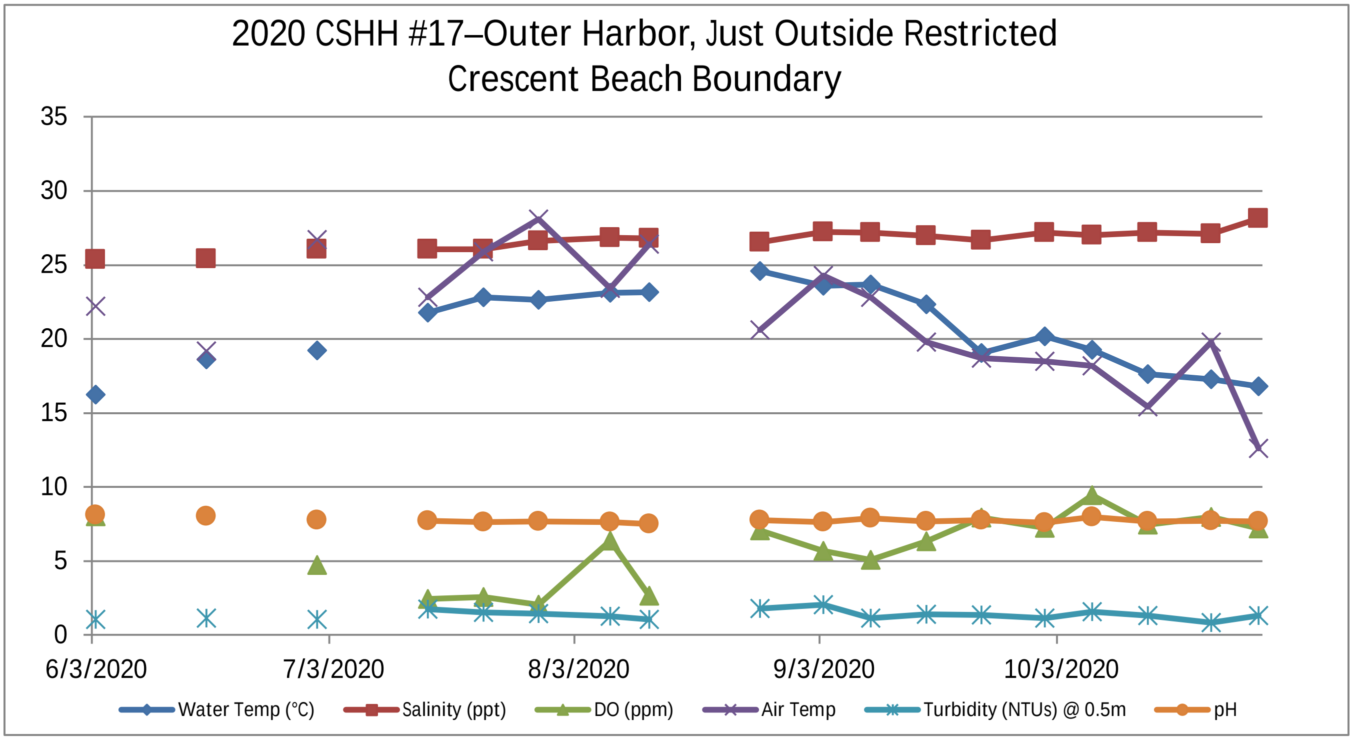


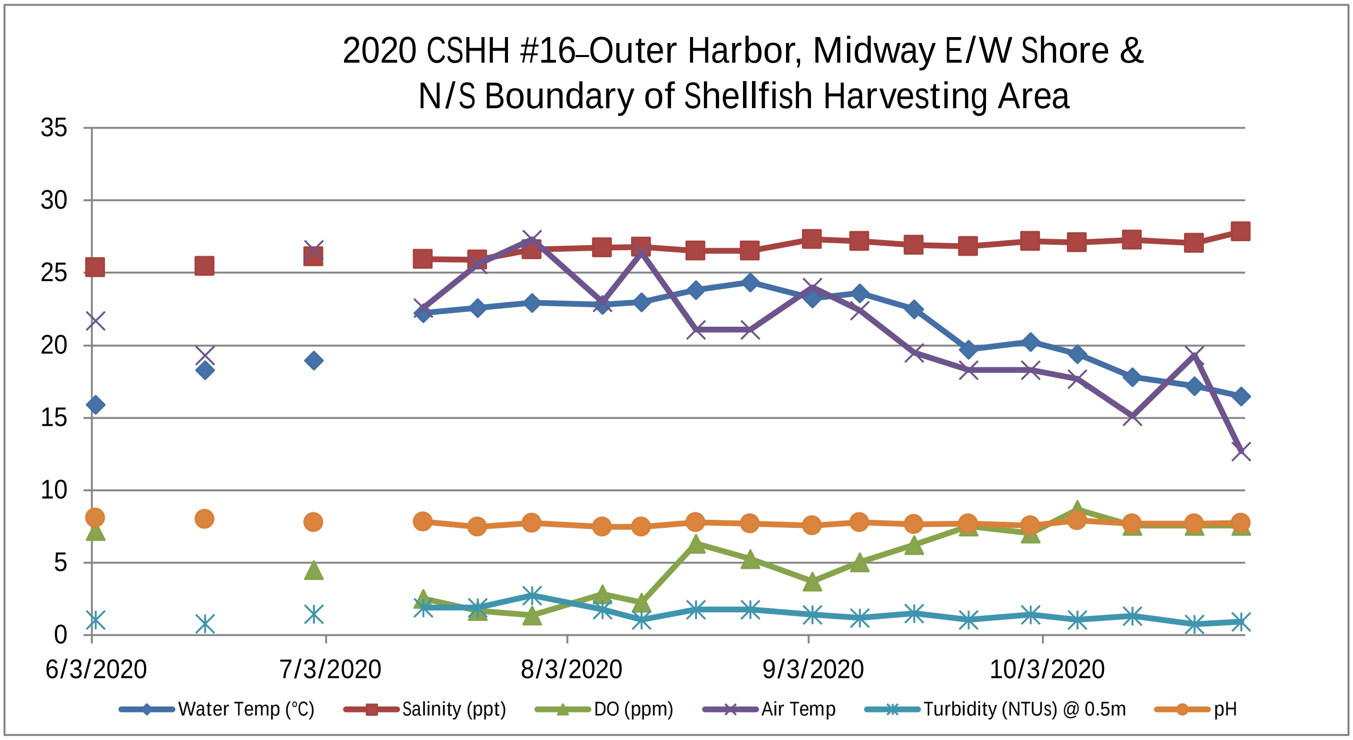
2020 Weekly Graphs for Water-Quality Parameters





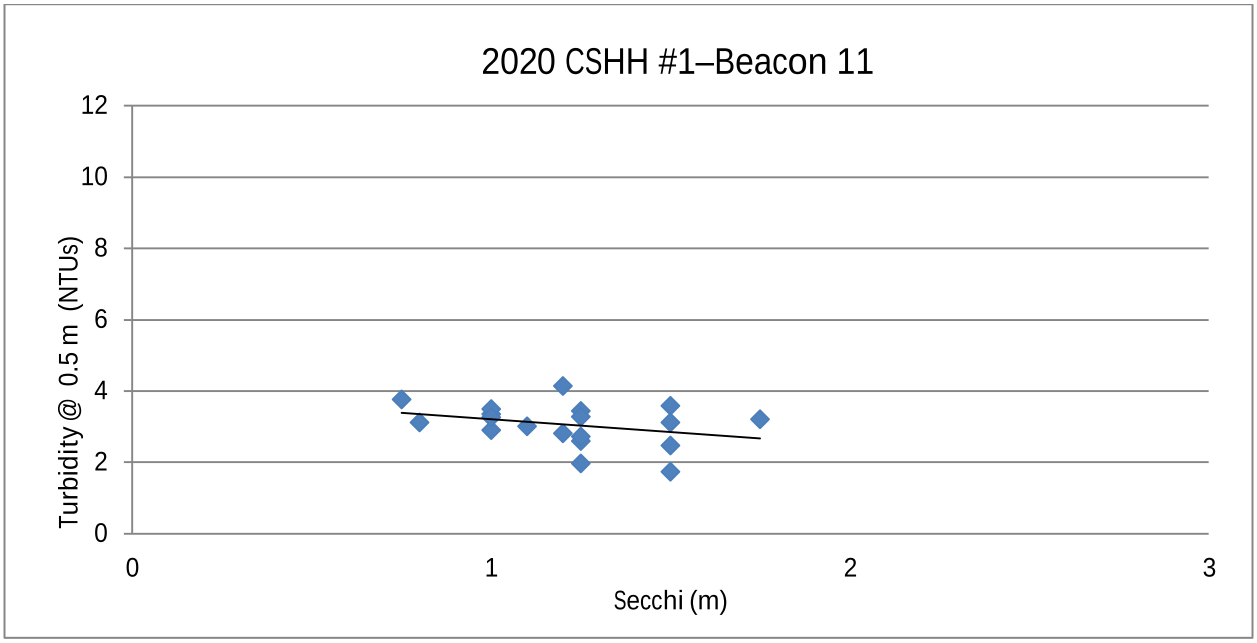
2020 Weekly Graphs for Water-Quality Parameters

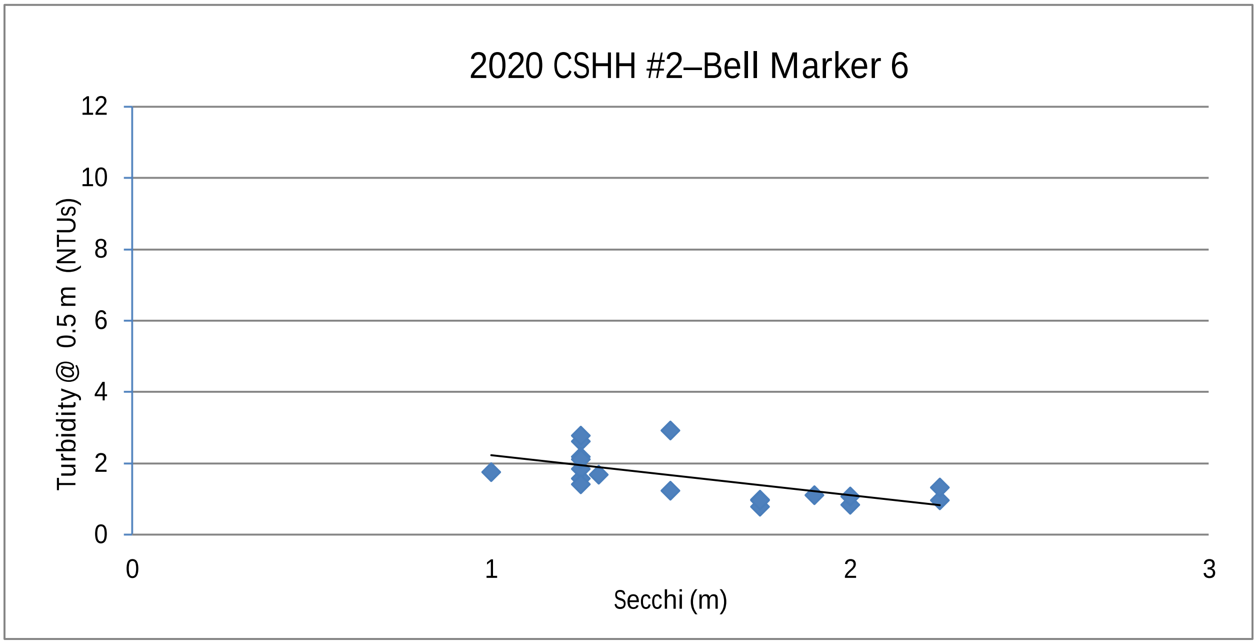




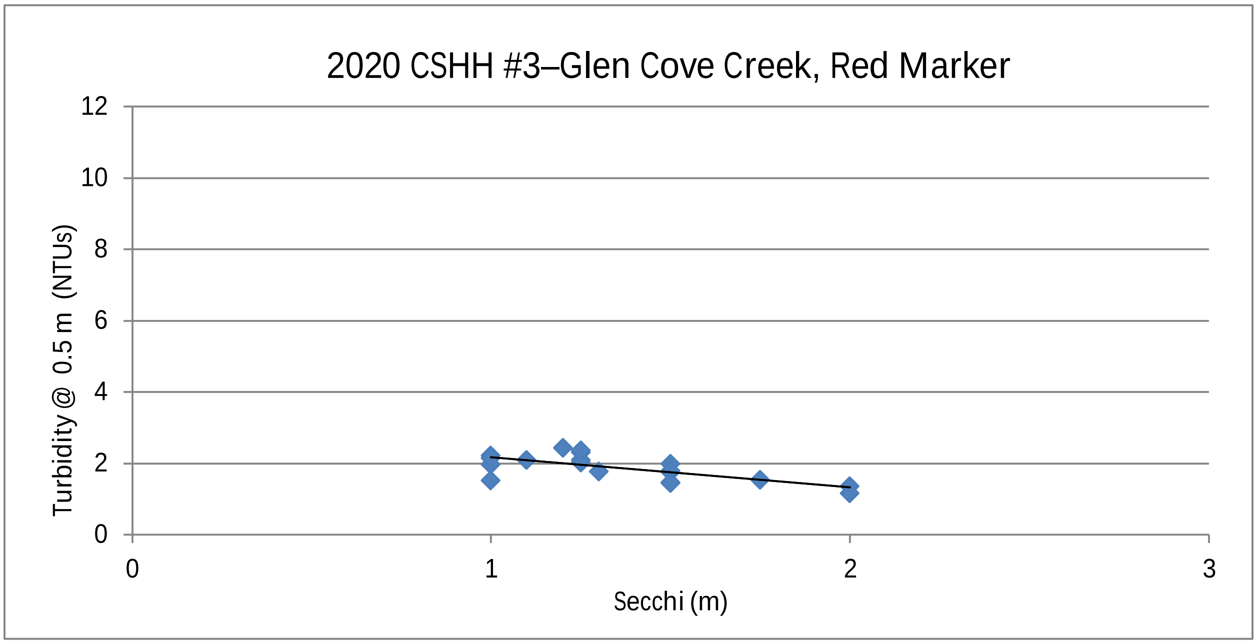
2020 Turbidity and Secchi-Disk Transparency Graphs

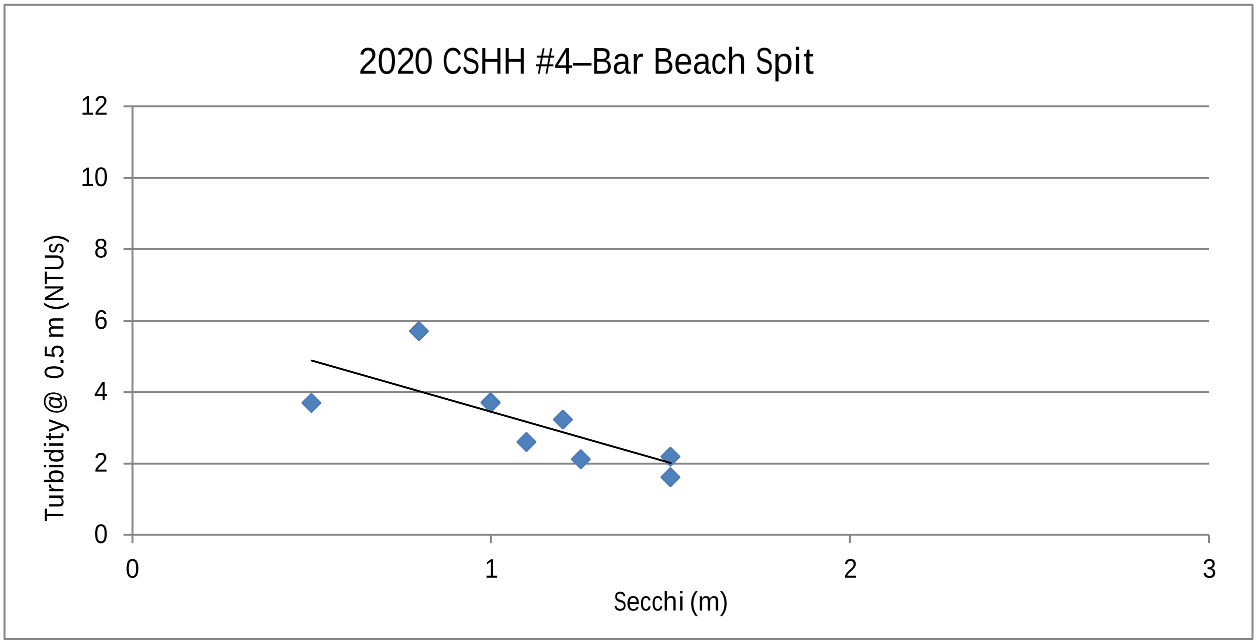
A linear trendline, generated by Microsoft Excel, is shown for each of the following graphs in this section. This line shows the inverse relationship between Secchi-disk depth and turbidity levels (NTUs), with turbidity measured at 0.5 m below the surface. The Secchi disk is visible to a greater depth when turbidity is lower. Unusually high turbidity measurements may not show on the graph, but still affect the slope of the trendline.



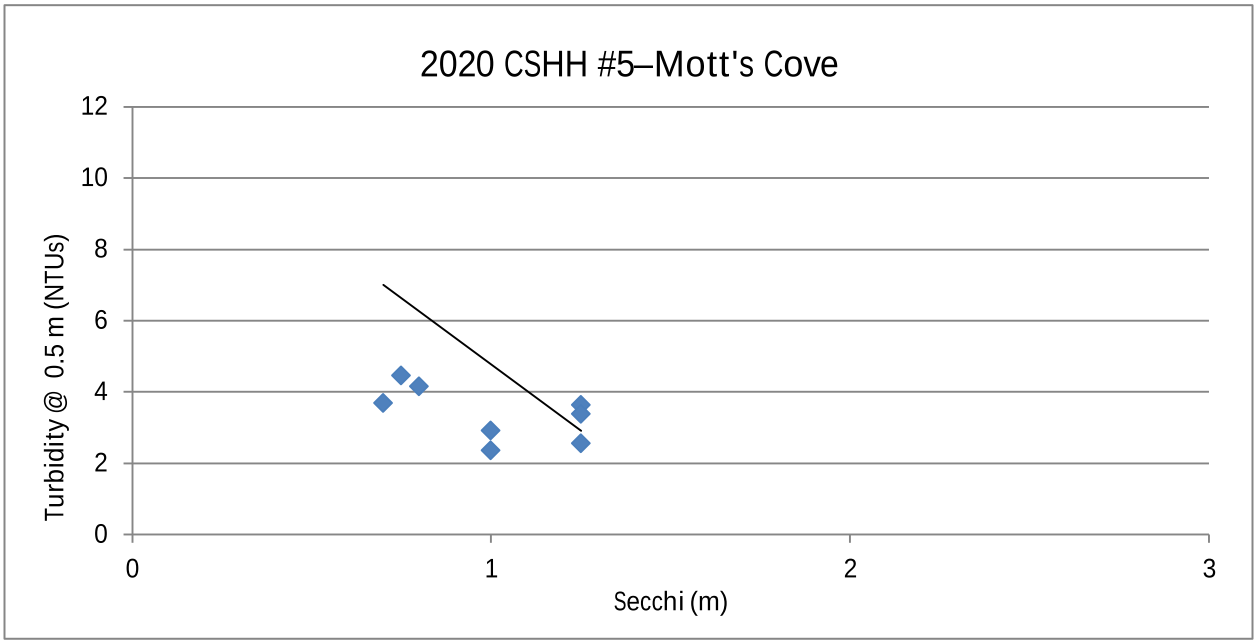


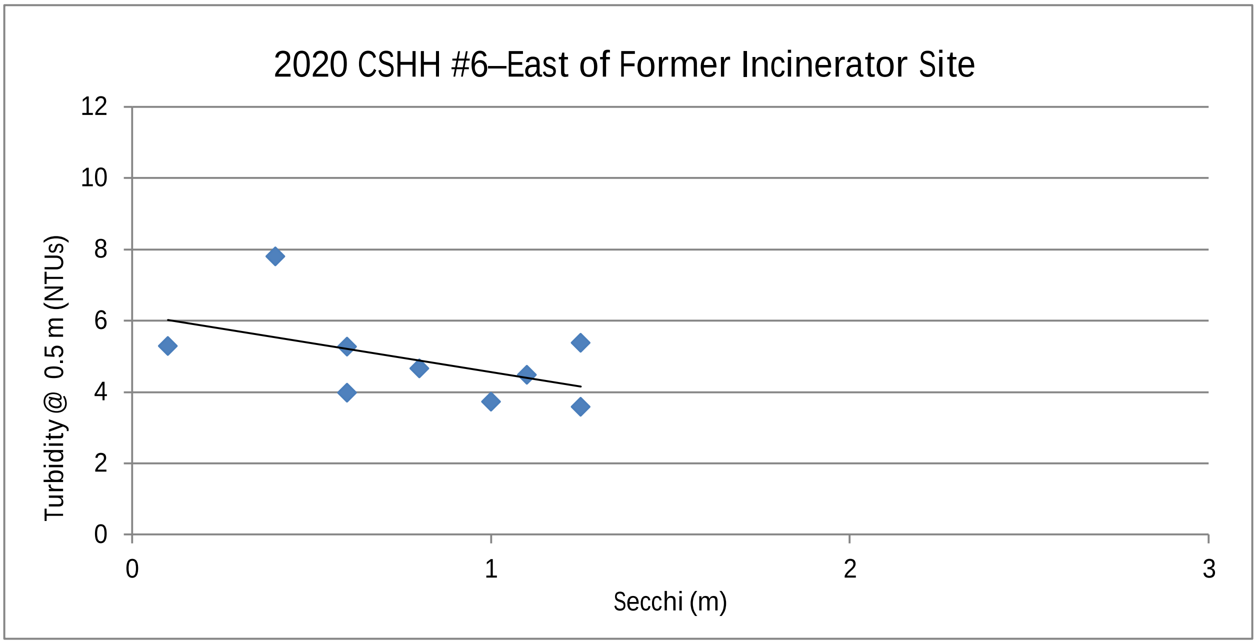
2020 Turbidity and Secchi-Disk Transparency Graphs



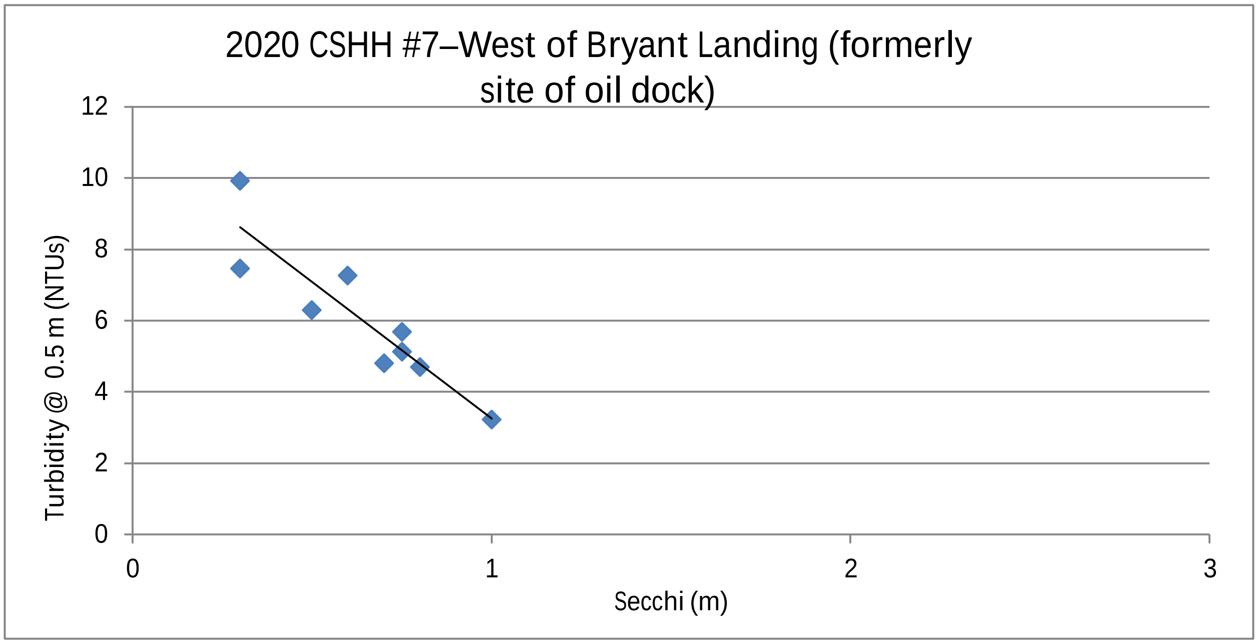


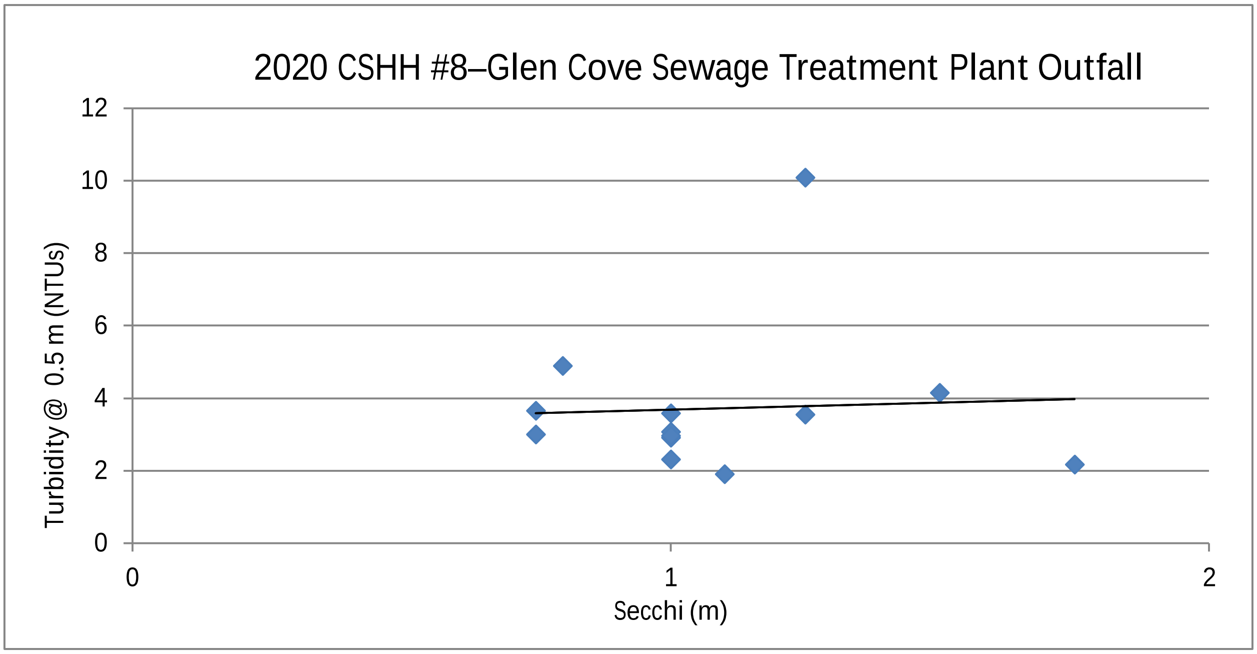
2020 Turbidity and Secchi-Disk Transparency Graphs



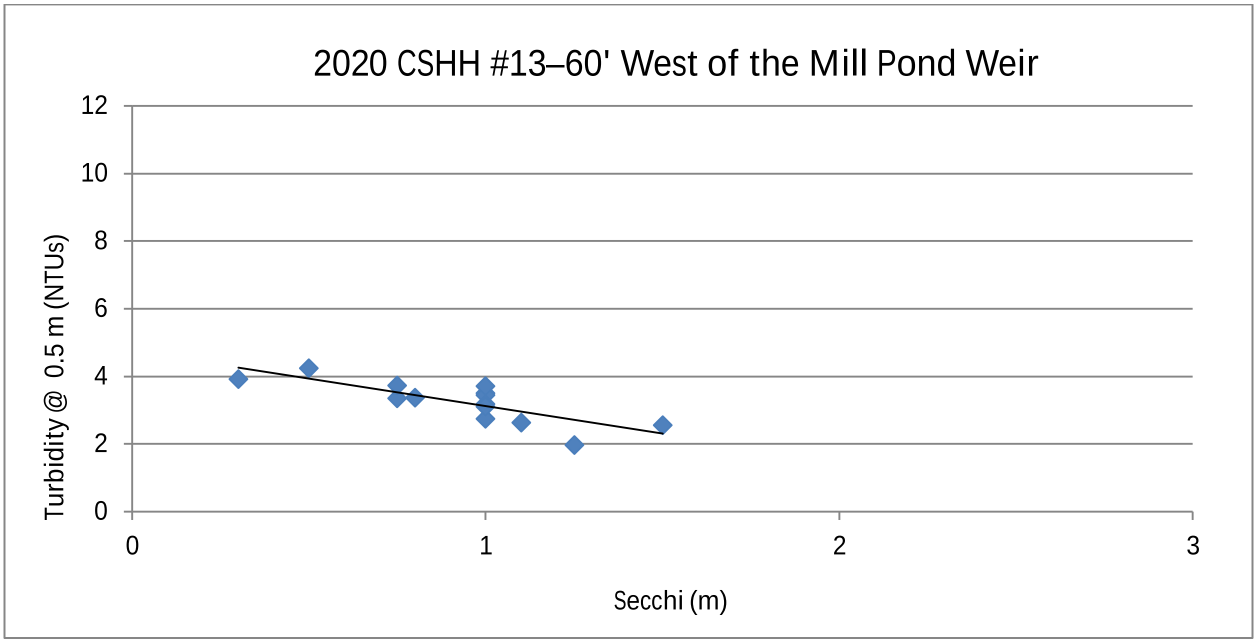


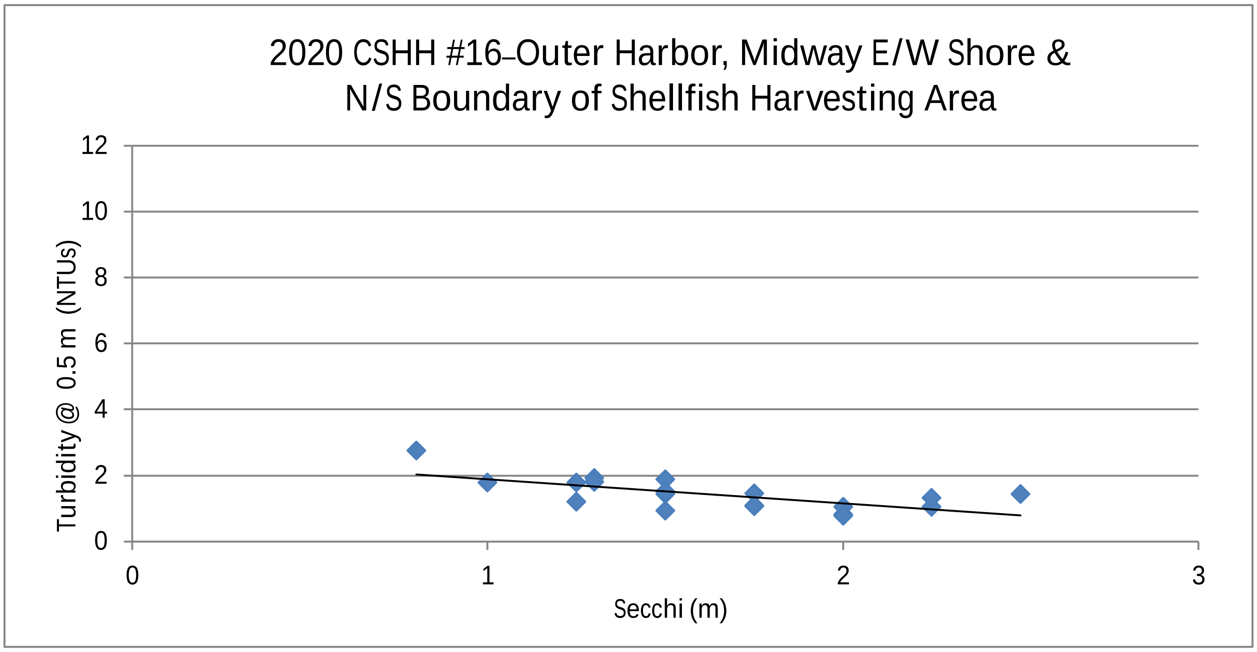
2020 Turbidity and Secchi-Disk Transparency Graphs



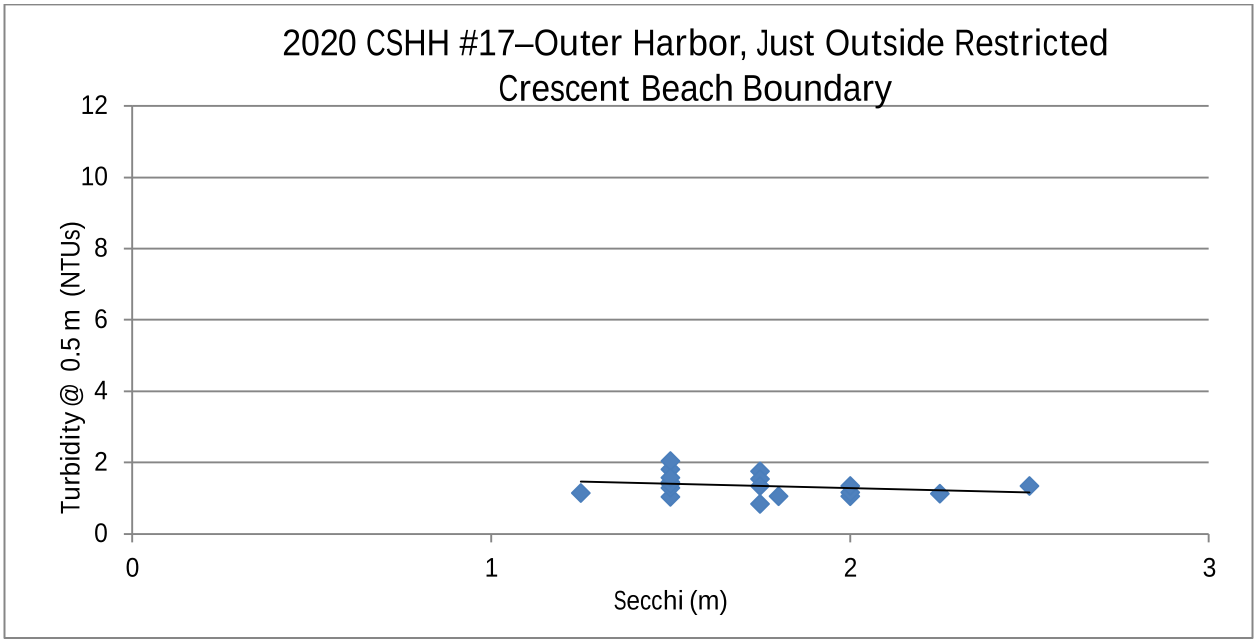


2020 Turbidity and Secchi-Disk Transparency Graphs



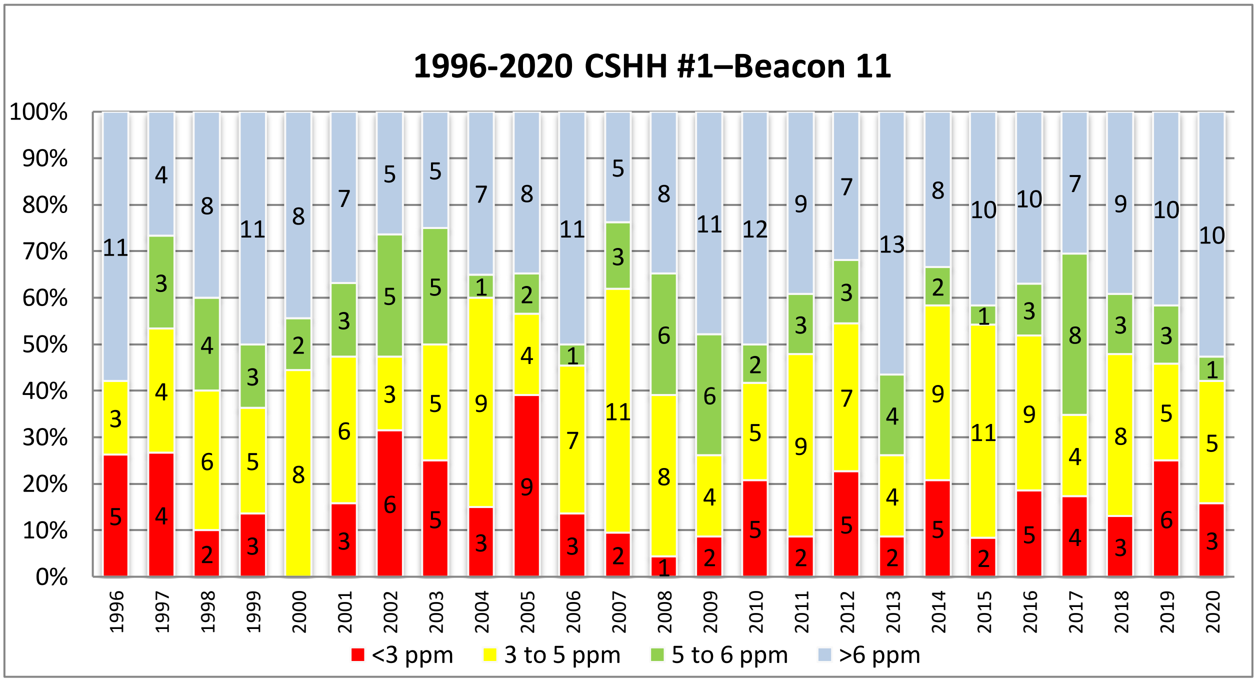


2020 Turbidity and Secchi-Disk Transparency Graphs

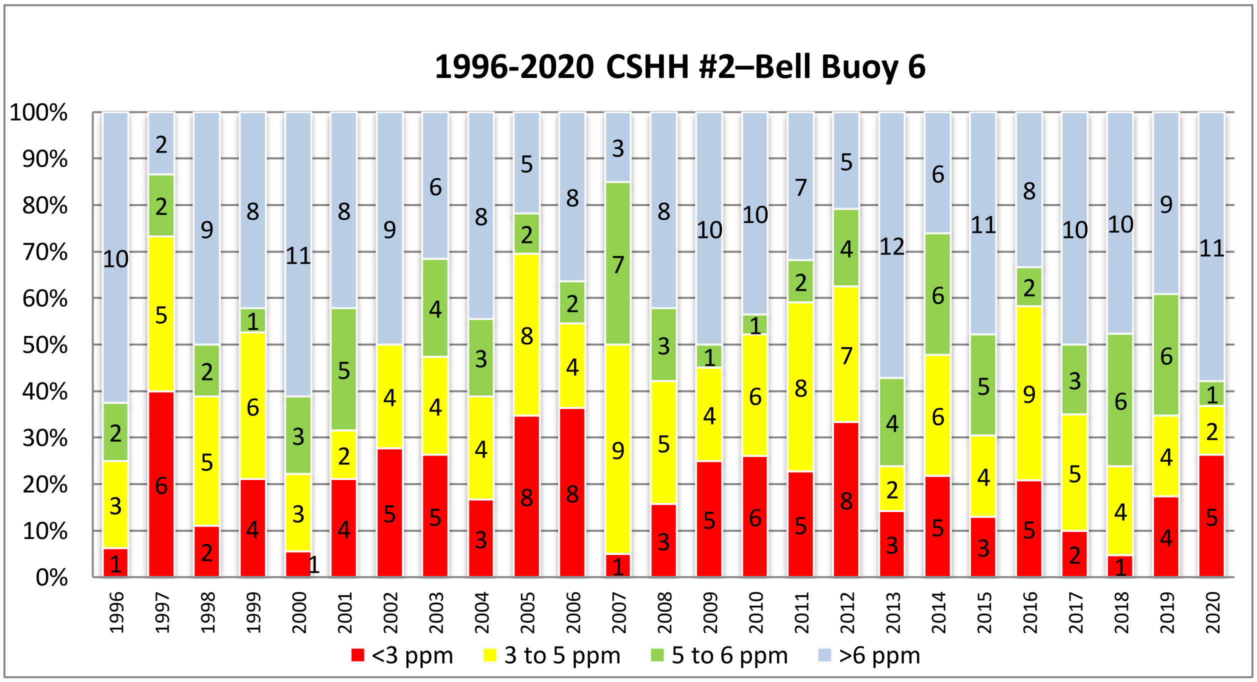


1996-2020 Dissolved Oxygen Graphs

Each vertical bar represents one of CSHH's monitoring sites. Colored bars indicate percentage of all samples taken at a location that fall into each of the four color-coded categories. Numbers inside the bars indicate the number of observations (sample size) within each bar segment. Red bars are representative of hypoxic conditions (DO below 3 ppm); DO between 3 and 5 is considered marginal, and DO above 5 ppm is considered a healthy condition.

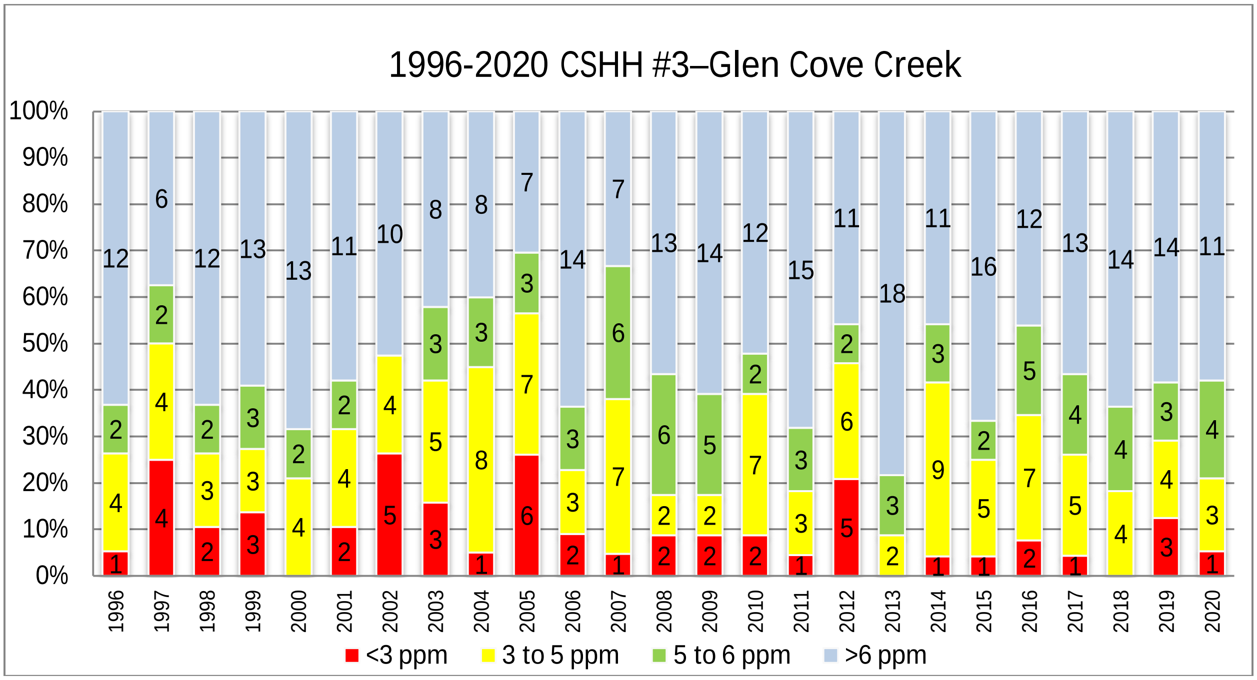


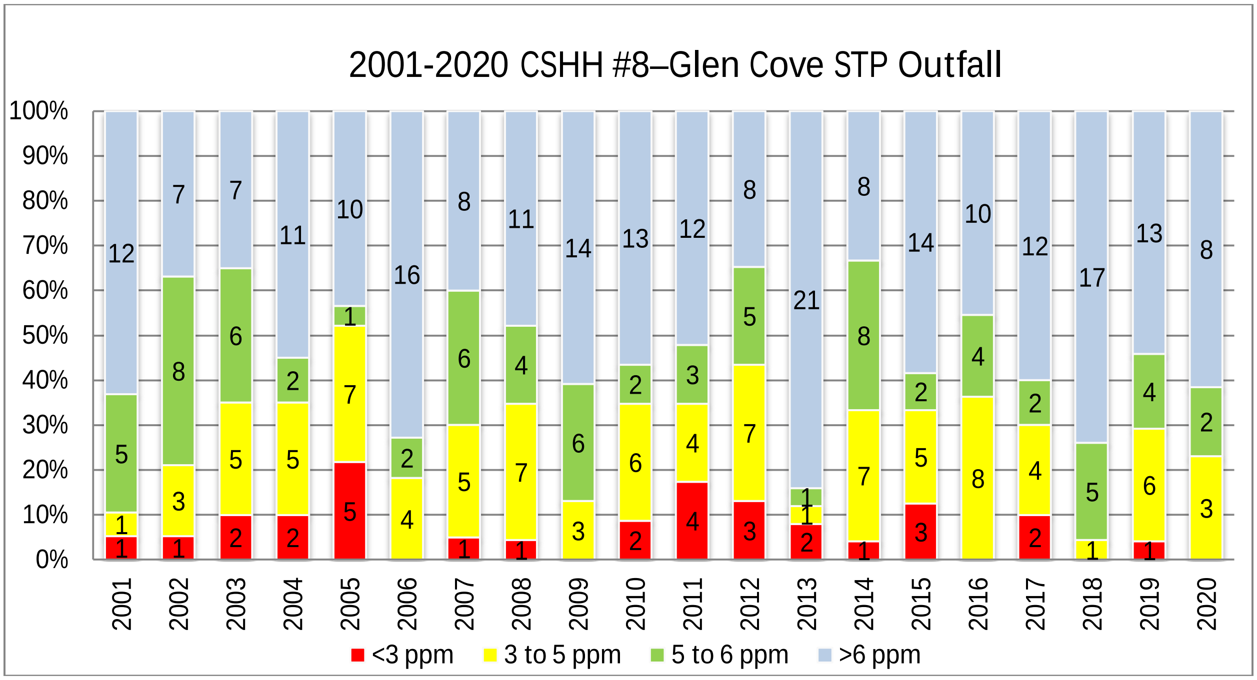
1996-2020 CSHH #1–Beacon 11



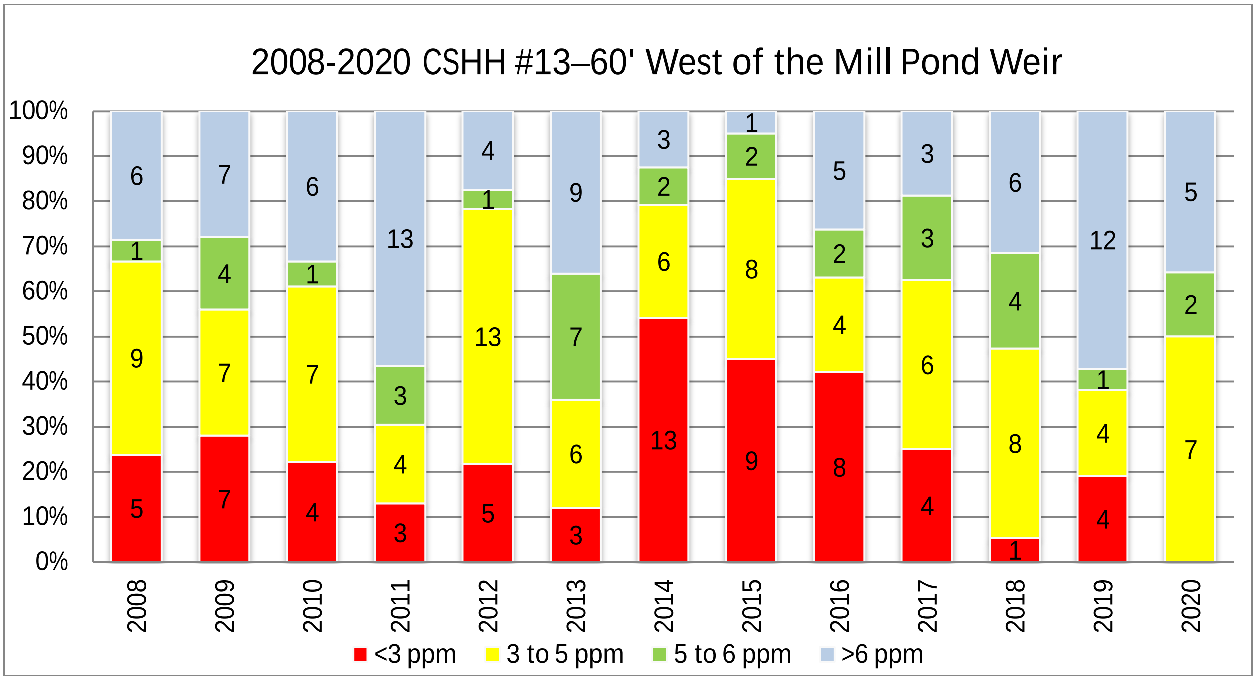
1996-2020 CSHH #2–Bell Buoy 6

1996-2020 Dissolved Oxygen Graphs

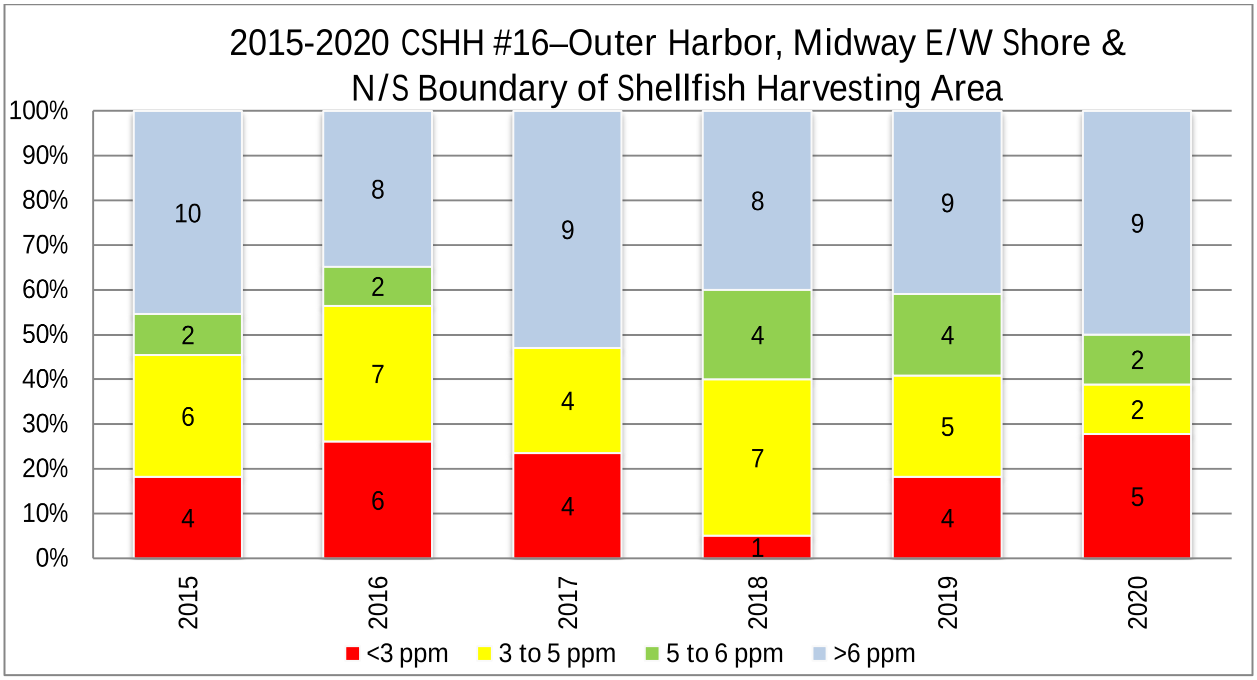




1996-2020 Dissolved Oxygen Graphs

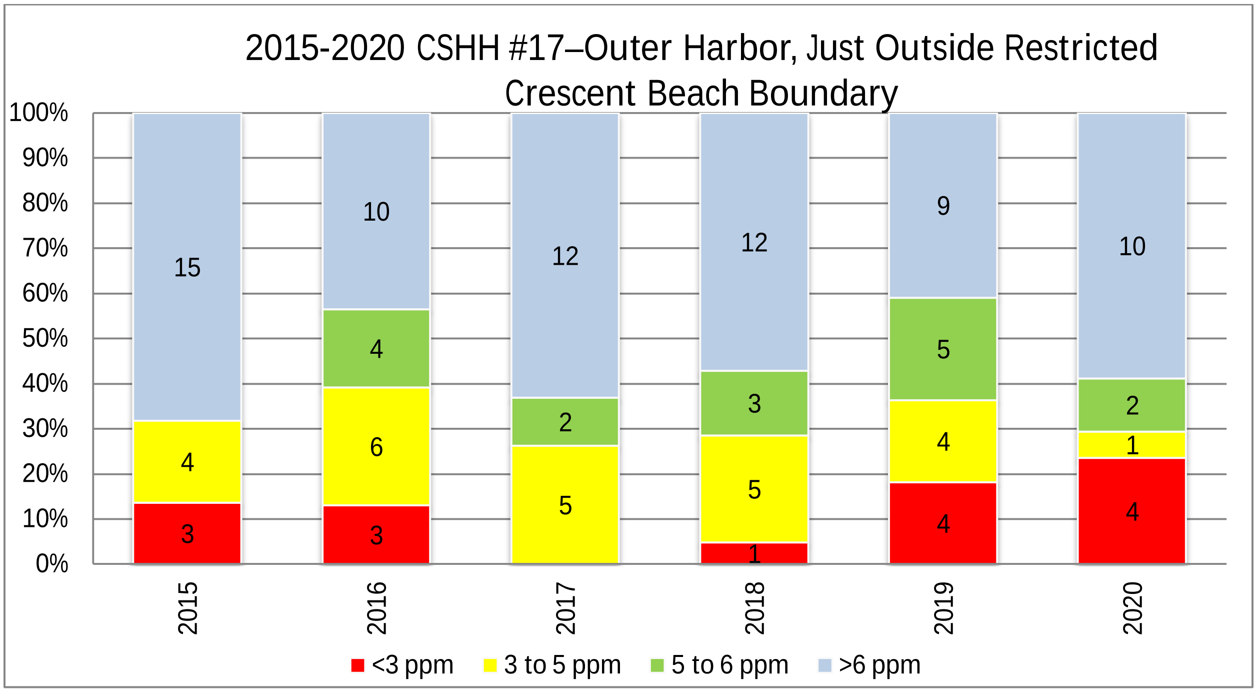


2008-2020 CSHH #13–60' West of the Mill Pond Weir



2015-2020 CSHH #16–Outer Harbor, Midway E/W Shore & N/S Boundary of Shellfish Harvesting Area

1996-2020 Dissolved Oxygen Graphs



1995-2020 Water-Quality Data Summary

CSHH #1–Beacon 11

	2020					2019				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	--	--	--	--	--	14.73	9.70	23.20	14.90	2.96
June	16.66	6.57	25.24	19.85	2.86	--	--	--	--	--
July	22.87	4.00	25.71	24.48	3.45	20.13	2.73	25.25	24.46	2.91
Aug.	23.94	4.29	26.19	22.80	2.91	22.88	1.84	25.72	23.78	2.65
Sept.	21.60	5.19	26.41	18.83	3.16	22.18	5.34	25.55	20.08	3.50
Oct.	17.96	7.11	26.61	15.18	2.84	16.30	7.89	25.11	14.68	2.74
Nov.	--	--	--	--	--	--	--	--	--	--

	2018					2017				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	14.97	6.83	24.65	19.2	1.73	14.43	24.47	7.98	17.63	4.40
June	18.08	7.28	24.51	19.4	4.83	19.07	23.13	6.93	20.85	6.38
July	20.28	3.78	25.82	25.0	5.64	20.53	23.95	3.41	23.47	4.70
Aug.	23.54	2.99	26.24	25.3	3.86	22.73	24.67	2.99	22.76	3.78
Sept.	22.81	4.67	25.92	22.6	3.77	21.52	24.92	4.93	20.43	3.54
Oct.	16.87	7.28	23.49	11.48	3.81	19.14	24.67	6.44	12.80	4.61
Nov.	-	-	-	-	-	-	-	-	-	-

	2016					2015				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	13.57	7.94	25.77	16.33	1.89	13.23	9.87	25.64	16.60	2.10
June	18.22	6.22	26.46	20.92	3.20	16.75	6.19	26.15	19.70	3.08
July	22.30	4.10	27.13	23.92	3.04	21.36	4.06	26.38	23.78	3.01
Aug.	23.76	2.26	27.66	24.20	2.79	23.30	3.47	27.14	23.60	2.69
Sept.	22.86	4.34	27.81	22.58	2.72	23.33	3.44	27.35	23.30	3.20
Oct.	17.00	6.75	27.79	12.40	2.71	17.10	6.62	27.22	15.18	4.13
Nov.	-	-	-	-	-	14.30	7.36	27.20	13.30	1.53

* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #1–Beacon 11

	2014					2013				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	16.08	7.92	24.14	17.00	2.61	14.79	7.71	25.82	21.17	3.43
June	18.59	4.52	24.28	22.00	3.31	19.49	7.93	25.07	21.10	3.12
July	20.62	3.92	25.39	23.22	4.53	22.84	4.73	25.33	25.18	1.72
Aug.	22.65	2.96	25.77	21.65	2.78	22.64	4.10	26.31	22.88	1.95
Sept.	21.81	4.46	26.07	18.38	4.08	20.75	7.42	26.60	15.90	3.19
Oct.	17.73	6.05	26.20	17.75	2.73	17.40	6.83	26.81	12.68	1.49
Nov.*	12.15	8.55	27.02	15.00	1.88	11.92	7.61	26.19	9.50	1.24

	2012					2011				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	18.91	6.39	24.98	23.20	2.32	15.23	6.67	23.57	23.3	2.86
June	20.09	4.92	24.65	21.85	2.26	17.83	5.84	23.82	22.4	2.55
July	22.35	3.12	25.58	25.18	2.98	22.18	3.95	24.37	23.7	1.49
Aug.	23.92	2.58	26.20	23.92	2.74	23.05	4.60	24.56	24.7	2.74
Sept.	22.52	3.60	26.60	18.77	2.33	21.95	4.36	23.74	21.4	2.12
Oct.	17.36	6.32	26.46	13.85	1.09	17.99	7.08	23.81	14.4	2.85
Nov.*	9.26	8.51	26.43	6.80	1.52	12.84	9.16	23.82	6.9	1.21

	2010					2009				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	13.02	8.50	24.11	18.10	1.50	14.15	8.33	24.54	14.37	1.95
June	18.21	6.68	24.94	21.46	2.70	17.93	7.29	24.00	18.73	2.11
July	22.13	3.48	26.06	27.43	2.35	21.06	5.67	23.99	23.30	1.88
Aug.	22.58	2.96	27.00	24.03	2.19	23.40	3.71	24.55	25.68	2.81
Sept.	21.81	5.45	26.65	22.30	2.19	21.33	5.31	24.80	19.24	3.46
Oct.	17.14	7.05	26.47	13.88	1.04	14.60	7.07	24.75	11.53	2.93
Nov.*	12.83	8.33	27.25	4.00	1.17	-	-	-	-	-

* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #1–Beacon 11

	2008					2007			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
May*	12.93	7.20	23.69	16.80	-	-	-	-	-
June	18.81	7.38	24.27	19.15	-	16.96	6.95	24.11	21.33
July	19.81	3.62	25.75	23.70	2.35	19.08	3.91	25.10	23.90
Aug.	23.25	4.52	25.28	22.00	3.83	22.67	3.61	25.92	21.70
Sept.	22.49	4.86	25.54	20.70	2.68	21.84	5.02	26.26	19.18
Oct.	16.37	6.21	25.96	12.08	2.77	19.3	4.65	26.99	16.64
Nov.*	12.60	7.06	25.85	14.80	1.89	-	-	-	-

	2006				2005			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.35	6.81	25.22	22.42	17.19	4.50	22.94	20.22
July	20.78	3.77	25.79	24.18	23.19	4.22	24.52	24.30
Aug.	23.64	3.29	25.64	23.78	23.73	1.85	25.36	24.40
Sept.	20.58	7.28	25.40	18.9	22.54	4.85	26.49	23.60
Oct.	16.41	7.98	25.56	14.78	16.30	7.36	25.09	13.30

	2004				2003			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.3	5.38	25.00	23.6	17.00	5.82	23.67	24.60
July	20.87	4.28	25.90	24.00	18.74	3.60	24.97	21.90
Aug.	22.33	3.86	26.31	24.00	21.75	2.10	25.79	23.60
Sept.	22.14	3.67	26.15	20.4	21.6	4.32	26.40	22.20
Oct.	16.53	7.66	25.21	12.9	16.49	6.73	25.23	12.80

* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #1–Beacon 11

	2002				2001			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.85	4.82	26.42	24.1	20.31	6.62	24.78	24.10
July	21.28	2.31	26.55	25.00	19.40	3.80	25.68	25.20
Aug.	24.02	2.91	26.89	25.00	23.25	2.96	26.19	25.40
Sept.	21.98	5.70	26.50	20.3	22.56	5.45	26.70	20.50
Oct.	17.12	7.13	26.38	13.5	17.05	7.86	26.79	15.80

	2000				1999			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.10	5.63	24.43	22.20	19.66	7.07	24.89	23.00
July	21.80	5.27	25.03	22.20	21.72	3.42	25.78	30.00
Aug.	22.53	6.41	24.70	24.20	24.35	4.60	25.99	25.00
Sept.	20.99	4.90	25.07	20.90	21.90	5.57	25.72	22.00
Oct.	16.78	6.02	25.24	13.20	17.76	8.29	24.70	12.00

	1998				1997			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.24	6.24	24.18	21.33	18.10	7.01	23.71	24.33
July	21.23	4.89	24.66	24.60	20.83	4.34	24.78	23.5
Aug.	23.95	3.66	24.84	24.50	21.85	1.96	25.96	21.5
Sept.	22.02	4.57	25.48	20.50	22.13	3.26	25.81	19.5
Oct.	17.19	6.84	25.27	13.75	17.45	5.83	26.06	13.67

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* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #1–Beacon 11

	1996				1995			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	19.00	8.35	N/A	23.25	17.78	5.30	26.27	19.67
July	20.04	3.74	24.66	22.75	20.77	2.66	26.53	25.25
Aug.	21.75	2.88	25.13	22.25	23.78	4.56	27.56	24.70
Sept.	21.70	5.14	25.48	19.83	21.72	4.34	28.05	20.50
Oct.	17.34	9.21	24.97	15.25	17.71	6.90	27.34	16.50

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* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #2–Bell Marker 6

	2020					2019				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	--	--	--	--	--	13.98	10.08	23.54	15.95	1.44
June	16.56	8.54	25.40	22.60	0.98	15.98	6.09	24.27	20.08	4.40
July	20.63	3.04	26.24	25.20	2.34	19.00	2.59	25.57	25.10	1.90
Aug.	23.21	4.86	26.63	23.43	1.88	22.40	3.25	26.09	23.60	1.72
Sept.	22.02	5.40	27.01	20.73	1.59	22.03	6.01	26.05	21.65	2.15
Oct.	18.25	7.93	27.30	16.44	1.04	16.37	8.81	26.45	15.90	1.28
Nov.*	--	--	--	--	--	--	--	--	--	--

	2018					2017				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	14.15	8.42	25.22	18.80	1.32	13.77	25.58	8.13	18.57	4.50
June	16.93	7.48	24.90	20.10	6.31	16.53	23.57	5.24	21.48	17.62
July	18.36	5.26	26.36	25.60	6.72	19.68	25.53	4.69	24.03	2.76
Aug.	22.91	3.93	26.63	27.50	4.76	22.45	25.55	3.67	23.33	2.25
Sept.	22.85	5.61	26.48	23.80	5.49	21.09	25.43	6.58	20.60	2.24
Oct.	18.28	7.24	25.11	15.50	2.89	19.53	25.44	6.79	15.63	1.68
Nov.*	-	-	-	-	-	-	-	-	-	-

	2016					2015				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	12.47	8.11	26.46	18.20	0.48	10.90	8.07	26.48	18.97	1.12
June	17.18	6.41	26.91	21.82	1.76	16.00	6.07	26.44	19.53	1.78
July	20.10	2.17	27.78	24.36	1.69	20.38	3.59	26.87	24.90	2.21
Aug.	23.58	3.22	28.09	24.20	2.21	23.00	4.02	27.56	24.08	1.66
Sept.	23.20	4.97	28.29	24.13	1.85	23.20	3.89	27.74	25.37	2.49
Oct.	17.70	7.61	28.29	18.35	0.98	16.45	7.47	27.80	16.70	1.91
Nov.*	-	-	-	-	-	14.30	7.56	27.52	14.80	0.91

* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #2–Bell Marker 6

	2014					2013				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	14.88	8.23	24.64	16.35	1.60	14.36	8.97	26.16	22.27	2.52
June	17.48	4.80	24.86	17.03	1.57	17.96	6.51	25.77	20.88	1.73
July	20.16	3.15	25.97	24.98	2.11	22.49	3.10	25.89	26.33	1.09
Aug.	22.53	3.73	26.58	23.48	1.83	22.51	4.18	26.87	26.45	1.33
Sept.	22.04	4.41	26.85	19.35	2.16	21.42	6.86	27.70	18.27	2.50
Oct.	18.00	6.59	26.97	18.88	1.55	17.17	7.63	27.29	15.30	0.97
Nov.*	13.10	8.65	27.75	17.60	1.99	12.81	7.05	27.27	12.40	0.87

	2012					2011				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	18.08	5.53	25.06	22.30	1.62	14.70	7.64	23.34	19.60	0.57
June	19.32	5.02	25.20	21.90	1.03	16.95	4.95	24.11	22.80	1.18
July	21.94	2.99	26.03	25.30	1.92	19.88	3.39	24.79	24.80	0.83
Aug.	23.26	2.11	26.91	25.72	1.66	22.03	2.86	25.59	23.30	1.93
Sept.	22.92	4.20	27.41	21.10	1.40	21.47	3.91	24.38	22.30	1.48
Oct.	17.68	5.57	27.31	15.25	0.88	18.11	6.93	24.35	16.20	1.71
Nov.*	9.30	9.19	27.33	8.55	1.10	13.75	8.15	24.42	7.20	-

	2010					2009				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	13.07	8.76	24.34	23.80	1.21	12.90	7.94	25.16	16.40	1.88
June	16.88	5.89	25.51	21.60	1.78	16.79	6.58	24.73	19.50	2.45
July	20.21	1.84	26.59	27.95	1.54	18.93	3.80	24.90	23.84	1.39
Aug.	22.09	2.66	27.21	24.70	1.54	21.43	1.34	25.28	25.78	1.94
Sept.	21.69	5.39	27.07	23.22	2.37	21.70	6.17	25.16	21.53	2.38
Oct.	16.82	7.54	27.06	15.00	0.78	14.66	7.90	25.64	12.47	1.58
Nov.*	12.66	10.14	27.43	9.60	1.05	-	-	-	-	-

* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #2–Bell Marker 6

	2008					2007			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
May*	12.13	8.72	24.22	14.20	-	-	-	-	-
June	16.03	6.35	25.29	20.80	-	16.03	6.92	24.66	22.53
July	18.69	3.37	26.06	25.58	2.62	17.62	4.49	25.88	24.67
Aug.	22.12	4.27	26.09	25.13	1.82	21.65	3.28	26.36	22.77
Sept.	22.19	5.34	26.13	20.68	2.11	21.55	5.43	26.78	21.48
Oct.	16.30	5.87	26.55	13.60	2.50	19.32	5.07	27.65	17.08
Nov.*	12.64	7.98	26.32	15.10	1.28	-	-	-	-

	2006				2005			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	16.93	7.74	25.89	22.72	16.80	5.22	23.21	21.90
July	18.67	3.99	26.51	25.5	21.78	4.59	23.03	24.40
Aug.	21.91	1.91	26.42	26.53	23.13	2.07	25.58	26.60
Sept.	20.41	5.98	26.24	20.33	22.8	2.98	27.01	24.20
Oct.	17.66	7.3	26.32	18.89	17.01	6.84	25.91	13.90

	2004				2003			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	16.38	5.92	25.41	22.50	15.58	6.35	24.26	22.40
July	19.82	5.11	26.24	24.80	17.16	2.93	25.35	22.90
Aug.	21.47	3.04	26.62	24.10	21.01	1.74	26.14	23.60
Sept.	21.96	6.17	26.33	20.70	21.2	5.38	26.55	22.00
Oct.	17.37	8.16	25.63	14.30	17.19	6.47	26.03	15.00

* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #2–Bell Marker 6

	2002				2001			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.06	6.13	26.55	23.40	16.67	4.97	25.36	23.20
July	19.91	1.81	26.87	27.40	18.45	5.32	26.00	26.20
Aug.	22.85	3.08	27.23	25.40	22.33	3.83	26.46	26.00
Sept.	21.97	5.84	26.89	21.40	21.88	5.80	27.07	21.10
Oct.	17.74	7.68	27.25	13.90	16.94	8.55	27.24	15.90

	2000				1999			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	16.45	6.29	24.77	22.4	17.13	6.41	25.42	23.00
July	20.19	4.80	25.38	22.7	19.62	2.87	26.23	27.00
Aug.	22.08	6.46	24.95	24.7	22.88	4.29	26.8	25.00
Sept.	20.89	6.08	25.54	22.3	22.15	5.75	26.84	26.00
Oct.	16.86	7.18	26.07	16.3	17.18	8.46	26.30	13.00

	1998				1997			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	16.39	6.90	24.45	21.33	16.70	9.12	24.14	24.50
July	19.88	4.78	25.13	24.60	18.32	3.12	25.33	23.25
Aug.	22.88	3.30	25.27	24.50	21.12	2.86	26.41	21.37
Sept.	21.62	6.03	25.82	20.50	21.33	3.18	26.79	19.75
Oct.	17.18	6.90	26.27	13.75	18.02	5.22	26.59	14.50

* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #2–Bell Marker 6

	1996				1995			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.50	7.80	N/A	22.00	17.61	7.78	26.50	21.25
July	19.15	5.17	24.92	24.50	20.09	4.19	26.93	24.87
Aug.	21.10	4.29	24.99	23.17	22.90	4.87	27.77	25.12
Sept.	22.05	8.00	25.73	20.17	21.73	5.27	28.44	21.50
Oct.	16.95	9.11	25.34	15.75	17.48	7.72	27.80	15.83

* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #3–Glen Cove Creek

	2020					2019				
	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Turbidity (NTUs) (0.5 m)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Turbidity (NTUs) (0.5 m)
May*	--	--	--	--	--	14.26	9.92	23.38	16.35	1.61
June	8.42	25.39	22.70	16.61	1.66	18.09	8.34	23.59	21.95	2.11
July	4.42	26.07	25.43	21.63	2.11	20.18	4.43	25.31	26.28	2.00
Aug.	6.01	26.51	23.35	23.92	2.20	22.68	2.74	25.97	25.80	1.66
Sept.	5.91	26.87	21.75	21.98	1.94	22.26	6.42	25.92	22.48	2.48
Oct.	7.98	27.04	16.86	18.12	1.45	16.72	8.67	25.75	16.40	2.30
Nov.*	--	--	--	--	--	--	--	--	--	--

	2018					2017				
	Avg. Water Temp. (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	14.61	8.49	25.14	20.60	0.32	14.41	25.27	8.78	19.00	3.33
June	17.63	8.01	24.71	22.00	5.21	18.07	23.57	7.13	22.43	18.58
July	19.92	6.01	26.06	26.40	6.47	20.59	25.17	5.37	24.80	2.51
Aug.	23.63	5.64	26.41	25.80	4.07	22.66	24.97	4.24	22.48	2.69
Sept.	22.91	6.12	26.35	24.40	5.35	21.47	25.44	5.83	21.83	3.21
Oct.	18.16	7.73	24.85	17.60	1.82	19.40	24.98	7.08	15.13	2.77
Nov.*	-	-	-	-	-	-	-	-	-	-

	2016					2015				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	13.63	8.83	26.19	18.60	1.08	12.50	9.45	26.21	19.33	1.89
June	18.30	7.25	26.74	21.10	2.51	16.88	7.04	26.30	20.85	2.41
July	21.60	3.93	27.54	25.76	2.54	21.34	5.06	26.64	26.04	2.56
Aug.	23.90	3.65	27.86	25.06	2.40	23.33	5.10	27.47	26.10	2.03
Sept.	23.08	5.76	28.05	23.62	2.33	23.50	4.56	27.61	26.30	3.41
Oct.	17.30	7.28	28.19	15.58	1.67	17.22	7.28	27.41	17.34	2.84
Nov.*	-	-	-	-	-	14.40	7.98	27.31	17.40	0.84

* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #3–Glen Cove Creek

	2014					2013				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	15.88	9.35	24.17	16.45	2.01	15.04	8.06	26.04	21.87	2.52
June	18.83	6.29	24.36	22.55	2.53	19.69	9.74	25.28	19.45	1.69
July	21.04	4.65	25.64	25.10	3.05	23.37	6.93	25.65	27.18	1.32
Aug.	22.89	4.22	26.10	24.33	2.12	22.87	5.98	26.52	27.10	1.78
Sept.	22.14	4.73	26.42	20.40	2.65	21.25	6.62	27.42	18.07	2.68
Oct.	17.86	6.57	26.50	18.98	1.94	17.62	7.37	27.06	15.72	1.14
Nov.*	12.30	8.54	27.27	16.80	1.15	12.57	6.77	26.83	13.40	0.74

	2012					2011				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	19.39	7.39	24.87	22.60	1.93	15.51	8.16	23.28	23.70	0.16
June	19.63	5.94	24.72	22.30	2.06	19.01	8.17	23.90	25.00	1.39
July	22.64	3.02	25.78	26.13	2.19	21.53	5.81	24.55	24.60	1.31
Aug.	23.91	3.82	26.56	25.50	1.95	22.60	4.10	25.13	24.10	2.18
Sept.	22.92	5.37	26.93	21.23	1.44	21.78	6.55	23.69	23.30	2.02
Oct.	17.56	8.06	26.78	15.88	0.59	17.91	8.16	23.96	12.80	1.96
Nov.*	9.64	9.29	27.19	8.30	1.28	13.04	9.20	24.03	9.30	0.91

	2010					2009				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	13.39	8.91	24.18	24.70	0.70	14.10	9.22	24.71	17.40	2.00
June	18.52	7.60	25.25	22.68	1.85	17.60	7.83	24.38	20.40	1.68
July	21.60	3.98	26.29	29.30	1.61	20.50	5.56	24.46	24.54	1.80
Aug.	22.82	4.62	26.80	25.30	1.64	23.13	5.62	24.76	26.83	2.64
Sept.	21.83	5.96	26.88	23.56	2.09	21.27	5.54	25.10	19.64	3.13
Oct.	16.80	8.26	26.62	15.90	0.59	14.98	7.76	25.27	13.80	2.28
Nov.*	12.72	10.25	27.29	9.10	0.80	-	-	-	-	-

* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #3–Glen Cove Creek

	2008					2007			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
May*	12.82	8.58	23.69	15.15	-	-	-	-	-
June	18.23	7.53	24.89	21.60	-	16.82	8.47	24.15	21.98
July	19.39	3.83	25.89	26.33	1.62	19.19	4.75	25.40	24.25
Aug.	23.12	6.08	25.68	24.15	-	22.67	5.98	26.16	23.20
Sept.	22.47	5.74	25.93	21.45	-	21.87	5.18	26.63	22.13
Oct.	16.43	7.25	26.17	13.58	1.67	19.31	4.70	27.59	17.70
Nov.*	12.60	7.49	26.36	15.60	-	-	-	-	-

	2006				2005			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.37	8.35	25.6	23.38	17.46	5.46	23.08	22.32
July	20.32	4.51	25.98	25.25	22.32	4.29	24.82	24.80
Aug.	23.19	5.13	26.13	25.46	23.53	2.16	25.67	25.30
Sept.	20.58	7.50	26.00	19.85	22.76	5.23	26.80	24.80
Oct.	16.91	8.55	26.17	16.03	16.66	8.14	25.58	14.30

	2004				2003			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.67	7.36	25.23	23.40	16.47	7.02	23.97	23.90
July	20.39	4.96	26.15	25.10	18.41	4.25	25.08	22.80
Aug.	22.00	4.30	26.48	22.80	21.26	3.74	25.92	23.60
Sept.	22.02	4.66	26.34	21.30	21.48	4.81	26.49	22.40
Oct.	16.86	7.62	25.97	13.10	16.97	6.58	25.61	15.60

* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #3–Glen Cove Creek

	2002				2001			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	19.05	6.36	26.48	23.70	18.45	7.63	25.23	24.40
July	20.71	2.61	26.69	25.40	18.55	4.53	25.92	26.00
Aug.	23.36	2.49	27.10	26.90	23.09	4.83	26.34	27.70
Sept.	21.78	6.49	26.71	22.00	22.10	6.92	26.88	21.30
Oct.	17.70	7.98	27.05	14.70	17.02	9.01	27.12	16.30

	2000				1999			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.69	6.60	24.35	21.60	18.43	6.32	25.09	23.00
July	21.16	5.87	25.26	23.00	21.57	5.02	25.89	30.00
Aug.	22.66	6.44	24.68	23.50	23.82	4.87	26.44	26.00
Sept.	21.45	6.13	24.99	20.50	21.80	6.16	26.25	23.00
Oct.	16.69	7.50	25.52	16.70	16.74	8.70	25.81	14.00

	1998				1997			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.23	7.25	24.27	21.33	17.36	8.32	24.11	26.50
July	21.03	6.34	24.76	24.60	20.20	6.21	25.07	23.37
Aug.	23.39	3.87	25.14	24.50	21.34	2.29	26.29	21.5
Sept.	21.88	5.76	25.75	20.50	21.61	3.12	26.67	20.00
Oct.	16.90	7.79	25.88	13.75	17.12	5.69	26.69	13.67

* Average based on less than full month

1995-2020 Water-Quality Data Summary

CSHH #3–Glen Cove Creek

	1996				1995			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.25	9.35	N/A	22.12	17.82	5.40	26.58	21.50
July	20.32	7.10	24.46	23.67	20.74	4.50	26.87	25.00
Aug.	21.45	3.20	25.29	22.87	23.24	4.79	27.94	24.70
Sept.	22.09	6.85	25.69	20.83	21.61	4.78	28.22	21.00
Oct.	16.61	9.88	25.12	15.40	17.40	7.54	27.57	16.50

* Average based on less than full month

1999-2020 Water-Quality Data Summary

CSHH #8–Glen Cove Creek STP Outfall

	2020					2019				
	Avg. Water Temp (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp (°C)	Avg. Turbidity (NTUs) (0.5 m)
May	--	--	--	--	--	14.41	9.88	23.14	17.60	2.13
June	--	--	--	--	--	18.30	7.13	23.39	22.63	7.50
July	--	--	--	--	--	21.99	5.65	24.75	27.56	4.29
Aug.	24.60	5.75	25.98	22.85	3.15	23.51	3.45	25.38	25.58	3.70
Sept.	22.33	5.63	26.47	22.00	4.50	22.32	5.29	25.42	22.25	9.91
Oct.	18.15	7.26	26.28	17.22	3.55	16.65	8.65	25.34	16.53	2.14
Nov.	--	--	--	--	--	--	--	--	--	--

	2018					2017				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	15.19	7.75	24.85	24.20	6.92	15.39	24.68	8.98	21.60	12.48
June	18.59	8.92	24.28	21.90	4.64	17.83	22.78	6.44	18.65	33.21
July	21.16	6.56	25.81	27.77	8.53	21.30	25.00	5.50	26.20	3.74
Aug.	24.37	6.19	26.07	26.50	4.84	23.15	24.66	4.33	24.12	3.47
Sept.	23.24	5.64	26.07	25.50	5.66	21.79	25.19	6.01	22.75	5.75
Oct.	16.79	7.27	24.04	15.90	5.50	19.45	24.65	6.24	14.93	3.78
Nov.*	-	-	-	-	-	-	-	-	-	-

	2016					2015				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	14.20	8.15	25.88	19.87	2.05	13.70	9.08	26.00	21.13	2.60
June	19.23	5.94	26.36	23.43	2.52	17.53	6.68	25.98	23.03	4.40
July	22.67	4.48	27.20	26.60	2.54	22.04	4.64	26.28	27.14	3.59
Aug.	24.55	4.79	27.31	26.48	2.88	23.67	4.31	27.19	26.43	2.61
Sept.	23.10	5.34	27.57	25.83	3.01	24.85	4.37	27.31	28.75	2.85
Oct.	17.25	6.84	27.76	16.78	2.93	17.16	6.01	26.72	18.06	8.81
Nov.*	-	-	-	-	-	14.60	7.05	26.88	18.50	1.44

* Average based on less than full month

1999-2020 Water-Quality Data Summary

CSHH #8–Glen Cove Creek STP Outfall

	2014					2013				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	16.70	9.43	21.84	18.40	2.61	15.85	8.59	22.92	24.20	3.51
June	19.53	5.58	23.45	23.78	3.47	20.19	8.64	20.44	23.45	2.78
July	21.77	3.64	21.98	26.34	4.35	23.58	7.08	24.14	28.55	2.36
Aug.	23.13	5.17	23.73	24.50	3.19	23.28	5.52	25.81	25.78	1.91
Sept.	22.35	5.52	25.09	20.73	2.96	21.16	7.47	26.29	18.60	3.34
Oct.	17.83	6.07	24.18	19.05	3.25	17.91	6.85	26.27	16.24	1.05
Nov.*	12.70	8.54	24.02	17.80	1.23	11.40	7.46	25.31	8.05	1.29

	2012					2011				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	20.17	6.16	24.14	24.50	3.14	16.64	8.22	22.95	26.10	0.26
June	20.21	5.00	22.43	23.83	2.28	18.75	7.56	23.51	25.50	2.08
July	23.36	4.90	23.87	27.50	2.26	21.96	3.66	24.38	26.00	2.30
Aug.	24.16	4.29	24.44	26.73	2.44	22.99	3.50	24.78	24.90	2.62
Sept.	23.07	4.54	24.95	22.43	2.97	22.17	5.48	23.40	23.60	2.59
Oct.	17.72	5.99	23.93	17.33	1.31	18.01	7.68	23.74	17.20	2.09
Nov.*	9.86	9.18	26.36	8.55	2.01	13.14	9.70	23.86	9.40	1.46

	2010					2009				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	14.40	8.87	23.67	26.10	2.07	14.49	8.46	24.62	19.37	2.78
June	19.11	8.14	25.06	23.90	2.54	18.08	7.71	24.22	20.85	1.74
July	22.78	4.22	26.07	29.90	2.28	21.12	5.23	24.26	25.86	2.58
Aug.	23.35	3.78	26.68	26.10	2.34	24.01	6.65	24.44	28.20	4.27
Sept.	22.25	5.67	26.47	23.90	2.40	21.38	6.21	24.74	20.46	3.15
Oct.	16.68	7.88	26.29	16.40	1.66	15.14	7.03	25.00	14.08	2.88
Nov.*	12.85	9.82	26.96	10.00	1.22	-	-	-	-	-

* Average based on less than full month

1999-2020 Water-Quality Data Summary

CSHH #8–Glen Cove Creek STP Outfall

	2008					2007			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
May*	13.22	6.81	23.67	19.30	-	-	-	-	-
June	19.08	8.34	24.55	23.80	4.75	17.69	8.75	24.03	22.83
July	20.53	4.83	25.64	28.80	3.02	19.76	4.46	25.26	26.50
Aug.	23.23	4.49	25.46	24.13	2.89	22.76	5.27	25.84	24.33
Sept.	22.67	4.04	25.84	20.80	2.74	22.17	6.05	26.27	21.75
Oct.	16.68	6.67	26.17	13.38	2.14	19.30	5.13	27.59	17.76
Nov.*	12.47	6.34	25.96	15.80	1.53	-	-	-	-

	2006				2005			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.21	7.98	25.27	24.52	18.90	7.10	22.25	23.72
July	21.43	5.08	25.51	26.33	23.07	5.48	24.50	25.50
Aug.	24.00	8.85	25.71	25.18	24.32	3.45	25.32	27.20
Sept.	20.65	8.25	25.36	20.20	23.24	5.07	26.42	25.20
Oct.	17.12	8.18	25.97	15.57	16.98	7.31	25.28	14.00

	2004				2003			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	19.38	8.14	24.80	26.30	17.01	5.92	23.70	25.70
July	21.26	4.52	25.39	27.00	18.94	4.03	24.94	24.40
Aug.	22.78	5.98	25.89	24.40	22.51	5.23	25.51	26.10
Sept.	22.22	4.66	25.62	22.10	21.58	4.87	25.99	23.50
Oct.	16.60	7.79	25.72	13.40	16.49	6.49	25.10	14.60

* Average based on less than full month

1999-2020 Water-Quality Data Summary

CSHH #8–Glen Cove Creek STP Outfall

	2002				2001			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	19.89	7.65	26.12	25.50	20.11	7.61	24.57	26.60
July	22.13	4.33	26.27	26.80	20.18	5.56	25.31	27.10
Aug.	24.64	4.85	26.67	27.70	23.82	6.16	25.86	29.20
Sept.	21.91	6.01	26.41	23.00	22.45	5.74	26.58	22.10
Oct.	17.67	7.69	26.77	16.40	16.67	9.56	26.54	16.70

	2000				1999			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.66	7.13	23.59	23.80	19.99	9.11	24.71	23.00
July	21.99	6.51	24.93	24.10	22.70	6.03	25.53	30.00
Aug.	23.58	7.75	24.18	24.50	24.28	5.32	26.19	26.00
Sept.	21.17	8.63	24.81	23.60	21.78	6.14	25.84	24.00
Oct.	17.25	7.17	24.87	15.30	16.63	8.63	25.53	15.00

* Average based on less than full month

Seasonal Averages for Selected Water-Quality Parameters

Bottom Dissolved Oxygen Averages (ppm)

	Beacon 11 CSHH #1	**Bell 6 CSHH #2**	**Red Channel Marker, Near Glen Cove Creek, CSHH #3**	**Glen Cove STP Outfall, CSHH #8**
2020	5.40	5.84	7.07	6.29
2019	4.91	5.50	6.66	6.50
2018	5.69	6.17	6.73	7.00
2017	5.32	5.71	6.25	5.90
2016	5.02	4.94	5.82	5.89
2015	5.66	5.55	6.46	6.04
2014	4.83	4.96	5.74	5.62
2013	6.42	6.28	7.49	7.29
2012	4.46	4.31	5.54	5.28
2011	5.64	4.77	6.87	6.14
2010	5.55	5.16	6.41	6.26
2009	6.09	5.30	6.72	6.73
2008	5.50	5.31	6.35	5.73
2007	4.99	5.37	6.02	5.93
2006	5.80	5.30	6.80	7.00
2005	4.59	4.63	5.09	5.76
2004	4.94	5.57	5.76	6.22
2003	4.63	4.55	5.21	5.28
2002	4.64	5.11	5.20	6.11
2001	5.16	5.46	6.47	6.82
2000	5.64	6.10	6.54	7.35
1999	5.85	5.44	6.32	7.14
1998	5.17	5.45	6.48	N/A
1997	4.39	4.54	5.15	N/A
1996	5.90	7.11	7.45	N/A

Seasonal Averages for Selected Water-Quality Parameters

Water Temperature Averages (ºC)

	Beacon 11 CSHH #1	Bell 6 CSHH #2	Red Channel Marker, Near Glen Cove Creek, CSHH #3	Glen Cove STP Outfall, CSHH #8
2020	20.88	21.72	19.99	21.42
2019	19.77	18.80	19.08	19.84
2018	19.33	19.95	20.68	20.36
2017	20.07	19.59	20.15	20.79
2016	20.36	20.27	20.62	20.57
2015	19.00	18.68	19.25	19.40
2014	19.60	19.41	19.84	20.26
2013	19.39	18.84	19.58	19.66
2012	20.32	20.03	20.43	20.32
2011	19.92	19.70	20.04	20.25
2010	19.90	19.68	20.15	20.60
2009	19.31	18.75	19.27	19.68
2008	19.25	19.15	19.32	19.63
2007	19.90	19.40	19.96	20.53
2006	20.20	19.80	20.10	20.63
2005	20.24	19.63	20.19	21.10
2004	19.55	19.14	19.41	N/A
2003	18.94	18.37	18.90	N/A
2002	20.67	20.13	20.53	N/A
2001	20.90	19.58	20.23	N/A
2000	19.49	19.03	19.59	N/A
1999	21.01	19.67	20.20	N/A
1998	20.52	19.66	20.28	N/A
1997	20.10	19.12	19.55	N/A
1996	19.87	19.20	19.43	N/A
1995	20.80	20.30	20.59	N/A

Seasonal Averages for Selected Water-Quality Parameters

Air Temperature Averages (ºC)

	Beacon 11 CSHH #1	**Bell 6 CSHH #2**	**Red Channel Marker, Near Glen Cove Creek, CSHH #3**	**Glen Cove STP Outfall, CSHH #8**
2020	20.00	22.86	19.62	20.42
2019	20.33	21.20	21.73	22.44
2018	20.80	22.00	23.00	23.10
2017	19.71	20.79	20.93	21.52
2016	20.62	22.49	22.14	23.14
2015	20.04	21.40	22.36	23.40
2014	20.18	20.57	21.68	22.44
2013	19.20	20.80	20.85	21.47
2012	20.00	21.12	21.38	20.00
2011	20.18	21.15	20.64	22.42
2010	20.81	22.40	23.18	23.90
2009	19.18	20.52	20.69	21.70
2008	18.88	20.68	20.27	21.20
2007	20.22	21.24	21.69	22.31
2006	21.00	23.40	22.20	22.92
2005	21.10	21.91	22.28	23.20
2004	19.24	19.80	19.48	N/A
2003	20.40	21.10	21.80	N/A
2002	21.10	21.50	22.10	N/A
2001	22.50	22.80	23.60	N/A
2000	20.40	21.80	20.90	N/A
1999	22.22	22.73	23.04	N/A
1998	21.10	21.10	21.10	N/A
1997	20.81	21.37	21.25	N/A
1996	20.71	20.53	20.55	N/A
1995	21.84	22.16	22.18	N/A

Seasonal Averages for Selected Water-Quality Parameters

Salinity Averages (ppt)

	Beacon 11 CSHH #1	Bell 6 CSHH #2	Red Channel Marker, Near Glen Cove Creek, CSHH #3	Glen Cove STP Outfall, CSHH #8
2020	26.15	25.58	25.73	26.25
2019	25.17	25.45	25.00	24.64
2018	24.95	25.67	25.41	23.95
2017	23.97	25.00	24.62	23.83
2016	26.98	27.49	27.32	25.46
2015	26.43	26.99	26.74	24.01
2014	25.48	26.22	25.72	23.48
2013	26.01	26.59	26.34	24.45
2012	25.90	26.56	26.19	24.15
2011	23.71	24.27	23.99	23.18
2010	25.77	26.32	26.00	24.94
2009	24.22	24.87	24.54	23.68
2008	25.01	25.78	25.28	24.29
2007	25.41	26.07	25.62	24.30
2006	25.30	26.00	25.60	24.30
2005	24.60	24.95	24.71	23.66
2004	25.73	26.06	26.04	25.50
2003	25.25	25.70	25.45	25.09
2002	26.56	26.99	26.83	26.47
2001	26.02	26.41	26.27	25.76
2000	24.87	25.28	24.94	24.40
1999	24.15	26.21	25.49	25.49
1998	24.88	25.40	25.16	N/A
1997	25.20	25.69	25.66	N/A

Seasonal Averages for Selected Water-Quality Parameters

pH Averages (Bottom)

	Beacon 11 CSHH #1	Bell 6 CSHH #2	Red Channel Marker, Near Glen Cove Creek, CSHH #3	Glen Cove STP Outfall, CSHH #8
2020	7.48	7.59	7.63	7.57
2019	7.48	7.58	7.69	7.65
2018	7.51	7.59	7.63	7.64
2017	7.45	7.54	7.54	7.53
2016	7.49	7.57	7.66	7.66
2015	7.62	7.68	7.80	7.72
2014	7.50	7.61	7.66	7.66
2013	7.64	7.72	7.88	7.81
2012	7.48	7.53	7.58	7.57
2011	7.69	7.63	8.25	7.74
2010	7.64	7.63	7.74	7.71
2009	7.70	7.68	7.81	7.75
2008	7.55	7.58	7.68	7.59
2007	7.61	7.66	7.72	7.69
2006	N/A	N/A	N/A	N/A
2005	N/A	N/A	N/A	N/A
2004	N/A	N/A	N/A	N/A
2003	N/A	N/A	N/A	N/A
2002	N/A	N/A	N/A	N/A
2001	N/A	N/A	N/A	N/A
2000	N/A	N/A	N/A	N/A
1999	N/A	N/A	N/A	N/A
1998	N/A	N/A	N/A	N/A
1997	N/A	N/A	N/A	N/A
1996	N/A	N/A	N/A	N/A
1995	N/A	N/A	N/A	N/A

Seasonal Averages for Selected Water-Quality Parameters

pH Averages (Surface)

	Beacon 11 CSHH #1	Bell 6 CSHH #2	Red Channel Marker, Near Glen Cove Creek, CSHH #3	Glen Cove STP Outfall, CSHH #8
2020	7.57	7.83	7.84	7.63
2019	7.55	7.87	7.88	7.74
2018	7.54	7.84	7.83	7.75
2017	7.57	7.84	7.78	7.60
2016	7.55	7.84	7.81	7.68
2015	7.54	7.90	7.93	7.74
2014	7.55	7.90	7.90	7.66
2013	7.61	7.97	7.99	7.91
2012	7.62	7.83	7.82	7.69
2011	7.88	8.08	8.08	8.08
2010	7.80	7.96	7.97	7.92
2009	7.82	8.02	7.95	7.83
2008	7.75	7.97	7.92	7.80
2007	7.72	7.91	7.88	7.71
2006	N/A	N/A	N/A	N/A
2005	N/A	N/A	N/A	N/A
2004	N/A	N/A	N/A	N/A
2003	N/A	N/A	N/A	N/A
2002	N/A	N/A	N/A	N/A
2001	N/A	N/A	N/A	N/A
2000	N/A	N/A	N/A	N/A
1999	N/A	N/A	N/A	N/A
1998	N/A	N/A	N/A	N/A
1997	N/A	N/A	N/A	N/A
1996	N/A	N/A	N/A	N/A
1995	N/A	N/A	N/A	N/A

Seasonal Averages for Selected Water-Quality Parameters

Turbidity at 0.5 m Averages (NTU)

	Beacon 11 CSHH #1	Bell 6 CSHH #2	Red Channel Marker, Near Glen Cove Creek, CSHH #3	Glen Cove STP Outfall, CSHH #8
2020	3.05	3.25	3.48	3.72
2019	2.72	1.78	1.78	4.90
2018	4.31	4.79	4.10	5.75
2017	4.57	5.83	5.75	8.13
2016	2.78	1.61	2.12	2.68
2015	3.05	1.84	2.46	4.30
2014	3.39	1.84	2.36	3.27
2013	2.32	1.61	1.71	2.26
2012	2.23	1.37	1.70	2.29
2011	2.33	1.41	1.61	1.61
2010	2.04	1.61	1.51	2.16
2009	2.58	1.93	2.30	2.19
2008	2.87	2.18	1.64	2.81
2007	N/A	N/A	N/A	N/A
2006	N/A	N/A	N/A	N/A
2005	N/A	N/A	N/A	N/A
2004	N/A	N/A	N/A	N/A
2003	N/A	N/A	N/A	N/A
2002	N/A	N/A	N/A	N/A
2001	N/A	N/A	N/A	N/A
2000	N/A	N/A	N/A	N/A
1999	N/A	N/A	N/A	N/A
1998	N/A	N/A	N/A	N/A
1997	N/A	N/A	N/A	N/A
1996	N/A	N/A	N/A	N/A

Appendix B

2020 In-Harbor Bacteria Data

CSHH #1 - Beacon 11

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	18.00	0.00	4.00	0.00
6/10/20	30.00	23.24	8.00	5.66
6/17/20	5.00	13.92	1.00	3.17
6/25/20	49.00	19.07	1.00	2.38
7/1/20	25.00	20.13	0.10	1.26
7/8/20	60.00	25.61	24.00	1.81
7/15/20	1.00	12.97	0.10	0.75
7/22/20	90.00	23.13	34.00	1.52
7/29/20	21.00	19.52	2.00	1.75
8/7/20	155.00	28.12	83.00	6.70
8/12/20	5.00	17.11	4.00	4.69
8/19/20	38.00	35.41	24.00	14.02
8/26/20	4.00	19.00	0.10	4.37
9/3/20	59.00	23.36	16.00	6.62
9/9/20	16.00	14.83	5.00	3.78
9/16/20	17.00	18.94	5.00	3.95
9/23/20	11.00	14.78	0.10	1.32
10/1/20	310.00	35.29	16.00	3.64
10/7/20	20.00	28.42	14.00	3.55
10/14/20	80.00	39.22	11.00	4.15
10/22/20	22.00	41.29	9.00	4.67
10/28/20	8.00	38.74	0.10	4.67

Note for bacteria data for CSHH stations: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log Avg (log average) refers to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS beach-closure standards: 1,000 CFU/100 ml (200 Log Avg) for the formerly used fecal coliform standard and 104 CFU/100 ml (35 Log Avg) for the currently used enterococci standard.

2020 In-Harbor Bacteria Data

CSHH #2 - Bell Marker 6

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	2.00	0.00	2.00	0.00
6/10/20	18.00	6.00	2.00	2.00
6/17/20	0.10	1.53	0.10	0.74
6/25/20	0.10	0.77	0.10	0.45
7/1/20	0.10	0.51	0.10	0.33
7/8/20	10.00	0.71	0.10	0.18
7/15/20	0.10	0.25	0.10	0.10
7/22/20	8.00	0.60	0.10	0.10
7/29/20	3.00	1.19	0.10	0.10
8/7/20	2.00	2.17	0.10	0.10
8/12/20	1.00	1.37	1.00	0.16
8/19/20	8.00	3.29	0.10	0.16
8/26/20	2.00	2.49	0.10	0.16
9/3/20	27.00	3.87	0.10	0.16
9/9/20	1.00	3.37	0.10	0.16
9/16/20	5.00	4.64	0.10	0.10
9/23/20	2.00	3.52	0.10	0.10
10/1/20	10.00	4.86	0.10	0.10
10/7/20	0.10	1.58	0.10	0.10
10/14/20	3.00	1.97	0.10	0.10
10/22/20	8.00	2.17	0.10	0.10
10/28/20	0.10	1.19	0.10	0.10

2020 In-Harbor Bacteria Data

CSHH #3 - Glen Cove Creek, Red Marker

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	7.00	0.00	0.10	0.00
6/10/20	41.00	16.94	13.00	1.14
6/17/20	11.00	14.67	1.00	1.09
6/25/20	590.00	36.94	6.00	1.67
7/1/20	2.00	20.62	2.00	1.73
7/8/20	240.00	41.81	15.00	4.72
7/15/20	0.10	12.55	0.10	1.78
7/22/20	23.00	14.55	3.00	2.22
7/29/20	100.00	10.20	0.10	0.98
8/7/20	8.00	13.46	1.00	0.85
8/12/20	32.00	8.99	3.00	0.62
8/19/20	60.00	32.33	12.00	1.61
8/26/20	8.00	26.18	1.00	1.29
9/3/20	31.00	20.71	1.00	2.05
9/9/20	25.00	26.01	0.10	1.29
9/16/20	5.00	17.94	0.10	0.65
9/23/20	18.00	14.10	3.00	0.50
10/1/20	260.00	28.29	3.00	0.62
10/7/20	6.00	20.37	1.00	0.62
10/14/20	26.00	20.53	0.10	0.62
10/22/20	16.00	25.91	7.00	1.45
10/28/20	13.00	24.28	6.00	1.66

2020 In-Harbor Bacteria Data

CSHH #4 - East of North Hempstead Beach (S) (Former Bar Beach) Sand Spit

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	24.00	0.00	4.00	0.00
6/17/20	6.00	12.00	3.00	3.46
7/1/20	12.00	12.00	2.00	2.88
7/15/20	140.00	21.60	31.00	5.71
7/29/20	80.00	51.22	7.00	7.57
9/16/20	31.00	0.00	3.00	0.00
10/1/20	130.00	63.48	2.00	2.45
10/14/20	120.00	78.49	10.00	3.91
10/28/20	7.00	47.80	3.00	3.91

CSHH #5 - Mott's Cove

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	150.00	0.00	70.00	0.00
6/17/20	49.00	85.73	11.00	27.75
7/1/20	53.00	73.03	9.00	19.07
7/15/20	55.00	52.27	11.00	10.29
7/29/20	110.00	68.45	20.00	12.56
9/16/20	46.00	0.00	23.00	0.00
10/1/20	100.00	67.82	4.00	9.59
10/14/20	210.00	98.85	24.00	13.02
10/28/20	14.00	66.49	0.10	2.13

2020 In-Harbor Bacteria Data

CSHH #6 - East of the Former Incinerator Site

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	52.00	0.00	21.00	0.00
6/17/20	26.00	36.77	3.00	7.94
7/1/20	20.00	30.01	3.00	5.74
7/15/20	7.00	15.38	0.10	0.97
7/29/20	27.00	15.58	20.00	1.82
9/16/20	22.00	0.00	10.00	0.00
10/1/20	37.00	28.53	0.10	1.00
10/14/20	300.00	62.51	56.00	3.83
10/28/20	30.00	69.31	4.00	2.82

CSHH #7 - West of Old Oil Dock

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	100.00	0.00	9.00	0.00
7/1/20	70.00	83.67	16.00	12.00
7/15/20	360.00	158.75	23.00	19.18
7/29/20	220.00	176.99	21.00	19.77
9/16/20	100.00	0.00	29.00	0.00
10/1/20	390.00	197.48	0.10	1.70
10/14/20	380.00	245.63	80.00	6.14
10/28/20	100.00	245.63	22.00	5.60

2020 In-Harbor Bacteria Data

CSHH #8 - Glen Cove STP Outfall

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
8/7/20	145.00	0.00	41.00	0.00
8/12/20	140.00	142.48	42.00	41.50
8/19/20	580.00	227.50	580.00	99.96
8/26/20	25.00	130.98	9.00	54.76
9/3/20	360.00	160.34	12.00	40.42
9/9/20	29.00	116.21	19.00	34.66
9/16/20	21.00	79.52	11.00	26.51
9/23/20	21.00	40.95	7.00	10.96
10/1/20	530.00	75.42	18.00	12.59
10/7/20	310.00	73.20	70.00	17.91
10/14/20	70.00	87.30	18.00	17.72
10/22/20	25.00	90.40	17.00	19.33
10/28/20	12.00	80.83	36.00	26.82

2020 In-Harbor Bacteria Data

CSHH #9 - First Pipe West of STP Outfall

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
8/7/20	200.00	0.00	34.00	0.00
8/12/20	600.00	346.41	600.00	142.83
8/19/20	590.00	413.69	590.00	229.17
8/26/20	33.00	219.86	43.00	150.83
9/3/20	630.00	271.38	16.00	96.30
9/9/20	590.00	336.93	13.00	79.45
9/16/20	29.00	183.82	3.00	27.54
9/23/20	100.00	128.89	35.00	15.65
10/1/20	630.00	232.48	48.00	16.00
10/7/20	540.00	225.42	360.00	29.82
10/14/20	180.00	177.78	41.00	37.52
10/22/20	270.00	277.76	100.00	75.66
10/28/20	570.00	393.41	620.00	134.44

2020 In-Harbor Bacteria Data

CSHH #10 - Pipe at Corner of Seawall West of STP Outfall

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
8/7/20	290.00	0.00	49.00	0.00
8/12/20	580.00	410.12	580.00	168.58
8/19/20	570.00	457.69	600.00	257.39
8/26/20	33.00	237.17	43.00	164.55
9/3/20	420.00	265.88	25.00	112.89
9/9/20	360.00	277.63	20.00	94.36
9/16/20	27.00	150.34	24.00	49.91
9/23/20	35.00	86.04	41.00	29.18
10/1/20	930.00	167.76	100.00	34.55
10/7/20	210.00	146.05	60.00	41.16
10/14/20	120.00	117.24	280.00	69.77
10/22/20	31.00	120.52	33.00	74.36
10/28/20	590.00	212.04	580.00	126.31

2020 In-Harbor Bacteria Data

CSHH #11 - 50 Yards East of STP Outfall

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
8/7/20	1800.00	0.00	220.00	0.00
8/12/20	560.00	1003.99	570.00	354.12
8/19/20	600.00	845.68	550.00	410.10
8/26/20	100.00	495.91	45.00	236.03
9/3/20	10200.00	907.91	43.00	167.91
9/9/20	300.00	634.47	7.00	84.26
9/16/20	140.00	480.84	3.00	29.50
9/23/20	180.00	377.94	32.00	16.70
10/1/20	860.00	581.20	120.00	20.32
10/7/20	400.00	304.10	57.00	21.50
10/14/20	450.00	329.79	39.00	30.32
10/22/20	200.00	354.17	60.0	55.19
10/28/20	620.00	453.56	590.00	98.86

2020 In-Harbor Bacteria Data

CSHH #12 - Bend in Seawall East of STP Outfall

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	580.00	0.00	60.00	0.00
6/10/20	290.00	410.12	140.00	91.65
6/17/20	140.00	286.63	10.00	43.80
6/25/20	600.00	344.77	150.00	59.58
7/1/20	590.00	383.88	1.00	26.31
7/8/20	590.00	385.19	58.00	26.13
7/15/20	590.00	443.98	0.10	6.14
7/22/20	170.00	461.56	80.00	9.30
7/29/20	590.00	460.01	2.00	3.92
8/7/20	2500.00	614.03	240.00	11.74
8/12/20	550.00	605.47	470.00	17.84
8/19/20	550.00	597.03	520.00	98.74
8/26/20	59.00	483.14	2.00	47.21
9/3/20	4600.00	728.54	39.00	85.52
9/9/20	290.00	473.53	57.00	64.15
9/16/20	150.00	365.17	5.00	25.86
9/23/20	70.00	241.79	3.00	9.22
10/1/20	11200.00	690.42	280.00	24.78
10/7/20	550.00	451.47	80.00	28.61
10/14/20	580.00	518.61	46.00	27.40
10/22/20	70.00	445.29	37.00	40.89
10/28/20	580.00	679.68	470.00	112.37

2020 In-Harbor Bacteria Data

CSHH #13 - 60 Feet Downstream of Mill Pond Weir

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	600.00	0.00	530.00	0.00
6/10/20	200.00	346.41	600.00	563.91
6/17/20	42.00	171.45	27.00	204.77
6/25/20	520.00	226.26	80.00	161.89
7/22/20	290.00	388.33	60.00	69.28
7/29/20	360.00	323.11	120.00	84.85
8/7/20	2100.00	602.99	290.00	127.81
8/12/20	570.00	594.56	580.00	186.55
8/19/20	590.00	593.65	560.00	232.42
8/26/20	240.00	571.60	25.00	195.09
9/3/20	6001.00	1003.40	46.00	161.04
9/16/20	160.00	607.23	41.00	71.68
9/23/20	300.00	512.77	55.00	40.13
10/1/20	250.00	518.03	190.00	66.63
10/7/20	310.00	246.97	170.00	92.38
10/14/20	590.00	293.95	190.00	106.71
10/28/20	550.00	398.23	490.00	234.17

2020 In-Harbor Bacteria Data

CSHH #14 - NW Corner of Power Plant, Approximately 50 Yards from Cement Outfall

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	53.00	0.00	14.00	0.00
6/17/20	90.00	69.07	23.00	17.94
7/1/20	52.00	62.83	7.00	13.11
7/15/20	15.00	41.25	4.00	8.64
7/22/20	580.00	76.77	610.00	25.75
7/29/20	150.00	90.76	23.00	25.04
9/16/20	32.00	0.00	7.00	0.00
9/23/20	26.00	28.84	3.00	4.58
10/1/20	250.00	59.25	32.00	8.76
10/14/20	150.00	74.74	26.00	11.50
10/28/20	550.00	274.24	240.00	58.45

CSHH #15 - NW Corner of Tappen Pool

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	40.00	0.00	6.00	0.00
6/17/20	16.00	25.30	1.00	2.45
7/1/20	80.00	37.13	1.00	1.82
7/15/20	60.00	42.51	2.00	1.26
7/29/20	15.00	41.60	4.00	2.00
8/12/20	320.00	66.04	54.00	7.56
10/1/20	210.00	0.00	3.00	0.00
10/14/20	80.00	129.61	11.00	5.74
10/28/20	16.00	64.54	1.00	3.21

2020 In-Harbor Bacteria Data

CSHH #16 - Outer Harbor, Midway Between E/W Shore

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	0.10	0.00	1.00	0.00
6/10/20	2.00	0.45	0.10	0.32
6/17/20	0.10	0.27	0.10	0.22
6/25/20	0.10	0.21	0.10	0.18
7/1/20	1.00	0.29	0.10	0.16
7/8/20	3.00	0.57	0.10	0.10
7/15/20	4.00	0.65	0.10	0.10
7/22/20	2.00	1.19	0.10	0.10
7/29/20	0.10	1.19	0.10	0.10
8/7/20	5.00	1.64	2.00	0.18
8/12/20	0.10	0.83	0.10	0.18
8/19/20	8.00	0.96	1.00	0.29
8/26/20	0.10	0.53	0.10	0.29
9/3/20	3.00	1.04	0.10	0.29
9/9/20	0.10	0.47	0.10	0.16
9/16/20	0.10	0.47	0.10	0.16
9/23/20	0.10	0.20	1.00	0.16
10/1/20	21.00	0.58	0.10	0.16
10/7/20	0.10	0.29	0.10	0.16
10/14/20	14.00	0.78	1.00	0.25
10/22/20	1.00	1.24	0.10	0.25
10/28/20	5.00	2.71	0.10	0.16

2020 In-Harbor Bacteria Data

CSHH #17 – Outer Harbor, Outside the Boundary of Crescent Beach Restricted Area

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	5.00	0.00	1.00	0.00
6/10/20	5.00	5.00	0.10	0.32
6/17/20	0.10	1.36	0.10	0.22
6/25/20	1.00	1.26	0.10	0.18
7/1/20	0.10	0.76	0.10	0.16
7/8/20	1.00	0.55	3.00	0.20
7/15/20	1.00	0.40	0.10	0.20
7/22/20	3.00	0.79	1.00	0.31
7/29/20	5.00	1.08	0.10	0.31
8/7/20	0.10	1.08	0.10	0.31
8/12/20	0.10	0.68	0.10	0.16
8/26/20	0.10	0.27	0.10	0.10
9/3/20	4.00	0.25	0.10	0.10
9/9/20	0.10	0.25	0.10	0.10
9/16/20	2.00	0.53	0.10	0.10
9/23/20	2.00	0.69	0.10	0.10
10/1/20	10.00	1.74	2.00	0.18
10/7/20	5.00	1.82	0.10	0.18
10/14/20	11.00	4.66	1.00	0.29
10/22/20	1.00	4.06	0.10	0.29
10/28/20	7.00	5.21	0.10	0.29

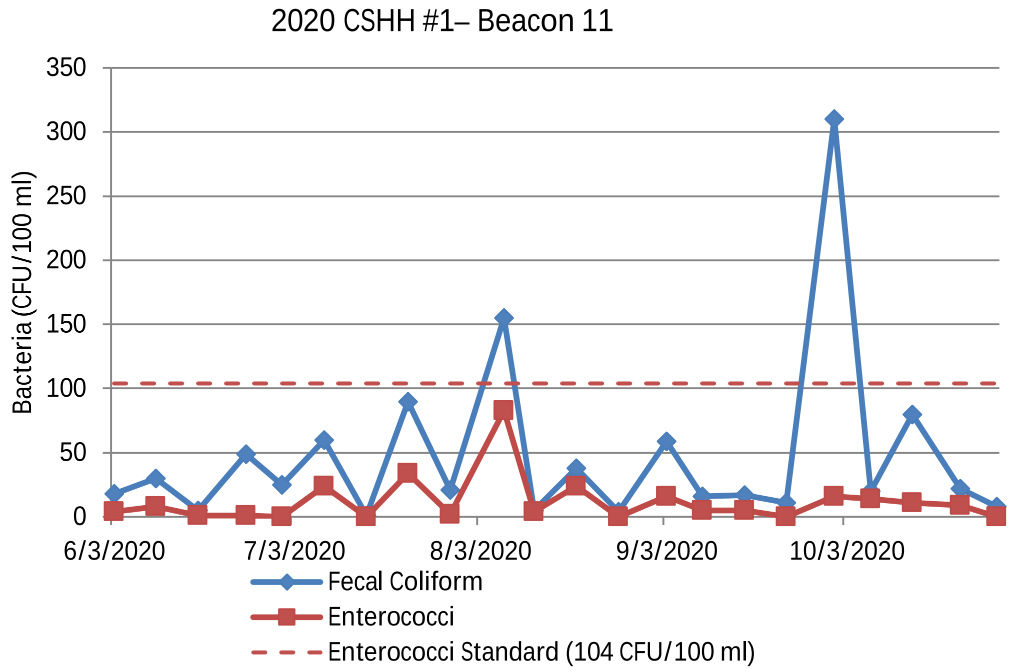
2020 In-Harbor Bacteria Data

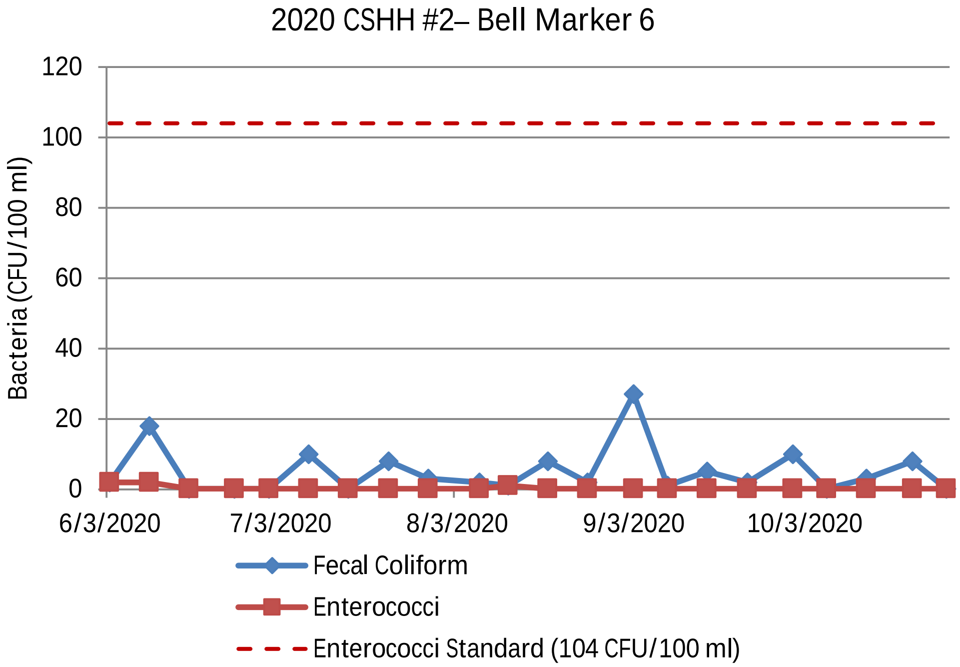
CSHH #17A - Within the Restricted Shellfishing Area

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
6/3/20	35.00	0.00	4.00	0.00
6/10/20	51.00	42.25	23.00	9.59
6/17/20	4.00	19.26	0.10	2.10
6/25/20	56.00	25.15	22.00	3.77
7/1/20	80.00	31.70	9.00	4.49
7/8/20	14.00	26.39	12.00	5.59
7/22/20	8.00	26.61	2.00	8.30
7/29/20	41.00	24.62	2.00	4.56
8/7/20	5.00	12.31	0.10	1.48
8/12/20	5.00	9.52	4.00	1.12
8/26/20	70.00	16.37	18.00	1.95
9/3/20	6.00	10.12	3.00	2.16
9/9/20	0.10	3.81	0.10	2.16
9/23/20	1.00	2.55	0.10	0.86
10/1/20	43.00	2.25	1.00	0.42
10/14/20	12.00	8.02	2.00	0.58
10/22/20	4.00	6.74	1.00	0.67
10/28/20	110.00	21.83	10.00	2.11

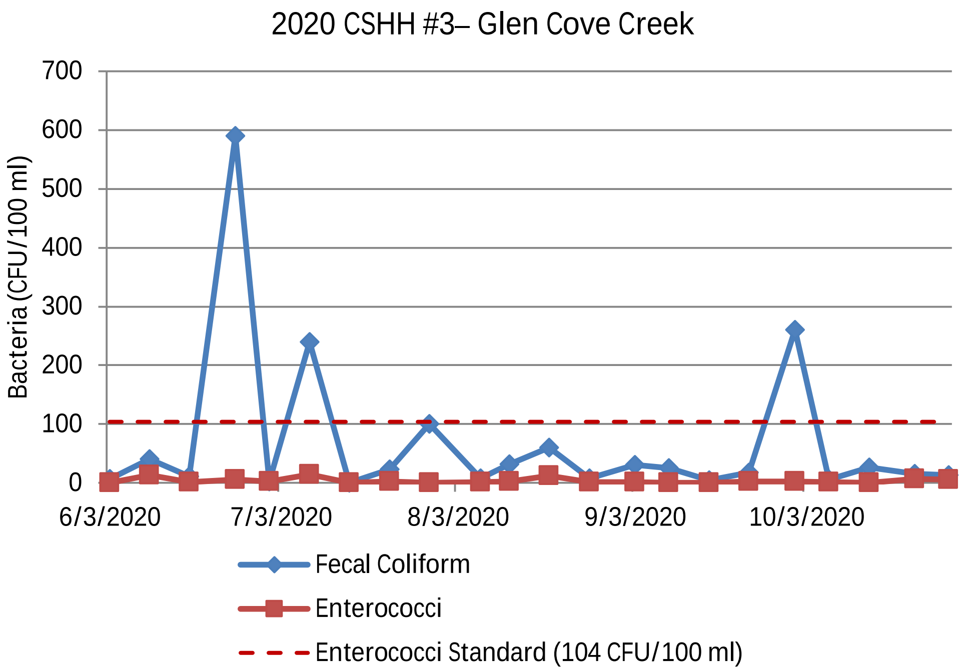
2020 In-Harbor Bacteria Graphs

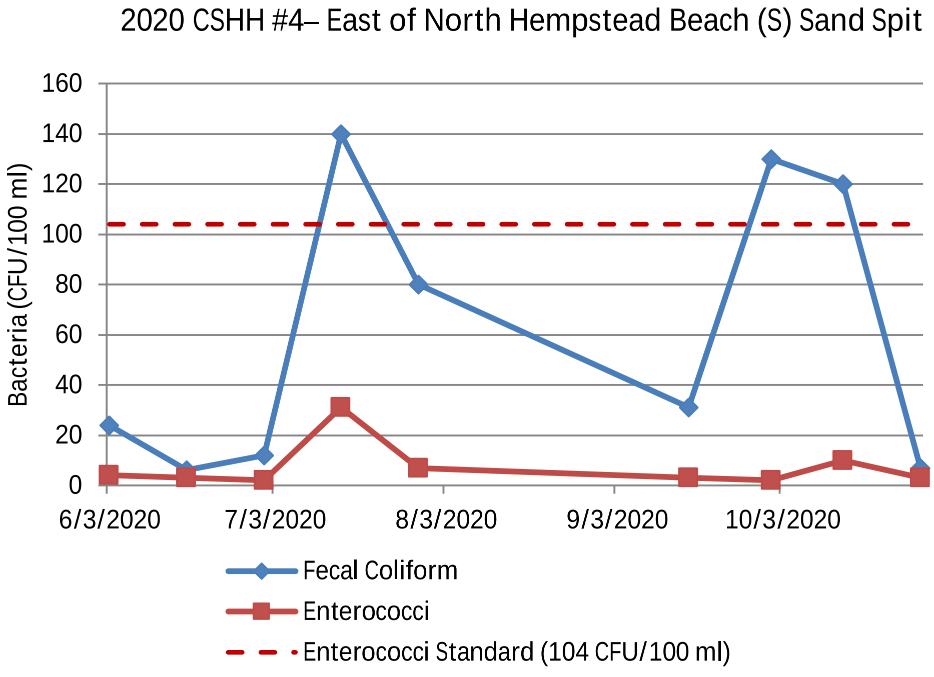
For each of the following graphs in this section, note that CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Under NYS beach-closure standards: the exceedance thresholds are 1,000 CFU/100 ml for the formerly used fecal coliform standard and 104 CFU/100 ml for the currently used enterococci standard.



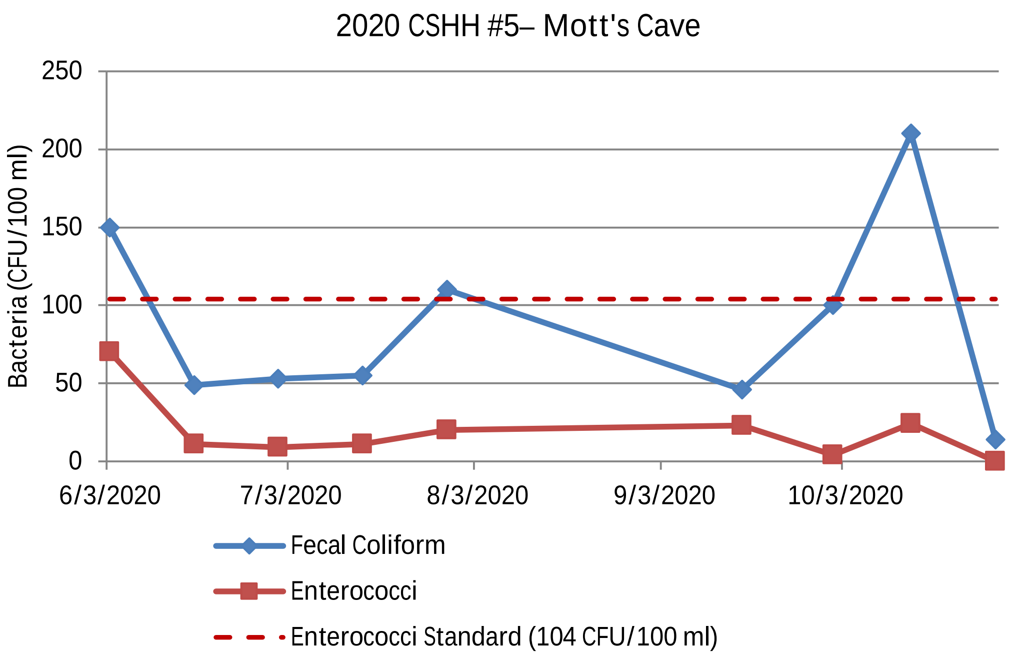


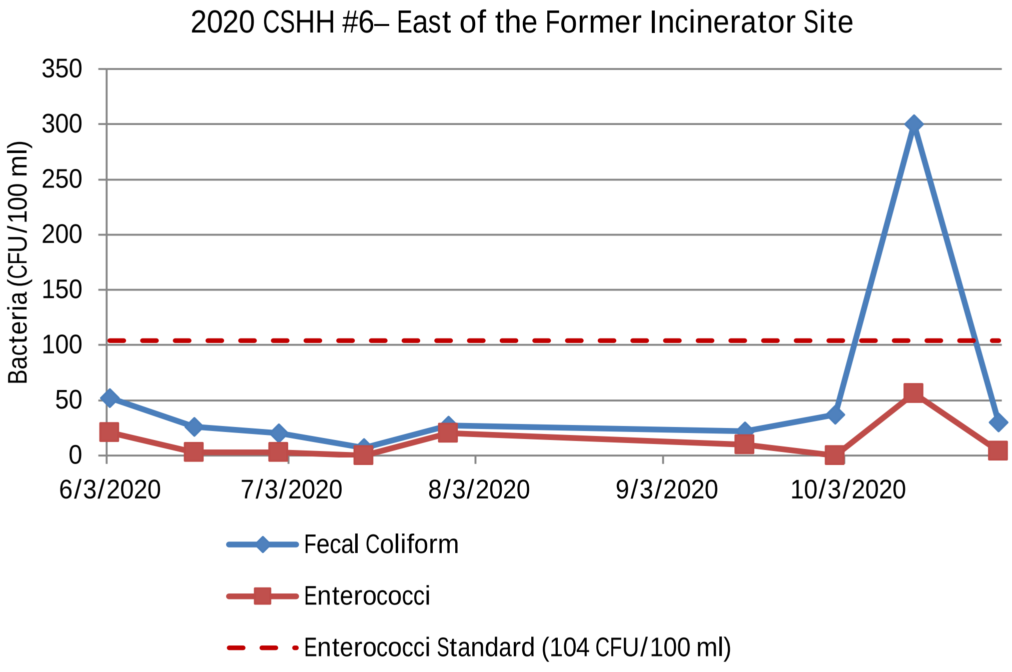
2020 In-Harbor Bacteria Graphs



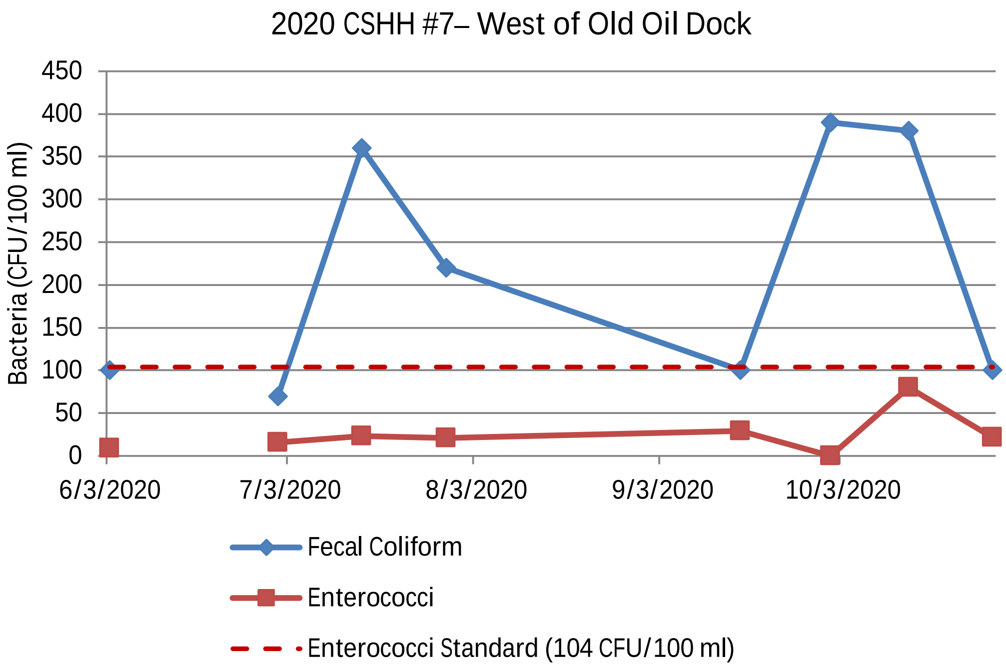


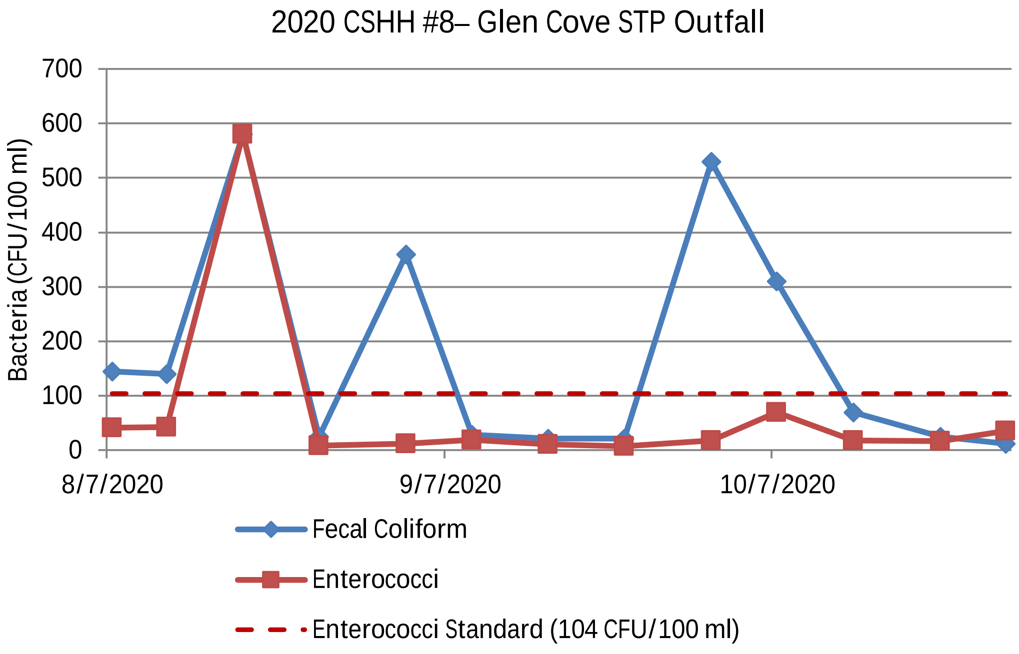
2020 In-Harbor Bacteria Graphs


2020 CSHH #5– Mott's Cave

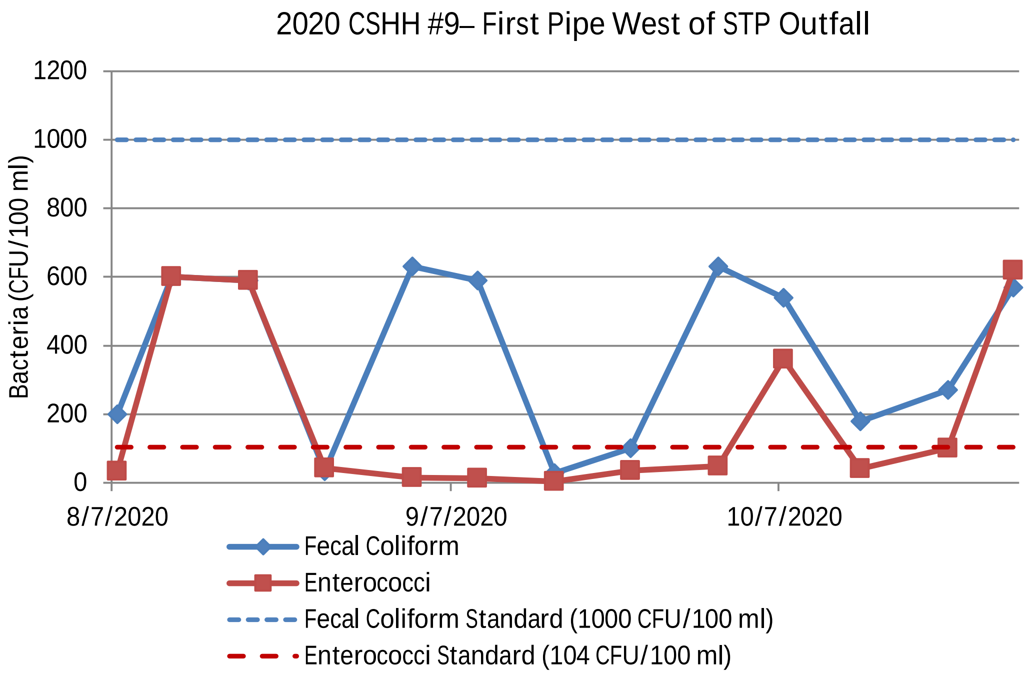

2020 CSHH #6– East of the Former Incinerator Site

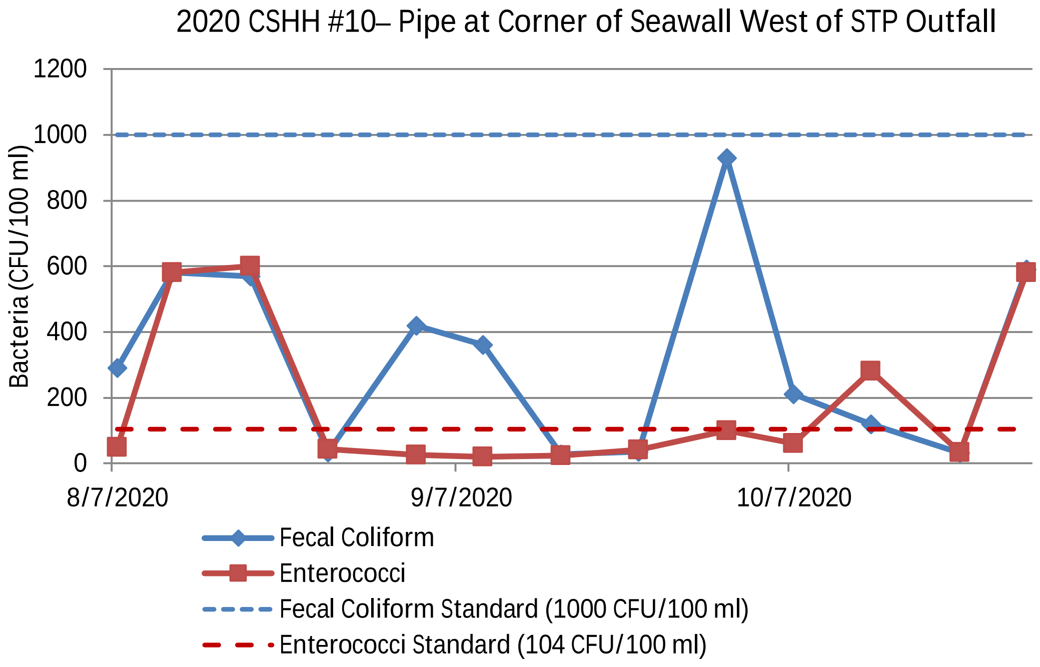
2020 In-Harbor Bacteria Graphs



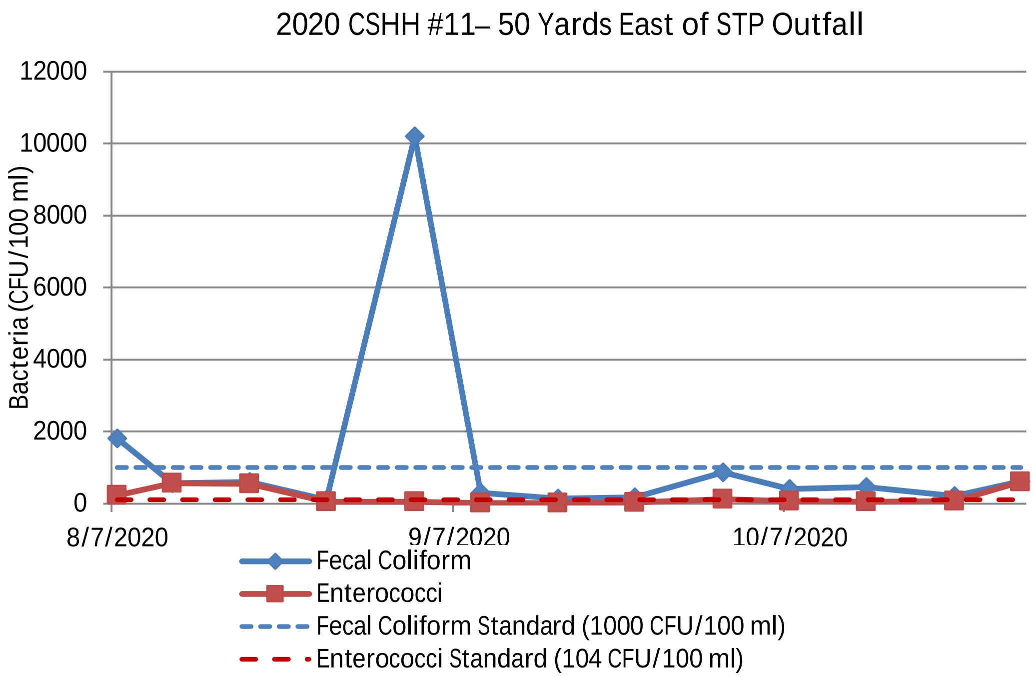


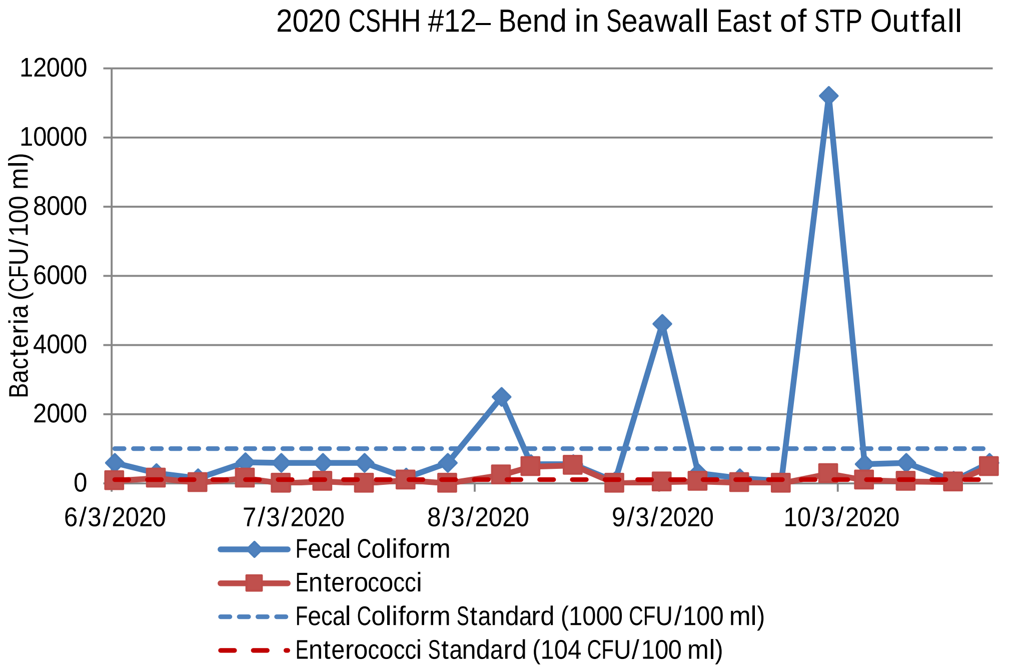
2020 In-Harbor Bacteria Graphs



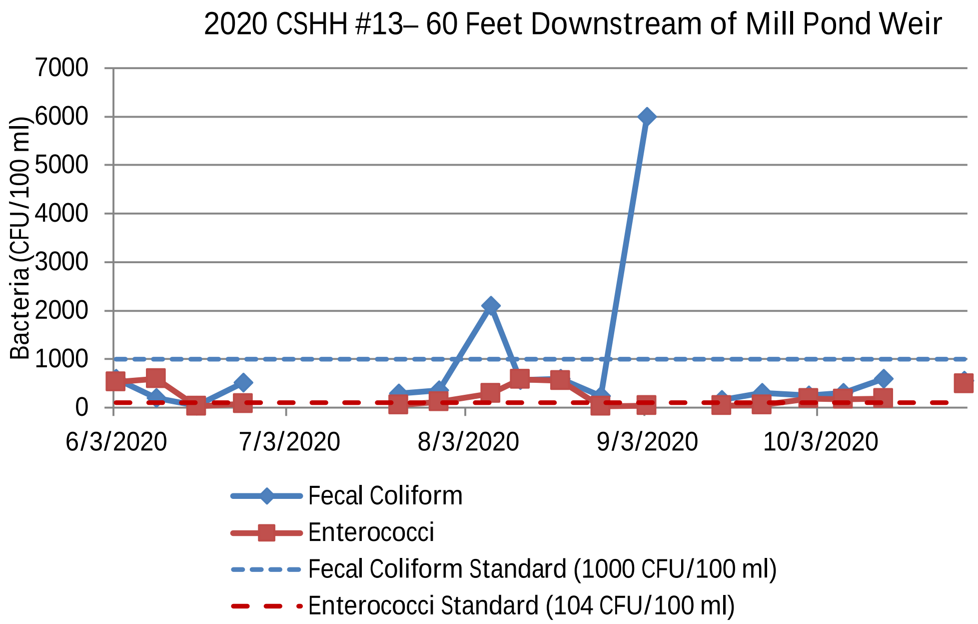


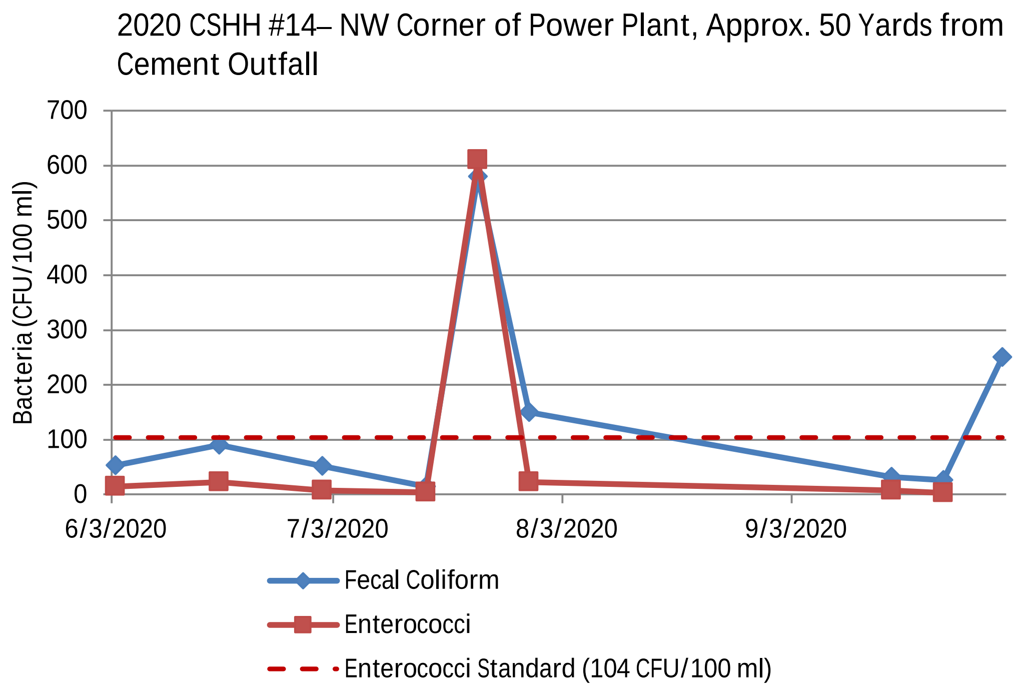
2020 In-Harbor Bacteria Graphs



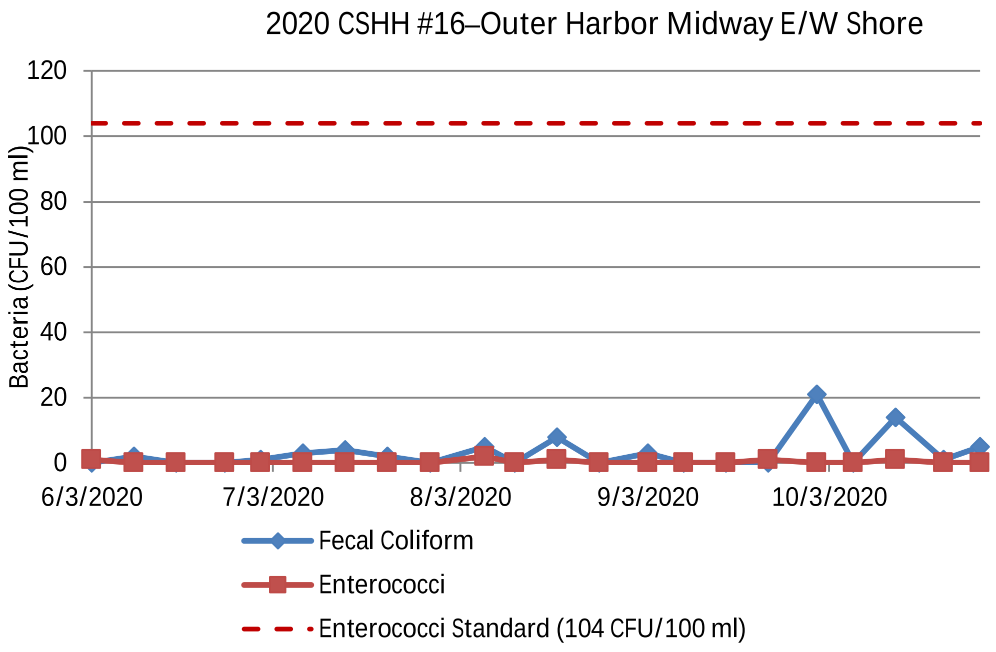


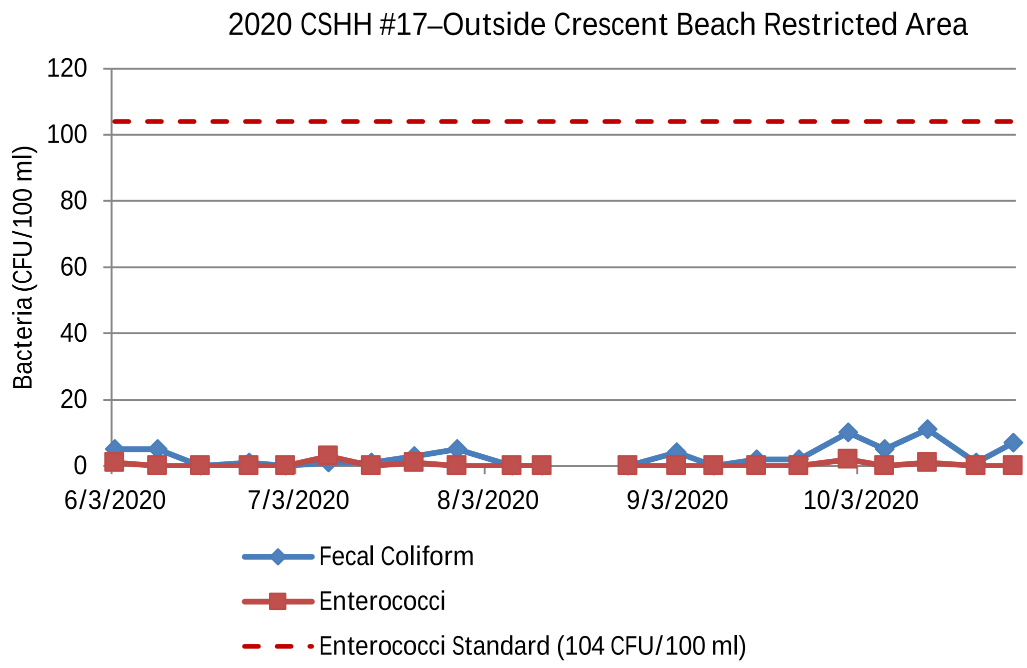
2020 In-Harbor Bacteria Graphs





2020 In-Harbor Bacteria Graphs





2020 Powerhouse Drain and Scudder's Pond Outfalls
Regular Season Monitoring Bacteria Data

CSHH #14A - At Powerhouse Outfall

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
5/20/20	290.00	0.00	240.00	0.00
5/27/20	370.00	327.57	100.00	154.92
6/3/20	540.00	386.96	410.00	214.29
6/10/20	570.00	426.30	470.00	260.78
6/17/20	280.00	391.93	180.00	242.14
6/25/20	260.00	383.46	120.00	210.80
7/8/2020	430.00	365.48	320.00	238.74
7/15/20	260.00	300.36	190.00	190.37
7/22/20	580.00	360.34	610.00	258.29
7/29/20	49.00	237.42	38.00	193.76
8/5/20	1800.00	356.01	410.00	225.09
8/12/20	210.00	308.47	60.00	161.05
8/19/20	570.00	360.91	330.00	179.85
8/26/20	170.00	282.36	70.00	116.65
9/3/20	620.00	469.07	330.00	179.73
9/9/20	350.00	338.07	150.00	146.99
9/16/20	290.00	360.61	59.00	146.49
9/23/20	26.00	194.47	3.00	57.22
9/30/20	580.00	248.57	590.00	87.64
10/7/20	470.00	235.18	130.00	72.74
10/14/20	390.00	240.32	380.00	87.60
10/21/20	700.00	286.64	1300.00	162.60
10/28/20	570.00	531.51	600.00	469.17

Note for bacteria data for CSHH stations: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log Avg (log average) refers to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS beach-closure standards: 1,000 CFU/100 ml (200 Log Avg) for the formerly used fecal coliform standard and 104 CFU/100 ml (35 Log Avg) for the currently used enterococci standard.

2020 Powerhouse Drain and Scudder's Pond Outfalls Regular Season Monitoring Bacteria Data

CSHH #15A - Scudder's Pond Outfall Pipe, North of Tappen Beach Pool Area

	Fecal Coliform		***Enterococci***	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/20/20	***1300.00***	0.00	56.00	0.00
5/27/20	64.00	***288.44***	37.00	***45.52***
6/3/20	570.00	***361.96***	70.00	***52.54***
6/10/20	280.00	***339.46***	59.00	***54.09***
6/17/20	110.00	***270.96***	29.00	***47.75***
6/25/20	190.00	184.45	39.00	***44.41***
7/8/20	440.00	***225.26***	***190.00***	***59.67***
7/15/20	600.00	***272.54***	***200.00***	***80.97***
7/22/20	340.00	***361.38***	80.00	***104.35***
7/29/20	56.00	***266.27***	31.00	***98.53***
8/5/20	***6001.00***	***496.48***	***280.00***	***121.42***
8/12/20	320.00	***465.84***	54.00	***128.34***
8/19/20	600.00	***465.84***	***600.00***	***159.88***
8/26/20	450.00	***492.70***	***130.00***	***176.18***
9/3/20	370.00	***364.61***	31.00	***88.31***
9/9/20	230.00	***374.36***	22.00	***77.92***
9/16/20	310.00	***371.99***	70.00	***82.07***
9/23/20	70.00	***242.06***	16.00	***39.75***
9/30/20	600.00	***256.39***	***600.00***	***53.98***
10/7/20	90.00	193.25	90.00	***66.80***
10/14/20	420.00	***217.98***	39.00	***74.91***
10/21/20	120.00	180.30	23.00	***59.96***
10/28/20	34.00	156.05	15.00	***59.19***

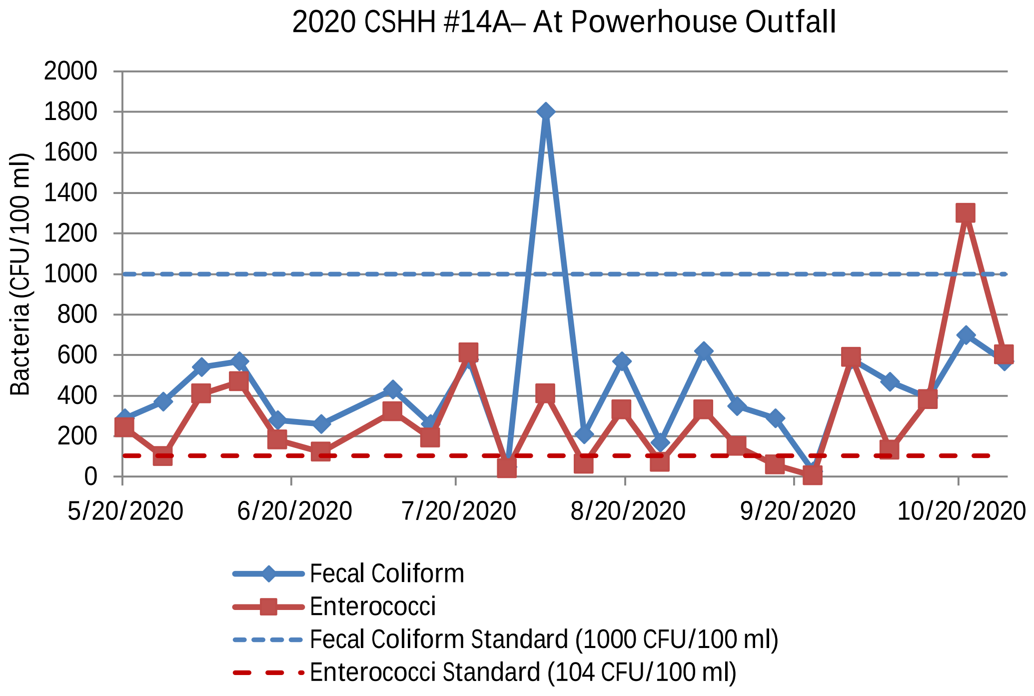
2020 Powerhouse Drain and Scudder's Pond Outfalls Regular Season Monitoring Bacteria Data

CSHH #15B - Scudder's Pond Weir on the East Side of Shore Road

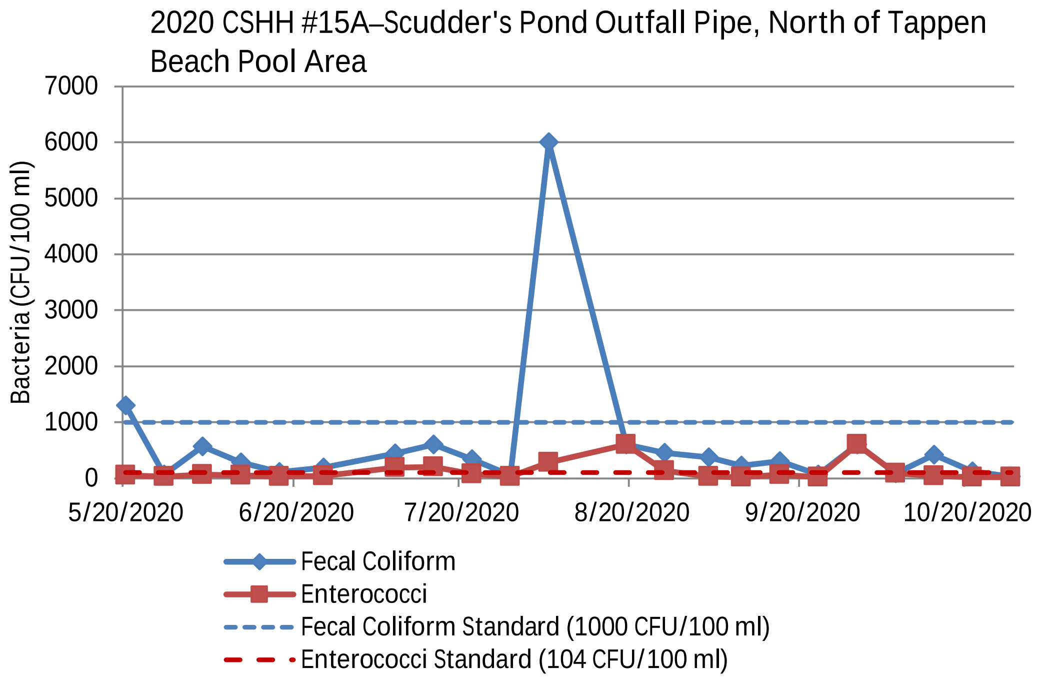
	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
5/20/20	430.00	0.00	44.00	0.00
6/17/20	120.00	227.16	8.00	18.76
7/15/20	260.00	176.64	58.00	21.54
8/5/20	6001.00	1249.10	300.00	131.91
9/3/20	43.00	507.98	29.00	93.27
9/9/20	190.00	90.39	5.00	12.04
9/30/20	630.00	172.66	580.00	43.81
10/14/20	500.00	561.25	31.00	134.09

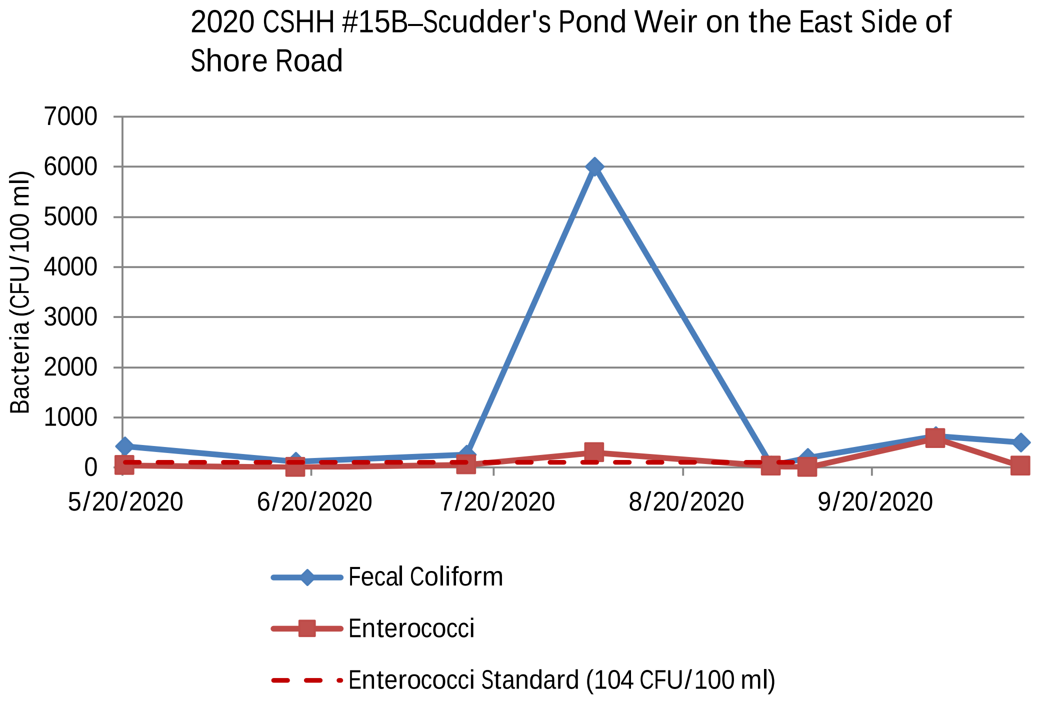
2020 Powerhouse Drain and Scudder's Pond Outfalls Regular Season Monitoring Bacteria Graphs

For each of the following graphs in this section, note that CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Under NYS beach-closure standards: the exceedance thresholds are 1,000 CFU/100 ml for the formerly used fecal coliform standard and 104 CFU/100 ml for the currently used enterococci standard.



2020 Powerhouse Drain and Scudder's Pond Outfalls Regular Season Monitoring Bacteria Graphs





2020-2021 Powerhouse Drain and Scudder's Pond Outfalls Winter-Monitoring Bacteria Data

CSHH #14A - At Powerhouse Outfall

	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
11/12/20	3700	11/12/20	490	0.00
11/18/20	360	11/18/20	110	232.16
11/25/20	66	11/25/20	48	137.28
11/25/20	49	11/25/20	59	
12/9/20	1700	12/9/20	1400	245.32
12/23/20	350	12/23/20	>6000	738.81
1/6/21	5500	1/6/21	5700	3631.41
1/20/21	4000	1/20/21	8	649.23
1/20/21	3500	1/20/21	14	
2/17/21	370	2/17/21	800	80.00
3/3/21	430	3/3/21	330	513.81
3/17/21	460	3/17/21	25	187.58
3/17/21	380	3/17/21	22	
3/31/21	600	3/31/21	100	93.79
4/14/21	155	4/14/21	250	85.50

Note for bacteria data for CSHH stations: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log Avg (log average) refers to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS beach-closure standards: 1,000 CFU/100 ml (200 Log Avg) for the formerly used fecal coliform standard and 104 CFU/100 ml (35 Log Avg) for the currently used enterococci standard.

2020-2021 Powerhouse Drain and Scudder's Pond Outfalls Winter-Monitoring Bacteria Data

CSHH #15A - Scudder's Pond Outfall Pipe,
North of Tappen Beach Pool Area

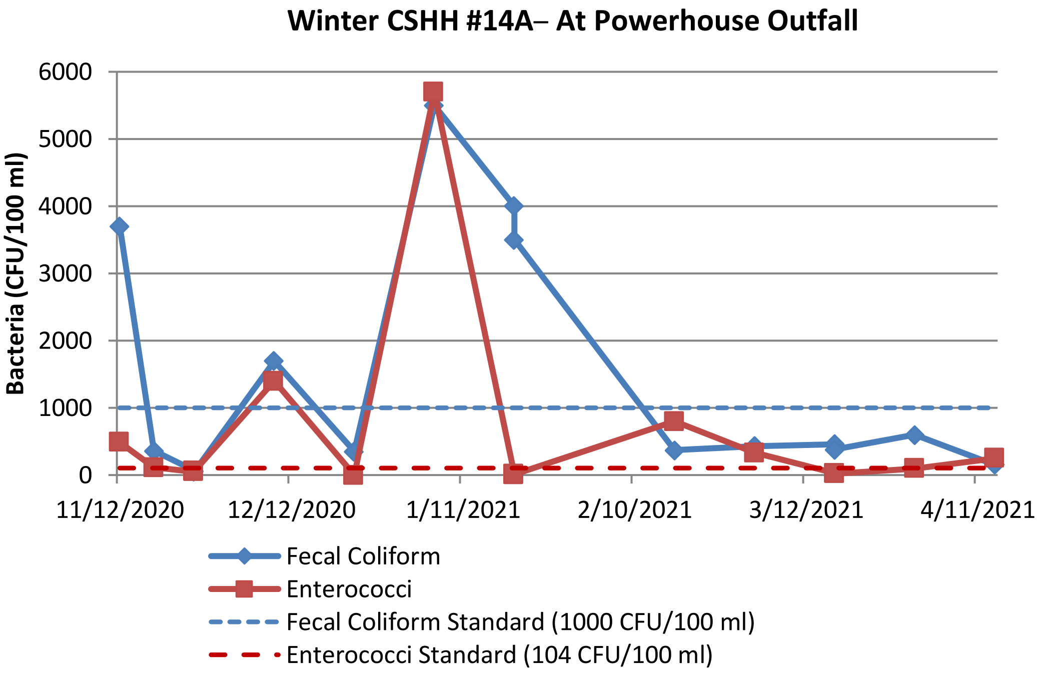
	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
11/12/20	2500	0.00	430	0.00
11/25/20	9	150.00	5	46.37
12/9/20	14	68.04	8	25.81
1/6/21	7	9.90	<1	0.89
2/17/21	27	0.00	150	0.00
3/3/21	4	10.39	3	21.21
3/31/21	59	15.36	7	4.58

CSHH #15B - Scudder's Pond Weir on the East Side of Shore Road

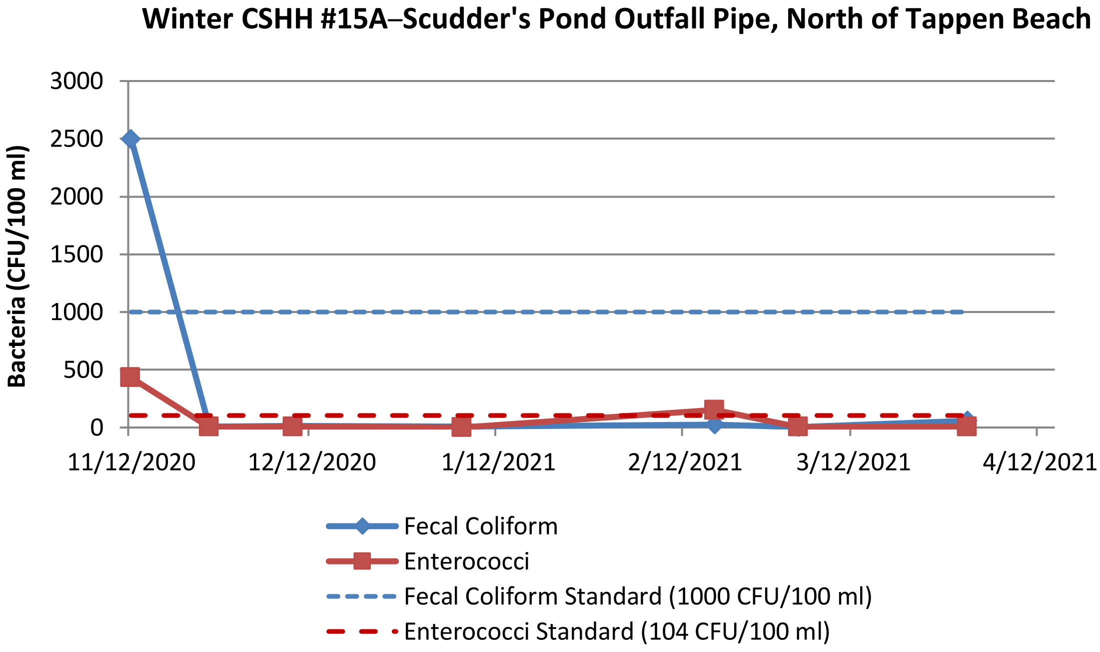
	Fecal Coliform		Enterococci	
Date	CFU/100 ml	Log Avg	CFU/100 ml	Log Avg
11/12/20	1300	0.00	190	0.00
12/9/20	19	157.16	<1	4.36
1/6/21	2	6.16	<1	0.10
2/17/21	29	0.00	120	0.00
3/3/21	2	7.62	<1	3.46
3/31/21	54	10.39	10	1.00
11/12/20	1300	0.00	190	0.00
12/9/20	19	157.16	<1	4.36
1/6/21	2	6.16		

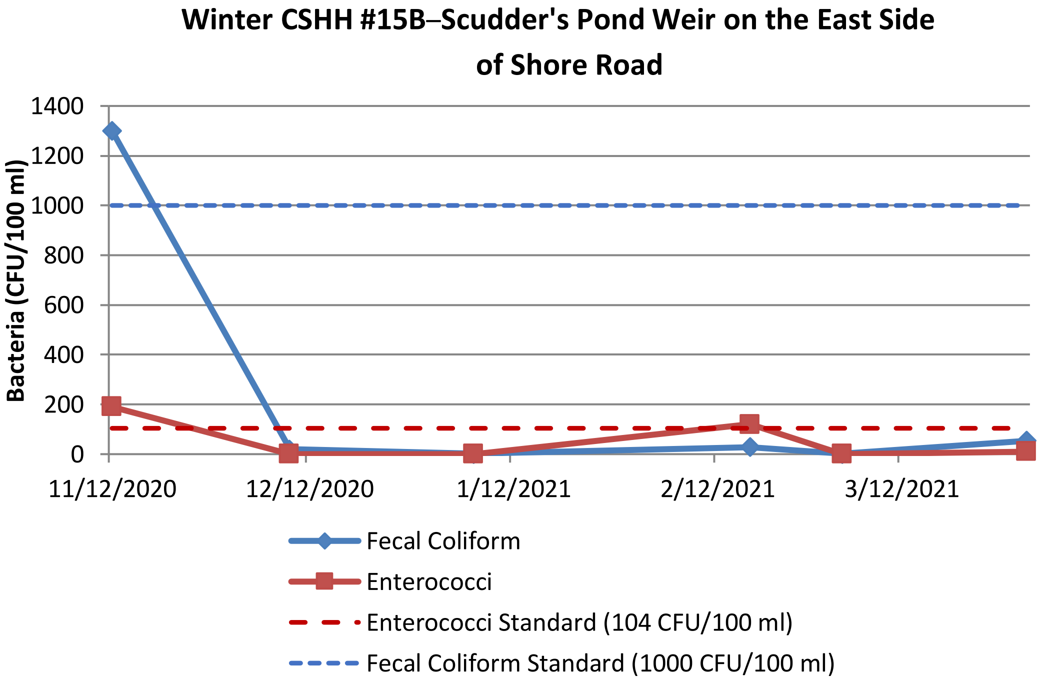
2020-2021 Powerhouse Drain and Scudder's Pond Outfalls Winter-Monitoring Bacteria Graphs

For each of the following graphs in this section, note that CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Under NYS beach-closure standards: the exceedance thresholds are 1,000 CFU/100 ml for the formerly used fecal coliform standard and 104 CFU/100 ml for the currently used enterococci standard.



2020-2021 Powerhouse Drain and Scudder's Pond Outfalls Winter-Monitoring Bacteria Graphs





2020 Sea Cliff Precipitation Data

JAN	mm	in	MARCH	mm	in	MAY	mm	in	JULY	mm	in	SEPT	mm	in	NOV	mm	in
3	6.35	0.25	2T	0.00	0.00	1	7.37	0.29	1	4.06	0.16	1	5.59	0.22	1	13.46	0.53
4	6.35	0.25	3	9.91	0.39	3	3.30	0.13	2	0.76	0.03	2	1.52	0.06	11	16.26	0.64
6**	1.02	0.04	4	0.51	0.02	4	0.51	0.02	3	9.40	0.37	3C†	29.97	1.18	12	11.18	0.44
12	1.78	0.07	6	2.54	0.10	6	0.76	0.03	6	2.79	0.11	10A†	44.96	1.77	13	8.13	0.32
14	1.27	0.05	10T	0.00	0.00	8	10.41	0.41	8	0.51	0.02	28	2.03	0.08	15	6.86	0.27
16	3.81	0.15	12	2.03	0.08	9	2.79	0.11	10B†	43.43	1.71	29	11.43	0.45	21T	0.00	0.00
18*	15.24	0.60	13	10.41	0.41	11	2.03	0.08	11†	3.81	0.15	30A	18.54	0.73	22	0.25	0.01
25	24.89	0.98	17	4.32	0.17	15	1.27	0.05	12	5.33	0.21				23	17.27	0.68
31T	0.00	0.00	19	22.61	0.89	16	2.54	0.10	14	1.02	0.04				24	0.25	0.01
			20	0.51	0.02	23B†	14.22	0.56	17	1.27	0.05				25T	0.00	0.00
			23	35.56	1.40	28	0.51	0.02	22C	15.75	0.62				26	17.02	0.67
			25T	0.00	0.00	29	0.76	0.03	23T†	0.00	0.00				30	41.15	1.62
			28	6.10	0.24				24	6.35	0.25						
			29	9.40	0.37				28T	0.00	0.00						
			31	2.29	0.09				29B	11.18	0.44						
									31A†	36.32	1.43						
TOTAL	**60.71**	**2.39**	**TOTAL**	**106.2**	**4.18**	**TOTAL**	**46.48**	**1.83**	**TOTAL**	**141.99**	**5.59**	**TOTAL**	**114.05**	**4.49**	**TOTAL**	**131.83**	**5.19**

FEB	mm	in	APRIL	mm	in	JUNE	mm	in	AUGUST	mm	in	OCT	mm	in	DEC	mm	in
1	0.76	0.03	3	8.89	0.35	3	11.43	0.45	3	6.35	0.25	2	2.03	0.08	4	2.29	0.09
2	2.29	0.09	6	0.76	0.03	5	10.92	0.43	4	10.67	0.42	6	0.76	0.03	5	33.27	1.31
3	1.02	0.04	8	4.57	0.18	6B	13.97	0.55	7	8.38	0.33	7	1.02	0.04	9*	0.51	0.02
4	0.51	0.02	9	11.18	0.44	11	6.86	0.27	12	0.25	0.01	12	31.75	1.25	12	0.76	0.03
5	0.51	0.02	10	1.02	0.04	27	2.54	0.10	13B	36.58	1.44	13	10.67	0.42	14	6.35	0.25
6	14.22	0.56	13	47.24	1.86	29	0.76	0.03	14†	0.51	0.02	16	46.48	1.83	16*	35.56	1.40
7	8.38	0.33	17T	0.00	0.00				16	7.87	0.31	17	13.46	0.53	17*	15.24	0.60
10	16.51	0.65	18	9.14	0.36				17C	18.54	0.73	20	1.27	0.05	20*	0.76	0.03
11	3.81	0.15	21	12.95	0.51				18†	2.79	0.11	21	0.51	0.02	24	3.81	0.15
12	1.02	0.04	23T*	0.00	0.00				19B	14.22	0.56	22	0.25	0.01	25	19.30	0.76
13	16.26	0.64	24	16.51	0.65				26	0.51	0.02	23	0.51	0.02	27T	0.00	0.00
18	0.76	0.03	26	3.81	0.15				27	8.89	0.35	25	0.76	0.03	28	0.51	0.02
25,26	5.08	0.20	27	1.27	0.05				29	0.76	0.03	26	0.76	0.03	29T**	0.00	0.00
27	22.61	0.89	29	0.51	0.02							27	1.02	0.04	31	14.22	0.56
			30	14.73	0.58							28	5.84	0.23			
												29	37.08	1.46			
												30	21.59	0.85			
TOTAL	**93.73**	**3.69**	**TOTAL**	**132.59**	**5.22**	**TOTAL**	**46.48**	**1.83**	**TOTAL**	**116.33**	**4.58**	**TOTAL**	**175.77**	**6.92**	**TOTAL**	**132.59**	**5.22**

Note: Precipitation recorded from midnight to midnight; snow recorded in inches, converted to approximate liquid equivalent (see below). "A" designates that about 12.5 mm of rain fell between midnight and 8 AM; "B," the first 12.5 mm of rain fell by 4 PM; "C," the first 12.5 mm of rain fell later in the evening, by midnight (meaningful during beach season).

T=trace amount

†Advisory/closure: Hempstead Harbor beaches were closed following half an inch or more of rain on 10 dates. North Hempstead Beach Park (S), Tappen Beach, Sea Cliff Beach, and Morgan Beach were closed on 9 dates: 5/23, 5/24, 7/10, 7/11, 7/23, 7/31, 8/14, 8/18, and 9/4. North Hempstead Beach Park (S) was also closed on 9/10. These same beaches were closed preemptively for 2 days (5/26, 5/27) due to a sewage spill in Port Washington on 5/26. Village Club at Sands Point and North Hempstead Beach Park (N) were not operational during this season. Crescent Beach remained closed all season.

†† Elevated bacteria beach closures: Sea Cliff Beach was also closed 4 days due to elevated bacteria levels (9/19-9/22).

*Sleet/rain mix or wet snow converted to approximate liquid equivalent in mm (5 in of wet snow approx. equal to 1 in liquid precip.).

**Snow--powdery--converted to approximate liquid equivalent in mm (10 in of snow equal to approx. 1 in liquid precip.).

2021 Partial Sea Cliff Precipitation Data

JAN	mm	in	FEB	mm	in	MARCH	mm	in	APRIL	mm	in
1	18.29	0.72	1**	31.75	1.25	1	1.02	0.04	1	8.38	0.33
3	6.35	0.25	2**	1.27	0.05	16T**.	0.00	0.00	9	0.25	0.01
15	9.40	0.37	3T**	0.00	0.00	18	13.21	0.52	10	1.27	0.05
16	16.76	0.66	5	2.03	0.08	19	3.05	0.12	11	11.43	0.45
19T*	0.00	0.00	7**	13.72	0.54	24	15.24	0.60	12	4.57	0.18
20*	1.27	0.05	9	0.25	0.01	25	2.03	0.08	13	1.78	0.07
26*	3.05	0.12	11**	3.56	0.14	28	28.70	1.13	14	0.25	0.01
31**	2.54	0.10	13T	0.00	0.00	29	0.76	0.03	15	21.59	0.85
			16	21.34	0.84	31	5.08	0.20	16	4.57	0.18
			18	10.16	0.40				19	0.51	0.02
			19	5.08	0.20				21	3.05	0.12
			22	15.24	0.60				25	13.21	0.52
			23	0.51	0.02				27	0.51	0.02
			27	12.19	0.48				28T	0.00	0.00
			28	11.43	0.45				29	1.02	0.04
TOTAL	**5.59**	**0.22**	**TOTAL**	**117.09**	**5.06**	**TOTAL**	**34.5**	**1.36**	**TOTAL**	**72.39**	**2.85**

Note: Precipitation recorded from midnight to midnight; snow recorded in inches, converted to approximate liquid equivalent (see below).

"A" designates that about 12.5 mm of rain fell between midnight and 8 AM; "B" designates that the first 12.5 mm of rain fell by 4PM;

"C" designates that the first 12.5 mm of rain fell later in the evening, by midnight (meaningful during beach season).

T=trace amount.

*Sleet/rain mix or wet snow converted to approximate liquid equivalent in mm (5 in of wet snow approx. equal to 1 in liquid precip.).

**Snow--powdery--converted to approximate liquid equivalent in mm (10 in of snow equal to approx. 1 in liquid precip.).

Appendix C

2020 Beach-Monitoring Bacteria Data

Village Club of Sands Point*

	Enterococci	
Date	CFU/100 ml	Log Avg
5/27/20	0.10	0.00
6/1/20	0.10	0.10
6/3/20	9.00	0.45
6/8/20	2.00	0.65
6/10/20	4.00	0.94
6/15/20	63.00	1.89
6/17/20	47.00	2.99
6/22/20	3.00	2.99
6/24/20	2.00	2.86
6/29/20	3.00	4.17
7/1/20	10.00	4.55
7/6/20	0.10	4.22
7/8/20	1.00	3.66
7/13/20	8.00	4.22
7/15/20	100.00	5.79
7/20/20	6.00	3.54
7/22/20	560.00	5.87
7/27/20	3.00	6.61
7/29/20	270.00	9.58
8/3/20	43.00	12.82
8/17/20	48.00	42.16
8/19/20	10.00	34.33
8/24/20	5.00	20.91
8/31/20	0.10	
9/2/20	12.00	

* Village Club at Sands Point is considered a “nonoperational” beach and is therefore not subject to preemptive or other closures. It is a historical testing site for the Nassau County Department of Health for which data continues to be collected.

Note for bacteria data for beaches: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log Avg (log average for enterococci) refers to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log Avg.

2020 Beach-Monitoring Bacteria Data

North Hempstead Beach Park (N) (formerly Hempstead Harbor Beach)

	Enterococci	
Date	CFU/100 ml	Log Avg
5/17/20	29.00	0.00
5/18/20	22.00	25.26
5/27/20	0.10	4.00
6/1/20	0.10	1.59
6/3/20	1.00	1.45
6/8/20	0.10	0.93
6/10/20	0.10	0.67
6/15/20	12.00	0.97
6/17/20	0.10	0.48
6/22/20	3.00	0.37
6/24/20	7.00	0.51
6/29/20	16.00	0.90
7/1/20	16.00	1.20
7/6/20	26.00	2.28
7/8/20	1.00	2.10
7/13/20	0.10	2.95
7/15/20	14.00	3.44
7/20/20	0.10	3.00
7/22/20	32.00	3.80
7/27/20	4.00	3.66
7/29/20	26.00	4.46
8/3/20	5.00	3.40
8/10/20	0.10	1.98
8/12/20	6.00	2.24
8/17/20	34.00	3.68
8/19/20	180.00	5.68
8/24/20	5.00	7.46
8/26/20	15.00	8.06
8/31/20	3.00	6.71
9/2/20	19.00	

2020 Beach-Monitoring Bacteria Data

North Hempstead Harbor Beach Park (S) (formerly Bar Beach)

	Enterococci	
Date	CFU/100 ml	Log Avg
5/17/20	31.00	0.00
5/18/20	0.10	1.76
5/27/20	0.10	0.68
6/1/20	23.00	1.63
6/3/20	0.10	0.93
6/8/20	1.00	0.95
6/10/20	8.00	1.28
6/15/20	2.00	1.36
6/17/20	1.00	0.88
6/22/20	2.00	1.28
6/24/20	3.00	1.41
6/29/20	3.00	2.06
7/1/20	10.00	2.41
7/6/20	4.00	2.83
7/8/20	7.00	3.09
7/13/20	0.10	2.16
7/15/20	2.00	2.14
7/20/20	1.00	2.16
7/22/20	27.00	2.78
7/27/20	1.00	2.55
7/29/20	10.00	2.92
8/3/20	11.00	2.94
8/10/20	5.00	2.72
8/12/20	15.00	3.29
8/17/20	601.00	10.37
8/19/20	19.00	11.09
8/24/20	1.00	9.93
8/26/20	24.00	10.95
8/31/20	1.00	11.07
9/2/20	8.00	10.68

2020 Beach-Monitoring Bacteria Data

Tappen Beach

	Enterococci	
Date	CFU/100 ml	Log Avg
5/17/20	4.00	0.00
5/18/20	0.10	0.63
5/27/20	2.00	0.93
6/1/20	0.10	0.53
6/3/20	23.00	1.13
6/8/20	1.00	1.11
6/10/20	6.00	1.41
6/15/20	3.00	1.55
6/17/20	2.00	1.42
6/22/20	2.00	2.07
6/24/20	10.00	2.46
6/29/20	32.00	3.35
7/1/20	48.00	4.37
7/6/20	3.00	5.30
7/8/20	28.00	6.26
7/13/20	1.00	6.29
7/15/20	39.00	7.55
7/20/20	7.00	9.62
7/22/20	7.00	9.32
7/27/20	2.00	9.24
7/29/20	5.00	8.69
8/3/20	8.00	6.16
8/5/20	2.00	5.51
8/10/20	0.10	3.15
8/12/20	0.10	2.23
8/17/20	11.00	2.12
8/19/20	25.00	2.71
8/24/20	2.00	2.12
8/26/20	4.00	2.26
8/31/20	2.00	2.07
9/2/20	26.00	

2020 Beach-Monitoring Bacteria Data

Sea Cliff Beach

	Enterococci	
Date	CFU/100 ml	Log Avg
5/17/20	0.10	0.00
5/18/20	0.10	0.10
5/27/20	0.10	0.10
6/1/20	1.00	0.18
6/3/20	15.00	0.43
6/8/20	0.10	0.34
6/10/20	0.10	0.28
6/15/20	2.00	0.36
6/17/20	1.00	0.48
6/22/20	11.00	0.87
6/24/20	36.00	1.32
6/29/20	51.00	2.63
7/1/20	6.00	2.86
7/6/20	5.00	2.84
7/8/20	3.00	2.86
7/13/20	4.00	6.25
7/15/20	50.00	7.69
7/20/20	0.10	6.92
7/22/20	5.00	6.70
7/27/20	16.00	5.79
7/29/20	7.00	5.90
8/3/20	3.00	4.30
8/5/20	1.00	3.72
8/10/20	2.00	3.44
8/12/20	7.00	3.69
8/17/20	5.00	2.83
8/19/20	4.00	2.93
8/24/20	2.00	3.86
8/26/20	3.00	3.76
8/31/20	0.10	2.00
9/2/20	2.00	2.00
9/18/20	380.00	3.50
9/22/20	3.00	3.33
9/23/20	0.10	2.02

2020 Beach-Monitoring Bacteria Data

Morgan Memorial Beach

	Enterococci	
Date	CFU/100 ml	Log Avg
5/17/20	3.00	0.00
5/26/20	0.10	0.55
5/27/20	0.10	0.31
5/27/20	1.00	0.42
6/1/20	0.10	0.31
6/2/20	5.00	0.50
6/3/20	2.00	0.61
6/8/20	6.00	0.81
6/9/20	7.00	1.03
6/10/20	1.00	1.02
6/15/20	3.00	1.13
6/16/20	0.10	0.92
6/17/20	1.00	0.84
6/22/20	17.00	1.06
6/23/20	3.00	1.14
6/24/20	58.00	1.48
6/29/20	26.00	2.89
6/30/20	5.00	3.00
7/1/20	100.00	3.79
7/6/20	63.00	6.40
7/7/20	6.00	6.38
7/8/20	80.00	7.55
7/13/20	46.00	10.37
7/14/20	12.00	10.48
7/15/20	0.10	7.68
7/20/20	10.00	13.77
7/21/20	7.00	13.12
7/22/20	33.00	13.96
7/27/20	10.00	13.51
7/28/20	0.10	9.52
7/29/20	9.00	9.48
8/3/20	17.00	8.04
8/4/20	26.00	8.75
8/6/20	24.00	8.16
8/10/20	2.00	6.29
8/11/20	0.10	4.68
8/12/20	1.00	4.22
8/17/20	36.00	5.10
8/18/20	13.00	5.45
8/19/20	70.00	6.47
8/24/20	8.00	5.57
8/25/20	23.00	6.17
8/26/20	3.00	5.88
8/31/20	2.00	6.88
9/1/20	0.10	5.08
9/2/20	3.00	4.91

2020 Beach-Monitoring Bacteria Data

Crescent Beach

	Enterococci				Enterococci		
Date	CFU/100 ml	Log Avg	Location	Date	CFU/100 ml	Log Avg	Location
5/17/20	0.10	0.00	center	6/22/20	12.00	6.06	right
5/17/20	1.00	0.32	left	6/23/20	1.00	5.75	center
5/17/20	0.10	0.22	right	6/23/20	2000.00	6.79	left
5/26/20	3.00	0.42	center	6/23/20	64.00	7.23	right
5/26/20	4.00	0.65	left	6/24/20	8.00	7.25	center
5/26/20	2.00	0.79	right	6/24/20	34.00	7.55	left
6/1/20	6.00	1.05	center	6/24/20	16.00	7.70	right
6/1/20	3.00	1.20	left	6/29/20	24.00	8.60	center
6/1/20	2.00	1.27	right	6/29/20	21.00	8.80	left
6/2/20	20.00	1.67	center	6/29/20	2.00	8.47	right
6/2/20	4.00	1.81	left	6/30/20	11.00	8.53	center
6/2/20	21.00	2.22	right	6/30/20	7.00	8.49	left
6/3/20	6.00	2.40	center	6/30/20	3.00	8.28	right
6/3/20	6.00	2.56	left	7/1/20	34.00	8.56	center
6/3/20	1.00	2.41	right	7/1/20	44.00	8.88	left
6/8/20	130.00	3.09	center	7/1/20	60.00	9.27	right
6/8/20	82.00	3.74	left	7/6/20	9.00	10.73	center
6/8/20	77.00	4.43	right	7/6/20	28.00	11.00	left
6/9/20	1.00	4.09	center	7/6/20	8.00	10.91	right
6/9/20	3.00	4.03	left	7/7/20	4.00	10.64	center
6/9/20	6.00	4.11	right	7/7/20	16.00	10.75	left
6/10/20	41.00	4.56	center	7/7/20	5.00	10.55	right
6/10/20	14.00	4.79	left	7/8/20	3.00	10.25	center
6/10/20	180.00	5.57	right	7/8/20	5.00	10.08	left
6/15/20	0.10	4.74	center	7/8/20	60.00	10.49	right
6/15/20	3.00	4.66	left	7/13/20	9.00	8.67	center
6/15/20	0.10	4.04	right	7/13/20	74.00	9.17	left
6/16/20	0.10	3.54	center	7/13/20	12.00	9.24	right
6/16/20	12.00	3.69	left	7/14/20	2.00	8.89	center
6/16/20	38.00	3.99	right	7/14/20	18.00	9.04	left
6/17/20	4.00	5.46	center	7/14/20	3.00	8.81	right
6/17/20	7.00	5.51	left	7/15/20	52.00	9.18	center
6/17/20	8.00	5.58	right	7/15/20	6.00	9.09	left
6/22/20	12.00	5.71	center	7/15/20	1.00	8.66	right
6/22/20	19.00	5.93	left	7/20/20	34.00	13.01	center
5/22/19	4.00	0.91		6/24/19	6.00	35.22	

2020 Beach-Monitoring Bacteria Data

Crescent Beach (cont.)

	Enterococci				Enterococci		
Date	CFU/100 ml	Log Avg	Location	Date	CFU/100 ml	Log Avg	Location
7/20/20	45.00	13.44	left	8/18/20	22.00	6.22	center
7/20/20	18.00	13.54	right	8/18/20	16.00	6.38	left
7/21/20	6.00	13.27	center	8/18/20	34.00	6.66	right
7/21/20	7.00	13.07	left	8/19/20	2900.00	7.75	center
7/21/20	18.00	13.17	right	8/19/20	900.00	8.70	left
7/22/20	13.00	13.16	center	8/19/20	1700.00	9.87	right
7/22/20	11.00	13.11	left	8/24/20	7.00	8.84	center
7/22/20	9.00	13.00	right	8/24/20	14.00	8.96	left
7/27/20	1.00	10.60	center	8/24/20	9.00	8.96	right
7/27/20	1.00	9.97	left	8/25/20	12.00	9.03	center
7/27/20	16.00	10.09	right	8/25/20	220.00	9.82	left
7/28/20	0.10	8.99	center	8/25/20	9.00	9.80	right
7/28/20	3.00	8.75	left	8/26/20	4.00	9.58	center
7/28/20	5.00	8.63	right	8/26/20	2.00	9.22	left
7/29/20	4.00	8.48	center	8/26/20	0.10	8.28	right
7/29/20	2.00	8.21	left	8/31/20	7.00	11.96	center
7/29/20	3.00	8.03	right	8/31/20	11.00	11.93	left
8/3/20	19.00	7.17	center	8/31/20	3.00	11.48	right
8/3/20	9.00	7.22	left	9/1/20	6.00	11.28	center
8/3/20	21.00	7.42	right	9/1/20	8.00	11.18	left
8/4/20	46.00	7.76	center	9/1/20	6.00	11.00	right
8/4/20	18.00	7.92	left	9/2/20	3.00	10.65	center
8/4/20	21.00	8.11	right	9/2/20	2.00	10.23	left
8/10/20	18.00	7.98	center	9/2/20	1.00	9.68	right
8/10/20	26.00	8.25	left	9/9/20	0.10	7.61	center
8/10/20	10.00	8.30	right	9/9/20	0.10	6.79	left
8/11/20	13.00	8.40	center	9/9/20	0.10	6.09	right
8/11/20	3.00	8.18	left	9/16/20	32.00	9.18	center
8/11/20	1.00	7.75	right	9/16/20	33.00	9.55	left
8/12/20	0.10	6.95	center	9/16/20	41.00	9.98	right
8/12/20	0.10	6.27	left	9/23/20	13.00	4.20	center
8/12/20	0.10	5.68	right	9/23/20	6.00	4.26	left
8/17/20	35.00	5.36	center	9/23/20	4.00	4.25	right
8/17/20	43.00	5.69	left				
8/17/20	41.00	6.01	right				

Comparison of Averaged Indicator Bacteria Data for Beaches

2020

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	--	--	--	--	--	--	--
May	Enterococci	0.10**	17.03	10.40	2.03	0.10	1.05	1.70
June	Enterococci	14.79	4.38	4.79	8.79	13.02	9.59	69.27
July	Enterococci	106.46	13.24	6.90	15.56	10.68	28.94	16.64
August	Enterococci	21.22	31.01	84.63	6.02	3.01	17.32	172.07
September	Enterococci	12.00**	19.00**	21.00	26.00**	96.28	1.55	10.35
Season Averages*	*Enterococci*	*48.38*	*15.89*	*27.19*	*9.85*	*18.41*	*16.15*	*71.87*

*Averages of all of the data points collected during the monitoring season.

**Only one data point collected.

2019

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	30.47	29.34	45.49	30.17	1.50	0.33	0.73
May	Enterococci	7.55	6.66	2.18	8.03	2.18	2.14	9.26
June	Enterococci	101.14	12.38	10.39	27.01	20.76	112.10	491.37
July	Enterococci	174.20	75.40	46.10	43.30	41.00	108.65	69.14
August	Enterococci	53.89	122.25	44.67	13.25	26.68	45.81	55.97
September	Enterococci	--	--	--	--	--	--	6.90
Season Averages*	*Enterococci*	*83.10*	*50.97*	*30.52*	*25.13*	*20.58*	*66.14*	*131.46*

*Averages of all of the data points collected during the monitoring season.

Comparison of Averaged Indicator Bacteria Data for Beaches

2018

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	3.64	27.47	4.20	39.76	27.64	1.37	0.73
May	Enterococci	8.31	8.93	1.94	2.68	5.04	1.58	8.36
June	Enterococci	4.93	12.64	25.29	19.16	10.51	25.90	45.84
July	Enterococci	51.91	51.63	7.76	12.65	14.03	37.43	426.19
August	Enterococci	42.17	124.67	14.36	11.79	19.89	13.75	97.82
September	Enterococci	--	--	--	--	--	--	55.09
Season Averages*	*Enterococci*	*22.20*	*45.07*	*10.71*	*17.21*	*15.42*	*16.00*	*105.67*

*Averages of all of the data points collected during the monitoring season.

2017

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	3.38	11.57	10.17	10.05	1.90	1.40	32.03
May	Enterococci	14.46	14.68	37.80	13.24	20.26	7.96	29.94
June	Enterococci	17.01	56.89	10.51	35.02	19.53	42.08	40.48
July	Enterococci	95.13	71.90	44.78	105.84	14.89	18.52	259.23
August	Enterococci	11.33	12.02	15.10	18.27	52.28	178.44	164.89
September	Enterococci	--	--	--	59.75	--	--	65.33
Season Averages*	*Enterococci*	*30.36*	*34.44*	*24.73*	*44.25*	*24.63*	*60.41*	*111.43*

*Averages of all of the data points collected during the monitoring season.

Comparison of Averaged Indicator Bacteria Data for Beaches

2016

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	0.58	0.25	0.57	0.88	0.57	63.67	0.92
May	Enterococci	24.17	7.05	10.16	4.89	2.30	10.43	76.97
June	Enterococci	4.58	5.58	2.91	6.57	622.72**	16.37	614.04
July	Enterococci	12.71	9.30	6.86	3.44	6.31	7.28	79.28
August	Enterococci	113.31	34.42	36.48	32.22	29.46	69.47	50.57
September	Enterococci	--	--	--	--	--	--	10.70
Season Averages*	*Enterococci*	*36.82*	*12.94*	*13.66*	*11.25*	*157.55*	*32.54*	*172.69*

*Averages of all of the data points collected during the monitoring season.
**June monthly average is highly influenced by a single reading that may be an anomaly. Excluding this reading the average for June is 25.13 CFU/100ml and the season average is 15.03 CFU/100ml.

2015

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	0.26	1.28	1.66	24.46	10.62	1.26	2.79
May	Enterococci	27.44	8.00	19.03	23.87	22.47	24.29	12.76
June	Enterococci	680.51	257.39	60.24	68.33	26.67	80.87	86.57
July	Enterococci	20.90	17.69	34.81	18.01	15.34	21.37	28.41
August	Enterococci	12.13	7.46	7.92	4.76	26.44	36.17	15.92
September	Enterococci	4.00**	11.00**	8.00**	0.10**	4.00**	1.00**	6.47
Season Averages*	*Enterococci*	*152.28*	*60.48*	*27.10*	*28.33*	*20.76*	*38.05*	*32.65*

*Averages of all of the data points collected during the monitoring season.
**Only one data point collected in September.

Comparison of Averaged Indicator Bacteria Data for Beaches

2014

	Units in CFU/100 ml	**Village Club of Sands Point**	**North Hempstead Beach Park (N) (former Hempstead Harbor Beach)**	**North Hempstead Beach Park (S) (former Bar Beach)**	**Tappen Beach**	**Sea Cliff Beach**	**Morgan Memorial Beach**	**Crescent Beach**
April	Enterococci	20.83	16.05	7.20	8.85	7.55	14.84	224.55
May	Enterococci	223.16	39.91	34.31	37.41	10.33	14.57	9.43
June	Enterococci	103.79	221.71	91.92	74.00	395.65	78.67	470.85
July	Enterococci	8.02	13.68	17.22	24.44	31.44	865.13	78.19
August	Enterococci	139.26	83.51	74.58	96.75	125.79	41.32	461.83
September	Enterococci	--	--	--	--	--	--	15.02
Season Averages*	*Enterococci*	*97.63*	*84.60*	*50.49*	*50.89*	*140.11*	*263.23*	*238.04*

*Averages of all of the data points collected during the monitoring season.

2013

	Units in CFU/100 ml	**Village Club of Sands Point**	**North Hempstead Beach Park (N) (former Hempstead Harbor Beach)**	**North Hempstead Beach Park (S) (former Bar Beach)**	**Tappen Beach**	**Sea Cliff Beach**	**Morgan Memorial Beach**	**Crescent Beach**
April	Enterococci	2.55	1.30	22.80	8.03	6.80	2.05	2.13
May	Enterococci	20.03	10.57	38.76	23.90	20.38	25.51	17.39
June	Enterococci	36.38	6.65	73.12	79.33	20.88	40.62	53.47
July	Enterococci	63.00	21.75	5.11	10.42	5.00	51.35	87.59
August	Enterococci	4.13	7.13	16.13	19.01	15.75	18.08	23.53
September	Enterococci	--	--	--	--	--	--	129.63
Season Averages*	*Enterococci*	*29.85*	*11.00*	*31.78*	*30.61*	*14.03*	*32.67*	*55.43*

*Averages of all of the data points collected during the monitoring season.

Comparison of Averaged Indicator Bacteria Data for Beaches

2012

	Units in CFU/100 ml	**Village Club of Sands Point**	**North Hempstead Beach Park (N) (former Hempstead Harbor Beach)**	**North Hempstead Beach Park (S) (former Bar Beach)**	**Tappen Beach**	**Sea Cliff Beach**	**Morgan Memorial Beach**	**Crescent Beach**
April	Enterococci	2.73	9.48	3.63	9.90	12.17	16.33	142.11
May	Enterococci	568.26	21.00	11.13	16.78	12.14	5.37	391.34
June	Enterococci	148.00	72.14	98.01	60.26	76.88	37.58	122.06
July	Enterococci	81.38	26.01	8.89	8.64	6.40	12.85	271.13
August	Enterococci	737.67	199.56	53.22	24.67	50.79	32.01	134.05
Season Averages*	*Enterococci*	*334.27*	*73.59*	*36.22*	*24.42*	*32.64*	*21.65*	*223.67*

*Averages of all of the data points collected during the monitoring season.

2011

	Units in CFU/100 ml	**Village Club of Sands Point**	**North Hempstead Beach Park (N) (former Hempstead Harbor Beach)**	**North Hempstead Beach Park (S) (former Bar Beach)**	**Tappen Beach**	**Sea Cliff Beach**	**Morgan Memorial Beach**	**Crescent Beach**
April	Enterococci	6.50	20.75	92.50	31.60	14.20	2.67	12.89
May	Enterococci	410.40	40.88	89.63	325.63	48.51	49.50	458.09
June	Enterococci	22.60	24.11	72.30	10.46	29.11	103.07	209.16
July	Enterococci	74.50	113.90	63.30	13.44	19.59	54.24	50.28
August	Enterococci	21.22	49.23	28.41	7.52	19.81	63.44	199.22
Season Averages*	*Enterococci*	*122.96*	*52.14*	*64.93*	*77.60*	*27.14*	*65.64*	*223.31*

*Averages of all of the data points collected during the monitoring season.

Comparison of Averaged Indicator Bacteria Data for Beaches

2010

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	6.82	9.42	12.44	22.60	2.24	0.10	24.22
May	Enterococci	17.88	14.50	8.14	30.89	23.65	42.01	338.19
June	Enterococci	94.37	12.48	17.02	14.01	56.85	87.34	78.69
July	Enterococci	65.00	19.22	14.11	88.23	54.55	76.10	286.52
August	Enterococci	104.34	89.23	77.12	44.13	159.64	86.84	113.02
September	Enterococci	--	7.00**	13.00**	1.00**	11.00**	0.10**	369.83
Season Averages *	*Enterococci*	*65.22*	*29.61*	*26.22*	*40.19*	*67.48*	*68.40*	*208.47*

*Averages of all of the data points collected during the monitoring season.
** Only one data point collected in September.

2009

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	2.20	1.52	1.53	2.52	9.70	3.73	4.03
May	Enterococci	6.78	5.16	4.14	4.03	5.78	3.74	20.29
June	Enterococci	104.24	47.22	290.88	247.31	21.46	23.86	634.65
July	Enterococci	31.03	102.89	206.46	23.24	26.62	46.34	231.47
August	Enterococci	84.00	86.24	16.82	7.37	70.36	79.14	282.44
September	Enterococci	4.00**	120**	90.00**	0.10**	11.00**	3.00**	19.86
Season Averages *	*Enterococci*	*48.69*	*54.70*	*109.23*	*65.02*	*29.97*	*40.35*	*290.61*

*Averages of all of the data points collected during the monitoring season.
** Only one data point collected in September.

Comparison of Averaged Indicator Bacteria Data for Beaches

2008[1]

	Units in CFU/100 ml	**Village Club of Sands Point**	**North Hempstead Beach Park (N) (former Hempstead Harbor Beach)**	**North Hempstead Beach Park (S) (former Bar Beach)**	**Tappen Beach**	**Sea Cliff Beach**
April	Enterococci	0.42	3.53	14.70	3.52	1.72
May	Enterococci	26.04	5.15	33.75	18.65	68.13
June	Enterococci	8.42	77.31	23.81	29.80	54.40
July	Enterococci	85.59	13.41	23.61	47.60	97.41
August	Enterococci	161.00	11.88	427.56	28.51	65.88
Season Averages	*Enterococci*	*56.29*	*22.26*	*104.69*	*25.62*	*57.51*

[1] First year in which enterococci was the only indicator bacteria monitored.

2007

	Units in CFU/100 ml	**Village Club of Sands Point**	**North Hempstead Beach Park (N) (former Hempstead Harbor Beach)**	**North Hempstead Beach Park (S) (former Bar Beach)**	**Tappen Beach**	**Sea Cliff Beach**
April	Enterococci	7.62	8.82	15.02	35.8	73.42
	Fecal Coliform	**8.82**	**14.22**	**12.42**	**89**	**5.64**
May	Enterococci	16.22	35.91	26.36	43.92	9.49
	Fecal Coliform	**29.36**	**157**	**84.68**	**49.89**	**17.8**
June	Enterococci	38.39	45.11	46.44	14.89	10.57
	Fecal Coliform	**27.38**	**438.56**	**219**	**130.67**	**73.33**
July	Enterococci	143.89	51.33	36.4	16.4	10.52
	Fecal Coliform	**890.25**	**877**	**581**	**519.6**	**193.70**
August	Enterococci	297	188.44	68.56	17.78	72.78
	Fecal Coliform	**166.11**	**1173**	**272.8**	**248.44**	**358.33**
Season Averages	*Enterococci*	*100.62*	*65.92*	*38.56*	*25.76*	*35.35*
	Fecal Coliform	***224.38***	***531.96***	***233.9***	***207.52***	***129.76***

Comparison of Averaged Indicator Bacteria Data for Beaches

2006

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach
April	Enterococci	0.1	0.1	0.1	2	0.1
	Fecal Coliform	**7**	**0.6**	**1**	**5**	**0.6**
May	Enterococci	7	16	35	333	73
	Fecal Coliform	**16**	**9**	**100**	**20**	**14**
June	Enterococci	6	27	30	33	12
	Fecal Coliform	**9**	**98**	**107**	**73**	**68**
July	Enterococci	68	46	40	35	47
	Fecal Coliform	**259**	**567**	**154**	**150**	**277**
August	Enterococci	120	46	76	11	65
	Fecal Coliform	**106**	**97**	**100**	**94**	**51**
Season Averages	*Enterococci*	*40*	*27*	*36*	*83*	*39*
	Fecal Coliform	***79***	***151***	***92***	***69***	***82***

2005

	Units in MPN/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach
April	Enterococci	1	5	33	12	1
	Fecal Coliform	**12**	**60**	**289**	**19**	**43**
May	Enterococci	8	29	33	19	13
	Fecal Coliform	**15**	**89**	**120.23**	**21**	**18**
June	Enterococci	9	20	9	5	3
	Fecal Coliform	**77**	**330**	**118**	**87**	**86**
July	Enterococci	17	26	6	15	39
	Fecal Coliform	**176**	**561**	**159**	**472**	**596**
August	Enterococci	186	50	79	20	18
	Fecal Coliform	**265**	**166**	**256**	**346**	**239**
Season Averages	*Enterococci*	*44.2*	*26*	*32*	*14.2*	*14.8*
	Fecal Coliform	***109***	***241***	***188***	***189***	***196***

Comparison of Averaged Indicator Bacteria Data for Beaches

2004

	Units in MPN/100 ml	**Village Club of Sands Point**	**North Hempstead Beach Park (N) (former Hempstead Harbor Beach)**	**North Hempstead Beach Park (S) (former Bar Beach)**	**Tappen Beach**	**Sea Cliff Beach**
April	Total Coliform	57	76	36	265	161
	Fecal Coliform	**4**	**71**	**29**	**66**	**25**
May	Total Coliform	140	1137	1910	851	22029
	Fecal Coliform	**46**	**141**	**822**	**210**	**3859**
June	Total Coliform	168	1179	560	701	864
	Fecal Coliform	**44**	**615**	**167**	**557**	**298**
July	Total Coliform	146	2353	571	790	624
	Fecal Coliform	**43**	**460**	**341**	**301**	**222**
August	Total Coliform	634	993	445	414	727
	Fecal Coliform	**375**	**905**	**383**	**313**	**442**
September	Total Coliform	*700*	*22*	*17*	*80*	*230*
	Fecal Coliform	***500***	***17***	***11***	***80***	***130***
Season Averages	*Total Coliform*	*268*	*1582*	*701*	*682*	*3574*
	Fecal Coliform	***126***	***505***	***359***	***337***	***761***

2003

	Units in MPN/100 ml	**Village Club of Sands Point**	**North Hempstead Beach Park (N) (former Hempstead Harbor Beach)**	**North Hempstead Beach Park (S) (former Bar Beach)**	**Tappen Beach**	**Sea Cliff Beach**
April	Total Coliform	13	140	159	155	19
	Fecal Coliform	**8**	**44**	**152**	**19**	**5**
May	Total Coliform	161	122	130	154	1277
	Fecal Coliform	**62**	**35**	**47**	**88**	**143**
June	Total Coliform	197	1747	478	724	915
	Fecal Coliform	**80**	**136**	**64**	**255**	**111**
July	Total Coliform	239	781	1237	517	1810
	Fecal Coliform	**65**	**539**	**874**	**203**	**304**
August	Total Coliform	347	678	804	2117	22364
	Fecal Coliform	**81**	**344**	**334**	**1904**	**3114**
September	Total Coliform	*6567*	*3500*	*1033*	*910*	*1820*
	Fecal Coliform	***977***	***1090***	***177***	***274***	***110***
Season Averages	*Total Coliform*	*632*	*949*	*816*	*1097*	*8735*
	Fecal Coliform	***126***	***370***	***421***	***809***	***1222***

Comparison of Averaged Indicator Bacteria Data for Beaches

2002

	Units in MPN/100 ml	**Village Club of Sands Point**	**North Hempstead Beach Park (N) (former Hempstead Harbor Beach)**	**North Hempstead Beach Park (S) (former Bar Beach)**	**Tappen Beach**	**Sea Cliff Beach**
April	Total Coliform	160	326	157	728	163
	Fecal Coliform	**44**	**39**	**11**	**658**	**53**
May	Total Coliform	130	145	127	282	194
	Fecal Coliform	**76**	**124**	**78**	**169**	**46**
June	Total Coliform	560	674	431	1604	750
	Fecal Coliform	**123**	**559**	**168**	**1016**	**154**
July	Total Coliform	613	1921	964	2770	4779
	Fecal Coliform	**246**	**810**	**831**	**1367**	**210**
August	Total Coliform	4773	3277	6202	1625	1832
	Fecal Coliform	**2593**	**2971**	**2130**	**1278**	**839**
Season Averages	*Total Coliform*	*1226*	*1969*	*3096*	*1463*	*1626*
	Fecal Coliform	***605***	***1637***	***1133***	***1008***	***451***

2001

	Units in MPN/100 ml	**Village Club of Sands Point**	**North Hempstead Beach Park (N) (former Hempstead Harbor Beach)**	**North Hempstead Beach Park (S) (former Bar Beach)**	**Tappen Beach**	**Sea Cliff Beach**
April	Total Coliform	26	239	68	194	86
	Fecal Coliform	**9**	**85**	**36**	**103**	**43**
May	Total Coliform	559	486	364	944	1689
	Fecal Coliform	**21**	**83**	**106**	**555**	**274**
June	Total Coliform	2373	974	1091	1045	494
	Fecal Coliform	**157**	**488**	**451**	**365**	**60**
July	Total Coliform	242	6025	11526	1308	1501
	Fecal Coliform	**44**	**3458**	**11297**	**566**	**399**
August	Total Coliform	2183	3360	2594	12230	24148
	Fecal Coliform	**124**	**1000**	**1872**	**10285**	**1623**
September	Total Coliform	468	348	570	1500	1100
	Fecal Coliform	**53**	**110**	**116**	**1308**	**300**
Season Averages	*Total Coliform*	***1143***	***2848***	***4187***	***4513***	***9080***
	Fecal Coliform	***75***	***1325***	***3754***	***3559***	***717***

Appendix D

2020 Nitrogen Data

TKN (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #15B**	**CSHH #16**
10/28/20	--	--	<0.50	1.4	--	--	7.3	--	--	--	--
10/22/20	1.5	1.4	--	--	2.6	<0.50	--	--	--	--	<0.50
10/21/20	--	--	--	--	--	--	--	1.6	1.9	--	--
10/7/20	1.6	1.5	--	--	4.0	1.5	2.6	2.7	<0.50	--	1.6
9/23/20	1.3	2.0	--	--	1.2	0.59	0.55	1.8	1.5	--	1.0
9/9/20	<0.250	<0.250	--	--	0.748	<0.250	--	1.440	0.971	--	<0.250
8/26/20	1.4	1.9	--	--	2.4	2.5	2.1	1.1	2.9	--	1.1
8/12/20	<0.10	<0.10	--	--	<0.10	<0.10	<0.10	<0.10	1.6	--	<0.10
7/29/20	<0.10	<0.10	<0.10	<0.10	--	<0.10	<0.10	<0.10	<0.10	--	<0.10
7/15/20	<0.10	<0.10	<0.10	<0.10	--	<0.10	--	<0.10	<0.10	--	<0.10
7/1/20	0.45	0.20	1.5	0.51	--	0.21	--	--	--	--	0.14
6/17/20	<1.0	<1.0	<1.0	<1.0	--	<1.0	<1.0	1.1	1.4	--	<1.0
6/3/20	<0.10	<0.10	<0.10	<0.10	--	<0.10	<0.10	<0.10	1.2	--	<0.10
5/20/20	--	--	--	--	--	--	--	<0.10	0.74	0.72	--

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

9/9: Data highlighted in yellow b/c TKN and ammonia samples were sent to a lab other than Pace Analytical and analyzed using "wet chemistry"; EPA methods remain the same.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2020 Nitrogen Data

Total Organic N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #15B**	**CSHH #16**
10/28/20	--	--	--	1.0	--	--	7.0	--	--	--	--
10/22/20	1.2	1.3	--	--	2.3	<0.10	--	<0.10	--	--	<0.10
10/21/20	--	--	--	--	--	--	--	--	1.8	--	--
10/7/20	1.3	1.4	--	--	3.7	1.4	2.5	1.2	<0.10	--	1.5
9/23/20	1.2	1.9	--	--	1.0	0.49	0.39	1.6	1.4	--	1.0
9/9/20	<0.25	<0.25	--	--	0.75	<0.25	-	<0.10	0.97	--	<0.25
8/26/20	1.3	1.9	--	--	2.4	2.0	1.8	0.87	2.8	--	1.0
8/12/20	<0.10	<0.10	--	--	<0.10	<0.10	<0.10	<0.10	1.5	--	<0.10
7/29/20	<0.10	<0.10	<0.10	<0.10	--	<0.10	<0.10	<0.10	<0.10	--	<0.10
7/15/20	<0.10	<0.10	<0.10	<0.10	--	<0.10	--	<0.10	<0.10	--	<0.10
7/1/20	0.18	<0.10	1.2	<0.10	--	<0.10	--	--	--	--	<0.10
6/17/20	<0.10	<0.10	<0.10	<0.10	--	<0.10	<0.10	0.25	1.4	--	<0.10
6/3/20	<0.10	<0.10	<0.10	<0.10	--	<0.10	<0.10	<0.10	0.94	--	<0.10
5/20/20	--	--	--	--	--	--	--	<0.10	0.63	0.63	--

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

9/9: Data highlighted in yellow b/c TKN and ammonia samples were sent to a lab other than Pace Analytical and analyzed using "wet chemistry"; EPA methods remain the same.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2020 Nitrogen Data

Ammonia as N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #15B**	**CSHH #16**
10/28/20	--	--	0.37	0.35	--	--	0.23	--	--	--	--
10/22/20	0.30	0.13	--	--	0.28	0.22	--	--	--	--	<0.10
10/21/20	--	--	--	--	--	--	--	1.6	0.12	--	--
10/7/20	0.29	<0.10	--	--	0.36	<0.10	0.11	1.5	<0.10	--	<0.10
9/23/20	0.10	<0.10	--	--	0.20	0.10	0.16	0.15	0.11	--	<0.10
9/9/20	<0.250	<0.250	--	--	<0.250	<0.250	--	1.400	<0.250	--	<0.250
8/26/20	<0.10	<0.10	--	--	<0.10	0.50	0.24	0.20	<0.10	--	<0.10
8/12/20	0.14	0.14	--	--	0.26	0.23	0.18	0.18	<0.10	--	<0.10
7/29/20	0.20	0.13	0.36	0.36	--	0.18	0.33	0.17	<0.10	--	0.13
7/15/20	0.21	0.13	0.31	0.37	--	0.17	--	0.20	0.14	--	<0.10
7/1/20	0.27	0.10	0.33	0.46	--	0.19	--	--	--	--	<0.10
6/17/20	<0.10	<0.10	<0.10	<0.10	--	<0.10	<0.10	0.85	<0.10	--	<0.10
6/3/20	<0.10	<0.10	<0.10	<0.10	--	<0.10	0.12	<0.10	0.29	--	<0.10
5/20/20	--	--	--	--	--	--	--	0.85	0.11	<0.10	--

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

9/9: Data highlighted in yellow b/c TKN and ammonia samples were sent to a lab other than Pace Analytical and analyzed using "wet chemistry"; EPA methods remain the same.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2020 Nitrogen Data

Nitrite as N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #15B**	**CSHH #16**
10/28/20	--	--	<0.050	<0.050	--	--	<0.050	--	--	--	--
10/22/20	<0.050	<0.050	--	--	0.070	<0.050	--	--	--	--	<0.050
10/21/20	--	--	--	--	--	--	--	0.11	<0.050	--	--
10/7/20	<0.050	<0.050	--	--	0.12	<0.050	<0.050	0.14	<0.050	--	<0.050
9/23/20	<0.050	<0.050	--	--	0.070	<0.050	<0.050	<0.050	<0.050	--	<0.050
9/9/20	<0.050	<0.050	--	--	<0.050	<0.050		0.10	0.057	--	<0.050
8/26/20	<0.050	<0.050	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050
8/12/20	<0.050	<0.050	--	--	<0.050	<0.050	<0.050	<0.050	0.057	--	<0.050
7/29/20	<0.050	<0.050	<0.050	<0.050	--	<0.050	<0.050	<0.050	<0.050	--	<0.050
7/15/20	<0.050	<0.050	<0.050	<0.050	--	<0.050	--	<0.050	<0.050	--	<0.050
7/1/20	<0.050	<0.050	<0.050	<0.050	--	<0.050	--	--	--	--	<0.050
6/17/20	<0.050	<0.050	<0.050	<0.050	--	<0.050	<0.050	0.094	0.094	--	<0.050
6/3/20	<0.050	<0.050	<0.050	<0.050	--	<0.050	<0.050	<0.050	0.099	--	<0.050
5/20/20	--	--	--	--	--	--	--	0.13	0.11	0.11	--

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2020 Nitrogen Data

Nitrate as N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #15B**	**CSHH #16**
10/28/20	--	--	0.38	0.62	--	--	1.1	--	--	--	--
10/22/20	0.25	0.27	--	--	2.5	0.81	--	--	--	--	0.20
10/21/20	--	--	--	--	--	--	--	9.2	5.5	--	--
10/7/20	0.24	0.13	--	--	3.9	2.2	4.8	11.6	0.074	--	6.6
9/23/20	0.22	0.22	--	--	1.9	1.2	1.7	0.85	2.1	--	0.12
9/9/20	<0.050	<0.050	--	--	1.7	<0.050	--	8.7	4.4	--	<0.050
8/26/20	<0.050	0.052	--	--	0.32	0.15	0.51	0.89	4.2	--	<0.050
8/12/20	<0.050	<0.050	--	--	0.86	0.55	1.0	0.68	4.9	--	<0.050
7/29/20	<0.050	<0.050	<0.050	0.18	--	0.53	0.81	0.52	0.67	--	<0.050
7/15/20	<0.050	0.15	<0.050	0.24	--	0.45	--	0.56	0.88	--	<0.050
7/1/20	<0.050	<0.050	0.063	0.34	--	0.71	--	--	--	--	<0.050
6/17/20	<0.050	<0.050	<0.050	0.078	--	0.88	<0.050	8.8	3.7	--	<0.050
6/3/20	<0.050	<0.050	0.052	0.28	--	0.85	2.4	0.87	3.4	--	<0.050
5/20/20	--	--	--	--	--	--	--	10.4	5.0	5.8	--

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2020 Nitrogen Data

Total Inorganic Nitrogen Calculation (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #15B**	**CSHH #16**
10/28/20	--	--	0.78	1.00	--	--	1.43	--	--	--	--
10/22/20	0.58	0.43	--	--	2.88	1.06	--	--	--	--	0.23
10/21/20	--	--	--	--	--	--	--	10.9	5.72	--	--
10/7/20	0.55	0.14	--	--	4.36	2.2	4.91	13.2	0.093	--	6.70
9/23/20	0.35	0.25	--	--	2.1	1.3	1.96	1.04	2.21	--	0.16
9/9/20	0	0	--	--	1.7	0	--	10.3	4.5	--	0
8/26/20	0	0.05	--	--	0.32	0.65	0.75	1.1	4.2	--	0
8/12/20	0.14	0.14	--	--	1.13	0.8	1.28	0.88	4.9	--	0
7/29/20	0.20	0.13	0.36	0.54	--	0.74	1.17	0.70	0.70	--	0.13
7/15/20	0.21	0.28	0.31	0.64	--	0.64	--	0.77	1.04	--	0
7/1/20	0.27	0.10	0.393	0.80	--	0.92	--	--	--	--	0
6/17/20	0	0	0	0.10	--	0.89	0	9.75	3.8	--	0
6/3/20	0	0	0.052	0.28	--	0.86	2.52	0.88	3.79	--	0
5/20/20	--	--	--	--	--	--	--	11.35	5.31	5.9	--

Notes:

Total Inorganic Nitrogen = Ammonia + (Nitrate + Nitrite); lab methodology results in a combined nitrate/nitrite value, which is used here to calculate Total Inorganic Nitrogen.

Values that are reported below the detection limit are treated as "0" (see individual tables for detection limits).

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

9/9: Data highlighted in yellow b/c TKN and ammonia samples were sent to a lab other than Pace Analytical and analyzed using "wet chemistry"; EPA methods remain the same.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2020 Nitrogen Data

Total N (mg/L)

Date	CSHH #1	CSHH #3	CSHH #6	CSHH #7	CSHH #8	CSHH #12	CSHH #13	CSHH #14A	CSHH #15A	CSHH #15B	CSHH #16
10/28/20	--	--	0.88	2.0	--	--	8.4	--	--	--	--
10/22/20	1.8	1.7	--	--	5.2	0.84	--	--	--	--	0.23
10/21/20	--	--	--	--	--	--	--	10.9	7.5	--	--
10/7/20	1.9	1.6	--	--	8.1	3.7	7.4	14.4	<0.10	--	8.2
9/23/20	1.5	2.2	--	--	3.1	1.8	2.3	2.7	3.6	--	1.2
9/9/20	<0.25	<0.25	--	--	2.4	<0.25	--	10.3	5.5	--	<0.25
8/26/20	1.4	2.0	--	--	2.7	2.7	2.6	2.0	7.2	--	1.1
8/12/20	<0.10	<0.10	--	--	0.87	0.57	1.1	0.70	6.5	--	<0.10
7/29/20	<0.10	<0.10	<0.10	0.18	--	0.56	0.84	0.53	0.70	--	<0.10
7/15/20	<0.10	0.15	<0.10	0.27	--	0.47	--	0.57	0.90	--	<0.10
7/1/20	0.47	0.20	1.6	0.85	--	0.94	--	--	--	--	0.14
6/17/20	<0.10	<0.10	<0.10	<0.10	--	0.89	<0.10	10.0	5.2	--	<0.10
6/3/20	<0.10	<0.10	<0.10	0.28	--	0.86	2.4	0.88	4.7	--	<0.10
5/20/20	--	--	--	--	--	--	--	10.6	5.9	6.7	--

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

9/9: Data highlighted in yellow b/c TKN and ammonia samples were sent to a lab other than Pace Analytical and analyzed using "wet chemistry"; EPA methods remain the same.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2019 Nitrogen Data

TKN (mg/L)										
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/30/19	0.41	<0.10	--	--	0.39	<0.10	0.38	1.6	0.52	0.24
10/16/19	0.34	0.34	--	--	0.29	0.36	0.36	<0.10	<0.10	0.49
10/11/19	0.84	0.57	0.89	0.38	0.31	<0.10	0.34	0.90	0.43	--
9/18/19	<0.10	<0.10	--	--	<0.10	0.95	<0.10	<0.10	0.36	<0.10
9/4/19	<0.10	<0.10	--	--	<0.10	<0.10	<0.10	0.31	<0.10	<0.10
8/22/19	0.46	0.62	--	--	<0.10	0.36	0.39	1.0	0.43	<0.10
8/7/19	<0.10	<0.10	--	--	<0.10	0.41	0.38	<0.10	<0.10	<0.10
7/24/19	<0.10	<0.10	--	--	<0.10	<0.10	<0.10	<0.10	0.77	<0.10
7/10/19	<0.10	<0.10	--	--	<0.10	<0.10	<0.10	<0.10	0.35	<0.10
6/26/19	0.26	0.22	--	--	0.16	0.12	<0.10	0.21	0.73	0.20
6/12/19	<0.10	0.33	0.38	0.32	0.41	0.25	0.20	<0.10	0.19	0.17
5/29/19	<0.10	0.23	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.85	<0.10
5/15/19	<0.10	<0.10	--	--	<0.10	<0.10	--	<0.10	<0.10	<0.10

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

2019 Nitrogen Data

Total Organic N (mg/L)										
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/30/19	0.24	<0.10	--	--	0.26	<0.10	0.15	0.55	0.52	0.16
10/16/19	0.27	0.31	--	--	0.26	0.31	0.33	<0.10	<0.10	0.46
10/11/19	0.71	0.51	0.52	<0.10	0.23	<0.10	0.18	0.14	0.33	--
9/18/19	<0.10	<0.10	--	--	<0.10	0.80	<0.10	<0.10	0.32	<0.10
9/4/19	<0.10	<0.10	--	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8/22/19	0.32	0.55	--	--	<0.10	0.11	0.13	0.21	0.36	<0.10
8/7/19	<0.10	<0.10	--	--	<0.10	0.28	0.16	<0.10	<0.10	<0.10
7/24/19	<0.10	<0.10	--	--	<0.10	<0.10	<0.10	<0.10	0.60	<0.10
7/10/19	<0.10	<0.10	--	--	<0.10	<0.10	<0.10	<0.10	0.27	<0.10
6/26/19	0.16	<0.10	--	--	<0.10	<0.10	<0.10	<0.10	0.64	0.12
6/12/19	<0.10	<0.10	0.31	<0.10	0.19	<0.10	<0.10	<0.10	0.14	<0.10
5/29/19	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.57	<0.10
5/15/19	--	--	--	--	--	--	--	--	--	--

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

On 5/15/19, all species of nitrogen collected for stations, however, total organic nitrogen and total nitrogen calculations were not provided by Pace Analytical.

2019 Nitrogen Data

Ammonia as N (mg/L)										
Date	**CSHH#1**	**CSHH#3**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#12**	**CSHH#13**	**CSHH#14A**	**CSHH#15A**	**CSHH#16**
10/30/19	0.17	0.13	--	--	0.14	0.18	0.23	1.00	<0.10	<0.10
10/16/19	<0.10	<0.10	--	--	<0.10	<0.10	<0.10	1.10	<0.10	<0.10
10/11/19	0.13	<0.10	0.37	0.56	<0.10	<0.10	0.16	0.76	<0.10	--
9/18/19	0.18	<0.10	--	--	0.14	0.15	0.26	0.75	<0.10	<0.10
9/4/19	0.15	<0.10	--	--	0.18	0.18	0.23	0.95	<0.10	<0.10
8/22/19	0.13	<0.10	--	--	0.30	0.26	0.26	0.79	<0.10	<0.10
8/7/19	0.15	<0.10	--	--	0.21	0.13	0.22	0.20	0.14	<0.10
7/24/19	0.26	0.13	--	--	0.33	0.31	0.33	0.43	0.17	<0.10
7/10/19	0.12	<0.10	--	--	0.16	<0.10	0.21	0.17	<0.10	<0.10
6/26/19	<0.10	0.14	--	--	0.21	0.18	0.19	0.17	<0.10	<0.10
6/12/19	0.19	0.5	<0.10	0.23	0.22	0.16	0.13	0.19	<0.10	0.14
5/29/19	<0.10	0.13	<0.10	0.13	0.18	0.11	0.13	0.16	0.28	0.15
5/15/19	0.13	0.12	--	--	0.18	0.16	--	0.23	0.15	<0.10

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

2019 Nitrogen Data

Nitrite as N (mg/L)										
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/30/19	<0.050	<0.050	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
10/16/19	<0.050	<0.050	--	--	<0.050	<0.050	<0.050	0.11	<0.050	<0.050
10/11/19	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.09	<0.050	--
9/18/19	<0.050	<0.050	--	--	<0.050	<0.050	<0.050	0.15	<0.050	<0.050
9/4/19	<0.050	<0.050	--	--	<0.050	<0.050	<0.050	0.19	<0.050	<0.050
8/22/19	<0.050	<0.050	--	--	<0.050	<0.050	<0.050	0.09	<0.050	<0.050
8/7/19	<0.050	<0.050	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
7/24/19	<0.050	<0.050	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
7/10/19	<0.050	<0.050	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
6/26/19	<0.050	<0.050	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
6/12/19	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
5/29/19	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
5/15/19	<0.050	<0.050	--	--	<0.050	<0.050	--	<0.050	<0.050	<0.050

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

2019 Nitrogen Data

Nitrate as N (mg/L)										
Date	**CSHH#1**	**CSHH#3**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#12**	**CSHH#13**	**CSHH#14A**	**CSHH#15A**	**CSHH#16**
10/30/19	0.16	0.10	--	--	0.45	0.34	0.49	5.20	3.30	0.09
10/16/19	0.29	<0.050	--	--	0.36	0.46	0.53	11.30	7.40	0.14
10/11/19	0.13	0.28	0.28	0.43	0.27	0.30	0.87	4.90	<0.050	--
9/18/19	0.35	0.10	--	--	0.26	0.19	0.51	7.70	4.40	0.08
9/4/19	0.08	<0.050	--	--	0.48	0.77	1.30	8.40	3.60	<0.050
8/22/19	<0.050	<0.050	--	--	0.33	0.91	1.00	6.70	3.00	<0.050
8/7/19	<0.050	<0.050	--	--	0.05	1.70	1.80	0.35	0.98	<0.050
7/24/19	0.08	<0.050	--	--	0.72	0.56	0.50	1.20	1.40	<0.050
7/10/19	<0.050	<0.050	--	--	0.34	0.89	1.30	0.43	1.90	<0.050
6/26/19	0.06	<0.050	--	--	0.51	0.64	1.00	0.42	2.50	<0.050
6/12/19	<0.050	<0.050	0.06	0.16	0.36	0.27	0.46	0.50	0.13	<0.050
5/29/19	<0.050	<0.050	0.07	0.26	0.14	0.27	0.37	0.30	2.80	<0.050
5/15/19	<0.050	<0.050	--	--	0.45	0.48	--	0.54	0.75	<0.050

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

2019 Nitrogen Data

Total Inorganic Nitrogen Calculation (mg/L)

Date	CSHH #1	CSHH #3	CSHH #6	CSHH #7	CSHH #8	CSHH #12	CSHH #13	CSHH #14A	CSHH #15A	CSHH #16
10/30/19	0.33	0.229	--	--	0.59	0.52	0.72	6.2	3.3	0.089
10/16/19	0.30	0	--	--	0.36	0.46	0.53	12.5	7.4	0.15
10/11/19	0.28	0.31	0.67	1.00	0.29	0.42	1.04	5.76	0	--
9/18/19	0.54	0.11	--	--	0.41	0.36	0.77	8.65	4.4	0.09
9/4/19	0.226	0	--	--	0.66	0.96	1.53	9.55	3.6	0
8/22/19	0.13	0	--	--	0.63	1.17	1.26	7.49	3.0	0
8/7/19	0.15	0	--	--	0.261	1.83	2.02	0.55	1.12	0
7/24/19	0.34	0.13	--	--	1.05	0.87	0.83	1.63	1.57	0
7/10/19	0.12	0	--	--	0.50	0.89	--	0.60	1.9	0
6/26/19	0.057	0.14	--	--	0.72	0.82	1.19	0.59	2.5	0
6/12/19	0.19	0.50	0.058	0.43	0.58	0.44	0.62	0.73	0.14	0.14
5/29/19	0	0.13	0.073	0.39	0.32	0.38	0.50	0.46	3.18	0.15
5/15/19	0.182	0.12	--	--	0.64	0.68	--	0.78	0.94	0

Notes:

Total Inorganic Nitrogen = Ammonia + (Nitrate + Nitrite); lab methodology results in a combined nitrate/nitrite value, which is used here to calculate Total Inorganic Nitrogen.
Values that are reported below the detection limit are treated as "0" (see individual tables for detection limits).
CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2019 Nitrogen Data

Total Nitrogen (mg/L)										
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/30/19	0.57	0.16	--	--	0.85	0.34	0.87	6.80	3.80	0.32
10/16/19	0.64	0.37	--	--	0.66	0.81	0.88	11.40	7.50	0.64
10/11/19	0.99	0.87	1.20	0.82	0.60	0.32	1.20	5.90	0.43	--
9/18/19	0.36	0.11	--	--	0.27	1.20	0.51	7.90	4.70	<0.10
9/4/19	<0.10	<0.10	--	--	0.48	0.78	1.30	8.90	3.60	<0.10
8/22/19	0.46	0.62	--	--	0.33	1.30	1.40	7.80	3.40	<0.10
8/7/19	<0.10	<0.10	--	--	<0.10	2.10	2.20	0.35	0.98	<0.10
7/24/19	0.12	<0.10	--	--	0.77	0.61	0.54	1.20	2.20	<0.10
7/10/19	<0.10	<0.10	--	--	0.43	0.97	1.30	0.50	2.30	<0.10
6/26/19	0.32	0.22	--	--	0.67	0.76	1.10	0.63	3.30	0.20
6/12/19	<0.10	0.35	0.43	0.51	0.77	0.54	0.69	0.55	0.32	0.17
5/29/19	<0.10	0.25	<0.10	0.26	0.14	0.27	0.37	0.30	3.70	<0.10
5/15/19	--	--	--	--	--	--	--	--	--	--

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

On 5/15/19, all species of nitrogen collected for stations, however, total organic nitrogen and total nitrogen calculations were not provided by Pace Analytical.

2018 Nitrogen Data

Total Inorganic Nitrogen Calculation (mg/L)																				
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#9**	**CSHH#10**	**CSHH#11**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#14A**	**CSHH#15**	**CSHH#15A**	**CSHH#15B**	**CSHH#16**	**CSHH#17**	**CSHH#17A**
10/31/2018	0.54	0.26	0.36	--	--	--	--	0.44	0.68	0.82	0.97	0.79	--	--	1.1	--	3.7	5.2	0.23	0.27	0.27
10/24/2018	0.62	--	--	0.6	0.66	0.63	0.85	0.76	1.14	1.14	1.01	1.03	1.5	0.6	--	--	6.1	5	--	--	--
10/17/2018	0.78	0.29	0.43	--	--	--	--	1.33	1.59	1.4	1.41	1.41	3.49	--	1.01	--	4.7	5.2	0.29	0.3	0.3
10/10/2018	0.52	0.38	0.46	0.44	0.57	0.63	0.83	0.7	1.08	1.09	1.01	1.09	1.42	0.48	--	0.45	4.97	5.53	0.31	0.3	0.3
10/2/2018	0.55	0.5	0.57	--	--	--	--	0.8	1.57	1.78	1.01	1.11	2.62	--	1.22	--	1.22	--	0.59	0.6	0.56
9/26/2018	0.58	0.25	0.43	--	--	--	--	0.72	1.23	1.34	0.72	0.77	0.84	--	--	--	3.8	4.2	0.25	0.25	0.26
9/19/2018	--	--	--	--	--	--	--	0.45	1.1	0.68	0.41	0.6	0.98	--	--	--	--	3.2	--	--	--
9/14/2018	0.74	0.3	0.19	--	--	--	--	0.71	1.07	0.92	0.63	0.66	0.91	--	--	--	3.38	2.98	0.16	0.17	0.18
9/5/2018	0.22	0	0.07	0.27	0.46	0.67	0.9	0.59	1.12	0.7	0.43	0.6	0.74	0.37	0.99	0.18	0.65	3.8	0	0	0
8/29/2018	0.48	0	0	--	--	--	--	0.77	1.2	1.05	1.33	1.24	--	--	--	--	4.3	--	0.08	0.11	0
8/23/2018	0.28	0.23	0.06	--	0.43	0.59	0.95	0.64	0.92	0.79	0.97	0.93	1.44	--	--	0.11	3.1	--	0.2	0	0.12
8/15/2018	0.55	0.08	0.11	--	--	--	--	0.96	2.18	1.44	1.79	1.59	1.83	--	--	--	2.25	3.07	0	0	0
8/8/2018	0.18	0	0	0.22	0.32	0.4	0.7	0.69	0.86	0.82	1.05	0.51	1.35	0.26	0.54	0.14	1.8	1.8	0	0	0
8/2/2018	0.35	0	0.08	--	--	--	--	0.45	0.94	0.79	0.51	0.42	1.58	--	--	--	1.51	1.8	0	0	0
7/17/2018	0.16	0	0	--	--	--	--	0.67	2.1	2.05	2.35	1.52	3.24	--	--	--	1.7	1.6	0	0	0
7/11/2018	0	0	0	0	0.11	0.12	0.36	0.36	0.47	0.36	0.11	0.95	--	0.24	9.45	0	1.5	1.6	0	0	0
7/3/2018	0.18	0	0	--	--	--	--	0.45	0.87	0.87	0.51	0.35	1.29	--	10.89	--	1.84	1.9	0	0	0
6/27/2018	0.11	0	0	--	--	0.15	0.19	0.32	0.61	0.73	0.78	1.1	1.02	--	9.26	0	2.24	2.62	0	0	0
6/20/2018	0	0	0	--	--	--	--	0.37	0.9	0.75	0.45	0.74	0.73	--	0.49	--	0.67	3.1	0	0	0
6/13/2018	0	0	0	--	--	--	--	0.38	0.71	0.83	1.4	1.1	1.9	--	8.9	0	3.22	3.34	0	0	0
6/6/2018	0	0	0	--	--	--	--	0	0.68	0	0.18	0	1.1	--	0.15	--	1.3	2.5	0	0	0
5/30/2018	0.34	0	0.07	--	--	--	--	1.11	1.02	1.03	0.57	0.53	0.8	--	10.26	--	4.81	4.1	0	0	0
5/23/2018	0.32	0.14	0.78	0.33	0.4	0.59	0.69	1.17	1.4	1	1.81	1.03	--	0.33	1.64	0.3	4.47	5.19	--	0.13	0.12

Notes:

Total Inorganic Nitrogen = Ammonia + (Nitrate + Nitrite); lab methodology results in a combined nitrate/nitrite value, which is used here to calculate Total Inorganic Nitrogen.

Values that are reported below the detection limit are treated as "0" (see individual tables for detection limits).

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2018 Nitrogen Data

Ammonia as N (mg/L)																				
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#9**	**CSHH#10**	**CSHH#11**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#14A**	**CSHH#15**	**CSHH#15A**	**CSHH#15B**	**CSHH#16**	**CSHH#17**	**CSHH#17A**
10/31/2018	0.13	<0.10	<0.10	--	--	--	--	<0.10	<0.10	0.32	0.13	0.14	0	--	0.18	--	<0.10	<0.10	<0.10	<0.10	<0.10
10/24/2018	0.19	--	--	0.19	0.18	0.18	0.31	<0.10	0.14	0.14	0.13	0.14	0.2	0.12	1.4	--	<0.10	<0.10	--	--	--
10/17/2018	0.44	<0.10	0.12	--	--	--	--	0.23	0.19	0.2	0.21	0.21	0.19	--	0.29	--	<0.10	<0.10	<0.10	<0.10	<0.10
10/10/2018	0.25	<0.10	0.13	0.15	0.22	0.29	0.35	0.18	0.19	0.19	0.24	0.24	0.32	0.16	1.4	0.14	0.27	0.13	<0.10	<0.10	<0.10
10/2/2018	0.2	0.16	0.16	--	--	--	--	0.2	0.17	0.28	0.22	0.21	0.22	--	0.38	--	0.22	--	0.21	0.28	0.24
9/26/2018	0.27	<0.10	0.13	--	--	--	--	0.15	0.13	0.14	0.13	0.14	0.25	--	0.8	--	<0.10	<0.10	<0.10	<0.10	<0.10
9/19/2018	0.17	<0.10	<0.10	0.16	0.28	0.38	0.6	0.17	0.14	0.2	0.21	0.2	0.32	0.21	0.25	0.19	0.22	<0.10	<0.10	<0.10	<0.10
9/14/2018	0.54	0.13	<0.10	--	--	--	--	0.17	0.2	0.22	0.2	0.23	0.22	--	1.2	--	0.28	0.38	<0.10	<0.10	<0.10
9/5/2018	0.22	<0.10	<0.10	0.17	0.22	0.45	0.52	0.15	0.12	0.14	0.13	0.14	0.19	0.27	0.21	0.11	0.12	<0.10	<0.10	<0.10	<0.10
8/29/2018	0.33	<0.10	<0.10	--	--	--	--	0.13	<0.10	0.11	0.13	0.14	--	--	1	--	<0.10	--	<0.10	0.11	<0.10
8/23/2018	0.19	0.15	<0.10	--	0.27	0.49	0.71	0.21	0.2	0.22	0.23	0.22	0.24	--	0.99	0.11	<0.10	--	0.13	<0.10	0.12
8/15/2018	0.34	<0.10	0.11	--	--	--	--	0.39	0.88	0.73	0.49	0.39	0.33	--	1.5	--	0.15	0.17	<0.10	<0.10	<0.10
8/8/2018	0.18	<0.10	<0.10	0.22	0.21	0.3	0.45	0.13	0.12	0.12	0.12	0.11	0.15	0.16	0.22	0.14	<0.10	<0.10	<0.10	<0.10	<0.10
8/2/2018	0.28	<0.10	<0.10	--	--	--	--	<0.10	0.14	0.15	<0.10	<0.10	0.18	--	1.2	--	0.11	<0.10	<0.10	<0.10	<0.10
7/17/2018	0.16	<0.10	<0.10	--	--	--	--	0.14	0.3	0.55	0.15	0.12	0.14	--	0.99	--	<0.10	<0.10	<0.10	<0.10	<0.10
7/11/2018	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--	<0.10	1.3	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
7/3/2018	0.18	<0.10	<0.10	--	--	--	--	0.18	0.17	0.27	<0.10	<0.10	0.19	--	1.1	--	0.14	<0.10	<0.10	<0.10	<0.10
6/27/2018	0.11	<0.10	<0.10	--	--	0.15	0.13	<0.10	<0.10	0.13	<0.10	<0.10	0.24	--	1.3	<0.10	0.14	0.12	<0.10	<0.10	<0.10
6/20/2018	<0.10	<0.10	<0.10	--	--	--	--	<0.10	<0.10	0.55	<0.10	<0.10	<0.10	--	<0.10	--	<0.10	<0.10	<0.10	<0.10	<0.10
6/13/2018	<0.10	<0.10	<0.10	--	--	--	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--	0.98	<0.10	0.12	0.14	<0.10	<0.10	<0.10
6/6/2018	<0.10	<0.10	<0.10	--	--	--	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--	<0.10	--	<0.10	<0.10	<0.10	<0.10	<0.10
5/30/2018	0.19	<0.10	<0.10	--	--	--	--	0.11	0.11	0.12	0.11	<0.10	0.23	--	1.1	--	0.41	0.4	<0.10	<0.10	<0.10
5/23/2018	0.23	0.14	0.66	0.23	0.19	0.36	0.36	0.17	0.3	0.64	0.21	0.2	0	0.19	0.34	0.17	0.27	0.29	--	0.13	0.12

Notes:

Values that are reported below the detection limit are treated as "0" (see individual tables for detection limits).

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2018 Nitrogen Data

Nitrite as N (mg/L)																				
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#9**	**CSHH#10**	**CSHH#11**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#14A**	**CSHH#15**	**CSHH#15A**	**CSHH#15B**	**CSHH#16**	**CSHH#17**	**CSHH#17A**
10/31/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050
10/24/2018	<0.050	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	<0.050	<0.050	--	--	--
10/17/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050
10/10/2018	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
10/2/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	--	<0.050	--	<0.050	<0.050	<0.050
9/26/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050
9/19/2018	--	--	--	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	--	<0.050	--	--	--
9/14/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050
9/5/2018	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
8/29/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	--	<0.050	--	<0.050	<0.050	<0.050
8/23/2018	<0.050	<0.050	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	<0.050	<0.050	--	<0.050	<0.050	<0.050
8/15/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050
8/8/2018	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
8/2/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050
7/17/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050
7/11/2018	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	0.15	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
7/3/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	0.09	--	<0.050	<0.050	<0.050	<0.050	<0.050
6/27/2018	<0.050	<0.050	<0.050	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	0.06	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
6/20/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050
6/13/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	0.12	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
6/6/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050
5/30/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	0	--	<0.050	<0.050	<0.050	<0.050	<0.050
5/23/2018	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	<0.050

Notes:

Values that are reported below the detection limit are treated as "0" (see individual tables for detection limits).

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2018 Nitrogen Data

Nitrate as N (mg/L)																					
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#9**	**CSHH#10**	**CSHH#11**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#14A**	**CSHH#15**	**CSHH#15A**	**CSHH#15B**	**CSHH#16**	**CSHH#17**	**CSHH#17A**
10/31/2018	0.41	0.26	0.36	--	--	--	--	0.44	0.68	0.5	0.84	0.65	--	--	0.92	--	3.7	5.2	0.23	0.27	0.27
10/24/2018	0.43	--	--	0.41	0.48	0.45	0.54	0.76	1	1	0.88	0.89	1.3	0.48	7.6	--	6.1	5	--	--	--
10/17/2018	0.34	0.29	0.31	--	--	--	--	1.1	1.4	1.2	1.2	1.2	3.3	--	0.72	--	4.7	5.2	0.29	0.3	0.3
10/10/2018	0.27	0.38	0.33	0.29	0.35	0.34	0.48	0.52	0.89	0.9	0.77	0.85	1.1	0.32	8.6	0.31	4.7	5.4	0.31	0.3	0.3
10/2/2018	0.35	0.34	0.41	--	--	--	--	0.6	1.4	1.5	0.79	0.9	2.4	--	0.84	--	1	--	0.38	0.32	0.32
9/26/2018	0.31	0.25	0.3	--	--	--	--	0.57	1.1	1.2	0.59	0.63	0.59	--	4.7	--	3.8	4.2	0.25	0.25	0.26
9/19/2018	0.16	0.13	0.2	0.14	0.14	0.21	0.19	0.28	0.96	0.48	0.2	0.4	0.66	0.19	0.38	0.25	0.96	3.2	0.16	0.12	0.12
9/14/2018	0.2	0.17	0.19	--	--	--	--	0.54	0.87	0.7	0.43	0.43	0.69	--	6.4	--	3.1	2.6	0.16	0.17	0.18
9/5/2018	<0.050	<0.050	0.07	0.1	0.24	0.22	0.38	0.44	1	0.56	0.3	0.46	0.55	0.1	0.78	0.07	0.53	3.8	<0.050	<0.050	<0.050
8/29/2018	0.15	<0.050	<0.050	--	--	--	--	0.64	1.2	0.94	1.2	1.1	0	--	10.5	--	4.3	0	0.08	<0.050	<0.050
8/23/2018	0.09	0.08	0.06	--	0.16	0.1	0.24	0.43	0.72	0.57	0.74	0.71	1.2	--	4.6	<0.050	3.1	0	0.07	<0.050	<0.050
8/15/2018	0.21	0.08	<0.050	--	--	--	--	0.57	1.3	0.71	1.3	1.2	1.5	--	7.9	--	2.1	2.9	<0.050	<0.050	<0.050
8/8/2018	<0.050	<0.050	<0.050	<0.050	0.11	0.1	0.25	0.56	0.74	0.7	0.93	0.4	1.2	0.1	0.32	<0.050	1.8	1.8	<0.050	<0.050	<0.050
8/2/2018	0.07	<0.050	0.08	--	--	--	--	0.45	0.8	0.64	0.51	0.42	1.4	--	7.6	--	1.4	1.8	<0.050	<0.050	<0.050
7/17/2018	<0.050	<0.050	<0.050	--	--	--	--	0.53	1.8	1.5	2.2	1.4	3.1	--	10.2	--	1.7	1.6	<0.050	<0.050	<0.050
7/11/2018	<0.050	<0.050	<0.050	<0.050	0.11	<0.050	0.36	0.36	0.47	0.36	0.11	0.95	0	0.24	8	<0.050	1.5	1.6	<0.050	<0.050	<0.050
7/3/2018	<0.050	<0.050	<0.050	--	--	--	--	0.27	0.7	0.6	0.51	0.35	1.1	--	9.7	--	1.7	1.9	<0.050	<0.050	<0.050
6/27/2018	<0.050	<0.050	<0.050	--	--	<0.050	0.06	0.32	0.61	0.6	0.78	1.1	0.78	--	7.9	<0.050	2.1	2.5	<0.050	<0.050	<0.050
6/20/2018	<0.050	<0.050	<0.050	--	--	--	--	0.37	0.9	0.2	0.45	0.74	0.73	--	0.49	--	0.67	3.1	<0.050	<0.050	<0.050
6/13/2018	<0.050	<0.050	<0.050	--	--	--	--	0.38	0.71	0.83	1.4	1.1	1.9	--	7.8	<0.050	3.1	3.2	<0.050	<0.050	<0.050
6/6/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	0.68	<0.050	0.18	<0.050	1.1	--	0.15	--	1.3	2.5	<0.050	<0.050	<0.050
5/30/2018	0.15	<0.050	0.07	--	--	--	--	1	0.91	0.91	0.46	0.53	0.57	--	9.1	--	4.4	3.7	<0.050	<0.050	<0.050
5/23/2018	0.09	<0.050	0.12	0.1	0.21	0.23	0.33	1	1.1	0.36	1.6	0.83	--	0.14	1.3	0.13	4.2	4.9	0	<0.050	<0.050

Notes:

Values that are reported below the detection limit are treated as "0" (see individual tables for detection limits).

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2020-21 Winter Nitrogen Data

TKN (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	<0.50	--
3/31/21	0.64	1.5
3/17/21	8.4	--
3/3/21	0.753	<0.250
2/17/21	1.5	0.52
1/20/21	1.2	--
1/6/21	1.3	1.6
12/23/20	0.89	--
12/9/20	0.87	1.5
11/25/20	1.7	1.3

Total Organic N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	<0.10	--
3/31/21	<0.10	1.4
3/17/21	7.0	--
3/3/21	<0.10	<0.10
2/17/21	<0.10	0.38
1/20/21	<0.10	--
1/6/21	<0.10	1.6
12/23/20	<0.10	--
12/9/20	<0.10	1.4
11/25/20	1.5	1.3

Ammonia as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	1.2	--
3/31/21	1.3	0.14
3/17/21	1.5	--
3/3/21	1.6	0.12
2/17/21	1.6	0.14
1/20/21	1.7	--
1/6/21	1.7	<0.10
12/23/20	1.8	--
12/9/20	1.6	0.14
11/25/20	0.25	<0.10

Nitrite as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	0.075	--
3/31/21	0.0500	0.0500
3/17/21	<0.050	--
3/3/21	0.054	<0.050
2/17/21	0.089	<0.050
1/20/21	0.055	--
1/6/21	0.075	<0.050
12/23/20	0.064	--
12/9/20	0.11	<0.050
11/25/20	<0.050	<0.050

Nitrate as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	9.4	--
3/31/21	7.7	4.8
3/17/21	10.3	--
3/3/21	8.1	5.8
2/17/21	6.6	5.0
1/20/21	8.1	--
1/6/21	7.8	5.6
12/23/20	7.4	--
12/9/20	8.0	4.9
11/25/20	0.35	2.6

Total Inorganic Nitrogen Calculation (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	10.7	--
3/31/21	9.0	4.94
3/17/21	11.9	--
3/3/21	9.7	6.02
2/17/21	8.3	5.24
1/20/21	9.8	--
1/6/21	9.6	5.7
12/23/20	9.2	--
12/9/20	9.7	5.14
11/25/20	0.63	2.6

Total N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	9.5	--
3/31/21	8.3	6.4
3/17/21	18.8	--
3/3/21	8.8	5.9
2/17/21	8.2	5.6
1/20/21	9.3	--
1/6/21	9.2	7.3
12/23/20	8.3	--
12/9/20	8.9	6.5
11/25/20	2.1	3.9

Notes:
A value given with a less than symbol indicates that the results were below the detection limit.
CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.
On 3/31/21, Pace Analytical outsourced nitrite testing to American Analytical.

2019-20 Winter Nitrogen Data

TKN (mg/L)

Date	CSHH #14A	CSHH #15A
4/23/20	<0.50	0.59
3/11/20	<0.10	<0.10
2/12/20	0.31	<0.10
1/15/20	<0.10	<0.10

Total Organic N (mg/L)

Date	CSHH #14A	CSHH #15A
4/23/20	<0.10	0.54
3/11/20	<0.10	<0.10
2/12/20	<0.10	<0.10
1/15/20	<0.10	<0.10

Ammonia as N (mg/L)

Date	CSHH #14A	CSHH #15A
4/23/20	0.92	<0.10
3/11/20	1.3	<0.10
2/12/20	1.2	<0.10
1/15/20	1.2	0.1

Nitrite as N (mg/L)

Date	CSHH #14A	CSHH #15A
4/23/20	0.064	<0.050
3/11/20	<0.050	<0.050
2/12/20	<0.050	<0.050
1/15/20	0.28	0.13

Nitrate as N (mg/L)

Date	CSHH #14A	CSHH #15A
4/23/20	8.5	4.9
3/11/20	8.2	6.6
2/12/20	7.5	6.2
1/15/20	7.0	7.5

Total Inorganic Nitrogen Calculation (mg/L)

Date	CSHH #14A	CSHH #15A
4/23/20	<0.10	0.54
3/11/20	<0.10	<0.10
2/12/20	<0.10	<0.10
1/15/20	<0.10	<0.10

Total N (mg/L)

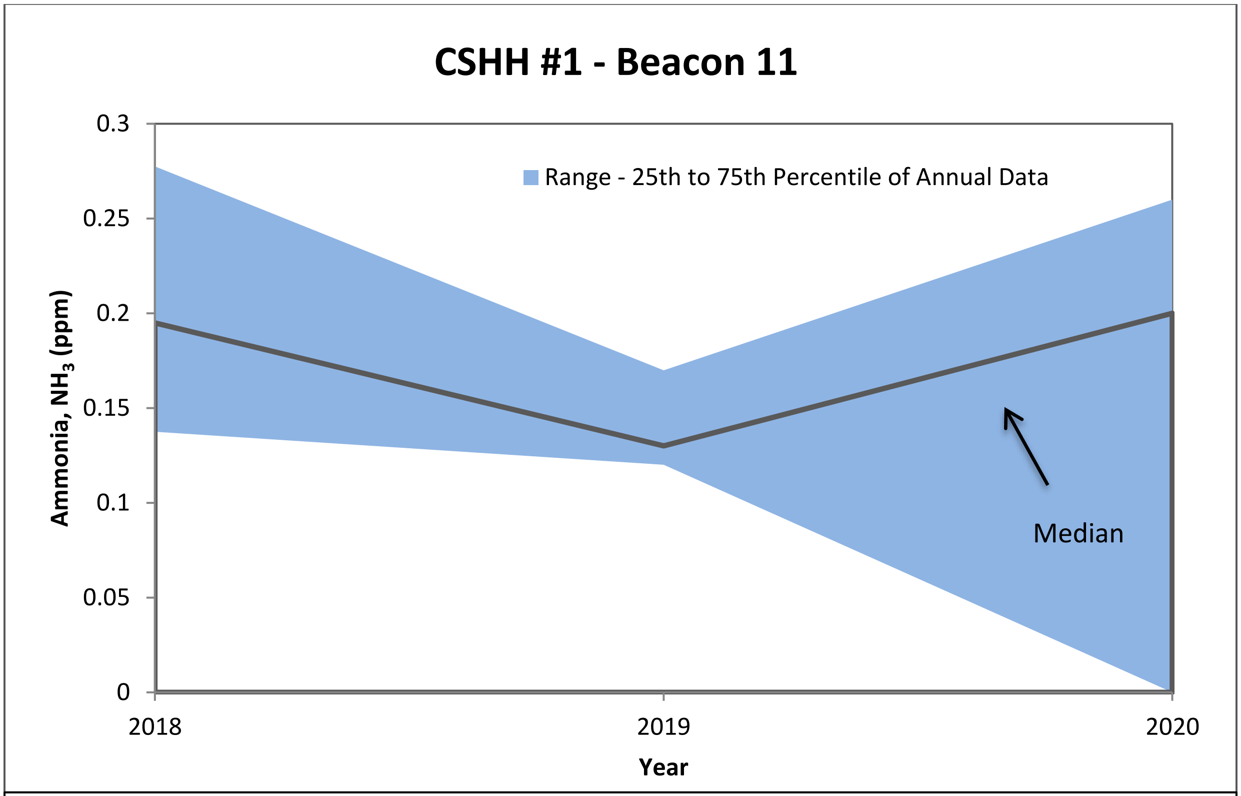
Date	CSHH #14A	CSHH #15A
4/23/20	8.5	5.5
3/11/20	8.2	6.7
2/12/20	7.8	6.2
1/15/20	7.3	7.7

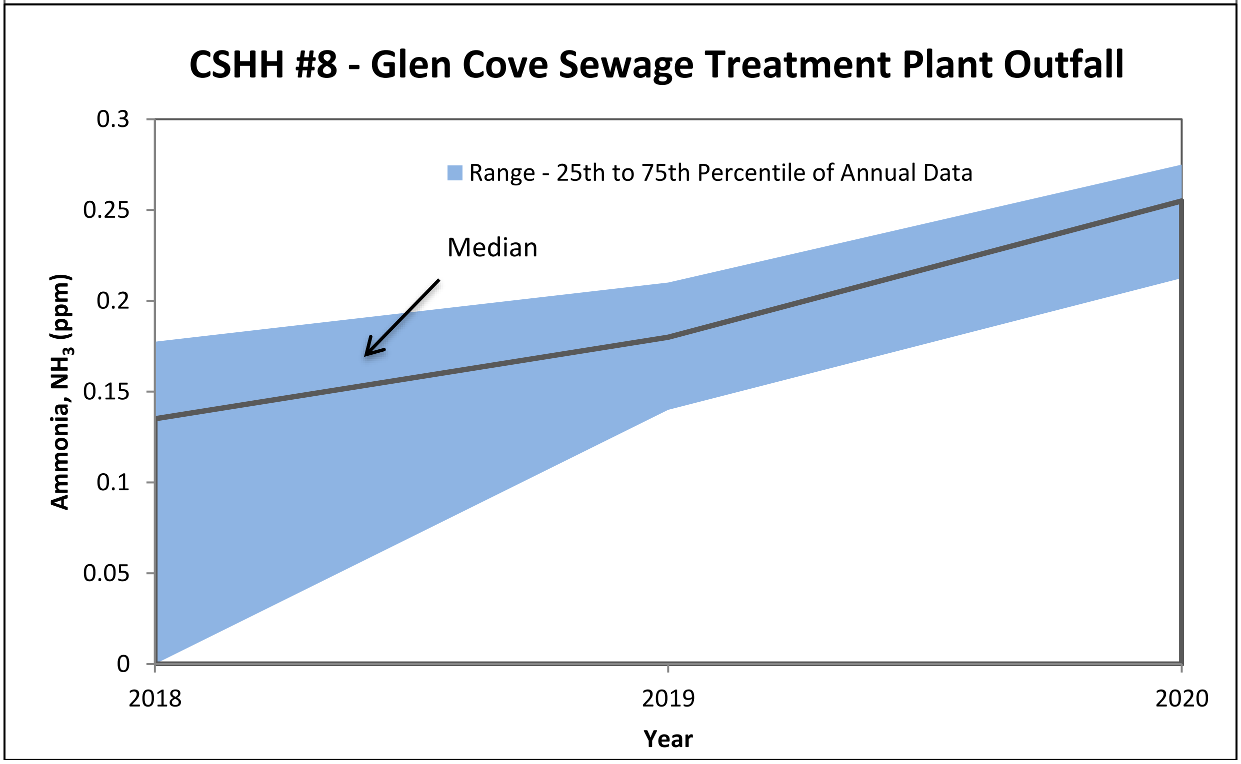
Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

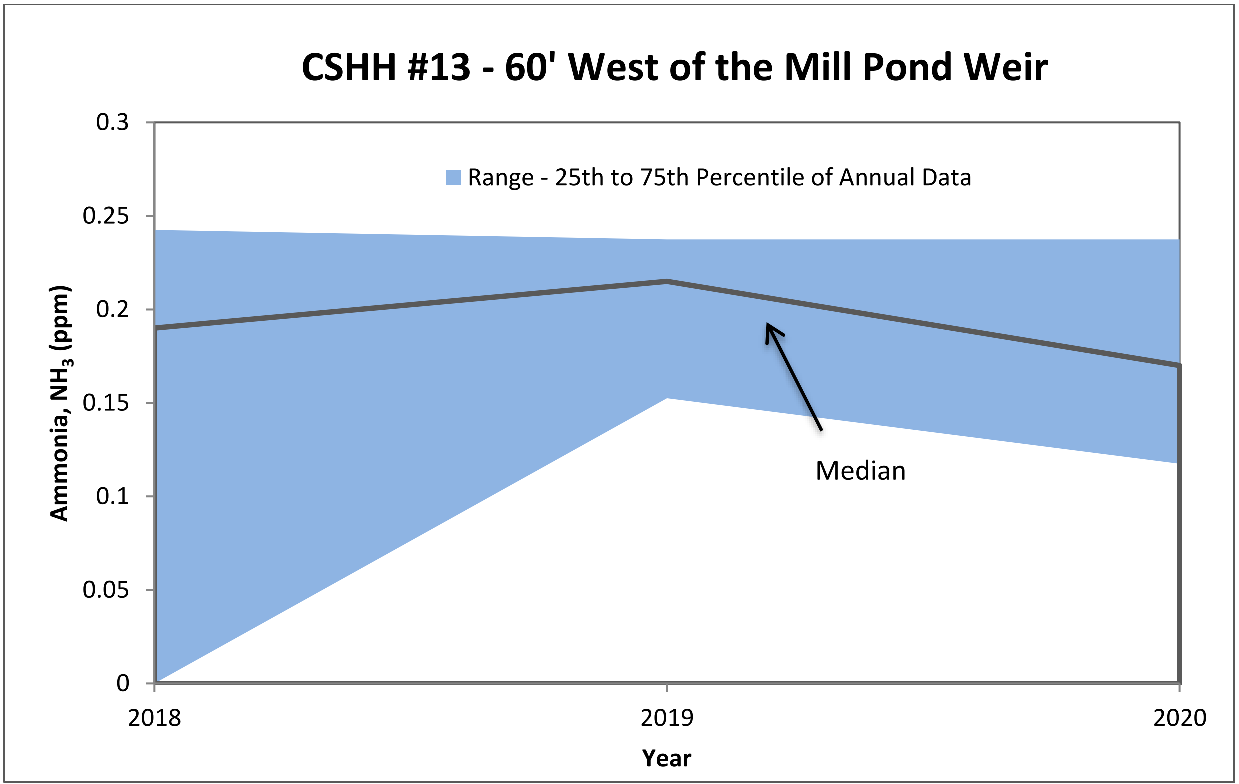
CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

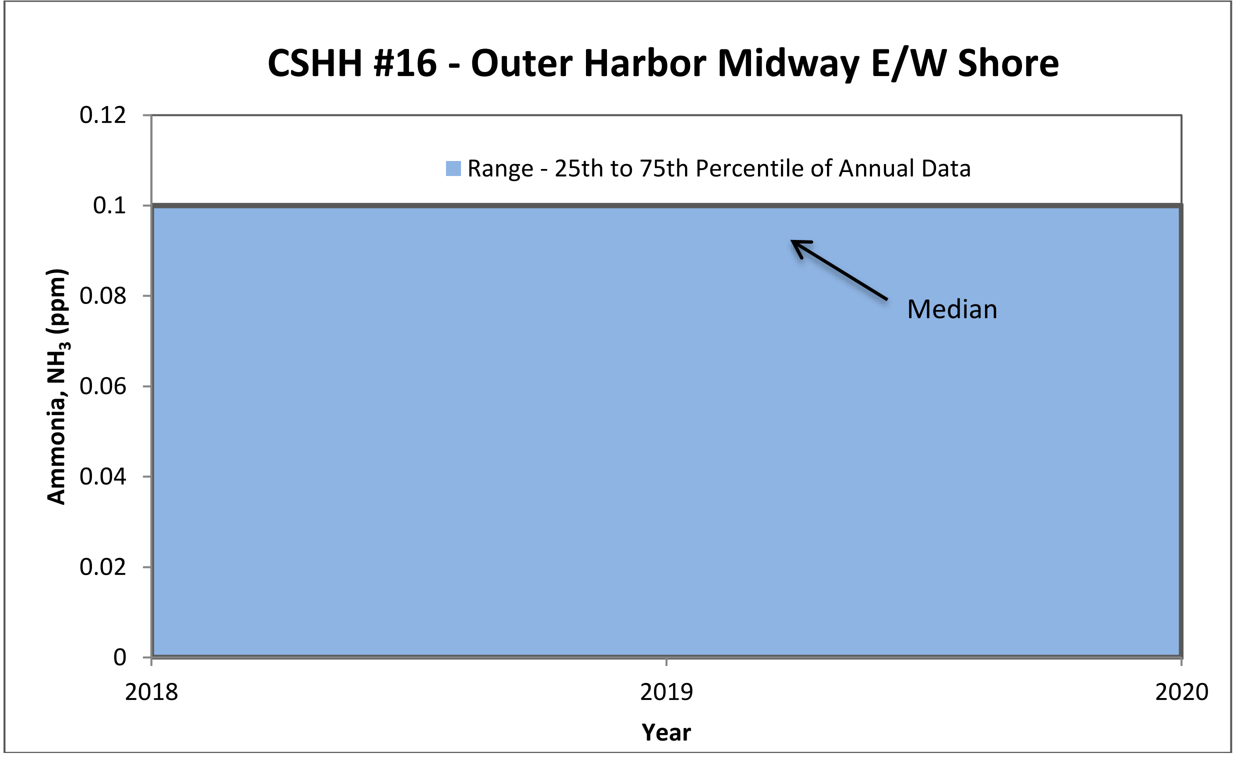
2018-2020 Ammonia Range Graphs



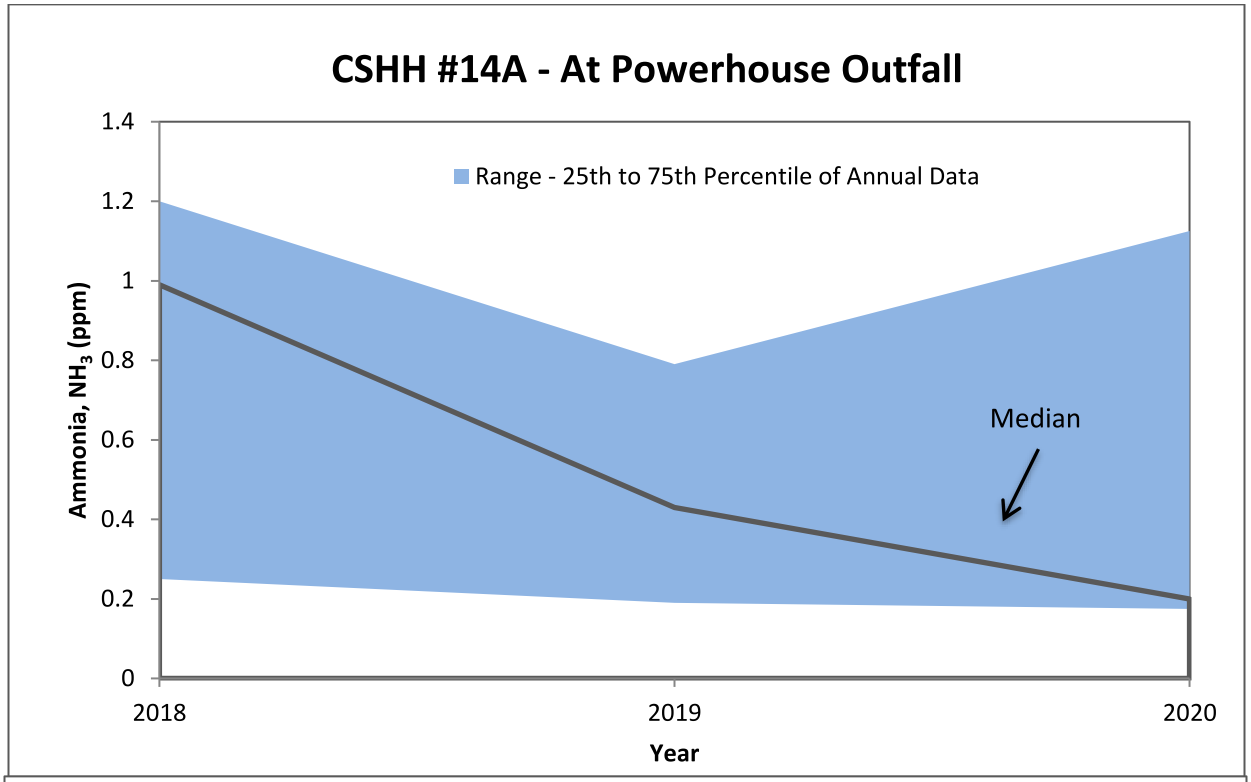


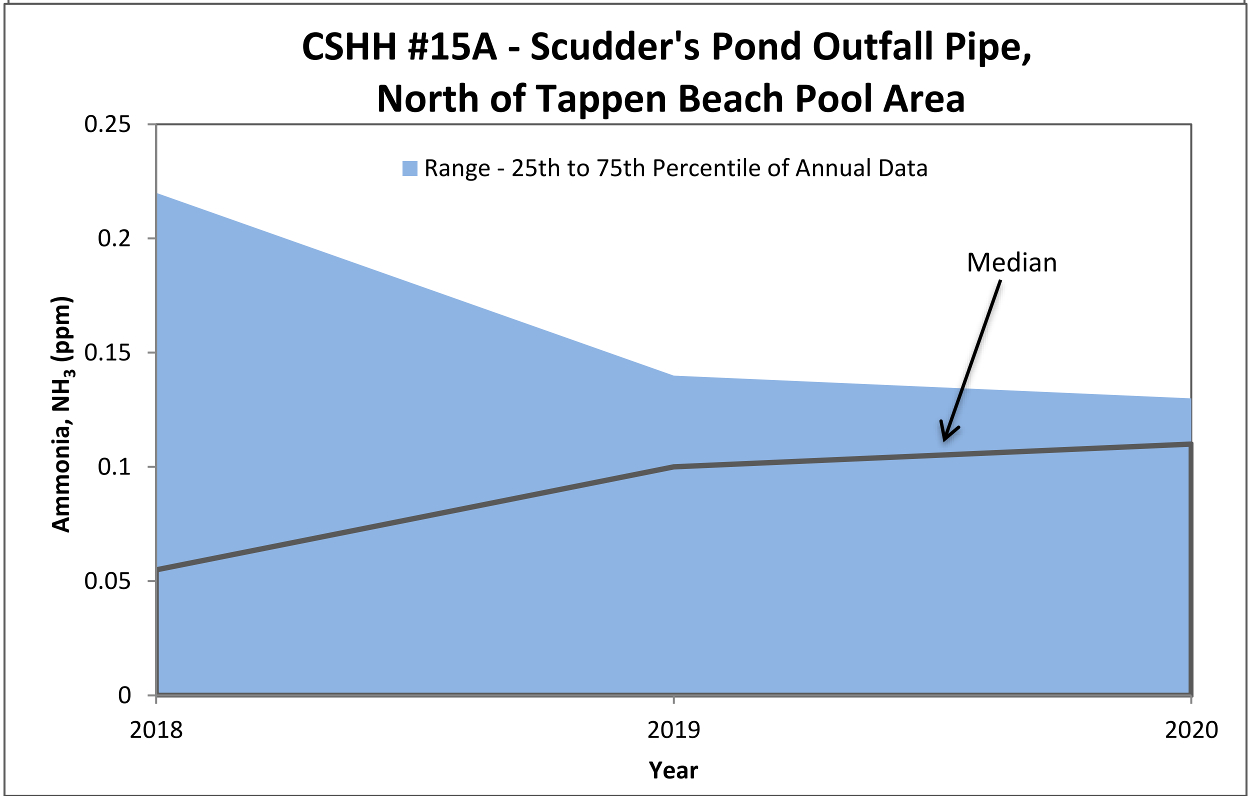
2018-2020 Ammonia Range Graphs



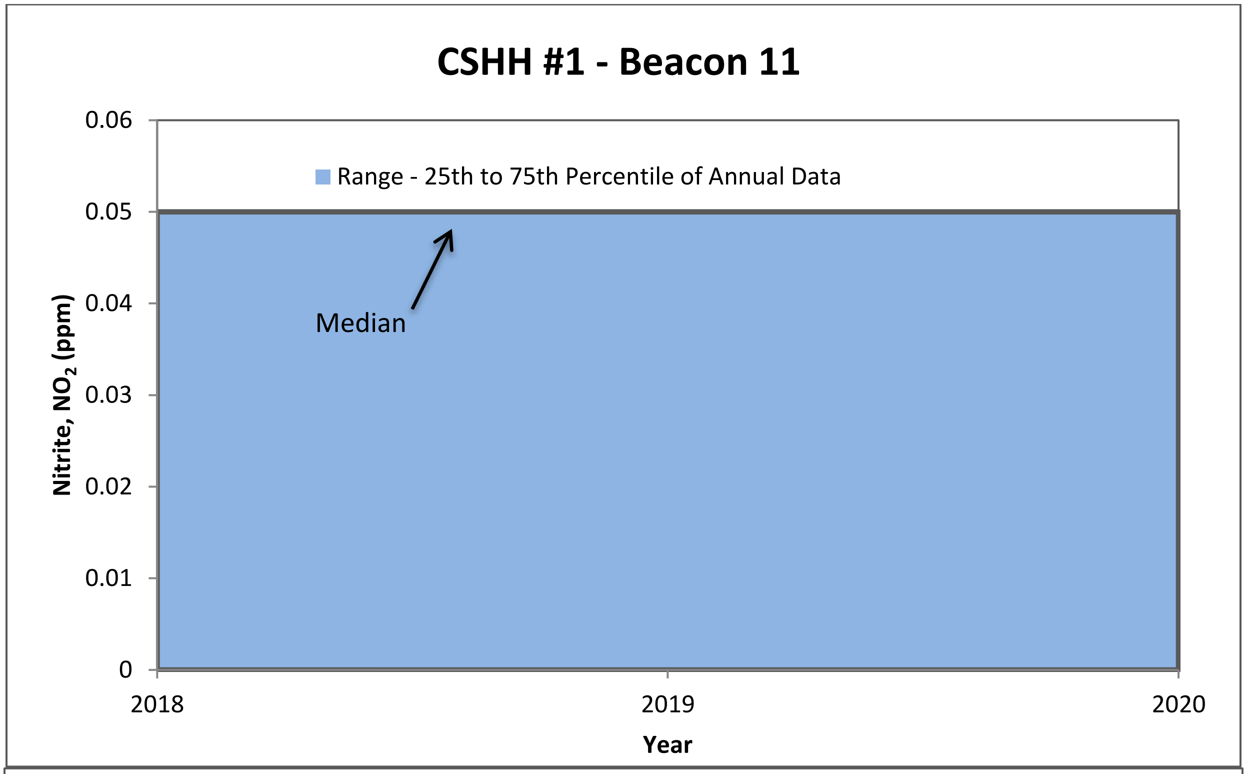


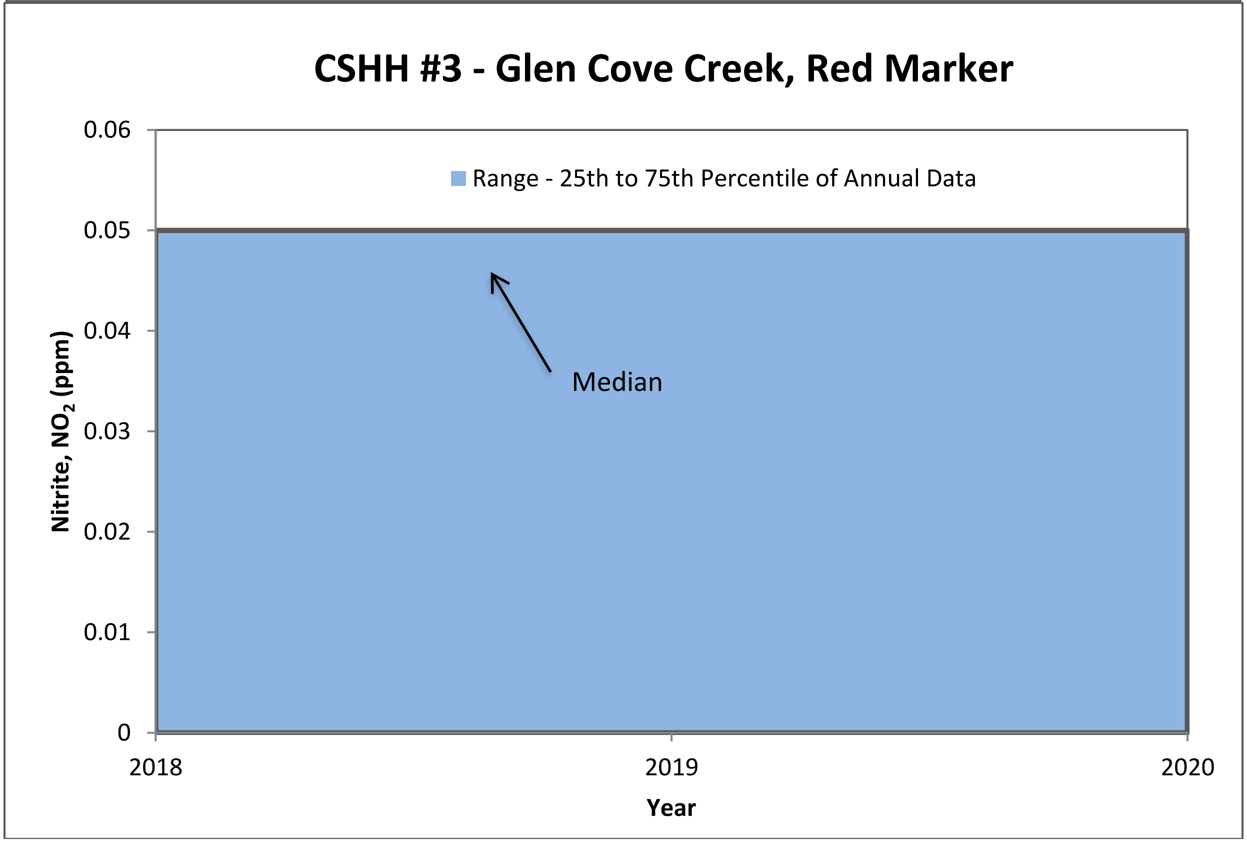
2018-2020 Ammonia Range Graphs



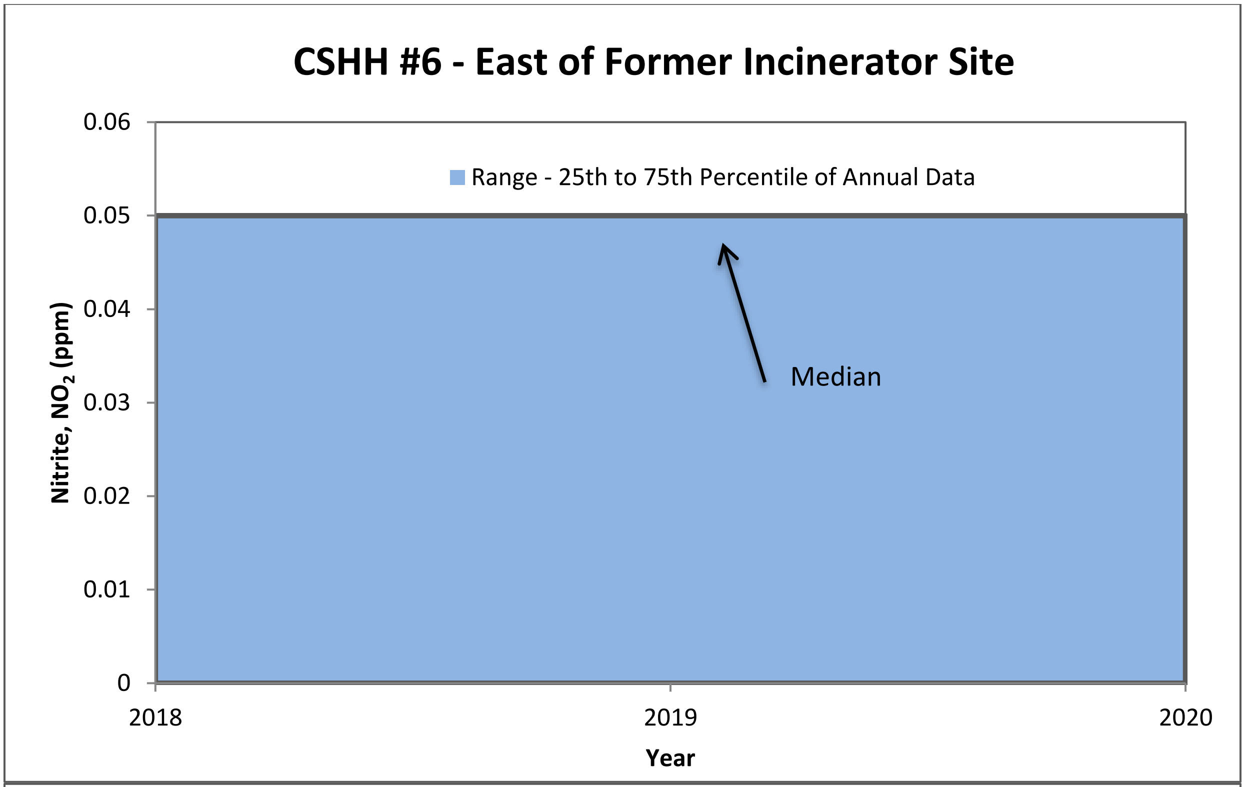


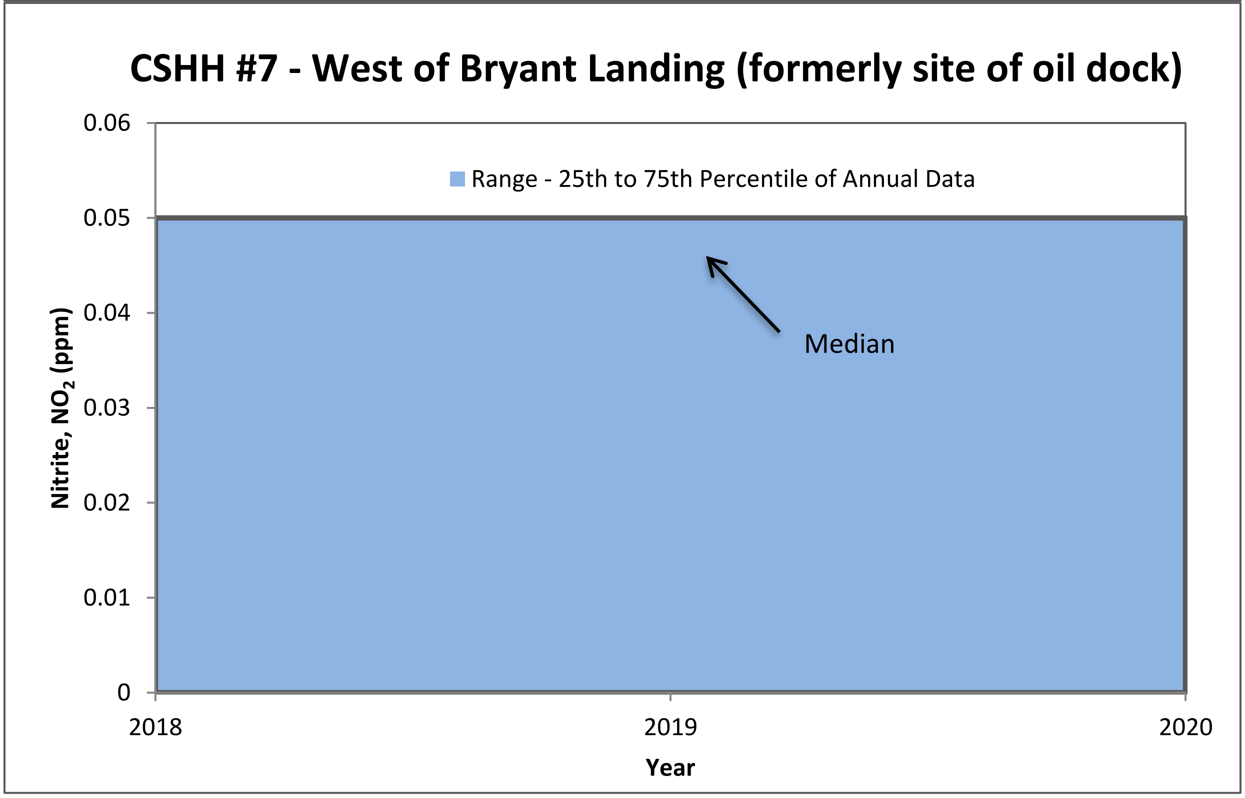
2018-2020 Nitrite Range Graphs



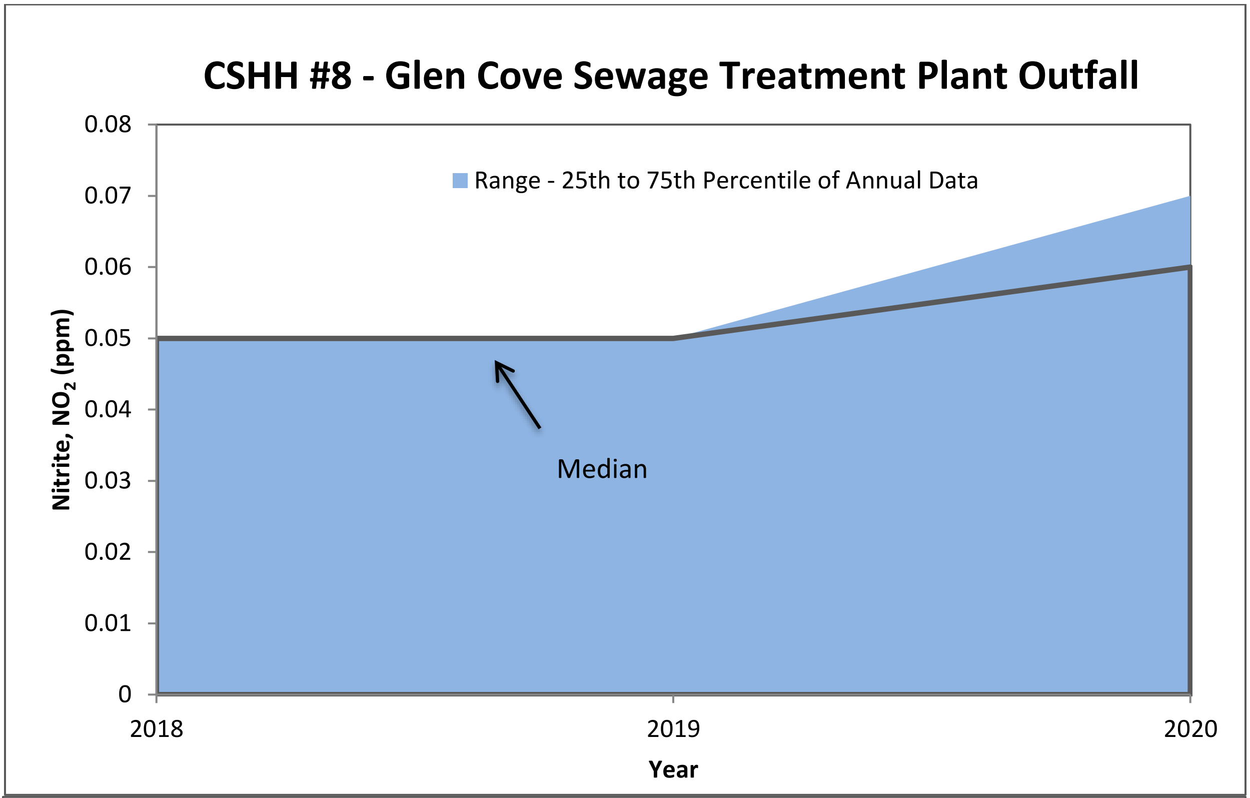


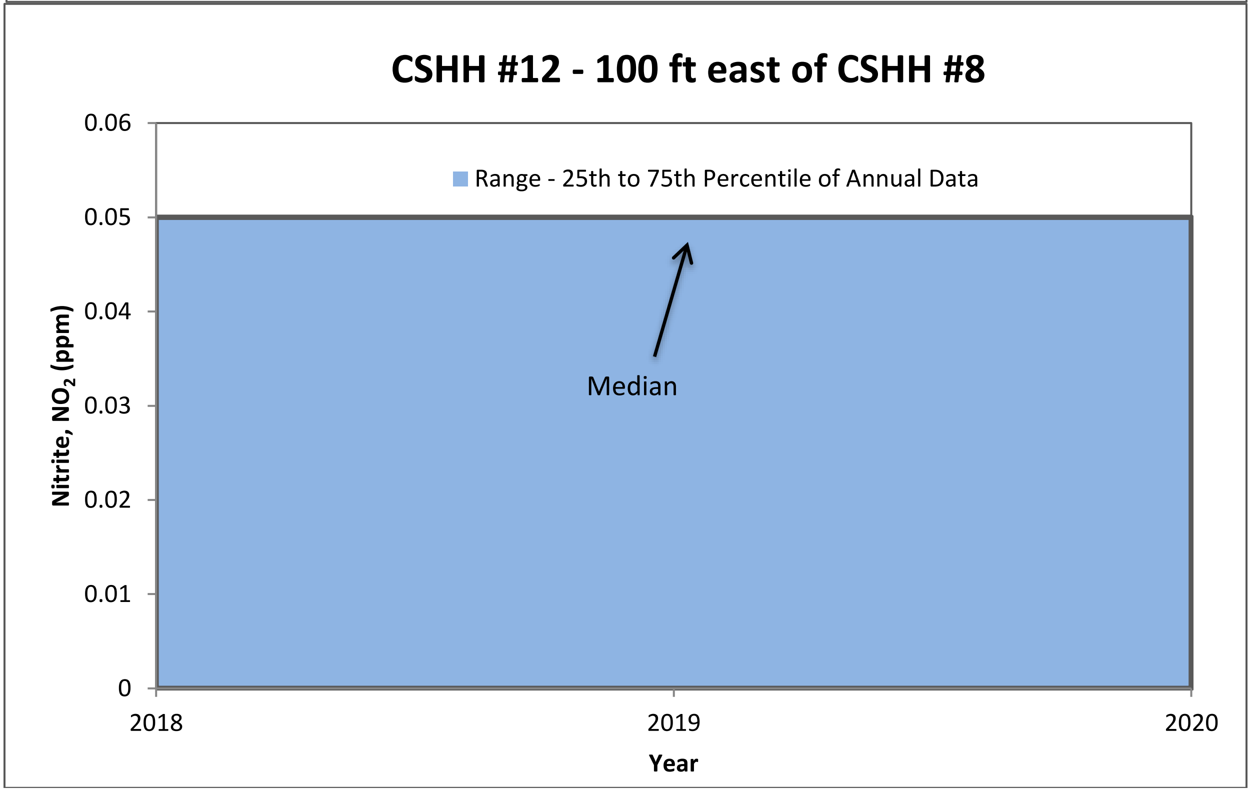
2018-2020 Nitrite Range Graphs



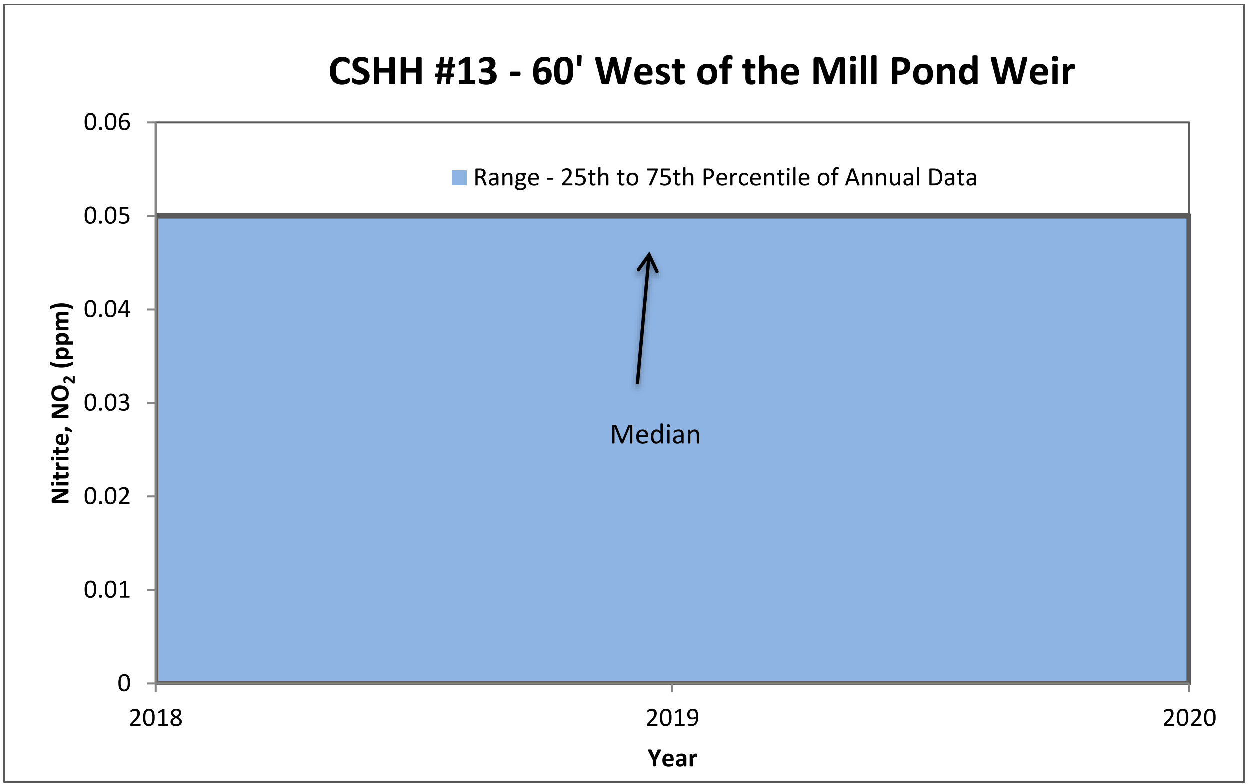


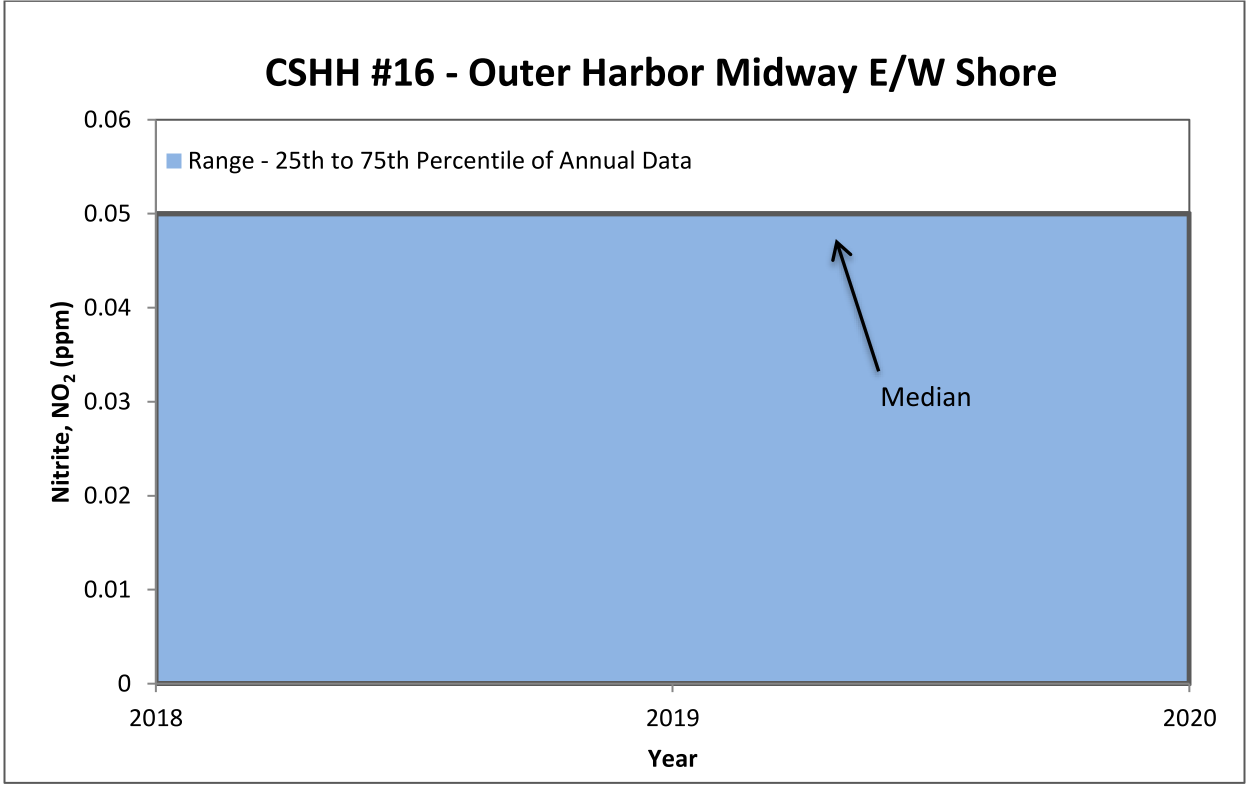
2018-2020 Nitrite Range Graphs



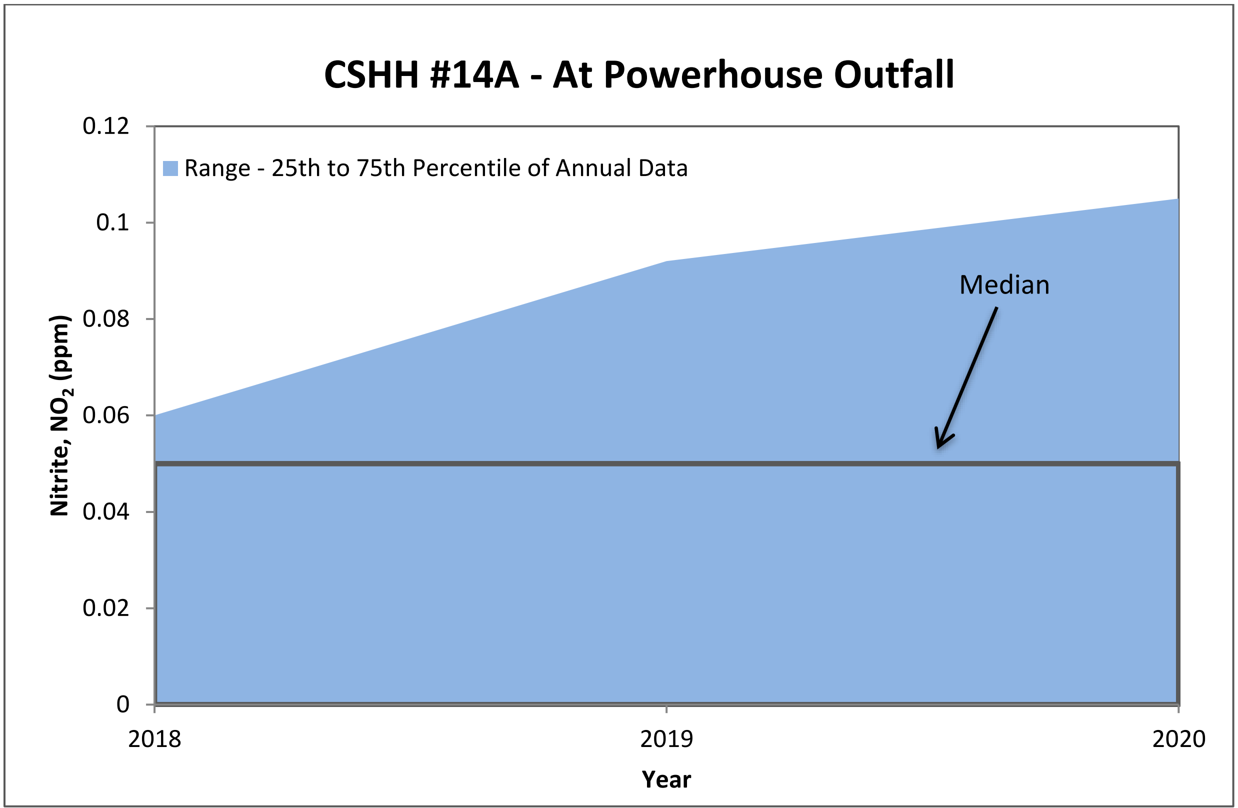


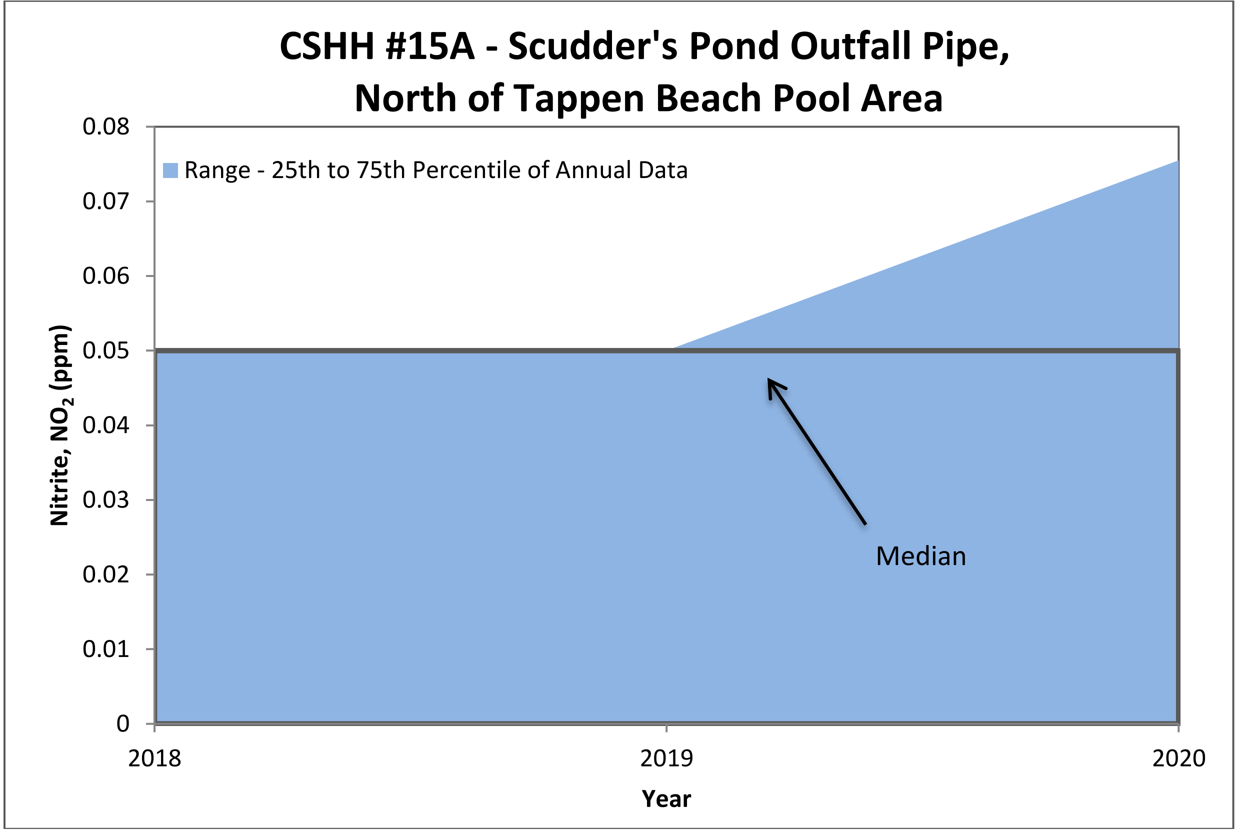
2018-2020 Nitrite Range Graphs



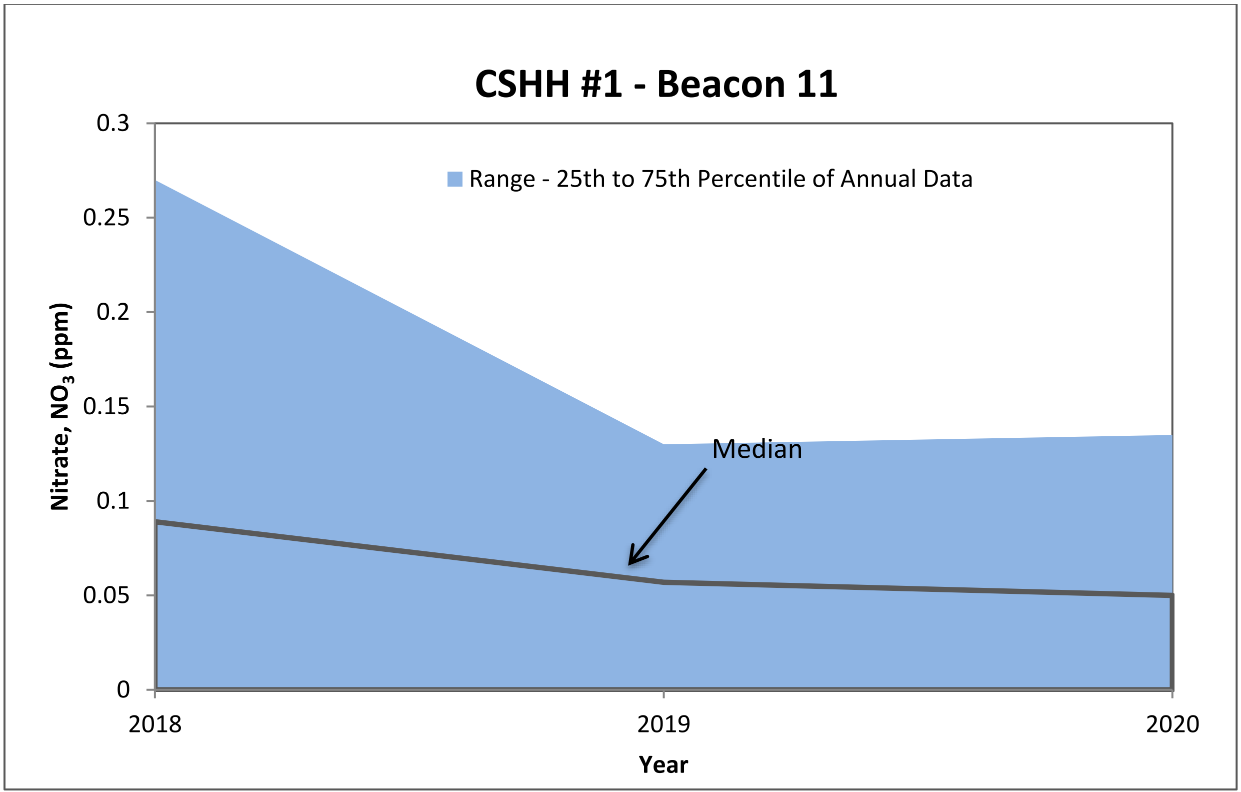


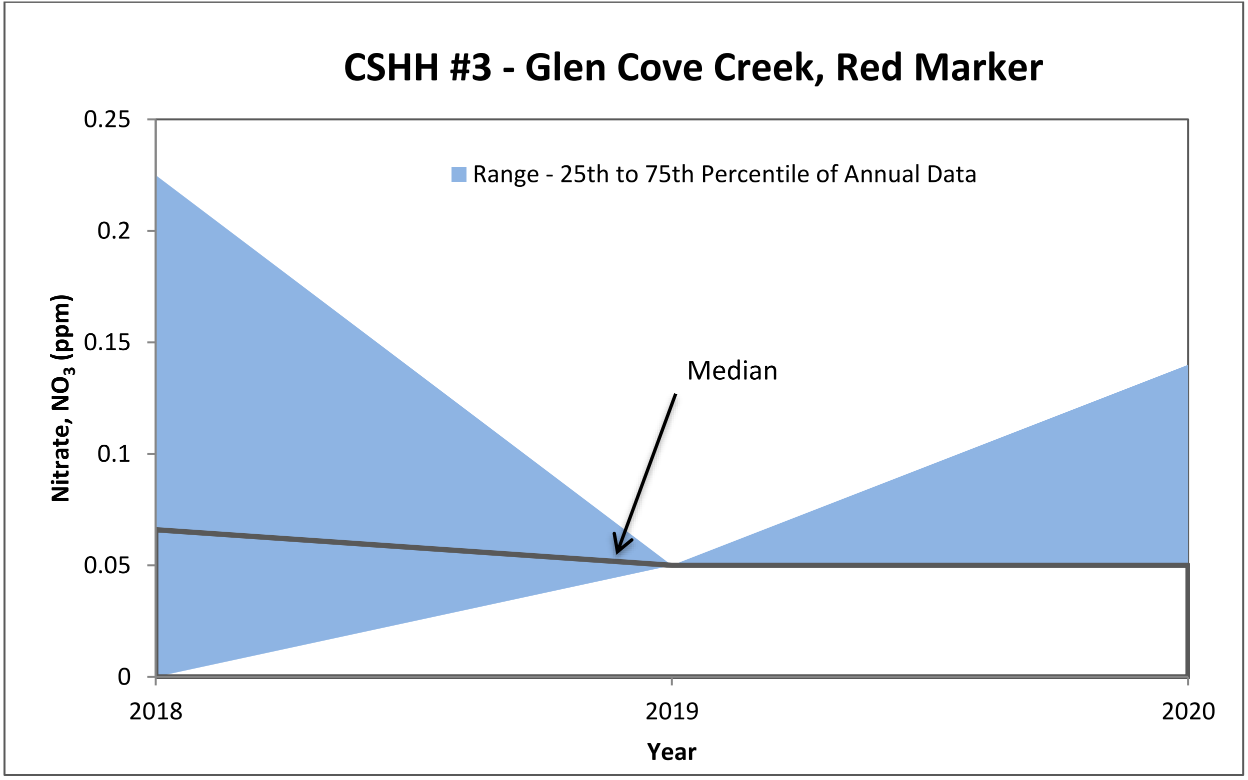
2018-2020 Nitrite Range Graphs



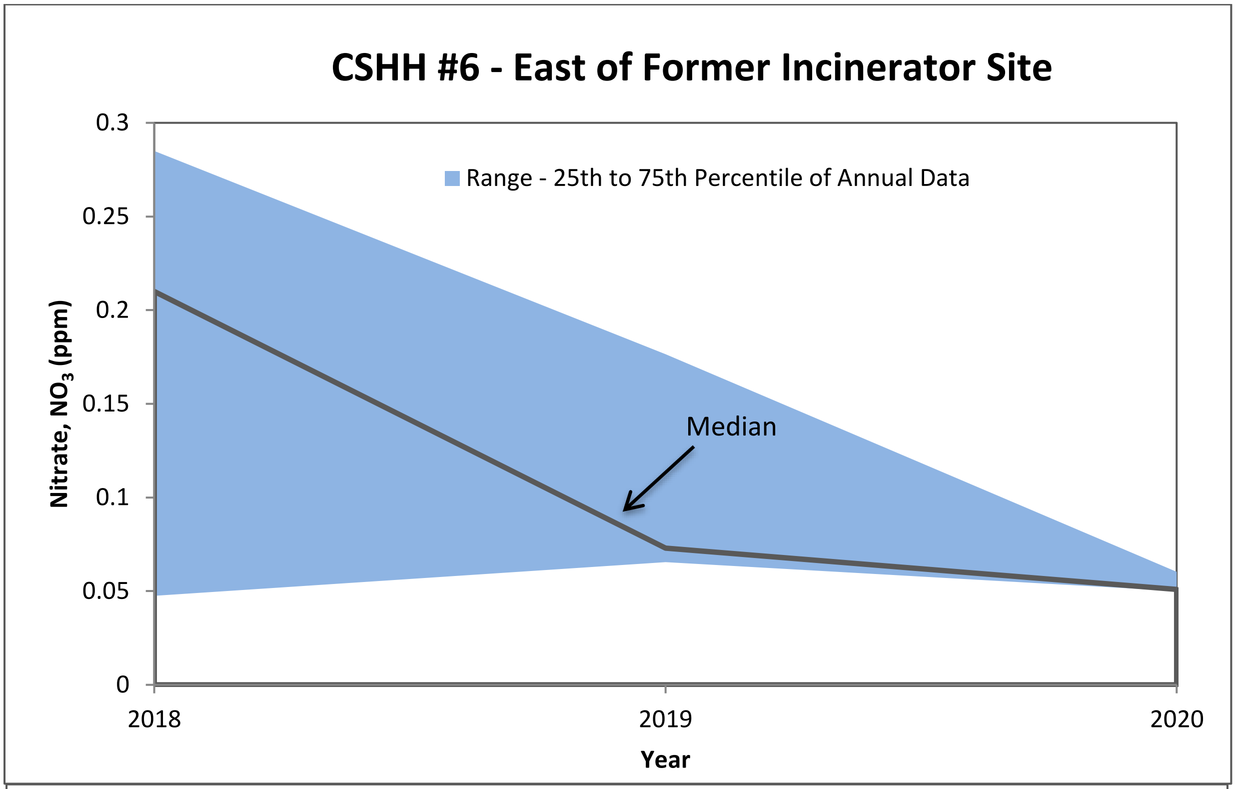


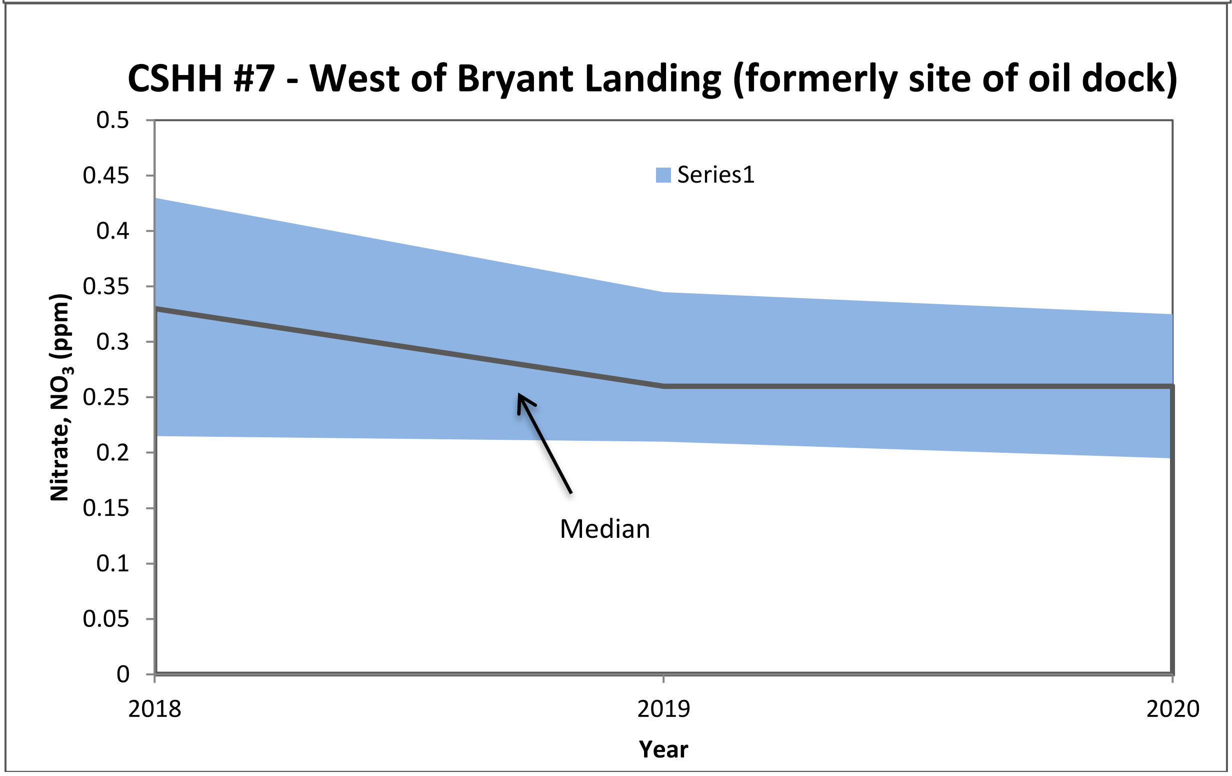
2018-2020 Nitrate Range Graphs



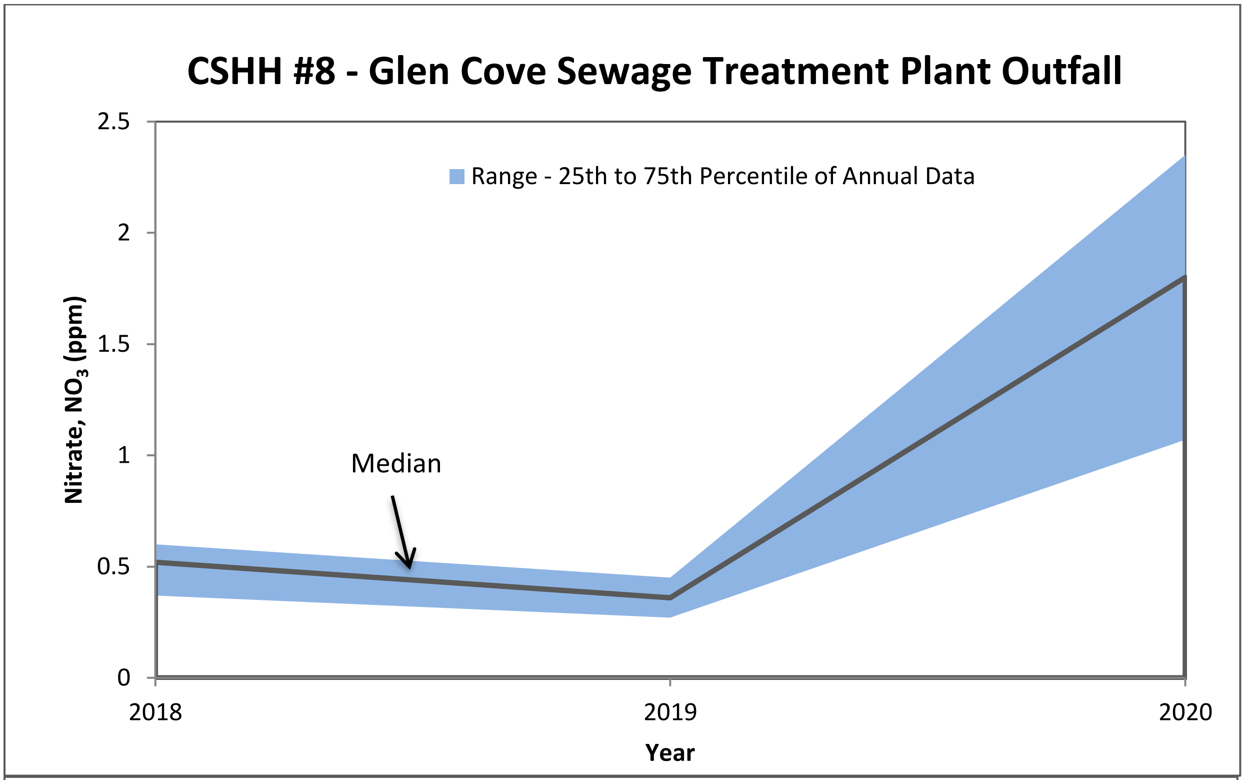


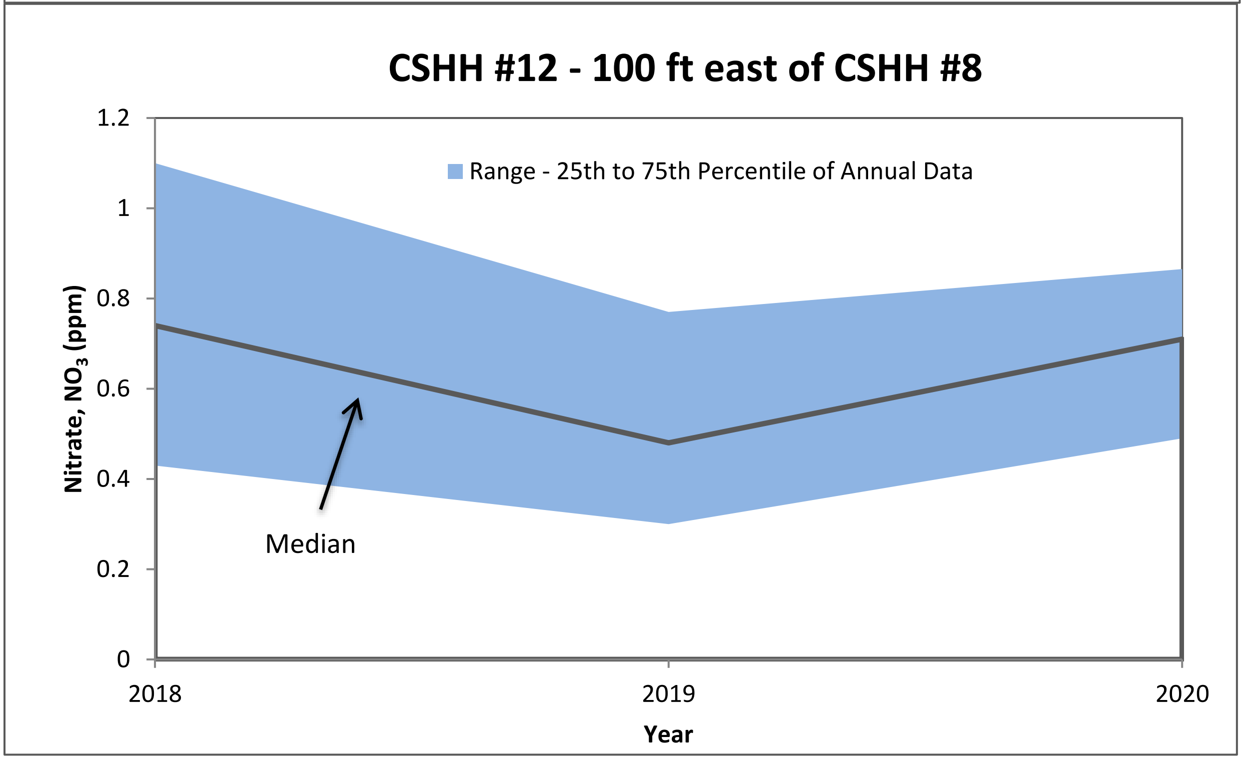
2018-2020 Nitrate Range Graphs



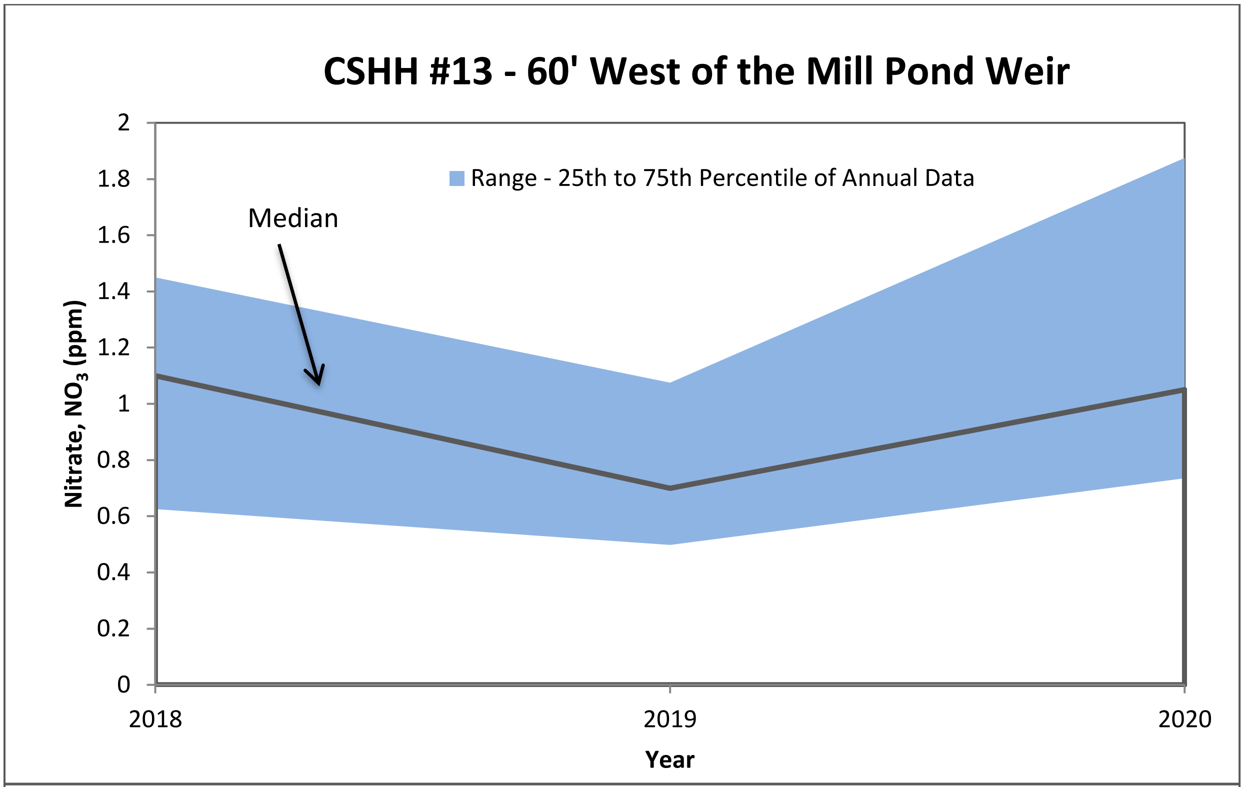


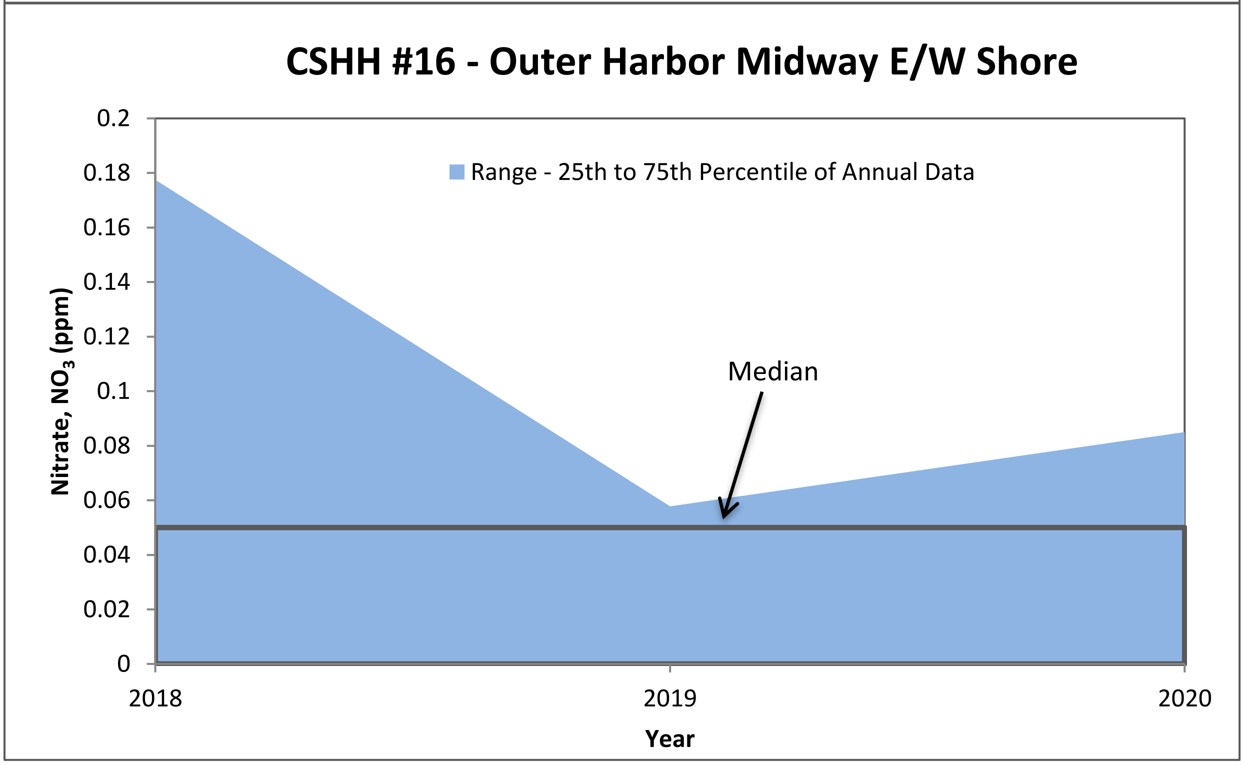
2018-2020 Nitrate Range Graphs



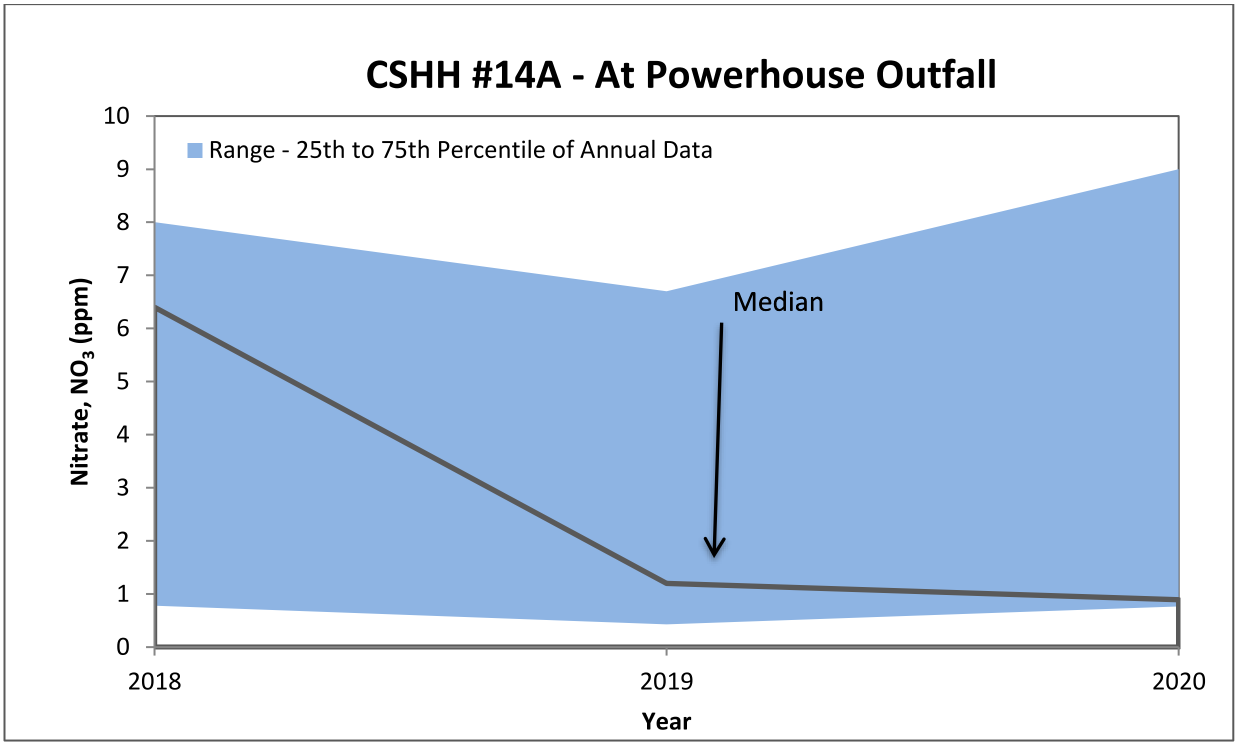


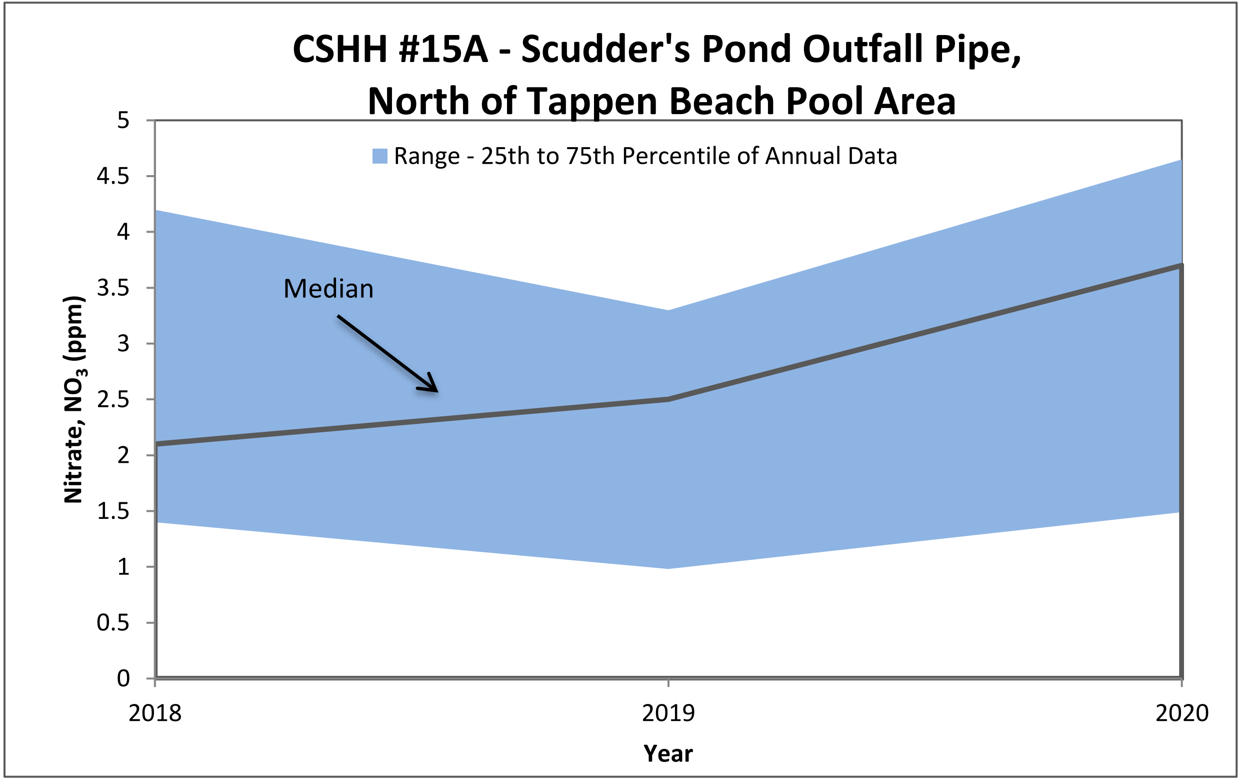
2018-2020 Nitrate Range Graphs





2018-2020 Nitrate Range Graphs





Appendix E

CSHH 2020 Tappen Marina Monitoring Program

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTU)		Depth (m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	1-meter	Bottom	(°C)	(m)	Surface	Bottom	(Total)***	(AM)
Red numbers indicate that the readings were unusually low or high but reflect station conditions.															
Green lines indicate replicate surveys.															
Purple lines indicate survey using YSI Pro Plus and LaMotte 2020e turbidity meter. Depth between sensor at bottom reading to sea floor is 0.15 m.															
*Sonde surface levels are taken at a half meter below the surface.															
**Bottom levels are read by the sonde depth sensor, which is 0.3 m off the harbor floor.															
***Total depth accounts for the 0.3 m distance between the Eureka sonde depth sensor and the harbor floor.															
CSHH #18 - Tappen Marina Interior of Northernmost Dock (S dock)															
10/28/20	16.35	16.28	26.72	26.77	8.76	7.47	5.20	5.67	5.70	11.7	1.0	3.90	3.51	3.17	8:17
Note: 500,000 clams removed from Tappen (10/27/20)															
Note: 500,000 clams removed from Tappen (10/23/20)															
Note: 50,000 oysters removed from Tappen (10/22/20)															
10/21/20	16.85	16.88	26.46	26.67	6.50	6.17	6.65	6.93	7.01	17.1	1.2	3.21	4.22	1.41	8:11
Note: 1 million clams removed from Tappen (10/16/20)															
10/14/20	17.23	16.72	26.16	26.00	7.89	7.05	6.61	6.78	6.23	9.6	1.0	3.55	6.21	2.44	6:38
10/7/20	19.17	19.27	26.44	26.67	7.74	7.66	6.74	6.82	6.86	16.6	1.0	2.47	3.49	1.97	6:46
9/30/20	20.12	20.52	25.41	26.86	7.18	6.00	7.04	7.07	7.18	17.8	1.5	2.85	7.41	3.52	10:21
9/23/20	18.35	18.43	26.06	26.09	8.25	8.23	7.28	7.12	6.98	12.0	0.8	2.44	3.35	3.17	6:55
9/16/20	21.74	21.79	26.24	26.37	7.53	6.15	6.95	7.12	7.15	12.5	1.25 bottom	1.71	1.76	1.44	6:56
9/9/20	23.7	23.9	25.92	26.74	4.71	2.72	7.57	7.57	7.49	19.0	1.0	2.10	N/A	2.65	6:50
Note: 50,000 oysters added to R dock (9/3/20)															
9/3/20	23.59	23.54	26.80	26.92	5.28	4.07	6.91	7.07 bottom	7.07	23.2	1.25 bottom	10.87	10.08	1.25	6:36
8/26/20	25.04	25.28	25.61	25.81	7.42	7.85	7.56	7.59	7.55	20.7	0.75	3.69	2.34	3.22	6:40
8/19/20	23.96	23.97	25.75	25.81	5.28	4.78	6.86	6.94 bottom	6.94	20.2	1.0 bottom	3.21	4.65	1.30	6:40
Note: FLUPSY at S dock moved to R dock (8/12/20)															
8/12/20	24.65	23.73	25.76	26.51	6.14	3.23	6.98	7.11	7.08	25.3	1.0	2.34	3.70	3.05	6:42
8/5/20	22.96	23.07	25.74	26.16	4.46	3.64	7.02	7.15 bottom	7.15	24.0	1.0	2.49	2.70	1.14	8:00
Note: 2 million seed clams added to three FLUPSYs (36 barrels); one at S dock, two at R dock (7/31/20)															
7/29/20	25.45	25.37	25.43	25.68	6.02	4.86	6.81	7.04	7.30	22.8	0.7	4.57	6.35	3.33	6:37

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTU)		Depth (m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	1-meter	Bottom	(°C)	(m)	Surface	Bottom	(Total)***	(AM)
7/22/20	24.50	23.50	25.56	25.82	5.48	4.46	6.65	6.84 bottom	6.84	23.2	0.8	3.12	3.55	1.17	6:33
7/15/20	25.33	25.23	24.86	24.91	7.62	7.23	7.34	7.53	7.68	20.7	0.25	9.52	12.89	3.07	6:35
7/8/20	21.53	21.52	24.76	25.14	5.12	4.33	7.35	7.33 bottom	7.33	28.0	0.75	2.70	3.06	1.20	9:46
7/1/20	21.57	20.95	24.77	25.22	6.80	4.81	6.93	7.17	7.27	20.9	1.0	3.27	6.69	2.97	6:35
6/25/20	20.67	20.59	25.03	25.14	7.24	6.66	7.58	7.64	7.64	20.4	0.5	2.34	3.08	2.09	6:27
6/17/20	19.51	18.91	24.57	24.83	8.45	7.93	7.74	7.73	7.61	14.8	0.6	3.64	6.24	2.08	6:22
6/10/20	17.20	15.84	24.27	24.79	7.40	6.09	7.21	7.41	7.48	20.5	0.75	3.34	7.51	2.62	6:20
6/10/20	17.10	15.84	24.98	25.43	5.91	5.84	7.58	7.60	7.55	N/A	N/A	4.87	6.57	2.56	N/A
6/3/20	17.72	17.50	23.92	24.24	8.99	9.17	7.56	7.99	7.99	18.3	0.75	4.61	12.95	1.95	6:22
6/3/20	17.73	17.68	24.10	24.15	9.04	9.16	8.01	8.02	8.02	N/A	N/A	5.46	5.50	2.01	N/A
5/27/20	15.01	14.74	24.45	24.74	7.83	7.81	7.89	7.88 bottom	7.88	18.5	0.75	15.97	8.70	1.19	9:07
5/27/20	15.00	14.78	24.46	24.66	7.72	7.86	7.90	7.90 bottom	7.90	N/A	N/A	10.34	11.63	1.19	N/A
5/27/20	15.4	14.8	23.76	24.40	8.50	7.90	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.0	9:18
5/27/20	15.1	14.9	24.12	24.28	7.96	7.90	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.0	N/A
Note: Four FLUPSYs assembled, and in water (5/22/20)															
5/20/20	13.54	13.34	24.33	24.46	10.93	11.18	7.80	8.03	8.02	13.9	1.0	8.29	6.18	2.68	8:06
5/20/20	13.49	13.30	24.34	24.51	11.11	11.23	8.10	8.12	8.12	N/A	N/A	4.65	5.55	2.77	N/A
CSHH #19 - Tappen Marina End of Main Dock Opposite Marina Entrance															
10/28/20	16.06	16.58	26.14	27.07	7.28	6.39	7.42	7.40	7.40	11.4	1.4	1.85	3.13	4.02	8:44
Note: 500,000 clams removed from Tappen (10/27/20)															
Note: 500,000 clams removed from Tappen (10/23/20)															
Note: 50,000 oysters removed from Tappen (10/22/20)															
10/21/20	16.87	16.90	26.25	26.65	6.76	6.40	7.50	7.52	7.53	17.8	1.75	2.30	2.92	1.94	9:28
Note: 1 million clams removed from Tappen (10/16/20)															
10/14/20	16.91	17.32	25.75	26.01	7.35	6.92	7.56	7.54	7.49	9.2	1.5	2.57	3.21	3.46	7:13
10/7/20	18.85	19.35	25.96	26.78	8.03	7.47	7.72	7.73	7.72	16.6	1.5	2.01	5.43	2.31	7:20
9/30/20	20.34	20.50	25.76	26.96	7.36	6.07	7.48	7.43	7.44	17.5	1.25	2.74	3.76	4.30	10:45
9/23/20	18.23	18.40	25.72	25.95	8.19	8.06	7.73	7.74	7.73	13.7	1.5	1.56	2.17	3.52	7:25
9/16/20	21.27	21.20	26.06	26.06	7.89	7.01	7.67	7.66	7.61	13.0	0.8	4.93	2.94	2.42	7:17
9/9/20	23.9	23.9	26.28	26.99	4.80	2.43	7.71	7.70	7.55	20.0	1.25	1.32	N/A	3.15	7:28
Note: 50,000 oysters added to R dock (9/3/20)															
9/3/20	23.47	23.41	26.61	26.98	5.82	3.83	7.48	7.39	7.35	23.0	1.25	3.27	3.61	1.91	6:58
8/26/20	24.60	25.26	25.50	25.99	7.54	7.26	7.77	7.75	7.90	21.2	1.0	2.45	5.83	3.84	7:12
8/19/20	23.71	23.80	25.42	25.67	4.67	3.98	7.35	7.33	7.30	19.9	1.0	3.13	4.26	1.70	7:08

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTU)		Depth (m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	1-meter	Bottom	(°C)	(m)	Surface	Bottom	(Total)***	(AM)
Note: FLUPSY at S dock moved to R dock (8/12/20)															
8/12/20	24.59	23.61	25.66	26.55	6.75	3.28	7.38	7.32	7.20	25.1	1.25	2.60	2.30	3.68	7:09
8/5/20	23.35	23.20	25.70	26.20	5.66	3.86	7.57	7.47	7.44	25.7	1.3	2.34	3.30	2.10	8:49
Note: 2 million seed clams added to three FLUPSYs (36 barrels); one at S dock, two at R dock (7/31/20)															
7/29/20	25.43	24.76	25.42	25.95	4.75	4.35	7.46	7.46	7.41	24.6	1.2	2.60	3.49	3.97	7:12
7/22/20	24.68	23.46	25.33	25.72	5.87	3.78	7.38	7.31	7.25	25.0	1.25	2.93	5.47	1.75	6:59
7/15/20	25.33	24.72	24.49	25.28	8.12	7.28	7.94	7.95	7.72	22.8	0.75	4.15	7.84	3.82	7:05
7/8/20	21.99	21.05	25.30	25.73	5.35	3.42	7.46	7.39	7.31	27.0	0.6	3.43	2.45	1.85	9:27
7/8/20	22.19	21.22	25.24	25.77	3.47	3.23	7.39	7.39	7.34	N/A	N/A	3.42	2.45	1.85	N/A
7/1/20	21.93	19.05	24.79	25.72	6.53	4.22	7.51	7.52	7.30	20.5	0.8	3.17	2.25	3.87	7:05
6/25/20	20.74	20.55	25.23	25.43	7.68	6.50	7.82	7.80	7.70	20.3	1.0	1.46	2.63	2.41	7:00
6/17/20	19.34	17.89	24.44	25.26	8.44	7.83	7.89	7.90	7.71	15.8	0.75	3.83	6.42	3.12	6:48
6/10/20	17.85	15.80	24.98	25.51	8.05	6.29	7.76	7.71	7.61	20.8	1.1	2.82	3.70	2.84	6:55
6/3/20	17.78	17.27	23.84	24.62	9.00	8.93	8.08	8.09	8.00	19.4	1.25	3.17	10.84	3.17	7:04
5/27/20	16.11	14.66	24.34	25.06	9.20	8.26	8.07	8.09	8.00	20.3	1.0	4.07	11.68	1.96	10:18
Note: Four FLUPSYs assembled, and in water (5/22/20)															
5/20/20	13.86	12.36	24.42	25.06	11.59	11.26	8.29	8.33	8.16	14.8	1.25	1.89	5.38	4.07	9:40
CSHH #20 - Tappen Marina Southern Side of Main Dock															
No longer testing this station due to changes in FLUPSYs quantity and placement.															
CSHH #21 - Tappen Marina "R" dock															
10/28/20	16.30	16.41	26.49	26.87	7.85	6.69	7.25	7.28	7.27	11.1	1.0	3.80	4.06	4.27	8:29
Note: 500,000 clams removed from Tappen (10/27/20)															
Note: 500,000 clams removed from Tappen (10/23/20)															
Note: 50,000 oysters removed from Tappen (10/22/20)															
10/21/20	15.85	16.88	26.26	26.50	7.81	6.59	7.53	7.52	7.52	17.4	1.5	3.08	4.24	2.29	8:51
Note: 1 million clams removed from Tappen (10/16/20)															
10/14/20	16.52	16.37	25.72	25.75	8.66	7.46	7.38	7.44	7.39	9.8	1.0	3.30	3.46	3.61	7:00
10/7/20	19.01	19.29	26.05	26.59	7.77	7.44	7.63	7.63	7.62	16.5	1.2	2.59	7.41	2.16	7:02
9/30/20	20.44	20.51	25.88	26.88	6.97	6.10	7.48	7.45	7.48	18.0	1.25	2.79	4.42	4.48	11:04
9/23/20	18.30	18.41	25.82	25.96	8.05	8.00	7.66	7.63	7.66	13.2	1.0	2.02	2.91	4.01	7:05
9/16/20	21.23	21.32	26.04	26.22	8.03	7.20	7.56	7.58	7.57	12.8	0.8	3.74	4.27	2.55	7:05
9/9/20	23.9	23.8	26.39	26.87	3.91	2.29	7.68	7.67	7.49	18.9	0.9	2.45	N/A	3.55	7:10
Note: 50,000 oysters added to R dock (9/3/20)															

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTU)		Depth (m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	1-meter	Bottom	(°C)	(m)	Surface	Bottom	(Total)***	(AM)
9/3/20	23.52	23.45	26.64	26.90	5.18	3.53	7.38	7.33	7.31	23.0	1.25	1.93	3.15	2.22	6:48
8/26/20	24.80	25.20	25.73	26.04	7.63	7.79	7.78	7.82	7.85	20.9	0.75	3.97	3.22	4.15	6:51
8/19/20»	23.90	23.82	25.53	25.67	5.60	4.60	7.32	7.29	7.27	N/A	N/A	3.22	3.96	1.98	6:55
8/19/20	23.86	23.82	25.50	25.64	4.49	4.46	7.29	7.29	7.28	20.8	1.0	2.83	4.19	1.99	7:00
Note: FLUPSYs at S dock moved to R dock (8/12/20)															
8/12/20	24.67	23.70	25.70	26.50	6.29	2.90	7.37	7.34	7.17	25.1	1.0	2.30	1.51	4.00	6:59
8/5/20	23.13	23.17	25.82	26.06	4.78	3.43	7.42	7.39	7.38	24.3	1.25	2.02	2.27	2.11	8:19
Note: 2 million seed clams added to three FLUPSYs (36 barrels); one at S dock, two at R dock (7/31/20)															
7/29/20	25.47	24.69	25.47	26.03	5.90	4.40	7.48	7.49	7.39	24.4	1.0	3.22	4.11	4.28	6:52
7/22/20	24.18	23.17	25.58	25.58	3.69	2.68	7.25	7.22	7.17	24.2	1.25	3.22	3.26	2.09	6:47
7/15/20	25.33	25.01	24.61	25.14	7.84	7.23	7.86	7.85	7.74	22.2	0.75	6.56	16.52	4.08	6:48
7/8/20	21.83	20.67	25.10	25.40	5.38	4.49	7.48	7.44	7.34	28.0	0.65	2.97	4.44	2.15	9:38
7/1/20	21.75	19.52	24.83	25.67	5.74	4.05	7.43	7.42	7.28	20.8	0.9	3.99	4.10	4.03	6:52
6/25/20	20.71	20.56	25.20	25.38	7.10	6.09	7.75	7.74	7.65	20.6	0.8	1.85	3.32	2.88	6:38
6/17/20	19.50	18.84	24.41	24.85	8.59	7.64	7.82	7.85	7.72	14.4	0.75	3.25	4.86	3.20	6:30
6/10/20	17.77	15.81	24.97	25.53	8.10	6.76	7.60	7.61	7.53	20.4	1.0	2.48	4.98	3.27	6:34
6/3/20	17.69	17.16	23.98	24.31	8.65	8.28	8.03	8.02	7.91	19.5	0.75	3.18	6.30	3.23	6:43
5/27/20	15.70	14.40	24.36	24.73	8.90	7.19	8.02	7.95	7.87	21.0	0.8	5.67	20.63	2.08	9:45
Note: Four FLUPSYs assembled, and in water (5/22/20)															
5/20/20	13.56	12.86	24.26	24.81	11.63	11.79	8.24	8.23	8.20	14.0	1.25	2.51	3.76	4.03	9:00
» replicate performed with air pumps on															
Red numbers indicate that the readings were unusually low or high but reflect station conditions.															
Green lines indicate replicate surveys.															
Purple lines indicate survey using YSI Pro Plus and LaMotte 2020e turbidity meter. Depth between sensor at bottom reading to sea floor is 0.15 m.															
*Sonde surface levels are taken at a half meter below the surface.															
**Bottom levels are read by the sonde depth sensor, which is 0.3 m off the harbor floor.															
***Total depth accounts for the 0.3 m distance between the Eureka sonde depth sensor and the harbor floor.															

Bacteria Data

CSHH #18 - Tappen Marina Interior of Northernmost Dock

	Fecal coliform (CFU/100ml)	Enterococci (CFU/100ml)	Rainfall prev. 48 hrs (inches)	Time	Air Temp. (°C)	Water Temp. (°C)	Wind (mph)	Weather (see key)
10/28/20	14	18	0.27	8:12	12	16	0	4
Note: 500,000 clams removed from Tappen (10/27/20)								
Note: 500,000 clams removed from Tappen (10/23/20)								
Note: 50,000 oysters removed from Tappen (10/22/20)								
10/21/20	41	21	0.07	8:07	17	17	0	4
Note: 1 million clams removed from Tappen (10/16/20)								
10/14/20	41	15	1.74	6:39	10	17	0	1
10/7/20	15	2	0.03	6:48	17	19	SW-2	3
9/30/20	560	**560**	1.26	9:50	18	20	NW-9	3
9/23/20	15	4	0	6:47	12	18	0	1
9/16/20	16	<1	0	6:26	13	22	0	3
9/9/20	14	<1	0	6:40	19	24	0	3
Note: 50,000 oysters added to R dock (9/3/20)								
9/3/20	21	7	0.09	6:40	23	24	0	3
8/26/20	30	9	0.02	6:30	21	25	0	1
8/19/20	36	14	0.89	6:40	20	24	0	3
Note: FLUPSYs at S dock moved to R dock (8/12/20)								
8/12/20	24	14	0.01	6:37	25	25	0	3
8/5/20	280	57	0.67	7:55	24	23	0	1
Note: 2 million seed clams added to three FLUPSYs (36 barrels); one at S dock, two at R dock (7/31/20)								
7/29/20	43	42	Trace	6:30	23	25	0	1
7/22/20	140	44	0.05	6:33	23	25	0	2
7/15/20	26	9	0.04	6:40	21	25	0	2
7/8/20	90	46	0.11	9:38	28	22	SW-6	3
7/1/20	22	10	0.03	6:35	21	22	0	3
6/25/20	31	10	0	6:15	20	21	0	2
6/17/20	36	31	0	6:16	15	20	0	1
6/10/20	25	19	0	6:10	21	17	0	3
6/3/20	160	**110**	0.11	6:15	18	18	0	3
5/27/20	20	18	0	8:47	19	15	W-1	6
Note: Four FLUPSYs assembled, and in water (5/22/20)								
5/20/20	9	26	0	8:23	14	14	0	2

Numbers in **bold** are exceedences.

Key for weather:	
1	fair
2	partly cloudy
3	cloudy
4	rain
5	snow
6	fog

Bacteria Data cont.

CSHH #19 - Tappen Marina End of Main Dock Opposite Marina Entrance

	Fecal coliform (CFU/100ml)	Enterococci (CFU/100ml)	Rainfall prev. 48 hrs (inches)	Time	Air Temp. (°C)	Water Temp. (°C)	Wind (mph)	Weather (key)		
10/28/20	32	11	0.27	8:44	11	16	0	4	**Key for weather:**	
Note: 500,000 clams removed from Tappen (10/27/20)									1	fair
Note: 500,000 clams removed from Tappen (10/23/20)									2	partly cloudy
Note: 50,000 oysters removed from Tappen (10/22/20)									3	cloudy
10/21/20	31	9	0.07	9:19	18	16	SW-3	3	4	rain
Note: 1 million clams removed from Tappen (10/16/20)									5	snow
10/14/20	57	25	1.74	6:58	9	17	0	1	6	fog
10/7/20	5	2	0.03	7:17	17	19	SW-5	3		
9/30/20	590	**570**	1.26	10:10	17	20	NW-14	3		
9/23/20	5	<1	0	7:25	14	18	0	1		
9/16/20	23	1	0	7:15	13	21	0	3		
9/9/20	9	3	0	7:25	20	24	0	3		
Note: 50,000 oysters added to R dock (9/3/20)										
9/3/20	13	5	0.09	6:58	23	24	N-7	3		
8/26/20	10	3	0.02	7:10	21	25	N-4	1		
8/19/20	49	9	0.89	7:05	21	24	0	3		
Note: FLUPSYs at S dock moved to R dock (8/12/20)										
8/12/20	5	12	0.01	7:14	25	25	0	3		
8/5/20	290	31	0.67	8:50	26	23	NW-4	1		
Note: 2 million seed clams added to three FLUPSYs (36 barrels); one at S dock, two at R dock (7/31/20)										
7/29/20	44	14	Trace	7:05	25	25	0	1		
7/22/20	41	20	0.05	7:00	25	25	0	2		
7/15/20	18	2	0.04	7:10	23	25	0	2		
7/8/20	49	12	0.11	9:10	27	22	SW-7	2		
7/1/20	17	10	0.03	7:06	21	22	0	3		
6/25/20	47	10	0	6:50	21	21	0	2		
6/17/20	22	15	0	6:50	16	19	0	1		
6/10/20	26	14	0	6:56	21	18	0	3		
6/3/20	59	60	0.11	7:01	19	18	E-4	3		
5/27/20	11	<1	0	10:15	20	16	SW-1	2		
Note: Four FLUPSYs assembled, and in water (5/22/20)										
5/20/20	14	1	0	9:45	15	14	SE-7	2		
Numbers in **bold** are exceedences.										

Bacteria Data cont.

CSHH #20 - Tappen Marina Southern Side of Main Dock

No longer testing this station due to changes in FLUPSYs quantity and placement.

CSHH #21 - Tappen Marina "R" dock

	Fecal coliform (CFU/100ml)	Enterococci (CFU/100ml)	Rainfall prev. 48 hrs (inches)	Time	Air Temp. (°C)	Water Temp. (°C)	Wind (mph)	Weather (key)
10/28/20	31	35	0.27	8:26	11	16	0	4
Note: 500,000 clams removed from Tappen (10/27/20)								
Note: 500,000 clams removed from Tappen (10/23/20)								
Note: 50,000 oysters removed from Tappen (10/22/20)								
10/21/20	28	14	0.07	8:45	17	16	0	3
Note: 1 million clams removed from Tappen (10/16/20)								
10/14/20	70	26	1.74	7:10	10	17	0	1
10/7/20	3	2	0.03	6:57	17	19	SW-5	3
9/30/20	570	**590**	1.26	10:02	18	20	NW-13	3
9/23/20	20	1	0	7:05	13	18	0	1
9/16/20	24	5	0	7:09	13	21	0	3
9/9/20	19	5	0	7:05	19	24	0	3
Note: 50,000 oysters added to R dock (9/3/20)								
9/3/20	47	4	0.09	6:46	23	24	NE-7	3
8/26/20	14	5	0.02	6:52	21	25	NE-7	1
8/19/20	27	10	0.89	6:50	21	24	0	3
Note: FLUPSYs at S dock moved to R dock (8/12/20)								
8/12/20	18	4	0.01	6:55	25	25	0	3
8/5/20	145	60	0.67	8:26	24	23	NW-4	1
Note: 2 million seed clams added to three FLUPSYs (36 barrels); one at S dock, two at R dock (7/31/20)								
7/29/20	26	20	Trace	6:55	23	25	0	1
7/22/20	130	38	0.05	6:47	24	24	0	2
7/15/20	15	1	0.04	6:52	22	25	0	2
7/8/20	80	22	0.11	9:30	28	22	SW-6	2
7/1/20	20	12	0.03	6:50	21	22	0	3
6/25/20	55	39	0	6:38	21	21	0	2
6/17/20	15	14	0	6:31	14	20	0	1
6/10/20	38	15	0	6:32	20	18	0	3
6/3/20	70	49	0.11	6:43	20	18	S-3	3
5/27/20	25	10	0	9:42	21	16	SW-2	6
Note: Four FLUPSYs assembled, and in water (5/22/20)								
5/20/20	5	8	0	9:06	14	14	E-5	2

Key for weather:	
1	fair
2	partly cloudy
3	cloudy
4	rain
5	snow
6	fog

Numbers in **bold** are exceedences.

Nitrogen Data

CSHH #18 - Tappen Marina Interior of Northernmost Dock

	Total N	*TKN*	Total Org. N	Ammonia	Nitrate	Nitrite	→All units in mg/L
Note: 50,000 oysters removed (10/22/20), all clams removed on two dates (10/23, 10/27)							
10/21/20	0.60	*<0.50*	<0.10	0.15	0.57	<0.050	
Note: 1 million clams removed from Tappen (10/16/20)							
10/7/20	1.5	*0.92*	0.80	0.12	0.51	<0.050	
9/23/20	1.5	*1.2*	1.1	<0.10	0.29	<0.050	
9/9/20	0.27	*<2.5*	<2.5	<0.250	0.26	<0.050	
Note: 50,000 oysters added to R dock (9/3/20)							
8/26/20	2.0	*1.9*	1.8	<0.10	0.13	<0.050	
Note: FLUPSYs at S dock moved to R dock (8/12/20)							
8/12/20	0.29	*<0.10*	<0.10	0.13	0.28	<0.050	
Note: 2 million seed clams added to three FLUPSYs (36 barrels); one at S dock, two at R dock (7/31/20)							
7/29/20	0.10	*<0.10*	<0.10	0.25	0.10	<0.050	
7/15/20	<0.10	*<0.10*	<0.10	0.22	0.066	<0.050	
7/1/20	1.4	*0.48*	<0.10	0.45	0.96	<0.050	
6/17/20	<0.10	*<1.0*	<0.10	<0.10	<0.050	<0.050	
6/3/20	0.15	*<0.10*	<0.10	<0.10	0.15	<0.050	
Note: Four FLUPSYs assembled, and in water (5/22/20)							
5/20/20	0.55	*0.39*	0.36	<0.10	0.16	<0.050	

CSHH #19 - Tappen Marina End of Main Dock Opposite Marina Entrance

	Total N	*TKN*	Total Org. N	Ammonia	Nitrate	Nitrite	→All units in mg/L
Note: 50,000 oysters removed (10/22/20), all clams removed on two dates (10/23, 10/27)							
10/21/20	0.45	*<0.50*	<0.10	0.17	0.42	<0.050	
Note: 1 million clams removed from Tappen (10/16/20)							
10/7/20	0.52	*<0.50*	<0.10	0.11	0.34	<0.050	
9/23/20	1.3	*1.0*	0.94	<0.10	0.24	<0.050	
9/9/20	0.24	*<0.250*	<0.25	<0.250	0.23	<0.050	
Note: 50,000 oysters added to R dock (9/3/20)							
8/26/20	1.4	*1.3*	1.2	<0.10	0.10	<0.050	
Note: FLUPSYs at S dock moved to R dock (8/12/20)							
8/12/20	0.13	*<0.10*	<0.10	0.18	0.13	<0.050	
Note: 2 million seed clams added to three FLUPSYs (36 barrels); one at S dock, two at R dock (7/31/20)							
7/29/20	0.11	*<0.10*	<0.10	0.27	0.11	<0.050	
7/15/20	0.11	*<0.10*	<0.10	0.29	0.11	<0.050	
7/1/20	0.72	*0.50*	0.22	0.29	0.22	<0.050	
6/17/20	<0.10	*<1.0*	<0.10	<0.10	0.079	<0.050	
6/3/20	0.15	*<0.10*	<0.10	<0.10	0.15	<0.050	
Note: Four FLUPSYs assembled, and in water (5/22/20)							
5/20/20	0.31	*0.26*	0.19	<0.10	<0.050	<0.050	

9/9: Data highlighted b/c TKN and Ammonia samples were sent to another lab and analyzed using "wet chemistry", EPA method unchanged.

7/29: Highlighted data in question because samples were out of temp. as a result of power loss at Pace from Hurricane Isaias.

Data in red where Total N numbers are > 1.0 mg/l, and second number indicates the major contributing nitrogen source (i.e., organic N or nitrate).

Nitrogen Data cont.

CSHH #20 - Tappen Marina Southern Side of Main Dock

No longer testing this station due to changes in FLUPSYs quantity and placement.

CSHH #21 - Tappen Marina "R" dock

	Total N	*TKN*	Total Org. N	Ammonia	Nitrate	Nitrite	→All units in mg/L
Note: 50,000 oysters removed (10/22/20), all clams removed on two dates (10/23, 10/27)							
10/21/20	0.55	*<0.50*	<0.10	0.16	0.52	<0.050	
Note: 1 million clams removed from Tappen (10/16/20)							
10/7/20	2.2	*1.8*	1.7	<0.10	0.39	<0.050	
9/23/20	1.3	*0.97*	0.90	<0.10	0.26	<0.050	
9/9/20	0.26	*<0.250*	<0.25	<0.250	0.25	<0.050	
Note: 50,000 oysters added to R dock (9/3/20)							
8/26/20	1.7	*1.5*	1.4	<0.10	0.14	<0.050	
Note: FLUPSYs at S dock moved to R dock (8/12/20)							
8/12/20	0.14	*<0.10*	<0.10	0.14	0.14	<0.050	
Note: 2 million seed clams added to three FLUPSYs (36 barrels); one at S dock, two at R dock (7/31/20)							
7/29/20	0.11	*<0.10*	<0.10	0.19	0.11	<0.050	
7/15/20	<0.10	*<0.10*	<0.10	0.24	0.099	<0.050	
7/1/20	0.27	*0.13*	<0.10	0.20	0.14	<0.050	
6/17/20	<0.10	*<1.0*	<0.10	<0.10	<0.050	<0.050	
6/3/20	0.20	*<0.10*	<0.10	<0.10	0.20	<0.050	
Note: Four FLUPSYs assembled, and in water (5/22/20)							
5/20/20	0.47	*0.35*	0.32	<0.10	0.12	<0.050	

9/9: Data highlighted b/c TKN and Ammonia samples were sent to another lab and analyzed using "wet chemistry", EPA method unchanged.

7/29: Highlighted data in question because samples were out of temp. as a result of power loss at Pace from Hurricane Isaias.

Data in red where Total N numbers are > 1.0 mg/l, and second number indicates the major contributing nitrogen source (i.e., organic N or nitrate).

Total Nitrogen = Total Organic N + Ammonia + Nitrate + Nitrite

TKN = Total Organic N + Ammonia

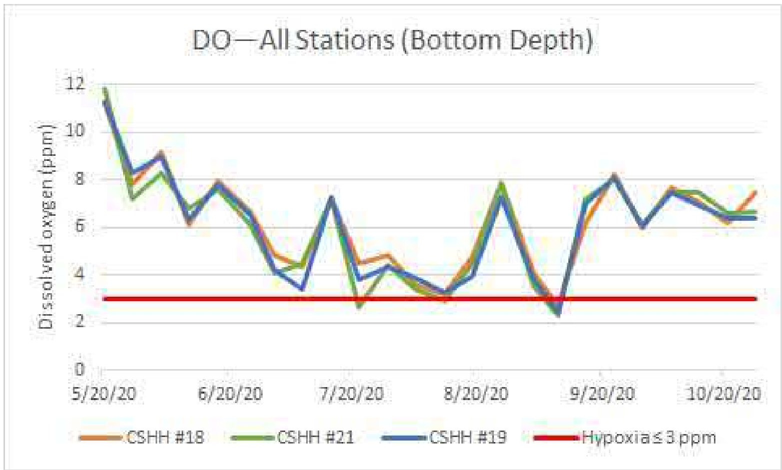


Figure 1. Dissolved oxygen in the 2020 season—all stations

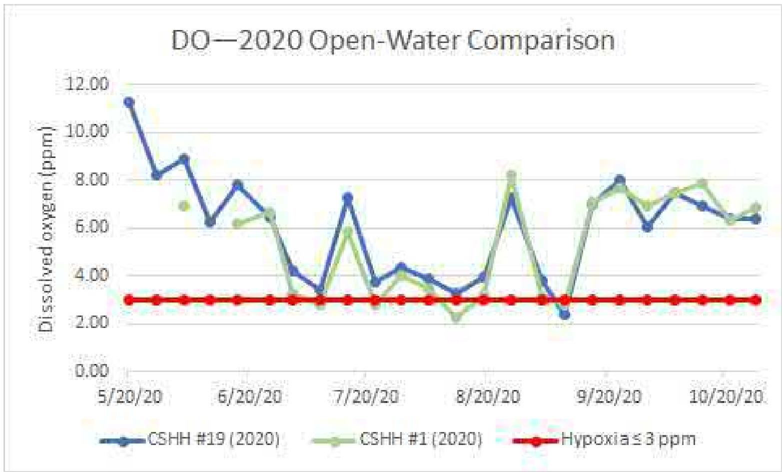


Figure 2. Dissolved oxygen comparing CSHH #19 and CSHH #1 in the 2020 monitoring season

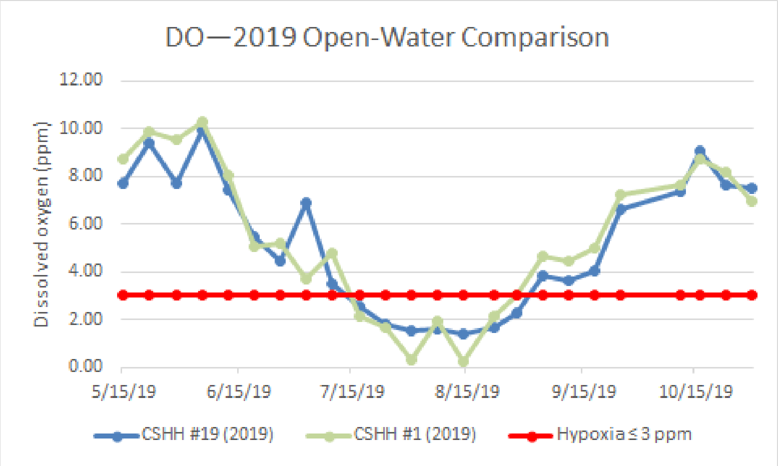


Figure 3. Dissolved oxygen comparing CSHH #19 and CSHH #1 in the 2019 monitoring season

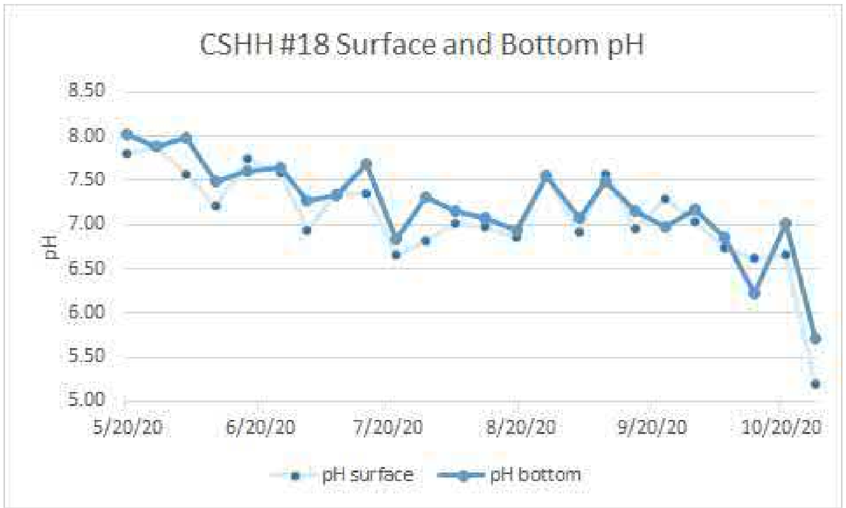


Figure 4. Comparison of pH at CSHH #18 (S dock), half a meter from the surface and at bottom depth

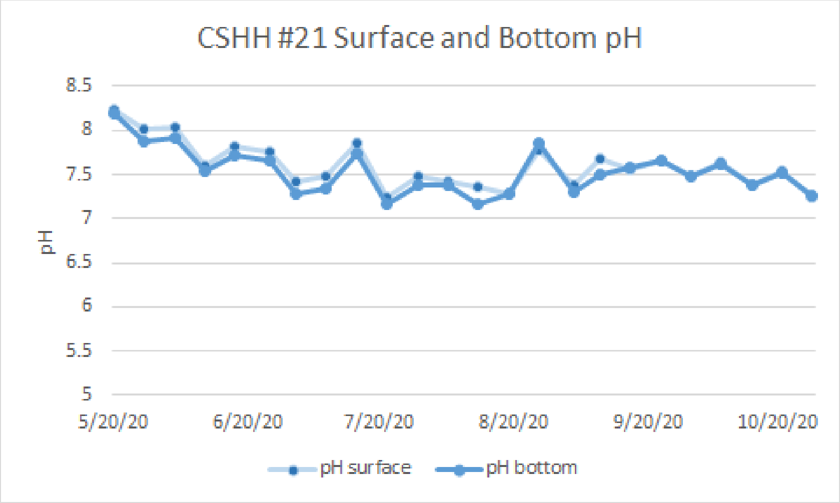


Figure 5. Comparison of pH at CSHH #21 (R dock), half a meter from the surface and at bottom depth

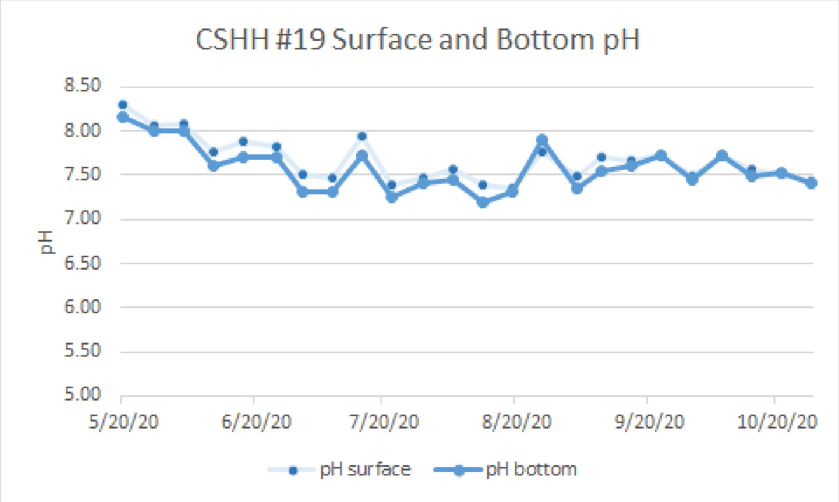


Figure 6. Comparison of pH at CSHH #19 (main dock), half a meter from the surface and at bottom depth

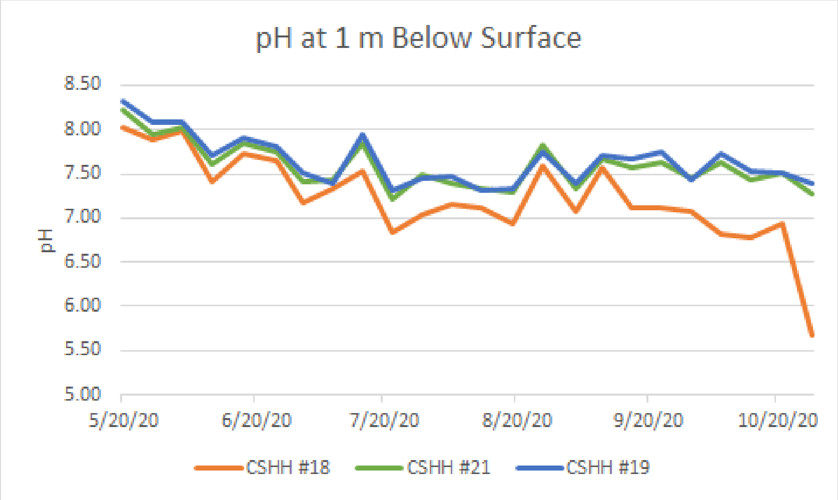


Figure 7. Comparison of pH at 1 meter below surface at all stations

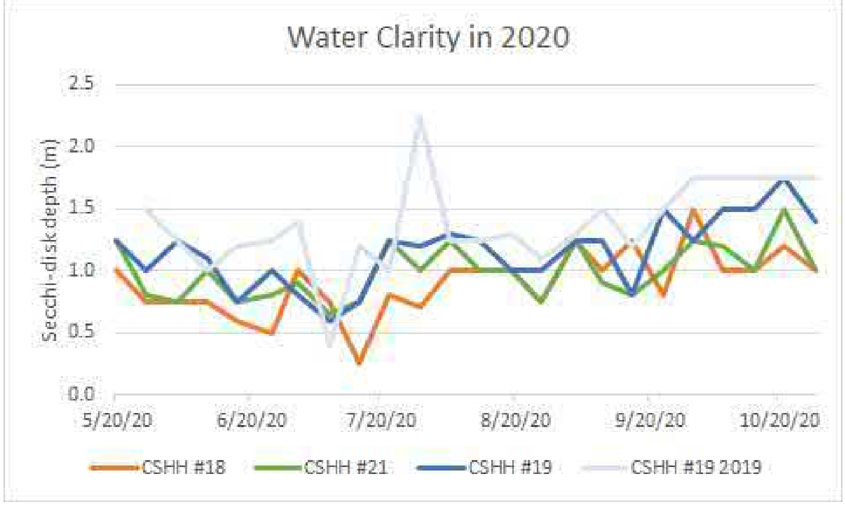


Figure 8. Comparison of water clarity at all stations in the 2020 season with CSHH #19 from the 2019 monitoring season

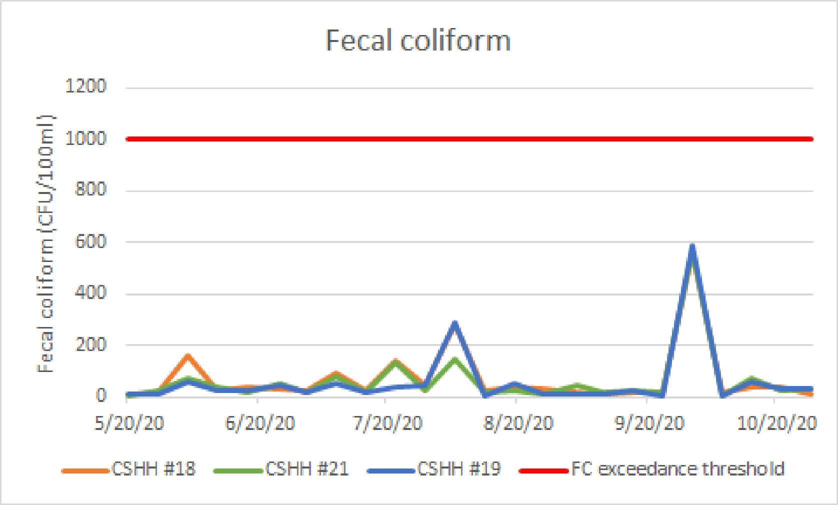


Figure 9. Fecal coliform bacteria at all stations in the 2020 monitoring season

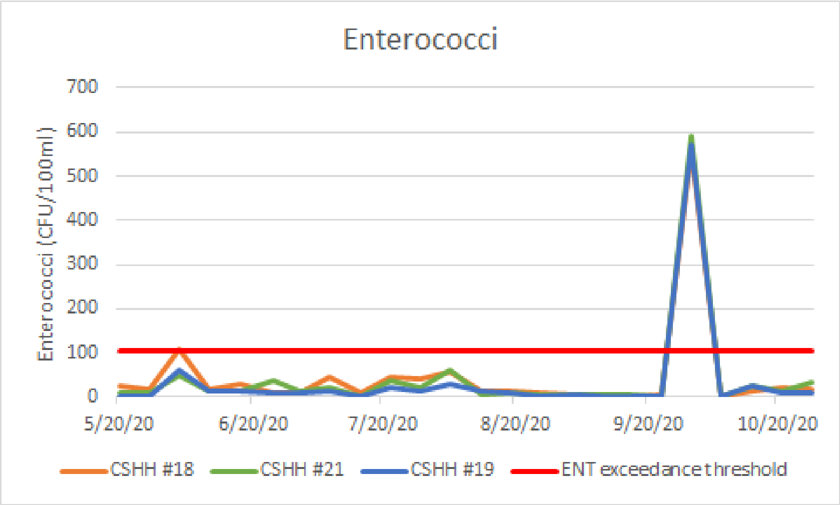


Figure 10. Enterococci bacteria at all stations in the 2020 monitoring season

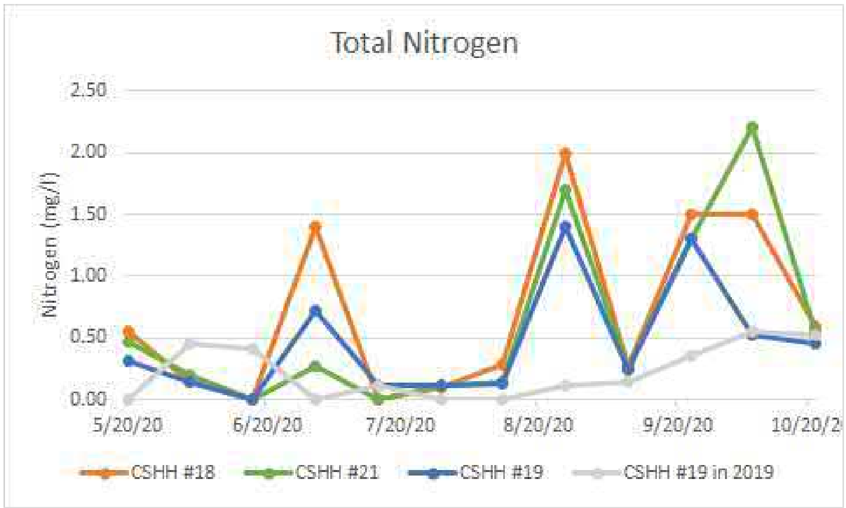


Figure 11. Total nitrogen at all stations in the 2020 monitoring season with a CSHH #19 comparison from the previous year

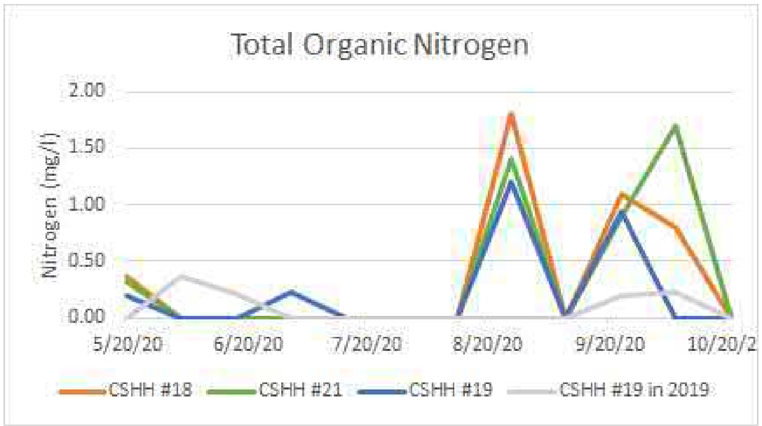


Figure 12. Total organic nitrogen at all stations in the 2020 monitoring season with a CSHH #19 comparison from the previous year

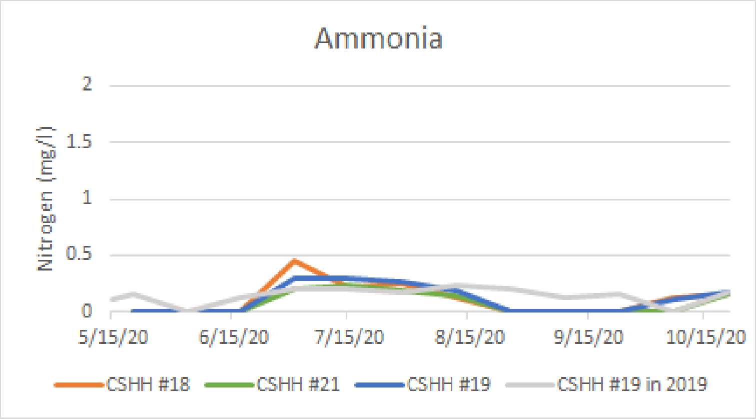


Figure 13. Ammonia at all stations in the 2020 monitoring season with a CSHH #19 comparison from the previous year

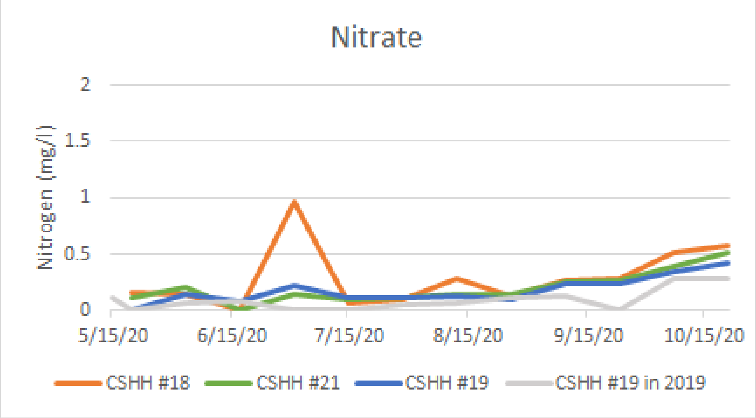


Figure 14. Nitrate at all stations in the 2020 monitoring season with a CSHH #19 comparison from the previous year

Total nitrogen = total organic nitrogen + ammonia + nitrate + nitrite*
Note: nitrite graph not shown because there were no detectable amounts of nitrite

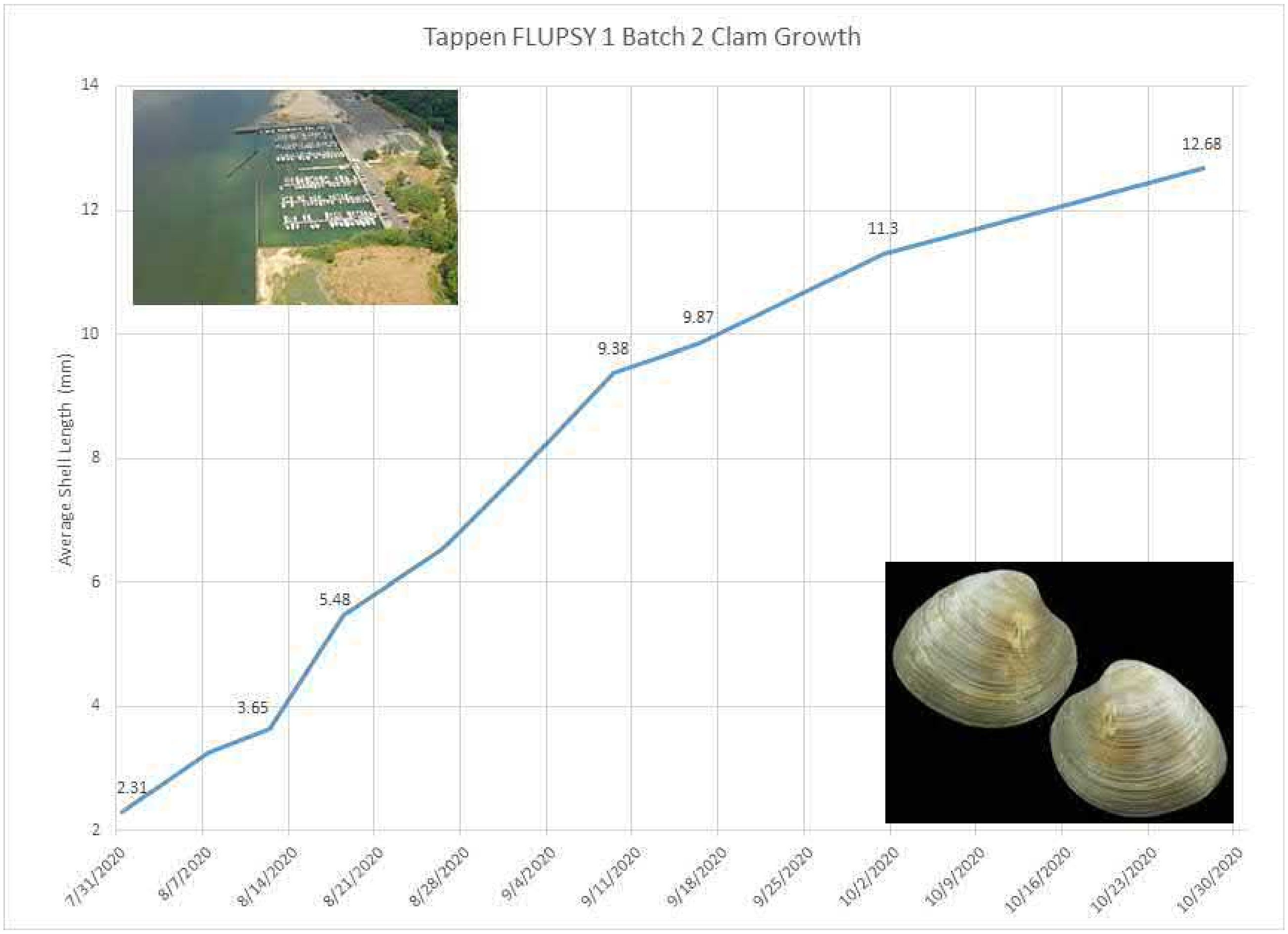


Figure 15. Clam growth for first FLUPSY from east side, R dock location

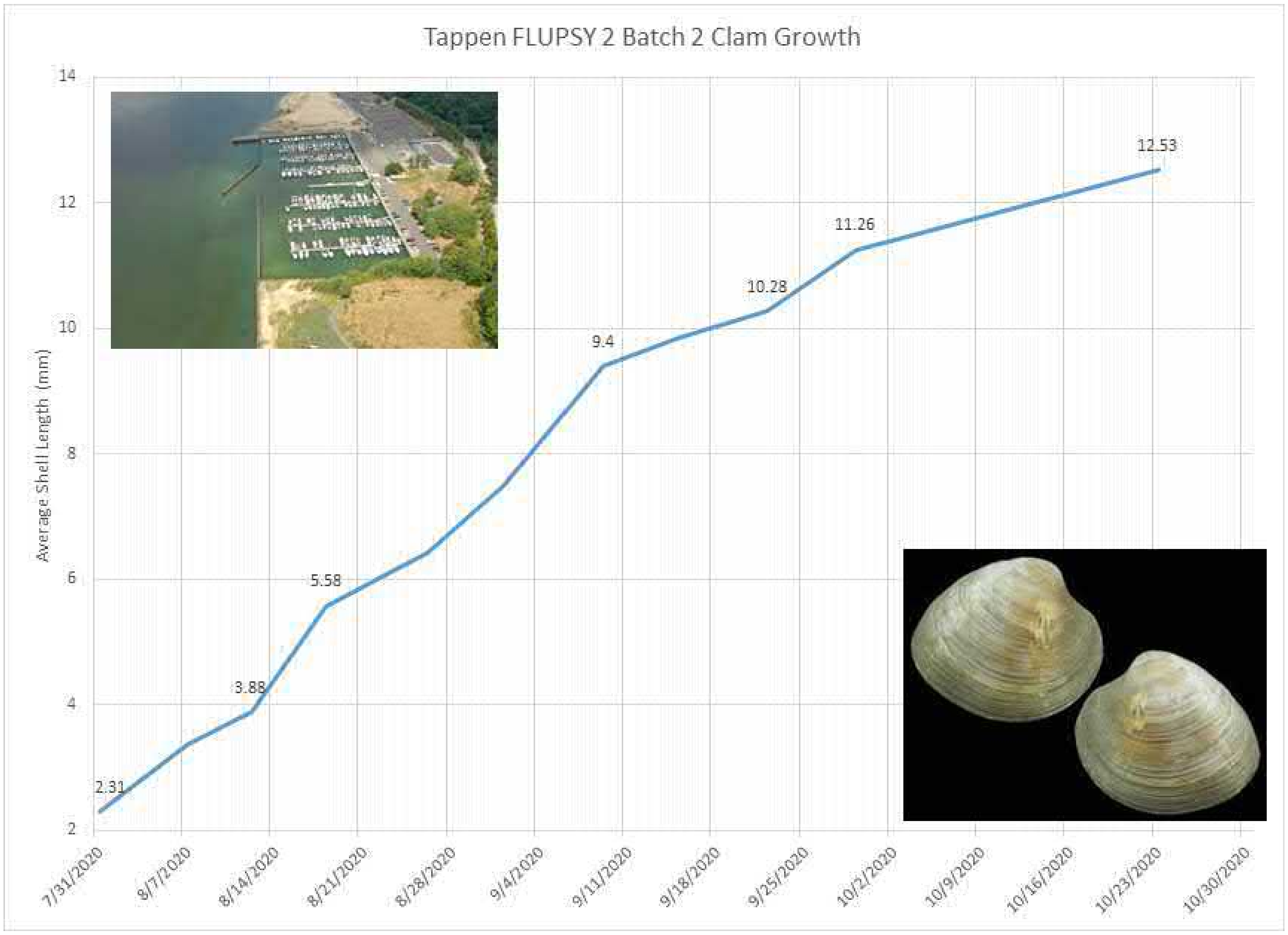


Figure 16. Clam growth for second FLUPSY from east side, R dock location

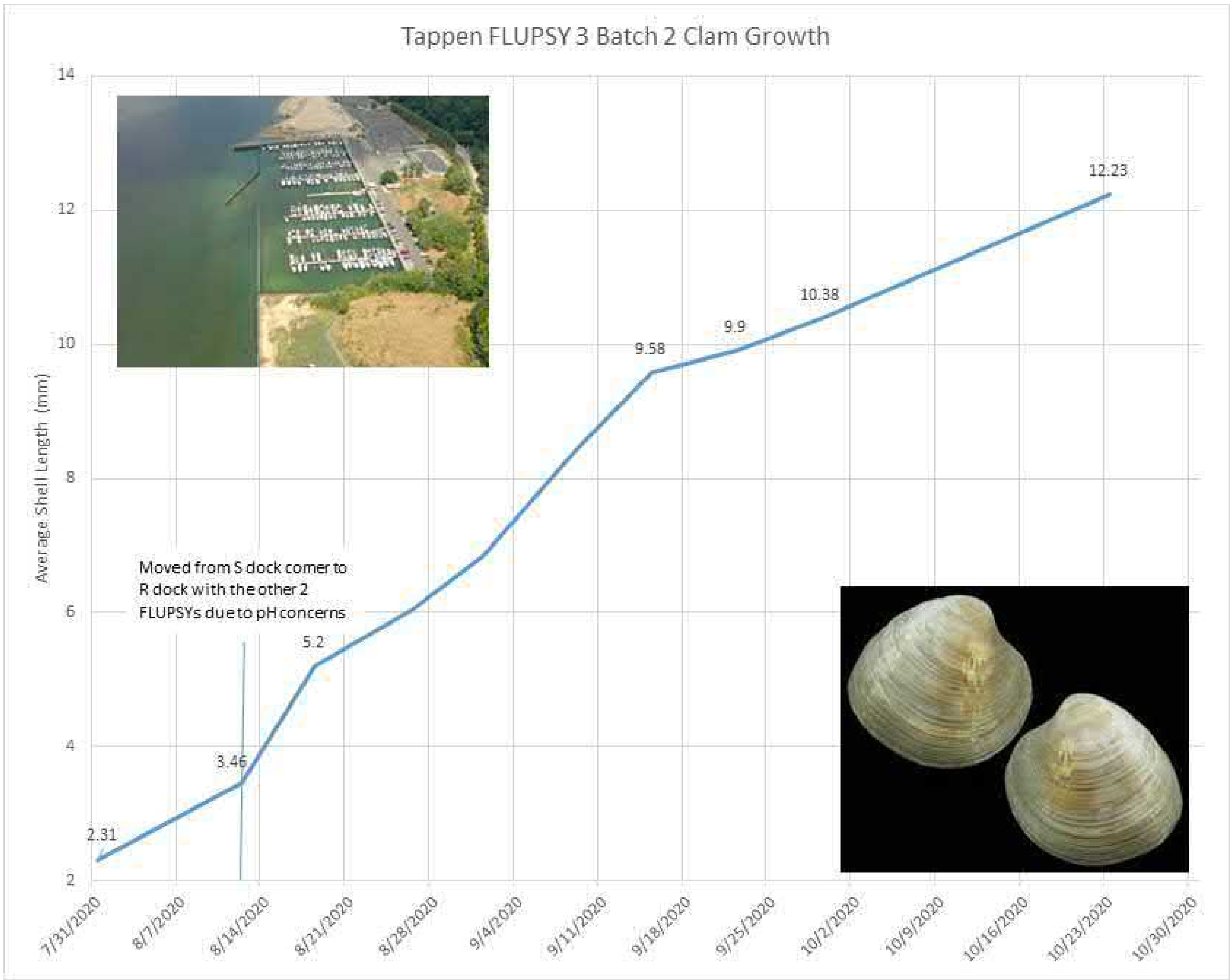


Figure 17. Clam growth for FLUPSY started at S dock, then moved to R dock in third position from east side

Credit: All growth charts provided courtesy of Environmental Resources Department, Town of Oyster Bay

Appendix F

2020 UWS Monitoring Data

Bottom samples (0.5 m off bottom)

Station	Date	Sample Depth (m)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	digital - Dissolved Oxygen (mg/L)	digital - Chlorophyll-a (ug/L)	filtered - Chlorophyll-a (ug/L)	Corrected Chlorophyll-a (ug/L)	Turbidity (NTU)
HEM01	6/23/20	2.83	19.98	25.36	83.80	6.67	78.53	100.77	2.84	0.40
HEM02	6/23/20	3.60	18.49	25.68	72.30	5.82	38.43	100.77	0.19	1.58
HEM03	6/23/20	2.96	19.88	25.50	104.40	8.38	38.60	100.77	0.19	1.62
HEM04	6/23/20	5.87	17.42	25.79	90.80	7.61	27.84	100.77	0.13	1.16
HEM05	6/23/20	8.19	16.16	25.88	82.20	7.09	15.51	100.77	0.06	2.74
HEM06	6/23/20	5.86	17.54	25.80	100.40	8.34	15.23	100.77	0.06	2.11
HEM01	7/8/20	2.98	21.42	25.58	36.20	2.84	56.42	49.00	0.21	2.79
HEM02	7/8/20	4.22	19.93	26.15	39.00	3.14	42.58	49.00	0.16	2.53
HEM03	7/8/20	3.16	21.08	25.93	68.60	5.40	27.05	49.00	0.10	1.70
HEM04	7/8/20	7.27	19.61	26.16	61.20	4.96	66.50	49.00	0.25	3.30
HEM05	7/8/20	8.39	19.46	26.26	80.60	6.54	32.40	49.00	0.12	2.39
HEM06	7/8/20	4.00	20.70	26.01	76.50	6.09	16.25	49.00	0.06	2.36
HEM01	7/21/20	2.59	25.13	25.50	84.70	6.22	43.95	33.72	21.03	4.50
HEM02	7/21/20	3.58	24.73	25.79	86.00	6.35	22.64	33.72	10.85	3.45
HEM03	7/21/20	2.74	24.88	25.80	110.30	8.13	14.94	33.72	7.16	2.10
HEM04	7/21/20	5.49	20.45	26.50	23.20	1.84	7.81	33.72	3.76	1.66
HEM05	7/21/20	8.21	19.99	26.62	39.80	3.19	8.66	33.72	4.16	1.70
HEM06	7/21/20	5.56	21.39	26.23	30.70	2.40	10.45	33.72	5.02	1.77
HEM01	8/6/20	2.97	23.34	26.18	48.90	3.70	27.30	26.80	12.34	4.30
HEM02	8/6/20	3.85	22.71	26.60	44.40	3.39	32.21	26.80	14.62	1.88
HEM03	8/6/20	3.00	23.32	26.53	65.10	4.92	32.43	26.80	14.72	2.25
HEM04	8/6/20	5.35	22.62	26.60	66.10	5.06	27.01	26.80	12.20	1.40
HEM05	8/6/20	8.80	22.53	26.58	67.70	5.18	13.11	26.80	5.76	2.61
HEM06	8/6/20	5.75	22.58	26.66	71.80	5.49	20.07	26.80	8.99	1.85
HEM01	8/20/20	2.92	23.60	25.98	60.90	4.59	33.55	21.95	12.22	5.52
HEM02	8/20/20	3.76	23.83	26.21	59.60	4.47	27.86	21.95	10.07	4.49
HEM03	8/20/20	2.55	23.84	26.25	81.80	6.13	33.47	21.95	12.19	2.18
HEM04	8/20/20	5.51	23.79	26.57	86.80	6.51	23.21	21.95	8.31	2.51
HEM05	8/20/20	8.10	23.73	26.59	84.10	6.31	21.24	21.95	7.57	4.13
HEM06	8/20/20	4.25	23.35	26.43	87.70	6.63	22.47	21.95	8.03	1.40
HEM01	9/4/20	2.50	23.77	26.03	54.10	2.50	34.89	9.21	22.30	3.88
HEM02	9/4/20	3.92	23.48	26.70	62.70	3.92	33.53	9.21	21.42	3.18
HEM03	9/4/20	3.04	23.80	26.58	84.20	3.04	30.43	9.21	19.43	2.85
HEM04	9/4/20	7.25	23.33	26.78	88.90	7.25	24.66	9.21	15.73	3.82

2020 UWS Monitoring Data

Bottom samples (0.5 m off bottom) (continued)

Station	Date	Sample Depth (m)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	digital - Dissolved Oxygen (mg/L)	digital - Chlorophyll-a (ug/L)	filtered - Chlorophyll-a (ug/L)	Corrected Chlorophyll-a (ug/L)	Turbidity (NTU)
HEM05	9/4/20	8.36	23.29	26.84	73.30	8.36	17.00	9.21	10.81	3.54
HEM06	9/4/20	6.09	23.75	26.38	101.70	6.09	37.18	9.21	23.77	2.17
HEM01	9/17/20	2.46	21.12	26.36	82.90	6.53	32.88	7.52	62.34	5.07
HEM02	9/17/20	3.95	21.64	26.89	91.10	7.09	33.57	7.52	63.66	3.60
HEM03	9/17/20	3.22	21.76	26.94	99.50	7.72	32.55	7.52	61.71	2.15
HEM04	9/17/20	7.31	21.91	27.15	101.30	7.84	25.72	7.52	48.62	2.01
HEM05	9/17/20	9.04	22.26	27.23	84.50	6.49	16.50	7.52	30.94	2.47
HEM06	9/17/20	6.72	22.20	27.26	87.80	6.75	18.38	7.52	34.55	1.94
HEM01	9/29/20	3.83	20.35	27.40	72.00	5.68	21.24	39.72	11.70	3.58
HEM02	9/29/20	5.35	20.36	27.26	80.20	6.32	23.36	39.72	12.90	2.69
HEM03	9/29/20	4.43	20.46	27.09	88.00	6.93	25.82	39.72	14.29	2.21
HEM04	9/29/20	8.54	20.34	27.35	74.80	5.90	19.29	39.72	10.60	1.08
HEM05	9/29/20	10.14	20.40	27.68	76.90	6.05	12.60	39.72	6.82	3.48
HEM06	9/29/20	8.07	20.62	27.11	108.20	8.50	39.07	39.72	21.78	1.34
HEM01	10/15/20	3.85	17.47	26.53	86.60	7.28	24.75	10.85	16.49	3.63
HEM02	10/15/20	5.65	17.66	26.74	86.40	7.23	14.34	10.85	9.48	2.37
HEM03	10/15/20	4.64	17.71	26.68	105.00	8.78	16.10	10.85	10.67	1.96
HEM04	10/15/20	8.57	17.86	26.91	93.20	7.75	10.19	10.85	6.69	1.85
HEM05	10/15/20	10.28	17.80	26.98	94.80	7.89	9.52	10.85	6.24	2.02
HEM06	10/15/20	8.43	17.87	27.03	96.90	8.05	10.74	10.85	7.06	3.68

2020 UWS Monitoring Data

Surface Samples (0.5 m below surface)

Station	Date	Sample Depth (m)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	digital - Dissolved Oxygen (mg/L)	digital - Chlorophyll-a (ug/L)	filtered - Chlorophyll-a (ug/L)	Corrected Chlorophyll-a (ug/L)	Turbidity (NTU)
HEM01	6/23/20	0.50	20.51	24.97	84.70	6.74	92.25	100.77	0.47	3.36
HEM02	6/23/20	0.50	20.24	25.17	85.60	6.86	65.87	100.77	0.33	2.70
HEM03	6/23/20	0.50	21.40	25.25	115.60	9.18	21.65	100.77	0.10	1.08
HEM04	6/23/20	0.50	20.06	25.46	102.40	8.22	12.61	100.77	0.05	0.75
HEM05	6/23/20	0.50	20.81	25.47	106.60	8.49	10.31	100.77	0.03	0.74
HEM06	6/23/20	0.50	21.03	25.50	114.60	8.99	11.50	100.77	0.04	0.80
HEM01	7/8/20	0.50	21.54	21.54	38.10	2.98	68.09	49.00	0.25	2.98
HEM02	7/8/20	0.50	21.32	21.32	46.80	3.68	51.05	49.00	0.19	2.18
HEM03	7/8/20	0.50	21.76	21.76	75.10	5.88	33.09	49.00	0.12	1.91
HEM04	7/8/20	0.50	21.45	21.45	81.80	6.42	23.46	49.00	0.09	1.49
HEM05	7/8/20	0.50	21.28	21.28	94.70	7.48	23.31	49.00	0.09	0.90
HEM06	7/8/20	0.50	21.11	21.11	78.10	6.17	13.90	49.00	0.05	1.53
HEM01	7/21/20	0.50	25.07	25.20	86.50	6.34	32.34	33.72	15.48	4.65
HEM02	7/21/20	0.50	25.07	25.32	89.80	6.60	31.24	33.72	14.96	4.36
HEM03	7/21/20	0.50	25.15	25.37	106.10	7.81	15.86	33.72	7.60	1.92
HEM04	7/21/20	0.50	24.18	25.87	143.30	10.50	28.67	33.72	13.73	1.47
HEM05	7/21/20	0.50	23.95	25.98	121.20	9.01	37.05	33.72	17.73	1.92
HEM06	7/21/20	0.50	25.07	25.90	107.50	8.05	13.47	33.72	6.46	1.59
HEM01	8/6/20	0.50	23.43	25.90	52.00	3.93	29.87	26.80	13.53	3.35
HEM02	8/6/20	0.50	23.30	25.98	59.00	4.47	30.68	26.80	13.91	2.53
HEM03	8/6/20	0.50	24.03	25.90	72.40	5.42	33.38	26.80	15.16	4.12
HEM04	8/6/20	0.50	23.10	26.43	84.80	6.44	32.65	26.80	14.82	1.48
HEM05	8/6/20	0.50	22.92	26.50	92.40	7.04	24.77	26.80	11.17	1.13
HEM06	8/6/20	0.50	22.94	26.57	89.60	6.82	31.02	26.80	14.06	1.64
HEM01	8/20/20	0.50	23.44	25.65	79.40	6.02	24.10	21.95	8.65	4.30
HEM02	8/20/20	0.50	23.47	25.56	68.60	5.16	29.87	21.95	10.83	3.50
HEM03	8/20/20	0.50	23.77	25.89	96.30	7.17	32.98	21.95	12.01	2.54
HEM04	8/20/20	0.50	23.54	26.34	102.80	7.75	36.10	21.95	13.19	1.75
HEM05	8/20/20	0.50	23.57	26.40	108.20	8.15	30.19	21.95	10.95	1.68
HEM06	8/20/20	0.50	23.43	26.51	94.00	7.10	25.64	21.95	9.23	1.82
HEM01	9/4/20	0.50	23.70	25.52	57.80	4.34	23.41	9.21	14.93	4.57
HEM02	9/4/20	0.50	23.08	24.74	79.60	6.06	32.32	9.21	20.65	3.23
HEM03	9/4/20	0.50	23.56	23.68	92.40	7.03	47.48	9.21	30.38	4.33
HEM04	9/4/20	0.50	23.76	26.40	105.40	7.86	46.32	9.21	29.64	1.75
HEM05	9/4/20	0.50	23.54	26.63	67.00	5.01	19.80	9.21	12.61	1.57
HEM06	9/4/2020	0.50	24.00	26.42	106.70	7.93	51.60	7.52	33.03	2.09

2020 UWS Monitoring Data

Surface Samples (0.5 m below surface) (continued)

Station	Date	Sample Depth (m)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	digital - Dissolved Oxygen (mg/L)	digital - Chlorophyll-a (ug/L)	filtered - Chlorophyll-a (ug/L)	Corrected Chlorophyll-a (ug/L)	Turbidity (NTU)
HEM01	9/17/20	0.50	21.09	26.38	90.10	7.11	32.07	7.52	60.79	6.03
HEM02	9/17/20	0.50	21.09	26.34	94.00	7.41	28.48	7.52	53.91	2.42
HEM03	9/17/20	0.50	21.69	26.73	100.30	7.81	43.71	7.52	83.10	2.01
HEM04	9/17/20	0.50	21.91	27.15	99.30	7.68	22.50	7.52	42.45	1.80
HEM05	9/17/20	0.50	22.26	27.27	84.50	6.48	12.94	7.52	24.12	1.73
HEM06	9/17/20	0.50	22.19	27.24	95.00	7.28	17.73	7.52	33.30	1.84
HEM01	9/29/20	0.50	20.47	26.84	90.10	7.11	38.19	39.72	21.28	1.92
HEM02	9/29/20	0.50	20.56	26.90	97.00	7.64	52.02	39.72	29.10	1.31
HEM03	9/29/20	0.50	20.55	26.73	101.50	8.00	56.51	39.72	31.64	1.26
HEM04	9/29/20	0.50	20.42	27.17	98.60	7.77	31.19	39.72	17.32	0.71
HEM05	9/29/20	0.50	20.72	27.13	101.30	7.94	20.88	39.72	11.50	0.49
HEM06	9/29/20	0.50	20.65	27.07	107.50	8.44	33.52	39.72	18.64	1.07
HEM01	10/15/20	0.50	16.64	25.64	87.60	7.52	15.03	10.85	9.95	2.33
HEM02	10/15/20	0.50	16.83	25.68	97.30	8.32	18.56	10.85	12.32	4.64
HEM03	10/15/20	0.50	16.80	25.57	102.10	8.75	19.78	10.85	13.14	1.47
HEM04	10/15/20	0.50	17.56	26.71	96.00	8.05	12.07	10.85	7.95	1.26
HEM05	10/15/20	0.50	17.48	26.77	98.20	8.24	10.00	10.85	6.56	1.15
HEM06	10/15/20	0.50	17.45	26.77	98.90	8.28	7.99	10.85	5.21	1.85

2020 UWS Monitoring Data

Mid-Depth Samples (if total depth > 10 m)

Station	Date	Sample Depth (m)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	digital - Dissolved Oxygen (mg/L)	digital - Chlorophyll-a (ug/L)	filtered - Chlorophyll-a (ug/L)	Corrected Chlorophyll-a (ug/L)	Turbidity (NTU)
HEM05	10/15/20	5.39	17.79	26.96	93.20	7.76	9.26		6.06	1.60

Appendix G

Coalition to Save Hempstead Harbor

FUSS & O'NEILL

Hempstead Harbor Water-Quality Monitoring
2020 Data Usability Assessment

1.1 Background

The Coalition to Save Hempstead Harbor (CSHH) oversees a routine water-monitoring program for 21 stations, including 10 “in-harbor stations” and 11 “outfall stations,” to document water quality conditions and pollutant sources in Hempstead Harbor and its watershed and to support local municipal, county, and state-level water resource management decisions. In-harbor water-quality monitoring includes measuring parameters related to the ecological health of the harbor and sample collection to measure nitrogen and bacteria levels. The outfall-monitoring program involves identifying critical areas of pathogen loading in the harbor. Sampling begins in May and continues until the end of October. In 2020, however, the beginning of the monitoring season was delayed until June due to the COVID-19 pandemic.

The monitoring data are used by the Coalition to Save Hempstead Harbor, Hempstead Harbor Protection Committee, Nassau County Department of Health, Nassau County Department of Public Works, the Interstate Environmental Commission, the New York State Department of Environmental Conservation, the Connecticut Department of Energy and Environmental Protection, Long Island Sound Study, other nongovernmental/environmental organizations, and the communities surrounding Hempstead Harbor.

The monitoring program helps assess the impact of watershed management improvements on the harbor, collects data to supplement agency data for beach closure and shellfish monitoring, and tracks the impact of environmental policy in the watershed communities. The data are used to produce an annual report for CSHH and local municipal members of the Hempstead Harbor Protection Committee to:

- Identify and study seasonal-scale trends in water quality
- Monitor aquatic habitats
- Identify causes for negative events (e.g., algal blooms and fish kills)
- Investigate long-term trends in water-quality parameter levels
- Guide municipal, county, and state-level environmental planning, policy, and compliance efforts (e.g., Phase II Stormwater Program, TMDL development, the Long Island Nitrogen Action Plan, and the Long Island Sound Nitrogen Reduction Strategy)
- Measure progress towards meeting water-quality goals in the watershed
- Determine whether the opening of additional shellfish-harvesting areas within the harbor is feasible
- Identify pathogen sources for targeting pathogen-load reduction efforts

1.2 Planning—Quality Assurance Project Plan

CSHH conducted water-quality monitoring under an EPA-approved Quality Assurance Project Plan (QAPP) for the 2020 water-quality monitoring season, which served as the main quality assurance planning project document. The updated QAPP was approved in 2020. The QAPP and its appendices (equipment calibration procedures, standard operating procedures, etc.) were made available to all project personnel, including the Quality Assurance (QA) Manager, QA Officer, Project Manager/Field Team Leader, and Field Samplers. Copies of the QAPP and related quality assurance documentation are retained for recordkeeping and for future reference.

1.3 Sampling

Prospective Field Samplers (staff, volunteers, and/or municipal employees) met with the Program Manager/Field Team Leader regarding the monitoring program. Individuals who conducted sampling received formal training, which included review and discussion of the QAPP and sampling SOPs (sample collection procedures, sample handling and labeling, potential safety hazards, and equipment maintenance, inspection, and calibration) before collecting water-quality samples. These individuals adhered to the sampling design outlined in the sampling SOPs throughout the duration of sample collection. The Project Manager/Team Leader periodically monitored field activities, which included reviewing sampling procedures and field data sheets, to ensure compliance with sampling SOPs.

Any deviations from typical sampling (e.g., missed samples due to weather or tidal conditions) were recorded in field notes. Aside from missing sampling events due to weather/other events, deviations of consequence included: a delayed start of the monitoring season due to COVID-19 and delayed monitoring at CSHH #8 due to concerns relating to the sewage treatment plant and the spread of COVID-19. Information from field data sheets was recorded electronically following sampling events. Data entry was conducted by two CSHH members, and the electronic copy of the data was immediately checked against the field data sheet. The QA Officer also compared field data forms with electronic records to ensure accuracy at least once per month. A field audit was conducted at least once per season by the Project Manager/Field Team Leader and consisted of overseeing sampling procedures. An equipment maintenance audit was conducted at least once over the monitoring season by the Project Manager/Field Team Leader and consisted of overseeing precheck, post check, and calibration procedures. Any deficiencies were reported to the QAPP Manager. Physical copies of the field data sheets are kept for at least five years in the annual logbook at the CSHH office. Equipment and instruments were calibrated within 24 hours before sampling based on user manual guidelines—calibration records for field equipment were also maintained and kept for future reference. Post-checks of equipment were also conducted immediately following sampling events.

Both vertical profiles and grab samples were collected. Vertical profiles were taken at up to 13 stations to measure the following field parameters: dissolved oxygen, water temperature, salinity, pH, and turbidity, as well as chlorophyll a (for frame-of-reference purposes). Results were not confirmed by a fixed laboratory, but a LaMotte 5860-01 kit (Winkler Titration), a LaMotte 5858-01 kit, and a calibrated thermometer were used at one location per sampling event to confirm the validity of the Eureka Manta+ 35 results for dissolved oxygen (bottom), pH, and water temperature, respectively. Grab samples were collected at up to 21 stations weekly for bacteria analysis, for both fecal coliform and enterococci. Also, grab samples were collected at up to 10 stations biweekly for nitrogen analysis to measure total Kjeldahl nitrogen, ammonia, nitrite, and nitrate. Two NYS DOH ELAP certified laboratories were used for sample analysis: the Nassau County Department of Health laboratory for bacteria analysis and the Pace Analytical Services, LLC laboratory for nitrogen analysis.

1.4 Analysis

Analytical procedures were adhered to as outlined in the project planning documents. The Project Manager/Field Team Leader completed data review during or soon after monitoring events and unusual values were flagged (e.g., missing values, or unexpectedly large or small values) in the data. The cause of the data deficiency was determined and a decision was made on the usability of the data, which was then either accepted, marked as conditional, or discarded. The QA Officer then reviewed the data for usability according to data quality objectives. Additionally, laboratory deliverables were reviewed by the Project Manager/Field Team leader and met the project requirements outlined in the QAPP.

1.5 Review of Data and Data Deliverables

The QAPP outlined data quality indicators including precision, bias/accuracy, representativeness, comparability, completeness, and sensitivity for each parameter measured. The results of data collection were reviewed at least once per month by the QA Officer to ensure accuracy. Laboratory data deliverables were reviewed by the Project Manager/Field Team Leader for adherence to the project measurement quality objectives outlined in the QAPP. Data were reviewed and validated as outlined in the QAPP. In lieu of data review or validation reports, notes on the validity of the data were included in comments in the data sheet (e.g., marking data as conditional or flagging seemingly high values that were still deemed accurate).

1.6 Project Oversight

Performance evaluation samples were not required for this project. A duplicate sample was taken for approximately one in every 10 samples to confirm the results of field and fixed laboratory analysis. The duplicate field samples were analyzed for the same parameters as the corresponding primary samples. As with other samples, proper sample handling and custody procedures were followed for delivery of samples to the lab. Laboratory-reported results for primary and Field QC samples were within project acceptance limits.

1.7 Data Usability Assessment

Table 1 and **Table 2** summarize acceptance criteria for accuracy, precision, and sensitivity of specific field and laboratory monitoring parameters.

Table 1: Acceptance Criteria for Field Monitoring Parameters

Parameter	Units	Accuracy	Precision (allowable RPD)	Approximate Expected Range	Sensitivity
Depth (calibrated line)	meters (m)	± 0.1 m	20%	0 – 12 m	0.1 m
Depth (Eureka Manta+ 35)	meters (m)	0 to 10 m ±0.02 (±0.2% of FS) 0 to 25 m ±0.05 (±0.2% of FS) *FS=Full Scale*	20%	0 – 12 m	0.01 m
Air/Water Temperature (digital thermometer)	degrees Celsius (°C)	± 1 °C	10%	-15 – 36 °C	0.1°C
Water Temperature (Eureka Manta+ 35)	degrees Celsius (°C)	± 0.1 °C	10%	4 – 26 °C	0.01 °C
Salinity (Eureka Manta +35)	pss/ppt	±1% of reading ±0.1 ppt	10%	5 – 30 ppt	4 digits
Dissolved Oxygen (LaMotte 5860-01), Winkler titration method)	milligrams per liter (mg/L) = parts per million (ppm)	±0.2 ppm	10%	0 –14 ppm	0.2 ppm
Dissolved Oxygen (Eureka Manta+ 35)	milligrams per liter (mg/L) = parts per million (ppm);	0 to 20 mg/l ± 0.2 mg/l 20 to 50 mg/l ± 10% reading	20%	0 – 14 mg/L	0.1 mg/L

Parameter	Units	Accuracy	Precision (allowable RPD)	Approximate Expected Range	Sensitivity
(continued) Dissolved Oxygen (Eureka Manta+ 35)	percent saturation (% sat.)	0 to 200% sat. ±1% of reading or ±0.1 % sat. 200 to 500% sat. ±10% of reading	20%	0 – 120 % sat.	0.1 % sat.
Turbidity (Eureka Manta+ 35)	NTU	0 to 400 NTU ± 1% of reading ± 1 count	20%	0 – 30 NTU	4 digits
Water Clarity (Secchi disk)	m	±0.1	10%	0 – 4 m	0.1 m
pH (LaMotte 5858 wide-range indicator)	N/A	5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0, 10.5	(color metric)	6.5 – 8.5	0.5
pH (Eureka Manta +35)	N/A	± 0.2	5%	6.5 – 8.5	0.01

Table 2: Acceptance Criteria for Laboratory Monitoring Parameters

Parameter	Method	Reporting limit	Accuracy	Precision
Fecal Coliform	Membrane Filter, SM 9222 D-2006	<1 CFU/100mL	± 20	20%
Enterococci	Membrane Filter, EPA 1600	<1 CFU/100mL	± 20	20%
Total Kjeldahl Nitrogen	EPA 351.2 Rev. 2.0	<0.10 mg/L	± 20	20%
Ammonia	EPA 350.1 Rev 2.0	<0.10 mg/L	± 20	20%
Nitrate	EPA 353.2 Rev. 2.0	<0.050 mg/L	± 20	20%
Nitrite	EPA 353.2 Rev. 2.0	<0.050 mg/L	± 20	20%

Precision

- Duplicate field measurements were taken for one station per sampling day at the first in-harbor station sampled (representing approximately 10% of all samples) for 19 sampling events.
- Relative percent difference (RPD), as outlined in **Table 1** and **Table 2**, was used as precision acceptance criteria. RPD was calculated as follows:

$$RPD = \frac{|Conc(p) - Conc(d)|}{(1/2)(Conc(p) + Conc(d))} * 100$$

where:

Conc(p) = Primary Sample Concentration, the first sample collected at that location
Conc(d) = Duplicate Sample Concentration, the second sample collected at that location

- **Table 3** summarizes the results of the precision acceptance criteria for primary samples and their corresponding duplicate samples for parameters analyzed in the field. No duplicate measurements were recorded for water clarity (secchi disk) or air temperature for any of the 19 duplicate samples. Laboratory QA/QC was reviewed by CSHH as lab results were received to ensure that all results fell within acceptable limits defined for precision criteria.

Table 3: Summary of Precision Acceptance Criteria Results

Parameter	Precision (RPD)	Number of sampling events outside precision criteria	Dates (RPD value for each date)
Water Temperature (surface)	10%	0	N/A
Water Temperature (bottom)	10%	0	N/A
Salinity (surface)	10%	0	N/A
Salinity (bottom)	10%	0	N/A
Dissolved Oxygen (surface)	20%	5	7/1 (42%), 7/15 (21%), 7/29 (27%), 8/7 (26%), and 8/12 (22%)
Dissolved Oxygen (bottom)	20%	2	7/1 (22%) and 8/12 (28%)
pH (surface)	5%	0	N/A
pH (bottom)	5%	0	N/A
Turbidity (top)	20%	1*	10/1 (21%)
Turbidity (bottom)	20%	4*	7/15 (22%), 7/29 (37%), 10/7 (22%), and 10/28 (59%)
Depth	20%	0	N/A

*Only 18 duplicate samples (no duplicates for turbidity on 9/9/20)

Accuracy

- Field-measurement accuracy was assessed by performing calibrations and post-checks of the field monitoring equipment the day prior to and the day of monitoring events, respectively. The Eureka Manta+ 35 was calibrated according to procedures outlined in the user manual. Each parameter was successfully calibrated as per the sensor response factor (SRF) indicated by the instrument. Calibration records are logged and maintained by CSHH and are available upon request. Quality control checks of the equipment were performed at the first monitoring station visited, generally CSHH #1, by completing the following checks:
    - Comparing DO results from the Eureka Manta+ 35 to a result obtained via Winkler titration.
    - Comparing pH results from the Eureka Manta+ 35 to a result obtained via LaMotte wide-range color-comparator.
    - Comparing water temperature results from the Eureka Manta+ 35 to a result obtained via calibrated electronic thermometer.
- Laboratory accuracy was evaluated from laboratory control samples (trip blanks) and surrogate samples, published historical data, method validation studies, and experience with similar samples. No laboratory control samples were flagged for contamination or for being outside of standards.
- Parameter-specific acceptance criteria for accuracy are summarized in **Table 1** and **Table 2**.

Representativeness of the Data

- Sampling sites were selected to be representative of the conditions for a specific area of the water body (or a specific pollution source).
- Outfall pathogen monitoring stations were not representative of estuarine water quality but are considered representative of conditions in areas within close proximity to fresh water inflow and/or similar pollutant loadings.
- Sample-collection timing and frequency at in-harbor stations were chosen to capture data that were representative of a range of conditions (e.g., wet/dry weather, rising/ebb tide, and seasonal variability).

Comparability of the Data

Established field protocols were used for vertical profiles and sampling, and standard laboratory analytical methods were used for sample analysis, consistent with previous CSHH water-quality monitoring events. Vertical profiles were performed and samples were collected generally on the same day of the week and at the same time of day.

Completeness of the Data

Data were collected for 19 monitoring events for vertical profiles, 13 events for nitrogen grab samples, and 24 events for bacteria grab samples (including monitoring events on 6/10, 6/25, and 7/8, during which vertical profiles were not performed, but bacteria sampling was conducted due to logistics of monitoring during COVID pandemic). The goal was to collect data for at least 80% of the anticipated vertical profiles and the anticipated number of grab samples (for in-harbor and outfall bacteria and nitrogen monitoring) for each monitoring event.

- Six stations (#4-7, #14, and #15) were difficult to consistently access due to varying tidal cycles. Failure to collect sampling data at these sites does not affect the completeness of the data. It was anticipated that the monitoring sites would be accessible a minimum of once every three to four weeks (an average of at least five times) over the 19 event monitoring season. This goal was met, as each station was sampled at least eight times during the sampling period.
- Data collection was evaluated for completeness for vertical profiles, which included the following parameters: water temperature, salinity, dissolved oxygen, pH, water clarity, and turbidity. All sampling events met or exceeded the 80% completeness criterion.
- Data collection was evaluated for completeness with respect to grab samples for bacteria and nitrogen sampling.
    - Data collection for stations #1-3, #8-13, #14A, #15A, #16-17, and #17A was evaluated for completeness for the following parameters: fecal coliform and enterococci. All sampling dates exceeded the 80% acceptance criterion. [1]
    - Data collection for stations #1, #3, #6-8, #12-13, #14A, #15A, and #16 was evaluated for completeness for the following parameters: total Kjeldahl nitrogen (TKN), ammonia, nitrate, and nitrite. All sampling days met or exceeded the 80% acceptance criterion for sample collection except for 7/1 (78%), 9/9 (70%), 10/22 (70%[2]), and 10/28 (30%).

Sensitivity of the Data

- Sensitivity limits were determined by the laboratory analytical method or the field instrument (from published specifications). The sensitivity limits for each parameter measured in the field are outlined in **Table 1**.
- Laboratory analytical methods have preset limits of detection for fecal coliform, enterococci, ammonia, nitrate, nitrite, and total Kjeldahl nitrogen, as outlined in **Table 2**.

Conclusion: A majority of sampling events met the completeness goal outlined in the QAPP. Procedures were in place to ensure accuracy, precision, representativeness, and comparability of the data. Additionally, there are annotations in the data—color-coded notes indicating data where values appear low/high but have been validated for accuracy, as well as field notes indicating reasons for missing data—which provide additional detail on data quality for consideration when analyzing the data. Although deviations from the precision acceptance and completeness criteria should be noted and considered when analyzing the data, the data collected by the Coalition to Save Hempstead Harbor during the 2020 water-quality monitoring season can be considered appropriate for use for its intended purposes.

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[1] Sample collection at CSHH #8 was delayed due to the potential risk of aerosolized spread of COVID-19 from the sewage treatment plant discharge. Testing began on 8/7/20, and therefore samples before this date do not include CSHH #8 in completeness calculations.

[2] This includes the two samples for CSHH #14A and CSHH #15A from 10/21.

Appendix H

Coalition to Save
Hempstead Harbor

Water-Monitoring Data Sheet, Core Program

Collection Date: Wed. other ______________ ___/___ /2020 **Time**: ______________

GPS Land Reference: ____ **BP:** _________ **Depth:** _______

Monitor Name: Carol DiPaolo, Mark Ring, Michelle L. McAllister, _____________________________________

Site Name: CSHH #1, Beacon 11 ____________________________ **Location**: Hempstead Harbor

Weather: fog/haze drizzle intermittent rain rain snow clear partly cloudy

% Cloud Cover: 0% 25% 50% 75% 100% other _________

Wind Direction: N NE NW S SE SW E W Velocity: _______kt (mph)

			Date	Amount
Rainfall:	Previous 24 hrs accumulation	_____.__mm	_________	_________
	Previous 48 hrs accumulation	_____.__mm	_________	_________
	Previous week’s accumulation	_____.__mm	_________	_________

Tidal Stage: ☐ incoming ☐ outgoing ☐ hours to high tide: _______ H:________ L:________

Water Surface: ☐ calm ☐ ripple ☐ waves ☐ whitecaps

Water Color: ☐ normal: ☐ brown ☐ green ☐ other __________________________
☐ abnormal: ☐ brown ☐ green ☐ other __________________________

Water Observations: ☐ jelly fish ☐ dead fish ☐ dead crabs ☐ algal bloom
☐ odors ☐ sea weed ☐ bubbles ☐ foam
☐ oil slick ☐ floatables ☐ ice ☐ turbidity (suspended particles)
☐ other____

Comments____
____
____
____

Plankton count ________ type ________ sample taken: ☐ surface ☐ ______ below surface

Human Activities

☐ Barges/tugs, Pt. W. gravel op. _________________ Gladsky _________________ Raison ___________________
DiNapoli __________________ Global/fuel ______________ other _________________________
☐ Boats: power ______ sailboats ______kayaks _____ crew _____ shellfishing _______________________ near Matinecock Pt._____ Webb Inst._____ other____________
☐ Anglers, at beaches _________________________________ at piers _________________________________

☐ Other ____

Floatables Observations (type, approximate number …)

☐ Bottles, glass ______ plastic ______ ☐ Cans ______ ☐ Paper ______ ☐ Plastic bags/pieces ______other______
☐ Styrofoam, cups _______pieces ______ ☐ Wood, boards ______ pieces ___________ other________________
☐ Other ____

Coalition to Save Hempstead Harbor

Water-Monitoring Data Sheet

Date: ____________

Station: ________________ GPS: 40.______________073.______________ Time: _________ Grab Samples: N____ B____

	Sample Depth (m)	Temp (°C)	Salinity (ppt)	DO		pH	Secchi (m)	Chlorophyll (ug/L)	Turbidity (NTU)
				(%)	(ppm)				
Wind	Surface								
_____	0.5								
	1								
	2								
Air °C	3								
_____	4								
	5								
Repeat	0.5								
	1								
	2								
	3								
	4								
	5								

Station: ________________ GPS: 40.______________073.______________ Time: _________ Grab Samples: N____ B____

	Sample Depth (m)	Temp (°C)	Salinity (ppt)	DO		pH	Secchi (m)	Chlorophyll (ug/L)	Turbidity (NTU)
				(%)	(ppm)				
Wind	Surface								
	0.5								
	1								
_____	2								
	3								
	4								
Air °C	5								
	6								
_____	7								
	8								
	9								
	10								
	11								

Station: _______________GPS: 40.______________073.______________ Time: _________ Grab Samples: N____ B____

	Sample Depth (m)	Temp (°C)	Salinity (ppt)	DO		pH	Secchi (m)	Chlorophyll (ug/L)	Turbidity (NTU)
				(%)	(ppm)				
Wind	Surface								
	0.5								
	1								
_____	2								
	3								
	4								
Air °C	5								
	6								
_____	7								
	8								
	9								
	10								
	11								

Note: Bottom depth of sampling represented here is not the total depth. Total depth includes an addition of 0.3 m, which is the distance from the depth sensor on the Eureka to the bottom of the platform. Total depth is reflected in the data entry Excel spreadsheet.

Water-Monitoring Data Sheet

Wildlife Observations

Date ____________

BIRDS

	Upper Harbor	Lower Harbor
☐ Cormorants	____________	____________
☐ Ducks, mallards	____________ ducklings ______	____________ ducklings ______
☐ Egrets, great	____________	____________
snowy	____________	____________
☐ Geese, Canada	____________ goslings ______	____________ goslings ______
brandts	____________	____________
☐ Gulls, hooded	____________	____________
☐ Herons, blue	____________	____________
night, green	____________	____________
☐ Kingfisher, belted	____________	____________
☐ Ospreys	____________	____________ chicks ______
☐ Plover-type, killdeer	____________	____________
☐ Swans, mute	____________ cygnets ______	____________ cygnets ______
☐ Other	____________	____________

JELLIES/JELLYFISH

☐ Comb, sea walnuts: CSHH stations ☐#1_____ ☐#2_____ ☐#3_____ ☐#4_____ ☐#5_____ ☐#6____ ☐#7_____

☐#8-10_____ ☐#11____ ☐#12___ ☐#13____________

sea gooseberries: CSHH stations ☐#1_____ ☐#2_____ ☐#3_____ ☐#4_____ ☐#5_____ ☐#6____ ☐#7_____

☐#8-10_____ ☐#11____ ☐#12____ ☐#13____________

☐ Lion's mane: CSHH stations ☐#1_____ ☐#2_____ ☐#3_____ ☐#4_____ ☐#5_____ ☐#6____ ☐#7__________

☐ Moon: CSHH stations ☐#1_____ ☐#2_____ ☐#3_____ ☐#4_____ ☐#5_____ ☐#6____ ☐#7__________

FISH

☐ Baitfish ____________

☐ Blue ____________

☐ Bunker ____________

☐ Striped bass ____________

☐ Small shrimp ____________

CRABS

☐ Asian shore ____________

☐ Blue-claw ____________

☐ Horseshoe ____________

OTHER ____________

____

____

Hempstead Harbor Core Program
Calibration Datasheet Eureka Manta+ 35

• Calibrations to be completed **DAY BEFORE** or **MORNING OF** Field Sampling Date •

• Post-Readings to be completed the **AFTERNOON OF** or **DAY AFTER** Field Sampling Date •

Calibrations • Person: ______________________________ **Date:** ______________________ **Time:** ____________________

Post-Readings • Person: ____________________________ **Date:** ______________________ **Time:** ____________________

Handheld S/N: 197407 **Sonde S/N:** MT04172710

◊ COMPLETE **BEFORE** SAMPLING ◊

① Fill cup with **AIR-SATURATED WATER** (Reagent Grade Water)

② Record **CHLOROPHYLL (µg/L)** reading in air-saturated water

Chl µg/L ••••

③ Calibrate **DISSOLVED OXYGEN (HDO%)**

Barometric Pressure (mmHg) •••••••

Pre-Calibration Reading

HDO% ••••

Post-Calibration Reading

SRF ••• HDO% •••

④ Calibrate **TURBIDITY • 2-Point Calibration**

→1st Cal Value: ZERO (Reagent Grade Water)

Pre-Calibration Reading

Turbidity 0 NTU •••

→2nd Cal Value: NON-ZERO (Turbidity Standard)

Pre-Calibration Reading

Turbidity 100 NTU •••

Post-Calibration Reading

Turbidity **100 NTU** ••• SRF*•••

*SRF: Will need to look up in Cal Records

⑤ Calibrate **CONDUCTIVITY STANDARD (50,000 µS/cm)**

Pre-Calibration Reading

SpCond µS/cm •••

Post-Calibration Reading

SRF ••• SpCond µS/cm •••

*pH

⑥ Loosen cup to read **DEPTH (0 m)**

Pre-Calibration Reading

Depth m •••

Post-Calibration Reading

SRF ••• Depth m •••

◊ COMPLETE **AFTER** SAMPLING ◊

① Fill cup with **AIR-SATURATED WATER** (Reagent Grade Water)

Post-Readings

HDO %Sat ••• Chl µg/L •••

Turbidity 0 NTU •••

② Fill cup with **TURBIDITY STANDARD (100 NTU)**

Post-Reading

Turbidity 100 NTU •••

③ Fill cup with **CONDUCTIVITY STANDARD (50,000 µS/cm)**

Post-Reading

SpCond µS/cm ••••

*pH

④ Loosen cup to read **DEPTH (0 m)**

Post-Reading

Depth m •••

	Reagent Grade Water	**Turbidity Standard** 100 NTU	**Conductivity Standard** 50,000 µS/cm
Manufacturer	Ricca	YSI	YSI
Lot Number			
Expiration			

Accuracy Range Table	
HDO% (100%)	97 – 103
Chl *a* (0 µg/L)	-0.30 – 0.30
Turbidity (0 NTU)	-3.00 – 3.00
Turbidity (100 NTU)	97.0 – 103.0
SpCond (50,000 µS/cm)	48,500 – 51,500
Depth (0 m)	-0.1 – 0.1

GPS of reference station: (circle one) [✓ **NAD-83**] **WGS-84**

• within 2 days of sampling day • in decimal degrees •

Lat.:	**Long.:**

*See page 2 for pH calibration checks.

Sonde Calibration Datasheet

Eureka Manta+ 35

♦COMPLETE **BEFORE** SAMPLING♦

5a. Calibrate **pH STANDARD • 2-Point Calibration**

Pre-Calibration Reading

➔ **1st Cal Value: pH 7 •••**

➔ **2nd Cal Value: pH 10 •••**

Post-Calibration Reading

➔ **2nd Cal Vaue: pH 10 •••**

SRF •••

♦COMPLETE **AFTER** SAMPLING♦

Post-Readings

3a. Fill cup with **pH STANDARD**

➔ **1st Cal Value: pH 7 •••**

➔ **2nd Cal Value: pH 10 •••**

	pH 7 Standard	**pH 10 Standard**
Manufacturer	LaMotte	LaMotte
Lot Number		
Expiration		

Change pH reference standard monthly.

Date of pH reference standard replacement:

____

Accuracy Range Table	
pH 7	6.8 – 7.2
pH 10	9.8 – 10.2

Hempstead Harbor Core Program
Calibration Datasheet YSI ProPlus

• Calibrations to be completed **DAY BEFORE** or **MORNING OF** Field Sampling Date •

• Post-Readings to be completed the **AFTERNOON OF** or **DAY AFTER** Field Sampling Date •

Calibrations • Person: ______________________________ **Date:** ______________________ **Time:** ____________________

Post-Readings • Person: ____________________________ **Date:** ______________________ **Time:** ____________________

Handheld S/N: 14B104664 **Sonde S/N:** 18M100228

◊ COMPLETE **BEFORE** SAMPLING ◊

① Calibrate **CONDUCTIVITY STANDARD (50,000 µS/cm)**

Pre-Calibration Reading

SpCond µS/cm ···

Post-Calibration Reading

SpCond µS/cm ···

② Calibrate **pH • 2-Point Calibration**

Pre-Calibration Reading

→ 1st Cal Value: pH 7 • • •

→ 2nd Cal Value: pH 10 • • •

Post-Calibration Reading

pH 10 • • •

③ Calibrate **DISSOLVED OXYGEN (HDO%)** with **WATER-SATURATED AIR** (Reagent Grade Water)

- place a small amount of clean water (1/8 inch) in the storage cup
- make sure there are no water droplets on the DO membrane or temperature sensor
- screw the cap back on, disengage one or two threads to ensure atmospheric venting (make sure the DO and temperature sensors are not immersed in water)
- wait approximately 10 minutes for the storage container to become completely saturated

Barometric Pressure (mmHg) ·······

Pre-Calibration Reading

HDO% ···

Post-Calibration Reading

HDO% ···

☐ DO cap changed (once per month); follow instructions on pg. 21 of YSI Professional Plus User Manual

◊ COMPLETE **AFTER** SAMPLING ◊

① Fill cup with **CONDUCTIVITY STANDARD (50,000 µS/cm)**

Post-Reading

SpCond µS/cm • • •

② Fill cup with **pH 7.00 Standard**

Post-Reading

pH 7.00 • • •

③ Fill cup with **pH 10.00 Standard**

Post-Reading

pH 10.00 • • •

④ Follow WATER-SATURATED AIR procedure on left

Post-Reading

HDO% • • •

	Conductivity Standard 50,000 µS/cm	pH 7 Buffer	pH 10 Buffer	Reagent Grade Water
Manufacturer				
Lot Number				
Expiration				

Accuracy Range Table	
SpCond (50,000 µS/cm)	48,500 – 51,500
pH 7	6.8 – 7.2
pH 10	9.8 – 10.2
HDO% (100%)	97.0 – 103.0

GPS of reference station: (circle one) [✓ **NAD-83**] **WGS-84**

• within 2 days of sampling day • in decimal degrees •

Lat.: **Long.:**

Nassau Co. DOH PHL 209 Main Street Hempstead, NY 11550	FORM NAME: COALITION TO SAVE HEMPSTEAD HARBOR □ QC □ Equip Maint □ Training □ Comp Doc ☑ Other		
LABORATORY SECTION □ Chemistry ☑ Environmental Microbiology □ Clinical Microbiology	Form. No.: Beach Monitoring Daily Sampling Log - 1	Rev: 2	
	Date: 4/8/2011	Created By: CONNIE IANNUCCI	

Beach Monitoring Daily Sampling Log

COALITION TO SAVE HEMPSTEAD HARBOR

Elap ID
#10339

NASSAU COUNTY DEPARTMENT OF HEALTH
DIVISION OF Public HEALTH LABORATORIES
209 MAIN STREET, HEMPSTEAD, NY 11550
THOMAS EDWARDS, LEAD TECHNICAL DIRECTOR; CONNIE IANNUCCI, MICROBIOLOGY TECHNICAL DIRECTOR TELEPHONE (516) 572-1202 FAX (516) 572-1206

Michelle Lapinel McAllister
COLLECTOR'S NAME **DATE**

ALL SAMPLES SUBMITTED IN STERILE POLYSTYRENE VESSELS CONTAINING SODIUM THIOSULFATE (UNLESS OTHERWISE SPECIFIED)

Field No.	**Area No.**	**Point No.**	**Sample Type**	**Location**	**Time**	**Temperature**		**Wind**	**Weather**	**Wave Height**	**Laboratory Use Only**			
						Air	**Water**				**Lab Number**	**Fecal Coliforms CFU/100 mL**	**Enterococci CFU/100 mL**	**Comments**
CSHH-1	10		5	BEACON ELEVEN										
CSHH-2	10		5	BELL BUOY 6										
CSHH-3	10		5	RED MARKER GLEN COVER CREEK										
CSHH-4	10		5	BAR BEACH SPIT										
CSHH-5	10		5	MOTT'S COVE										
CSHH-6	10		5	EAST OF FORMER TNH INCINERATOR										
CSHH-7	10		5	BRYANT LANDING										
CSHH-8	10		5	GLEN COVE STP										
CSHH-9	10		5	FIRST PIPE WEST OF STP OUTFALL										
CSHH-10	10		5	PIPE AT CORNER OF SEAWALL WEST OF STP OUTFALL										
CSHH-11	10		5	50 YARDS EAST OF STP OUTFALL										
CSHH-12	10		5	EAST OF STP OUTFALL BY BEND IN SEAWALL										
CSHH-13	10		5	60 FEET WEST OF MILL POND WEIR										
CSHH-1A	10		5											

COMMENTS/REMARKS

***ESTIMATED COUNT**

REPORT TO: **RECREATIONAL FACILITIES**
200 COUNTY SEAT DRIVE
MINEOLA, NY 11501

TNTC = "TOO NUMEROUS TO COUNT"

DATA ENTRY PROOFED

TEST	**TECHNOLOGY**	**METHOD**
Fecal Coliform CFU/100 ml.	MF-QN	SM 9222 D-2006
Enterococci CFU/100 ml	MF-QN	EPA 1600

TEMP CONTROL:

TIME RECEIVED:

DATE ANALYZED:

DATE RECEIVED:

SAMPLE ACCEPTABLE: YES ☐ NO ☐

ANALYSIS SUCCESSFUL: YES ☐ NO ☐

LABORATORY ACCREDITATION NOTICE:

The results provided on this report have been produced in compliance with "NELAC" (National Environmental Laboratory Accreditation Conference) standards and relate only to the identified sample. Any deviations from the accepted "NELAC" collection requirements for non-potable samples are appropriately noted. This report shall not be reproced except in full without the written approval of the laboratory. Current New York State laboratory certification status is maintained under ELAP ID #10339.

VERIFICATION REVIEW		
Name:	**Title:**	**Date:**
Comments:		

Nassau Co. DOH PHL 209 Main Street Hempstead, NY 11550	FORM NAME: COALITION TO SAVE HEMPSTEAD HARBOR ☐ QC ☐ Equip Maint ☐ Training ☐ Comp Doc ☑ Other	
LABORATORY SECTION ☐ Chemistry ☑ Environmental Microbiology ☐ Clinical Microbiology	Form. No.: Beach Monitoring Daily Sampling Log - 1	Rev: 2
	Date: 4/8/2011	Created By: CONNIE IANNUCCI

Beach Monitoring Daily Sampling Log

COALITION TO SAVE HEMPSTEAD HARBOR

Elap ID
#10339

NASSAU COUNTY DEPARTMENT OF HEALTH
DIVISION OF PUBLIC HEALTH LABORATORIES
209 MAIN STREET, HEMPSTEAD, NY 11550
THOMAS EDWARDS, LEAD TECHNICAL DIRECTOR; CONNIE IANNUCCI, MICROBIOLOGY TECHNICAL DIRECTOR TELEPHONE (516) 572-1202 FAX (516) 572-1206

Michelle Lapinel McAllister
COLLECTOR'S NAME **DATE**

ALL SAMPLES SUBMITTED IN STERILE POLYSTYRENE VESSELS CONTAINING SODIUM THIOSULFATE (UNLESS OTHERWISE SPECIFIED)

Field No.	Area No.	Point No.	Sample Type	Location	Time	Temperature		Wind	Weather	Wave Height	Laboratory Use Only			
						Air	Water				Lab Number	Fecal Coliforms CFU/100 mL	Enterococci CFU/100 mL	Comments
CSHH-14	10		5	NW CORNER OF POWER PLANT ~ 50 YARDS FROM CEMENT OUTFALL										
CSHH-14A	10		5	CEMENT OUTFALL ADJACENT TO POWER PLANT										
CSHH-15	10		5	NW CORNER OF TAPPEN POOL										
CSHH-15A	10		5	SCUDDER'S POND OUTFALL @ SEAWALL N. OF TAPPEN POOL										
CSHH-15B	10		5	SCUDDER'S POND WEIR										
CSHH-16	10		5	OUTER HARBOR MIDWAY BETWEEN EAST/WEST SHORE										
CSHH-17	10		5	OUTSIDE RESTRICTED AREA OF CRESCENT BCH ACROSS FROM WHITE BLDG										
CSHH-17A	10		5	INSIDE RESTRICTED AREA OF CRESCENT BCH ACROSS FROM WH BLDG & STREAM										
CSHH-18	10		5	TAPPEN MARINA, "S" Dock, NORTHERNMOST DOCK,										
CSHH-19	10		5	TAPPEN MARINA, END OF MAIN DOCK, OPPOSITE MARINA ENTRANCE										
CSHH-21	10		5	TAPPEN MARINA, "R" DOCK										
TRIP BLANK														

COMMENTS/REMARKS

REPORT TO: **RECREATIONAL FACILITIES**
200 COUNTY SEAT DRIVE
MINEOLA, NY 11501

Tide: High / Low **Time**: _______
Tide: High / Low **Time**: _______

14A: Mixed / Direct **15A**: Mixed / Direct

***ESTIMATED COUNT**

TNTC = "TOO NUMEROUS TO COUNT"

24hr rain: **48hr rain:**

DATA ENTRY PROOFED

TEST	TECHNOLOGY	METHOD
Fecal Coliform CFU/100 ml.	MF-QN	SM 9222 D-2006
Enterococci CFU/100 ml	MF-QN	EPA 1600

TEMP CONTROL: TIME RECEIVED: DATE ANALYZED:

DATE RECEIVED:

SAMPLE ACCEPTABLE: YES ☐ NO ☐ ANALYSIS SUCCESSFUL: YES ☐ NO ☐

LABORATORY ACCREDITATION NOTICE:

The results provided on this report have been produced in compliance with "NELAC" (National Environmental Laboratory Accreditation Conference) standards and relate only to the identified sample. Any deviations from the accepted "NELAC" collection requirements for non-potable samples are appropriately noted. This rpeort shall not be reproced except in full without the written approval of the laboratory. Current New York State laboratory certification status is maintained under ELAP ID #10339. **Page 2 of 2**

VERIFICATION REVIEW

Name: **Title:** **Date:**

Comments:

C:\Users\CSHH\Documents\Water Monitoring\2019 Core Program\2019 Data Sheets\NCDH Data Sheet for HH Bacteria Samples p 2.exl

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 **Of** 1

Section A **Required Client Information:**	**Section B** **Required Project Information:**	**Section C** **Invoice Information:**	
Company: Coalition to Save Hempstead Harbor	Report To: Carol DiPaolo	Attention:	
Address: PO Box 159	Copy To: cshh@optonline.net	Company Name:	
Sea Cliff, NY 11579		Address:	**Regulatory Agency**
Email: cshh@optonline.net	Purchase Order #:	Pace Quote:	
Phone: (516) 801-6792 Fax	Project Name: HEMPSTEAD HARBOR MONITORING	Pace Project betty.harrison@pacelabs.com	**State / Location**
Requested Due Date:	Project #:	Pace Profile #: 7288	NY

MATRIX	CODE
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Other	OT
Tissue	TS

ITEM #	**SAMPLE ID** **One Character per box. (A-Z, 0-9 / , -)** **Sample Ids must be unique**	MATRIX CODE (see valid codes to	SAMPLE TYPE (G=GRAB C=CO	COLLECTED				SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives								**Requested Analysis Filtered (Y/N)**													
				START		END												**Y/N**														
				DATE	TIME	DATE	TIME			Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	**Analyses Test**	No2/NO3,	NO2	NH3	TKN	Total Nitrogen	Total Organic Nitrogen							Residual Chlorine (Y/N	
1	CSHH #1	WT	G						2	1	1								X	X	X	X	X	X								
2	CSHH #3	WT	G						2	1	1								X	X	X	X	X	X								
3	CSHH #6	WT	G						2	1	1								X	X	X	X	X	X								
4	CSHH #7	WT	G						2	1	1								X	X	X	X	X	X								
5	CSHH #8	WT	G						2	1	1								X	X	X	X	X	X								
6	CSHH #12	WT	G						2	1	1								X	X	X	X	X	X								
7	CSHH #13	WT	G						2	1	1								X	X	X	X	X	X								
8	CSHH #14A	WT	G						2	1	1								X	X	X	X	X	X								
9	CSHH #15A	WT	G						2	1	1								X	X	X	X	X	X								
10	CSHH #16	WT	G						2	1	1								X	X	X	X	X	X								
11																																
12																																
13																																
14																																**SAMPLE CONDITIONS**

ADDITIONAL COMMENTS	**RELINQUISHED BY / AFFILIATION**	**DATE**	**TIME**	**ACCEPTED BY / AFFILIATION**	**DATE**	**TIME**				

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Michelle Lapinel McAllister

SIGNATURE of SAMPLER:

DATE Signed:

TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

UWS Field Datasheet

EMBAYMENT NAME(S): Hempstead Harbor **SAMPLE DATE:** ____________________

PEOPLE: ____________________ **TIME:** ____________________

• Tides nearest time of sampling, use NOAA Tide Tables •

Low Tide: ____________ **High Tide:** ____________

APPROX. EXPECTED RANGE	
Salinity (ppt/PSS)	5 – 30 ppt/PSS
Dissolved Oxygen (mg/L)	0 – 14 mg/L
Dissolved Oxygen (% Sat.)	0 – 120 %
Chlorophyll *a* (µg/L)	0 – 30 µg/L
Turbidity (NTU)	0 – 30 NTU

WEATHER CONDITIONS

• 24 hours preceding time of sampling •

High Air Temperature (˚C)	
Low Air Temperature (˚C)	

Cloud Cover (%)	
Precipitation State (mist, drizzle, rain, etc.)	
Wind at Embayment (use Beafort scale)	

Daily Precipitation	
Date	**Inches**

NOTES: ____________________

Embayment Name	Hempstead Harbor
Sample Date	- -
People	

GPS units (circle one):
[✓ decimal degree (40.772240°)]
degree minutes (40° 46.334')
degree min. sec. (40° 46' 20.06")

Station ID	HEM-M-01 / CSHH #1			HEM-M-02			HEM-M-03 / CSHH #3		
Time									
Station Depth (m) add 0.5 m									
GPS N	40.			40.			40.		
GPS W	073.			073.			073.		
	bottom (0.5 m off bottom)	**mid-depth** (if total depth > 10m)	**surface** (0.5m below surface)	**bottom** (0.5 m off bottom)	**mid-depth** (if total depth > 10m)	**surface** (0.5m below surface)	**bottom** (0.5 m off bottom)	**mid-depth** (if total depth > 10m)	**surface** (0.5m below surface)
Sample Depth (m) add 0.13 m									
Temperature (°C)									
Salinity (ppt)									
Dissolved Oxygen (%)									
Dissolved Oxygen (mg/L)									
Fluroescence (RFU)									
Chl-a (µg/L)									
Turbidity (NTU)									

Enter additional field notes on back of sheet

If using a different method than usual, make a note!

At 1 station per embayment,do a second profile (usually at last station).

If total depth < 1.5m, do only mid-depth.

data entry ______________ person checking ______________

Embayment Name	Hempstead Harbor
Sample Date	- - 19
People	M. L. McAllister, M. Ring, E. Neice

GPS units (circle one):
[✓ decimal degree (40.772240°)]
degree minutes (40° 46.334')
degree min. sec. (40° 46' 20.06")

Station ID	HEM-O-04 / CSHH #2			HEM-O-05 / CSHH #16			HEM-O-06 / CSHH #17		Replicate	
Time										
Station Depth (m) add 0.5 m										
GPS N	40.			40.			40.		40.	
GPS W	073.			073.			073.		073.	
	bottom (0.5 m off bottom)	**mid-depth** (if total depth > 10m)	**surface** (0.5m below surface)	**bottom** (0.5 m off bottom)	**mid-depth** (if total depth > 10m)	**surface** (0.5m below surface)	**bottom** (0.5 m off bottom)	**surface** (0.5 m below surface)	**bottom** (0.5 m off bottom)	**surface** (0.5 m below surface)
Sample Depth (m) add 0.13 m										
Temperature (°C)										
Salinity (ppt)										
Dissolved Oxygen (%)										
Dissolved Oxygen (mg/L)										
Fluroescence (RFU)										
Chl-a (µg/L)										
Turbidity (NTU)										

Enter additional field notes on back of sheet

If using a different method than usual, make a note!

At 1 station per embayment,do a second profile (usually at last station).

If total depth < 1.5m, do only mid-depth.

Chlorophyll Reference Check in Bucket (do once per day per embayment)

					sonde reading
date & time	Vol Filt.	Vol Filt.	Vol. Filt.	Vol Filt.	RFU
	ID HEM-DA	ID HEM-DB	ID HEM-DC	ID HEM-DD	ug/L

data entry ______________ person checking ______________

Site Name (short identifier) ______________________________ Date ______________________

People (full names) ____

____

Time of Low Tide _______________ Time of Sampling (now) _______________

Site Description / Notes (optional) ____

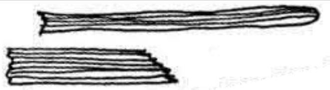
____

GPS location (in decimal degrees) ____________________________N ____________________________W

For rake toss, complete 6 tosses. For soft shoreline, provide an overview photo and close-up photos of algae types. Remember to include something for a size reference in soft shoreline close-up photos (shoe, keys, ruler, etc.).

Select one: ○ soft shoreline ○ rake toss photo ID	*NONE*	*SOME*	*LOTS*	*green hair-like*	*green twig/leaf-like*	*green sheets*	*non-green hair-like*	*non-green twig/leaf-like*	*non-green sheets*	*marsh grass*	*eelgrass*

eelgrass
- green when fresh
- ribbon-like
- up to 6 ft. long
- may be brown or grey when decaying

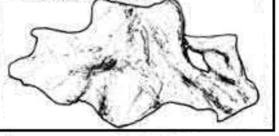


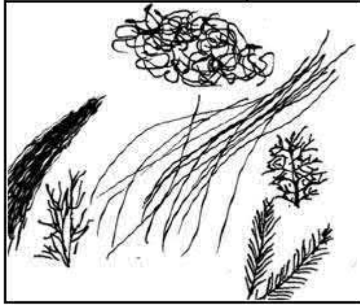
marsh grass
- no drawing, look at land plants along shore for comparison

twig/leaf like
- most of algae is thicker than a hair
- may have small leaf-like sections
- may branch or not branch
- most maintain their shape when removed from water, but not all

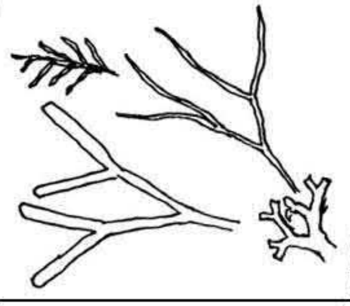
all drawings are to scale when printed on standard paper

sheets
- may look like floppy lettuce leaves or rubbery straps (kelp)
- may be very large or the size of a quarter
- a few have a mid-rib (line up the middle), but most of plant does not have a "stem"





hair-like
- most of algae is the width of a hair
- may be slimy or dry
- may be tangled or straight
- *most lose shape when removed from water, but not all*



prepared by

COALITION TO SAVE HEMPSTEAD HARBOR
EST. 1986

FUSS & O'NEILL