HHPC
Hempstead
Harbor
Protection
Committee

2021
Water-Quality Report
Hempstead Harbor
(Full Report, Including Appendices)

COALITION TO SAVE HEMPSTEAD HARBOR
EST. 1986

Report printed on recycled paper.

prepared by

COALITION TO SAVE HEMPSTEAD HARBOR
EST. 1986

July 19, 2022

Cover Photos

Bell 6 - Michelle Lapinel McAllister
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Glen Cove Creek - Allen Moore
Cave-in on Shore Road, Glenwood Landing - Carol DiPaolo

Coalition to Save Hempstead Harbor

Errata to
2021 Water-Quality Report, Hempstead Harbor (July 19, 2022)

on August 3, 2022

The errata corrections listed below apply to salinity units in Monitoring Results, Section 3.3, at page 32. All salinity units should be in ppt, not ppm.

Page	Location	Change
32	Key Findings, bullet 4	27.15 ppt (from 27.15 ppm)
32	Key Findings, bullet 4	14.23 ppt (from 14.23)
32	Paragraph 3, line 8	24.81 ppt (from 24.81 ppm)
32	Paragraph 3, line 8	25.64 ppt (from 25.64 ppm)

on February 1, 2023

The errata corrections listed below apply to nitrogen in Monitoring Results, Section 3.7, at pages 39, 41, and 42.

Page	Location	Change
39	Key Findings, bullet 2	0.72 mg/L (from 1.0 mg/L)
39	Key Findings, bullet 5	two stations (from one)
41	Paragraph 3, line 1	0.72 mg/L (from 1.0 mg/L)
41	Paragraph 3, line 2	marginal (from poor)
42	Paragraph 1, line 5	#1 (from #15A)
42	Paragraph 1, line 6	0.01 mg/L (from 0.13 mg/L)
42	Paragraph 1, line 6	0.09 mg/L (from 0.16 mg/L)
42	Paragraph 1, line 6	0.14 mg/L (from 0.15 mg/L)
42	Paragraph 3, lines 8-9	0.03 mg/L (from 0.09 mg/L)
42	Paragraph 3, line 11	addition of CSHH #6
42	Paragraph 3, line 13	67% for CSHH #6 (from 50% for CSHH #1)

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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.

We especially thank the National Fish and Wildlife Foundation, Long Island Sound Futures Fund, Nassau County Soil and Water Conservation District, and NYS Department of Environmental Conservation for funds to support the Hempstead Harbor core regular-season and winter water-monitoring program, as well as for funds awarded separately to the Coalition to Save Hempstead Harbor (CSHH) to conduct additional harbor programs.

We are grateful to all of the individuals who have helped us maintain our water-monitoring programs, including CSHH volunteers; members of local fishing clubs, local beach and marina managers, boaters and sailors, and other community members who report on harbor conditions; Town of Oyster Bay Department of Environmental Resources for staff assistance and use of its boat and Department of Parks for use of a Tappen Marina boat slip; Nassau County Department of Health staff members who facilitate and perform the lab analysis and data review of bacteria samples collected at up to 21 CSHH stations weekly in Hempstead Harbor; and Nassau County Department of Public Works staff.

We also thank the organizations and agencies that work with CSHH and the Hempstead Harbor Protection Committee (HHPC) as technical advisers and partners, including:

- New York State Department of Environmental Conservation
- New York State Department of State
- US Environmental Protection Agency, Long Island Sound Study Office
- The Long Island Regional Planning Council/Long Island Nitrogen Action Plan

This report was prepared by the

Coalition to Save Hempstead Harbor

with

technical advisory support and review provided by:

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Introduction

About 30 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 were 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 2021 (l) and coir banks for stream and upper-pond restoration in 2014 (r) (photos by Carol DiPaolo, 11/14/21 and 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 or just beyond the boundaries 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 website 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. NCSWCD awarded grants to CSHH in 2020 and 2021 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; the program continued in 2021 and included oysters.

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 Strategy, and Long Island Pathogen TMDL Work Group).

Volunteers for the CSHH Scudder's Pond Cleanup (4/24/21) and International Coastal Cleanup (9/25/21)

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 2021, CSHH coordinated local activities as part of the **International Coastal Cleanup**, as it has for all but three 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 intermunicipal 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 efforts save each municipality expenses and provide a coordinated approach to solving harbor problems and a year-round focus on harbor issues.

HHPC event display (10/6/19) and Executive Director Eric Swenson (10/7/18)

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.

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.

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 unquestionably 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.

View of National Grid property (foreground) and western shore of Hempstead Harbor from Ram's Hill (photo by Carol DiPaolo, 3/26/21)

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 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.

Starting point of the Hempstead Harbor shoreline trail and extension south along the western shoreline (above l and r) (photos by Carol DiPaolo, 5/20/15 and 9/16/20, respectively); the trail was completed and new plantings installed by the Town of North Hempstead in 2019 (r) (photo by Kevin Braun, 10/22/19)

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. In 2021, DEC closed 134 acres of shellfish beds adjacent to Prospect Point in the harbor, while certifying 6,150-acres in Long Island Sound, just beyond the mouth of the harbor (see *Section 3.8.6*).

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.

Aerial view of Garvies Point development project, Glen Cove (photo by Allen Moore, 7/21/21)

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. The data collected over the years are a critical resource as we look for trends that point to the health of Hempstead 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 approved by NYS DEC. Data assessment reports were completed for 2020 and 2021; see Appendix G for the 2021 report.

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 2.4,* and these are indicated in *Table 1*.

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)

2.2.1 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 Harbour 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

- CSHH #15, about 50 yds from Scudder's Pond outfall, near 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, near 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 west of the powerhouse outfall
- CSHH #14A, directly from the powerhouse outfall (may be mixed with harbor water at higher tide)

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

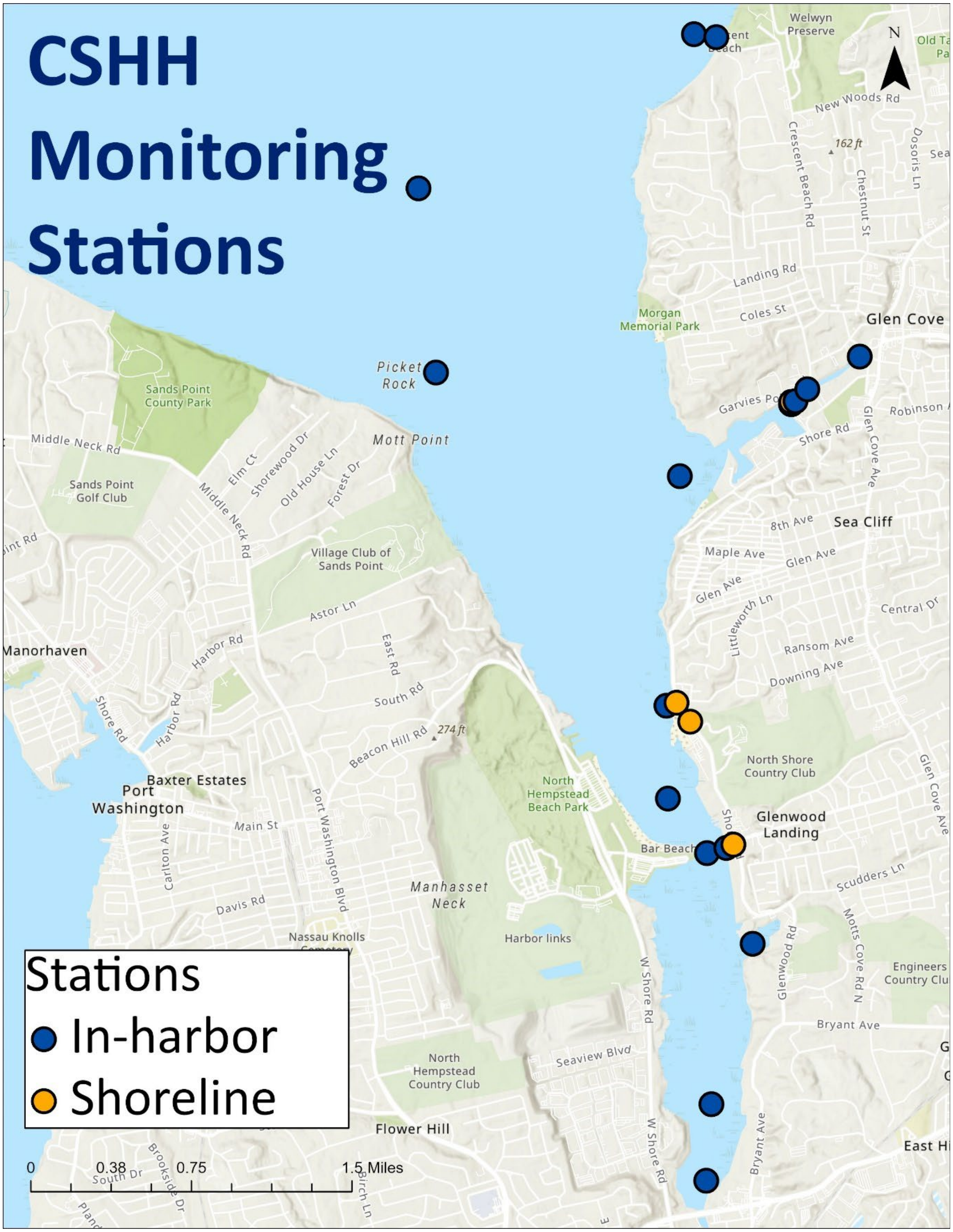


Figure 2
Station Locations for Harbor Sections and Glen Cove Creek

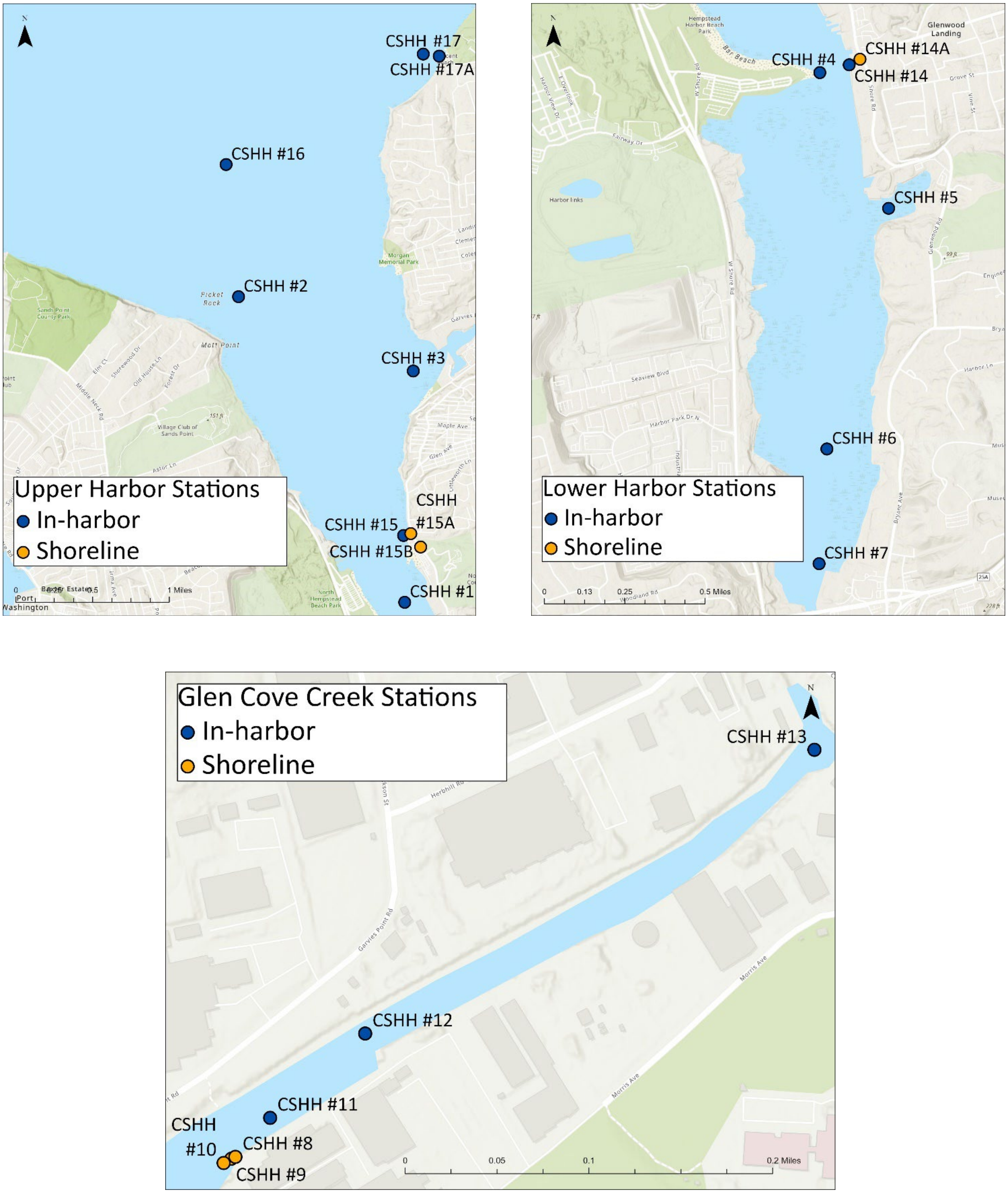


Table 1
Latitude/Longitude Points for Monitoring Stations (NAD 83 Datum)

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-O-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	40.85851	073.64191
CSHH #9, 10 ft west of #8	40.85850	073.64195
CSHH #10, 20 ft west of #8	40.85846	073.64203
CSHH #11, 50 ft east of #8	40.85881	073.64154
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-O-05)	40.87349	073.67493
CSHH #17, just outside the Crescent Beach restricted shellfish area (Corresponds to UWS station HEM-O-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

2.2.2 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 2018-2021 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, #15, #15A, and #15B (established in 2009) for bacteria analysis by the NCDH (using water-quality standards for bathing beaches) as an alternative way to monitor discharges from the powerhouse outfall (#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 into Hempstead Harbor (photo by Carol DiPaolo, 8/28/21)

2.2.3 Frequency of Testing and Testing Parameters

Testing for the core Hempstead Harbor monitoring program includes the regular-season and winter-season testing. Testing for the regular season 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; as of 2020, winter testing is conducted biweekly for bacteria and nitrogen. Beginning in 2018, winter sample collection has 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 at the Town of Oyster Bay lab until 2016 when the facility 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 from a select 10 stations 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, pH, and turbidity are recorded with an electronic meter. In 2017 to present, 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. The LaMotte 2020e portable turbidity meter, which had been used previously, is also maintained as a backup.) 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 for core program (10/28/21)

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 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 station 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 electronic 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
Water 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 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 around the Town of Oyster Bay's installation of six floating upweller systems (FLUPSYs) and seed clams (about one million clams in each unit) at two locations in Tappen Marina. CSHH's testing program began in May and concluded at the end of October. However, due to an unexpected shortage of seed clams in 2019, the FLUPSYs were not installed in 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.

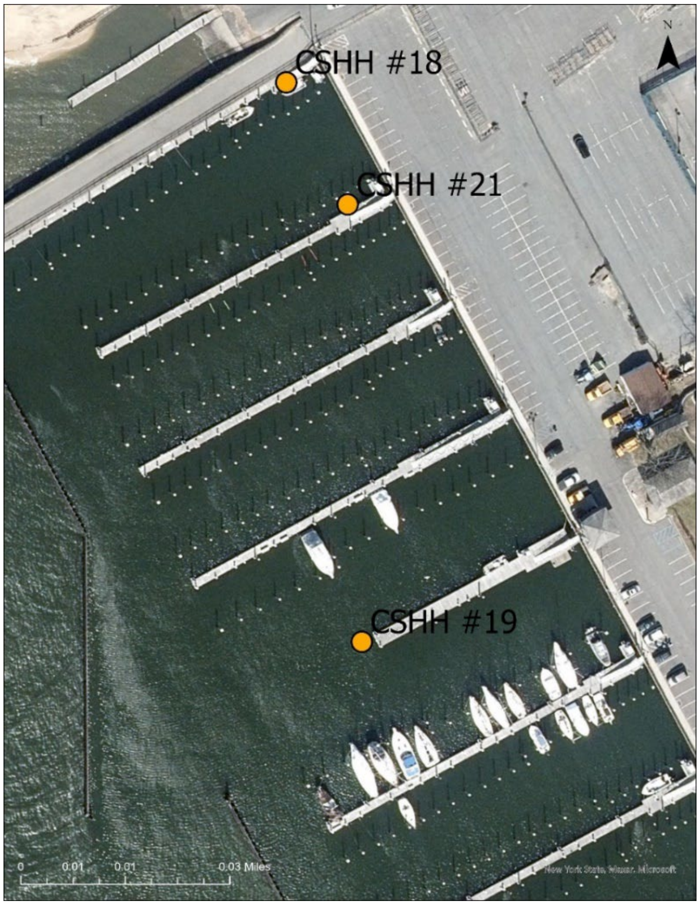
For the 2021 season, the town had planned to raise 800,000 seed clams dispersed among six FLUPSY units positioned along dock R in the marina, with shellfish installed by July 14. The 2021 Tappen Marina shellfish culture program was expanded to include approximately 4.8 million seed clams, 20,000 larger clams, and 45,000 oysters. However, to accommodate seeding and growth needs, the Town of Oyster Bay rotated batches of shellfish in and out of Tappen Marina and also moved two of the six FLUPSYs from R dock to S dock late in the season.

2.3.1 Marina Station Locations

Sampling sites originally selected in 2019 were modified to accommodate changes to the Town of Oyster Bay's plans regarding the number and placement of FLUPSYs and clams installed in Tappen Marina. Stations CSHH #18, #19, and #20 were initially selected, with CSHH #19 selected as a control station because of its proximity to the entrance to the marina from the open harbor. The data collected in 2019 provided baseline information about water-quality conditions in the marina.

For 2020, testing was discontinued at CSHH #20 and conducted instead at new station CSHH #21 (located at R dock) as well as continued at CSHH #18 (S dock) and CSHH #19 (at the end of the service dock).

In 2021, testing continued at stations CSHH #19 and #21. Testing was suspended at CSHH #18 as water-quality conditions from the previous year were found to be less favorable for clam growth (low pH). Late in the 2021 season, FLUPSYs were moved to S dock (CSHH #18), so a one-time vertical profile and sample collection for bacteria and nitrogen were performed.



Aerial photo of Tappen Marina monitoring stations.

2.3.2 Marina Testing Parameters and Results

Weekly testing was conducted at 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. Also, water samples were collected weekly for bacteria analysis (fecal coliform and enterococci), which was conducted by the Nassau County Department of Health. Biweekly water samples were collected for nitrogen analysis (nitrite, nitrate, ammonia, and total Kjeldahl nitrogen), which was conducted by Pace Analytical Services, LLC.

For the two seasons that seed clams and other shellfish stock were set in FLUPSYs in Tappen Marina, the testing that was conducted did not indicate measurable differences in water quality within the growing area that could be attributed to the presence of the shellfish. It is not clear whether the quantity or size of the shellfish in the FLUPSYs or the duration of their presence in a particular season reached the threshold necessary to see those differences when given the size of the marina and the amount of tidal flow that normally occurs there. However, the monitoring provided important information that indicated why shellfish in a location in the marina had better growth rates that those in another location. Also important are the town's observations that shellfish growth rates in Tappen Marina were comparable with those in the other two town marinas. This allows for future efforts of growing shellfish in the marina that may ultimately be used to seed Hempstead Harbor.

Appendix E includes 2021 monitoring data and graphs for Tappen Marina monitoring stations. Testing occurred from May 19 to October 28. By October 25, all shellfish stock from three FLUPSYs had been removed from Tappen Marina, following our last water testing in the marina.

Below are highlights of the data collected in 2021 for dissolved oxygen, pH, water clarity, bacteria, and nitrogen.

Dissolved oxygen. Dissolved oxygen (DO) is the amount of oxygen that is available to marine life and can affect their growth and reproductive systems. (See also *Section 3.1.*)

Although Tappen Marina stations followed the pattern of midsummer decreased oxygen levels that are observed in Hempstead Harbor and Long Island Sound, there were fewer hypoxic events (i.e., DO levels below 3.0 ppm), and these occurred on August 11 (CSHH #21) and August 18 (CSHH #21 and CSHH #19). By comparison, at CSHH #1 (the open-water station closest to the entrance of Tappen Marina), hypoxia was observed on the above-mentioned dates as well as on July 21 and August 4.

Sorting seed clams at R dock (CSHH #21) (l) and dawn monitoring at service dock (#19) (r)
(photos by Carol DiPaolo, 10/7/20, and Michelle Lapinel McAllister, 10/28/21, respectively)

pH. Average pH for Hempstead Harbor is approximately 7.7. (See also *Section 3.4.*) Surface and bottom pH levels were similar for CSHH #21 and CSHH #19, ranging between about 7.2 and 8.3. CSHH #21 had slightly lower pH levels, which may be due to the nearby flow from a large outfall in the bulkhead. An outlier pH level was observed on June 23 at CSHH #21, when water color was observed to be a coffee brown from what appeared to be an in-process algal bloom. Levels of pH at marina stations were generally reflective of the open-water station CSHH #1.

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. Marina stations generally ranged between 0.75 m and 1.75 m Secchi depth, with a higher reading at CSHH #19 on October 28 and a low reading of 0.6 m at CSHH #21 on May 26.

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

NCDH performs the bacteria analysis of the water samples CSHH collects at Tappen Marina and other stations around Hempstead Harbor and provides both enterococci and fecal coliform levels (even though county beach data is reported for enterococci only).

CSHH #19 and #21 had generally low numbers of bacteria throughout most of the season, with no exceedances in fecal coliform. However, each station had exceedances of enterococci on four dates: June 23, July 7, September 3, and September 9. At least two of those dates (June 23 and September 3) correspond with rain events.

The September 1-2 Ida-related storm caused major flooding in surrounding areas and highwater levels lasted for days in local water bodies. Tappen Marina has several outfalls and beach septic systems that may have been affected by the flooding. By comparison, the open-water station CSHH #1 had no exceedances for fecal coliform or enterococci on any of the monitoring dates this past season.

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.*)

Total nitrogen (TN) is used here to compare nitrogen levels among monitoring stations. To further characterize the data for water-quality purposes (e.g., in “pass” or “fail” ranges) the Mid-Atlantic Tributary Assessment Coalition’s tidal indicator protocol is used (Wicks et al., 2011), as described in Water Quality Gradients and Trends in New York Harbor (Taillie et al., 2019).

Total nitrogen levels at stations within Tappen Marina are similar; however, TN levels are generally higher than those at open-water stations. (Also, nitrate levels are higher at Tappen Marina stations than at CSHH #1, where nitrate is frequently below the detectable limit of 0.050 mg/L.) Using the tidal indicator protocol mentioned above, only two samples each (out of a total of 12 for the season) for CSHH #19 and #21 had TN levels that fell within the “pass” to “good” range (≤ 0.5 mg/L); CSHH #21 had one sample that fell within the “fair” range (0.5 - 0.6 mg/L). All other samples fell within the “marginal” to “fail” range (> 0.6 mg/L).

2.4 Unified Water Study

The Coalition to Save Hempstead Harbor has participated in the *Unified Water Study: Long Island Sound Embayment Research* (UWS) since the program's inception in 2016. 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 2021, 24 groups monitored 41 bays, from as far west as the Bronx River in NY to the easternmost location at Wequetequock Cove in 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).

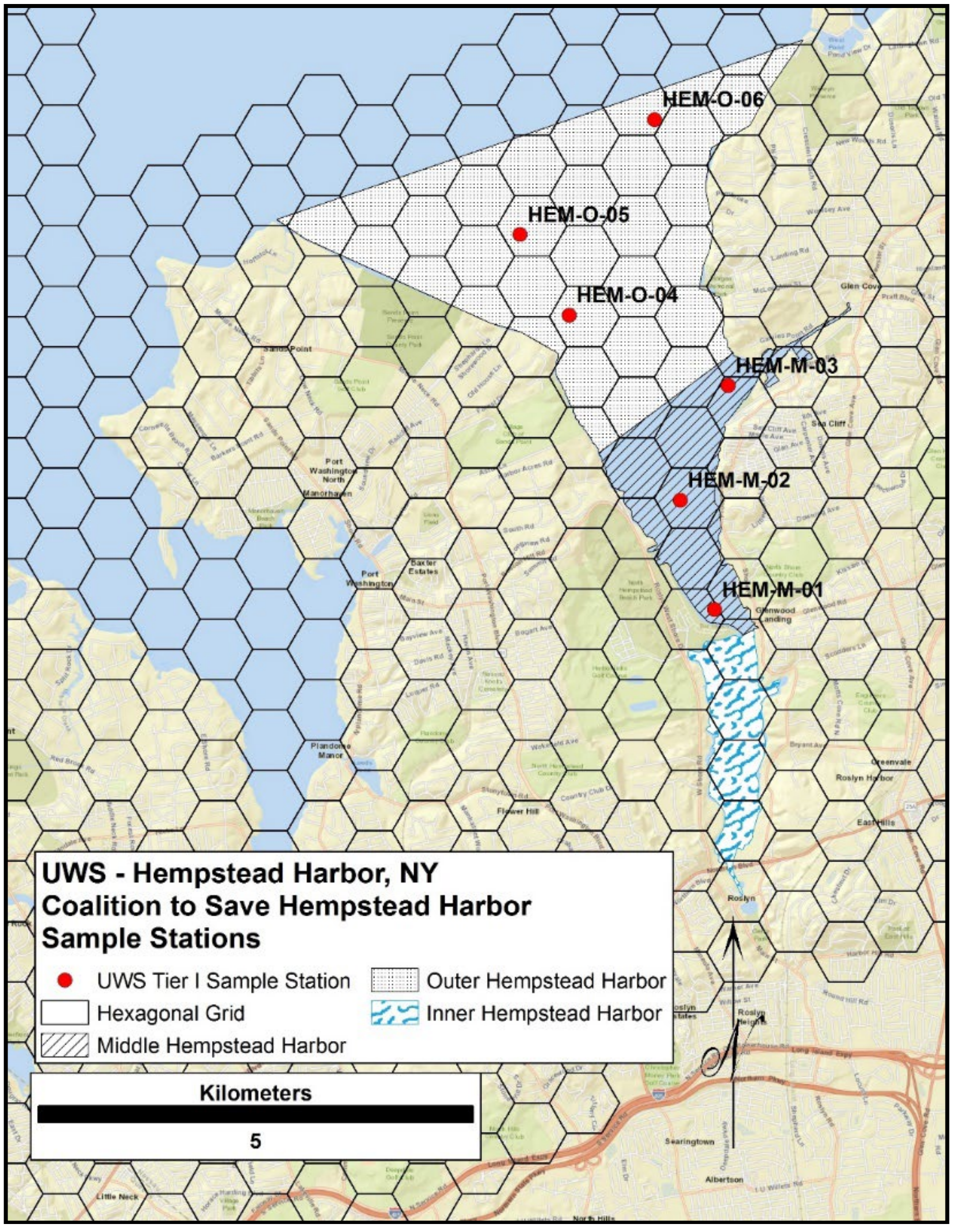
Navigational marker Bell 6 is the location of CSHH #2 for the core program and HEM-0-04 for the UWS program (photo by Carol DiPaolo, 8/28/21)

2.4.1 UWS Station Locations

In 2017, five CSHH/Hempstead Harbor core monitoring program stations were selected 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 (added in 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

Figure 3
Location of Hempstead Harbor UWS Stations



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

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 are performed along with meter readings from the same water that is filtered, and two of the filters are sent to a laboratory for analysis (i.e., the Interstate Environmental Commission's lab through 2021) (see also *Section 3.6*).

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). CSHH selected unraked areas of three Hempstead Harbor 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).

Close-up of red and green seaweed (l) and view looking north from Tappen Beach pool (r)
(photos by Michelle Lapinel McAllister, 8/3/21 and 7/27/21, respectively)

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 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 and UWS sampling programs. Where possible, data from the CSHH program from 1995-2021 are compared with 2021 data. *Appendices A, B, C, D, E,* and *F* include graphs and tables constructed with the data reflecting the period beginning in 1995.

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.

Lower DO levels may be the result of a variety of factors, including anthropogenic influences such as nutrient enrichment (e.g., from nitrogen) via 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 (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.

Nitrogen accelerates the growth of phytoplankton (including algae) and increases the density of organisms that grow. This can result in frequent or prolonged “blooms.” When the cells in the phytoplankton 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, 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 4.8 ppm) were observed in 79.3% of all surface and bottom measurements taken in 2021, compared with 83.8% in 2020.
- For bottom DO levels (which are most crucial to bottom-dwelling marine life), hypoxic conditions (less than 3.0 ppm) were observed in 9.1% of all measurements taken in 2021, a slight improvement over conditions observed in 2020.
- Hypoxic conditions were observed in none of the surface readings for the 2021 season.
- In 2021, there were no anoxic readings (less than 1.0 ppm).
- Hypoxic conditions occurred from the third week of July through early September, but at most stations, hypoxic conditions subsided by mid-August, a slightly shorter period than that observed in 2020.
- Hypoxic conditions were observed at stations CSHH #1-2, #4, #6-7, #15, and #16-17.
- Station CSHH #7 had the highest percentage of hypoxic readings for bottom DO levels in 2021 at 29%.

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. 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 this effect.

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. (For example, bottom-dwelling marine species would be more affected by low DO than species that can move more easily to higher-oxygen areas.)

Bunker finning (photo by Carol DiPaolo, 9/22/21)

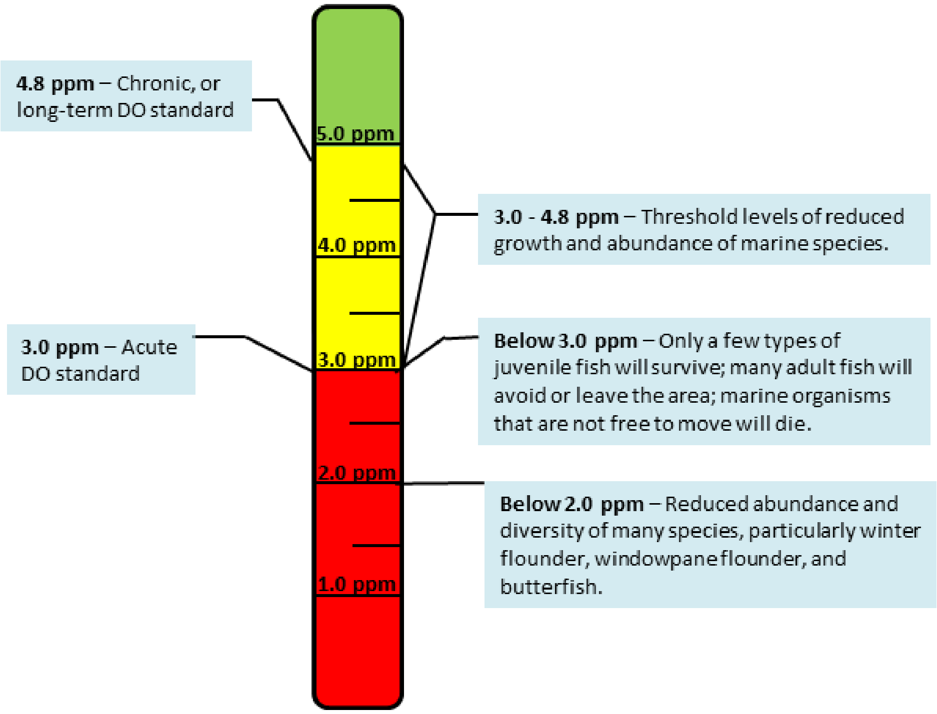
A revised dissolved oxygen standard was implemented by the NYS DEC on February 16, 2008. For estuarine waters such as Hempstead Harbor, the chronic, or long-term, DO standard is 4.8 ppm. This means DO levels of 4.8 ppm and above are considered to be protective of most marine species. The acute DO standard 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.

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 plant/algal photosynthesis, which produces oxygen, and undersaturated at night (50% or lower) due to the process of respiration, which uses up oxygen in the decomposition of dead organic matter.

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



ppm = parts per million

Figure 5 evaluates 2021 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.

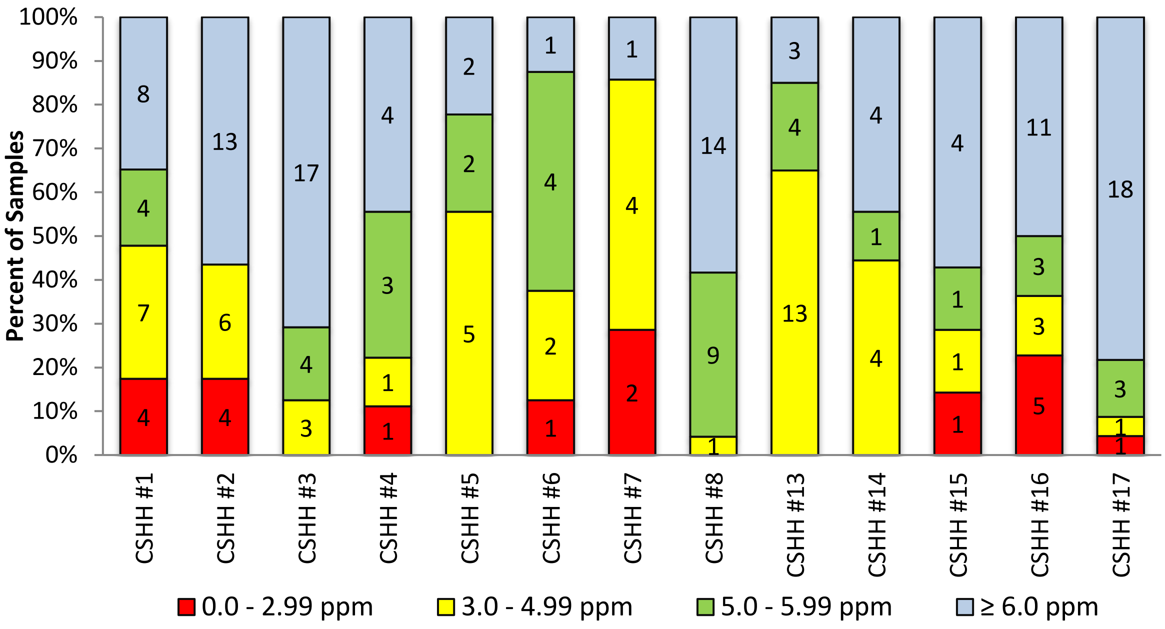
Table 3
Fish Kill Occurrences since 2001

Years	Fish Kills	Locations	Conditions
2021	Limited/scattered bunker kills	Harborwide	Large bunker population; limited bottom hypoxia (9.1% of all measurements taken)
2020	Limited/scattered bunker kills	Soundwide, New Jersey	Large bunker population present; vibrio bacterium present
2019	Limited fish kill (primarily bunker)	Parts of Hempstead Harbor and other bays in western Long Island Sound	Hypoxic and anoxic conditions
2016-2018	None reported	N/A	N/A
2015 (October-November)	Two limited bunker kills	Harborwide	(corresponded with large bunker population that remained in the harbor through January 2016)
2007-2014	None reported	N/A	N/A
2006 (August)	Small, localized fish kill	Morgan Beach	Low DO and hydrogen sulfide produced by bacteria
2005	Clam kill	Near CSHH #5 (Mott's Cove)	Lunar/tidal effects exposing clam beds
2001-2004	None reported	N/A	(despite extended periods of hypoxia)

In 2021, there were no significant fish kills in Hempstead Harbor, although several dead bunker were observed on most monitoring trips. This seemed similar to 2020 observations, but the limited and scattered fish kill that occurred over several months in 2020 affecting the bunker population in Hempstead Harbor was occurring soundwide as well. In early 2021, it was discovered that a vibrio bacterium was implicated in the 2020 fish kill. 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. See *Table* 3. (See also *Section 4.5*.)

Figure 5
2021 Bottom Dissolved Oxygen by Station

Each vertical bar represents one of CSHH's monitoring stations. They indicate percentage of all samples taken at a location that fall into each of the four ranges. Numbers inside the bars indicate the number of observations within each bar segment. Red bars are representative of hypoxic conditions (DO below 3.0 ppm). DO in the 3.0 to 5.0 ppm range is considered marginal and is shown in yellow. DO above at 5.0 ppm and above is considered a healthy condition and is shown in green and blue.



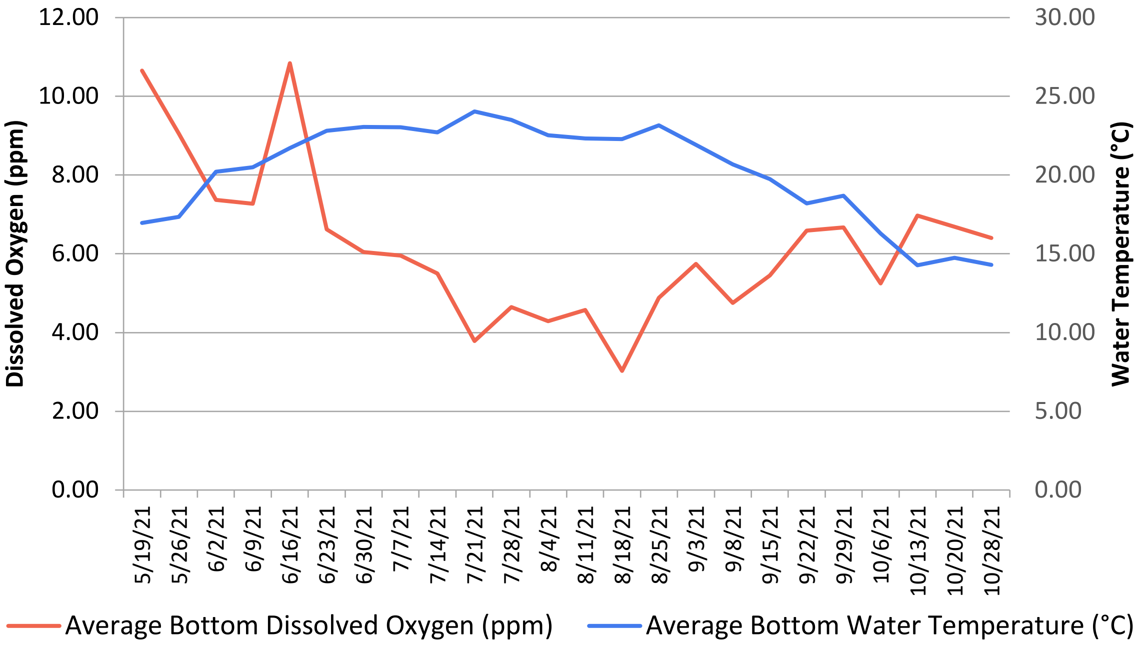
3.1.1 Seasonal Conditions

We observed the usual trend of decreasing DO that occurs in the middle of the summer season. However, the period over which hypoxic conditions were observed was shorter in 2021 than in 2020. In 2021, hypoxic conditions occurred from July 21 through September 3, but at most stations, hypoxic conditions subsided by late August.

Although understanding typical seasonal change is important, it is important also to recognize the extent of variability from other factors. For example, harborwide average bottom DO jumped up from 7.27 ppm to an unusual 10.84 ppm on June 16, 2021 (and returned to expected trend in the weeks following). Seven stations were sampled (the survey on this day and for the two weeks prior did not include lower-harbor stations). The average for bottom DO does not appear to be skewed by any particular station sampled that day—bottom DO was consistently high with above 100% saturation. It was noted that water color was distinctly green or brown in some areas, and that an algal bloom was likely in progress.

Figure 6
2021 Harborwide Dissolved Oxygen and Water Temperature

Data for dissolved oxygen and water temperature, recorded at bottom depth and averaged for the entire harbor, is depicted below and illustrates the seasonal trend for both parameters.



For the entire 2021 regular monitoring season, 9.1% of all bottom readings exhibited hypoxic conditions (DO < 3.0 ppm), 24.5% of bottom readings fell in the 3.0 to 5.0 ppm range, and 66.4% of bottom readings were at healthy levels (≥ 5.0 ppm). See also *Figure 5*. (Although the "healthy" threshold for DO is currently 4.8 ppm, for purposes of this report, we use 5.0 ppm in order to make both short- and long-term comparisons. See *Appendix A*.)

The percentage of bottom DO measurements that exhibited hypoxic conditions in 2021 (9.1%) is a slight improvement over that of 2020 (10.5%). A greater percentage of observations fell in the 3.0 to 5.0 ppm range in 2021 than in 2020 (18.6% in 2020 and 24.5% in 2021). In 2021, there were no hypoxic surface DO measurements, as was the case in 2020.

Anoxic conditions (less than 1.0 ppm) were not observed at any stations during the 2021 monitoring season. (None were observed in 2020, but six instances of anoxia were recorded in 2019 for two sampling events.)

Over the long term (from 1996), a slight improvement in dissolved oxygen has been observed in Hempstead Harbor with respect to the frequency and severity of hypoxic and anoxic incidents and the time frame over which these conditions occur. However, there is high interannual variability. This is consistent with observations for Long Island Sound. (See *Whitney, M. and Vlahos, P. (2021). Reducing hypoxia in an urban estuary despite climate warming. Retrieved from https://pubs.acs.org/doi/abs/10.1021/acs.est.0c03964.)*

3.1.2 Spatial Considerations

Of the 13 core-program stations where dissolved oxygen was measured in 2021, eight had measurements indicative of hypoxic conditions (CSHH #1-2, #4, #6-7, and #15, #16-17). CSHH #7 had the highest percentage of hypoxic readings of all stations (29%, representing 2 out of 7 surveys) and CSHH #16 had the second highest percentage of hypoxic readings (23%, representing 5 out of 22 surveys). Note that the lower harbor stations (e.g., CSHH #7) are visited less frequently due to limited tidal access (see *Figure 5*).

There is often no discernable spatial pattern to the distribution of hypoxic conditions. For 2021 monitoring events, both the outer and lower harbor experienced hypoxia, but no stations in Glen Cove Creek (CSHH #3, #8, #13) experienced hypoxia. Over the course of the entire season, the average for bottom DO for Glen Cove Creek stations (6.44 ppm) was slightly higher than the average for all other stations (5.74 ppm). CSHH #13 (located at the head of Glen Cove Creek) had a high percentage of bottom samples (65%) in the 3.0 to 5.0 ppm range. This does not align with other observable and measurable conditions in Glen Cove Creek. (See *Appendix A* for long-term dissolved oxygen graphs).

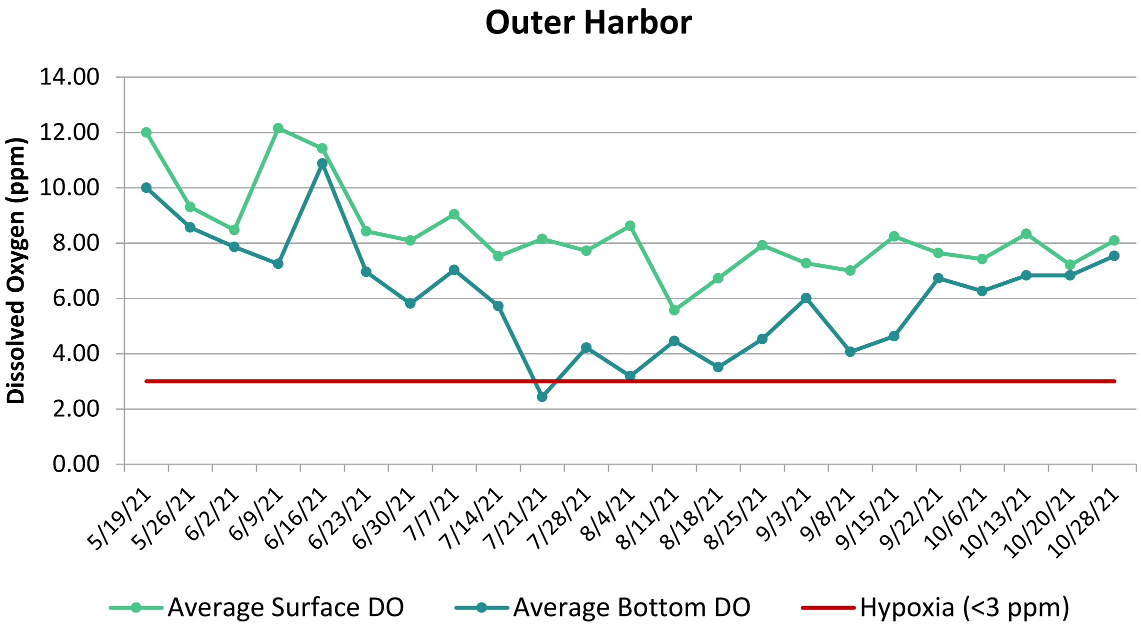
Glen Cove Creek experiences higher nutrient loading than other areas of the harbor because of the number of stormwater outfalls that empty into the creek as well as the discharge from the Glen Cove sewage treatment plant, which is located on the south side of the creek. In addition, a sewer-line break that was confirmed in November 2021 was responsible for discharging raw sewage to Mill Pond and Glen Cove Creek for months. (See *Section 3.8* for details.)

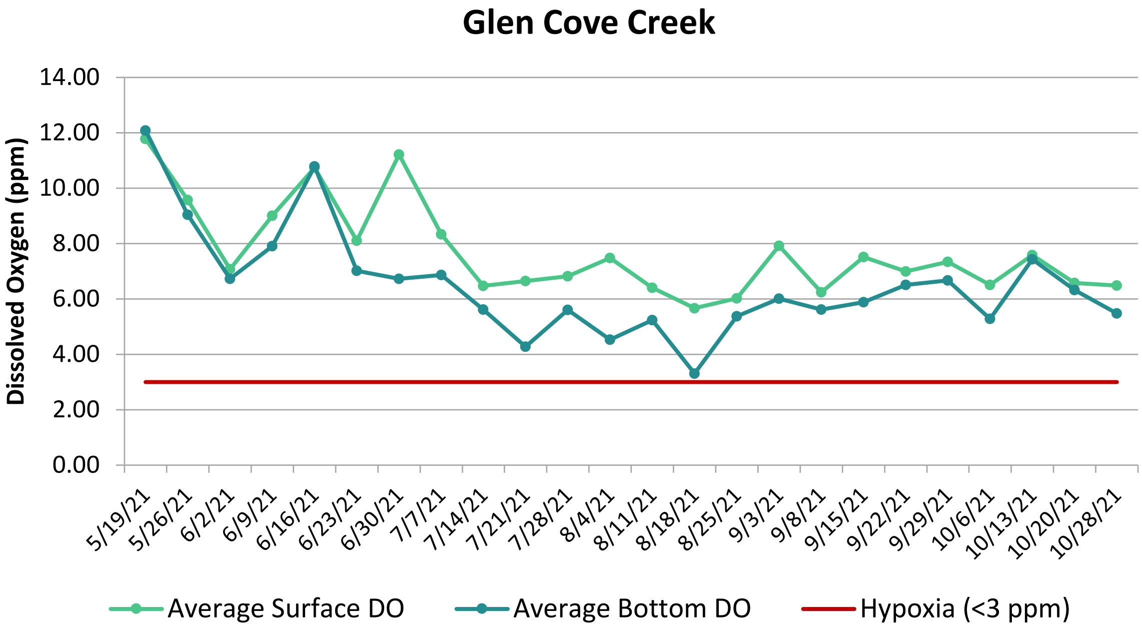
Discharges from outfalls along Glen Cove Creek at north bulkhead (l) and south bulkhead (r)
(photos by Carol DiPaolo, 6/2/21 and 9/22/21, respectively)

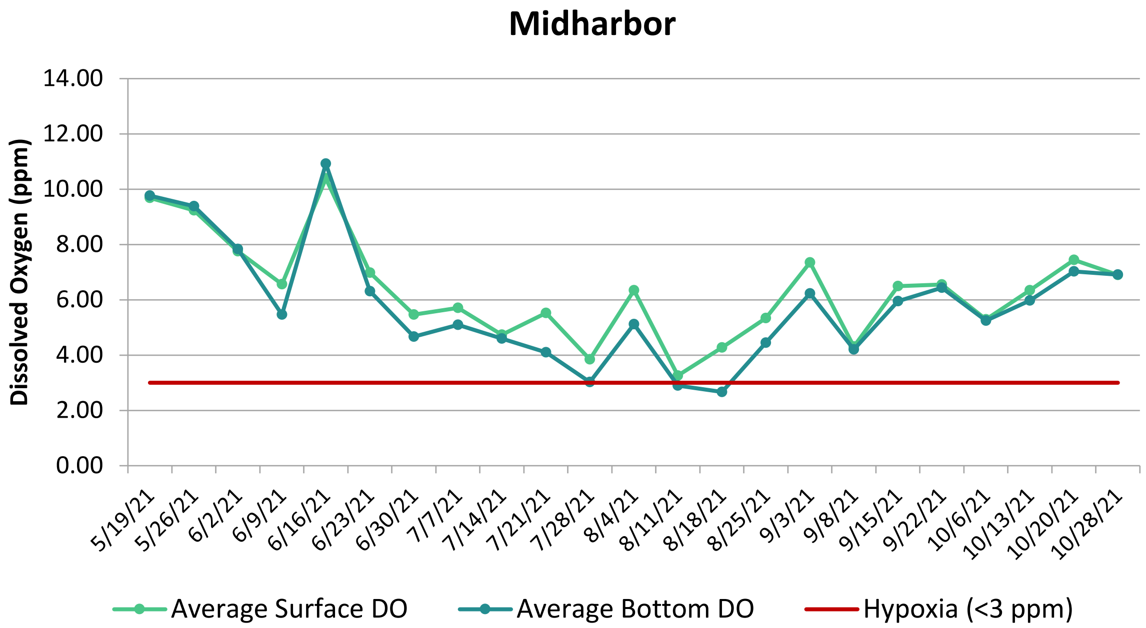
At lower-harbor stations CSHH #4-7, we observed more hypoxic events and lower average DO in 2021 than in 2020; however, because of tidal cycles, there were fewer survey events in August 2020 (July and August typically are months when low DO is observed).

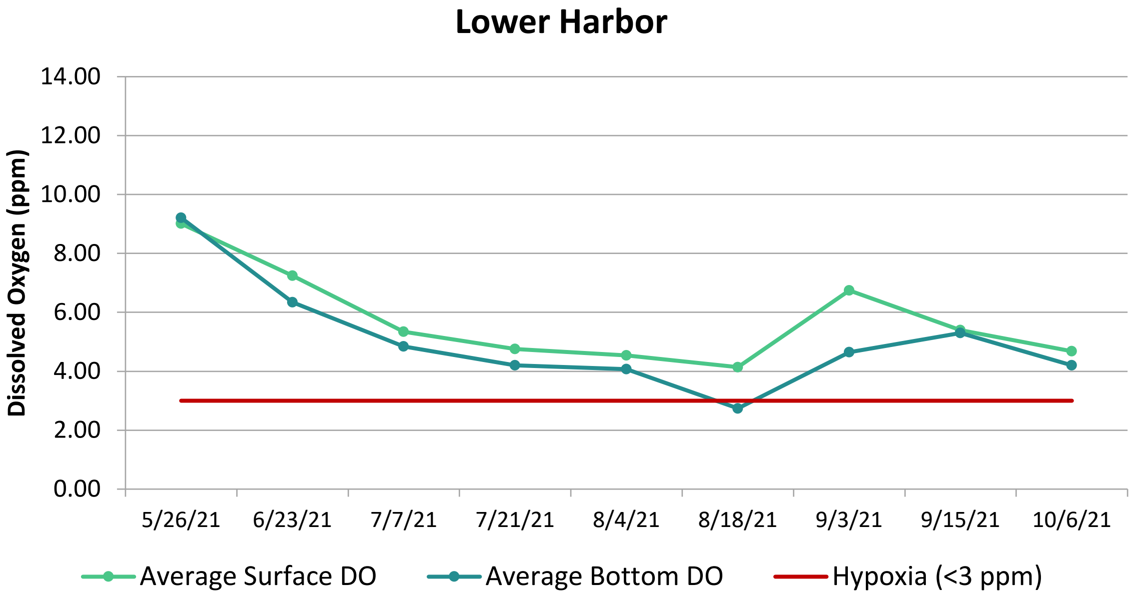
Figure 7
2021 Average Dissolved Oxygen Compared Spatially

The graphs below show average dissolved oxygen on each monitoring date within sections of the harbor. Outer-harbor stations include CSHH #2, #16, and #17; Glen Cove Creek stations include CSHH #3, #8, and #13; midharbor stations include CSHH #1, #4, #14, and #15; lower-harbor stations include CSHH #5-7.






Midharbor
Dissolved Oxygen (ppm)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
5/19/21
5/26/21
6/2/21
6/9/21
6/16/21
6/23/21
6/30/21
7/7/21
7/14/21
7/21/21
7/28/21
8/4/21
8/11/21
8/18/21
8/25/21
9/3/21
9/8/21
9/15/21
9/22/21
10/6/21
10/13/21
10/20/21
10/28/21
Average Surface DO
Average Bottom DO
Hypoxia (<3 ppm)


Lower Harbor
Dissolved Oxygen (ppm)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
5/26/21
6/23/21
7/7/21
7/21/21
8/4/21
8/18/21
9/3/21
9/15/21
10/6/21
Average Surface DO
Average Bottom DO
Hypoxia (<3 ppm)

3.2 Temperature

Key Findings – Temperature

- The average surface water temperature for the 2021 season was 20.91°C.
- The average bottom water temperature for the 2021 season was 20.42°C.
- Unusual cooler surface temperatures occurred on September 3, 2021, likely due to heavy rainfall from Hurricane Ida.

Water temperature is monitored to record seasonal and annual changes 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. A warming trend has been observed in Long Island Sound (0.03°C per year in the central basin and 0.04°C for the eastern basin, for 1976-2010 data; see *Rice, E. and Stewart, G. (2013), Analysis of interdecadal trends in chlorophyll and temperature in the Central Basin of Long Island Sound)*. The western portion of Long Island Sound, 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 of the shallower water of the harbor, tidal flushing, and 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.

The average surface water temperature for the 2021 regular season was 20.91°C; the average bottom water temperature was 20.42°C. In the 2020 regular season, the average surface temperature was 21.13°C, and the average bottom temperature was 20.53°C. A difference between surface and bottom temperature is expected, with bottom water cooler than surface water. However, on September 3, 2021, the difference was atypical and likely attributable to the heavy precipitation brought by Hurricane Ida (about 6.57 inches on September 1-2). The average surface water temperature (22.11°C) in Hempstead Harbor on September 3 was 0.61°C cooler than average bottom water (22.72°C).

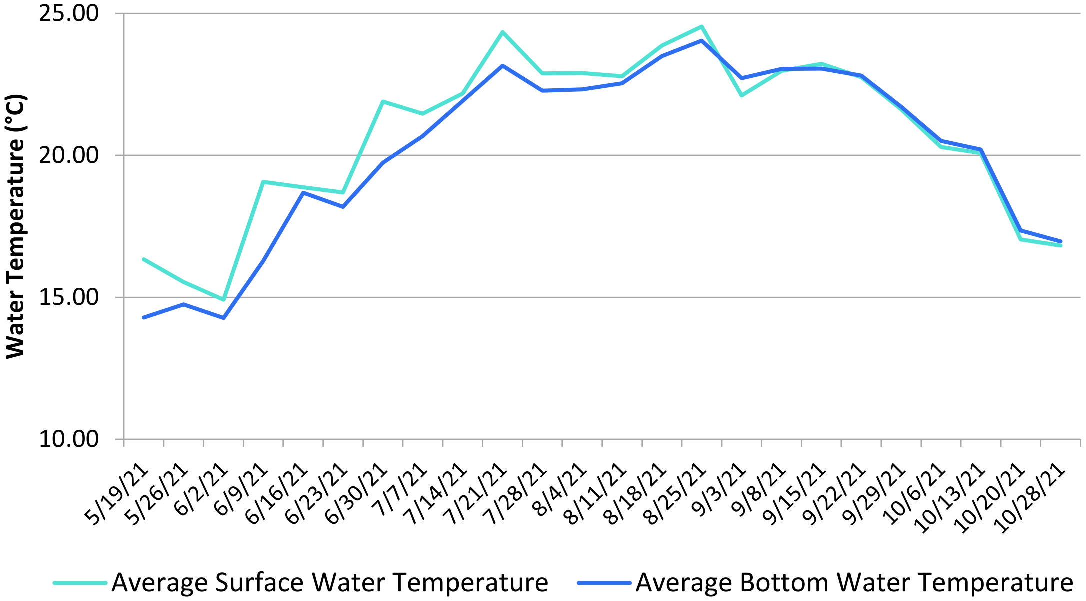
Many factors affect water temperature, but it is representative more of conditions that occur over several days and is not heavily influenced by daily variation in air temperature.

See *Appendix A* for additional water temperature monitoring data.

Figure 8

2021 Harborwide Average Water Temperature

Lines for average surface and bottom water temperature are depicted below. Note the lower surface water temperature on September 3, likely due to Hurricane Ida.



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, air temperature more strongly indicates the time of day that CSHH monitored a certain location. However, because monitoring events begin at similar times each season and have similar durations (i.e., May through October, and measuring air temperature at stations from approximately 8-11:30 am), changes in air temperature averaged between sites during a season could be indicative of annual variability in weather conditions.

The average air temperature for the 2021 season was 22.4 °C. This represents all data points taken using a long-stem digital thermometer throughout Hempstead Harbor for every sampling date. This is higher than the long-term average air temperature for 1995-2020 of 21.5 °C.

3.3 Salinity

Key Findings – Salinity

- The average salinity in Hempstead Harbor was 2.34% lower in 2021 than in 2020.
- In 2021, Tropical Storm Elsa and Hurricanes Henri and Ida resulted in significant local rain events with notable impacts on salinity.
- Near-shore stations show stronger correlations between rainfall and average salinity than other stations, and in 2021, the changes in salinity at near-shore stations could be explained to a large extent by the amount of rainfall within 48 hours of sampling.
- The highest salinity recorded in 2021 was 27.15 ppt (bottom CSHH #16 on June 30), and the lowest was 14.23 ppt (surface CSHH #7 on September 3)—exhibiting a larger range than seen in previous years.

Salinity, the amount of salt dissolved in a body of water, can be influenced by tidal cycles, direct precipitation, and freshwater from the watershed (i.e., from streams, ponds, rivers, and lakes, as well as 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 saltwater than in freshwater. 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).

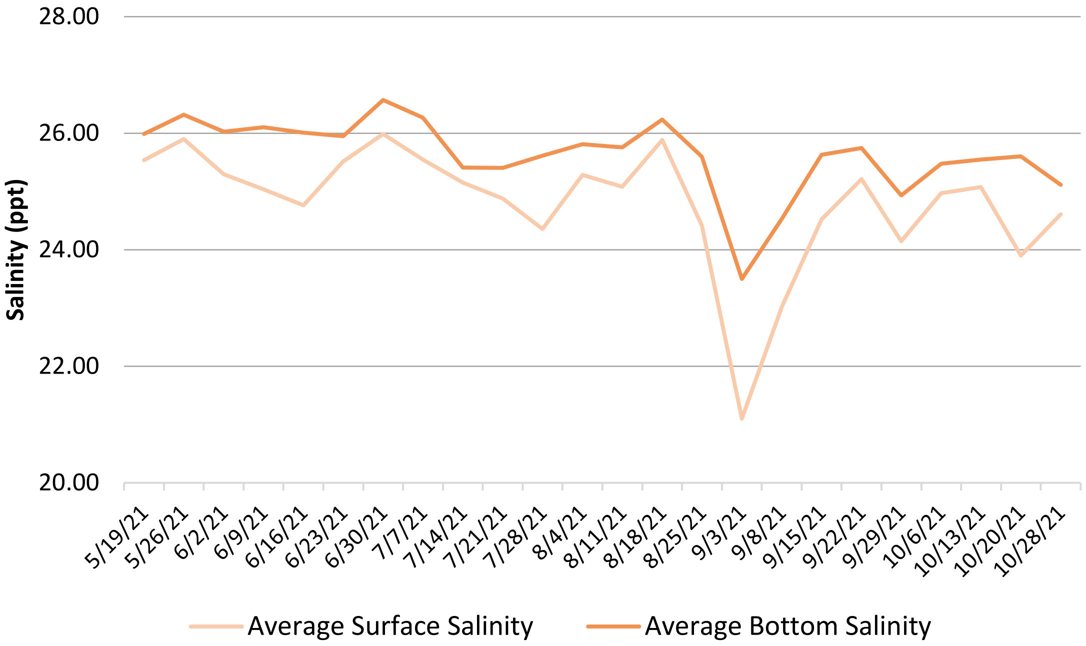
Salinity tends to be higher in winter, particularly at greater depths. In the summer season, salinity tends to be lower, driven by freshwater inputs. Typically, salinity values throughout Hempstead Harbor are approximately 25 ppt, and surface salinity is generally lower than bottom salinity. In 2021, the average surface salinity for Hempstead Harbor was 24.81 ppt, and the average bottom salinity was 25.64 ppt.

Although the data for the 2021 monitoring season indicate a weak relationship between salinity and precipitation, the impact to salinity was clearly evident on the monitoring trip following Hurricane Ida with surface salinity readings much lower than usual. On September 3, 2021, following 6.57 inches of precipitation from Hurricane Ida on September 1-2, average surface salinity was 21.10 ppt. (See *Figure 9.*)

See *Appendix A* for additional salinity data results.

Figure 9
2021 Harborwide Average Salinity

Lines for average surface and bottom salinity data illustrate the seasonal trend. Note the decrease in surface and bottom salinity for September 3, likely a result of Hurricane Ida.



3.4 pH

Monitoring pH (a measure of acidity or alkalinity) helps in following trends in aquatic life and water chemistry. Carbon dioxide (CO_2) released by respiration and uptake via plant photosynthesis affect aquatic pH over short periods (hours to days), whereas the increase in atmospheric CO_2 may affect aquatic pH over decades. Increasing amounts of CO_2 in seawater lower pH, making conditions more acidic, which affects the growth of shellfish and other marine life. Also, 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*.)

Key Findings – pH

- Average pH levels in Hempstead Harbor in 2021 were 7.77 at the surface and 7.64 at the bottom.
- Average surface and bottom pH levels in 2021 were comparable with long-term averages (2005-2021).
- The lowest (7.15) and highest (8.43) pH measurements for the season were recorded at CSHH #16.

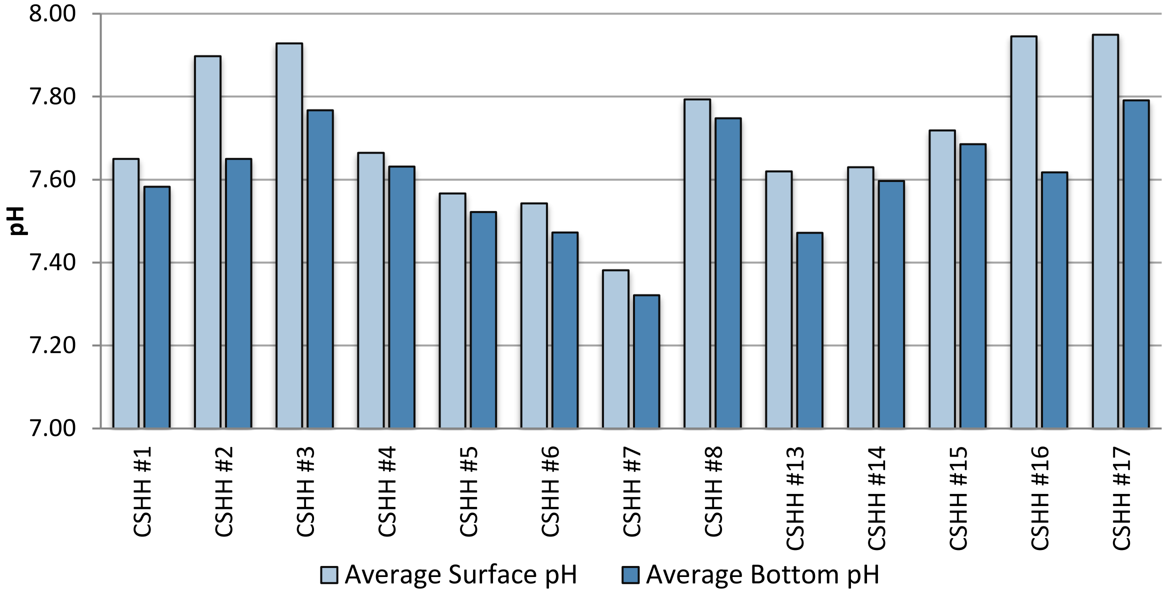
Average pH levels in Hempstead Harbor in 2021 were 7.77 for surface pH and 7.64 for bottom pH. These are comparable with the long-term (2005-2021) averages of 7.76 for surface pH and 7.72 for bottom pH. (The long-term values represent data collected over fairly consistent time periods each season, and generally over the same spatial extent, but outer-harbor profiles began only in 2015.)

Although there are fluctuations within each season and over the years, pH readings in Hempstead Harbor rarely drop below 7.0 and rarely exceed 8.5. The lowest and highest pH measurements for the season were recorded at CSHH #16; at bottom, the pH measurement of 7.15 was recorded on August 4, 2021, and a surface pH measurement of 8.43 was recorded on June 16, 2021. Note, however, that on June 16, pH was high at every station tested and throughout the water column.

In 2021, CSHH #7 had the lowest average surface and bottom pH. Lower-harbor stations generally have lower pH readings than other stations sampled, particularly lower than outer-harbor stations. However, tidal-dependent access to the lower-harbor provides fewer profiles over the season, making the averages less representative.

Figure 10
2021 Average Surface and Bottom pH by Station

Each set of bars depicts the average surface and bottom pH for each of CSHH's monitoring stations.



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 uncontrolled construction-site runoff) also increase turbidity.

Key Findings – Water Clarity/Turbidity

- The average Secchi-disk depth for the 2021 season was 9.9% deeper than the 2020 average.
- Unusually clear water conditions occurred on June 2, 2021.
- The highest average turbidity measurements, for both surface and bottom, occurred at CSHH #7.
- Stations in the lower harbor and ones closer to the shore tend to have higher turbidity, while stations in the outer harbor tend to have lower turbidity. This is reflected in the 2021 data.

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). For Hempstead Harbor, Secchi readings are typically 1 to 2 meters but can range from 0.25 to 3 meters during the monitoring season.

In 2021, Secchi-disk readings were comparable with typical harbor conditions. The average of Secchi-disk measurements for the 2021 season was 1.38 m. This is 9.9% deeper than the 2020 average of 1.25 m. The deepest Secchi-disk measurement in 2021 was 3.5 m, occurring on June 2 at CSHH #16, which was unusual for this time of year. The lowest Secchi-disk measurement in 2021was 0.3 m, occurring on September 3 at CSHH #7.

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.

According to the US EPA's National Recommended Water Quality Criteria—Aquatic Life Criteria Table (referencing the 1986 Quality Criteria for Water) (https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table), 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.

Because of the previously cited significance of turbidity in 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.)

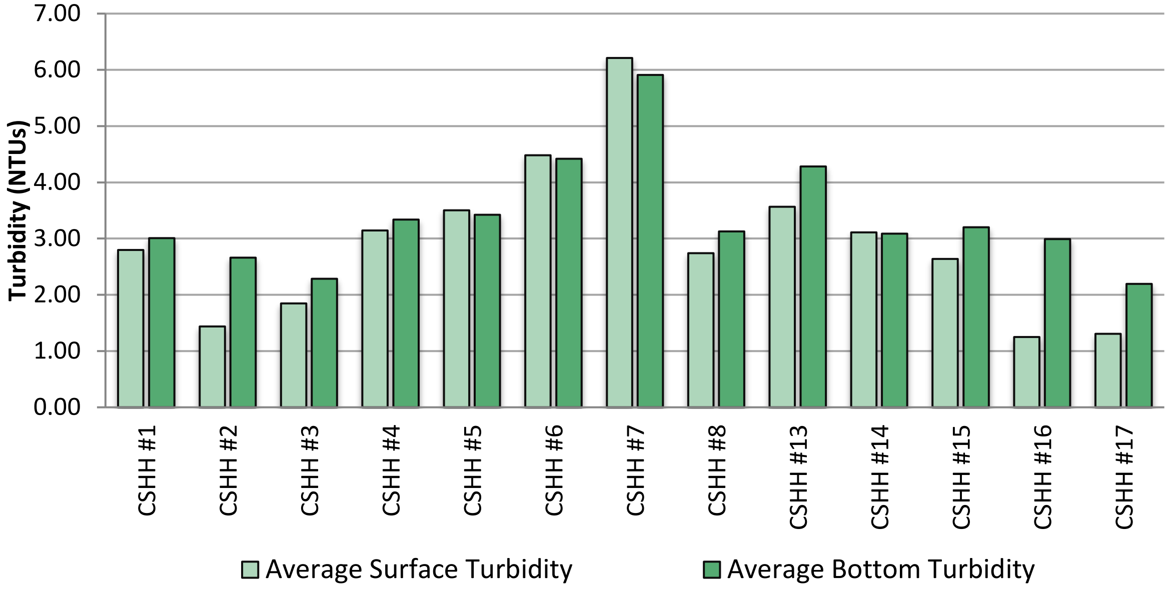
Given that the Secchi-disk depth decreases as the water sampled gets harder to see through, it follows that turbidity measurements should generally be inversely related. Measures of conditions at Hempstead Harbor stations clearly indicate an inverse relationship; that is, the greater the number for the 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). (See *Appendix A* for additional turbidity data and graphs.)

Secchi disk in green water post-Hurricane Ida
(photo by Carol DiPaolo, 9/3/21)

For all readings throughout the 2021 season, the range for surface turbidity was 0.38-10.90 NTUs for surface, and 0.50-10.75 NTUs for bottom turbidity. For 2021, the average surface turbidity was 2.50 NTUs; the average bottom turbidity was 3.13 NTUs.

The highest averages (most turbid readings) for both surface and bottom turbidity were recorded at CSHH #7 (6.21 and 5.91 NTUs, respectively). The lowest average (least turbid readings) for surface turbidity occurred at CSHH #16 at 1.25 NTUs; the lowest average bottom turbidity occurred at CSHH #17 at 2.19 NTUs.

Figure 11
2021 Average Surface and Bottom Turbidity by Station
Each set of bars depicts the average surface and bottom turbidity for each of CSHH's monitoring stations. Higher turbidity values and higher bars correspond to lower water clarity.



High values for turbidity were recorded at CSHH #6 and #7 towards the end of the season (September 3, following Hurricane Ida), and water color was noted as abnormal green/brown for the lower harbor. On the same date, the lowest Secchi depth of the season (0.3 m) was recorded at CSHH #7 as well.

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 (including algae and cyanobacteria) (cyanobacteria, often called "blue-green algae," 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 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, which may result in 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.

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*.

Preparing for filtration when Chl a was unusually high
(photo by Michelle Lapinel McAllister, 6/21/21)

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.

3.7.1 The Nitrogen Cycle

Nitrogen is generally made available to the marine environment through fixation, the transformation of nitrogen gas into ammonia by nitrogen-fixing bacteria. Nitrogen is also made available to the marine environment through inputs from the watershed. Inputs of nitrogen from the watershed are in the form of **ammonia** (NH_3), **nitrite** (NO_2), or **nitrate** (NO_3) (inorganic nitrogen). Inorganic forms of nitrogen can be assimilated into organic forms, such as amino acids, proteins, and urea, that are needed for growth and reproduction. (*Figure 12* presents a diagram of the nitrogen cycle in the water environment.) However, too much nitrogen can have adverse impacts on water quality. Nitrogen loading to the marine environment generally originates from fertilizer and human or animal wastes transported to water bodies through old or failing septic systems and wastewater treatment plants and from stormwater runoff.

Key Findings – Nitrogen

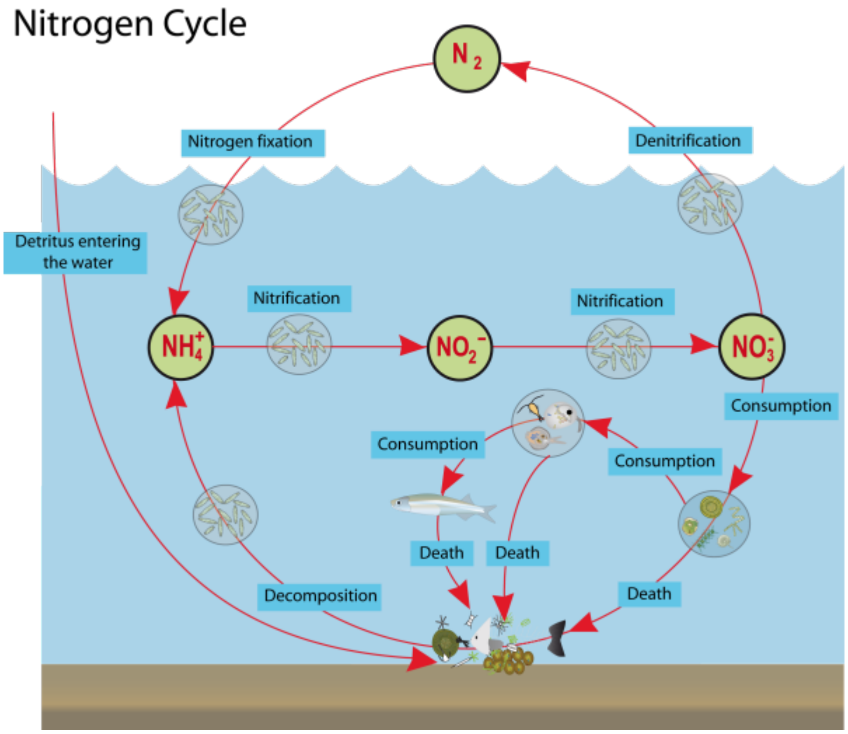
- In 2021, average total nitrogen was highest at outfall stations (CSHH #14A, #15A, and #8).
- In 2021, average total nitrogen ranged from 0.72 mg/L to 5.3 mg/L; in 2020, average total nitrogen ranged from 0.41 mg/L to 5.8 mg/L.
- CSHH #8 had the highest average ammonia levels of all stations sampled; for each sampling date for the entire season, total nitrogen consisted of up to 66% ammonia.
- All stations tested in 2021 had at least one reading over the course of the season that exceeded the 1.2 mg/L total nitrogen threshold, considered very poor.
- The average total nitrogen for all but two stations exceeded 1.2 mg/L, considered very poor quality.

What is important for water-quality concerns is not only the quantity of nitrogen entering a water body, but also the form of nitrogen. For example, ammonia can be present in the un-ionized form as free ammonia, NH_3, which 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).

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; $NH_4^{(+)}$ is ammonium; $NO_2^{(-)}$ is nitrite; $NO_3^{(-)}$ is nitrate



3.7.2 Nitrogen Monitoring by CSHH

From 2004 to October 2016, CSHH collected samples weekly at CSHH #1-3, #8, #13, #16, and #17 and, when tidal and weather conditions permitted, at CSHH #4-7, #14, and #15 to test for inorganic forms of nitrogen—ammonia, nitrite, and nitrate. Over that period, differing testing equipment and methodologies were used to test for nitrogen.

Beginning in 2018, water samples were collected weekly at CSHH #1-3, #8, #13, #16, and #17 and, when tidal and weather conditions allowed, at CSHH #4-7, #14, and #15; samples were delivered to Pace Analytical Services, LLC for analysis of nitrite, nitrate, and ammonia. Starting in 2019, water samples for nitrogen analysis, including total Kjeldahl nitrogen, were collected biweekly at 10 stations: #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 organic nitrogen and inorganic nitrogen. Organic nitrogen includes amino acids and urea; inorganic nitrogen consists of nitrate (NO_3), nitrite (NO_2), and ammonia (NH_3), in both dissolved and undissolved forms. Total Kjeldahl nitrogen (TKN) is the sum of organic nitrogen and ammonia.

The tidal indicator protocol established by the Mid-Atlantic Tributary Assessment Coalitions (*Wicks, et al., 2011, as cited in Taillie, et al., Water quality gradients and trends in New York Harbor, Regional Studies in Marine Science, Vol. 33, 2020, 100922*) identifies the following indicator thresholds for total nitrogen levels:

>1.2 mg/L, considered very poor (failing score)
0.8-1.2 mg/L, considered poor
0.6-0.8 mg/L, considered marginal
0.4-0.6 mg/L, considered fair
<0.4 mg/L, considered good (a passing score)

In 2021, **average total nitrogen** in Hempstead Harbor ranged from 0.72 mg/L at CSHH #16 to 5.3 mg/L at CSHH #14A, indicating marginal to very poor conditions. In comparison, the 2020 range (0.41 mg/L to 5.8 mg/L) indicated fair to very poor conditions. There were notable increases in 2021 for average total nitrogen for stations CSHH #1, #3, #6-7, and #12. (See *Appendix D* for total nitrogen graphs.)

Dissolved inorganic nitrogen (DIN) comprises NO_3, NO_2, and NH_4, which are the forms of nitrogen 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 calculates total inorganic nitrogen (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. Most of CSHH's TIN measurements are above this threshold; elevated TIN levels may indicate elevated DIN levels.

In 2021, CSHH #14A had the highest **average total inorganic nitrogen** (4.3 mg/L). This was the case in 2020 as well (5.1 mg/L). Average TIN levels for the ten stations regularly tested ranged from 0.05 mg/L to 4.3 mg/L. Stations CSHH #16, #3, and #1 had the lowest average TIN levels (0.05 mg/L, 0.16 mg/L, and 0.22 mg/L, respectively). At CSHH #1, #3, #6-7, and #16, average TIN concentrations and the majority of individual TIN values were below 0.5 mg/L, indicating good to fair estuarine water quality at these locations in terms of this parameter.

The presence of ammonia in the harbor can indicate nutrient enrichment. As stated previously, ammonia can be 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). In 2021, ammonia contributed more to total nitrogen at CSHH #8 than at any other station. This also represents a shift from 2020—last year, CSHH #14A had the highest average ammonia level at 0.65 mg/L, this is about half of what was seen in 2021 at CSHH #8. CSHH #16, #3, and #1 had the lowest average ammonia levels of all stations tested (0.01 mg/L, 0.09 mg/L, and 0.14 mg/L, respectively). In 2020, the same stations had the lowest average ammonia levels, however, the amounts were substantially lower.

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, 2017, and 2018, when ammonia was detected at all stations and seemed to coincide with a large presence of Atlantic menhaden throughout the harbor.

Large bunker school near pipes by Glen Cove STP outfall (photo by Carol DiPaolo, 9/15/21)

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. Nitrite is frequently below the detectable limit of 0.050 mg/L. Values are consistently low across stations when nitrite is detectable. In 2021, average nitrate levels ranged from 0.03 mg/L (at CSHH #16) to 3.7 mg/L (at CSHH #14A). High average nitrate values were also seen at CSHH #15A (2.4 mg/L) and CSHH #8/#8A (1.0 mg/L and 1.4 mg/L). The lowest average nitrate levels were at CSHH #16, #3, #6, and #1. The majority of readings at most of these stations were below the detectable limit for nitrate of 0.050 mg/L (73% of readings for CSHH #16, 67% for CSHH #6, and 58% for CSHH #3).

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, thereby reducing 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.).

3.8 Bacteria

For Hempstead Harbor, Nassau County Department of Health 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** are the types of bacteria 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.

Key Findings – Bacteria

- Levels for fecal indicator bacteria were lower at outer-harbor stations than near-shore and outfall stations, likely because they are less influenced by stormwater and other discharges from the watershed.
- Samples tested for fecal indicator bacteria at stations in Glen Cove Creek had levels that consistently exceeded the beach closure thresholds toward the end of the season and were later discovered to be related to a sewer line break.
- The outfall for the powerhouse drain had consistently high levels of bacteria for samples taken directly from the discharge.
- Results from both summer and winter monitoring at Scudder's Pond have shown lower bacteria levels for both fecal coliform and enterococci as compared with prerestoration levels.
- Hempstead Harbor beaches were closed due to high bacteria levels for 11 days during the season.

3.8.1 Beach-Closure Standards

The Beaches Environmental Assessment and Coastal Act of 2000 (BEACH Act) 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.

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

- 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.
- 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.

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 a half inch or more of rain within 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. Note that in calculating the total number of days 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. In 2018, additional tests, including DNA/source tracking, were conducted that pointed to wildlife and two ponds on private property as the source of the bacteria. As part of the 2021 DEC-approved remediation plan, the structure for the helix water-filtration system was installed in the fall on private properties adjoining the stream. In addition, a bioswale and wetland plants were installed to aid in natural filtration. Work will be completed in 2022.

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 2021, Hempstead Harbor beaches were closed on 16 dates as a precautionary measure following half an inch or more of rain in a 24-hour period (see *Appendix B*); beaches were closed a total of 11 days due to high bacteria levels. By comparison, in 2020, Hempstead Harbor beaches were closed a total of 4 days due to high bacteria levels (and all of these days were for Sea Cliff Beach).

Monthly average bacteria results for enterococci at Hempstead Harbor beaches in 2021 ranged from 0.40 CFU/100 ml, at Morgan Memorial Beach in April, to 279.42 CFU/100 ml at Crescent Beach in July. Crescent Beach remained closed all season and had the highest average fecal indicator bacteria levels of all area beaches for the season—143.08 CFU/100 ml. This is approximately double the season average for Crescent Beach in 2020 (71.87 CFU/100 ml). North Hempstead Beach Park (S) (former Bar Beach) had an average fecal indicator bacteria level of 31.93 CFU/100 ml for the season, the lowest among area beaches. All beaches, with the exception of North Hempstead Beach Park (S), exhibited much higher season averages compared with 2020. See *Appendix C* for previous years' comparisons.

Table 4
2021 Monthly Average for Beach Enterococci Data

	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	14.42	24.02	9.02	19.33	1.88	0.40	10.69
May	Enterococci	5.71	4.75	13.13	9.14	7.16	14.93	96.31
June	Enterococci	20.22	4.33	3.57	46.01	9.34	36.36	85.53
July	Enterococci	152.38	67.89	77.78	72.56	117.56	77.29	279.42
August	Enterococci	165.78	69.67	46.44	163.40	107.50	56.73	178.76
September	Enterococci	—	—	—	—	7.70	1.00**	52.83
Season Averages	Enterococci	79.08	35.59	31.93	68.28	51.31	44.25	143.08

**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.*
***Value based on only one sampling event.*

3.8.3 Monitoring CSHH Stations for Bacteria Levels

CSHH collects samples for bacteria analysis at 21 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 and have been the focus of the Hempstead Harbor winter monitoring program since 2013.

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 milky-white flow from CSHH #10 observed and reported over several years at these outfalls, which are near the Glen Cove sewage treatment plant outfall. Unusual discharges have been noted since 2004 and reported to Glen Cove city officials, NCDH, HHPC, Nassau County Department of Public Works (NCDPW), and NYS DEC. Despite efforts to identify the source(s) of these discharges, the results of the investigations provided inconclusive results.

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 has not been conclusively identified.

Outfalls in Glen Cove Creek: brown discharge from CSHH #9 (l); milky-white discharge from CSHH #10 (r) (photos by Carol DiPaolo, 6/2/21 and 5/19/21, 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 and 19 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.

In 2021, additional instances of brown flow from CSHH #9 were observed. In response, in early June, Glen Cove DPW installed a filtration system inside the manhole behind the STP that drains water through to that outfall. There were still a few instances of discolored or brown flow; about half of the samples collected after the installation of the filtration system had exceedances in bacteria levels. By October 13, 2021, the outfall at CSHH #9 was covered by construction of a new bulkhead.

A white flow was periodically seen at CSHH #10, but it was generally lighter than had been observed previously.

Bulkhead construction along the Glen Cove STP began in June 2021 and was completed December 2021. During that time, a bypass was constructed to divert the flow from the STP outfall (CSHH #8), and we continued to collect samples from the diverted flow (CSHH #8A). Once the work was completed at the western end of the STP, outfall pipes for both CSHH #8 and #9 were installed through the new bulkhead.

3.8.3.1 Comparing Bacteria Data for CSHH Stations

The bar graphs in *Appendix B* 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, including from municipal stormwater systems, which a recent report by the US Geological Survey found to be the most likely transport mechanism of fecal contamination into the harbor (See *USGS, Using Microbial Source Tracking To Identify Fecal Contamination Sources in an Embayment in Hempstead Harbor on Long Island, New York, Scientific Investigations Report 2021-5042)*. The outer-harbor stations typically show lower bacteria levels than other stations, and that pattern held true in 2021.

As in previous years, some of the highest bacteria levels in 2021 were recorded at stations within Glen Cove Creek (CSHH #9-13). Results from Glen Cove Creek stations in 2021 showed bacteria levels even higher than usual. Results showed consistent exceedances at the head of the creek (near Mill Pond) as early as July.

In observing bacteria levels from Glen Cove Creek stations, beginning with CSHH #3 (near the entrance to Glen Cove Creek and farthest from Mill Pond) to CSHH #13 (the station at the head of Glen Cove Creek and closest to Mill Pond), a pattern of higher bacteria levels for FC and ENT were noticeable. The percent of samples exceeding thresholds in Glen Cove Creek stations were:

- CSHH #3: 4% FC, 12% ENT (25 total samples)
- CSHH #8: 18% FC, 25% ENT (28 total samples)
- CSHH #9: 14% FC, 71% ENT (21 total samples)
- CSHH #10: 21% FC, 57% ENT (28 total samples)
- CSHH #11: 55% FC, 82% ENT (22 total samples)
- CSHH #12: 48% FC, 78% ENT (27 total samples)
- CSHH #13: 52% FC, 78% ENT (27 total samples)

By October 28, 2021, the degree and consistency of these exceedances were alarming. CSHH alerted the Glen Cove DPW, Nassau County DPW and Department of Health, the Hempstead Harbor Protection Committee, as well as Suez (the operator of the Glen Cove sewage treatment plant) about the high bacteria counts throughout the creek, including near the STP plant. CSHH continued weekly testing beyond the regular monitoring season through early December, adding new testing stations in order to narrow the location of the pollution source. CSHH was assisted by Glen Cove DPW and Glen Cove Harbor Patrol in collecting samples for Glen Cove Creek as well as Mill Pond, which drains into the creek, and areas of Cedar Swamp Creek, which runs through Glen Cove and into Mill Pond (NCDH provided the analysis for these additional samples). The results from the samples collected narrowed the location of the pollution source to the vicinity of Bridge Street.

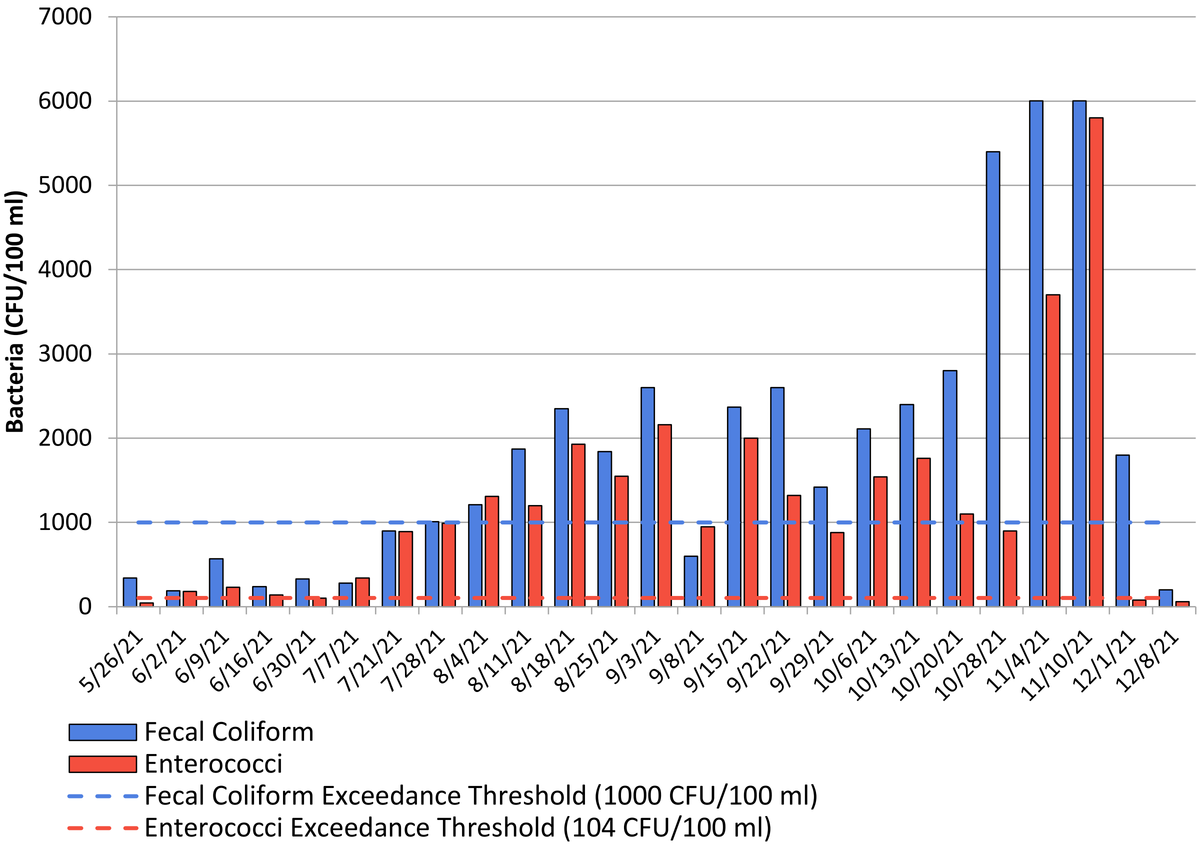
Discolored water at Mill Pond spillway leading to Glen Cove Creek (l); Mill Pond (r) at Pratt Park fed by Cedar Swamp Creek (photos by Carol DiPaolo, 10/12/21 and 11/18/21)

On November 22, CSHH, Glen Cove DPW, and Nassau County DPW met with a representative of Suez at Mill Pond to plan the next day's water-sample collection. On the day of the meeting, a long-time Glen Cove resident familiar with the culvert that ran under Bridge Street walked through the culvert and observed a broken pipe, which he filmed. Water samples were collected on November 23 to determine whether there were other "hot" spots throughout the stream system and confirm that the broken pipe in the video was the source of contamination.

Cedar Swamp Creek culvert (l) along Pratt Blvd. leading to center of Glen Cove; manhole (c) tested west of Cedar Swamp Creek culvert and east of sewer line break in Glen Cove at Bridge Street (r) (photos by Carol DiPaolo, 11/18/21 and 11/23/21, and Martha Braun, 12/2/21, respectively)

All parties were informed of the data results, Suez scheduled work on November 29, confirmed that the broken pipe was a broken sewer line, and installed a bypass. CSHH collected water samples in Glen Cove Creek on December 1, and lab results showed a dramatic decrease in the bacteria levels following the installation of the bypass, although the sample collected at the head of the creek still had a very high fecal coliform count. The sewer line repair was completed by the end of the day on December 2, and CSHH collected another round of water samples from Glen Cove Creek on December 8; lab results showed dramatically lower bacteria levels, well below thresholds that are used for beach closure standards. See *Figure 13*.

Figure 13
2021 Fecal Indicator Bacteria Testing at CSHH #13
Fecal coliform and enterococci results for each sampling date are depicted as blue and red bars, respectively. Exceedance thresholds for both fecal indicator species are depicted as dashed lines. Lab results for fecal coliform greater than 6000 CFU/100 ml are represented at an absolute value of 6001 CFU/100 ml.



For some 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 one might expect that all indicators of fecal pollution would behave similarly, it is not uncommon for differences to occur. 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.

The data collected from the Hempstead Harbor water-monitoring program has helped us to understand expected levels of bacteria at various in-harbor and shoreline stations and stations in Glen Cove Creek during the regular season. This information is what helped to identify the 2021 Glen Cove sewer line break.

The winter monitoring program, which first focused on conditions at Scudder's Pond, currently focuses primarily on the Powerhouse Drain Subwatershed (CSHH #14A) with continued monthly checks at Scudder's Pond (CSHH #15A and #15B). This program now has nine 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.)

Scudder's Pond in late autumn (photo by Carol DiPaolo, 11/18/21)

During the first winter monitoring season, results from the analysis of water samples collected did not show a significant decline in bacteria levels that could be attributed solely to colder temperatures. Although there was some expectation that bacteria levels would decrease in the colder temperatures, there are factors that may contribute to the continued higher bacteria levels during the winter (e.g., lower temperatures and UV conditions during winter months may promote slower decay and longer survival rates of the bacteria species).

In the winter samples for 2021-2022, there were no fecal coliform exceedances at Scudder's Pond stations (CSHH #15A and #15B). Summer samples for 2021 also had relatively few fecal coliform exceedances at these stations. For both CSHH #15A and #15B, a lower percentage of samples exceeded enterococci standards in the winter than in the summer (there were no exceedances in enterococci at these stations for 2021-2022 winter monitoring). Overall, the data indicate significant improvement in conditions at the Scudder's Pond outfall as a result of the restoration. See *Table 5*.

Table 5
Stations Exceeding Bacteria Standards[1]—Summer and Winter Monitoring

CSHH Stations	#15A[2]		#15B[3]		#14A[2]	
% of CFU[4] Exceedances	FC[5]	ENT[6]	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%	--[7]	--[7]
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%
5/19/21-10/28/21	4%	38%	0%	33%	0%	57%
11/10/21-4/14/22	0%	0%	0%	0%	57%	79%

[1] *For purposes of comparison, beach-closure thresholds for fecal coliform and enterococci 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] *Starting in summer 2019 season, only monthly testing at CSHH #15B.*

[4] *CFU: colony-forming units.*

[5] *FC: fecal coliform.*

[6] *ENT: enterococci.*

[7] *Only one sample collected during this period.*

Winter exceedances for the powerhouse drain outfall (CSHH #14A, at the bottom of Glenwood Road) increased for both fecal coliform and enterococci from 2020 to 2021 and reached new highs in December 2021. The higher levels prompted an investigation similar to what had occurred in Glen Cove Creek. An extended sampling schedule was developed for Glenwood Landing and encompassed areas around the small creek that runs through the lower part of Glenwood Landing and into Hempstead Harbor through the powerhouse drain outfall. With the assistance of Nassau County DPW, CSHH collected water samples from selected manholes that are located on both sides of Glenwood Road. The investigation continued through the spring of 2022.

Samples collected in winter 2021-2022 for CSHH #14A had elevated levels of fecal coliform (57% of fecal coliform samples exceeded the threshold of 1,000 CFU/100 ml), whereas there were no exceedances in summer 2021 water samples. In contrast, enterococci levels for summer samples collected at CSHH #14A were high and remained high in the winter, with 79% of samples exceeding the threshold of 104 CFU/100 ml. Bacteria levels from discharges from the powerhouse drain outfall and the surrounding subwatershed are of concern, and, despite extended sampling to areas upland of the outfall, the source of the bacteria remains inconclusive.

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, a portion of the 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 applied to marine and estuarine waters that are considered to have ecological, social, scenic, economic, or recreational importance. Class SA waters have the highest level 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 meeting on October 16, 2008, 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 created a pathogen TMDL workgroup (of which CSHH and HHPC are members) to discuss formulation of new TMDLs and prioritization of waterbodies around the state; Hempstead Harbor is expected to be among the first waterbodies to have a new TMDL.

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

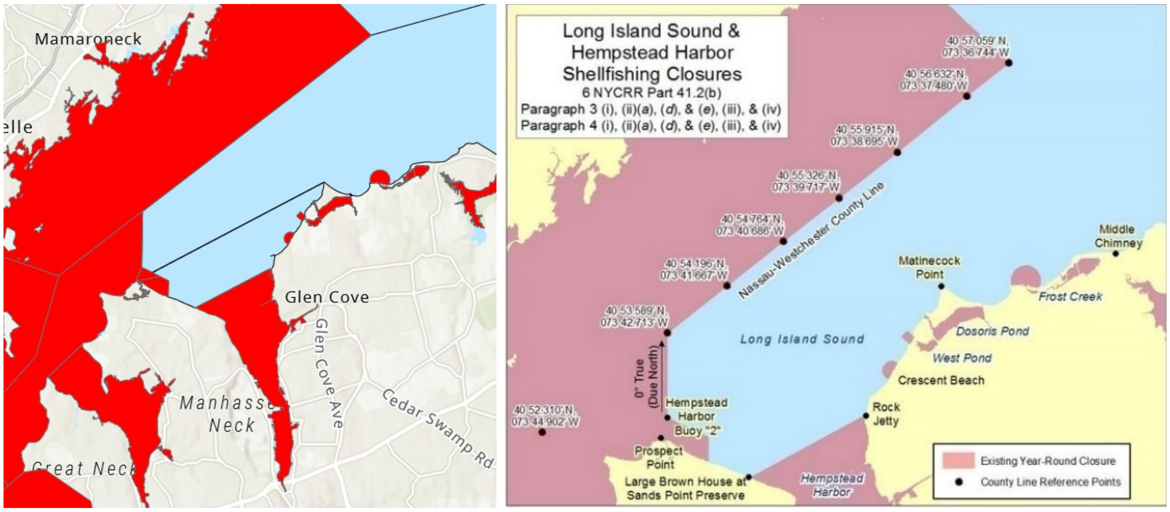
On June 1, 2011, 2,500 acres of recertified shellfish beds were opened in the outer section of Hempstead Harbor. This followed five years of rigorous water-quality testing, as well as testing of samples of hard-shell clams from the area. For the first time in more than 40 years, clams, oysters, mussels, 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. 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, were reclassified as uncertified (closed) for shellfish harvesting because of an increase in bacteria levels. On November 22, 2021, 134 acres of Hempstead Harbor adjacent to Prospect Point were downgraded from certified year-round to uncertified year-round. However, 6,150-acres of Long Island Sound east of Prospect Point and south of the Nassau-Westchester County Line were upgraded from uncertified year-round to certified year-round. See *Figure 14*.

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 2021, there were four emergency closures of shellfish beds in Hempstead Harbor and other bays along Long Island’s north shore due to extreme rain events that occurred on July 9, August 23, September 2, and October 26. Shellfish beds remained closed as a result of these events for up to 13 days for a single event (following Hurricane Ida). (See also *Section 3.9*.)

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 14
NYS DEC's Map of Hempstead Harbor and Long Island Sound Uncertified Shellfishing Areas
Areas in red (map below at left) and pink (map below at right) designate uncertified areas as of 2021.



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 and other wildlife 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 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*).

In 2018-2019, USGS worked with NYS DEC and used microbial source tracking (MST) to assess potential sources of fecal contamination entering Hempstead Harbor. Water samples were collected in Glen Cove Creek (near CSHH #8), Tappen Beach (near CSHH #15A), at the powerhouse drain outfall (CSHH #14A), and an outfall and spillway in the lower harbor at the end of Skillman Street in Roslyn. MST was used to determine whether genetic material (from *Bacteroides* and *Heliobacter* bacteria) in samples collected for the study was consistent with that found in humans, dogs, ruminants (e.g., deer), or water fowl. The report concluded that (1) a substantial number of samples showed markers from humans, dogs, and water fowl, and (2) stormwater from municipal stormwater systems was the most likely transport mechanism for fecal contamination to Hempstead Harbor, and (3) outfalls at the end of Glenwood Road and Skillman Street contributed a substantial amount of fecal contamination to Hempstead Harbor (see *USGS, Using Microbial Source Tracking to Identify Fecal Contamination Sources in an Embayment in Hempstead Harbor on Long Island, New York, Scientific Investigations Report 2021-5042*).

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.

Stormy view of east shore of Hempstead Harbor
(photo by Michelle Lapinel McAllister, 9/22/21)

CSHH collects precipitation data using a rain gauge located in Sea Cliff. (See *Appendix B* for 2021 monthly total precipitation and 1997-2021 monthly rainfall totals.) In 2021, there were four storms that accompanied extreme rain events affecting Hempstead Harbor: July 9, Tropical Storm Elsa, 3.72 in of rain; August 22, Hurricane Henri, 4.81 in of rain; September 1, Hurricane Ida, 6.57 in of rain; and October 26, a nor'easter storm, 3.44 in.

Total precipitation measured during June through October 2021 was 36.15 in, or 918.21 mm. The summer precipitation amount of 27.83 in, 706.88 mm (for June 20 through September 22), was more than double that for the same period in 2020. July was the wettest month in 2021 (12.39 in, or 314.71 mm), followed by September (9.29 in, or 25.97 mm) and August (7.13 in or 181.10 mm), respectively. For 2021, 14 rain events had precipitation amounts that were greater than an inch.

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

4 Observations

The 2021 water-monitoring season for the Hempstead Harbor core program began on May 19 and extended through October 28 (monitoring for the Unified Water Study began on May 16 and extended through October 25); winter monitoring of shoreline outfalls ran from November 10, 2021, through April 13, 2022.

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).

CSHH #14A, powerhouse drain outfall, adjacent to lot that was the site of the old powerhouse building (photo by Carol DiPaolo, 9/2/21)

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 this change has contributed to the increase in fish populations noted over the last several years 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; in 2021, the total was up to 7,815. (Note that in 2020, no seining was conducted in May and June because of COVID-19 delays; therefore, total catches and the number of species represented for the entire season are reduced compared with other years' seasonal totals.)

Significant seine catches in Hempstead Harbor for 2021 included bluefish (643), northern puffers (274), scup (aka porgies) (9,139), silversides (16,961), and killifish (786). Also of note, the number of blue crabs (61) was up significantly from previous years and corresponds with our monitoring observations.

Table 6
2021 NYS DEC Western Long Island Beach-Seine Survey for Hempstead Harbor

NYS DEC Western Long Island Survey- Hempstead Harbor 2021

			MONTH						
Type	Common_name	AGE	5	6	7	8	9	10	TOTAL
Diadromous:	ALEWIFE	99			1			1	2
	AMERICAN EEL	99		1	1				2
	STRIPED BASS	1	4	10	14	8	6	1	43
Marine:	ATLANTIC MENHADEN	0			5788	1700	319	8	7815
	BAY ANCHOVY	99					162	1	163
	BLACK SEA BASS	99				3	2		5
	BLACKFISH (TAUTOG)	0			1	245	24	3	273
	BLACKFISH (TAUTOG)	1	6	16	11	18	13	1	65
	BLUEFISH	0			78	28	437	100	643
	CREVALLE JACK	99					3		3
	FEATHER BLENNY	99					2	2	4
	GRUBBY SCULPIN	99	2	4	3	2	1		12
	NAKED GOBY	99	1	1	2	1	2	2	9
	NORTHERN KINGFISH	99				2	10	1	13
	NORTHERN PIPEFISH	99	10	8	6	36	4	3	67
	NORTHERN PUFFER	99			2	193	79		274
	NORTHERN SEAROBIN	99	1				5	2	8
	NORTHERN SENNET	99			1				1
	OYSTER TOADFISH	99		1		2	1		4
	SAND LANCE SPP.	99		38					38
	SCUP	99			109	4787	3949	294	9139
	SILVER PERCH	99				2			2
	SILVERSIDE SPP.	99	281	119	1501	8213	6135	712	16961
	SKILLETFISH	99						1	1
	SPOTTED HAKE	99	1						1
	STRIPED ANCHOVY	99				3			3
	STRIPED SEAROBIN	99	8		5	18	5	2	38
	SUMMER FLOUNDER	99	1	2	2	2			7
	WHITE MULLET	99						13	13
	WINTER FLOUNDER	0		7	4	7	1		19
Estuarine:	KILLIFISH SPP.	99	117	4	84	457	59	65	786
Invertebrate:	ASIAN SHORE CRAB	99		2					2
	BLUE CRAB	0	2	3	3	1			9
	BLUE CRAB	1	1	10	12	18	2	9	52
	CALICO (LADY) CRAB	99			1				1
	CHANNELED WHELK	99			1				1
	HORSESHOE CRAB	1					1		1
	HORSESHOE CRAB	99	2	4	1				7
	MUD CRAB	99			6		2		8
	SEA STAR	99		1			1		2
	SPIDER CRAB	99	9	3	12	21	1	4	50
		# of hauls	6	6	6	6	6	6	36

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

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.

Bayman Tom LoCicero clamming in the fog (l) and sorted clams from Hempstead Harbor on opening day of the shellfish area (above) (photos by Carol DiPaolo, 7/7/21 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. As of November 22, 2021, 134-acres of shellfish beds were closed in waters adjacent to Prospect Point, while 6,150-acres were opened for the first time just outside of Hempstead Harbor in the open waters of Long Island Sound. (See *Figure 14.*)

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 used to harvest clams in Hempstead Harbor; the clams were then transported 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 for shellfish areas. Subsequent landing reports showed a substantial decrease in the hard-clam haul for Hempstead Harbor. In 2020, however, the hard-clam haul was 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.

The 2021 haul was down from the previous year, but still substantial, at 11,111 bushels of hard clams. The soft-shell clam haul increased to 12 bushels, and the oyster haul was a third of what it was in the prior year. In Oyster Bay and Huntington Bay, hauls continued to decrease, with the exception of soft-shell clams in Oyster 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 2021, we observed 4-6 clammers on most monitoring dates, with a high of 11 clammers at Matinecock Point on October 13. 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.

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, 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 50 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* 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 limited shellfish-density survey focusing on 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), there was an abundance of the very small surf clams referred to as “duck feed” and no hard-shelled clams or oysters in the samples. As the bottom transitioned to sand closer to shore, samples included a variety of hard-clam sizes, from littlenecks to chowder; the largest number in one raking included 10 clams. A few seed clams of both types of clams used in the seeding project–*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 large-scale shellfish population-density survey that included 61 stations in Hempstead Harbor. Future population-density surveys would replicate the stations used in the 2008 survey and compare results. The density of seeds found in 2008 was concerning at 0.57 clam/sqm, representing 31.7 percent of the total population. This meant that there was an aging clam population and that Hempstead Harbor could benefit from seeding projects.

In 2009, 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 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 in the area off of Morgan Park. The assessment helped determine suitable sites to plant seed clams and oysters In preparation for Nassau County’s 2009 shellfish seeding in Hempstead Harbor.

During the sediment assessment, a natural population of predominately hard clams (*Mercenaria mercenaria*) was observed in the central and southern area of the survey and also 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, the Town of Oyster Bay used Cashin Associates to conduct a second shellfish-density survey that encompassed 120 bottom grab samples at the same 61 stations used in the 2008 survey. Among the findings in the survey report (July 9, 2014) were 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.

In October 2021, HHPC used Cashin Associates to conduct a shellfish density survey for Hempstead Harbor. The survey included 183 samples that were collected from stations throughout the harbor and were consistent with those used for the 2008 and 2013 surveys. The final survey report (issued on April 13, 2022) concluded that, overall, clam density had increased, with the highest number of clams per square meter in the lower harbor. The percent of seed clams by population was still very low compared with the 2008 finding, mean size of clams had also increased, overall indicating an older and therefore unstable clam population. No oysters were obtained in grab samples, although some were observed by divers who assessed the harbor bottom to create a sediment survey map.

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

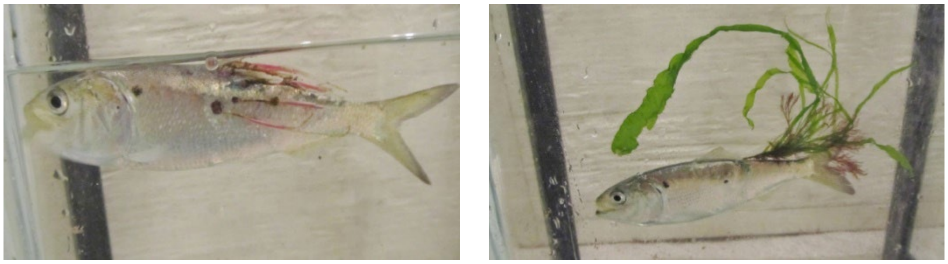
Ribbed-mussel colonies on Hempstead Harbor's eastern shore (l) and a close-up of ribbed mussels around spartina roots of the former Bar Beach cove (r) (photos by Skip Dommin, 5/17/21, and Carol DiPaolo, 7/15/17, respectively) the IBM Country Club/Guggenheim Estate), was used as part of NOAA's National 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.

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 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.

Saladbacks have been seen in Hempstead Harbor every year since that first observation in 2015, except for 2018, but in smaller numbers. In 2021, saladbacks were observed on three occasions and appeared in 10-20% of the population. The last bunker/saladback sighting was on December 8 near the Glen Cove STP outfall.

(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 Hempstead Harbor. Starting off our 2021 reports, Skip Dommin reported seeing migratory birds in January and February on his walks along Tappen Beach and Prospect Avenue (Sea Cliff). He reported seeing red-breasted mergansers, greater scaup, and bufflehead. He also saw brants, American black ducks, and common loons. Skip noted that there were fewer migratory birds in Hempstead Harbor than he had seen in other places on the north shore, such as Oyster Bay.

On January 17, large bunker were observed swimming at the head of the creek at the dogleg section that spills out from Mill Pond. Several dead fish were on the rocks below the spillway, seemingly left as the tide went down. Freezing temperatures likely contributed to this bunker mortality.

Spillway from Mill Pond to Glen Cove Creek (l) and dead bunker on nearby rocks (r)
(photos by Carol DiPaolo, 1/17/21)

It was also noted that the dilapidated barge that was rusting away for years at the head of Glen Cove Creek was finally removed in early January. It was the source of large foam blocks escaping and ending up in pieces throughout the creek and harbor.

On three occasions in January and February, while collecting water samples from the powerhouse drain outfall during a low tide, we saw large depressions in the sand below the outfall. The depressions appeared to be the result of someone digging for clams, but there were no signs of human footprints—just a lot of tracks left by ducks and gulls. These depressions were seen again later in the season.

Powerhouse drain outfall during winter sampling and sand holes and bird tracks below the outfall (photos by Carol DiPaolo and Michelle Lapinel McAllister, 1/20/21 and 1/6/21, respectively)

In February, Sanjay Jain photographed Hempstead Harbor's resident bald eagles in a snowy perch in Roslyn Harbor and reported that at the end of the month they had been observed mating. He also reported seeing a few red foxes in Roslyn Harbor, all looking in good health, and noted the activity of some migrating birds:

> *I also noticed what looked like mergansers a few weeks ago. Buffleheads have been around for a while on an intermittent basis. Have had a few flocks of scaups hanging around as well.*

Red fox and bald eagles in Roslyn Harbor (photos by Sanjay Jain, 2/12/21 and 2/5/21, respectively)

On March 2, we received a "low water" marine alert for New York City; high winds were driving the water out of the bays and sound. Sebastian Li reported that it was the lowest tide he had ever seen in Hempstead Harbor, and the wave action was intense with long bands of swells. Besides large boulders being fully exposed around the shoreline, Sebastian said his neighbor "…went down to the beach and saw oysters the size of his hand well below the normal tide line."

By March 26, the ospreys had returned. Two new osprey nests were spotted around the harbor—one built precariously on top of a crane at Gladsky Marine Salvage in Glenwood Landing and another on the dock house of the Sea Cliff Yacht Club.

Osprey perched on mast and swan prints (photos by Carol DiPaolo and Sebastian Li, 3/26/21 and 3/13/21, respectively)

Some of the harbor's swans remained in view in the upper harbor through the winter; Sebastian Li sent photos of prints they left behind.

Reports for Hempstead Harbor seemed to indicate that the bunker were returning earlier than usual. On April 7, 2021, Sebastian Li reported seeing schools of bunker in the harbor. On April 14, the owner of the Cove Restaurant in Glen Cove reported seeing schools of bunker in Glen Cove Creek. On April 19, Matt Richards of NYS DEC reported that large schools of bunker were already in the eastern part of Long Island Sound and were also being feasted on by large numbers of gannets.

On April 13, 2021, Kenny Neice reported seeing a large lion's mane jellyfish by Safe Harbor Marina in Glen Cove, and Michelle Lapinel McAllister saw one in the Glen Cove Creek the next day. Our first report of a lion's mane jelly in 2020 occurred later in the month—on April 25. Although lion's mane jellies can range in color from orange to maroon, we have been seeing more of the orange variety over the last few years.

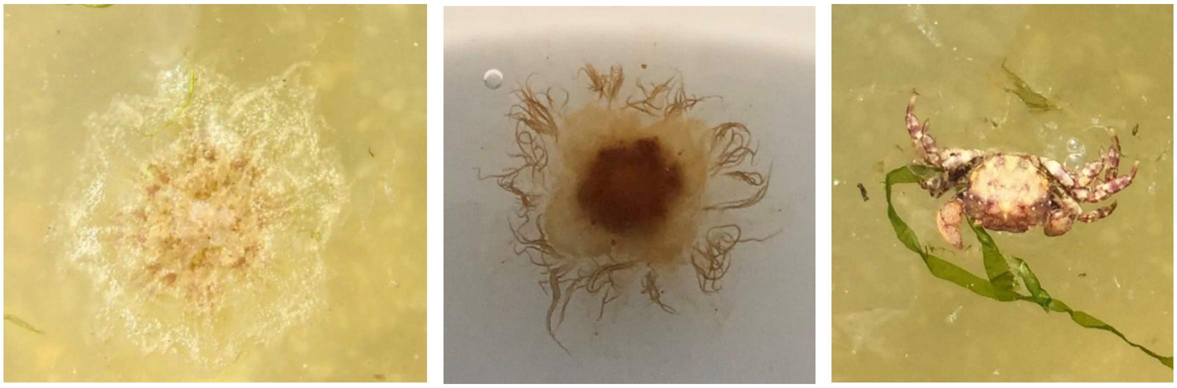
May

The core monitoring weekly surveys began in May and were conducted on May 19 and 26. There were 15 osprey nests easily visible around the shores of Hempstead Harbor, (three of the nests were built in 2020). Large numbers of comb jellies (sea walnuts) were present near Beacon 11 and a few in Tappen Marina. We saw many of the usual birds (ospreys, cormorants, mallard ducks, swans, terns, and one snowy and great egret, respectively) and up to 9 goslings and 15 ducklings. On May 26, there were 5 turkey vultures flying over Glen Cove Creek and 5 hooded gulls at Bar Beach.

Sea robin (photo by Carol DiPaolo, 5/19/21)

On May 19, while providing boat transportation for the monitoring program, Paul Boehm caught three sea robins. Also on May 19, local fisherman Tom Binder reported catching a 42-lb striped bass off of Matinecock Point. In early May, we received a report that a severely decomposed turtle was seen in Safe Harbor Marina in Glen Cove. The photos of the remains sent by Serge and Karen Papasergiou seemed to indicate it was a diamondback terrapin.

In mid-May, we received reports of jellyfish in the harbor that seemed to have a red dot on them and other reports of clear jellies in the water off of Sea Cliff beach. On May 19, we saw more than 40 small jellyfish carried quickly out of the lower harbor on an outgoing tide. Although they had some similarities to lion's mane jellies that we have seen previously in Hempstead Harbor, there were several differences. The top of the bell was a deep orange-brown color in the center surrounded by a lighter orange color with a dark fringe, and there were no apparent long tentacles trailing from the underside of the bell. Kim McKown of NYS Department of Environmental Conservation, Marine Resources, and others helped with identifying them as early stages of lion's mane jellies, which can also be clear—as seemed to be the case with the jellies seen off of Sea Cliff Beach at about the same time in May.



Early stages of lion's mane jellyfish at Sea Cliff Beach (l) and near Beacon 11 (c) and Asian shore crab (r) (photos by Joanna Keenan, (l) and (r) 5/17/21, and Carol DiPaolo, (c) 5/19/21)

In the mix with other observations off of Sea Cliff Beach were tiny Asian shore crabs—floating belly up.

On May 26, the water appeared brown in color in Tappen Marina. Similar coloration occurred in Safe Harbor Marina the following day.

June

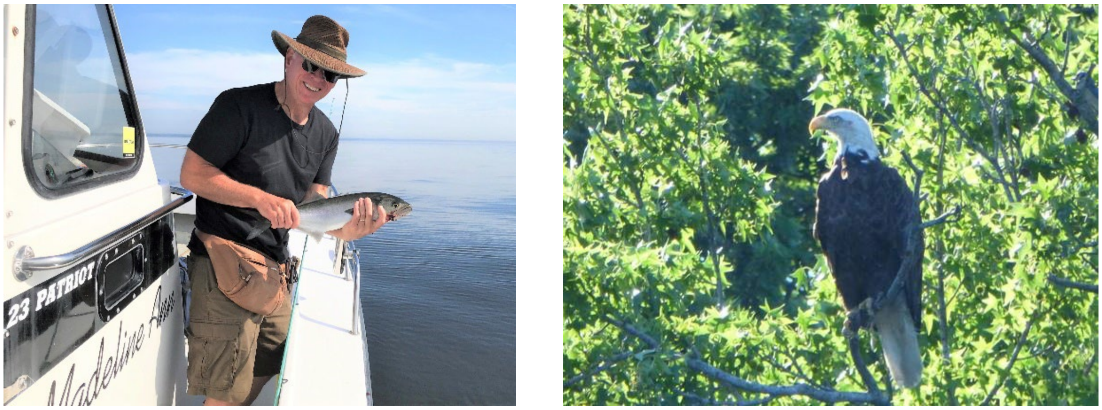
Weekly monitoring was conducted on June 2, 9, 16, 23, and 30. On June 2, we observed remarkably high-water clarity for this time of year throughout the upper harbor stations, this was particularly of note after six days of consecutive rain (May 26-31). The greatest Secchi-disk depth on June 2 was 3.5 m at CSHH #16. By early to mid-June, Secchi depth had decreased to about 1.5 m at CSHH #16, and the observed water color was brown in Glen Cove Creek, Tappen Marina, and lower harbor stations.

Each week in June, we observed large numbers of ducklings (up to 32 on one day), particularly in Glen Cove Creek. The osprey population continued to increase around Hempstead Harbor, and fledglings were seen at nests with adults.

On June 2, we saw large comb jellies (sea walnuts), too numerous to count, in Tappen Marina. The following week, only two sea walnuts were observed near Beacon 11.

On June 8, Sanjay Jain reported observing two fledglings in the bald eagle nest in Roslyn Harbor. He also reported seeing two red foxes with two kits and many goslings and groundhogs in the area. At this point, we had not seen the youngest members of the bald eagle family, but we did observe two adults on June 23 during the monitoring trip to the lower harbor.

In the early morning of June 9, depressions in the sand below the Powerhouse Drain outfall were observed that were similar to those seen at that location in January and February.



Paul Boehm with bluefish (l) and bald eagle perched in a tree along the eastern shore of the harbor (r)
(photos by Michelle Lapinel McAllister, 6/9/21, and Martha Braun, 6/23/21, respectively)

Paul Boehm reported that during the first week of June he was catching bluefish by the bell buoy in the outer harbor and fluke and lots of porgies off the west shore of the outer harbor. On June 9, Bob Chaputian caught two striped bass—34 inches and 29 inches long— off the east shore of the outer harbor. On the same day, while transporting the crew to monitoring stations, Paul Boehm caught a blue fish at one of the stops.

On June 30, we saw our first blue-claw crabs for the season in both Tappen Marina and Glen Cove Creek. We also saw two killdeer on the Sea Isle sand spit.

July

Weekly monitoring was conducted on July 7, 14, 21, and 28. On July 5, we received reports of dolphins in Oyster Bay. The next day, a pod of about 50 dolphins was seen in Hempstead Harbor near the Legend Yacht & Beach Club (the former Lowe estate) in Glen Cove at about 3 pm. During the next day's monitoring survey, we noticed more bunker activity at the surface throughout the harbor, which may have attracted the dolphins.

Dolphins in Hempstead Harbor
(photo by Doug Brown, 7/6/21)

Also, during monitoring on July 7, we observed a light brown discharge from an outfall east of the ferry terminal discoloring the creek water around it. We called Rocco Graziosi (Glen Cove DPW); he said the spill came from remediation of Mattiace Petrochemical Superfund site located at 16 Garvies Point Road. The remediation ended on this day, the culmination of a 5-year cleanup project.

On July 9, Tropical Storm Elsa arrived in New York and brought 3.72" of rain, following 1.39" of rain on the previous day.

On July 14, we saw more than two dozen striped bass by the Glen Cove STP that were about 6-9 inches long. A clammer by Crescent Beach reported seeing lots of moon snail kill, about 3 in every grab of clams. Most of his grabs comprised "middle necks," not many small clams, some seed, and he found that conditions were similar in Long Island Sound and other bays. All month long, blue-claw crabs were present near the Glen Cove STP outfall and/or in Tappen Marina.

Great blue heron (l) and great egret taking off from Glen Cove Creek (r) (photos by Carol DiPaolo, 7/28/21)

Throughout the month, we saw the usual variety of birds: cormorants, mallard ducks, great egrets, a few snowy egrets, Canada geese, great blue herons (up to 12 on one day), one hooded gull, ospreys, swans, and terns. In early July, we saw one turkey vulture flying over Glen Cove Creek. On July 21, we saw one belted kingfisher, 3 killdeer, and 3 tiny piper types (possibly sanderlings). On the two trips to the lower harbor during June, we saw two adult bald eagles; on the second trip, we had our first sighting for the season of two juvenile bald eagles.

By July 21, we started to see hypoxic conditions at bottom depths at four mid- and outer-harbor stations. Hypoxia was detected again at two outer harbor stations a week later. On July 28, a hazy smoke was present in the atmosphere from wildfires in the western United States. Meanwhile, the water appeared clearer than it had been in weeks. Doug Brown said that Long Island Sound still appeared brown, but Hempstead Harbor looked good as he entered from the sound.

By the last monitoring survey in July, the new overlook along the north side of Glen Cove Creek by the Garvies Point development and adjacent to the recently replanted wetland area was completed. Pile driving continued for the new bulkhead on the south side of Glen Cove Creek that would replace the old bulkhead along the Glen Cove sewage treatment plant (work for new bulkhead began around June 23).

August

Weekly monitoring took place August 4, 11, 18, and 25. At the start of the month, the water in the lower harbor appeared olive green in color with algal/pollen slick in patches. The water turned to a normal green as the month progressed. By August 25, we observed a brown hue.

Three ospreys in the Beacon 11 nest and a blue-claw crab underwater on the bulkhead in Glen Cove Creek (photos by Elaine Neice, 8/4/21, and Carol DiPaolo, 8/18/21, respectively)

On August 11, we noticed about 30-40 dead bunker floating by as we traveled to our monitoring stations. Most were very large and in varying states of decomposition. We also noticed about a dozen dead bunker on docks in Glen Cove Creek—brought up and eaten by birds. There have been large schools of bunker throughout the harbor. We saw large schools of bait fish and numerous blue crabs that seem to be unaffected by whatever was affecting the bunker. We did see a very large dead carp in Glen Cove Creek on August 11 (we've noted previously that some carp evidently make their way from Mill Pond and end up at the head of Glen Cove Creek, but this one was closer to the mouth of the creek, following an outgoing tide).

Only two stations in Hempstead Harbor had hypoxic conditions at bottom depths on August 11—one station in Tappen Marina and CSHH #1 at the navigational light, Beacon 11; other stations had DO near or above 5 ppm. We continued to get hits of hypoxia at bottom depths throughout the month, mainly in the mid- and upper-harbor stations. The highest incidence of hypoxia occurred on August 18 at six stations in both the upper- and lower-harbor stations.

We saw the usual variety of birds, including cormorants, mallard ducks, Canada geese, great blue herons, ospreys, and mute swans. Great egrets were seen as well and up to a stunning count of 32 between the lower and upper harbor on August 18. We saw just two snowy egrets on August 25. We counted up to 30 terns on August 4. On the same day, we saw a plover-type bird at Tappen rocks and 5 killdeers in the lower harbor. A belted kingfisher was spotted on August 4 and 11 in the upper and lower harbor, respectively. On trips to the lower harbor, we saw up to two adult and two juvenile bald eagles. On one of these days, we watched an adult bald eagle catch a fish only to be thwarted by its younger counterpart; the fish was lost in the scramble.

Two types of comb jellies—sea walnuts and sea gooseberries—were present in the latter part of the month (August 18, 19, 25). Blue-claw crabs were observed throughout the month between the Glen Cove STP outfall and Cove restaurant. On August 25, we saw 18 blue crabs, including one swimming near the red nun before the mouth of Glen Cove Creek. We also saw 1 to 2 Asian shore crabs this month.

Hurricane Henri occurred August 22 and brought 4.81” of rain.

September

Hurricane Ida arrived September 1 and continued through the night. The storm hit from the northeast and brought heavy rain (6.57”) and flooding. There were at least five landslides/ washouts around Hempstead Harbor that resulted from this event along both the east and west shores. Trees were uprooted, fences and sidewalks collapsed, and street signs came down.

Landslides, cave-ins, and washouts (l to r) in Sea Cliff, Glenwood Landing, and Sands Point (photos by Carol DiPaolo, 9/3/21)

Monitoring surveys were conducted on September 3, 8, 15, 22, and 29. On September 3, one of the effects of the heavy rain brought in by Hurricane Ida was lower salinity for surface water readings in the lower harbor, Tappen Marina, and Glen Cove Creek. Also, hypoxia (2.90 ppm at bottom depth) was noted at one station only—CSHH #7 (at the head of the harbor).

We received a report of a possible coyote sighting at the North Shore Country Club—the first that CSHH had received and not yet confirmed. However, a Cat Wrangler Rescue post to Facebook on May 17, 2021, reported a coyote sighting near Kissam Lane in Glenwood Landing.

September 15 was a smokey/hazy day, possibly from atmospheric influences from the wildfires in California. During water monitoring, we noticed about 20 migrating monarch butterflies and a dozen dragon flies around the harbor. On this day we also saw many bunker in their usual spot this season, near the STP outfall. About 10% of them had copepods attached and a few with seaweed growing from the copepods. The bunker also seemed to be exhibiting some of the slow-motion rolling behavior, but the cause is not known (last year, the bacteria Vibrio attributed to this behavior, however this occurred primarily during the colder months).

During a Unified Water Study monitoring trip, we saw sea anemones attached to the docks in Safe Harbor Marina.

Bunker finning and rolling sideways (l) and sea anemones (r) (photos by Carol DiPaolo, 9/15/21, and Quentin Tyree, 9/28/21, respectively)

Sea walnuts were observed throughout the harbor on September 3, 8, and 15. The usual variety of birds were present: cormorants, mallard ducks, great egrets, Canada geese, great blue herons, ospreys, and mute swans. Belted kingfishers were spotted this month, as well two adult bald eagles and one juvenile. Blue crabs and sand shrimp were also seen periodically throughout the month.

October

Weekly monitoring surveys were conducted on October 6, 13, 20, and 28. On October 6, one peregrine falcon perched on the Gladsky Marine crane that has been a fixture in the lower harbor for years.

We continued to see a large bunker population throughout Hempstead Harbor, especially in the marinas and in Glen Cove Creek. The bunker were exceptionally large, and although some had parasitic copepods attached to them, there seemed to be many fewer fish affected by the copepods than was evident in previous years. We also saw birds preying on them, and there was scarring on a lot of the bunker that seem to indicate that bluefish or striped bass had been after them.

We continued seeing sea walnuts until the second monitoring event, October 13. On October 23, we received a report and video of a seal swimming near the mooring field off of Glen Cove.

On October 28, the last scheduled weekly survey for the core monitoring program was conducted for the season. However, extremely high bacteria results for water samples collected in Glen Cove Creek that day led to reporting to Glen Cove and Nassau County officials as well as Suez (the Glen Cove STP operator) and expanded testing to try to discover the source of the bacteria contamination. As described below and in *Section 3.8.3.1*, it was discovered that a sewer line break in the center of Glen Cove was discharging raw sewage to Mill Pond and into Glen Cove Creek.

November – December
Through continued testing and coordinating with Nassau County and Glen Cove officials, CSHH helped zero in on the location of the problem affecting Glen Cove Creek. Water samples were collected throughout Glen Cove Creek, with sampling sites extending from CSHH #3 near the mouth of the creek to its head at CSHH #13. Additional samples were collected at Mill Pond and culverts and manholes east of the pond and at Cedar Swamp Creek along Pratt Boulevard. The sewer line break at Bridge Street was confirmed on November 23; Suez installed a bypass on November 29 and completed the repair by December 2. Additional water samples collected in Glen Cove Creek and analyzed by NCDH during and after repairs to the sewer line confirmed that the broken line was the cause of contamination to Mill Pond and Glen Cove Creek; by December 8, bacteria levels in Glen Cove Creek were well below beach-closure thresholds.

Similarly, higher than usual bacteria levels in water samples collected from the powerhouse drain outfall as part of the winter monitoring program led to expanded testing in Glenwood Landing. The approach and collaboration with local officials were similar to those used in Glen Cove. The investigation continued into the spring of 2022.

On November 23, we received a report that an Atlantic right whale was spotted near the Throgs Neck Bridge. Bunker were present in Glen Cove Creek into December. On December 8, bunker were seen finning near the Glen Cove STP outfall, some swimming sideways, and some had copepods and algae attached to them.

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.

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

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 is now commonly seen in bays around Long Island Sound. Another nonnative crab species—the Chinese mitten crab—has shown up in the Hudson River as well as the lower Housatonic River in Connecticut, but the last report of mitten crabs in our area was in 2019 in Oyster Bay. Invasive species can upset the ecosystem and drive out native species. Marine scientist Dick Harris reported that large numbers of mitten crabs can create havoc when they burrow into riverbanks and can cause the banks to collapse. Both CT DEEP and NYS DEC have requested that anyone who sees a mitten crab (distinctive looking with its six spider-like legs and two claws that look like hairy mittens with white tips) capture the crab and put it on ice, freeze it, or preserve it in alcohol, note the date and location of capture, and report it; for NYS DEC, report to isinfo@dec.ny.gov or 518-402-9425.

Blue-claw crabs have been present in Hempstead Harbor and other areas of Long Island Sound, but the numbers have varied from year to year for both monitoring-date observations and NYS DEC seine hauls. In 2021, blue-claw crabs were included in every monthly DEC seine catch, May-October, for Hempstead Harbor; they were also observed regularly throughout the 2021 monitoring season, starting on June 30, with the last sighting on September 29. On August 25, 2021, 18 blue-claw crabs were noted, which was the highest number observed on a single 2021 monitoring date. This compares with 2020 DEC seine catches of blue crabs from July-September and our observations of blue crabs on all but one monitoring date from July 8 through September 23, with the highest number of 16 observed on one monitoring date in August.

Large numbers of blue crabs were observed in 2007 and 2010 in Hempstead Harbor, but in other years since 2007, numbers of blue crabs observed on monitoring dates have been sporadic.

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. In 2021, we saw a baby horseshoe crab on July 27 that was roughly the size of a pencil eraser.

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.

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

A rarely seen crustacean along the shores of 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. Many years ago (1996) during a low DO event, mantis shrimp and other bottom-dwelling creatures were driven to the surface for air. They have also been seen in raked samples for Hempstead Harbor shellfish population density surveys (e.g., four small mantis shrimp in the 2008 survey and a large one in the November 2013 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.

On July 8, 2020, a bloom of tiny shrimp occurred in Tappen Marina; they were later identified as **mysid shrimp** by John Waldman and Gillian Stewart. Mysid shrimp are a benefit to marine health as they are known to eat anything, including harmful dinoflagellates.

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.

In 2021, comb jellies were observed on monitoring trips at the beginning and end of the season, often in numbers too numerous to count. However, none were observed on monitoring trips between June and August. Comb jellies had usually appeared in large numbers in Hempstead Harbor in late June and through mid-October. Monitoring observations generally reflected this pattern up until 2015, when no comb jellies were observed on monitoring dates; only a few were observed on a few monitoring dates in 2016-2020. The decrease in comb jellies observed in Hempstead Harbor and Long Island Sound seemed 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.

Early stages of lion's mane jellyfish (l) and (c) and fully developed (r) (photos by Joanna Keenan, 5/17/21, Carol DiPaolo, 5/19, and Kenny Neice, 4/13/21, respectively)

In 2021, we had no reports of moon jellies. We received our first report of a lion's mane jelly on April 13, seen in Safe Harbor Marina. This was a little earlier than the first report received in 2020 (on April 25). As mentioned in the monthly observations for May in this report, early-stage lion's mane jellyfish were observed about the middle of the month and had not been observed in previous monitoring seasons. In early stages, lion's mane jellyfish can be clear in color and without long tentacles. Most of the lion's man jellyfish that are observed in Hempstead Harbor are relatively small and orange-colored, rather than purplish brown.

In 2013, mixed among the lion's mane jellyfish and moon jellies in Hempstead Harbor, we observed hundreds of unfamiliar jellies that were later identified as **salps**.

4.8 Diamondback Terrapins and Other Turtles

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 Yacht Yard) 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 was seen in Brewer Yacht Yard. In 2010, a large (about a foot long) diamondback was seen swimming also in Brewer Yacht Yard, 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 sighting of a live diamondback terrapin in Hempstead Harbor was at Brewer Yacht Yard in Glen Cove (now Safe Harbor Marina) on June 17, 2014. On May 8, 2021, we received a report and photos of an approximately foot-long dead turtle in Safe Harbor Marina; although in a decomposed state, it seemed to be a diamondback terrapin.

Occasionally, large sea turtles have made their way into Long Island Sound and have been spotted in local bays. In 2019, a dead ridley turtle washed up on the beach near Tappen Marina. On August 13, 2015, a large sea turtle was seen in Long Island Sound near Hempstead Harbor. 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 2, 2011, a large sea turtle was seen at the Shelter Bay Yacht Club in Manhasset Bay.

We also often see snapping turtles (a fresh water species) in Scudder's Pond and other ponds around the harbor. However, there were no turtle sightings reported for 2020 and 2021. 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.

4.9 Marine Mammals

Although long-time residents share stories of harbor porpoises visiting Hempstead Harbor and Long Island Sound during the mid-1900s, their appearance became less frequent, and for decades there were no reported sightings of these or other marine mammals in the harbor (see http://longislandsoundstudy.net/wp-content/uploads/2010/03/fall2009.pdf). Marine mammals are classified into four different taxonomic groups: **cetaceans** (whales, dolphins, and porpoises), **pinnipeds** (seals, sea lions, and walruses), **sirenians** (manatees and dugongs), and **marine fissipeds** (polar bears and sea otters). There are many species within each of the groups (see https://www.fisheries.noaa.gov/species-directory/marine-mammals). Some of the characteristics marine mammals share with other mammals include being warm blooded, having lungs to breathe air, giving birth to live young, and producing milk to feed their young.

Seal in the mooring field near the Hempstead Harbour Club (l) (10/23/21) and fluke of an Atlantic right whale near the Throgs Neck Bridge (r) (11/23/21)

Beginning in 2005, we received reports of seals in Hempstead Harbor followed by bottlenose dolphins in 2009 and whales in 2015. Sightings of these marine mammals were also increasing in other bays around Long Island Sound as well as along the south shore of Long Island.

In 2021, on March 30, a dolphin had to be rescued from Manhasset Bay; it became stranded in the mud during low tide. In October 2021, a seal was seen in the mooring field in Hempstead Harbor near the Hempstead Harbour Club. On November 23, 2021, an Atlantic right whale was spotted near the Throgs Neck Bridge. See *Table 7* for a listing of marine mammal sightings reported since 2005 for Hempstead Harbor, nearby bays, and western Long Island Sound.

Table 7
Marine Mammal Sightings

Marine Mammal	Date	Description
Seal	November 21, 2020	Seen off of Sea Cliff Beach
Minke whale	May 15, 2020	Found on private beach in Oyster Bay in poor health, had to be euthanized
Seal	February 2020	Seen in the lower harbor
Seal	February 2019	Seen on a jet ski float in Safe Harbor Marina in Glen Cove
Seal	December 14, 2018	Seen surfacing in front of the Tilley stairs in Sea Cliff
Pilot whale	July 11, 2018	Seen in Oyster Bay
Whale and bottlenose dolphins	September 17, 2016	Seen off of Matinecock Point
Humpback whale	July 21, 2016	Seen breaching outside Hempstead Harbor, near Execution Rock lighthouse
Whales	May 5, 2016	2 whales, one large and one small, seen approximately one mile east of Prospect Point
Humpback whale	April 29, 2016	Seen midsound, between the outer section of Hempstead Harbor and the Rye/Westchester area
Dolphins	April 12, 2016	Seen in Oyster Bay
Humpback whale	December 7-9, 2015	Seen near red bell buoy off Sands Point, and again near Glen Cove Creek entrance
Humpback whales	October 5-6, 2015	Several reported to be in or near Hempstead Harbor
Humpback whales	September 18, 25, 28, 2015	2 seen at multiple locations across Long Island Sound and Hempstead Harbor over several days
Beluga whales	May 2015	Confirmed sightings of 3 young beluga whales in Manhasset Bay, Oyster Bay
Bottlenose dolphins	August 17, 2015	About two dozen seen near Glen Cove breakwater and Morgan Beach; another report received the next day of dolphins in the outer harbor
Bottlenose dolphins	August 9, 2015	About 100 seen over several hours in Long Island Sound, Hempstead Harbor near Morgan Beach, and outer harbor
Seals	November 16, 2013	Multiple seen at different locations—midharbor, Crescent Beach, and near Matinecock Point
Bottlenose dolphins	July 19, 2013	8 seen in Hempstead Harbor, near Sea Cliff Beach
Seals	April 27-29, 2013	Seen off the west shore of the upper Harbor and off the jetty at Morgan Park
Bottlenose dolphins	August 11, 2011	About 100 entered Hempstead Harbor, were seen near Morgan Park
Bottlenose dolphins	August 5, 2011	Seen in Long Island Sound
Bottlenose dolphins	June 27, 2009	Around 200 seen in western Long Island Sound, 100 near Tappen Beach
Seal	January 2008	Seen off of Sea Isle, near Tappen Marina, in Glen Cove Creek, and off of Centre Island
Seal	November 2005	Seen eating striped bass

4.10 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.

A belted kingfisher—stunned after flying into a glass door—(l), terns on a buoy (c), and a great egret (r) (photos by Carol DiPaolo, 5/3/19, 6/26/19, and 8/4/21)

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. In 2021, we observed 19 goslings while monitoring on May 26, 10 near Tappen Beach and 9 near Mott's Cove.

In 2021, the highest number of swans observed on a single monitoring date was 15 on June 7. In 2020, up to 37 swans were counted on June 17. The observed mute swan population in Hempstead Harbor has varied from a high of 55 swans counted on a single monitoring date in August 2019 to only up to a dozen observed on any single monitoring date in 2011-2017.

Observed less frequently during monitoring are **brants**, **green herons, black-crowned night herons, killdeer** and other **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*.

Three ospreys on Beacon 11 nest (photo by Elaine Neice, 8/3/21)

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 since at least 1995. Over the years the osprey population continued to increase along with nesting sites around the harbor. 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, 15 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. In 2021, ospreys built a nest on a dock piling at the Sea Cliff Yacht Club; following an early June storm, the dock tipped sideways, and although the nest remained, it was ultimately abandoned by the ospreys.

Since about 2004, **peregrine falcons**, a protected species, have been sighted near the Glenwood Landing power plant. On October 6, 2021, a peregrine falcon was seen on a crane in the lower harbor. In 2019, there was a sighting of what seemed to be a peregrine falcon in the vicinity of the vacant lot that was the site of the old brick powerhouse in Glenwood Landing.

Although **red-tailed hawks** are seen often in wooded areas around Hempstead Harbor, we see them only occasionally during water sampling. In April 2021, red-tailed hawks were seen by a resident near the shore of Roslyn Harbor. On October 11, 2019, two red-tailed hawks were seen near Tappen Beach pool. 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.

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)

We had our first sighting of a **turkey vulture** near Hempstead Harbor on a monitoring date in May 2008 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 2021, a turkey vulture was seen flying over Sea Cliff on April 30; five turkey vultures were seen during a monitoring date in May, and one was seen flying over Glen Cove Creek in July. During the last week of June 2018, five large turkey vultures were seen flying over Shore Road and Safe Harbor Marina (formerly Brewer Yacht Yard). None were seen on survey dates in 2017-2020, but they were seen frequently throughout the year over harbor communities. In August 2016, we saw three turkey vultures flying over the lower harbor. 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.

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. In 2018 it was confirmed that there was a nesting pair of bald eagles in a large tree along the shoreline in Roslyn Harbor and at least one chick was in the nest on May 28, 2018. In 2019-20, there were sightings of adult and immature bald eagles throughout the year around Hempstead Harbor. On June 8, 2021, a Roslyn Harbor resident reported seeing two large fledglings by the nest. During the 2021 monitoring season bald eagles were observed on nine monitoring dates, often one or both of the breeding pair along with one or two juveniles.

Two bald eagle fledglings (l) and adult with a fish (r) in the lower harbor (photos by Rich Boehm, 7/21/21)

In winter, many migratory waterfowl can be seen around Hempstead Harbor, including **brants**, **common mergansers**, **red-breasted mergansers**, **buffleheads**, **greater scaup**, **lesser scaup**, and **common loons.** In January 2021, during walks along the Tappen Beach shoreline, Skip Dommin saw brants, a bufflehead, greater scaup, red-breasted merganser, an American black duck, and a common loon. On April 7, he saw buffleheads and brants also from the Tappen Beach shoreline; on April 30, he saw 150-200 brants in the same area.

From left to right, brants, bufflehead, greater scaup, and red-breasted merganser (photos by Skip Dommin, over several days in January 2021)

There have been some unusual visitors over the years as well. 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. 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. Over recent years, we have received reports of **northern gannets** diving into the harbor and Long Island Sound for food. On April 19, 2021, we received a report that gannets were diving for bunker in the eastern Long Island Sound. Although there were no sightings reported in 2021 for Hempstead Harbor, on April 14, 2019, a large number of gannets were seen diving for bunker in Hempstead Harbor. In 2011, 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.

4.11 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, i.e., the accelerated growth and density of tiny plant cells (phytoplankton). 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.

During most seasons in Hempstead Harbor, we see the effects of algal blooms, such as unusual and dramatic water color and clarity changes, often followed by low dissolved oxygen levels as the algae decomposes and uses up oxygen in the process. For example, on June 16, 2021, the water in Glen Cove Creek was a brown/green, chlorophyll levels were high, and DO was supersaturated as the algae cells were in the bloom or growth phase. On June 23, a coffee brown color was observed in Tappen Marina and throughout Hempstead Harbor. An algal bloom was judged likely to be in process on seven monitoring dates in 2021: May 19; June 16; July 7, 14, and 21; and August 8 and 11.

Pollen slick—not sludge (l); stripe of pollen across outer harbor surface (c) and pollen slick closeup (l)
(photos by Carol DiPaolo, (l) 5/7/15, and Michelle Lapinel McAllister (c), (r) 5/19/21)

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 and form a thick coating over the water surface. A dramatic example of this occurred in May 2015, when the decaying pollen mixed with algae cells and created a mat on the water surface that covered a large area of the harbor as well as many areas around Long Island Sound. Many local residents were prompted to report the appearance of the slicks as the release of "sludge" or sewage spills. Water samples taken from the slick that spread across a section of Hempstead Harbor confirmed that no sewage was mixed in the mat of organic matter.

Brown water and duckweed at Scudder's Pond post-Hurricane Ida (photo by Michelle Lapinel McAllister, 9/3/21)

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 direction 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.

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 and Long Island Sound include sea lettuce (*Ulva lactuca),* red wooly grass *(Agardhiella subulata*), rockweed (*Fucus distichus)*, and Irish moss (*Chondrus crispus*) and the similar looking Turkish washcloth (*Mastocarpus papillatus*).

Seaweeds commonly found around Hempstead Harbor include (from left to right) sea lettuce, red wooly grass, rockweed, and Turkish washcloth (photos by Sebastian Li, 7/6/21)

Appendix A

Coalition to Save Hempstead Harbor

2021 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.

*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**	**Chl 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																
10/28/21	15.74	16.18	23.40	23.99	6.90	6.91	7.55	7.59	11.5	2.5	5.84	7.64	2.50	2.34	4.96	8:10
10/28/21	15.77	16.19	23.36	24.00	6.87	6.92	7.56	7.60	N/A	N/A	5.78	7.47	2.72	2.77	4.83	N/A
10/20/21	16.0	16.3	24.61	24.89	6.75	6.37	7.79	7.80	16.0	1.5	N/A	N/A	2.21	N/A	3.45	8:00
10/20/21	15.9	16.4	24.61	24.92	6.81	6.66	7.79	7.80	N/A	N/A	N/A	N/A	N/A	N/A	3.45	N/A
10/13/21	19.98	20.21	24.83	25.60	6.34	5.97	7.59	7.62	18.5	1.5	29.34	26.50	2.87	1.68	4.41	8:20
10/13/21	20.05	20.21	24.83	25.52	5.87	5.89	7.57	7.61	N/A	N/A	26.70	29.50	2.06	1.69	4.32	N/A
10/6/21	20.06	20.46	24.84	25.37	4.98	5.02	7.57	7.61	17.8	1.4	30.52	13.58	2.99	3.84	3.56	7:50
10/6/21	20.06	20.44	24.80	25.26	5.09	5.04	7.60	7.62	N/A	N/A	24.35	16.49	3.20	3.12	3.60	N/A
9/29/21	High wind and waves. Grab samples only.															
9/22/21	22.64	22.73	24.78	25.26	6.55	6.44	7.70	7.72	23.7	1.2	37.87	36.27	3.77	4.64	2.80	7:46
9/22/21	22.70	22.73	25.04	25.22	6.66	6.49	7.71	7.72	N/A	N/A	41.68	39.43	4.31	4.45	2.74	N/A
9/15/21	23.19	23.00	25.21	25.84	6.91	5.78	7.75	7.65	23.9	1.25	38.36	22.31	2.29	2.79	3.76	8:40
9/15/21	23.21	23.00	25.29	25.82	6.44	5.88	7.71	7.65	N/A	N/A	38.42	21.47	2.35	2.93	3.66	N/A
9/8/21	23.04	23.12	23.67	23.96	4.31	4.20	7.39	7.38	23.3	1.0	32.36	22.86	3.84	4.43	2.30	7:49
9/8/21	23.03	23.10	23.55	23.95	4.30	4.20	7.39	7.38	N/A	N/A	34.49	23.49	4.36	4.88	2.41	N/A

2021 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl 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)																
9/3/21	21.80	23.31	21.09	25.04	7.68	4.71	7.82	7.52	17.6	0.5	52.47	22.57	4.10	3.31	5.92	7:55
9/3/21	21.83	23.30	21.09	25.04	6.18	4.90	7.74	7.54	N/A	N/A	46.72	21.35	4.30	2.47	5.78	N/A
8/25/21	24.50	24.56	24.42	24.79	5.34	4.45	7.43	7.39	22.8	1.0	39.25	41.63	2.92	2.74	2.94	7:43
8/25/21	24.50	24.56	24.43	24.87	4.29	4.28	7.36	7.38	N/A	N/A	37.14	33.28	3.41	3.35	2.94	N/A
8/18/21	23.81	23.23	26.12	26.49	4.36	2.04	7.45	7.28	24.0	1.3	49.65	17.09	1.38	1.58	4.91	7:46
8/18/21	23.80	23.26	26.19	26.49	3.54	2.03	7.42	7.28	N/A	N/A	50.87	19.56	1.58	1.12	4.91	N/A
8/11/21	22.66	22.60	25.22	25.56	3.26	2.90	7.36	7.35	25.3	1.25	37.72	31.61	3.09	3.37	2.30	7:45
8/11/21	22.66	22.62	25.17	25.51	2.95	2.82	7.35	7.35	N/A	N/A	37.61	31.72	2.88	2.73	2.11	N/A
8/4/21	22.85	21.96	25.25	26.22	6.55	2.97	7.61	7.28	20.5	1.0	57.82	20.52	2.49	1.90	4.99	7:46
8/4/21	22.85	21.94	25.29	26.23	5.57	3.02	7.57	7.28	N/A	N/A	58.92	24.34	2.68	1.91	5.07	N/A
7/28/21	22.94	22.69	24.97	25.23	3.84	3.03	7.36	7.30	22.2	1.5	28.56	33.79	2.65	2.73	3.07	7:46
7/28/21	22.96	22.59	24.93	25.28	3.16	3.05	7.31	7.29	N/A	N/A	31.13	28.68	2.52	2.49	3.10	N/A
7/21/21	24.25	22.75	25.00	25.72	6.26	2.79	7.71	7.34	22.9	1.5	28.31	15.07	2.35	3.02	4.88	7:24
7/21/21	24.21	22.83	24.83	25.71	4.48	2.51	7.64	7.32	N/A	N/A	26.47	16.66	2.31	3.12	4.99	N/A
7/14/21	22.48	22.39	24.76	24.91	4.74	4.60	7.50	7.50	22.0	1.0	52.35	41.89	3.91	4.24	2.98	7:50
7/14/21	22.47	22.39	24.77	24.93	4.68	4.63	7.49	7.50	N/A	N/A	51.37	41.11	4.10	3.67	2.94	N/A
7/14/21	22.4	22.3	24.97	25.13	4.35	4.10	7.51	7.53	N/A	N/A	N/A	N/A	N/A	N/A	2.45	7:50
7/7/21	20.85	20.20	25.83	26.33	5.77	4.93	7.55	7.46	25.4	1.25	72.38	43.28	2.81	3.91	4.10	7:52
7/7/21	21.01	20.21	25.91	26.66	5.59	4.85	7.58	7.47	N/A	N/A	77.63	45.83	3.07	4.82	4.15	N/A
6/30/21	21.12	19.17	26.14	26.74	5.47	4.67	7.62	7.60	28.8	1.25	37.18	43.28	3.22	3.27	4.76	8:14
6/30/21	21.03	19.86	26.23	26.58	4.94	4.84	7.58	7.58	N/A	N/A	39.11	47.42	3.29	4.08	4.58	N/A
6/23/21	18.55	18.53	25.87	25.92	6.23	6.07	7.76	7.74	15.9	1.0	57.94	51.71	4.06	3.53	4.48	7:56
6/23/21	18.55	18.53	25.91	25.94	6.04	6.00	7.75	7.74	N/A	N/A	51.06	65.56	3.57	3.56	4.54	N/A

2021 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl 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)																
6/16/21	19.03	19.01	25.68	25.71	10.39	10.92	8.31	8.29	18.6	1.25	51.51	55.63	1.77	2.51	5.28	7:50
6/16/21	19.01	19.00	25.71	25.72	10.89	10.86	8.29	8.28	N/A	N/A	53.23	63.50	2.48	2.51	5.50	N/A
6/9/21	17.74	16.00	25.46	26.12	6.56	5.47	7.52	7.45	24.2	1.25	44.62	12.84	2.54	3.89	3.91	7:50
6/9/21	17.73	16.11	25.49	26.11	5.98	5.72	7.48	7.46	N/A	N/A	31.69	12.62	2.62	2.93	3.93	N/A
6/2/21	14.35	13.90	25.59	26.30	7.75	7.83	7.74	7.77	18.0	2.25	8.57	5.86	1.84	0.66	4.78	7:48
6/2/21	14.37	13.92	25.68	26.25	7.95	7.86	7.72	7.78	N/A	N/A	8.57	8.32	1.37	0.44	4.72	N/A
5/26/21	14.98	14.69	25.99	26.21	8.13	7.74	7.80	7.77	19.5	1.25	45.97	24.67	2.67	4.26	3.15	7:50
5/26/21	15.05	14.42	26.00	26.35	8.05	7.71	7.80	7.77	N/A	N/A	35.60	25.59	3.04	4.15	3.45	N/A
5/19/21	15.41	13.65	25.43	26.02	9.69	9.77	8.07	8.00	19.0	1.25	33.94	55.32	2.02	1.49	5.58	7:58
5/19/21	15.63	13.63	25.41	26.10	10.02	9.80	8.04	7.99	N/A	N/A	31.52	55.23	2.21	2.41	5.49	N/A

2021 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl 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																
10/28/21	16.77	17.12	25.39	25.57	7.68	7.50	7.77	7.77	12.2	2.75	5.70	5.68	1.15	1.38	9.02	8:35
10/20/21	17.6	17.9	26.02	26.12	7.51	6.87	7.90	7.87	16.5	2.5	N/A	N/A	0.56	N/A	9.35	8:26
10/13/21	19.99	20.15	25.62	25.79	8.28	6.97	7.88	7.74	19.1	2.0	29.05	17.59	0.47	0.81	9.44	8:52
10/6/21	20.58	20.94	26.01	26.36	7.16	6.38	7.85	7.76	18.3	2.5	24.21	11.50	0.95	1.46	9.58	10:13
9/29/21	High wind and waves. Grab samples only.															
9/22/21	22.79	22.86	25.81	26.06	7.40	6.37	7.84	7.71	24.0	1.7	40.60	19.24	1.67	2.40	0.37	8:20
9/15/21	23.14	22.67	25.59	26.30	7.56	4.02	7.86	7.49	24.6	1.5	33.06	9.40	1.61	4.30	10.02	9:05
9/8/21	22.98	22.71	24.49	25.34	6.45	3.42	7.67	7.36	23.6	1.25	43.16	7.40	2.01	3.45	8.20	8:11
9/3/21	22.60	22.79	25.06	25.25	7.28	6.15	7.70	7.62	19.8	1.5	12.24	16.06	2.01	2.23	7.49	10:35
8/25/21	24.31	23.15	25.89	26.67	6.64	2.81	7.65	7.32	24.0	1.25	66.34	7.49	1.64	2.87	7.73	8:02
8/18/21	23.81	23.31	26.30	26.45	6.63	3.96	7.64	7.49	25.4	1.75	22.21	8.31	1.68	2.53	10.00	9:51
8/11/21	22.38	21.97	26.04	26.23	4.88	3.60	7.60	7.51	25.5	1.9	24.44	12.36	1.43	5.62	8.08	8:11
8/4/21	22.80	20.85	25.87	26.56	8.60	1.75	7.93	7.19	22.3	1.3	41.66	16.38	1.86	1.79	9.34	9:43
7/28/21	22.77	21.53	25.41	26.07	7.27	2.87	7.78	7.37	22.2	1.75	25.19	15.71	1.43	2.70	8.10	8:09
7/21/21	24.08	21.08	25.34	26.19	7.84	2.41	7.93	7.31	24.7	0.75	148.89	5.19	3.98	2.72	8.31	9:32
7/14/21	22.26	21.52	25.35	25.66	8.13	4.69	7.97	7.63	22.6	1.25	97.03	23.99	1.80	5.42	7.74	8:21
7/7/21	22.37	20.38	26.03	26.57	8.42	7.54	7.95	7.76	27.8	1.5	18.86	31.62	1.72	4.62	10.11	9:54
6/30/21	21.67	17.82	26.73	26.95	8.06	4.02	7.98	7.56	28.8	1.5	13.62	23.55	1.31	4.87	7.65	8:55
6/23/21	18.80	18.08	26.33	26.39	8.36	6.81	8.03	7.86	18.6	1.75	12.88	29.10	1.24	1.74	8.44	10:01
6/16/21	19.00	18.63	26.11	26.13	12.16	12.09	8.42	8.37	19.5	1.25	51.99	85.92	1.83	2.37	6.20	8:17
6/9/21	19.44	14.30	25.64	26.46	11.78	6.13	8.19	7.59	23.7	1.75	30.31	4.60	0.64	1.31	6.68	8:22
6/2/21	14.86	14.38	25.73	26.14	8.53	8.16	7.83	7.80	18.0	3.25	4.73	3.38	0.41	0.50	7.39	8:27
5/26/21	14.86	13.39	26.41	26.68	8.85	7.95	8.00	7.86	20.4	2.25	11.24	43.48	0.87	2.68	6.69	8:28
5/19/21	16.61	12.83	25.67	26.25	12.33	10.67	8.27	8.00	19.5	1.5	14.26	23.65	0.85	0.76	6.32	8:31

2021 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl 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																
10/28/21	High wind and waves. No survey or samples.															
10/20/21	18.3	18.4	26.28	26.28	6.89	6.73	7.86	7.85	17.6	3.25	N/A	N/A	0.73	N/A	9.75	8:51
10/13/21	19.96	20.17	25.51	25.88	8.48	6.68	7.90	7.72	19.2	N/A	26.93	8.52	0.65	1.32	9.79	9:13
10/6/21	20.43	21.00	26.01	26.49	7.72	6.34	7.89	7.77	19.2	2.25	19.52	13.01	1.07	2.37	11.08	10:30
9/29/21	High wind and waves. Grab samples only.															
9/22/21	22.87	22.88	25.87	26.05	7.64	6.67	7.86	7.74	24.0	1.8	31.14	17.64	1.44	1.88	9.05	8:39
9/15/21	23.15	22.63	25.72	26.73	7.61	3.58	7.87	7.49	24.5	1.5	29.60	7.56	1.52	4.58	10.42	9:21
9/8/21	22.99	22.68	24.37	25.63	6.84	3.36	7.69	7.37	23.6	1.0	34.77	6.00	1.91	4.60	8.80	8:29
9/3/21	22.85	22.94	25.40	26.11	7.09	5.43	7.73	7.58	20.5	1.25	20.23	13.54	1.93	8.75	10.69	11:00
8/25/21	24.88	22.86	25.52	26.84	8.50	2.59	7.85	7.34	25.2	1.25	45.90	5.90	1.25	3.11	8.64	8:23
8/18/21	24.03	22.95	26.37	26.62	6.59	2.24	7.78	7.35	26.2	1.75	17.54	6.37	0.92	1.53	10.45	10:07
8/11/21	22.50	21.93	26.08	26.28	5.93	4.25	7.70	7.55	26.0	2.0	26.50	8.92	1.31	2.56	8.51	8:29
8/4/21	22.71	20.62	25.83	26.68	8.27	1.05	7.91	7.15	22.3	1.25	54.58	11.77	1.89	1.17	10.56	9:58
7/28/21	22.33	21.31	25.69	26.15	7.92	2.87	7.93	7.38	22.2	1.75	29.68	11.09	1.16	2.38	8.70	8:24
7/21/21	24.34	20.17	25.34	26.48	8.04	2.56	8.05	7.36	27.3	1.50	46.25	4.11	2.02	2.77	11.10	9:52
7/14/21	22.08	21.81	25.53	25.64	7.87	6.64	7.98	7.87	21.5	1.75	48.99	29.27	1.39	5.69	8.64	8:41
7/7/21	21.62	19.84	26.41	26.68	9.73	6.18	8.00	7.62	28.0	1.4	37.33	31.13	1.75	1.80	10.48	10:15
6/30/21	21.27	16.74	26.71	27.15	8.43	5.18	8.00	7.62	27.7	1.75	10.41	31.62	0.98	3.22	9.02	9:19
6/23/21	18.66	16.23	26.35	26.78	8.58	6.04	8.05	7.70	19.3	1.75	10.91	13.21	1.01	3.45	11.00	10:25
6/16/21	18.80	17.89	26.20	26.26	11.84	8.80	8.43	8.11	19.3	1.25	28.71	82.23	1.43	2.61	9.19	8:38
6/9/21	19.48	13.84	25.88	26.65	13.14	5.86	8.23	7.60	23.1	1.5	48.18	4.84	1.14	2.26	9.97	8:44
6/2/21	14.56	13.65	25.79	26.38	8.40	7.67	7.81	7.76	19.3	3.5	4.59	3.75	0.38	2.46	9.97	8:48
5/26/21	15.17	13.46	26.50	26.72	9.62	8.39	8.05	7.90	20.0	2.75	12.15	31.12	0.83	1.99	9.57	8:48
5/19/21	15.63	11.45	25.94	26.64	11.34	7.03	8.23	7.76	20.0	1.75	12.74	12.07	0.81	2.32	9.40	8:56

2021 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl 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																
10/28/21	17.32	17.24	26.06	26.10	8.50	7.57	7.81	7.80	12.4	2.5	4.31	3.35	1.16	1.50	5.37	8:55
10/20/21	17.8	17.9	26.17	26.20	7.23	6.90	7.89	7.87	17.8	2.75	N/A	N/A	0.60	N/A	5.45	9:11
10/13/21	20.04	20.19	25.63	25.94	8.22	6.84	7.89	7.73	20.5	2.0	25.21	10.94	0.92	1.59	5.11	9:33
10/6/21	20.48	20.78	26.09	26.46	7.37	6.06	7.89	7.73	19.0	2.5	12.98	5.92	0.97	2.15	6.45	10:50
9/29/21	High wind and waves. Grab samples only.															
9/22/21	22.88	22.79	26.23	26.20	7.87	7.14	7.89	7.79	24.4	1.75	34.55	18.38	1.21	1.42	5.29	9:01
9/15/21	23.37	22.95	25.74	26.29	9.55	6.30	8.08	7.71	25.6	1.25	34.85	15.10	1.25	2.60	6.04	9:41
9/8/21	23.16	22.84	24.39	25.32	7.71	5.43	7.85	7.52	24.3	1.4	31.32	9.11	1.72	2.95	4.89	8:48
9/3/21	22.63	22.92	25.15	25.63	7.44	6.46	7.77	7.64	20.4	1.25	19.76	13.36	1.91	2.34	5.25	11:20
8/25/21	24.99	24.56	25.74	25.79	8.62	8.19	7.87	7.79	25.4	1.4	32.20	25.65	1.22	1.60	4.06	8:40
8/18/21	24.15	23.56	26.28	26.44	6.96	4.32	7.78	7.52	26.6	1.5	33.07	6.29	1.15	1.76	6.37	10:29
8/11/21	22.69	22.47	25.97	26.10	5.91	5.54	7.70	7.66	25.4	1.75	33.82	17.86	1.76	1.03	4.22	8:48
8/4/21	22.82	22.18	25.96	26.11	9.00	6.75	7.97	7.66	22.3	1.75	22.92	8.68	1.32	2.82	6.23	10:20
7/28/21	22.75	21.78	25.56	25.98	7.96	6.92	7.96	7.70	22.4	2.0	17.91	11.75	1.22	1.69	4.25	8:41
7/21/21	23.92	20.43	25.47	26.40	8.55	2.34	7.93	7.34	27.8	1.5	44.97	3.11	2.05	2.31	6.67	10:17
7/14/21	21.83	21.76	25.60	25.62	6.58	5.83	7.84	7.73	21.5	1.5	41.96	15.68	1.87	4.49	4.48	9:00
7/7/21	22.02	20.59	26.44	26.64	8.95	7.35	7.96	7.78	27.0	1.7	18.44	26.49	1.77	6.26	6.55	10:34
6/30/21	21.83	21.09	26.70	26.79	7.77	8.25	7.98	7.95	27.1	1.5	9.26	10.57	0.98	1.67	4.30	9:43
6/23/21	18.86	18.03	26.37	26.42	8.35	8.03	8.01	7.96	20.3	N/A	7.42	23.95	1.34	2.38	5.51	10:47
6/16/21	18.79	18.76	26.22	26.22	10.26	11.73	8.40	8.40	19.5	1.25	19.74	50.83	1.91	2.10	3.88	9:01
6/9/21	19.43	16.98	25.80	26.11	11.54	9.73	8.22	7.89	24.1	1.5	42.41	15.47	1.19	1.13	5.31	9:10
6/2/21	14.92	13.88	26.03	26.35	8.47	7.76	7.84	7.77	19.4	3.25	2.85	3.48	0.54	1.83	4.92	9:14
5/26/21	15.54	15.15	26.45	26.51	9.45	9.36	8.06	8.03	21.1	2.0	7.72	24.45	1.21	1.76	5.09	9:12
5/19/21	16.18	15.98	25.89	25.92	12.32	12.29	8.24	8.23	22.9	1.75	11.97	29.78	0.78	0.88	3.98	9:21

2021 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl 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 Channel Marker																
10/28/21	16.81	16.86	24.99	25.33	8.19	7.55	7.80	7.78	12.3	2.5	8.70	6.27	2.55	2.83	4.95	9:19
10/20/21	17.0	17.5	25.55	25.96	7.98	7.48	7.99	7.94	18.0	2.0	N/A	N/A	0.95	N/A	5.15	9:45
10/13/21	20.01	20.21	24.94	25.79	7.97	7.74	7.80	7.75	20.2	1.75	44.64	16.27	0.93	1.68	4.15	9:58
10/6/21	20.40	21.00	25.34	26.24	7.20	5.84	7.83	7.73	19.5	2.2	15.32	10.92	1.46	2.01	5.85	11:14
9/29/21	21.21	21.43	24.34	25.27	8.44	8.29	7.95	7.97	14.4	1.0	37.94	30.44	1.77	2.69	4.43	8:42
9/22/21	22.86	22.80	25.64	25.88	8.03	7.42	7.90	7.82	24.4	1.6	42.64	31.31	1.67	2.80	4.27	9:23
9/15/21	23.77	22.87	24.00	26.11	9.63	5.27	8.04	7.60	25.7	1.0	35.15	14.82	1.98	3.97	4.78	10:00
9/8/21	23.29	23.09	23.97	24.39	7.38	6.52	7.79	7.62	25.2	1.0	39.16	14.05	2.50	3.33	4.05	9:08
9/3/21	22.16	23.34	22.51	25.07	8.94	6.20	8.04	7.69	20.5	0.8	33.05	25.64	3.26	3.26	4.77	11:50
8/25/21	24.95	24.71	25.08	25.51	7.43	6.65	7.77	7.65	26.5	1.0	50.58	30.38	2.20	1.83	3.40	9:10
8/18/21	24.18	23.39	25.51	26.48	6.34	3.16	7.70	7.41	27.1	1.1	40.27	11.36	1.67	1.52	4.94	10:56
8/11/21	23.06	22.64	25.44	25.86	6.37	5.06	7.69	7.59	26.3	1.3	42.40	29.58	1.55	1.85	3.34	9:07
8/4/21	23.11	21.78	25.21	26.24	9.70	3.89	7.97	7.37	24.2	N/A	43.98	8.72	2.02	2.33	5.24	10:41
7/28/21	23.01	22.78	25.35	25.45	7.65	7.50	7.95	7.83	22.0	1.65	37.74	40.97	1.33	2.17	3.38	9:06
7/21/21	24.79	22.89	25.00	25.66	8.93	4.20	8.03	7.49	26.6	0.9	100.18	5.99	3.54	3.52	5.49	10:41
7/14/21	22.15	22.03	25.31	25.48	6.41	5.54	7.73	7.70	22.2	1.25	69.07	29.52	2.70	2.26	3.27	9:27
7/7/21	22.27	20.51	26.08	26.57	8.46	7.46	7.89	7.71	27.4	1.25	12.93	45.7	1.85	3.79	5.33	10:56
6/30/21	22.68	20.20	25.87	26.74	8.63	7.48	8.03	7.81	30.2	1.0	38.43	21.41	2.21	2.98	3.28	10:03
6/23/21	19.14	18.48	26.03	26.22	8.23	8.33	8.01	7.98	20.4	1.5	11.51	36.09	1.45	1.56	5.34	11:07
6/16/21	19.29	19.08	25.76	26.16	9.91	11.31	8.32	8.40	20.0	1.10	12.61	42.25	1.67	1.13	3.36	9:28
6/9/21	18.55	16.01	25.77	26.15	9.36	8.19	8.00	7.68	26.2	1.25	45.77	12.11	1.03	1.29	5.06	9:36
6/2/21	14.84	14.26	25.71	26.17	8.07	8.50	7.80	7.82	22.2	2.75	8.94	6.97	1.05	0.75	4.04	9:39
5/26/21	15.45	14.44	26.25	26.51	9.44	9.00	8.05	7.96	21.0	2.0	26.43	41.98	1.47	1.65	4.90	9:36
5/19/21	16.77	14.99	25.53	25.98	11.44	11.70	8.21	8.11	20.7	1.5	6.60	42.33	1.52	1.38	3.61	9:53

2021 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl 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																
10/28/21	17.10	17.06	23.95	24.89	7.41	5.66	7.66	7.57	12.1	1.75	11.38	7.17	1.60	1.75	3.08	9:38
10/20/21	16.7	17.0	19.58	25.22	6.41	6.95	7.62	7.86	17.9	1.7	N/A	N/A	2.15	N/A	3.75	10:13
10/13/21	20.22	20.17	24.59	24.94	7.49	7.49	7.77	7.78	20.9	1.5	43.33	38.62	1.60	2.41	1.64	10:24
10/6/21	20.45	20.41	23.37	25.50	6.32	5.79	7.75	7.74	19.7	1.75	17.61	13.06	1.62	2.70	3.78	11:37
9/29/21	21.81	21.84	23.71	24.87	8.09	7.03	7.82	7.86	14.6	1.25	43.63	39.21	2.51	2.70	2.33	9:05
9/22/21	22.81	22.82	24.95	25.48	6.88	6.59	7.74	7.76	25.0	1.25	32.53	32.92	3.19	4.35	2.10	9:45
9/15/21	23.52	23.55	23.73	24.98	7.50	7.53	7.83	7.86	26.9	1.0	41.37	40.75	2.78	3.18	2.29	10:35
9/8/21	23.49	23.51	22.03	23.82	5.97	5.73	7.69	7.61	24.4	1.25	42.96	32.44	3.70	3.21	1.99	9:26
9/3/21	23.11	23.45	20.74	23.77	6.91	5.82	7.69	7.58	20.8	1.0	26.77	32.60	2.63	3.63	2.66	12:09
8/25/21	24.47	24.39	22.94	25.19	6.39	5.84	7.60	7.51	24.8	1.0	35.84	26.40	2.28	3.98	1.36	9:38
8/18/21	24.61	24.12	25.63	26.03	5.00	3.16	7.49	7.41	28.5	1.25	16.06	19.01	2.11	1.26	2.45	11:22
8/11/21	23.44	23.19	23.09	25.14	6.65	5.90	7.68	7.60	26.1	1.0	50.75	37.54	2.02	2.44	1.22	9:29
8/4/21	23.21	23.09	25.11	25.59	7.30	6.09	7.73	7.61	23.6	1.25	37.96	24.83	1.83	3.04	2.87	11:06
7/28/21	23.86	23.07	22.08	25.26	7.12	6.00	7.73	7.55	22.0	1.25	62.79	29.83	2.55	2.84	1.28	9:27
7/21/21	24.74	24.36	24.29	25.11	6.28	5.59	7.69	7.66	27.0	1.25	27.74	6.21	2.77	6.96	3.34	11:01
7/14/21	22.28	22.02	24.35	25.16	6.53	5.69	7.67	7.53	22.1	1.25	85.82	22.68	2.59	2.63	1.25	10:01
7/7/21	22.16	21.59	22.56	26.11	7.84	7.47	7.82	7.72	29.5	0.5	82.77	47.77	4.55	3.29	3.01	11:15
6/30/21	22.76	22.41	25.21	25.57	9.38	7.14	8.03	7.97	31.2	0.75	128.86	65.80	7.36	6.85	1.22	10:25
6/23/21	19.04	18.48	23.04	25.91	7.99	5.71	7.95	7.72	20.3	1.0	32.01	33.40	3.28	2.40	3.18	11:23
6/16/21	19.35	19.15	21.59	25.96	9.92	10.37	8.21	8.24	20.6	1.0	54.82	41.27	3.71	2.45	1.37	9:48
6/9/21	19.44	18.48	22.80	25.71	9.46	9.66	7.95	7.86	26.7	1.0	65.25	35.85	2.45	2.45	2.90	10:00
6/2/21	15.32	14.91	23.71	25.61	7.85	7.37	7.68	7.72	21.5	1.75Bottom	4.30	4.43	1.01	1.08	1.65	10:09
5/26/21	16.53	15.81	24.77	25.88	9.06	9.87	8.02	8.05	23.5	1.0	64.15	39.64	3.21	2.95	2.83	10:02
5/19/21	17.45	16.86	24.77	25.12	12.12	12.47	8.22	8.18	25.0	1.0	52.68	47.90	2.22	3.38	1.37	10:25

2021 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl 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																
10/28/21	17.23	17.36	23.85	24.79	3.85	3.22	7.23	7.22	12.6	1.25	4.93	3.76	3.71	3.18	1.74	10:06
10/20/21	16.5	17.4	18.14	25.06	5.35	4.53	7.45	7.60	19.8	1.25	N/A	N/A	3.51	N/A	2.95	10:39
10/13/21	20.33	20.35	24.40	24.89	7.29	7.08	7.73	7.69	20.9	1.0Bottom	60.19	43.09	2.39	2.54	1.37	10:53
10/6/21	20.60	20.75	24.53	25.51	5.99	4.23	7.65	7.59	19.6	1.5	19.63	10.06	2.93	2.74	3.35	12:02
9/29/21	21.85	21.89	24.39	24.65	5.49	4.68	7.66	7.67	15.8	1.0	39.16	34.72	5.64	4.05	1.82	9:29
9/22/21	22.40	22.74	23.22	25.30	6.07	5.51	7.58	7.56	25.0	1.0	56.88	29.42	3.52	3.95	1.92	10:08
9/15/21	22.76	23.42	20.63	24.67	5.41	4.85	7.55	7.50	27.6	1.0	25.11	30.75	3.73	4.17	1.73	11:01
9/8/21	21.91	23.34	18.24	23.28	5.39	4.62	7.36	7.33	25.1	0.75	71.27	28.97	2.64	3.91	1.96	9:51
9/3/21	Ran out of time for survey. Grab samples only.															
8/25/21	23.66	24.05	21.32	24.40	4.26	3.65	7.31	7.24	26.3	1.0	20.76	19.97	3.16	4.04	1.20	10:00
8/18/21	Ran out of time for full survey.			N/A	N/A	3.61	N/A	N/A	27.0	N/A	N/A	N/A	N/A	N/A	2.19	11:48
8/11/21	22.80	22.93	23.74	25.11	6.20	4.76	7.58	7.44	27.1	1.0	61.02	27.79	2.87	4.43	1.79	9:48
8/4/21	23.38	23.24	24.97	25.44	5.43	3.60	7.50	7.32	24.1	0.75	55.09	19.05	2.22	2.97	2.34	11:25
7/28/21	22.58	22.76	21.44	25.15	5.70	3.31	7.51	7.24	22.2	1.0	50.87	17.28	5.31	6.42	1.62	9:45
7/21/21	24.66	24.48	24.43	24.94	4.73	3.05	7.47	7.33	28.7	1.25	18.07	5.24	3.31	4.67	3.26	11:22
7/14/21	Not accessible due to low tide.															
7/7/21	21.57	21.30	24.95	25.89	8.70	5.66	7.73	7.47	29.7	1.0	92.08	68.93	5.40	4.31	2.74	11:37
6/30/21	21.92	20.79	24.54	26.05	15.64	5.55	8.13	7.46	32.3	0.8	81.64	23.73	4.62	7.93	1.95	10:48
6/23/21	Ran out of time for survey.															
6/16/21	17.86	18.27	21.79	25.61	12.39	10.67	8.36	7.77	22.3	1.0	120.56	18.07	3.36	5.70	1.71	10:12
6/9/21	19.41	18.35	23.90	25.51	8.21	5.86	7.62	7.43	28.3	1.0	46.69	12.23	2.97	3.01	2.65	10:29
6/2/21	15.57	14.93	24.51	25.22	5.32	4.31	7.41	7.32	24.4	1.4Bottom	6.20	7.97	2.26	3.48	1.46	10:33
5/26/21	17.11	16.15	23.96	25.78	10.21	8.26	7.94	7.78	24.1	1.0	36.08	19.26	4.21	5.56	2.95	10:25
5/19/21	Access blocked by large barge with crane.															

2021 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl 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 #14–50 yds from Powerhouse Drain																
10/20/21	Ran out of time for survey.															
10/6/21	20.33	20.35	25.05	25.22	4.92	4.92	7.59	7.59	18.4	1.25	14.30	14.29	3.92	3.96	1.55	8:31
9/15/21	23.21	23.19	25.09	25.17	6.15	6.15	7.65	7.66	23.4	1.0	38.75	43.55	3.55	2.61	2.21	8:24
9/3/21	22.21	22.70	21.08	22.43	6.80	6.32	7.66	7.62	17.6	0.75	53.65	45.67	4.40	4.58	2.92	8:40
8/18/21	23.55	23.46	25.97	26.15	4.44	3.31	7.44	7.35	26.9	1.25	34.33	20.67	1.92	1.44	2.27	9:16
8/4/21	22.74	22.68	25.28	25.55	5.72	5.46	7.53	7.47	22.1	1.25	53.89	66.84	2.70	3.76	2.29	9:08
7/21/21	23.95	23.83	24.91	25.06	5.31	4.72	7.54	7.50	23.8	1.25	19.97	17.36	3.19	3.31	2.30	7:56
7/7/21	20.74	20.34	26.06	26.32	5.05	4.78	7.44	7.42	26.0	1.25	41.25	43.87	3.38	3.39	1.93	8:28
6/23/21	18.19	18.20	25.61	25.71	7.11	6.48	7.77	7.76	16.7	1.0	44.79	47.79	2.33	2.10	2.13	8:28
5/26/21	15.37	14.97	26.25	26.30	9.20	9.94	8.05	8.00	23.1	1.0	27.92	46.16	2.58	2.66	2.72	11:10
CSHH #15–50 yds from Scudder's Pond Outfall, North of Tappen Pool																
10/20/21	16.4	16.4	24.84	25.11	8.13	7.69	7.89	7.91	18.8	1.75	N/A	N/A	1.13	N/A	2.55	11:03
10/6/21	20.46	20.60	25.43	25.56	6.22	6.03	7.71	7.73	17.7	1.75	18.74	18.81	1.80	1.87	2.52	9:58
9/15/21	Did not sample this station on this day.															
9/3/21	22.00	22.60	21.61	23.00	7.36	6.48	7.73	7.68	18.7	0.75	33.92	50.30	5.24	6.11	2.92	10:10
8/18/21	23.66	23.38	25.96	26.33	4.27	2.65	7.42	7.28	25.7	N/A	41.83	19.21	1.61	1.83	2.95	9:37
8/4/21	22.78	22.90	25.35	25.66	6.57	5.77	7.60	7.56	22.8	1.25	53.31	41.68	4.58	4.45	2.62	9:31
7/21/21	24.24	24.00	25.12	25.28	5.81	4.95	7.60	7.57	25.6	1.4	13.79	18.57	2.33	2.88	1.77	9:17
7/7/21	Ran out of time for survey.															
6/23/21	Ran out of time for survey. Grab samples only.															
5/26/21	15.10	14.83	26.11	26.29	9.99	10.22	8.08	8.07	22.5	1.25	11.93	43.08	1.78	2.08	2.35	10:54

2021 CSHH Field-Monitoring Data

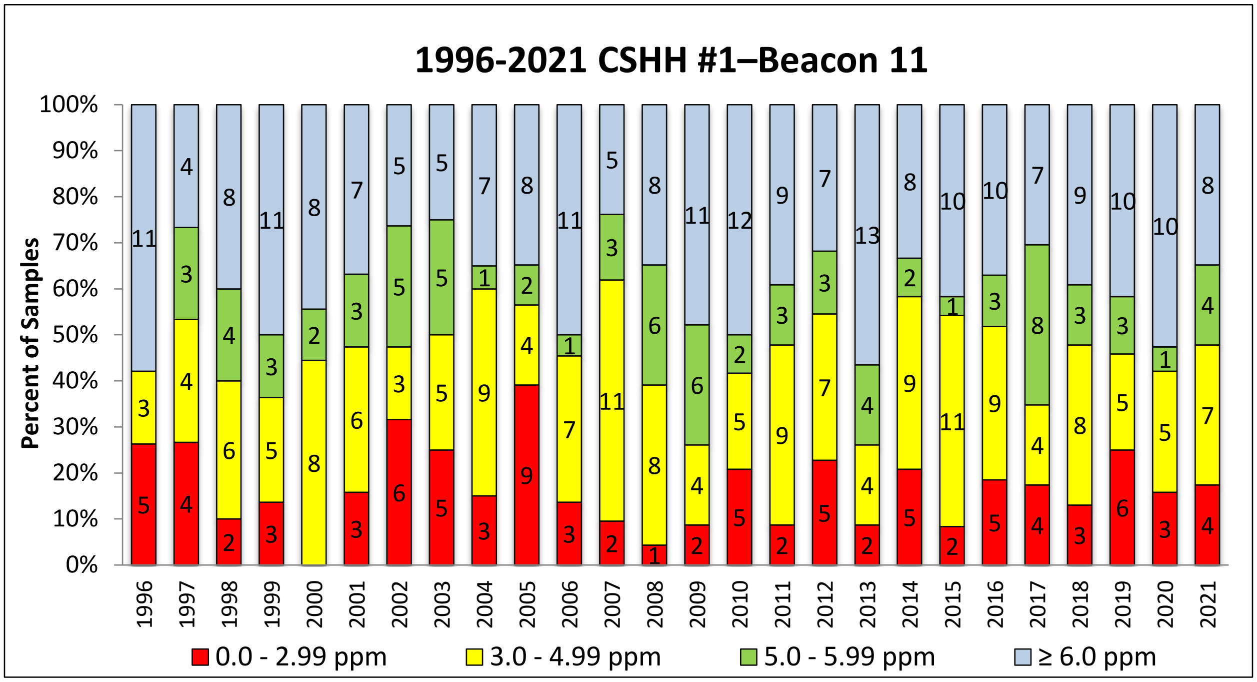
Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl a (ug/L)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #4–Bar Beach Spit																
10/20/21	Ran out of time for survey.															
10/6/21	20.40	20.40	25.30	25.32	5.03	5.02	7.62	7.62	18.2	1.4	11.86	11.29	3.58	4.33	3.53	8:20
9/15/21	23.19	23.07	25.34	25.67	6.41	5.91	7.69	7.66	24.0	1.0	37.02	29.88	2.77	3.15	2.62	8:31
9/3/21	22.00	22.13	21.22	21.38	7.54	7.41	7.79	7.77	17.4	0.75	61.63	52.81	4.64	5.07	2.79	8:25
8/18/21	23.55	23.49	26.16	26.23	4.03	2.67	7.42	7.33	26.1	1.5	27.72	21.52	1.71	1.68	2.57	9:23
8/4/21	22.86	22.80	25.31	25.37	6.52	6.26	7.61	7.58	23.3	1.0	71.31	83.74	3.15	3.21	1.60	9:17
7/21/21	23.84	23.79	25.26	25.30	4.69	3.95	7.49	7.44	23.9	1.25	31.93	23.32	3.44	3.63	2.14	7:45
7/7/21	20.67	20.62	26.35	26.36	6.29	5.57	7.54	7.53	26.2	1.25	35.54	38.26	3.49	3.23	2.00	8:17
6/23/21	18.54	18.54	25.79	25.74	7.59	6.38	7.80	7.76	16.7	0.8	47.60	70.67	2.72	2.92	2.68	8:20
5/26/21	14.93	14.64	26.36	26.39	9.63	9.66	8.02	7.99	22.0	1.0	35.61	46.32	2.79	2.82	2.15	11:05
CSHH #5–Mott's Cove																
10/20/21	Ran out of time for survey.															
10/6/21	20.19	20.19	25.01	24.97	4.83	4.80	7.58	7.57	18.2	1.25	14.31	14.09	4.42	4.72	1.51	8:48
9/15/21	23.01	23.02	24.75	25.19	5.78	5.32	7.58	7.54	23.4	1.2	33.51	36.16	2.81	2.88	2.15	8:09
9/3/21	21.79	22.80	20.31	22.32	6.32	5.95	7.61	7.52	19.3	0.6	66.66	35.38	5.94	4.96	2.09	9:00
8/18/21	23.42	23.39	25.69	26.00	4.98	3.23	7.43	7.30	25.6	1.25	17.43	14.34	1.52	1.62	2.12	9:00
8/4/21	22.45	22.24	25.28	25.82	4.12	3.35	7.33	7.27	22.3	1.25	44.03	33.84	2.70	2.76	1.94	8:55
7/21/21	24.09	24.09	24.64	24.87	5.33	4.60	7.52	7.45	24.4	1.0	21.93	15.41	4.53	4.51	2.14	8:09
7/7/21	20.69	20.61	25.96	26.04	5.03	4.89	7.43	7.43	25.9	0.9	49.58	47.04	3.48	3.09	1.58	8:47
6/23/21	18.47	18.42	25.56	25.67	6.49	6.20	7.73	7.72	17.2	0.8	52.65	62.83	2.90	2.30	1.72	8:42
5/26/21	15.92	14.72	25.82	26.24	9.01	9.21	7.89	7.90	24.1	1.25	17.43	30.99	3.24	3.98	2.10	11:25

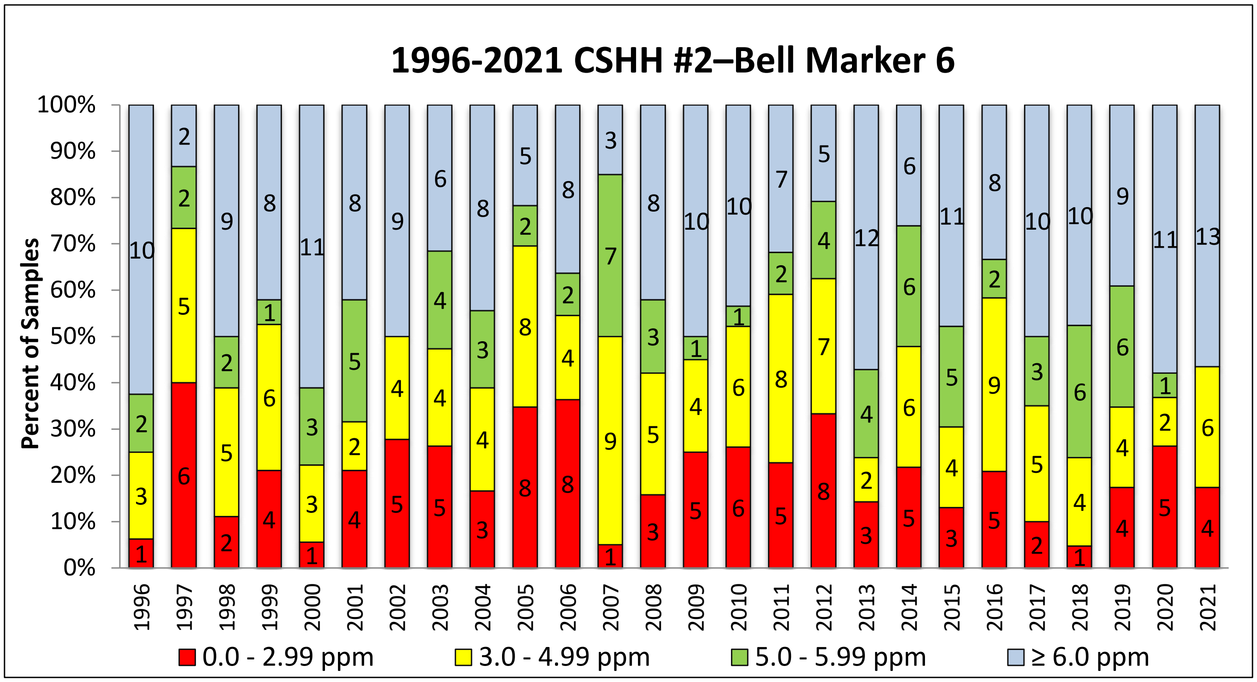
2021 CSHH Field-Monitoring Data

Date	**Water Temp (°C)**		**Salinity (ppt)**		**DO (ppm)**		**pH**		**Air Temp**	**Secchi**	**Chl 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 #6–East of Former Incinerator Site																
10/20/21	Ran out of time for survey.															
10/6/21	19.90	20.01	24.35	24.65	4.76	4.37	7.53	7.51	18.3	1.0	19.72	17.08	5.01	7.09	1.87	9:11
9/15/21	23.18	23.24	23.91	25.01	5.01	5.28	7.50	7.57	23.3	1.0	31.39	41.23	4.51	4.38	2.44	7:55
9/3/21	21.02	21.15	14.82	22.86	7.76	5.08	7.88	7.50	18.4	0.5	80.17	39.49	5.40	5.62	2.42	9:25
8/18/21	23.69	23.70	25.05	25.94	3.06	2.49	7.27	7.25	25.5	1.25	24.61	20.40	2.85	2.34	2.37	8:40
8/4/21	23.02	22.91	24.68	25.52	5.48	5.01	7.37	7.37	21.3	0.85	109.16	35.13	4.82	3.19	2.27	8:37
7/21/21	24.67	24.38	24.42	24.80	4.78	4.32	7.41	7.43	24.5	1.0	51.43	13.56	4.98	5.31	2.54	8:27
7/7/21	21.37	20.88	25.72	25.96	6.30	5.41	7.52	7.45	26.4	1.0	53.83	44.17	3.47	4.71	2.00	9:05
6/23/21	18.77	18.43	24.86	25.60	8.01	6.56	7.86	7.70	17.7	0.5	137.32	59.75	4.83	2.73	2.32	9:21
5/26/21	Ran out of time for survey.															
CSHH #7–West of Bryant Landing (formerly site of oil dock)																
10/20/21	Ran out of time for survey.															
10/6/21	19.56	19.68	23.26	23.54	4.46	3.42	7.43	7.34	18.2	0.75	19.66	18.47	10.90	10.75	1.30	9:23
9/15/21	Grab samples only because of tide.															
9/3/21	21.18	22.46	14.23	19.13	6.16	2.90	7.29	7.16	18.6	0.3	41.81	18.80	8.38	8.77	1.68	9:40
8/18/21	23.90	23.95	25.58	25.67	4.38	2.50	7.35	7.24	25.3	1.0	15.71	14.80	2.89	2.84	1.88	8:25
8/4/21	22.95	23.02	24.61	24.77	4.01	3.85	7.26	7.24	21.3	0.75	32.64	35.77	5.38	6.10	1.44	8:26
7/21/21	24.81	24.82	24.22	24.46	4.16	3.68	7.34	7.32	25.2	0.75	39.20	17.81	5.62	5.58	1.89	8:41
7/7/21	21.34	21.27	24.19	25.72	4.71	4.22	7.30	7.28	27.0	0.8	26.66	25.27	5.11	4.23	1.35	9:22
6/23/21	18.64	18.68	24.85	25.09	7.22	6.27	7.70	7.67	17.5	0.5	92.70	89.07	5.18	3.08	1.93	9:38
5/26/21	Ran out of time for survey.															

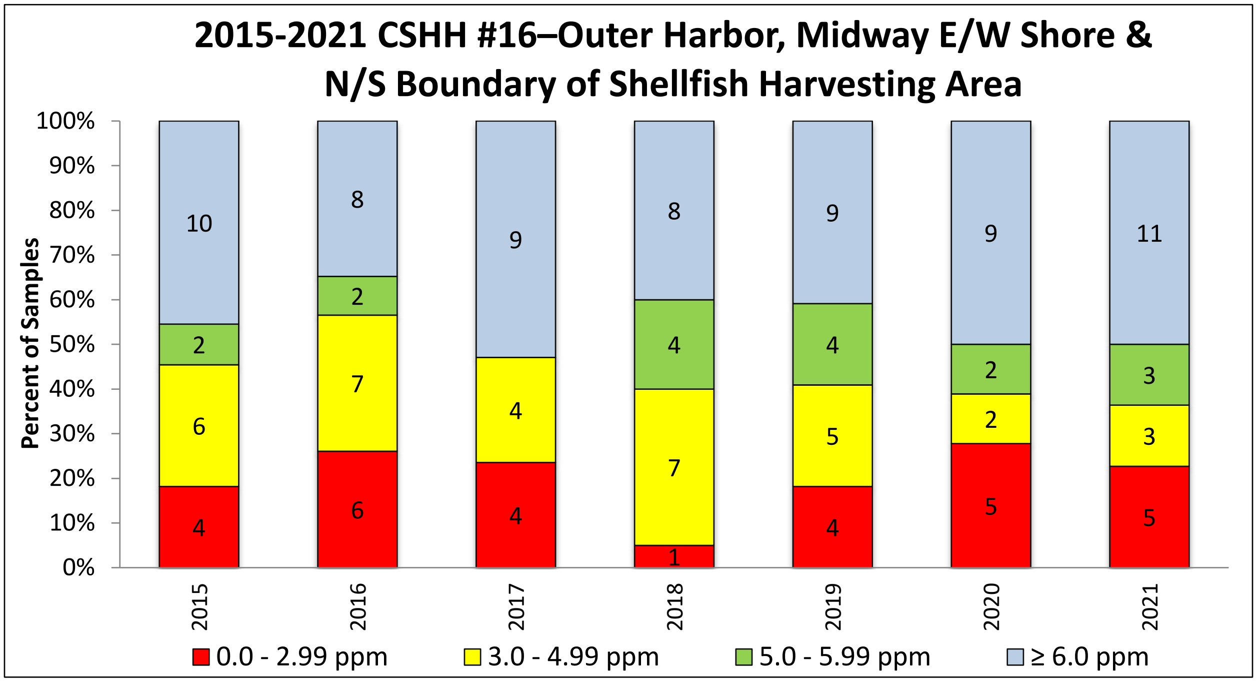
Long-Term Dissolved Oxygen Graphs

Each graph displays results from one of CSHH's monitoring sites. Each vertical bar represents the bottom samples taken during the indicated year and is divided into four categories. Red bars are representative of hypoxic conditions (DO below 3 ppm), yellow bars of DO between 3 and 5 ppm, green bars of 5 to 6 ppm, and blue of greater than 6 ppm. The number of samples falling into each category is indicated within the bars, and the percentage of said samples on the y-axis.

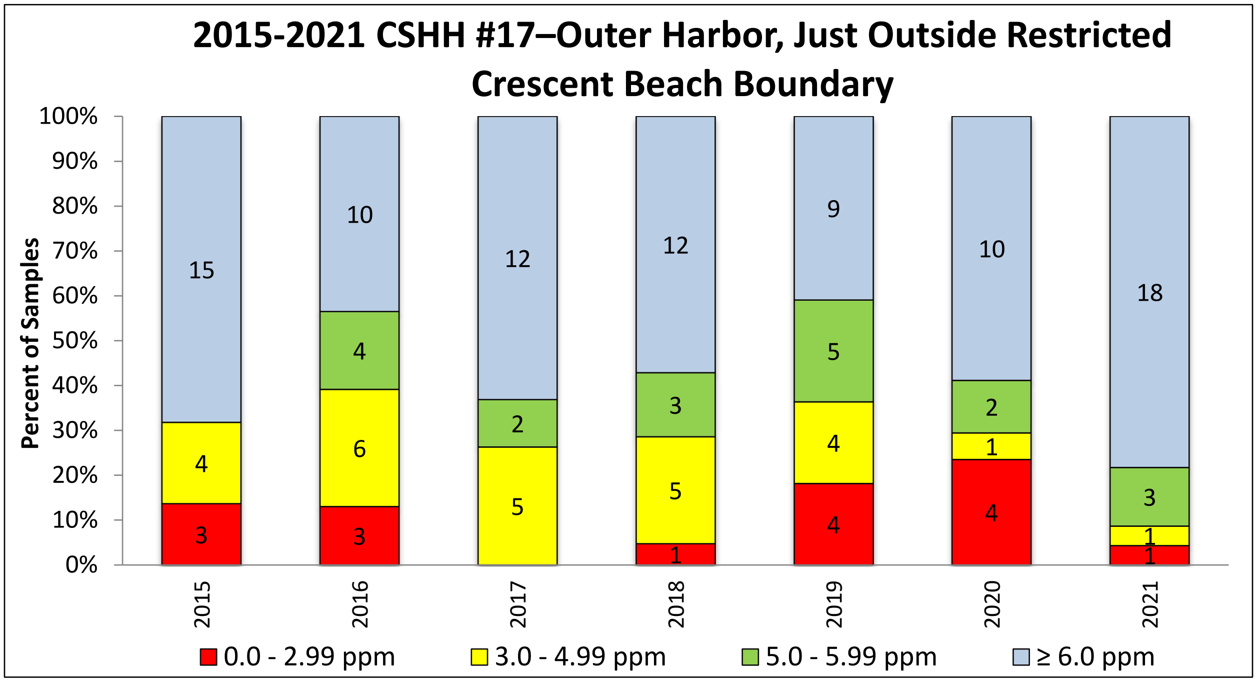




Long-Term Dissolved Oxygen Graphs

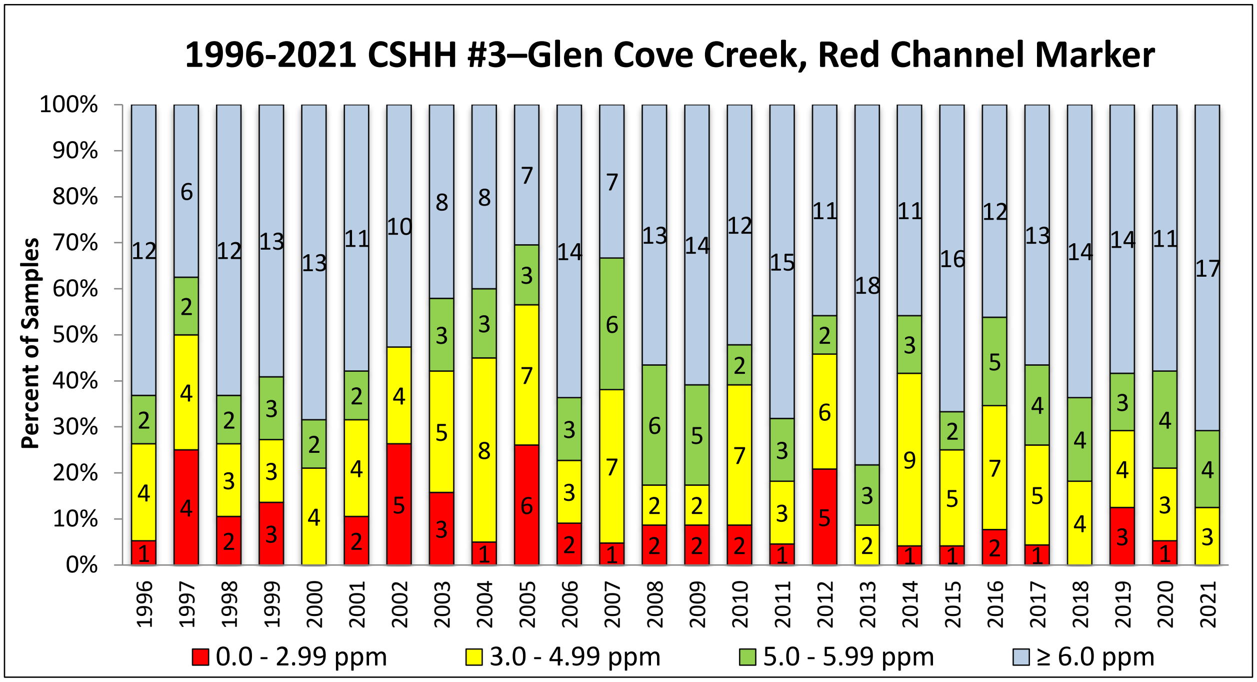


2015-2021 CSHH #16–Outer Harbor, Midway E/W Shore & N/S Boundary of Shellfish Harvesting Area

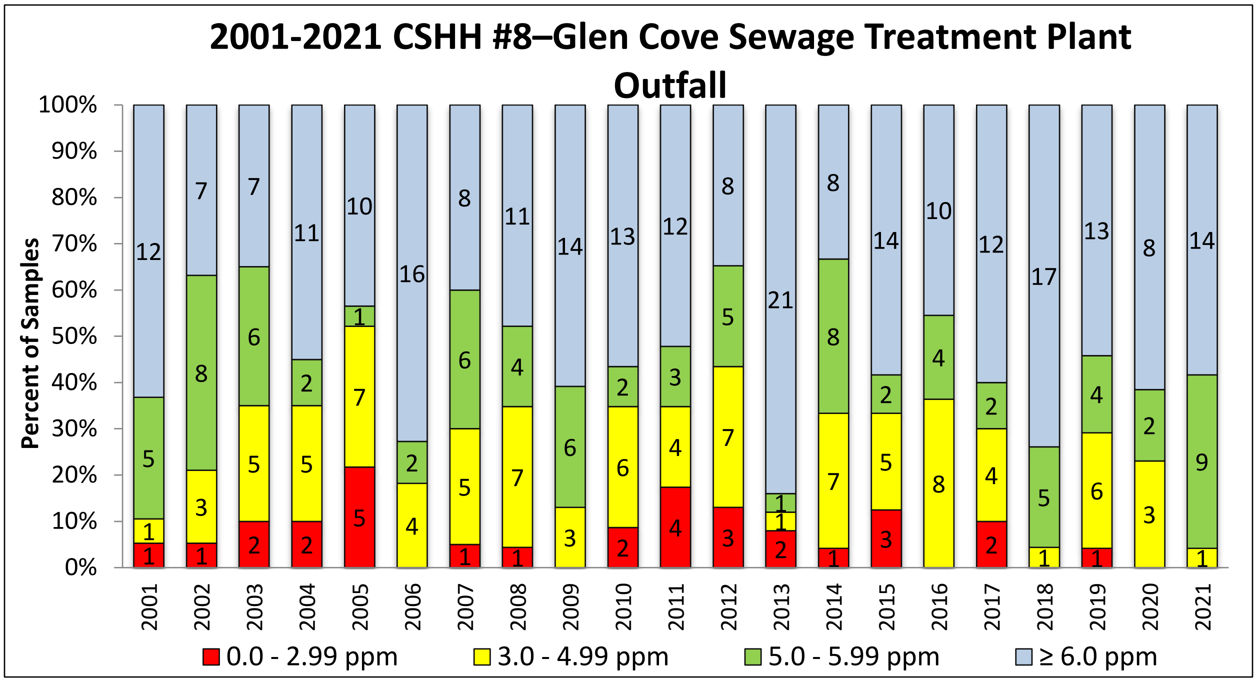


2015-2021 CSHH #17–Outer Harbor, Just Outside Restricted Crescent Beach Boundary

Long-Term Dissolved Oxygen Graphs

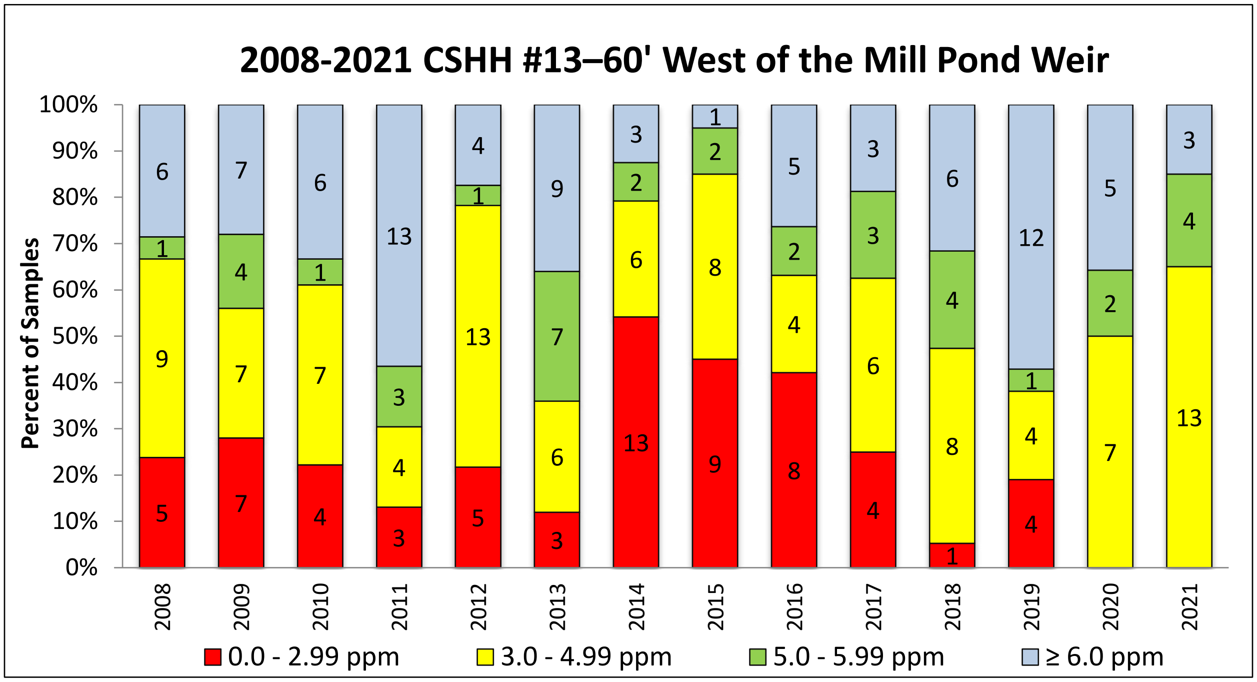


1996-2021 CSHH #3–Glen Cove Creek, Red Channel Marker



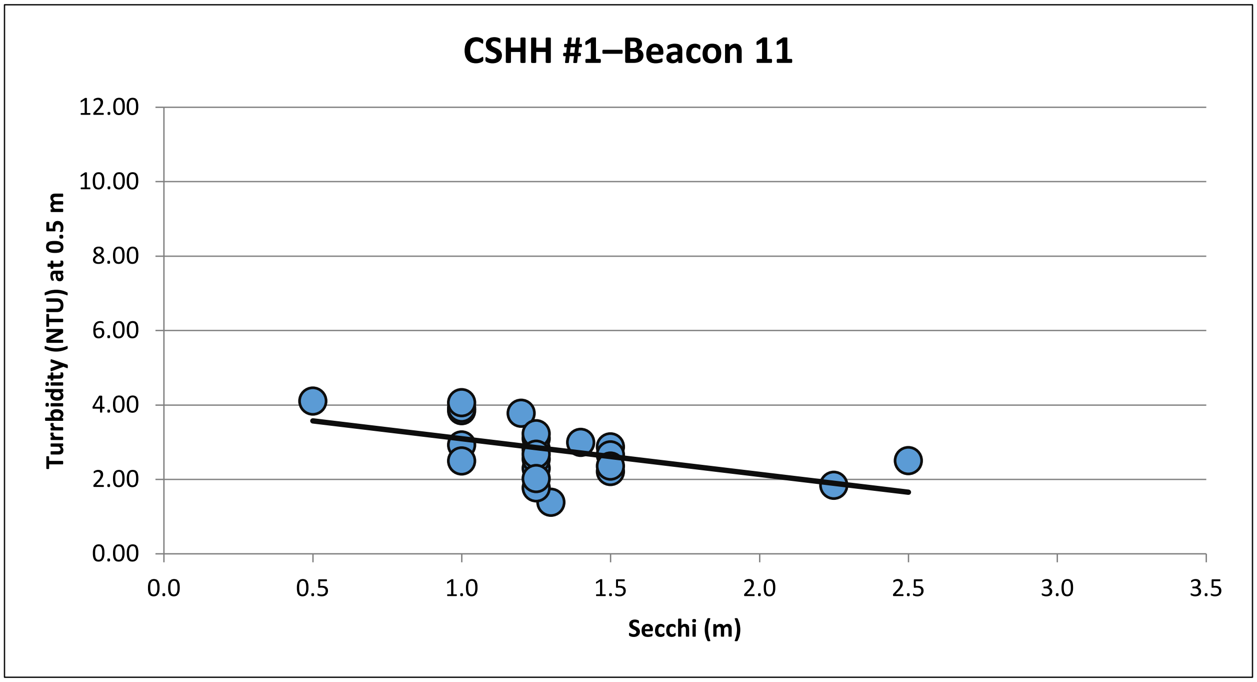
2001-2021 CSHH #8–Glen Cove Sewage Treatment Plant Outfall

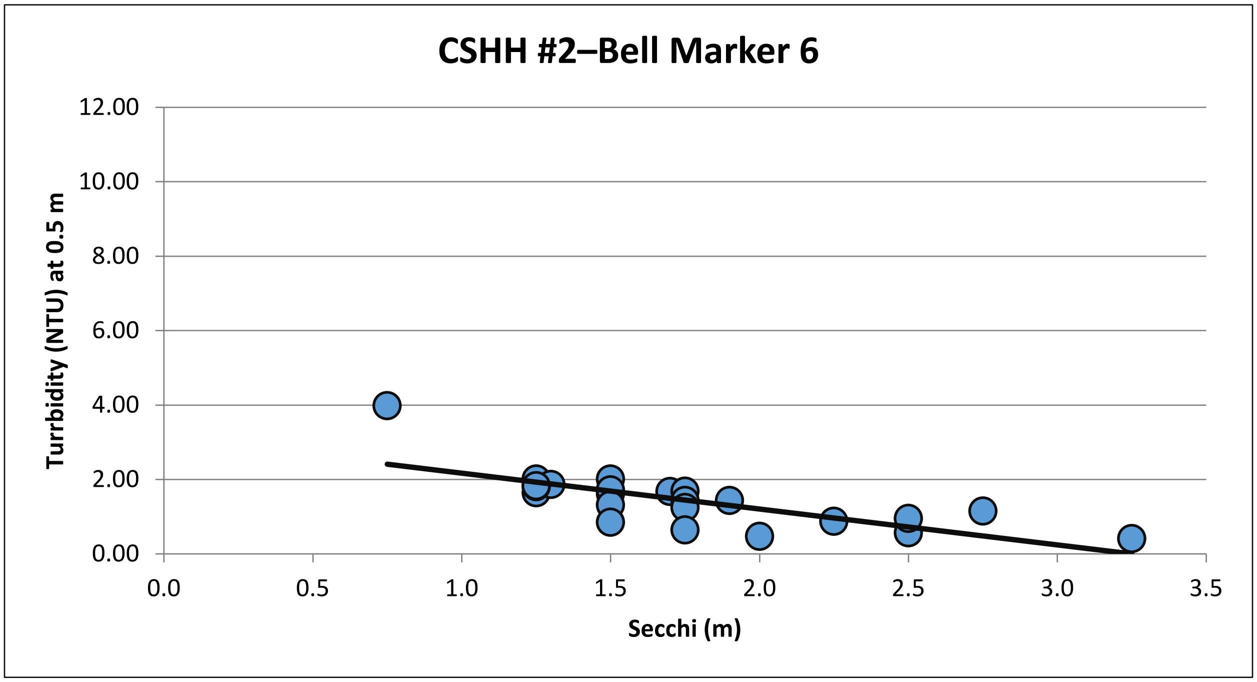
Long-Term Dissolved Oxygen Graphs



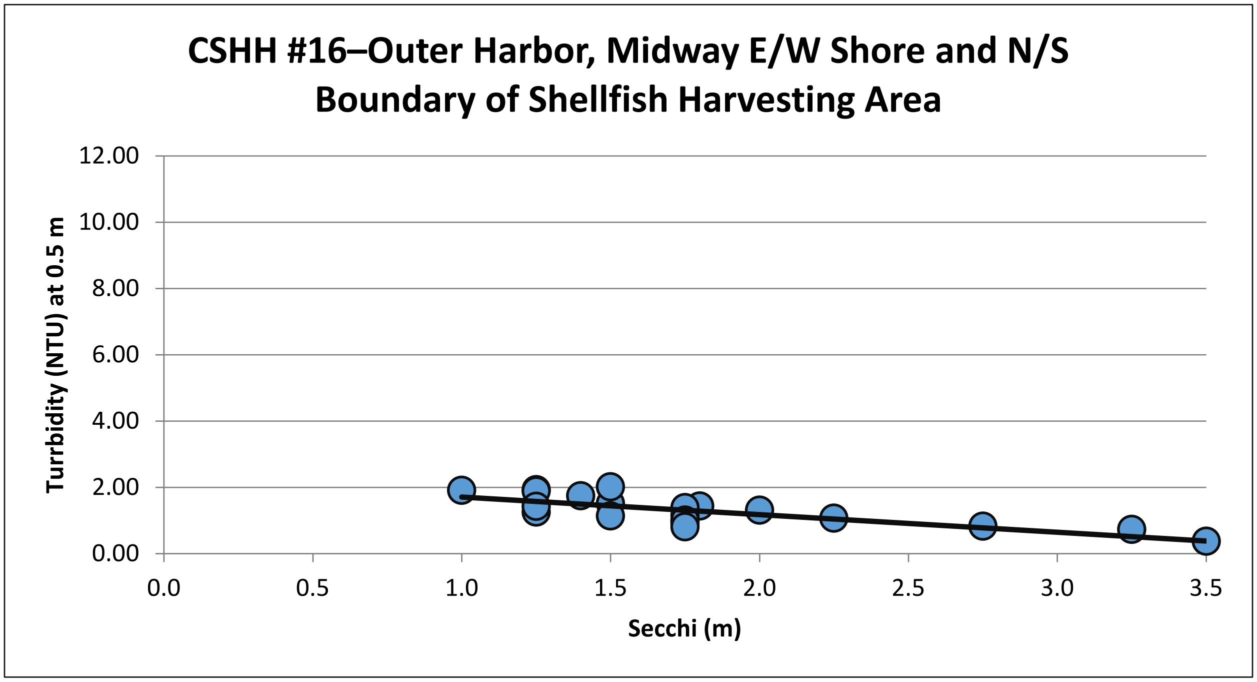
2021 Turbidity and Secchi-Disk Transparency Graphs

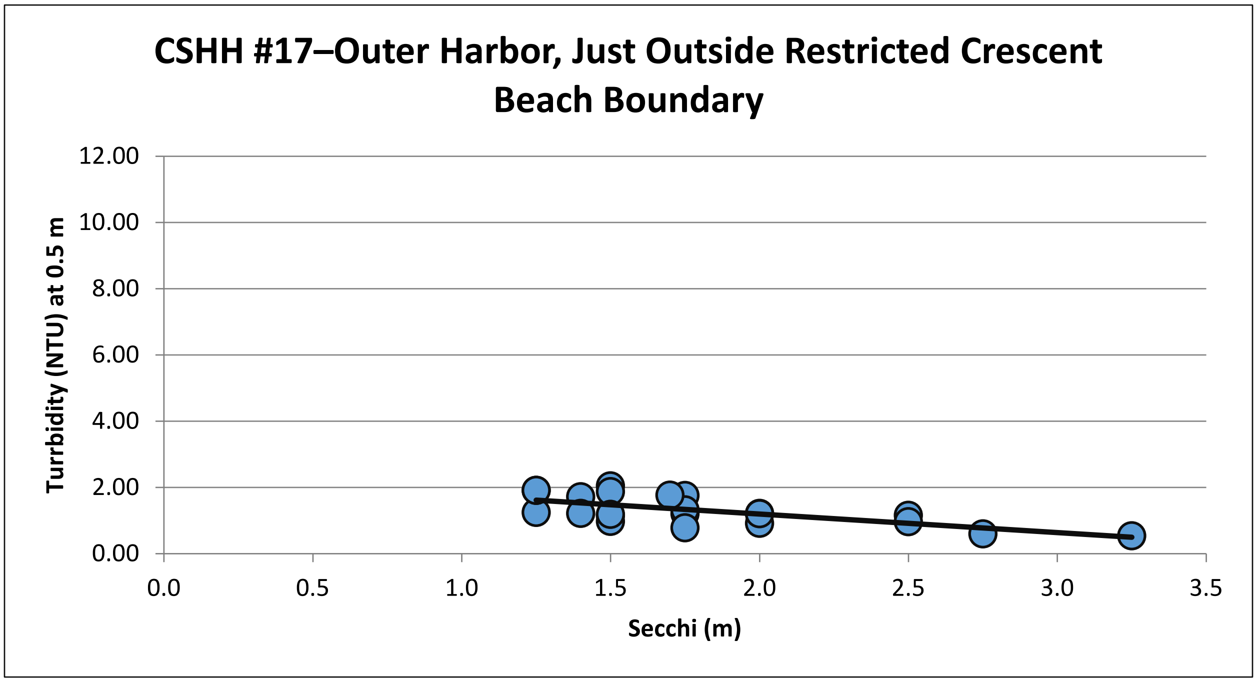
A linear trendline, generated by Microsoft Excel, is shown for each of the following graphs in this section. This line shows the inverse relationship between Secchi-disk depth and turbidity levels (NTUs), with turbidity measured at 0.5 m below the surface. The Secchi disk is visible to a greater depth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



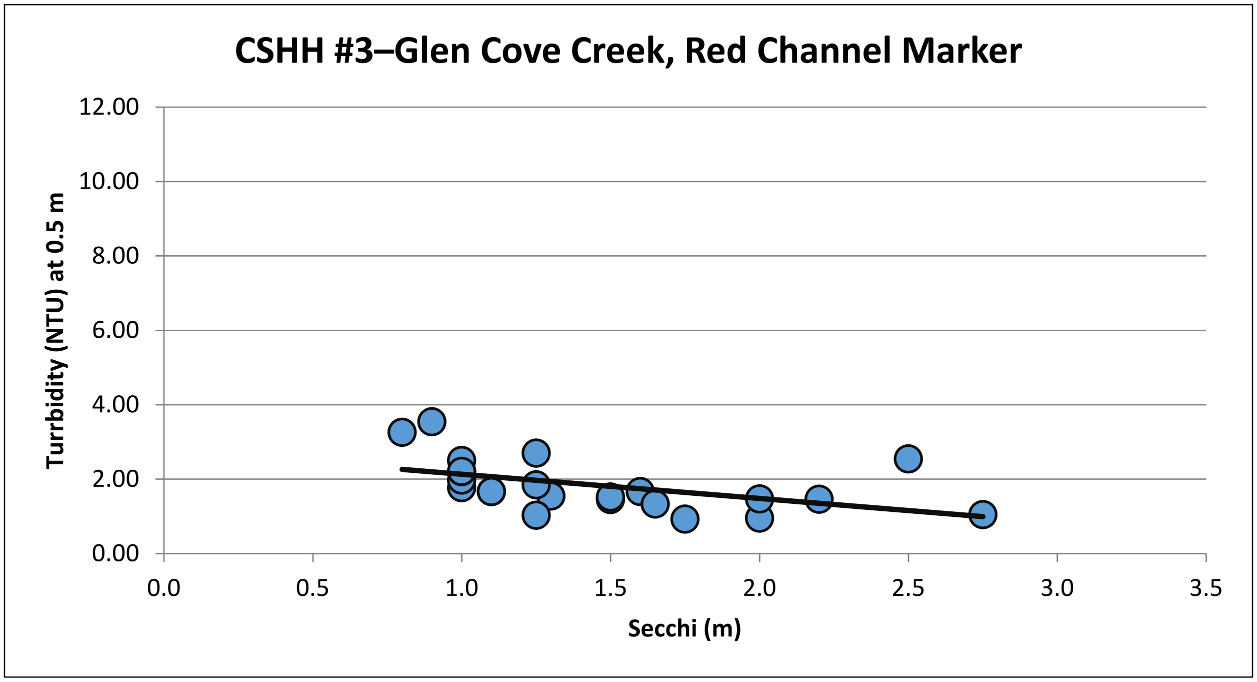


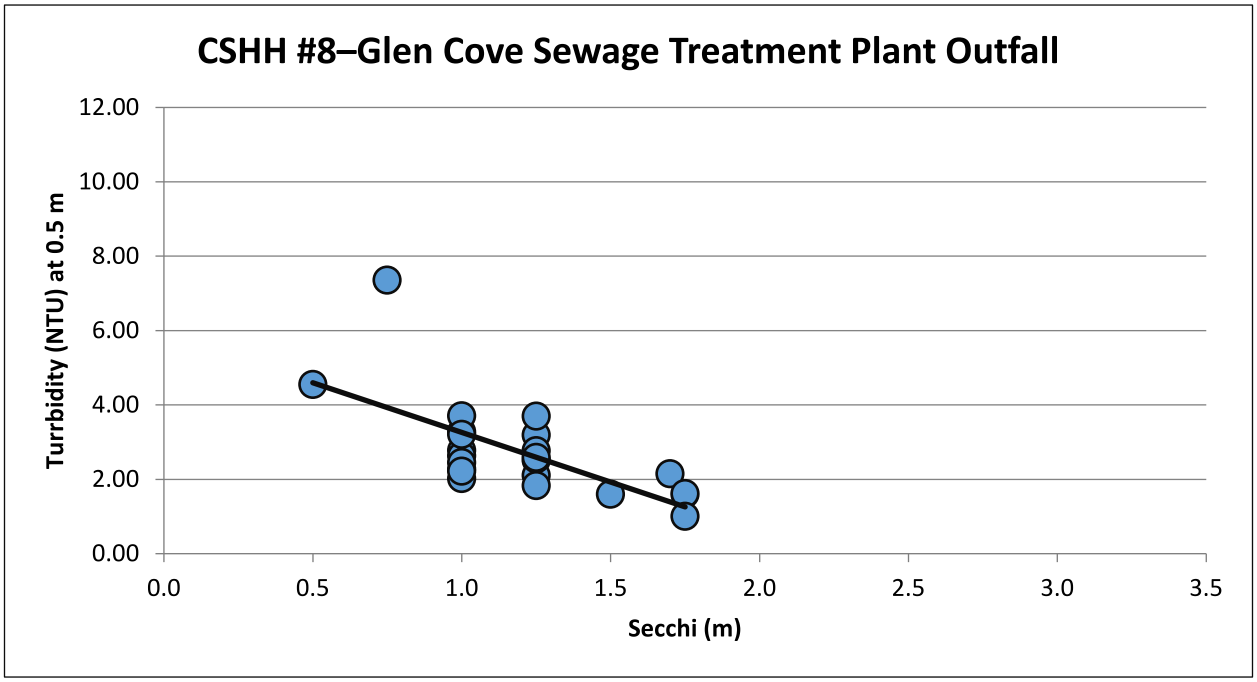
2021 Turbidity and Secchi-Disk Transparency Graphs



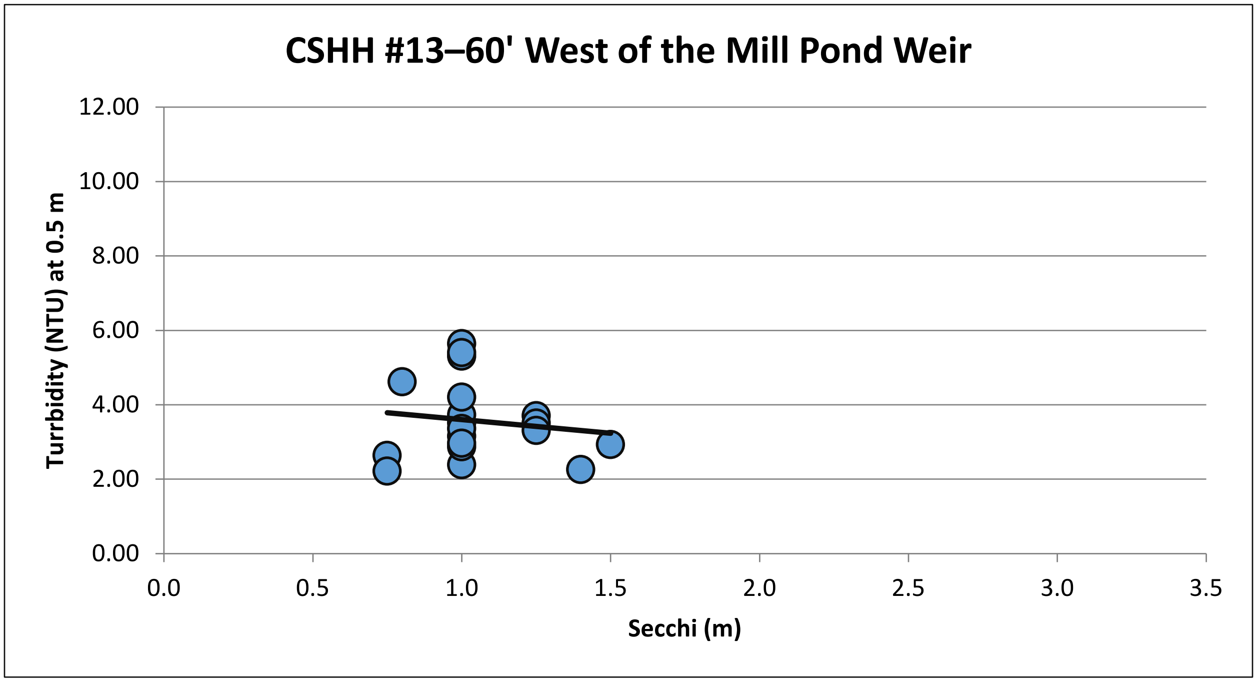


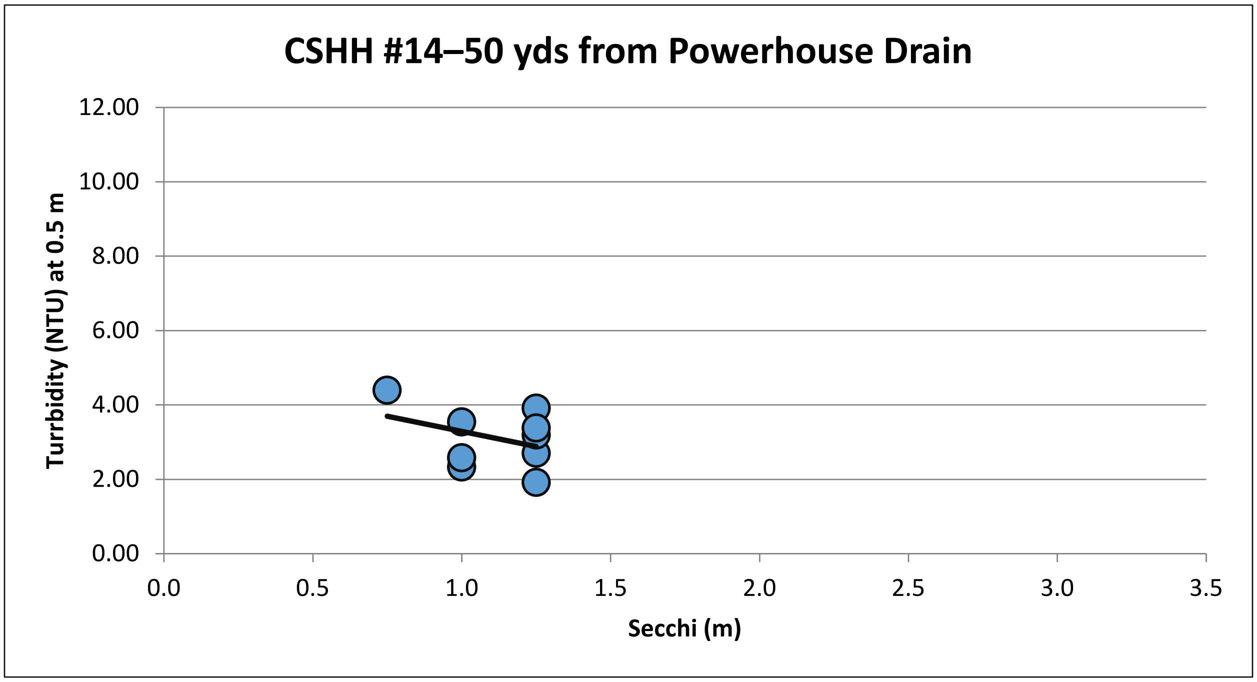
2021 Turbidity and Secchi-Disk Transparency Graphs



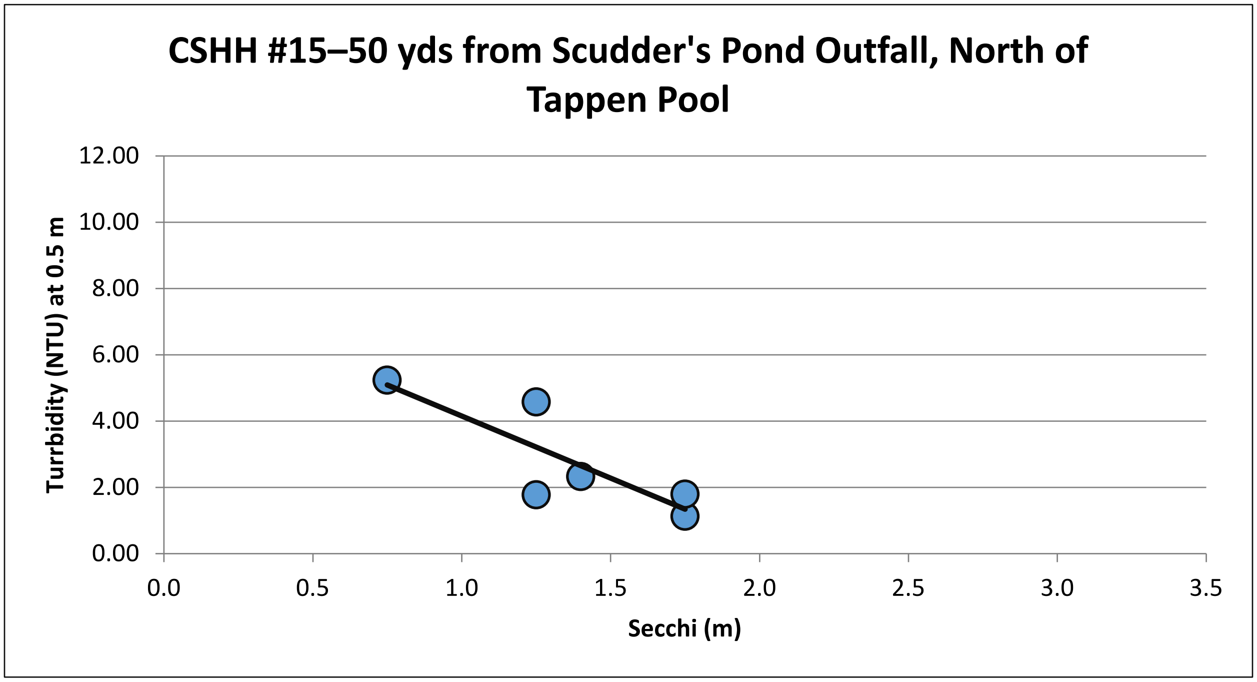


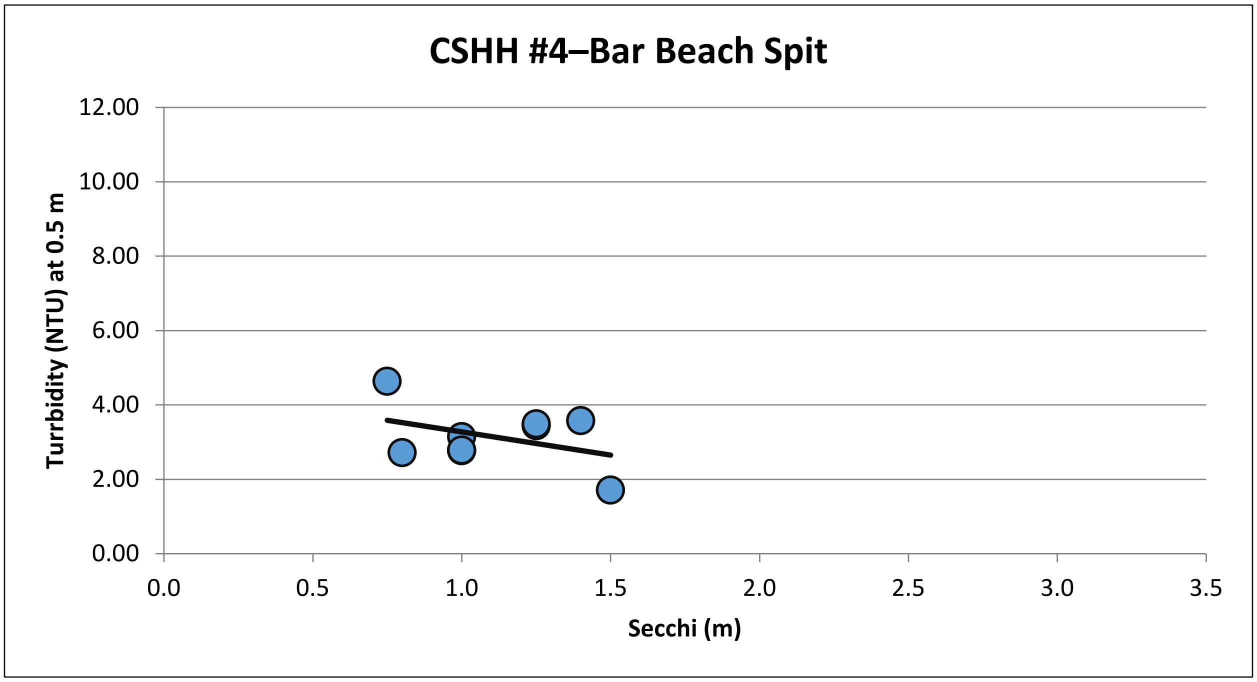
2021 Turbidity and Secchi-Disk Transparency Graphs



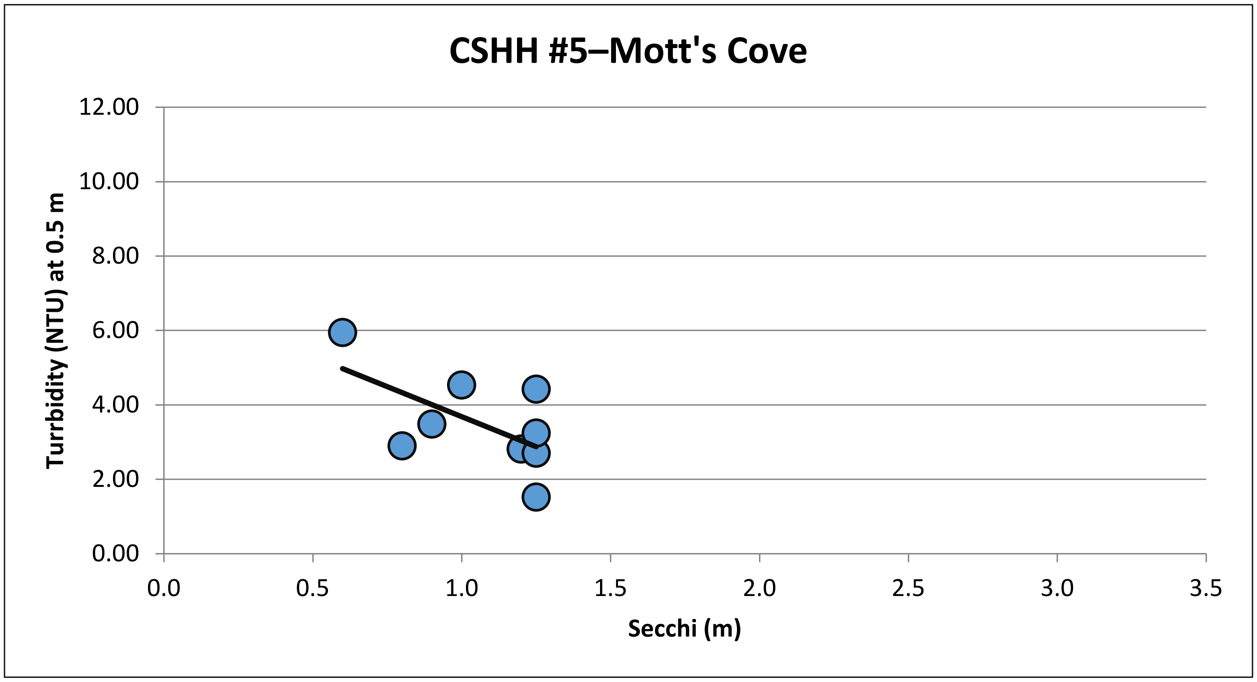


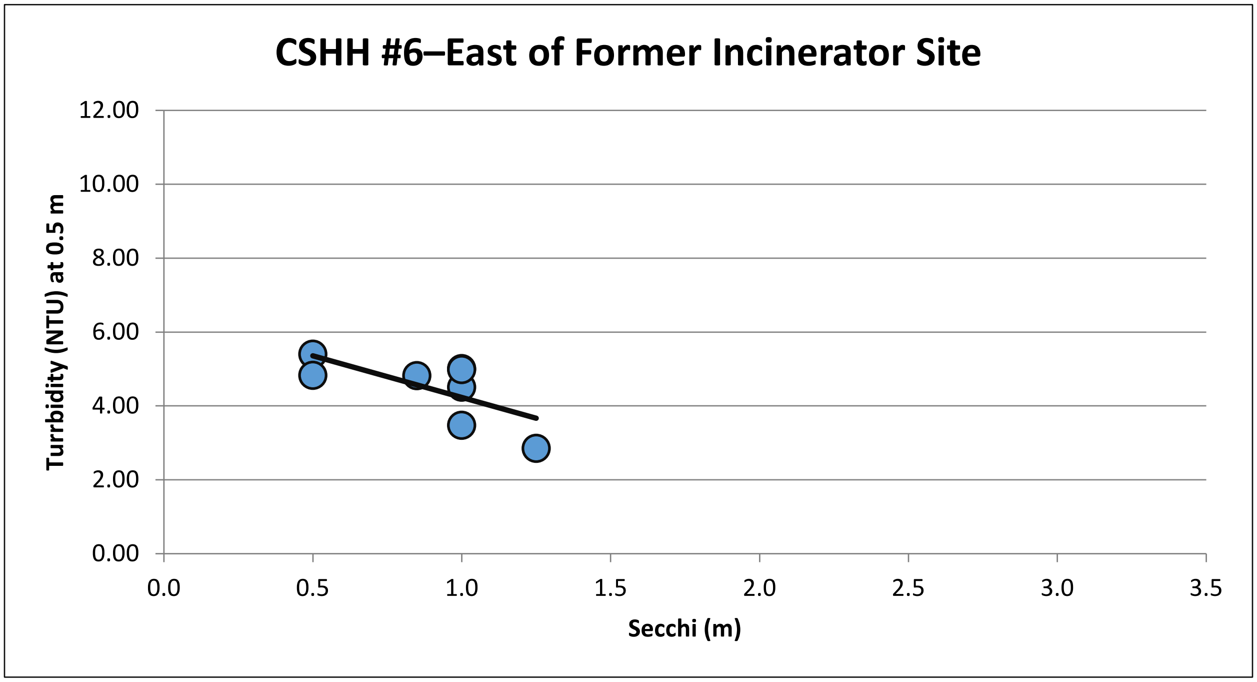
2021 Turbidity and Secchi-Disk Transparency Graphs



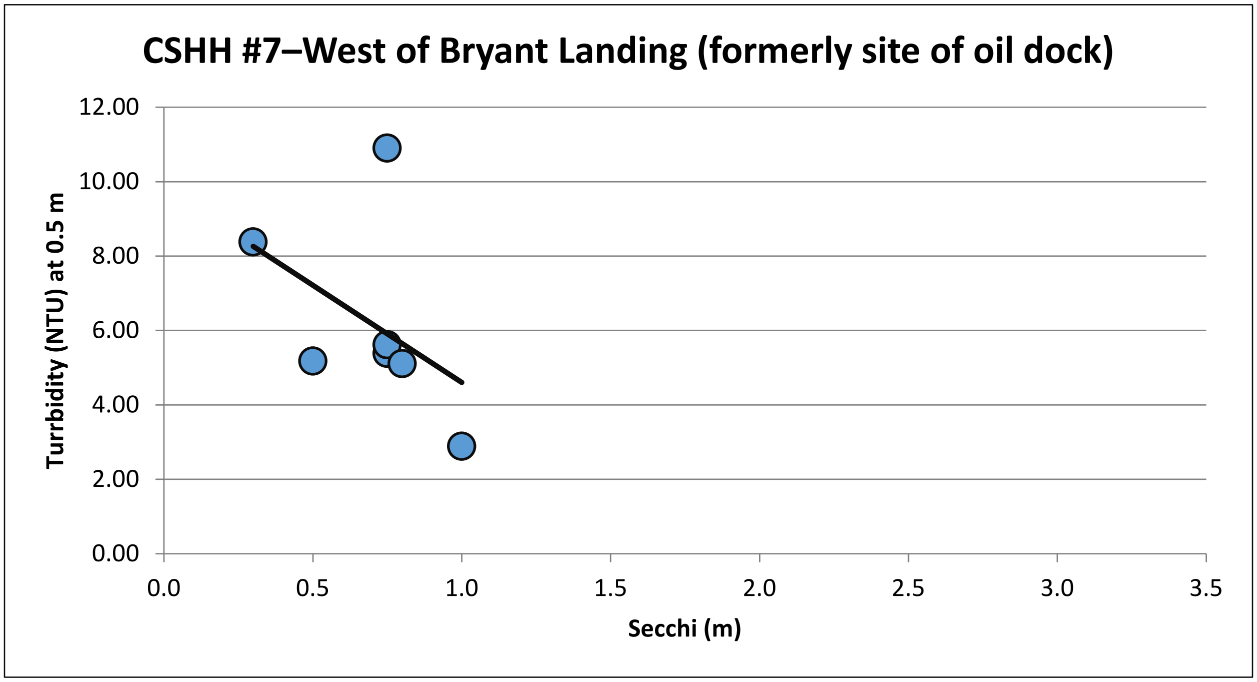


2021 Turbidity and Secchi-Disk Transparency Graphs





2021 Turbidity and Secchi-Disk Transparency Graphs



Appendix B

2021 In-Harbor Bacteria Data

CSHH #1–Beacon 11

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/19/21	5.00	0.00	5.00	0.00
5/26/21	34.00	13.04	7.00	5.92
6/2/21	5.00	9.47	4.00	5.19
6/9/21	60.00	15.03	46.00	8.96
6/16/21	11.00	14.12	10.00	9.16
6/23/21	60.00	23.21	44.00	14.15
6/30/21	27.00	22.16	9.00	14.88
7/7/21	80.00	38.59	5.00	15.56
7/14/21	33.00	34.24	32.00	14.47
7/21/21	580.00	75.67	63.00	20.90
7/28/21	54.00	74.09	60.00	22.24
8/4/21	13.00	64.01	11.00	23.15
8/11/21	140.00	71.59	59.00	***37.93***
8/18/21	45.00	76.18	3.00	23.62
8/25/21	47.00	46.08	21.00	18.96
9/3/21	630.00	75.33	24.00	15.79
9/8/21	53.00	99.77	9.00	15.17
9/15/21	18.00	66.20	2.00	7.71
9/22/21	42.00	65.29	4.00	8.16
9/29/21	57.00	67.86	6.00	6.36
10/6/21	210.00	54.47	11.00	5.44
10/13/21	120.00	64.14	28.00	6.82
10/20/21	27.00	69.56	5.00	8.19
10/28/21	430.00	110.77	41.00	13.05

Note that 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 30-day 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.

2021 In-Harbor Bacteria Data

CSHH #2–Bell Marker 6

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/19/21	0.10	0.00	0.10	0.00
5/26/21	0.10	0.10	0.10	0.10
6/2/21	3.00	0.31	1.00	0.22
6/9/21	8.00	0.70	5.00	0.47
6/16/21	1.00	0.75	1.00	0.55
6/23/21	5.00	1.64	0.10	0.55
6/30/21	3.00	3.25	0.10	0.55
7/7/21	15.00	4.48	0.10	0.35
7/14/21	47.00	6.38	3.00	0.31
7/21/21	36.00	13.07	4.00	0.41
7/28/21	0.10	5.97	0.10	0.41
8/4/21	39.00	9.98	1.00	0.65
8/11/21	3.00	7.23	0.10	0.65
8/18/21	0.10	2.11	0.10	0.33
8/25/21	25.00	1.96	0.10	0.16
9/3/21	110.00	7.97	3.00	0.31
9/8/21	6.00	5.48	1.00	0.31
9/15/21	13.00	7.35	0.10	0.31
9/22/21	2.00	13.38	0.10	0.31
9/29/21	1.00	7.03	0.10	0.31
10/6/21	52.00	6.05	0.10	0.16
10/13/21	9.00	6.56	0.10	0.10
10/20/21	12.00	6.46	0.10	0.10
10/28/21	55.00	12.53	3.00	0.20

2021 In-Harbor Bacteria Data

CSHH #3–Glen Cove Creek, Red Channel Marker

	Fecal Coliform		**Enterococci**	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/19/21	5.00	0.00	2.00	0.00
5/26/21	6.00	5.48	0.10	0.45
6/2/21	32.00	9.86	14.00	1.41
6/9/21	70.00	16.10	2.00	1.54
6/16/21	26.00	17.72	5.00	1.95
6/23/21	300.00	40.19	13.00	2.83
6/30/21	60.00	63.69	6.00	6.42
7/7/21	170.00	88.95	1.00	3.79
7/14/21	590.00	136.24	***130.00***	8.73
7/21/21	500.00	***246.10***	25.00	12.04
7/28/21	400.00	***260.67***	***400.00***	23.90
8/4/21	800.00	***437.61***	49.00	***36.38***
8/11/21	810.00	***597.99***	***110.00***	***93.13***
8/18/21	590.00	***597.99***	70.00	***82.29***
8/25/21	210.00	***502.74***	4.00	***57.04***
9/3/21	***1170.00***	***623.11***	29.00	33.75
9/8/21	210.00	***476.86***	0.10	9.78
9/15/21	980.00	***495.38***	5.00	5.27
9/22/21	680.00	***509.65***	14.00	3.82
9/29/21	570.00	***622.30***	100.00	7.27
10/6/21	210.00	***441.38***	2.00	4.26
10/13/21	650.00	***553.28***	30.00	13.32
10/20/21	51.00	***306.35***	0.10	6.09
10/28/21	490.00	***286.92***	33.00	7.23
11/10/21	164.00	***227.19***	8.00	5.30

2021 In-Harbor Bacteria Data

CSHH #4–Bar Beach Spit

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/26/21	5.00	0.00	1.00	0.00
6/23/21	270.00	36.74	54.00	7.35
7/7/21	45.00	110.23	18.00	31.18
7/21/21	43.00	80.54	29.00	30.43
8/4/21	7.00	23.84	12.00	18.43
8/18/21	13.00	15.76	11.00	15.64
9/3/21	670.00	39.36	43.00	17.84
9/15/21	47.00	74.25	5.00	13.32
10/6/21	120.00	75.10	20.00	10.00

CSHH #5–Mott's Cove

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/26/21	40.00	0.00	1.00	0.00
6/23/21	240.00	97.98	90.00	9.49
7/7/21	60.00	120.00	21.00	***43.47***
7/21/21	54.00	91.96	38.00	***41.57***
8/4/21	48.00	53.78	11.00	20.63
8/18/21	120.00	67.75	33.00	23.98
9/3/21	710.00	159.92	62.00	28.23
9/15/21	54.00	166.32	19.00	33.88
10/6/21	140.00	86.95	17.00	17.97

2021 In-Harbor Bacteria Data

CSHH #6–East of Former Incinerator Site

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
6/23/21	360.00	0.00	**120.00**	0.00
7/7/21	59.00	145.74	38.00	***67.53***
7/21/21	130.00	140.29	**130.00**	***84.00***
8/4/21	55.00	75.00	**140.00**	***88.43***
8/18/21	57.00	74.14	59.00	***102.40***
9/3/21	880.00	140.25	49.00	***73.97***
9/15/21	52.00	137.65	25.00	***41.65***
10/6/21	430.00	149.53	64.00	***40.00***

CSHH #7–West of Bryant Landing (formerly site of oil dock)

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
6/23/21	330.00	0.00	59.00	0.00
7/7/21	40.00	114.89	27.00	***39.91***
7/21/21	90.00	105.91	36.00	***38.56***
8/4/21	21.00	42.28	***220.00***	***59.80***
8/18/21	34.00	40.05	23.00	***56.69***
9/3/21	***1260.00***	96.54	100.00	***79.69***
9/15/21	47.00	126.27	12.00	30.22
10/6/21	280.00	114.72	56.00	25.92

2021 In-Harbor Bacteria Data

CSHH #8–Glen Cove Sewage Treatment Plant Outfall

	Fecal Coliform		**Enterococci**	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/19/21	28.00	0.00	33.00	0.00
5/26/21	22.00	24.82	10.00	18.17
6/2/21	34.00	27.56	9.00	14.37
6/9/21	100.00	38.04	44.00	19.01
6/16/21	35.00	37.41	13.00	17.62
6/23/21	330.00	61.28	58.00	19.72
6/30/21	24.00	62.35	8.00	18.86
7/7/21	58.00	69.38	36.00	24.89
7/14/21	240.00	82.66	59.00	26.40
7/21/21	370.00	132.47	59.00	***35.72***
7/28/21	580.00	148.28	***110.00***	***40.60***
8/4/21	650.00	***286.84***	27.00	***51.78***
8/11/21	470.00	***435.88***	***130.00***	***66.94***
8/18/21	330.00	***464.55***	***140.00***	***79.57***
8/25/21	400.00	***471.85***	36.00	***72.08***
9/3/21	620.00	***478.18***	***130.00***	***74.53***
9/8/21	270.00	***401.13***	4.00	***50.87***
9/15/21	530.00	***410.89***	22.00	***35.66***
9/22/21	49.00	***280.58***	3.00	16.53
9/29/21	220.00	***248.96***	11.00	13.04
10/6/21	870.00	***266.41***	26.00	9.45
10/13/21	***1240.00***	***361.38***	70.00	16.76
10/20/21	***2100.00***	***475.94***	***660.00***	33.08
10/28/21	***4300.00***	***1164.69***	***3000.00***	***131.71***
11/04/21	***6001.00***	***2256.16***	***590.00***	***292.09***
11/10/21	***1900.00***	***2637.65***	80.00	***365.71***
12/1/21	200.00	***1316.24***	48.00	***131.34***
12/8/21	34.00	***234.65***	20.00	***42.51***

2021 In-Harbor Bacteria Data

CSHH #9–First Pipe West of Sewage Treatment Plant Outfall

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/19/21	17.00	0.00	30.00	0.00
5/26/21	70.00	34.50	13.00	19.75
6/2/21	570.00	87.86	***520.00***	***58.75***
6/9/21	530.00	137.70	***200.00***	***79.80***
6/16/21	600.00	184.83	***620.00***	***120.25***
6/23/21	480.00	***360.52***	100.00	***152.99***
6/30/21	590.00	***552.18***	***700.00***	***339.55***
7/7/21	600.00	***557.87***	90.00	***239.09***
7/14/21	630.00	***577.49***	***1100.00***	***336.22***
7/21/21	640.00	***585.00***	***210.00***	***270.76***
7/28/21	990.00	***676.13***	***1120.00***	***438.97***
8/4/21	710.00	***701.64***	***190.00***	***338.19***
8/11/21	710.00	***725.66***	***770.00***	***519.54***
8/18/21	***1040.00***	***802.18***	***400.00***	***424.37***
8/25/21	***1100.00***	***893.95***	***1600.00***	***636.98***
9/3/21	601.00	***809.03***	***601.00***	***562.42***
9/8/21	***1120.00***	***886.25***	***500.00***	***682.50***
9/15/21	800.00	***907.66***	***210.00***	***526.32***
9/22/21	530.00	***793.18***	25.00	***302.29***
9/29/21	430.00	***657.33***	***120.00***	***180.07***
10/6/21	590.00	***654.91***	22.00	***92.93***

2021 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**
5/19/21	28.00	0.00	21.00	0.00
5/26/21	100.00	52.92	15.00	17.75
6/2/21	470.00	109.59	***510.00***	***54.36***
6/9/21	580.00	166.22	***390.00***	***88.97***
6/16/21	590.00	***214.14***	***590.00***	***129.89***
6/23/21	600.00	***395.28***	***270.00***	***216.47***
6/30/21	28.00	***306.43***	28.00	***245.25***
7/7/21	580.00	***319.60***	90.00	***173.35***
7/14/21	670.00	***328.95***	***310.00***	***165.58***
7/21/21	710.00	***341.36***	***320.00***	***146.51***
7/28/21	***1100.00***	***385.36***	***840.00***	***183.84***
8/4/21	750.00	***743.78***	***110.00***	***241.70***
8/11/21	***1330.00***	***878.07***	***830.00***	***376.92***
8/18/21	480.00	***821.41***	***260.00***	***363.89***
8/24/21	***1250.00***	***919.80***	***140.00***	***308.44***
9/3/21	601.00	***815.06***	***910.00***	***313.42***
9/8/21	601.00	***779.74***	***190.00***	***349.62***
9/15/21	740.00	***693.47***	46.00	***196.03***
9/22/21	670.00	***741.30***	77.00	***153.69***
9/29/21	350.00	***574.68***	22.00	***106.14***
10/6/21	970.00	***632.42***	26.00	***52.13***
10/13/21	840.00	***676.22***	70.00	***42.69***
10/20/21	***2250.00***	***844.65***	***700.00***	***73.59***
10/28/21	***2400.00***	***1090.19***	***520.00***	***107.82***
11/04/21	***6001.00***	***1924.57***	***500.00***	***201.39***
11/10/21	800.00	***1851.81***	58.00	***236.44***
12/1/21	390.00	***1232.52***	70.00	***126.619***
12/8/21	59.00	***264.039***	20.00	***43.3031***

2021 In-Harbor Bacteria Data

CSHH #11–50 yds East of STP Outfall

	Fecal Coliform		**Enterococci**	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/19/21	27.00	0.00	3.00	0.00
5/26/21	390.00	102.62	***140.00***	20.49
6/2/21	590.00	183.83	***570.00***	***62.09***
6/9/21	600.00	***247.09***	***580.00***	***108.55***
6/16/21	580.00	***293.07***	***460.00***	***144.90***
6/30/21	200.00	***450.16***	21.00	***237.72***
7/7/21	650.00	***461.19***	80.00	***145.50***
7/21/21	***1010.00***	***508.26***	***740.00***	***107.53***
8/11/21	***1570.00***	***1259.25***	***790.00***	***764.59***
8/18/21	***2240.00***	***1525.77***	***1350.00***	***924.13***
8/25/21	***1220.00***	***1624.93***	***370.00***	***733.48***
9/3/21	601.00	***1267.20***	***601.00***	***697.85***
9/8/21	601.00	***1091.57***	***520.00***	***657.97***
9/15/21	***1410.00***	***1068.35***	***520.00***	***605.18***
9/22/21	***3600.00***	***1174.70***	***420.00***	***479.14***
9/29/21	970.00	***1122.04***	***770.00***	***554.78***
10/6/21	***1220.00***	***1292.72***	***200.00***	***445.20***
10/13/21	***1280.00***	***1503.74***	***100.00***	***320.15***
10/20/21	***2500.00***	***1686.23***	***850.00***	***353.21***
10/28/21	***6001.00***	***1867.67***	***3000.00***	***523.37***
11/4/21	***6001.00***	***2689.00***	***1500.00***	***598.04***
11/10/21	***6001.00***	***3697.98***	***1500.00***	***894.84***

2021 In-Harbor Bacteria Data

CSHH #12–East of STP Outfall, by Bend in Seawall

	Fecal Coliform		**Enterococci**	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/19/21	37.00	0.00	8.00	0.00
5/26/21	280.00	101.78	28.00	14.97
6/2/21	290.00	144.30	70.00	25.03
6/9/21	590.00	***205.19***	***360.00***	***48.74***
6/16/21	580.00	***252.58***	***460.00***	***76.36***
6/30/21	300.00	***415.38***	18.00	***120.19***
7/7/21	680.00	***514.02***	***380.00***	***183.45***
7/14/21	740.00	***543.97***	***1520.00***	***262.97***
7/21/21	860.00	***600.26***	***850.00***	***306.61***
7/28/21	***1150.00***	***683.62***	***920.00***	***381.96***
8/4/21	990.00	***867.99***	***1000.00***	***853.03***
8/11/21	***1710.00***	***1043.79***	***1010.00***	***1037.23***
8/18/21	***1970.00***	***1269.58***	***1400.00***	***1020.31***
8/25/21	***1370.00***	***1393.49***	***360.00***	***859.23***
9/3/21	601.00	***1223.88***	***1870.00***	***990.19***
9/8/21	601.00	***1107.61***	***220.00***	***731.48***
9/15/21	***1590.00***	***1091.61***	***440.00***	***619.48***
9/22/21	***2750.00***	***1166.92***	***450.00***	***493.68***
9/29/21	***1110.00***	***1118.82***	***800.00***	***579.17***
10/6/21	***1870.00***	***1403.96***	***860.00***	***495.83***
10/13/21	***2120.00***	***1806.53***	***370.00***	***550.16***
10/20/21	***2600.00***	***1993.25***	***900.00***	***634.82***
10/28/21	***5000.00***	***2246.41***	***800.00***	***712.24***
11/4/21	***6001.00***	***3148.25***	***3000.00***	***927.75***
11/10/21	***6001.00***	***3975.07***	***900.00***	***936.22***
12/1/21	300.00	***2210.66***	70.00	***573.88***
12/8/21	118.00	***596.68***	60.00	***155.77***

2021 In-Harbor Bacteria Data

CSHH #13–60' West of Mill Pond Weir

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/26/21	340.00	0.00	44.00	0.00
6/2/21	190.00	***254.17***	***180.00***	***88.99***
6/9/21	570.00	***332.69***	***230.00***	***122.13***
6/16/21	240.00	***306.61***	***140.00***	***126.37***
6/30/21	330.00	***304.33***	100.00	***155.16***
7/7/21	280.00	***335.30***	***340.00***	***181.90***
7/21/21	900.00	***436.49***	***890.00***	***311.62***
7/28/21	***1010.00***	***538.34***	***990.00***	***416.03***
8/4/21	***1210.00***	***744.95***	***1310.00***	***791.49***
8/11/21	***1870.00***	***1197.56***	***1200.00***	***1084.85***
8/18/21	***2350.00***	***1370.41***	***1930.00***	***1217.33***
8/25/21	***1840.00***	***1581.13***	***1550.00***	***1360.18***
9/3/21	***2600.00***	***1910.28***	***2160.00***	***1589.86***
9/8/21	601.00	***1660.79***	***950.00***	***1490.90***
9/15/21	***2370.00***	***1741.39***	***2000.00***	***1651.27***
9/22/21	***2600.00***	***1776.96***	***1320.00***	***1530.46***
9/29/21	***1420.00***	***1687.22***	***880.00***	***1366.64***
10/6/21	***2110.00***	***1618.20***	***1540.00***	***1277.22***
10/13/21	***2400.00***	***2134.52***	***1760.00***	***1444.85***
10/20/21	***2800.00***	***2206.90***	***1100.00***	***1282.03***
10/28/21	***5400.00***	***2554.27***	***900.00***	***1187.49***
11/4/21	***6001.00***	***3407.64***	***3700.00***	***1582.61***
11/10/21	***6001.00***	***4199.93***	***5800.00***	***2063.27***
12/1/21	***1800.00***	***4017.04***	80.00	***1197.40***
12/8/21	200.00	***1292.73***	60.00	***303.08***

2021 In-Harbor Bacteria Data

CSHH #14–NW Corner of Power Plant, Approximately 50 yds from Cement Outfall

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/26/21	5.00	0.00	0.10	0.00
6/23/21	360.00	42.43	***130.00***	3.61
7/7/21	70.00	158.75	50.00	***80.62***
7/21/21	340.00	***204.63***	40.00	***63.83***
8/4/21	6.00	52.27	3.00	18.17
8/18/21	19.00	33.84	6.00	8.96
9/3/21	710.00	43.26	56.00	10.03
9/15/21	120.00	117.42	15.00	17.15
10/6/21	160.00	138.56	20.00	17.32

CSHH #15–50 yds from Scudder's Pond Outfall, North of Tappen Beach Pool

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/26/21	17.00	0.00	1.00	0.00
6/23/21	160.00	52.15	23.00	4.80
7/21/21	110.00	132.66	5.00	10.72
8/4/21	18.00	44.50	7.00	5.92
8/18/21	11.00	27.93	1.00	3.27
9/3/21	660.00	50.75	68.00	7.81
10/6/21	410.00	0.00	3.00	0.00
10/20/21	23.00	97.11	0.10	0.55

2021 In-Harbor Bacteria Data

CSHH #16–Outer Harbor, Midway E/W Shore and N/S Boundary of Shellfish Harvesting Area

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/19/21	0.10	0.00	0.10	0.00
5/26/21	0.10	0.10	0.10	0.10
6/2/21	2.00	0.27	0.10	0.10
6/9/21	0.10	0.21	0.10	0.10
6/16/21	0.10	0.18	0.10	0.10
6/23/21	0.10	0.18	0.10	0.10
6/30/21	1.00	0.29	0.10	0.10
7/7/21	1.00	0.25	0.10	0.10
7/14/21	5.00	0.55	1.00	0.16
7/21/21	0.10	0.55	0.10	0.16
7/28/21	3.00	1.08	4.00	0.33
8/4/21	1.00	1.08	0.10	0.33
8/11/21	2.00	1.25	0.10	0.33
8/18/21	4.00	1.19	0.10	0.21
8/25/21	250.00	5.70	1.00	0.33
9/3/21	80.00	10.99	1.00	0.25
9/8/21	15.00	18.88	0.10	0.25
9/15/21	6.00	23.52	0.10	0.25
9/22/21	2.00	20.48	1.00	0.40
9/29/21	1.00	6.79	0.10	0.25
10/6/21	12.00	4.64	0.10	0.16
10/13/21	21.00	4.97	2.00	0.29
10/20/21	1.00	3.47	0.10	0.29

2021 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**
5/19/21	0.10	0.00	0.10	0.00
5/26/21	0.10	0.10	0.10	0.10
6/2/21	0.10	0.10	0.10	0.10
6/9/21	5.00	0.27	2.00	0.21
6/16/21	0.10	0.22	0.10	0.18
6/23/21	4.00	0.46	1.00	0.29
6/30/21	1.00	0.72	0.10	0.29
7/7/21	2.00	1.32	0.10	0.29
7/14/21	3.00	1.19	2.00	0.29
7/21/21	3.00	2.35	1.00	0.46
7/28/21	4.00	2.35	1.00	0.46
8/4/21	1.00	2.35	0.10	0.46
8/11/21	16.00	3.57	1.00	0.72
8/18/21	1.00	2.86	1.00	0.63
8/25/21	60.00	5.21	0.10	0.40
9/3/21	58.00	8.89	11.00	0.64
9/8/21	19.00	16.03	0.10	0.64
9/15/21	2.00	10.57	0.10	0.41
9/22/21	10.00	16.76	0.10	0.26
9/29/21	1.00	7.39	1.00	0.41
10/6/21	15.00	5.64	0.10	0.16
10/13/21	24.00	5.91	1.00	0.25
10/20/21	1.00	5.14	0.10	0.25
10/28/21	13.00	5.42	0.10	0.25

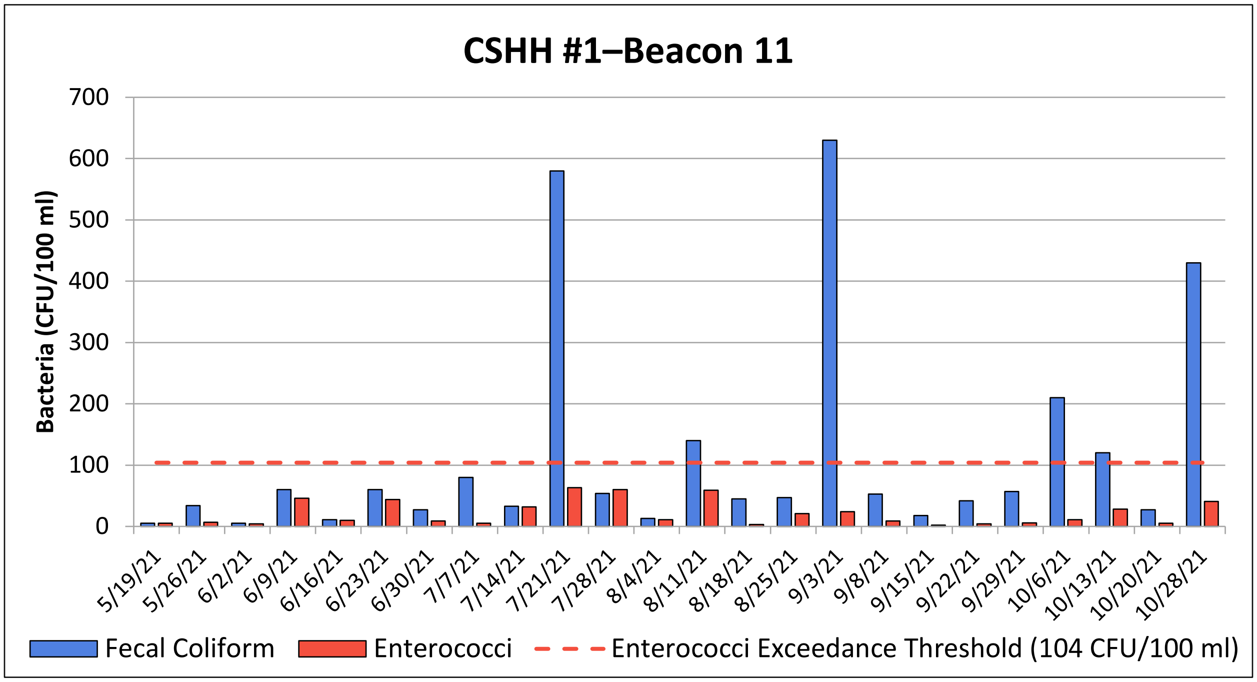
2021 In-Harbor Bacteria Data

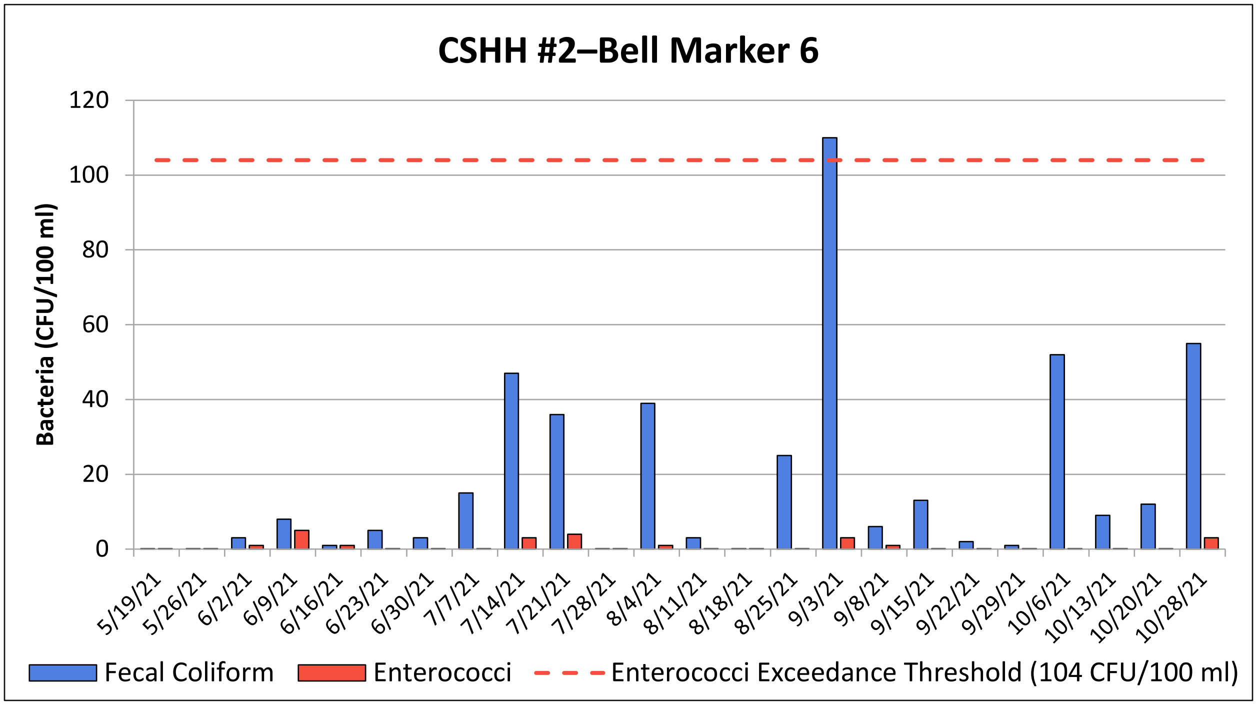
CSHH #17A–Within Restricted Shellfishing Area

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/19/21	0.10	0.00	0.10	0.00
6/2/21	15.00	1.22	1.00	0.32
6/9/21	2.00	1.44	1.00	0.46
6/16/21	4.00	1.86	1.00	0.56
6/30/21	4.00	4.68	2.00	1.19
7/14/21	20.00	6.84	2.00	1.59
7/28/21	16.00	10.86	13.00	3.73
8/11/21	17.00	17.59	4.00	4.70
8/25/21	90.00	29.04	0.10	1.73
9/8/21	67.00	46.80	0.10	0.34
9/22/21	10.00	39.21	0.10	0.10
10/13/21	8.00	8.94	1.00	0.32
10/20/21	5.00	7.37	2.00	0.58
10/28/21	60.00	13.39	16.00	3.17

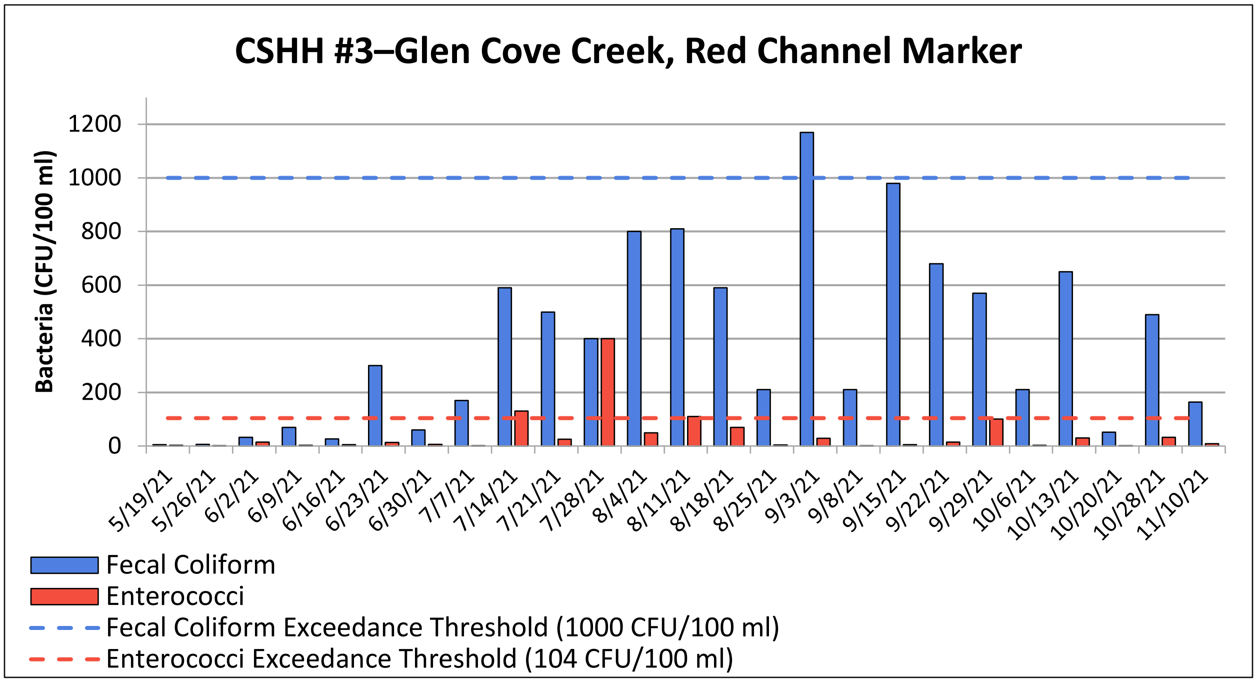
2021 In-Harbor Bacteria Graphs

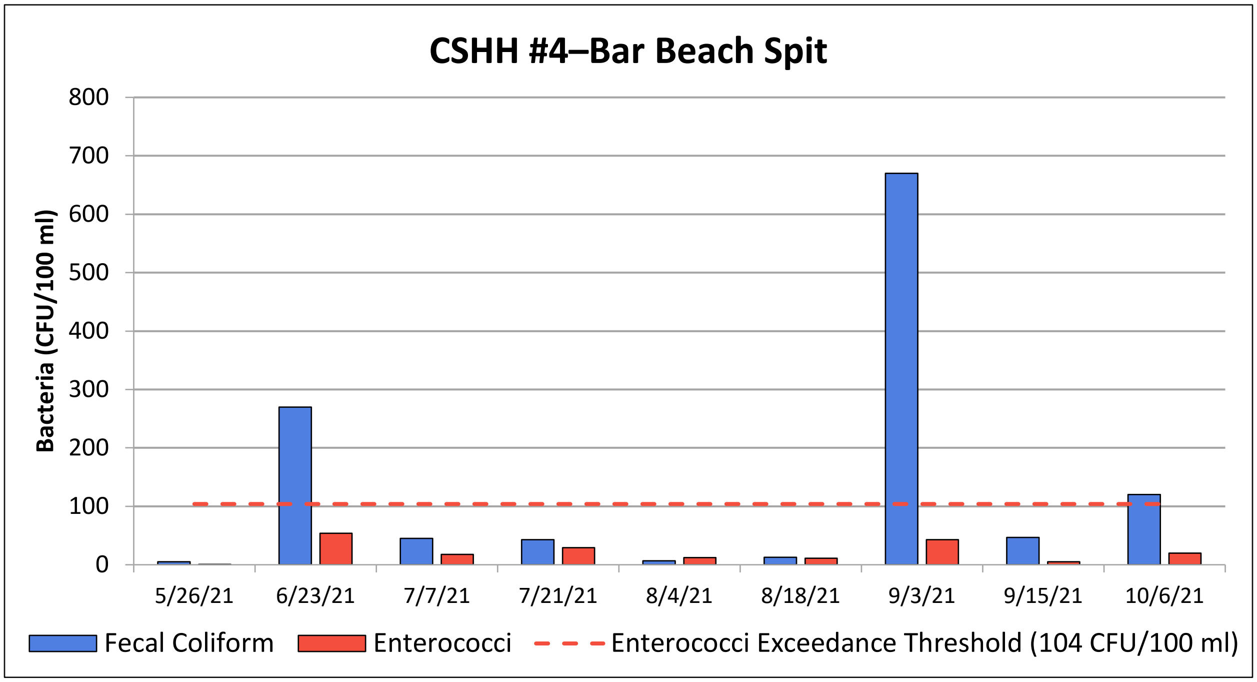
The following graphs display fecal coliform and enterococci data received from the Nassau County Department of Health. Lab results for fecal coliform greater than 6000 CFU/100 ml are represented at an absolute value of 6001 CFU/100 ml.



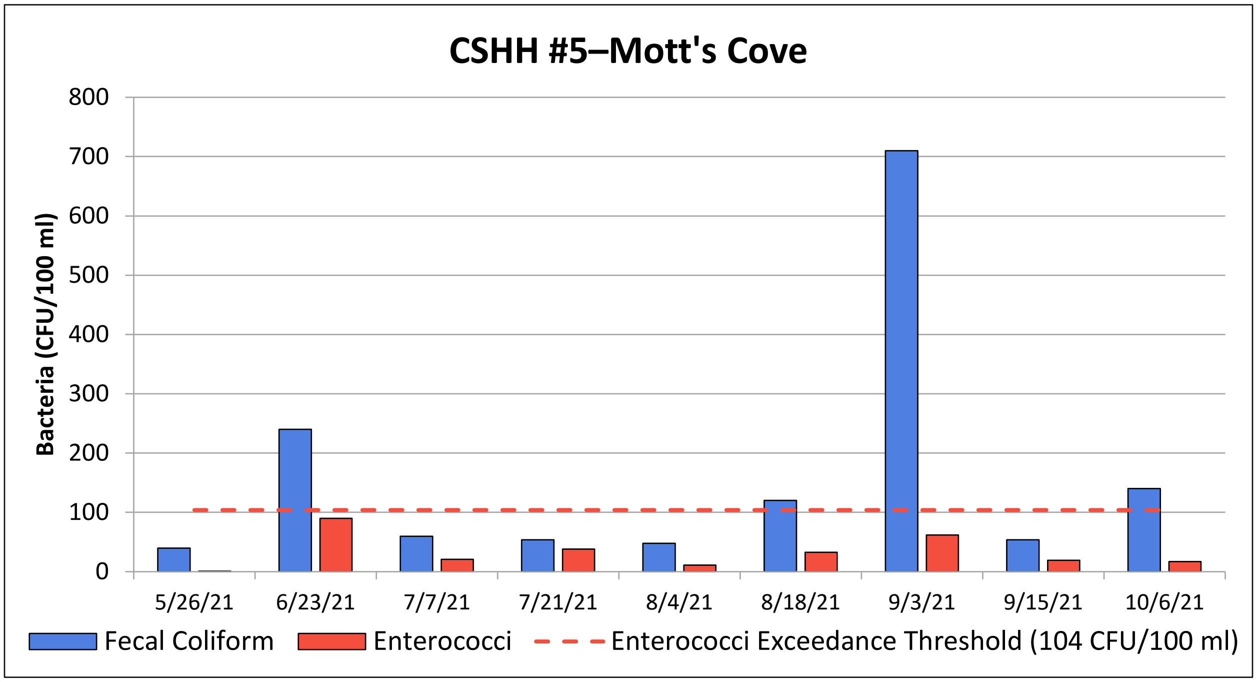


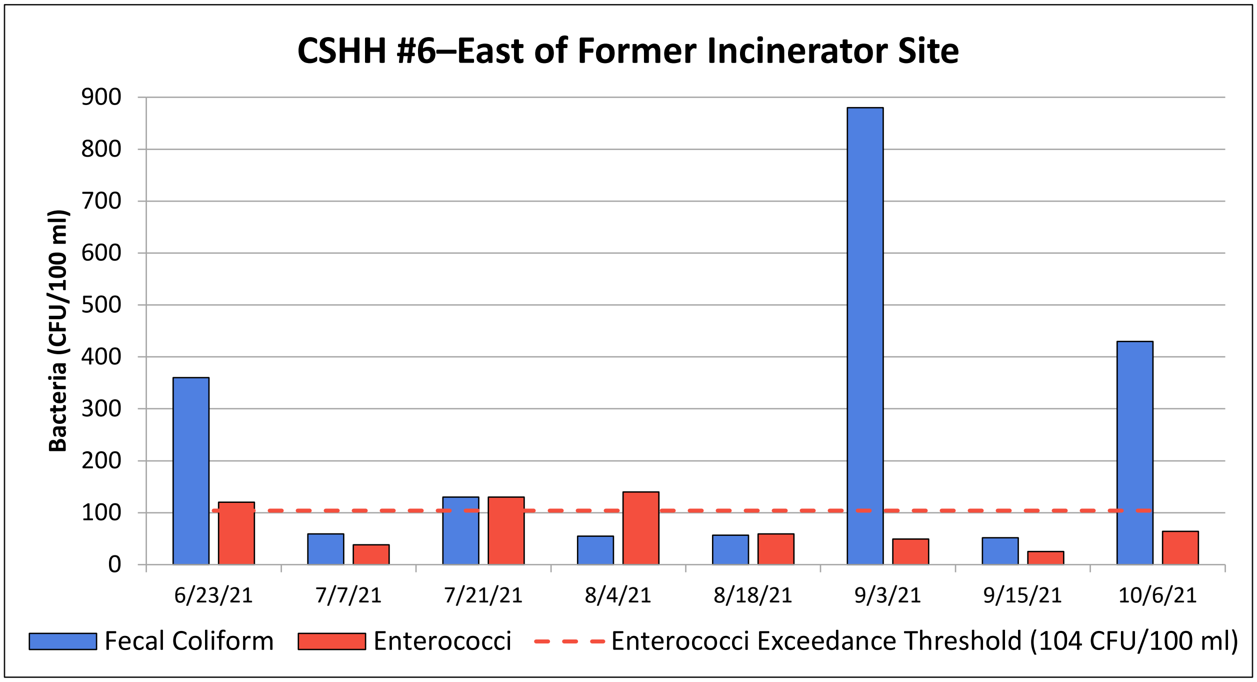
2021 In-Harbor Bacteria Graphs



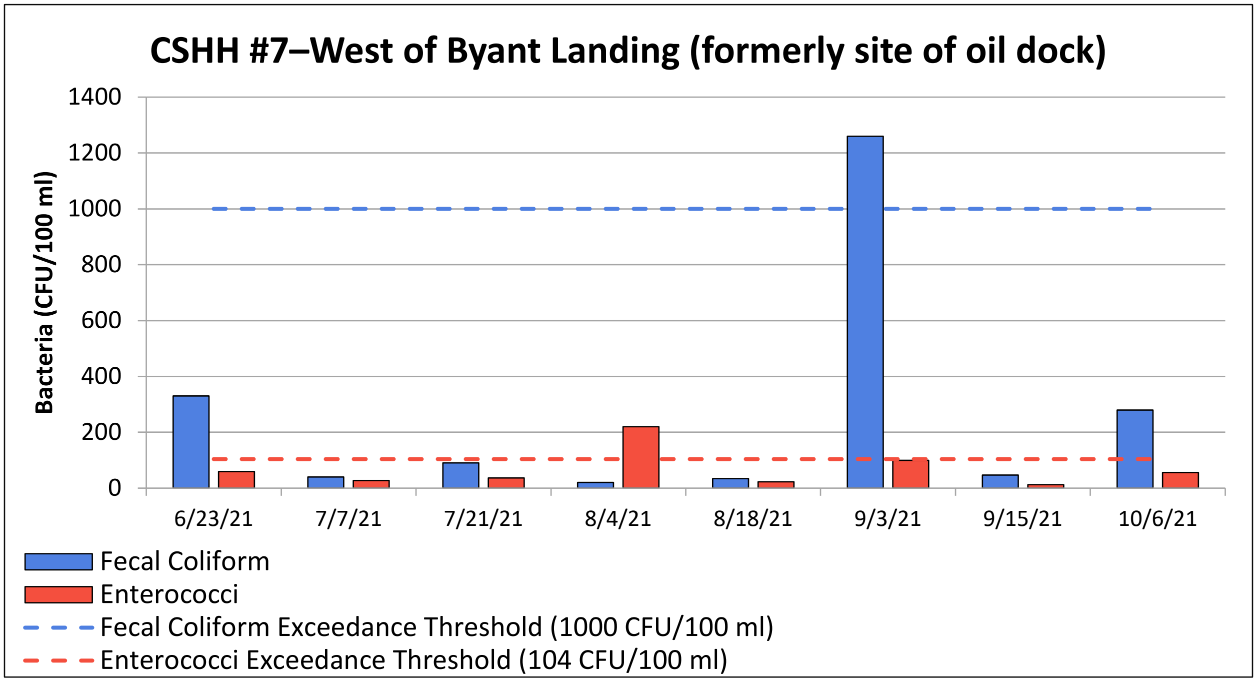


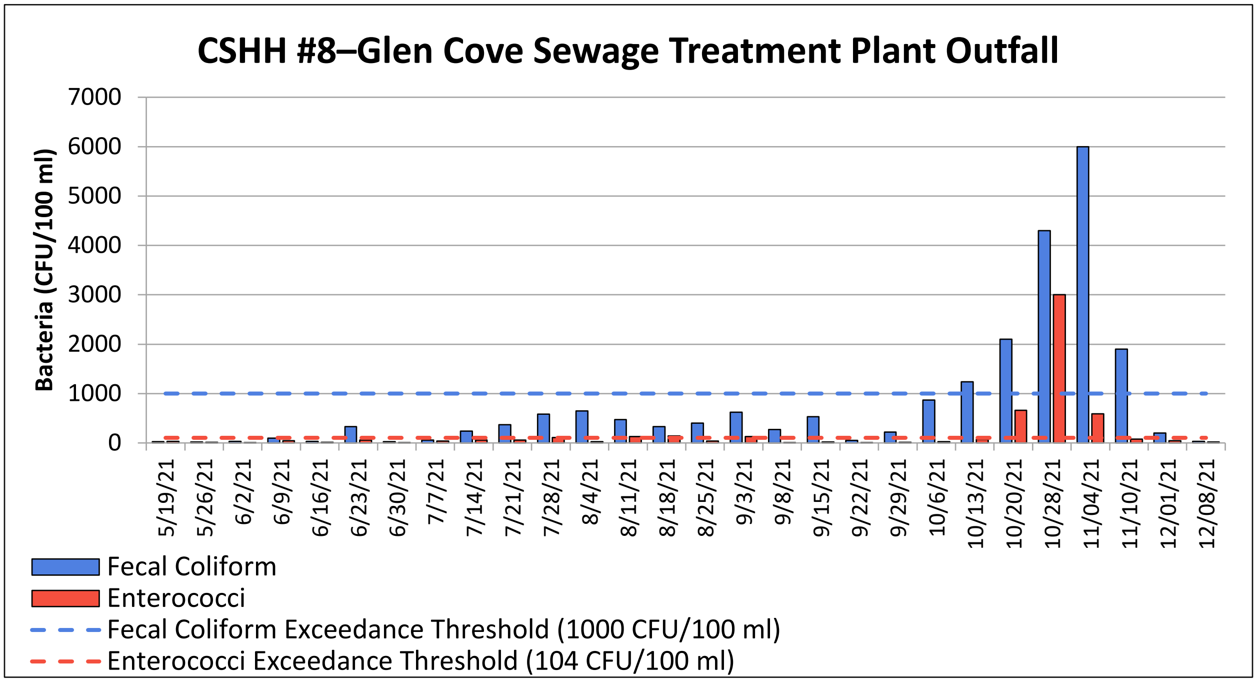
2021 In-Harbor Bacteria Graphs



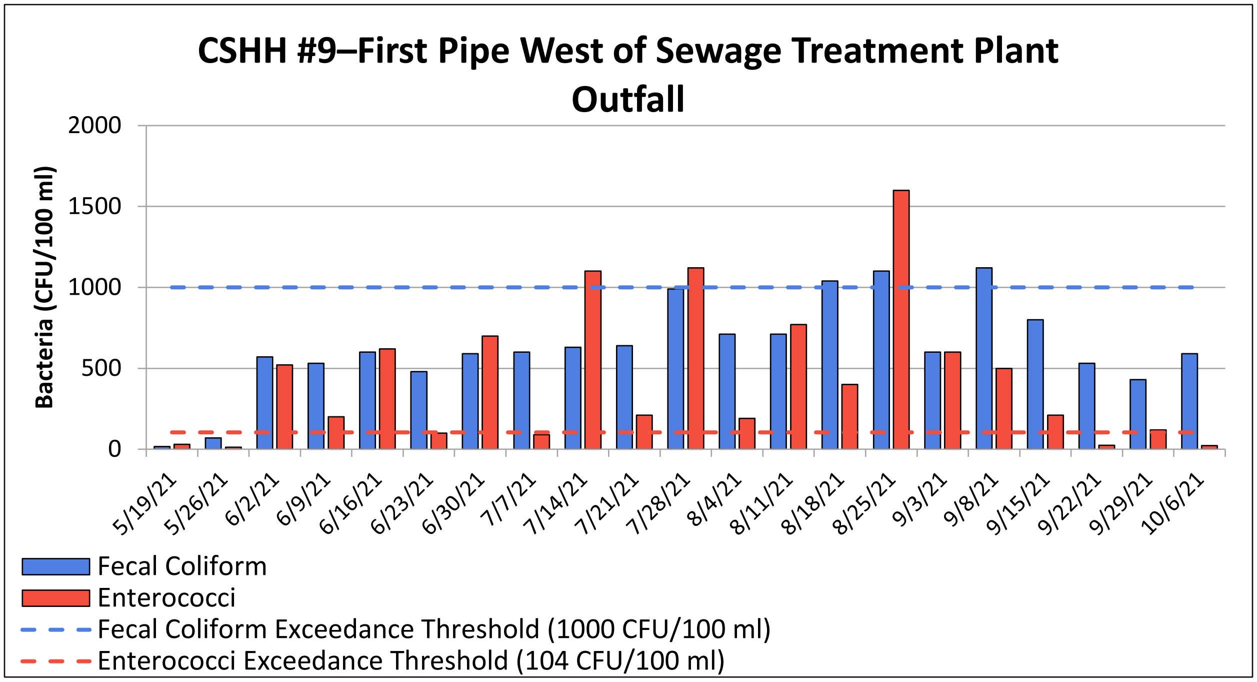


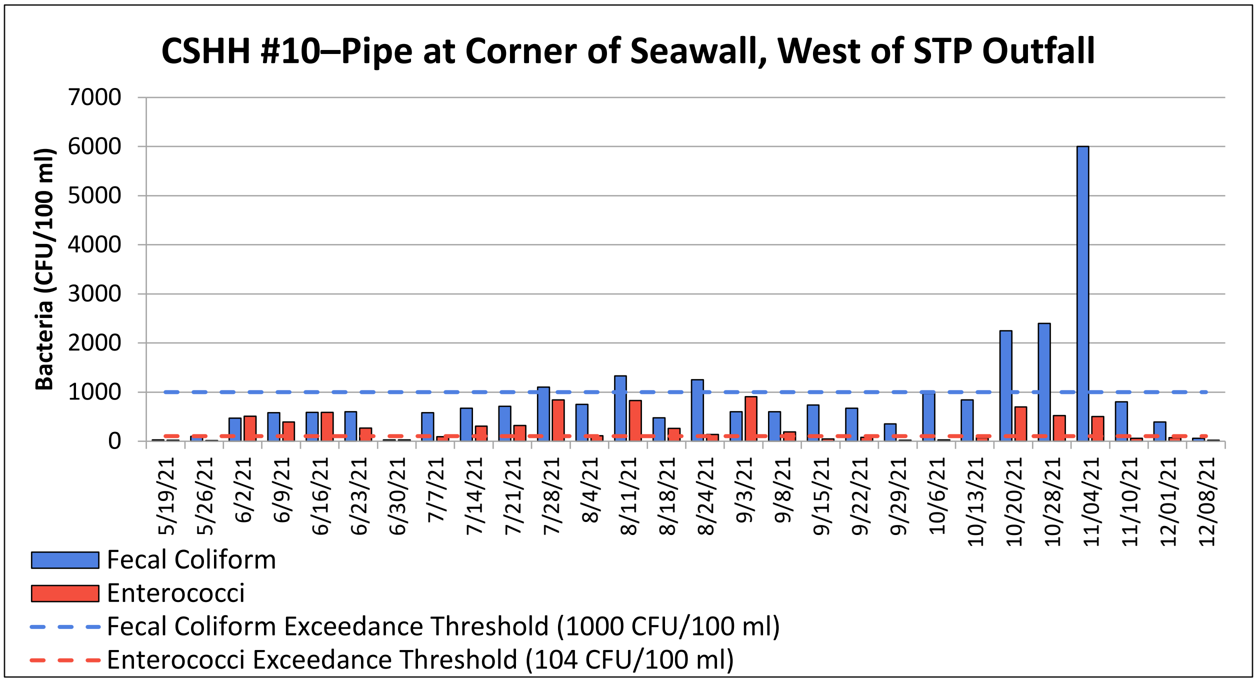
2021 In-Harbor Bacteria Graphs



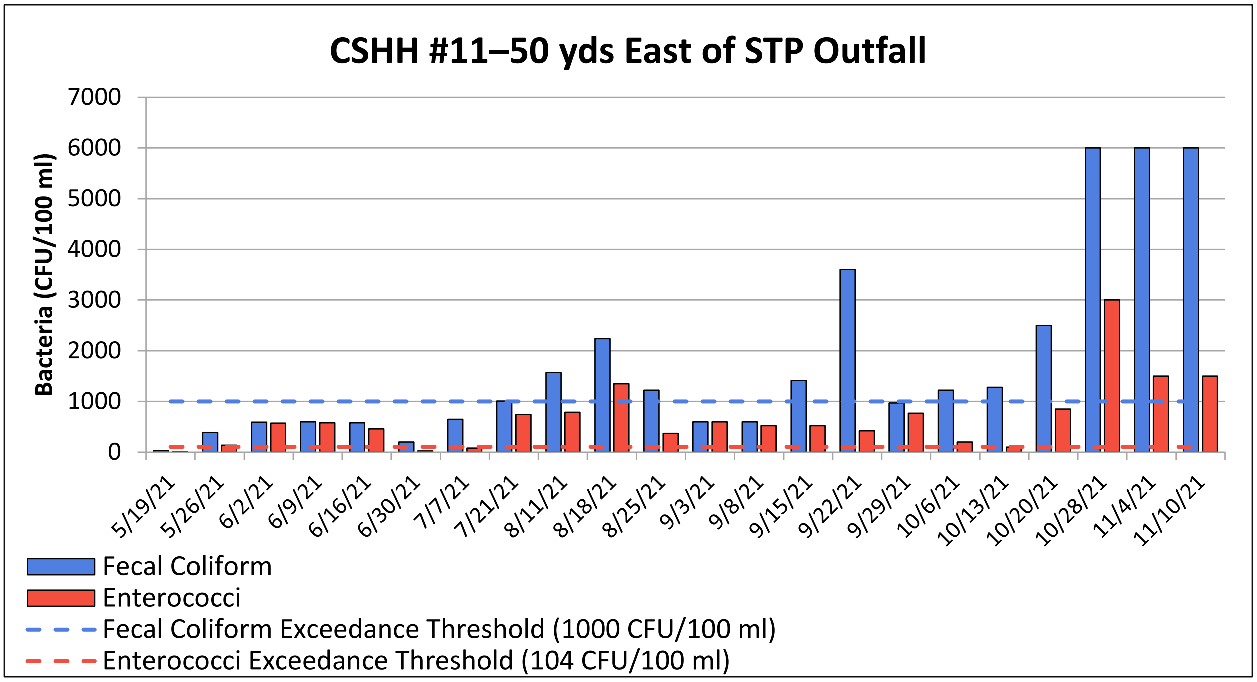


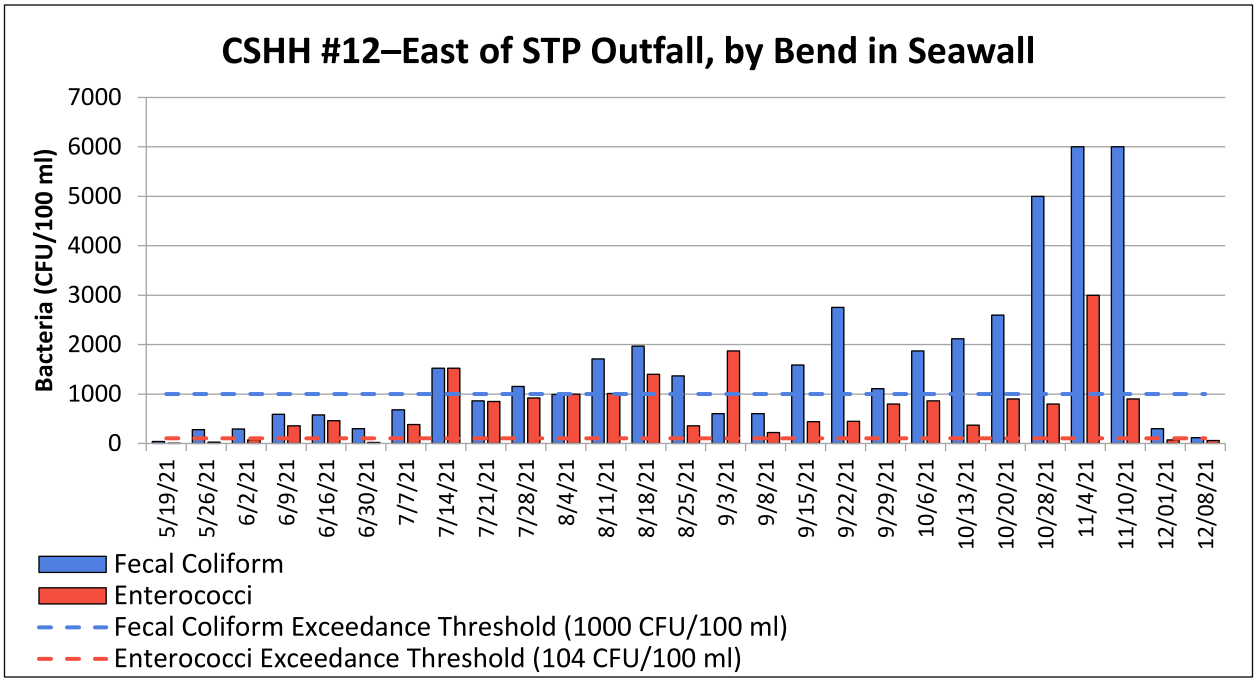
2021 In-Harbor Bacteria Graphs



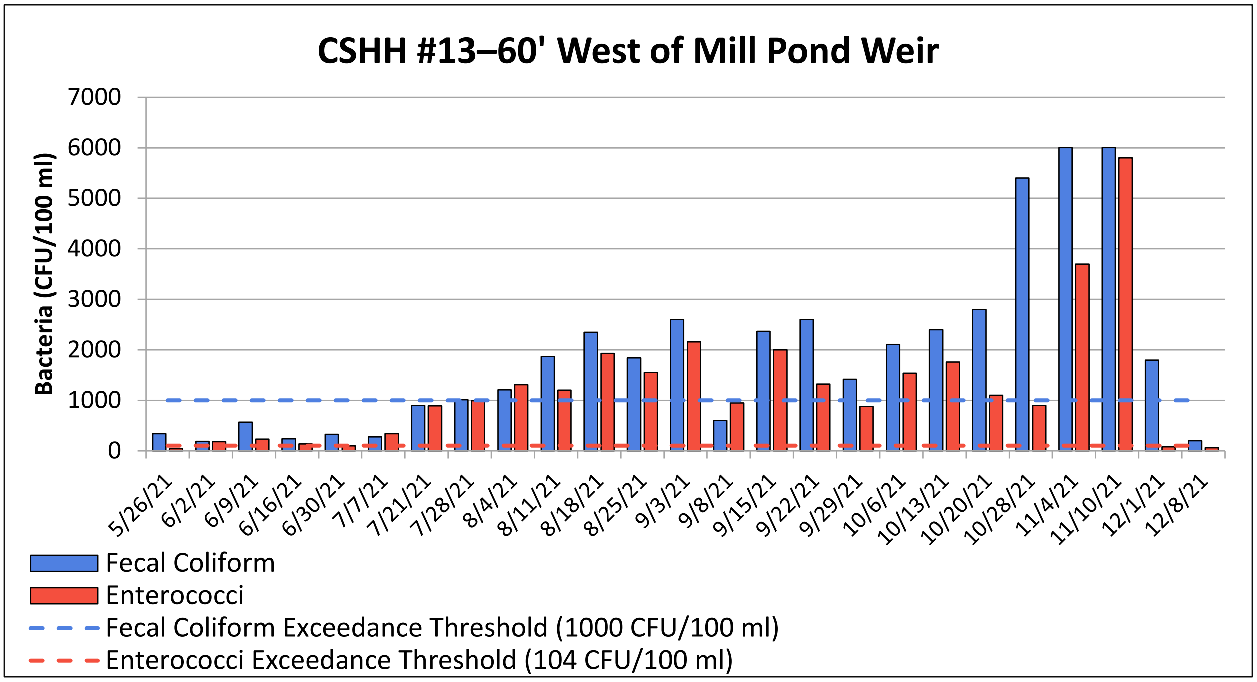


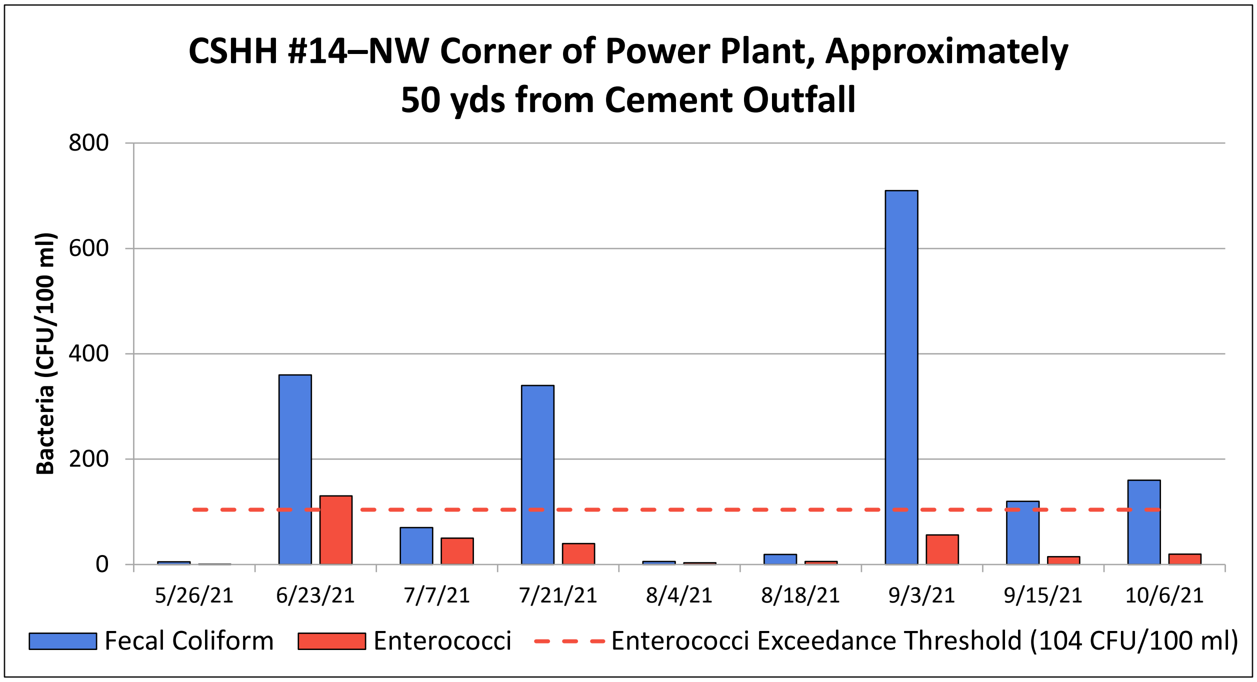
2021 In-Harbor Bacteria Graphs



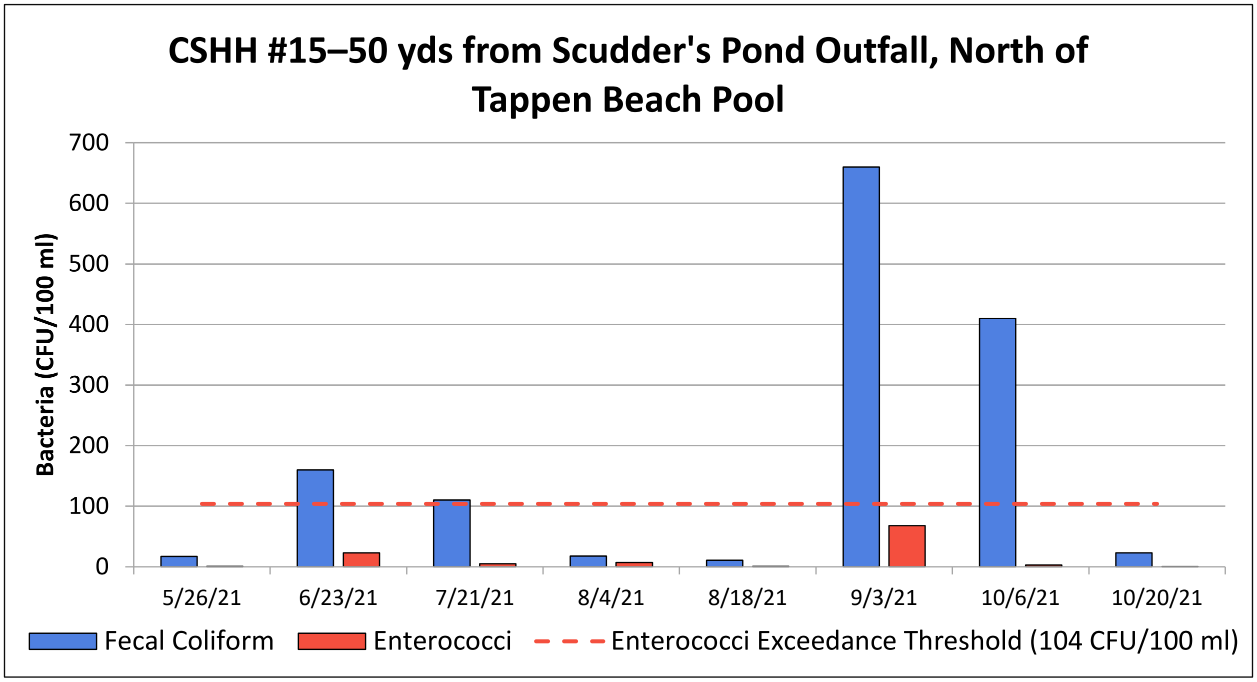


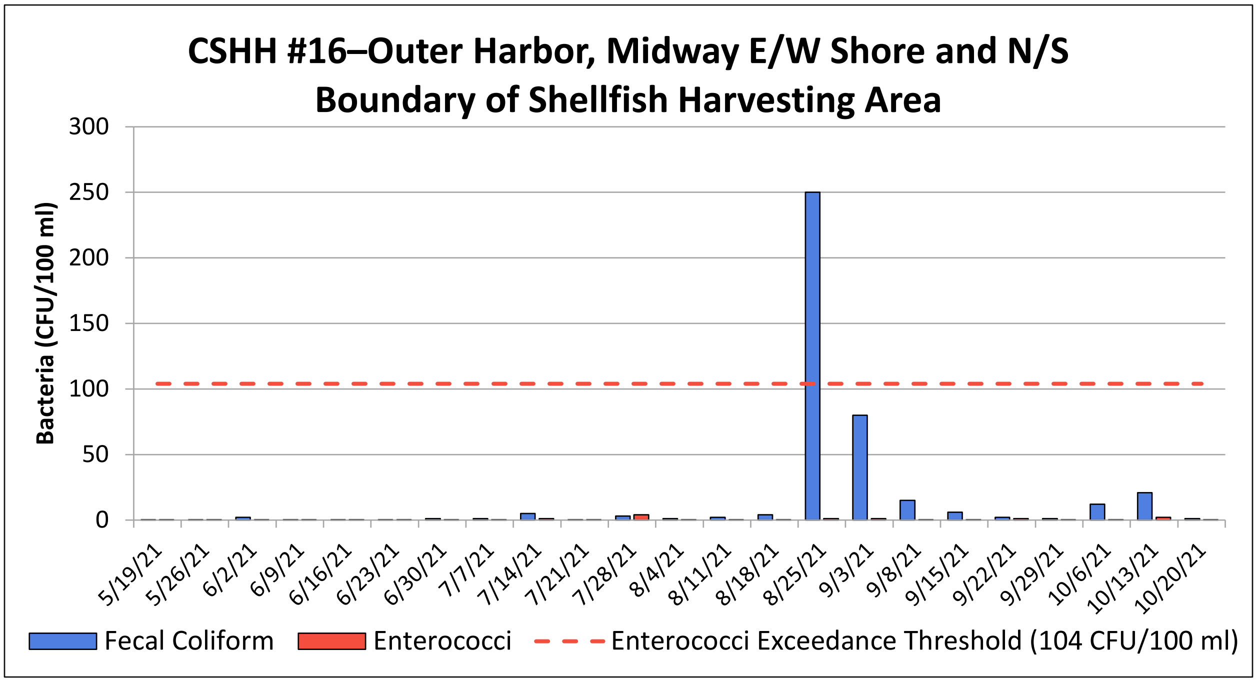
2021 In-Harbor Bacteria Graphs



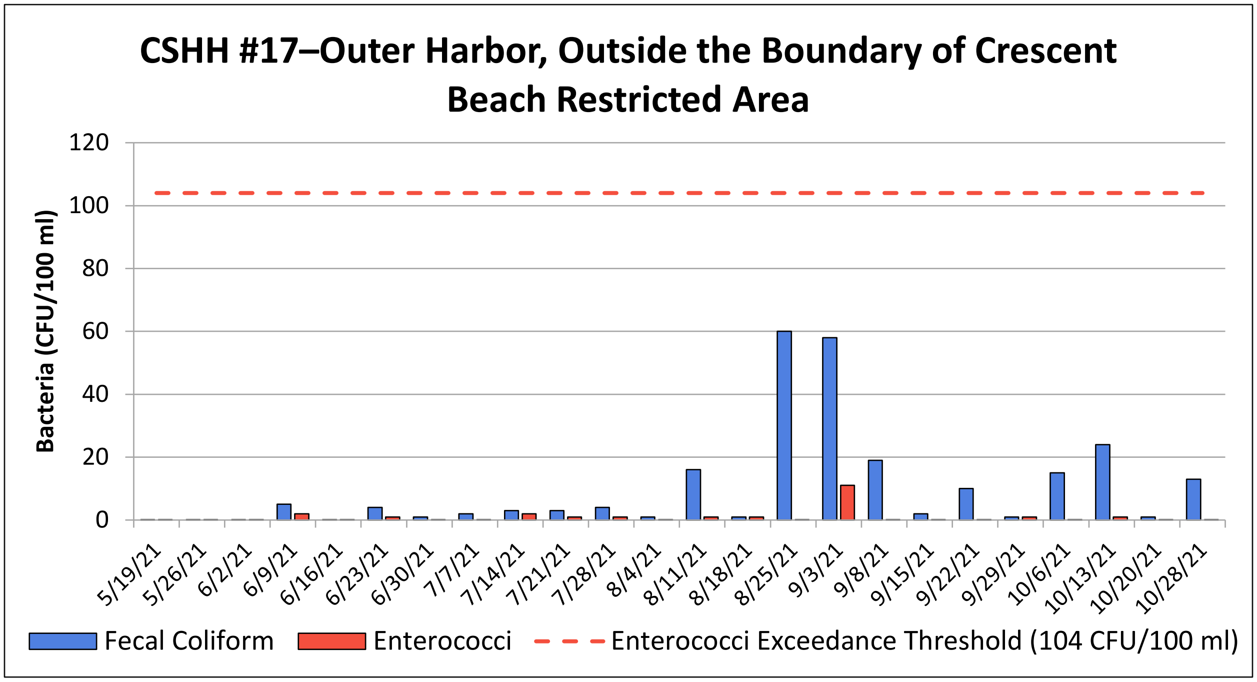


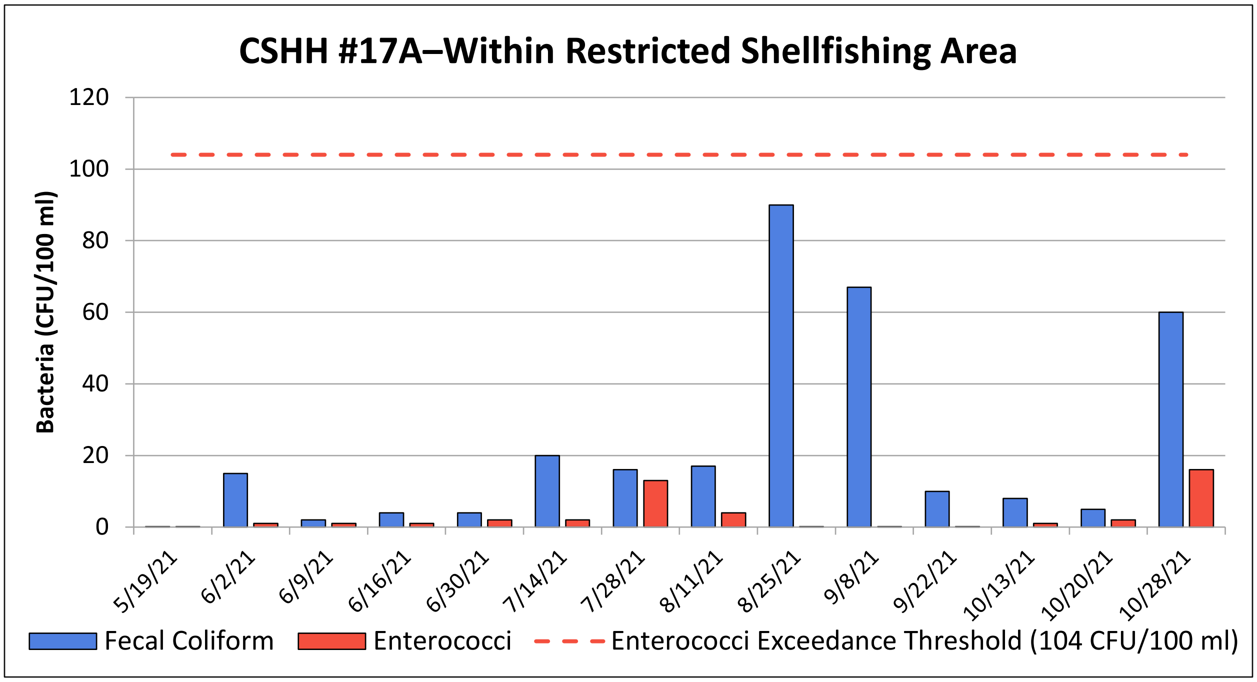
2021 In-Harbor Bacteria Graphs





2021 In-Harbor Bacteria Graphs





2021 Powerhouse Drain and Scudder's Pond Outfalls Regular Season Monitoring Bacteria Data

CSHH #14A–at Powerhouse Drain Outfall

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/19/21	13.00	0.00	25.00	0.00
5/26/21	100.00	36.06	***160.00***	***63.25***
6/2/21	58.00	42.25	58.00	***61.45***
6/9/21	590.00	81.67	***600.00***	***108.62***
6/16/21	130.00	89.63	90.00	***104.61***
6/23/21	470.00	183.68	***330.00***	***175.26***
6/30/21	170.00	***204.25***	***130.00***	***168.13***
7/7/21	420.00	***303.47***	***510.00***	***259.71***
7/14/21	460.00	***288.74***	***250.00***	***217.99***
7/21/21	190.00	***311.50***	***150.00***	***241.44***
7/28/21	760.00	***342.93***	***760.00***	***285.28***
8/4/21	37.00	***252.79***	***100.00***	***270.70***
8/11/21	670.00	***277.54***	***640.00***	***283.27***
8/18/21	22.00	151.10	17.00	***165.47***
8/25/21	840.00	***203.40***	***360.00***	***197.13***
9/3/21	740.00	***202.32***	***290.00***	***162.58***
9/15/21	140.00	***209.18***	27.00	***83.20***
9/22/21	340.00	***414.74***	100.00	***129.57***
9/29/21	230.00	***300.01***	25.00	***66.52***
10/6/21	620.00	***287.03***	***130.00***	***54.43***
10/13/21	60.00	***209.88***	41.00	***51.43***
10/20/21	240.00	***233.77***	60.00	***60.33***
10/28/21	600.00	***261.89***	***110.00***	***61.50***

Note that 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 30-day 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.

2021 Powerhouse Drain and Scudder's Pond Outfalls Regular Season Monitoring Bacteria Data

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

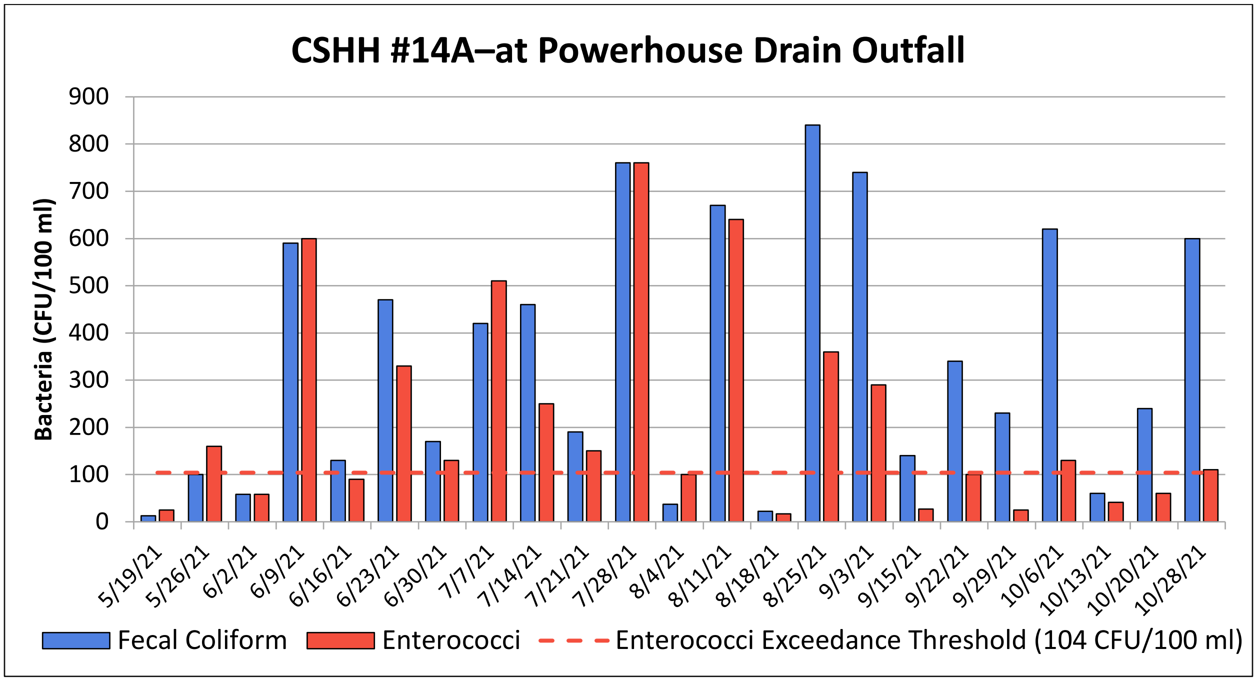
	Fecal Coliform		**Enterococci**	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/19/21	120.00	0.00	40.00	0.00
5/26/21	90.00	103.92	44.00	**41.95**
6/2/21	500.00	175.44	100.00	**56.04**
6/9/21	570.00	***235.54***	**420.00**	**92.72**
6/16/21	70.00	184.79	80.00	**90.03**
6/23/21	590.00	***254.10***	**570.00**	**153.16**
6/30/21	220.00	***303.84***	**210.00**	**209.36**
7/7/21	480.00	***301.37***	**600.00**	**299.58**
7/14/21	190.00	***241.92***	60.00	**203.00**
7/21/21	48.00	***224.34***	34.00	**171.07**
7/28/21	800.00	***238.42***	***390.00***	**158.57**
8/4/21	46.00	174.35	15.00	**93.54**
8/11/21	160.00	139.96	***380.00***	**85.37**
8/18/21	130.00	129.73	70.00	**88.04**
8/25/21	500.00	***207.29***	***290.00***	**135.17**
9/3/21	601.00	195.76	***601.00***	**147.38**
9/8/21	190.00	***259.98***	34.00	**173.59**
9/15/21	49.00	***205.19***	9.00	**82.11**
9/22/21	200.00	***223.65***	10.00	**55.64**
9/29/21	250.00	194.70	70.00	**41.87**
10/6/21	140.00	145.48	44.00	24.82
10/13/21	100.00	127.96	37.00	25.25
10/20/21	100.00	147.58	21.00	29.91
10/28/21	***3300.00***	***258.53***	***300.00***	**59.05**

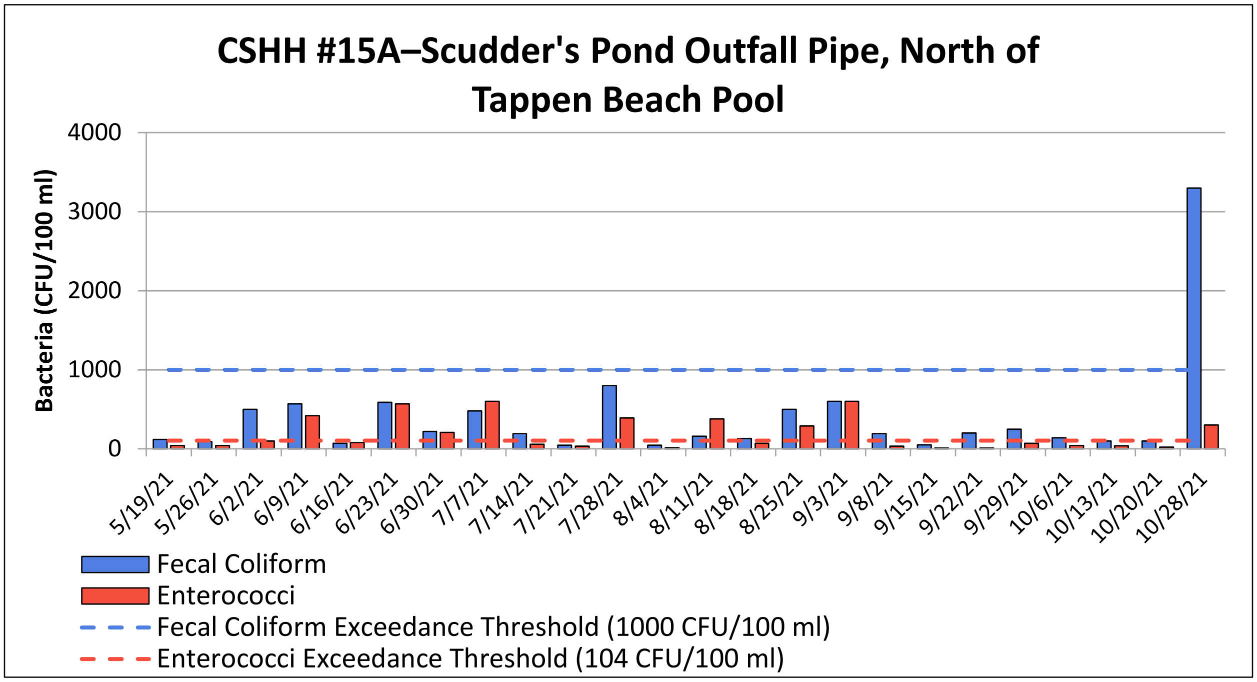
2021 Powerhouse Drain and Scudder's Pond Outfalls Regular Season Monitoring Bacteria Data

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

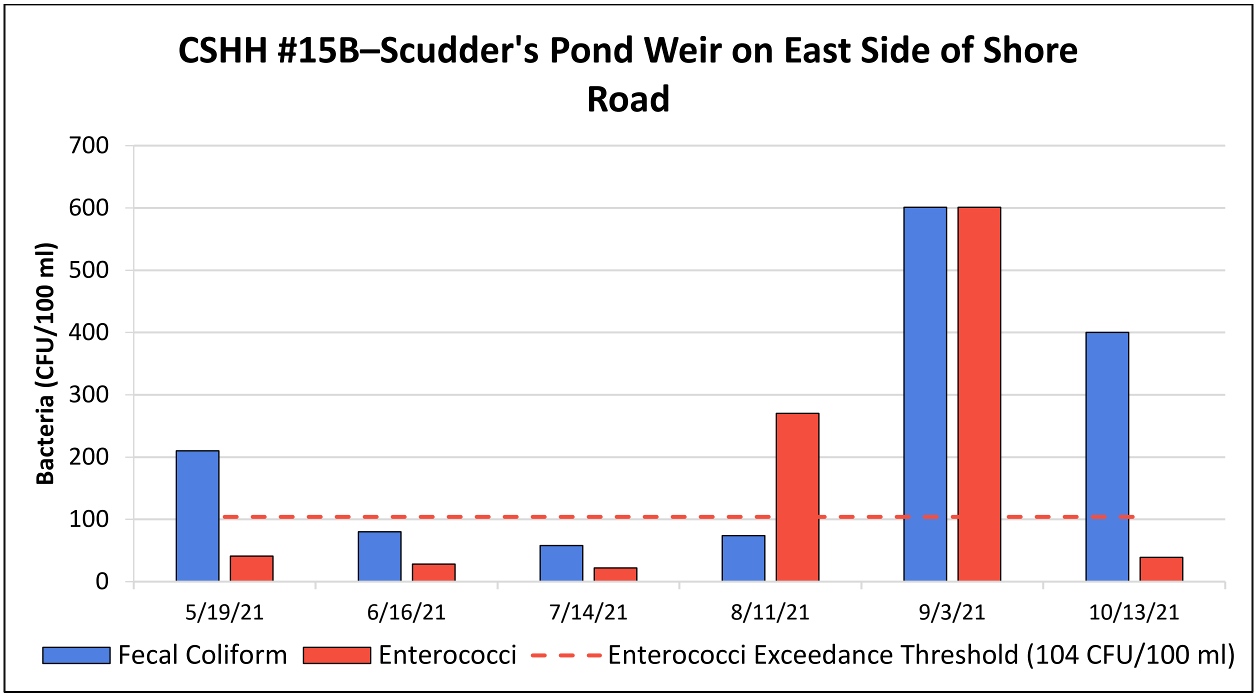
	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/19/21	210.00	0.00	41.00	0.00
6/16/21	80.00	129.61	28.00	33.88
7/14/21	58.00	68.12	22.00	24.82
8/11/21	74.00	65.51	***270.00***	***77.07***
9/3/21	601.00	***210.89***	***601.00***	***402.83***
10/13/21	400.00	0.00	39.00	0.00

2021 Powerhouse Drain and Scudder's Pond Outfalls Regular Season Monitoring Bacteria Graphs





2021 Powerhouse Drain and Scudder's Pond Outfalls Regular Season Monitoring Bacteria Graphs



2021-2022 Powerhouse Drain and Scudder's Pond Outfalls Winter-Monitoring Bacteria Data

CSHH #14A–at Powerhouse Drain Outfall

	Fecal Coliform	Enterococci
Date	**CFU/100 ml**	**CFU/100 ml**
11/10/21	***>6000***	***1300***
11/24/21	***3200***	***1700***
12/8/21	***>6000***	***>1800***
12/14/21	***2900***	***420***
12/22/21	***>6000***	***5900***
12/29/21	***5000***	60
1/5/22	***3500***	***1200***
1/19/22	410	***310***
2/2/22	18	21
2/15/22	182	***490***
3/2/22	340	***1900***
3/16/22	91	70
3/30/22	182	***570***
4/13/22	***1300***	***6000***

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.

2021-2022 Powerhouse Drain and Scudder's Pond Outfalls Winter-Monitoring Bacteria Data

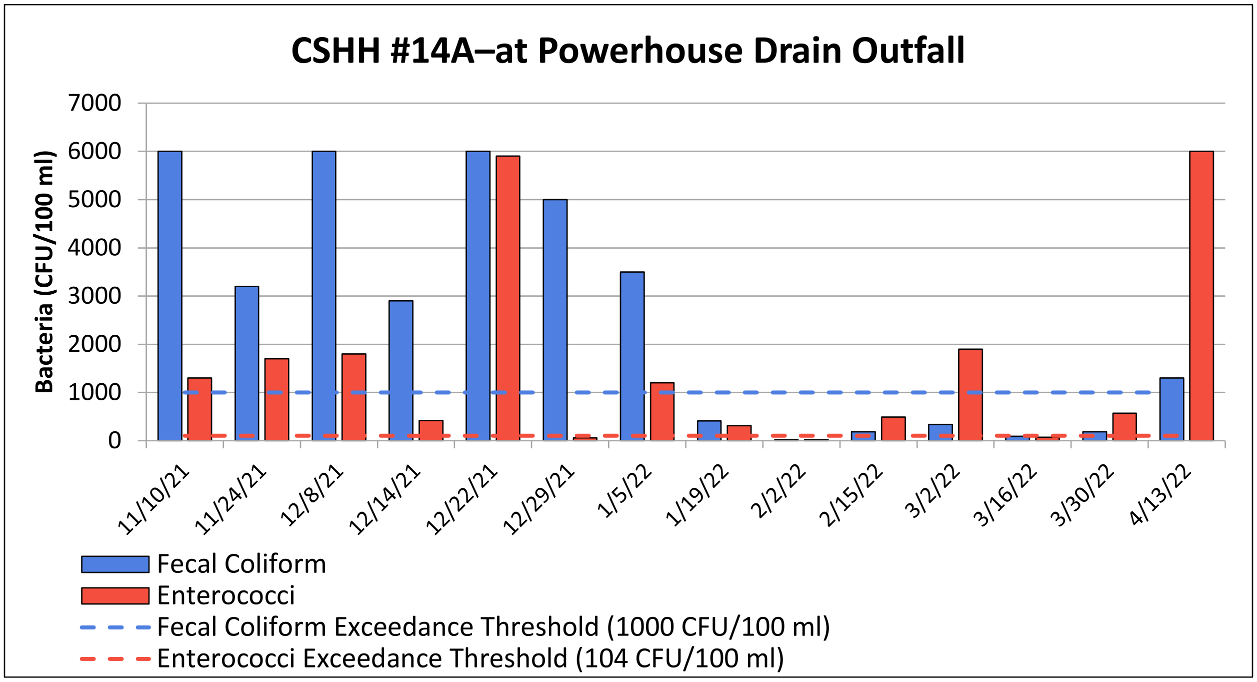
CSHH #15A–Scudder's Pond Outfall Pipe, North of Tappen Beach Pool

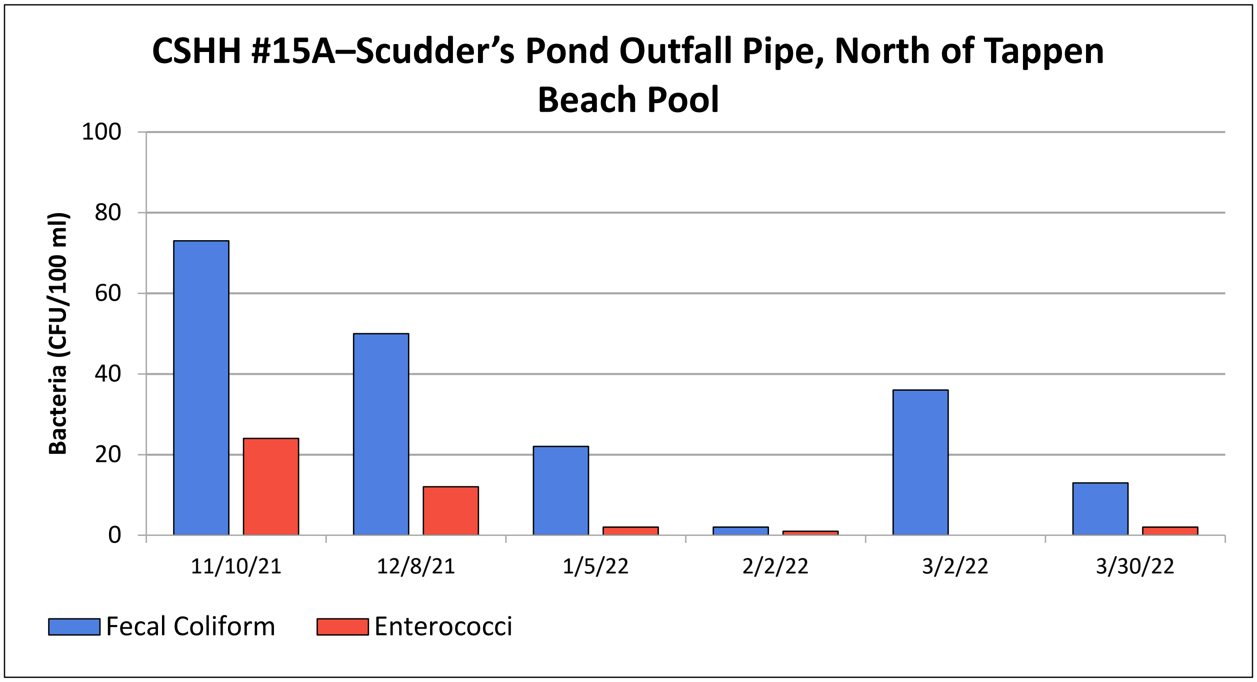
	Fecal Coliform	**Enterococci**
Date	**CFU/100 ml**	**CFU/100 ml**
11/10/21	73	24
12/8/21	50	12
1/5/22	22	2
2/2/22	2	1
3/2/22	36	<1
3/30/22	13	2

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

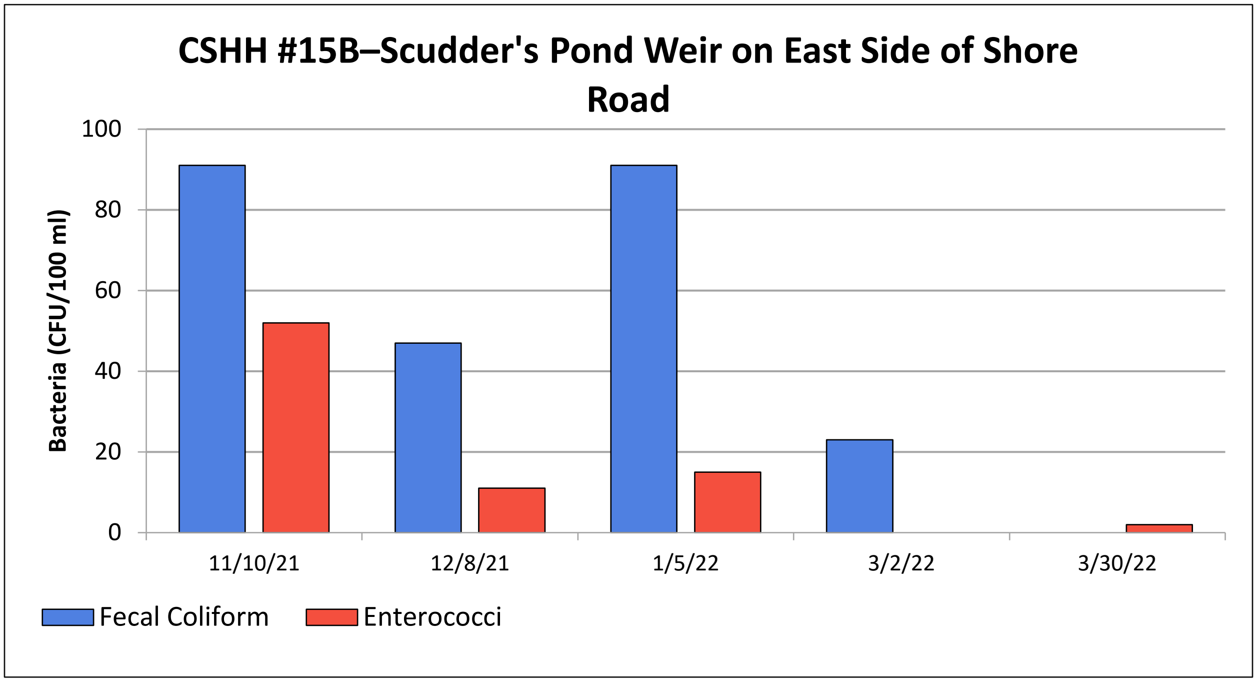
	Fecal Coliform	**Enterococci**
Date	**CFU/100 ml**	**CFU/100 ml**
11/10/21	91	52
12/8/21	47	11
1/5/22	91	15
3/2/22	23	<1
3/30/22	<1	2

2021-2022 Powerhouse Drain and Scudder's Pond Outfalls Winter-Monitoring Bacteria Graphs





2021-2022 Powerhouse Drain and Scudder's Pond Outfalls Winter-Monitoring Bacteria Graphs



2021 Sea Cliff Precipitation Data

JAN	mm	in	MARCH	mm	in	MAY	mm	in	JULY	mm	in	SEPT	mm	in	NOV	mm	in
1	18.29	0.72	1	1.02	0.04	2	4.32	0.17	1†	22.35	0.88	1,2†	166.88	6.57	2	0.25	0.01
3	6.35	0.25	16T**.	0.00	0.00	3	9.65	0.38	2†	30.48	1.20	5	1.52	0.06	11	0.76	0.03
15	9.40	0.37	18	13.21	0.52	5	6.35	0.25	3†	22.35	0.88	9	10.67	0.42	12	9.40	0.37
16	16.76	0.66	19	3.05	0.12	8	2.03	0.08	4	0.51	0.02	13	2.29	0.09	13	4.06	0.16
19T**	0.00	0.00	24	15.24	0.60	9	12.70	0.50	6†	9.91	0.39	21T	0.00	0.00	14	1.27	0.05
20*	1.27	0.05	25	2.03	0.08	10	1.52	0.06	8B†	35.31	1.39	23-24	49.78	1.96	15	0.25	0.01
26*	3.05	0.12	28	28.70	1.13	12T	0.00	0.00	9A†	94.49	3.72	28B	4.57	0.18	19	2.79	0.11
31**	2.54	0.10	29	0.76	0.03	16T	0.00	0.00	10†	0.51	0.02	29	0.25	0.01	21T	0.00	0.00
			31	5.08	0.20	26	1.27	0.05	12	5.33	0.21				22	2.03	0.08
						27	2.54	0.10	13	0.76	0.03				26	4.06	0.16
						28†	25.40	1.00	14	0.25	0.01				28T**	0.00	0.00
						29†	24.38	0.96	18	6.35	0.25				30*	0.51	0.02
						30†	29.72	1.17	19	0.76	0.03						
						31†	4.06	0.16	21B	10.16	0.40						
									25A†	5.08	0.20						
									26A†	59.69	2.35						
									28A	7.87	0.31						
									29C	2.54	0.10						
TOTAL	**57.66**	**2.27**	**TOTAL**	**69.1**	**2.72**	**TOTAL**	**123.95**	**4.88**	**TOTAL**	**314.71**	**12.39**	**TOTAL**	**235.97**	**9.29**	**TOTAL**	**25.40**	**1.00**
FEB	mm	in	APRIL	mm	in	JUNE	mm	in	AUG	mm	in	OCT	mm	in	DEC	mm	in
1**	31.75	1.25	1	8.38	0.33	3	5.84	0.23	8B†	16.26	0.64	4	4.06	0.16	2	1.52	0.06
2**	1.27	0.05	9	0.25	0.01	7T	0.00	0.00	9†	4.57	0.18	5T	0.00	0.00	6	10.92	0.43
3T**	0.00	0.00	10	1.27	0.05	8	5.59	0.22	10T	0.00	0.00	10	4.32	0.17	8	1.78	0.07
5	2.03	0.08	11	11.43	0.45	11	1.27	0.05	11	4.32	0.17	11	0.51	0.02	11	3.81	0.15
7**	13.72	0.54	12	4.57	0.18	14	4.06	0.16	12A	4.57	0.18	13T	0.00	0.00	15	0.76	0.03
9	0.25	0.01	13	1.78	0.07	15	0.51	0.02	19	6.35	0.25	16	5.08	0.20	18	3.56	0.14
11**	3.56	0.14	14	0.25	0.01	18T	0.00	0.00	21C†	25.40	1.00	17	0.25	0.01	22	3.05	0.12
13T	0.00	0.00	15	21.59	0.85	19	1.27	0.05	22A†	96.77	3.81	18T	0.00	0.00	24**	0.76	0.03
16	21.34	0.84	16	4.57	0.18	22	8.13	0.32	23A†	20.83	0.82	23T	0.00	0.00	25	5.08	0.20
18	10.16	0.40	19	0.51	0.02	25T	0.00	0.00	27T	0.00	0.00	25	0.76	0.03	28	2.29	0.09
19	5.08	0.20	21	3.05	0.12	30†	21.59	0.85	28†	2.03	0.08	26	87.38	3.44	29	4.57	0.18
22	15.24	0.60	25	13.21	0.52							27	16.26	0.64	30	1.52	0.06
23	0.51	0.02	27	0.51	0.02							29	11.94	0.47	31	0.25	0.01
27	12.19	0.48	28T	0.00	0.00							30	5.08	0.20			
28	11.43	0.45	29	1.02	0.04							31	2.54	0.10			
TOTAL	**128.52**	**5.06**	**TOTAL**	**72.39**	**2.85**	**TOTAL**	**48.26**	**1.90**	**TOTAL**	**181.10**	**7.13**	**TOTAL**	**138.18**	**5.44**	**TOTAL**	**39.88**	**1.57**

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 16 dates. North Hempstead Beach Park (S) and Sea Cliff Beach were closed on 16 dates: 5/29-5/31, 7/1-7/3, 7/7, 7/9, 7/10, 7/26, 8/9, 8/22-24, 8/28, and 9/2. Morgan Beach was closed for these same dates except on 7/7. Tappen Beach was closed for a total of 8 dates mentioned above that occurred 7/1 through 8/9. 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: Hempstead Harbor beaches were closed a total of 11 days due to high bacteria levels. Morgan Beach was closed 8 days (7/16-7/23), Sea Cliff Beach was closed 7/21, and Sea Cliff Beach and Tappen Beach were closed 8/13.

*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 approx. equal to 1 in liquid precip.).

2022 Partial Sea Cliff Precipitation Data

CSHH 2022 (JANUARY-APRIL) PRECIPITATION DATA FOR SEA CLIFF											
JAN	**mm**	**in**	**FEB**	**mm**	**in**	**MARCH**	**mm**	**in**	**APRIL**	**mm**	**in**
1	7.62	0.30	3-4	30.23	1.19	3	1.78	0.07	1	9.40	0.37
2	14.22	0.56	7	1.52	0.06	6	2.03	0.08	3	3.81	0.15
5	6.60	0.26	13**	8.89	0.35	7	2.03	0.08	6	10.67	0.42
7**	21.59	0.85	18	17.78	0.70	9*	16.76	0.66	7	10.92	0.43
9	4.32	0.17	19T	0.00	0.00	12*	13.97	0.55	8	8.38	0.33
11**	0.25	0.01	22	11.43	0.45	13**	0.51	0.02	9*	1.27	0.05
16-17*	44.20	1.74	25*	20.57	0.81	17	4.32	0.17	12	1.78	0.07
20*	6.86	0.27				19	3.81	0.15			
23-24**	1.02	0.04				23	2.03	0.08			
28-29**	20.32	0.80				24	22.35	0.88			
						25	3.81	0.15			
						26*	6.35	0.25			
						27**	0.00	0.00			
						31	0.51	0.02			
TOTAL	**127.00**	**5.00**	**TOTAL**	**90.42**	**3.56**	**TOTAL**	**80.3**	**3.16**	**TOTAL**	**46.23**	**1.82**

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 4 PM; "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.).

1997-2021 Monthly Rainfall Totals

	June	July	August	September	October	Total
2021	48.26	314.71	181.10	235.97	138.18	918.21
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+

Appendix C

2021 Beach-Monitoring Bacteria Data

Village Club of Sands Point*

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
4/12/21	57.00	0.00
4/15/21	13.00	27.22
4/19/21	0.10	4.20
4/21/21	1.00	2.93
4/26/21	1.00	2.37
5/3/21	2.00	2.30
5/5/21	3.00	2.39
5/10/21	10.00	2.86
5/12/21	3.00	2.87
5/19/21	5.00	1.76
5/24/21	14.00	3.85
5/26/21	3.00	3.73
6/2/21	51.00	6.10
6/7/21	5.00	7.70
6/9/21	28.00	9.05
6/14/21	5.00	9.60
6/16/21	11.00	9.76
6/21/21	62.00	13.37
6/23/21	13.00	13.33
6/28/21	5.00	14.12
6/30/21	2.00	11.37
7/5/21	46.00	11.24
7/7/21	19.00	11.84
7/12/21	***120.00***	15.32
7/14/21	70.00	17.83
7/19/21	***120.00***	26.79
7/21/21	***530.00***	***36.10***
7/26/21	***310.00***	***48.36***
7/28/21	4.00	***37.69***
8/2/21	2.00	***47.18***

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
8/4/21	7.00	***38.98***
8/9/21	***810.00***	***58.07***
8/11/21	2.00	***41.46***
8/16/21	54.00	***35.80***
8/18/21	27.00	34.80
08/23/21	***580.00***	30.64
8/25/21	7.00	26.43
8/30/21	3.00	19.47

* 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 30-day 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.

2021 Beach-Monitoring Bacteria Data

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

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
04/12/21	***124.00***	0.00
04/15/21	4.00	22.27
04/19/21	0.10	3.67
04/21/21	2.00	3.16
04/26/21	10.00	3.97
04/29/21	4.00	3.98
05/03/21	2.00	3.61
05/05/21	4.00	3.65
05/10/21	16.00	4.31
05/12/21	1.00	3.72
05/17/21	5.00	2.58
05/19/21	6.00	2.81
05/24/21	2.00	4.07
05/26/21	2.00	3.79
06/02/21	4.00	3.40
06/07/21	1.00	3.06
06/09/21	11.00	3.53
06/14/21	3.00	3.35
06/16/21	6.00	3.57
06/21/21	4.00	3.26
06/23/21	1.00	2.86
06/28/21	1.00	2.74
06/30/21	8.00	3.09
07/05/21	7.00	3.28
07/07/21	12.00	3.74
07/12/21	21.00	4.65
07/14/21	11.00	5.07
07/16/21	44.00	6.63
07/19/21	12.00	7.11
07/21/21	***180.00***	9.53
07/26/21	***300.00***	18.39
07/28/21	24.00	18.84
08/02/21	5.00	24.11
08/04/21	4.00	20.48
08/09/21	***410.00***	32.45
08/11/21	8.00	28.57
08/16/21	3.00	24.40
08/18/21	19.00	23.79
08/23/21	***160.00***	25.34
08/25/21	11.00	23.31
08/30/21	7.00	15.30

2021 Beach-Monitoring Bacteria Data

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

	Enterococci	
Date	**CFU/100 ml**	**Log Avg**
4/12/21	36.00	0.00
4/15/21	9.00	18.00
4/19/21	3.00	9.91
4/21/21	0.10	3.14
4/26/21	4.00	3.30
4/29/21	2.00	3.03
5/3/21	8.00	3.48
5/5/21	24.00	4.43
5/10/21	49.00	5.79
5/12/21	2.00	5.21
5/17/21	9.00	4.20
5/19/21	1.00	3.64
5/24/21	9.00	6.13
5/26/21	3.00	5.71
6/2/21	1.00	5.50
6/7/21	1.00	3.52
6/9/21	1.00	3.06
6/14/21	6.00	2.49
6/16/21	8.00	2.83
6/21/21	0.10	1.84
6/23/21	11.00	2.24
6/28/21	3.00	1.88
6/30/21	1.00	1.76
7/5/21	44.00	2.67
7/7/21	10.00	3.05
7/12/21	7.00	4.29
7/14/21	***110.00***	5.93
7/16/21	3.00	5.53
7/19/21	13.00	5.81
7/21/21	23.00	6.58
7/26/21	***450.00***	14.50
7/28/21	40.00	15.90
8/2/21	30.00	26.39
8/4/21	14.00	24.92
8/9/21	***210.00***	31.92
8/11/21	9.00	28.45
8/16/21	31.00	37.08
8/18/21	9.00	32.18
8/23/21	90.00	***41.42***
8/25/21	21.00	***38.70***
8/30/21	4.00	22.81

2021 Beach-Monitoring Bacteria Data

Tappen Beach

	Enterococci	
Date	**CFU/100 ml**	**Log Avg**
04/12/21	68.00	0.00
04/15/21	29.00	***44.41***
04/19/21	1.00	12.54
04/21/21	1.00	6.66
04/26/21	5.00	6.29
04/29/21	12.00	7.01
05/03/21	3.00	6.21
05/05/21	2.00	5.39
05/10/21	47.00	6.85
05/12/21	13.00	7.31
05/17/21	0.10	3.04
05/19/21	1.00	2.72
05/24/21	6.00	3.71
05/26/21	1.00	3.25
06/02/21	6.00	2.87
06/07/21	6.00	3.27
06/09/21	6.00	3.50
06/14/21	23.00	2.72
06/16/21	25.00	3.48
06/21/21	***230.00***	10.70
06/23/21	***110.00***	13.86
06/25/21	42.00	17.20
06/28/21	12.00	22.67
06/30/21	0.10	13.18
07/05/21	***150.00***	18.19
07/07/21	8.00	16.88
07/12/21	9.00	19.49
07/14/21	4.00	16.88
07/19/21	80.00	18.38
07/21/21	***160.00***	22.38

	Enterococci	
Date	**CFU/100 ml**	**Log Avg**
07/21/21	***160.00***	22.38
07/23/21	47.00	19.37
07/26/21	***190.00***	18.94
07/28/21	5.00	16.78
08/02/21	2.00	23.41
08/04/21	6.00	20.68
08/09/21	***260.00***	24.03
08/11/21	***930.00***	33.50
08/13/21	9.00	33.50
08/16/21	4.00	33.50
08/18/21	47.00	34.46
08/23/21	***370.00***	33.40
08/25/21	2.00	25.86
08/30/21	4.00	20.71

2021 Beach-Monitoring Bacteria Data

Sea Cliff Beach

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
04/12/21	6.00	0.00
04/15/21	3.00	4.24
04/19/21	0.10	1.22
04/21/21	0.10	0.65
04/26/21	0.10	0.45
04/29/21	2.00	0.57
05/03/21	0.10	0.45
05/05/21	26.00	0.74
05/10/21	19.00	1.07
05/12/21	0.10	0.84
05/17/21	0.10	0.46
05/19/21	7.00	0.61
05/24/21	3.00	1.08
05/26/21	2.00	1.15
06/02/21	5.00	1.67
06/07/21	13.00	2.18
06/09/21	1.00	2.00
06/14/21	28.00	3.06
06/16/21	5.00	3.23
06/21/21	8.00	5.07
06/23/21	17.00	5.80
06/28/21	0.10	4.33
06/30/21	7.00	4.57
07/05/21	25.00	5.46
07/07/21	8.00	5.68
07/12/21	90.00	8.53
07/14/21	***130.00***	11.20
07/16/21	4.00	9.22
07/19/21	***601.00***	14.89
07/21/21	19.00	15.22

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
07/26/21	***150.00***	20.18
07/28/21	31.00	20.99
08/02/21	21.00	***39.98***
08/04/21	11.00	***35.56***
08/09/21	***150.00***	***49.37***
08/11/21	***601.00***	***61.97***
08/13/21	2.00	***43.84***
08/16/21	42.00	***49.75***
08/18/21	33.00	***47.93***
08/23/21	***210.00***	***47.33***
08/25/21	4.00	***37.81***
08/30/21	1.00	23.36
09/08/21	22.00	25.54
09/15/21	1.00	11.44
09/22/21	0.10	3.50

2021 Beach-Monitoring Bacteria Data

Morgan Memorial Beach

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
4/13/21	0.10	0.00
4/20/21	0.10	0.10
4/27/21	1.00	0.22
5/3/21	0.10	0.18
5/4/21	1.00	0.25
5/5/21	0.10	0.22
5/10/21	10.00	0.37
5/11/21	4.00	0.50
5/12/21	6.00	0.66
5/17/21	3.00	0.96
5/18/21	***134.00***	1.58
5/19/21	4.00	1.72
5/24/21	3.00	2.34
5/25/21	13.00	2.70
5/26/21	1.00	2.50
6/1/21	7.00	2.91
6/2/21	1.00	2.69
6/7/21	8.00	5.54
6/8/21	3.00	5.29
6/9/21	35.00	6.05
6/14/21	15.00	6.48
6/15/21	3.00	6.11
6/16/21	9.00	6.28
6/21/21	30.00	6.12
6/22/21	***190.00***	7.98
6/23/21	47.00	9.05
6/28/21	90.00	14.01
6/29/21	12.00	13.85
6/30/21	59.00	15.36
7/6/21	20.00	20.54
7/7/21	18.00	20.35
7/12/21	***110.00***	28.39
7/13/21	38.00	29.03
7/14/21	***130.00***	32.31
7/16/21	47.00	***42.36***
7/19/21	***180.00***	***53.33***
7/20/21	40.00	***52.25***
7/21/21	41.00	***51.41***
7/22/21	8.00	***47.07***
7/23/21	52.00	***43.18***
7/26/21	***370.00***	***49.55***
7/27/21	22.00	***47.10***
7/28/21	6.00	***41.72***
8/2/21	14.00	***39.13***
8/3/21	7.00	***35.14***
8/4/21	9.00	32.43
8/9/21	58.00	***35.97***
8/10/21	4.00	31.61
8/11/21	1.00	26.09
8/16/21	2.00	16.83
8/17/21	0.10	12.21
8/18/21	0.10	9.21
8/23/21	***640.00***	7.15
8/24/21	4.00	6.86
8/25/21	28.00	7.53
8/30/21	20.00	5.64
8/31/21	7.00	5.73
9/1/21	1.00	5.10

2021 Beach-Monitoring Bacteria Data

Crescent Beach

Enterococci			
Date	**CFU/100 ml**	**Log Avg**	**Location**
4/13/21	7.00	0.00	CENTER
4/13/21	11.00	8.77	LEFT
4/13/21	66.00	17.19	RIGHT
4/20/21	0.10	4.75	CENTER
4/20/21	4.00	4.59	LEFT
4/20/21	0.10	2.42	RIGHT
4/27/21	3.00	2.50	CENTER
4/27/21	4.00	2.65	LEFT
4/27/21	1.00	2.38	RIGHT
5/3/21	10.00	2.75	CENTER
5/3/21	6.00	2.95	LEFT
5/3/21	9.00	3.24	RIGHT
5/4/21	***150.00***	4.35	CENTER
5/4/21	***130.00***	5.54	LEFT
5/4/21	***280.00***	7.20	RIGHT
5/5/21	15.00	7.53	CENTER
5/5/21	23.00	8.05	LEFT
5/5/21	13.00	8.26	RIGHT
5/10/21	90.00	9.37	CENTER
5/10/21	70.00	10.36	LEFT
5/10/21	70.00	11.35	RIGHT
5/11/21	0.10	9.15	CENTER
5/11/21	55.00	9.89	LEFT
5/11/21	8.00	9.81	RIGHT
5/12/21	1.00	8.95	CENTER
5/12/21	5.00	8.75	LEFT
5/12/21	1.00	8.08	RIGHT
5/17/21	14.00	7.54	CENTER
5/17/21	18.00	7.80	LEFT
5/17/21	24.00	8.13	RIGHT
5/18/21	1.00	7.54	CENTER
5/18/21	***140.00***	8.34	LEFT
5/18/21	2.00	7.95	RIGHT
5/19/21	1.00	7.44	CENTER
5/19/21	0.10	6.50	LEFT
5/19/21	0.10	5.73	RIGHT

Enterococci			
Date	**CFU/100 ml**	**Log Avg**	**Location**
5/24/21	54.00	8.09	CENTER
5/24/21	48.00	8.55	LEFT
5/24/21	63.00	9.09	RIGHT
5/25/21	***520.00***	10.24	CENTER
5/25/21	***210.00***	11.16	LEFT
5/25/21	***1400.00***	12.76	RIGHT
5/26/21	21.00	12.94	CENTER
5/26/21	2.00	12.32	LEFT
5/26/21	13.00	12.33	RIGHT
6/1/21	10.00	14.06	CENTER
6/1/21	***290.00***	15.22	LEFT
6/1/21	26.00	15.43	RIGHT
6/2/21	100.00	16.17	CENTER
6/2/21	47.00	16.60	LEFT
6/2/21	23.00	16.73	RIGHT
6/7/21	19.00	14.55	CENTER
6/7/21	15.00	14.57	LEFT
6/7/21	11.00	14.45	RIGHT
6/8/21	104.00	15.24	CENTER
6/8/21	9.00	15.03	LEFT
6/8/21	28.00	15.28	RIGHT
6/9/21	***280.00***	16.43	CENTER
6/9/21	***700.00***	18.00	LEFT
6/9/21	***250.00***	19.17	RIGHT
6/14/21	84.00	25.47	CENTER
6/14/21	***160.00***	26.84	LEFT
6/14/21	51.00	27.32	RIGHT
6/15/21	6.00	26.23	CENTER
6/15/21	5.00	25.11	LEFT
6/15/21	6.00	24.20	RIGHT
6/16/21	1.00	22.35	CENTER
6/16/21	2.00	21.07	LEFT
6/16/21	1.00	19.60	RIGHT
6/21/21	6.00	31.24	CENTER
6/21/21	13.00	30.47	LEFT
6/21/21	9.00	29.45	RIGHT

2021 Beach-Monitoring Bacteria Data

Crescent Beach (cont.)

Enterococci			
Date	CFU/100 ml	Log Avg	Location
6/22/21	***190.00***	30.98	CENTER
6/22/21	39.00	31.16	LEFT
6/22/21	***110.00***	32.19	RIGHT
6/23/21	***230.00***	33.81	CENTER
6/23/21	***320.00***	***35.72***	LEFT
6/23/21	***370.00***	***37.76***	RIGHT
6/28/21	3.00	30.73	CENTER
6/28/21	25.00	30.55	LEFT
6/28/21	11.00	29.70	RIGHT
6/29/21	11.00	28.91	CENTER
6/29/21	10.00	28.11	LEFT
6/29/21	8.00	27.22	RIGHT
6/30/21	1.00	25.06	CENTER
6/30/21	8.00	24.38	LEFT
6/30/21	0.10	21.39	RIGHT
7/6/21	1.00	17.46	CENTER
7/6/21	8.00	17.10	LEFT
7/6/21	7.00	16.72	RIGHT
7/7/21	5.00	16.22	CENTER
7/7/21	21.00	16.32	LEFT
7/7/21	42.00	16.69	RIGHT
7/12/21	8.00	11.96	CENTER
7/12/21	8.00	11.82	LEFT
7/12/21	3.00	11.38	RIGHT
7/13/21	16.00	11.49	CENTER
7/13/21	41.00	11.88	LEFT
7/13/21	35.00	12.21	RIGHT
7/14/21	6.00	12.00	CENTER
7/14/21	7.00	11.84	LEFT
7/14/21	5.00	11.60	RIGHT
7/19/21	42.00	13.06	CENTER
7/19/21	51.00	13.58	LEFT
7/19/21	***110.00***	14.39	RIGHT
7/20/21	7.00	14.11	CENTER
7/20/21	7.00	13.85	LEFT
7/20/21	6.00	13.56	RIGHT

Enterococci			
Date	CFU/100 ml	Log Avg	Location
7/21/21	33.00	13.86	CENTER
7/21/21	32.00	14.15	LEFT
7/21/21	26.00	14.36	RIGHT
7/26/21	***2800.00***	11.33	CENTER
7/26/21	***3200.00***	13.32	LEFT
7/26/21	***2600.00***	15.42	RIGHT
7/27/21	16.00	15.43	CENTER
7/27/21	16.00	15.45	LEFT
7/27/21	23.00	15.61	RIGHT
7/28/21	13.00	15.54	CENTER
7/28/21	22.00	15.67	LEFT
7/28/21	4.00	15.17	RIGHT
8/2/21	***5700.00***	25.10	CENTER
8/2/21	7.00	24.20	LEFT
8/2/21	13.00	23.79	RIGHT
8/3/21	0.10	20.52	CENTER
8/3/21	1.00	18.95	LEFT
8/3/21	1.00	17.57	RIGHT
8/4/21	9.00	17.28	CENTER
8/4/21	7.00	16.90	LEFT
8/4/21	12.00	16.77	RIGHT
8/9/21	***370.00***	20.59	CENTER
8/9/21	***420.00***	22.29	LEFT
8/9/21	***410.00***	24.02	RIGHT
8/10/21	19.00	23.88	CENTER
8/10/21	11.00	23.43	LEFT
8/10/21	6.00	22.68	RIGHT
8/11/21	15.00	22.46	CENTER
8/11/21	17.00	22.32	LEFT
8/11/21	20.00	22.27	RIGHT
8/16/21	4.00	25.88	CENTER
8/16/21	4.00	24.64	LEFT
8/16/21	0.10	21.40	RIGHT
8/17/21	49.00	21.84	CENTER
8/17/21	27.00	21.96	LEFT
8/17/21	22.00	21.96	RIGHT

2021 Beach-Monitoring Bacteria Data

Crescent Beach (cont.)

Enterococci			
Date	**CFU/100 ml**	**Log Avg**	**Location**
8/18/21	14.00	21.73	CENTER
8/18/21	10.00	21.35	LEFT
8/18/21	37.00	21.61	RIGHT
8/20/21	10.00	21.40	CENTER
8/20/21	6.00	20.75	LEFT
8/20/21	19.00	20.71	RIGHT
8/23/21	***160.00***	21.19	CENTER
8/23/21	***100.00***	22.00	LEFT
8/23/21	***210.00***	23.22	RIGHT
8/24/21	37.00	23.47	CENTER
8/24/21	11.00	23.07	LEFT
8/24/21	37.00	23.31	RIGHT
8/25/21	24.00	23.33	CENTER
8/25/21	40.00	23.60	LEFT
8/25/21	90.00	24.27	RIGHT
8/30/21	6.00	17.85	CENTER
8/30/21	2.00	16.92	LEFT
8/30/21	4.00	16.35	RIGHT
8/31/21	1.00	15.32	CENTER
8/31/21	2.00	14.63	LEFT
8/31/21	80.00	15.19	RIGHT
9/1/21	***140.00***	15.94	CENTER
9/1/21	55.00	16.37	LEFT
9/1/21	***170.00***	17.18	RIGHT
9/8/21	0.10	18.51	CENTER
9/8/21	0.10	16.29	LEFT
9/8/21	0.10	14.43	RIGHT
9/15/21	0.10	9.40	CENTER
9/15/21	***110.00***	10.08	LEFT
9/15/21	0.10	8.87	RIGHT

Comparison of Averaged Indicator Bacteria Data for Beaches

The tables in this section display the average values for indicator bacteria for Hempstead Harbor Beaches from 2001-2021. The current year is displayed below, and the previous years follow.

2021

	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	14.42	24.02	9.02	19.33	1.88	0.40	10.69
May	Enterococci	5.71	4.75	13.13	9.14	7.16	14.93	96.31
June	Enterococci	20.22	4.33	3.57	46.01	9.34	36.36	85.53
July	Enterococci	152.38	67.89	77.78	72.56	117.56	77.29	279.42
August	Enterococci	165.78	69.67	46.44	163.40	107.50	56.73	178.76
September	Enterococci	—	—	—	—	7.70	1.00**	52.83
Season Averages*	*Enterococci*	79.08	35.59	31.93	68.28	51.31	44.25	143.08

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

**Only one data point collected.

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

2021 Nitrogen Data

TKN (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #8A**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/28/21	2.1	2.0	—	—	3.5	3.5	2.8	3.1	2.5	3.4	—
10/13/21	<0.50	<0.50	—	—	--	1.8	1.6	1.6	0.85	<0.50	<0.50
9/29/21	2.5	1.5	—	—	3.2	—	2.2	3.4	2.4	4.6	2.9
9/15/21	<0.50	<0.50	—	—	1.6	—	4.0	0.89	<0.50	<0.50	2.0
9/3/21	<0.50	<0.50	<0.50	<0.50	<0.50	—	2.8	<0.50	<0.50	<0.50	<0.50
8/18/21	<0.50	<0.50	<0.50	2.2	2.0	—	<0.50	1.4	<0.50	<0.50	<0.50
8/4/21	0.59	1.2	1.5	2.6	0.85	—	<0.50	1.3	1.0	2.1	<0.50
7/21/21	1.3	<0.50	<0.50	<0.50	<0.50	—	<0.50	<0.50	0.88	1.4	<0.50
7/7/21	2.0	2.8	1.7	1.7	3.7	—	—	—	4.7	3.3	1.3
6/23/21	3.1	2.0	4.1	3.1	3.9	—	—	—	3.2	5.8	<0.50
6/9/21	<0.50	0.69	—	—	5.2	—	1.1	<0.50	<0.50	1.6	<0.50
5/26/21	1.7	0.92	—	—	3.7	—	—	2.2	2.2	1.3	<0.50

Notes:

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

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

2021 Nitrogen Data

Total Organic N (mg/L)

Date	CSHH #1	CSHH #3	CSHH #6	CSHH #7	CSHH #8	CSHH #8A	CSHH #12	CSHH #13	CSHH #14A	CSHH #15A	CSHH #16
10/28/21	1.8	1.8	—	—	3.1	3.3	2.4	2.6	2.2	3.2	—
10/13/21	<0.10	<0.10	—	—	—	1.2	1.2	1.1	0.55	<0.10	<0.10
9/29/21	2.4	1.4	—	—	2.8	—	1.8	2.9	2.2	4.5	2.8
9/15/21	<0.10	<0.10	—	—	0.89	—	3.4	<0.10	<0.10	<0.10	2.0
9/3/21	<0.10	<0.10	<0.10	<0.10	<0.10	—	2.3	<0.10	<0.10	<0.10	<0.10
8/18/21	<0.10	<0.10	<0.10	1.9	1.1	—	<0.10	1.0	<0.10	<0.10	<0.10
8/4/21	0.44	1.1	1.1	2.3	0.29	—	<0.10	0.70	0.85	2.0	0.11
7/21/21	1.2	<0.10	<0.10	<0.10	<0.10	—	<0.10	<0.10	<0.10	1.3	0.23
7/7/21	1.9	2.8	1.6	1.5	2.2	—	—	—	3.7	3.2	1.3
6/23/21	3.0	2.0	4.0	3.0	1.7	—	—	—	2.3	5.6	<0.10
6/9/21	<0.10	0.64	—	—	1.3	—	0.70	<0.10	<0.10	1.5	0.39
5/26/21	1.6	0.87	—	—	0.94	—	—	2.0	1.3	1.2	<0.10

Notes:

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

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

2021 Nitrogen Data

Ammonia as N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #8A**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/28/21	0.34	0.19	—	—	0.34	0.25	0.37	0.46	0.36	0.22	—
10/13/21	0.25	<0.10	—	—	—	0.61	0.38	0.40	0.30	0.17	<0.10
9/29/21	0.12	0.13	—	—	0.37	—	0.38	0.46	0.18	0.15	<0.10
9/15/21	<0.10	0.13	—	—	0.68	—	0.62	1.0	0.23	0.16	<0.10
9/3/21	0.20	0.10	0.27	0.54	0.30	—	0.46	0.43	0.86	0.21	<0.10
8/18/21	0.13	0.11	0.22	0.28	0.92	—	0.41	0.37	0.19	0.11	<0.10
8/4/21	0.15	0.10	0.36	0.32	0.56	—	0.21	0.55	0.18	0.11	0.13
7/21/21	0.12	0.37	0.23	0.30	0.64	—	0.37	0.40	0.97	<0.10	<0.10
7/7/21	<0.10	<0.10	0.18	0.18	1.4	—	—	—	1.0	0.12	<0.10
6/23/21	<0.10	<0.10	<0.10	0.14	2.2	—	—	—	0.94	0.20	<0.10
6/9/21	0.24	<0.10	—	—	3.9	—	0.45	0.33	0.87	0.12	<0.10
5/26/21	0.10	<0.10	—	—	2.8	—	—	0.19	0.94	0.11	<0.10

Notes:

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

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

2021 Nitrogen Data

Nitrite as N (mg/L)

Date	CSHH #1	CSHH #3	CSHH #6	CSHH #7	CSHH #8	CSHH #8A	CSHH #12	CSHH #13	CSHH #14A	CSHH #15A	CSHH #16
10/28/21	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	—
10/13/21	<0.050	<0.050	—	—	—	0.057	<0.050	<0.050	<0.050	<0.050	<0.050
9/29/21	<0.050	<0.050	—	—	<0.050	—	<0.050	<0.050	<0.050	<0.050	<0.050
9/15/21	<0.050	<0.050	—	—	0.088	—	<0.050	<0.050	<0.050	<0.050	<0.050
9/3/21	<0.050	<0.050	<0.050	<0.050	<0.050	—	<0.050	<0.050	<0.050	<0.050	<0.050
8/18/21	<0.050	<0.050	<0.050	<0.050	0.16	—	<0.050	<0.050	<0.050	<0.050	<0.050
8/4/21	<0.050	<0.050	<0.050	<0.050	0.13	—	<0.050	<0.050	<0.050	0.058	<0.050
7/21/21	<0.050	<0.050	<0.050	<0.050	0.091	—	<0.050	<0.050	0.11	<0.050	<0.050
7/7/21	<0.050	<0.050	<0.050	<0.050	0.073	—	—	—	0.073	0.052	<0.050
6/23/21	<0.050	<0.050	<0.050	<0.050	0.064	—	—	—	0.11	<0.050	<0.050
6/9/21	<0.050	<0.050	—	—	0.21	—	<0.050	<0.050	0.12	0.077	<0.050
5/26/21	<0.050	<0.050	—	—	0.40	—	—	<0.050	0.36	0.14	<0.050

Notes:

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

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

2021 Nitrogen Data

Nitrate as N (mg/L)

Date	CSHH #1	CSHH #3	CSHH #6	CSHH #7	CSHH #8	CSHH #8A	CSHH #12	CSHH #13	CSHH #14A	CSHH #15A	CSHH #16
10/28/21	0.21	0.17	—	—	0.44	1.1	0.42	0.36	0.70	1.4	—
10/13/21	0.20	0.19	—	—	—	1.6	0.63	0.43	0.95	1.5	0.13
9/29/21	<0.050	0.064	—	—	0.97	—	0.19	0.15	0.43	4.7	<0.050
9/15/21	0.12	0.16	—	—	1.2	—	0.84	1.2	0.48	0.63	0.092
9/3/21	0.12	0.063	0.21	0.70	0.91	—	0.46	0.44	2.2	0.88	0.058
8/18/21	<0.050	<0.050	<0.050	<0.050	2.7	—	0.14	0.14	0.12	0.21	<0.050
8/4/21	<0.050	<0.050	0.092	0.17	1.1	—	0.33	0.56	0.68	3.7	<0.050
7/21/21	<0.050	<0.050	<0.050	0.11	0.69	—	0.40	0.34	4.6	1.9	<0.050
7/7/21	<0.050	<0.050	<0.050	0.086	1.1	—	—	—	7.9	2.5	<0.050
6/23/21	<0.050	<0.050	<0.050	<0.050	0.88	—	—	—	9.2	3.1	<0.050
6/9/21	0.11	<0.050	—	—	0.48	—	0.78	1.2	8.3	3.9	<0.050
5/26/21	0.055	<0.050	—	—	0.41	—	—	1.4	8.5	3.8	<0.050

Notes:

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

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

2021 Nitrogen Data

Total Inorganic Nitrogen Calculation (mg/L)

Date	CSHH #1	CSHH #3	CSHH #6	CSHH #7	CSHH #8	CSHH #8A	CSHH #12	CSHH #13	CSHH #14A	CSHH #15A	CSHH #16
10/28/21	0.58	0.39	—	—	0.81	1.35	0.81	0.84	1.08	1.62	—
10/13/21	0.47	0.22	—	—	—	2.31	1.05	0.9	1.28	1.67	0.15
9/29/21	0.182	0.216	—	—	1.37	—	0.59	0.63	0.63	4.95	0.1
9/15/21	0.15	0.31	—	—	1.98	—	1.51	2.2	0.74	0.82	0.12
9/3/21	0.33	0.178	0.49	1.27	1.23	—	0.94	0.9	3.06	1.12	0.078
8/18/21	0.13	0.11	0.22	0.28	3.72	—	0.58	0.53	0.33	0.34	0
8/4/21	0.15	0.1	0.452	0.49	1.86	—	0.57	1.15	0.88	3.81	0.13
7/21/21	0.12	0.37	0.288	0.42	1.42	—	0.81	0.78	5.67	2	0
7/7/21	0	0	0.18	0.266	2.6	—	—	—	9	2.72	0
6/23/21	0	0	0	0.14	3.14	—	—	—	10.24	3.3	0
6/9/21	0.38	0	—	—	4.58	—	1.3	1.53	9.27	4.12	0
5/26/21	0.155	0	—	—	3.61	—	—	1.59	9.84	4.01	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.

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

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

2021 Nitrogen Data

Total N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #8A**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/28/21	2.4	2.2	—	—	3.9	4.6	3.2	3.5	3.2	4.8	—
10/13/21	0.22	0.22	—	—	—	3.5	2.3	2.0	1.8	1.5	0.15
9/29/21	2.5	1.6	—	—	4.2	—	2.4	3.5	2.8	9.4	3.0
9/15/21	0.15	0.18	—	—	2.8	—	4.9	2.1	0.51	0.66	2.2
9/3/21	0.30	<0.10	0.39	0.89	0.93	—	3.3	0.63	2.7	1.1	0.24
8/18/21	<0.10	<0.10	<0.10	2.2	4.8	—	0.17	1.6	0.14	0.23	<0.10
8/4/21	0.62	1.2	1.6	2.8	2.1	—	0.36	1.9	1.7	5.9	0.24
7/21/21	1.4	<0.10	0.37	0.12	0.78	—	0.44	0.38	5.6	3.3	0.31
7/7/21	2.0	2.9	1.8	1.8	4.8	—	—	—	12.7	5.8	1.3
6/23/21	3.1	2.0	4.1	3.1	4.8	—	—	—	12.5	9.0	<0.10
6/9/21	0.14	0.72	—	—	5.9	—	2.0	1.2	8.6	5.5	0.46
5/26/21	1.8	0.92	—	—	4.5	—	—	3.6	11.1	5.2	<0.10

Notes:

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

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

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 .

2021-2022 Winter Nitrogen Data

TKN (mg/L)

Date	CSHH #14A	CSHH #15A
4/13/22	<2.5	N/A
3/30/22	<0.50	<0.50
3/16/22	0.90	N/A
3/2/22	<0.50	<0.50
2/15/22	0.68	N/A
2/2/22	0.82	<0.50
1/19/22	<0.50	N/A
1/5/22	<0.50	<0.50
12/22/22	1.9	N/A
12/8/21	<0.50	<0.50
11/24/21	5.0	N/A
11/10/21	2.0	1.0

Total Organic N (mg/L)

Date	CSHH #14A	CSHH #15A
4/13/22	<0.10	N/A
3/30/22	<0.10	<0.10
3/16/22	<0.10	N/A
3/2/22	<0.10	<0.10
2/15/22	<0.10	N/A
2/2/22	0.79	<0.10
1/19/22	<0.10	N/A
1/5/22	<0.10	<0.10
12/22/22	1.4	N/A
12/8/21	<0.10	<0.10
11/24/21	3.6	N/A
11/10/21	0.53	0.83

Ammonia as N (mg/L)

Date	CSHH #14A	CSHH #15A
4/13/22	1.2	N/A
3/30/22	1.1	<0.10
3/16/22	1.2	N/A
3/2/22	1.5	<0.10
2/15/22	1.5	N/A
2/2/22	<0.10	<0.10
1/19/22	1.4	N/A
1/5/22	0.85	<0.10
12/22/22	0.53	N/A
12/8/21	1.3	<0.10
11/24/21	1.3	N/A
11/10/21	1.5	0.21

Nitrite as N (mg/L)

Date	CSHH #14A	CSHH #15A
4/13/22	<0.050	N/A
3/30/22	0.062	<0.050
3/16/22	<0.050	N/A
3/2/22	<0.050	<0.050
2/15/22	<0.050	N/A
2/2/22	<0.050	<0.050
1/19/22	0.066	N/A
1/5/22	<0.050	<0.050
12/22/22	0.054	N/A
12/8/21	0.098	<0.050
11/24/21	0.092	N/A
11/10/21	0.11	<0.050

Nitrate as N (mg/L)

Date	CSHH #14A	CSHH #15A
4/13/22	8.2	N/A
3/30/22	8.5	6.0
3/16/22	7.4	N/A
3/2/22	7.6	6.0
2/15/22	9.2	N/A
2/2/22	0.20	7.5
1/19/22	8.4	N/A
1/5/22	1.3	0.22
12/22/22	2.6	N/A
12/8/21	7.2	5.4
11/24/21	6.9	N/A
11/10/21	8.5	5.7

Total Inorganic Nitrogen Calculation (mg/L)

Date	CSHH #14A	CSHH #15A
4/13/22	9.5	N/A
3/30/22	9.7	6.0
3/16/22	8.6	N/A
3/2/22	9.1	6.1
2/15/22	10.8	N/A
2/2/22	0.20	7.5
1/19/22	9.8	N/A
1/5/22	2.3	0.24
12/22/22	3.2	N/A
12/8/21	8.6	5.5
11/24/21	8.3	N/A
11/10/21	10.2	5.91

Total N (mg/L)

Date	CSHH #14A	CSHH #15A
4/13/22	8.3	N/A
3/30/22	8.6	6.0
3/16/22	8.3	N/A
3/2/22	8.0	6.1
2/15/22	10	N/A
2/2/22	1.0	7.5
1/19/22	8.7	N/A
1/5/22	1.4	0.24
12/22/22	4.6	N/A
12/8/21	7.3	5.5
11/24/21	12.0	N/A
11/10/21	10.7	6.8

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.

2020-2021 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.

2020 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

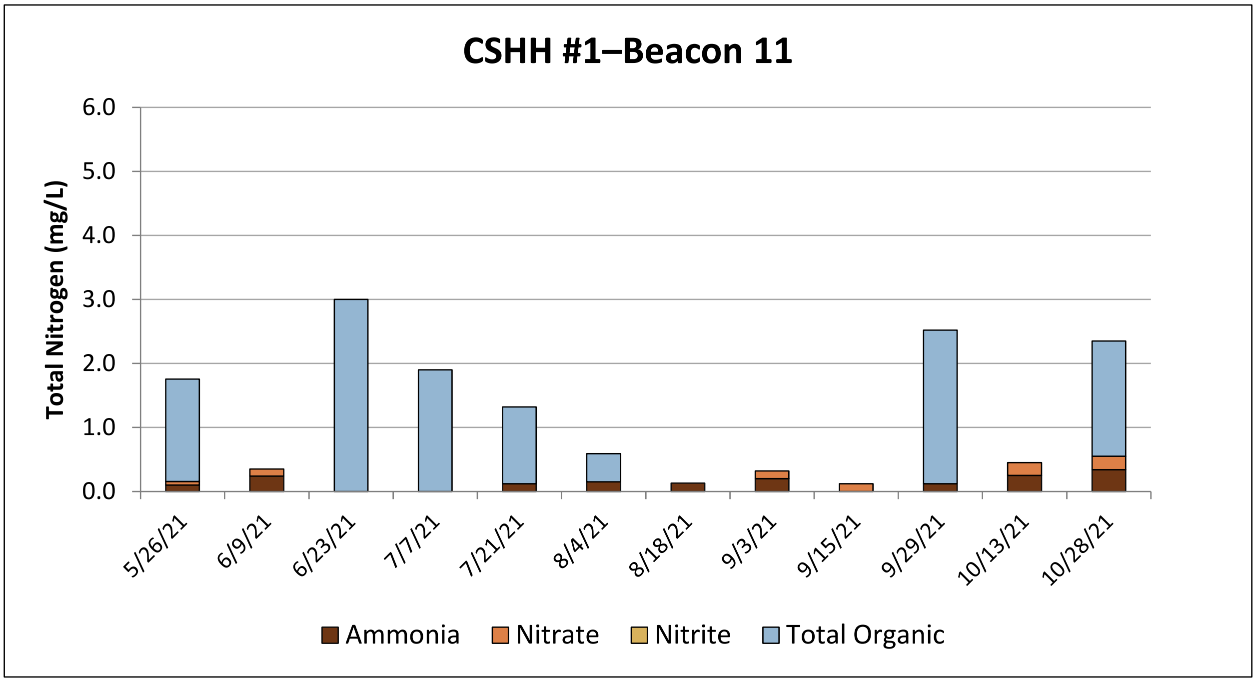
Notes:

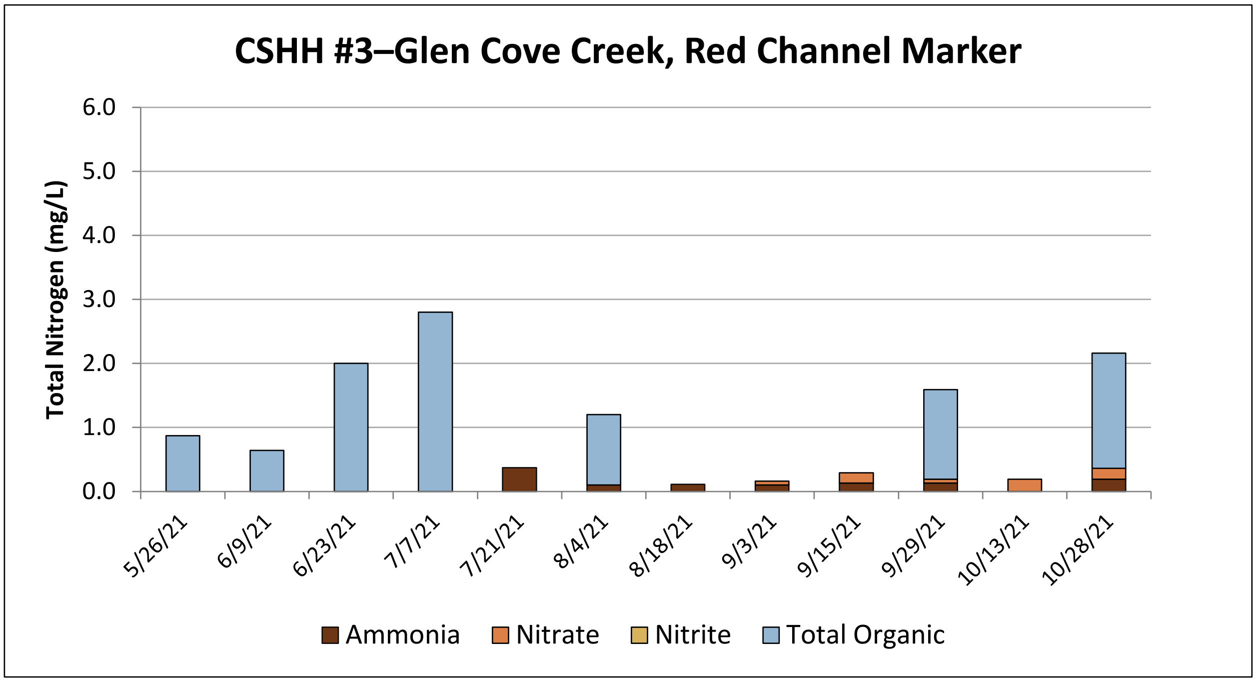
A value given with a less than symbol indicates that the results were below the detection limit.

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

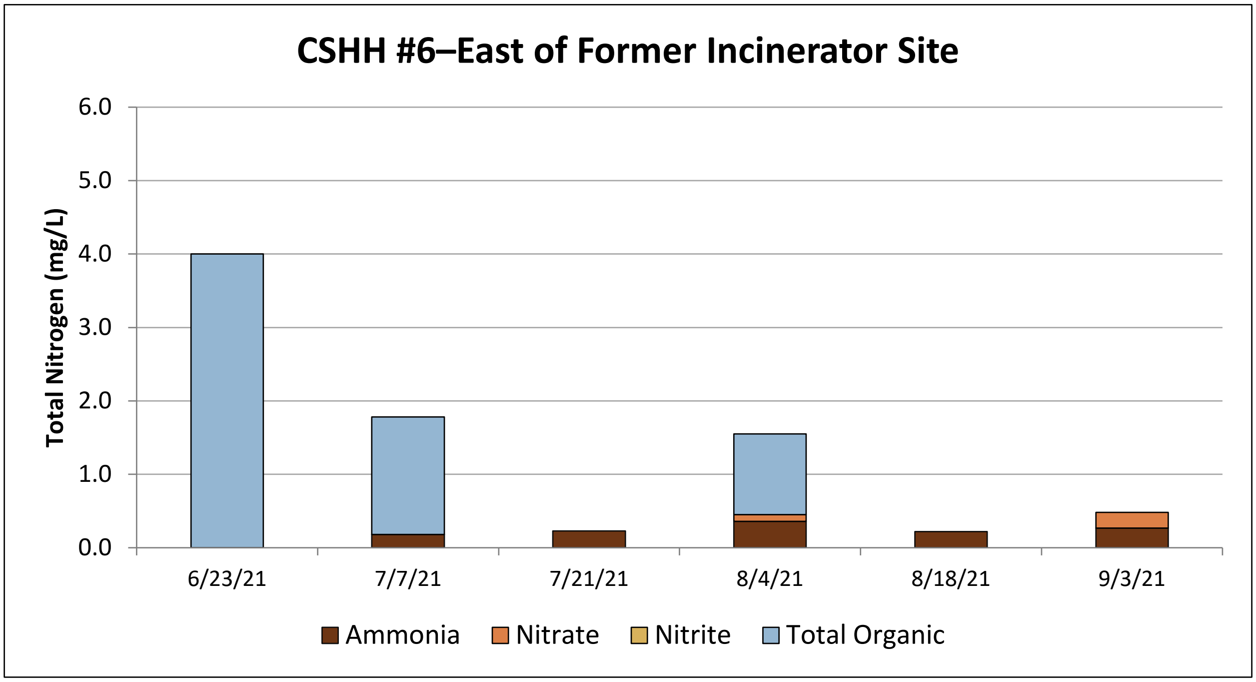
2021 Total Nitrogen Graphs

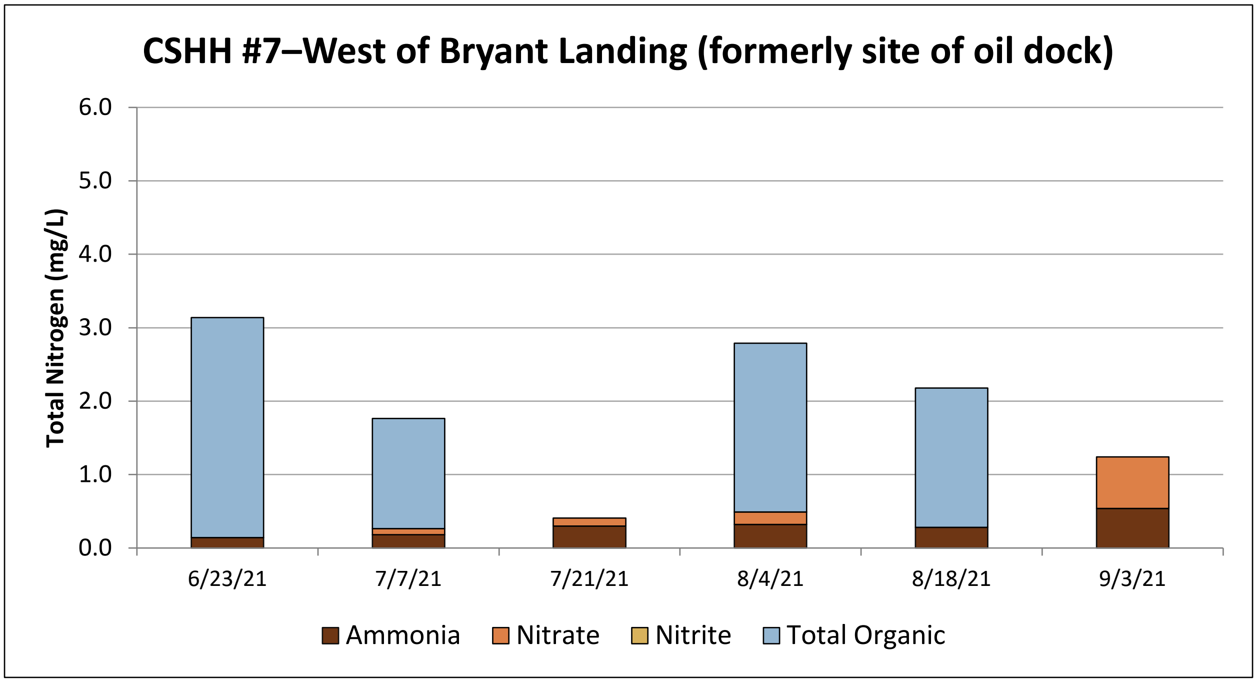
The graphs in this section display each station's total nitrogen throughout the 2021 season. The height of each vertical bar provides the total nitrogen recorded on the indicated date, but within each bar, total nitrogen is broken down into the subcategories of nitrogen it consists of. Total nitrogen comprises both organic nitrogen, shown in blue, and inorganic nitrogen—including ammonia, shown in brown, nitrate, shown in orange, and nitrite, shown in gold. Note that total nitrogen exceeding 1.2 mg/L indicates very poor water-quality for this parameter.



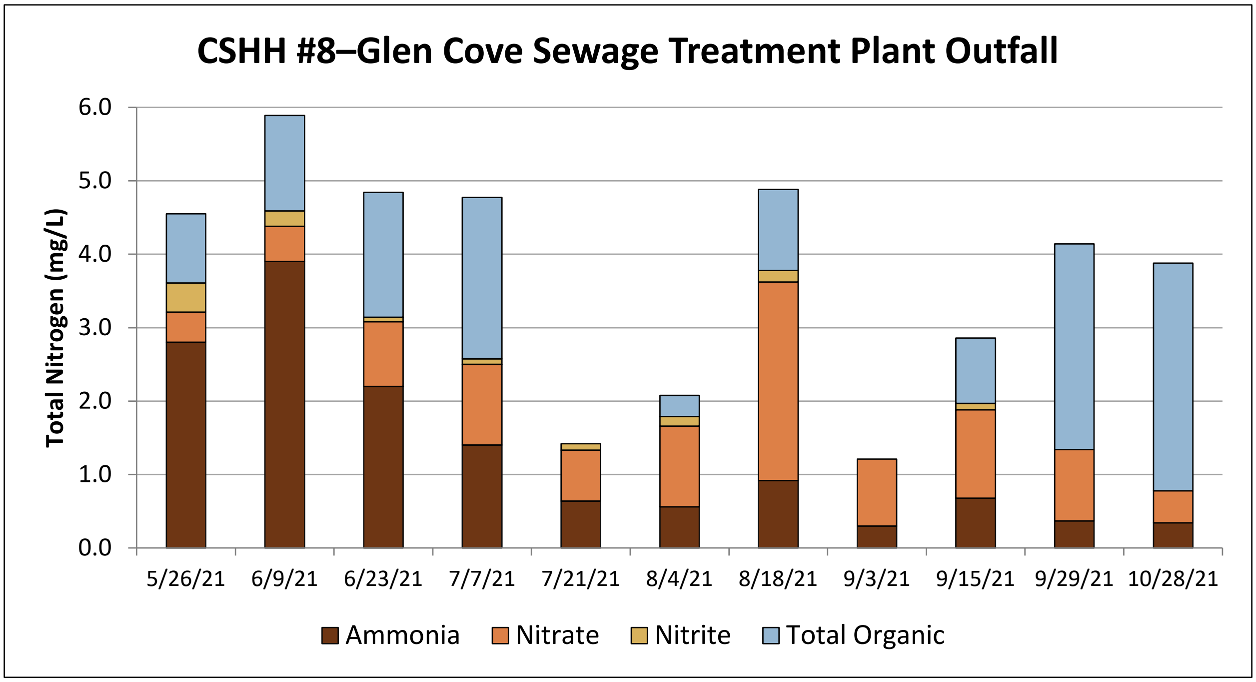


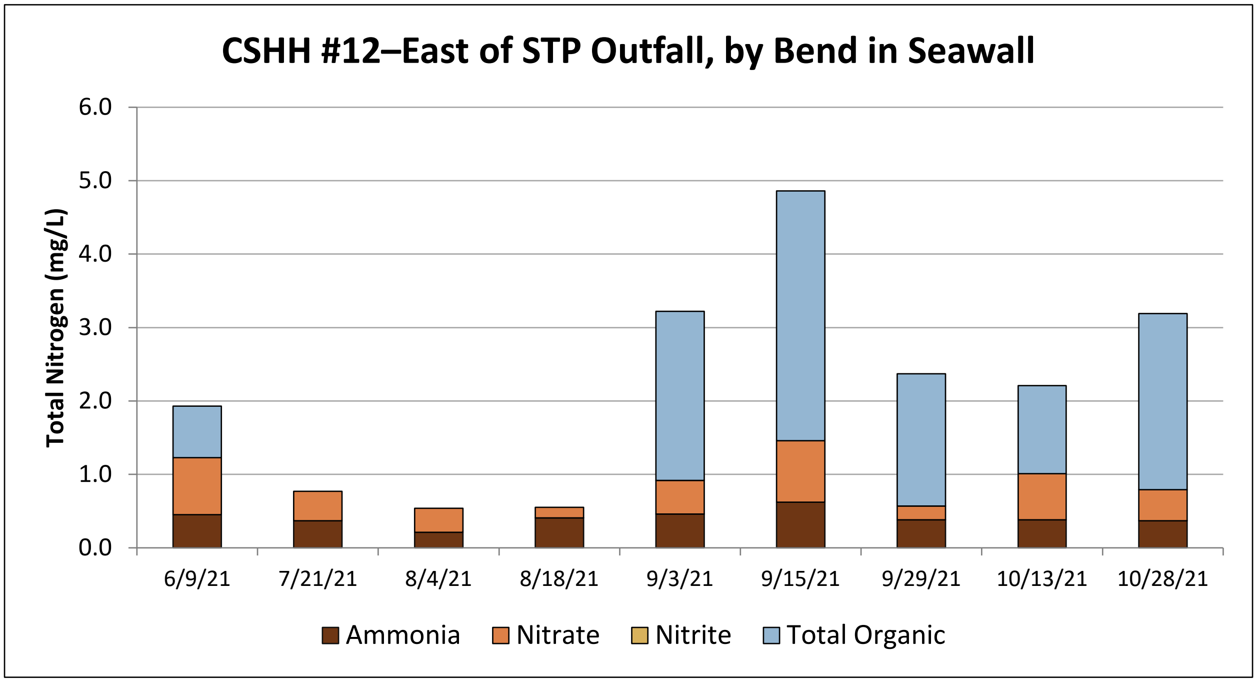
2021 Total Nitrogen Graphs



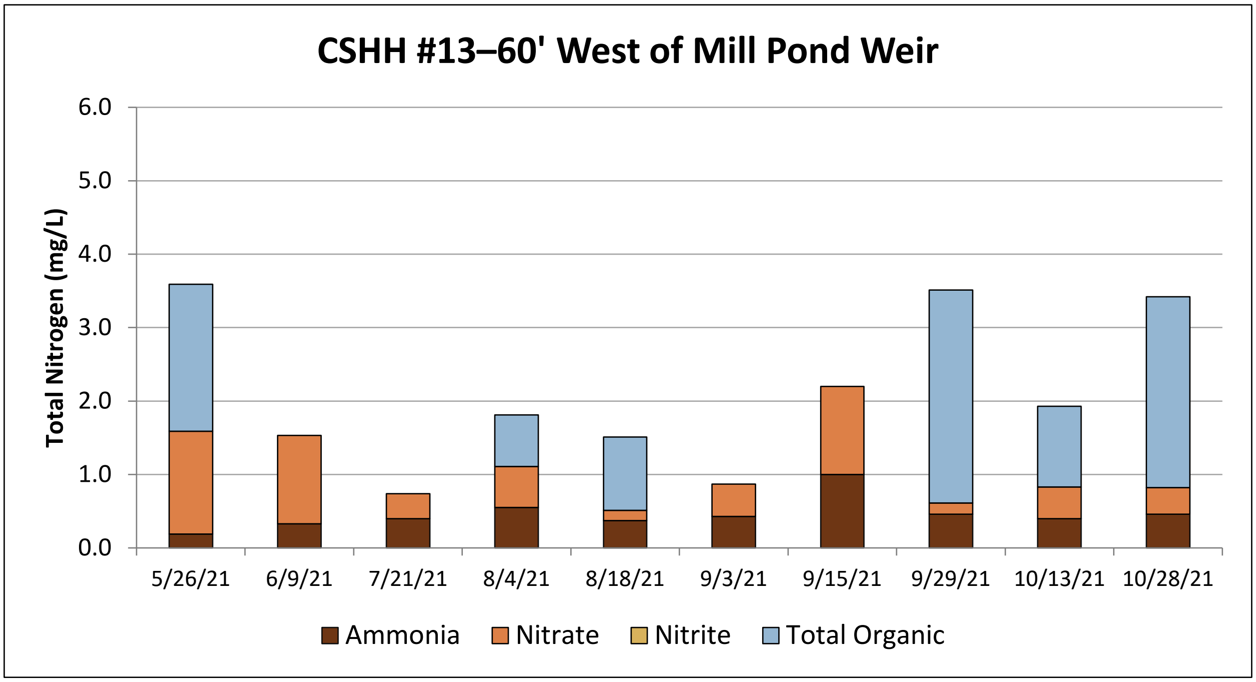


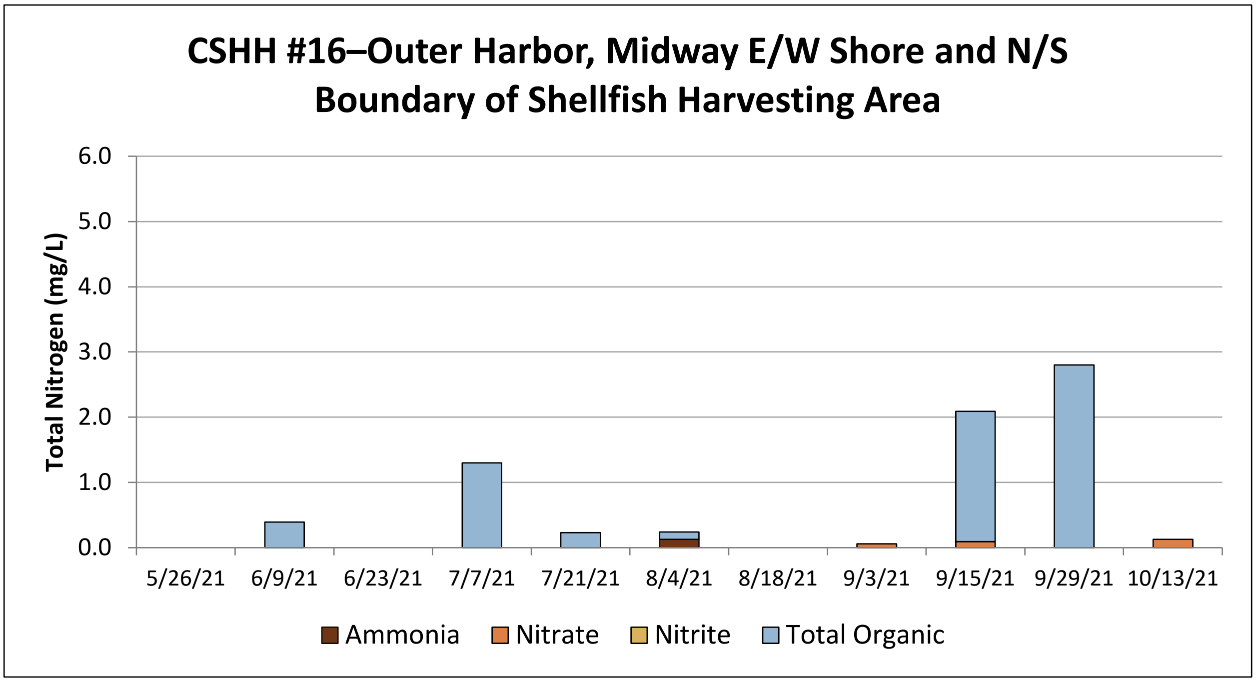
2021 Total Nitrogen Graphs



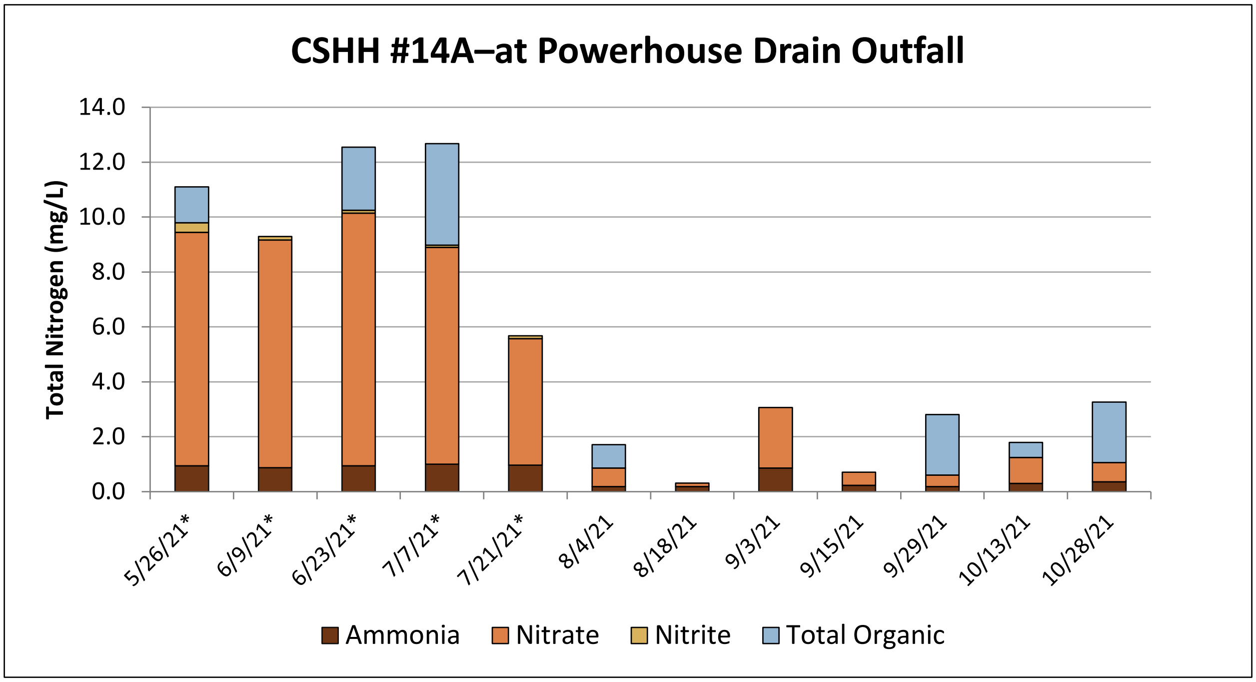


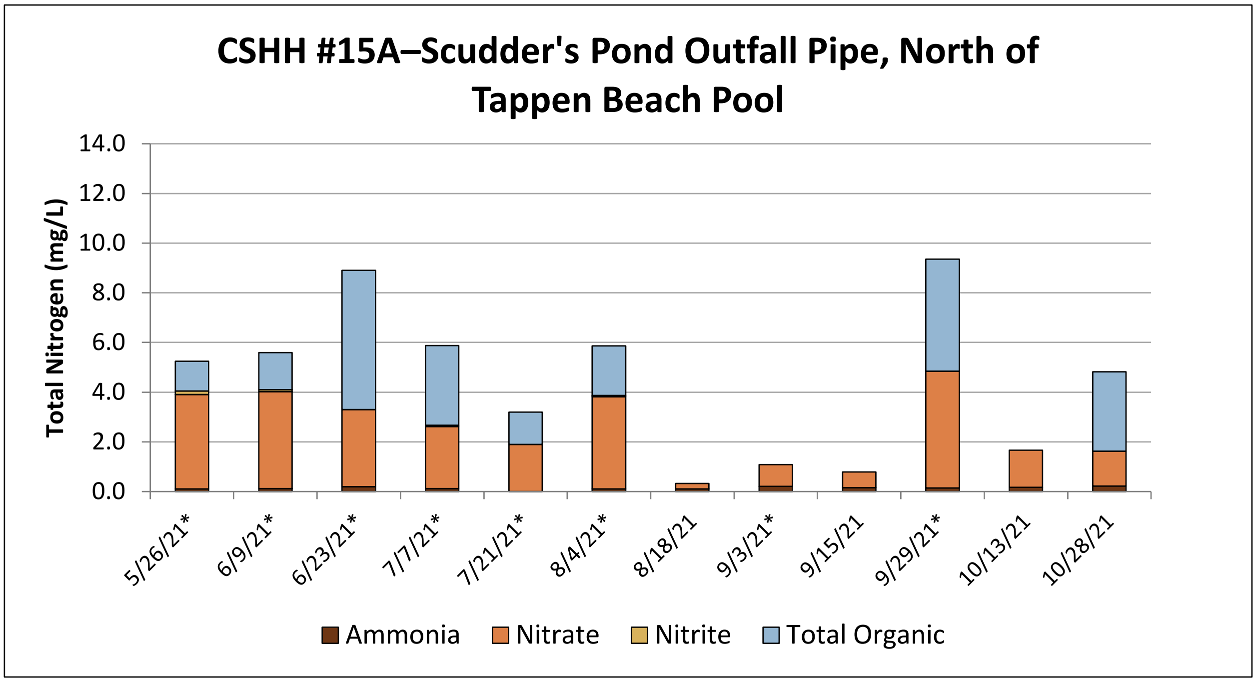
2021 Total Nitrogen Graphs





2021 Total Nitrogen Graphs





*Sample taken from direct flow.

Appendix E

Coalition to Save Hempstead Harbor

2021 CSHH Tappen Marina 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.

*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**	**Chl 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 #19–Tappen Marina End of Main Dock Opposite Marina Entrance																
10/28/21	15.96	16.34	23.48	24.17	6.93	6.62	7.51	7.55	10.8	2.0	6.16	10.60	1.90	3.79	4.07	7:31
10/20/21	16.0	16.3	24.10	24.84	6.71	6.74	7.75	7.82	14.3	1.5	N/A	N/A	1.89	N/A	2.05	7:20
10/13/21	19.78	20.18	24.50	25.46	7.08	5.92	7.63	7.58	17.4	1.75	31.89	34.39	1.53	2.06	3.86	7:34
10/6/21	20.08	20.28	25.01	25.16	5.42	5.27	7.58	7.59	16.8	1.5	19.61	18.06	1.97	2.53	2.02	7:25
9/29/21	20.93	20.89	24.53	24.77	7.70	7.35	7.81	7.86	13.1	1.0	52.31	68.53	3.47	5.12	3.59	7:18
9/22/21	22.63	22.72	24.82	25.09	6.98	6.69	7.70	7.71	22.9	1.25	49.41	49.63	2.51	4.77	1.88	7:12
9/15/21	23.29	22.99	24.19	25.55	6.78	5.53	7.66	7.59	23.1	1.2	46.73	29.15	3.23	3.51	4.08	7:19
9/8/21	22.86	23.06	23.52	23.73	6.31	5.41	7.47	7.43	20.2	1.25	40.19	41.49	2.45	3.15	1.75	7:00
9/3/21	22.18	23.14	20.81	24.20	6.51	5.04	7.58	7.41	15.7	1.0	51.91	63.51	4.56	4.40	3.61	7:05
8/25/21	24.35	24.28	24.74	25.10	5.60	4.74	7.43	7.38	20.6	1.0	48.16	54.15	2.92	2.90	1.90	7:05
8/18/21	23.58	23.31	25.60	26.41	4.30	2.15	7.30	7.24	23.3	1.25	30.29	22.45	1.89	2.28	3.90	7:10
8/11/21	22.75	22.42	25.22	25.76	5.62	3.78	7.41	7.36	23.3	1.25	39.70	31.06	1.68	3.55	1.84	7:03
8/4/21	22.79	22.41	25.14	26.00	5.58	3.49	7.39	7.28	18.9	1.0	45.29	39.59	3.14	4.34	3.45	7:05
7/28/21	23.18	22.36	24.86	25.68	6.04	3.62	7.42	7.32	21.2	1.5	43.90	41.20	2.15	3.72	2.60	6:56

2021 CSHH Tappen Marina Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl 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 #19–Tappen Marina End of Main Dock Opposite Marina Entrance (continued)																
7/21/21	24.12	24.24	24.53	25.01	5.86	4.86	7.51	7.45	21.1	1.25	16.38	22.14	3.26	5.32	3.02	6:41
7/14/21	22.31	22.13	24.91	25.23	5.30	4.60	7.53	7.49	21.2	1.25	49.77	37.29	2.80	4.63	2.29	7:18
7/7/21	21.22	20.36	25.50	26.10	6.35	4.93	7.50	7.41	24.0	0.75	93.69	52.84	3.17	4.79	2.51	7:00
6/30/21	21.42	19.43	26.23	26.68	6.62	5.05	7.68	7.55	28.0	1.0	73.70	34.35	3.92	3.24	3.13	7:16
6/23/21	18.02	18.31	25.43	25.78	7.22	5.63	7.44	7.47	14.5	0.75	56.87	51.41	2.37	2.06	2.04	6:57
6/16/21	19.24	18.98	25.56	25.83	10.23	11.09	8.28	8.23	18.0	1.25	50.31	73.56	1.22	5.20	3.10	6:57
6/9/21	17.93	17.60	25.43	25.66	6.97	6.76	7.44	7.50	23.1	1.75Bottom	16.06	21.72	1.90	2.04	1.88	7:04
6/2/21	15.06	13.77	24.99	26.16	7.53	7.03	7.61	7.66	16.2	1.75	6.73	8.50	1.28	2.06	3.78	7:00
5/26/21	15.03	14.58	25.96	26.27	8.31	8.25	7.71	7.73	18.1	0.75	69.21	62.65	4.37	3.55	1.23	6:56
5/19/21	16.48	13.86	25.28	25.94	10.66	9.91	8.01	7.92	16.0	1.25	70.77	64.17	3.87	4.28	3.42	6:56

Coalition to Save Hempstead Harbor

2021 CSHH Tappen Marina Monitoring Data

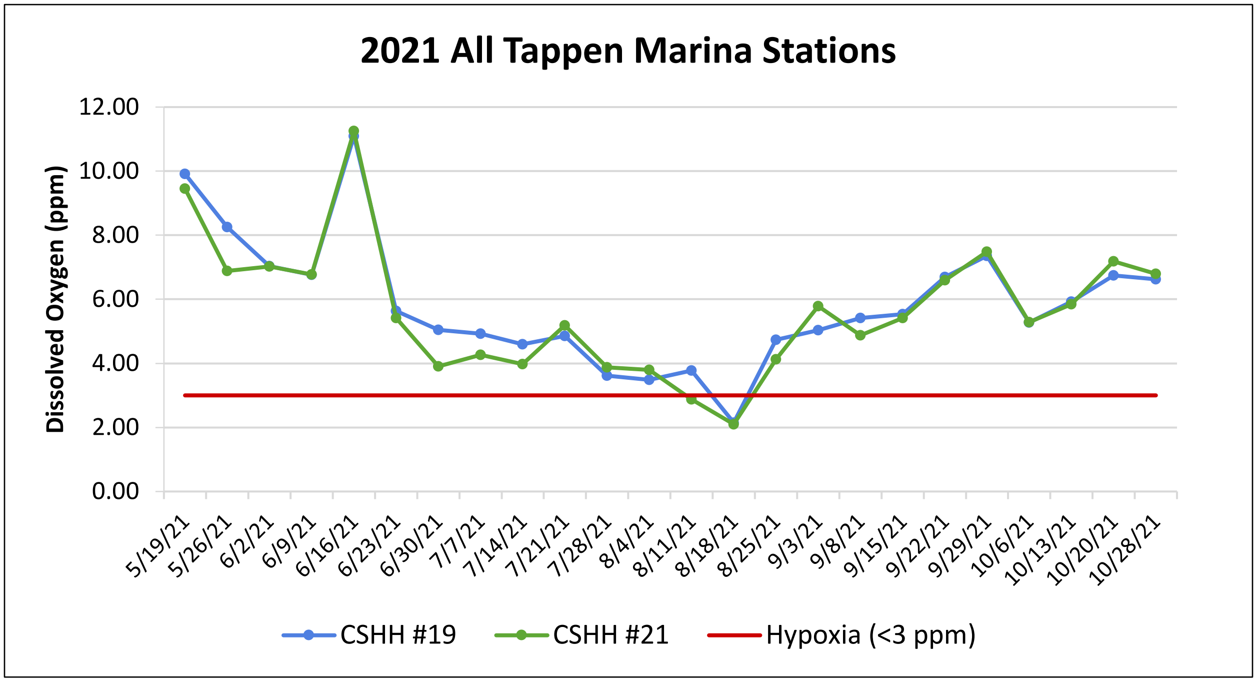
Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl a (ug/L)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #21–Tappen Marina “R” Dock																
10/28/21	16.19	16.33	23.72	24.13	6.70	6.79	7.53	7.51	10.8	1.5	6.96	11.84	2.09	3.29	4.54	7:12
10/20/21	16.1	16.1	24.69	24.75	7.32	7.18	7.72	7.73	15.0	1.25	N/A	N/A	2.63	N/A	2.15	7:01
10/13/21	19.91	20.19	24.97	25.87	7.09	5.84	7.55	7.52	17.3	1.5	31.44	39.59	2.21	2.51	4.34	6:57
10/6/21	20.07	20.18	24.45	24.68	7.02	5.28	7.55	7.56	16.7	1.25	19.92	18.44	2.15	5.08	2.18	7:07
9/29/21	20.97	21.11	24.09	24.30	7.60	7.48	7.81	7.87	13.1	1.0	57.32	61.73	3.74	4.56	2.64	7:03
9/22/21	22.57	22.61	24.77	24.84	6.59	6.59	7.60	7.64	22.7	0.8	50.01	49.42	3.00	4.53	2.18	6:58
9/15/21	23.28	23.02	24.19	25.47	6.42	5.41	7.60	7.57	22.9	1.0	51.99	33.35	2.87	3.55	4.37	6:57
9/8/21	22.97	22.86	23.59	23.64	4.81	4.88	7.35	7.38	20.4	0.75	39.70	43.29	2.64	2.84	2.07	6:45
9/3/21	22.14	22.91	20.70	21.63	6.44	5.78	7.21	7.44	16.2	0.75	54.75	53.16	4.60	4.75	3.73	6:46
8/25/21	24.30	24.31	24.94	25.01	4.58	4.13	7.32	7.30	20.1	1.0	44.75	42.06	3.19	3.57	2.27	6:47
8/18/21	23.62	23.43	25.81	26.26	2.58	2.10	7.18	7.20	22.8	1.25	26.63	19.42	2.29	2.53	4.13	6:46
8/11/21	22.69	22.37	25.41	25.65	5.48	2.88	7.22	7.25	23.3	1.25	42.04	27.10	2.09	3.42	2.25	6:44
8/4/21	22.82	22.69	25.21	25.78	6.41	3.80	7.35	7.27	18.7	1.0	45.12	37.08	3.81	4.33	3.65	6:45
7/28/21	23.09	22.17	24.95	25.68	6.04	3.88	7.08	7.21	21.2	1.25	38.11	28.63	1.89	3.76	3.09	6:35
7/21/21	24.31	24.16	24.81	24.82	6.28	5.18	7.29	7.41	21.4	1.0	17.92	18.46	4.17	6.54	3.10	6:23
7/14/21	22.34	22.07	24.94	25.12	6.48	3.98	7.45	7.40	21.0	1.0	45.81	44.11	2.47	7.01	2.80	6:45
7/7/21	21.10	20.03	25.47	25.76	6.65	4.27	7.49	7.29	21.7	0.8	56.13	37.77	2.80	4.73	2.56	6:42
6/30/21	21.18	19.35	26.13	26.67	6.31	3.91	7.33	7.42	27.3	1.0	69.26	41.70	2.87	5.17	3.77	6:45
6/23/21	18.41	18.55	25.53	25.80	7.23	5.41	6.33	6.88	14.2	0.75	74.85	77.81	2.66	2.34	2.20	6:41
6/16/21	19.29	19.23	25.57	25.87	10.35	11.25	8.23	8.29	17.7	1.25	44.72	115.91	1.72	2.63	3.63	6:38
6/9/21	18.44	16.88	25.59	25.54	7.46	6.77	7.18	7.33	21.4	1.5	25.60	19.34	1.64	5.37	2.13	6:40
6/2/21	14.92	13.77	24.83	25.82	7.22	7.02	7.52	7.63	15.4	1.75	7.56	6.28	2.09	1.52	4.16	6:38
5/26/21	14.24	14.19	26.02	26.09	6.89	6.88	7.53	7.54	17.5	0.6	62.81	42.99	22.65	17.40	1.62	6:34
5/19/21	15.74	13.88	25.24	25.97	9.88	9.45	7.79	7.85	14.7	0.8	68.61	56.67	7.65	6.48	3.87	6:33

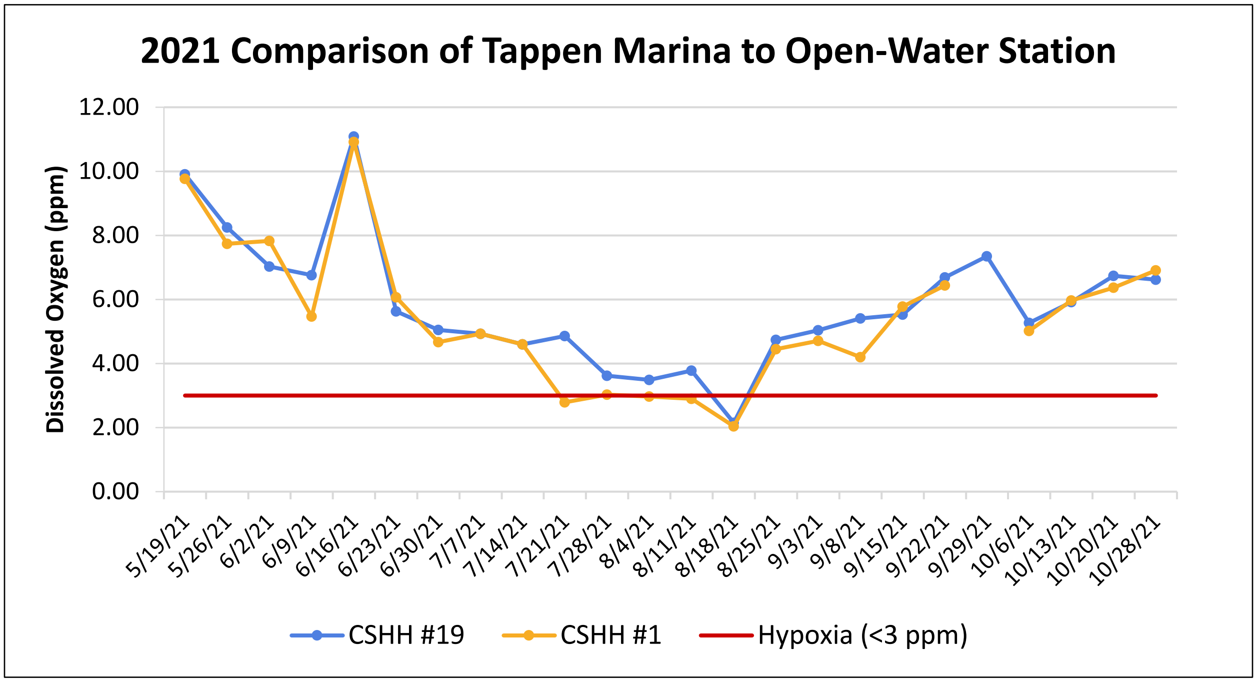
Coalition to Save Hempstead Harbor

2021 CSHH Tappen Marina Monitoring Data

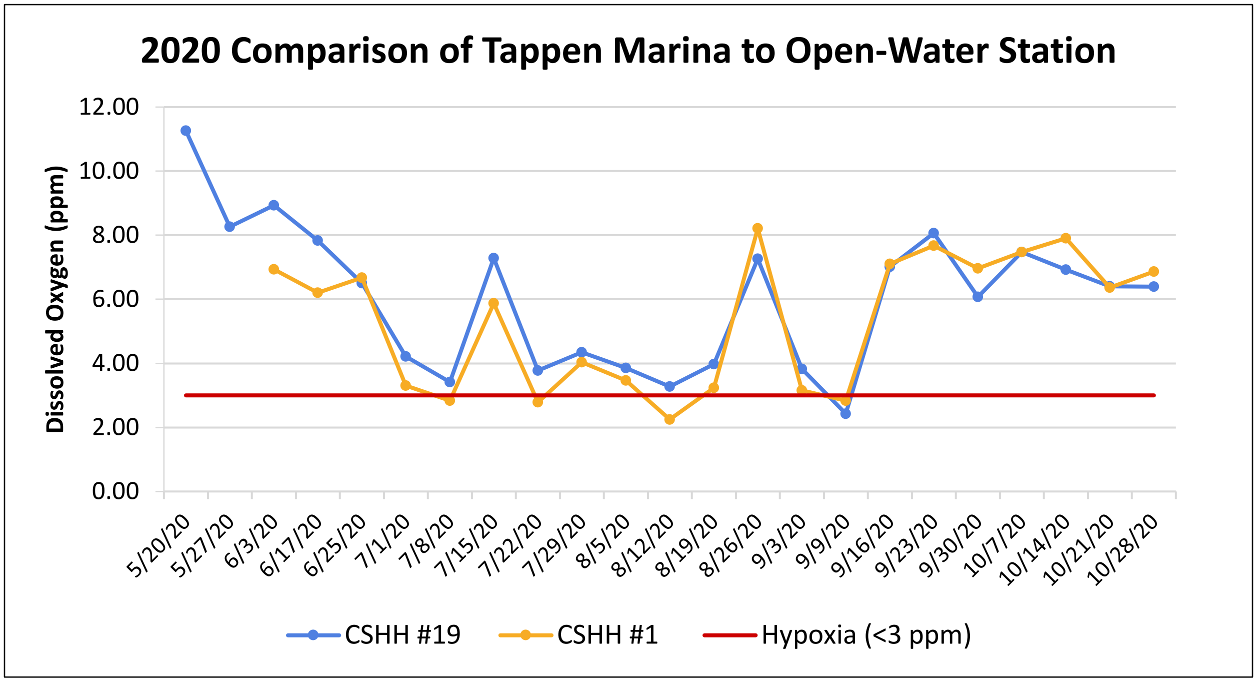
Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl a (ug/L)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #18–Tappen Marina "S" Dock, Northeast Corner of Marina																
10/13/21	19.86	20.18	24.64	25.68	6.82	5.90	7.56	7.56	17.4	1.5	34.36	37.19	2.24	1.93	3.34	7:11

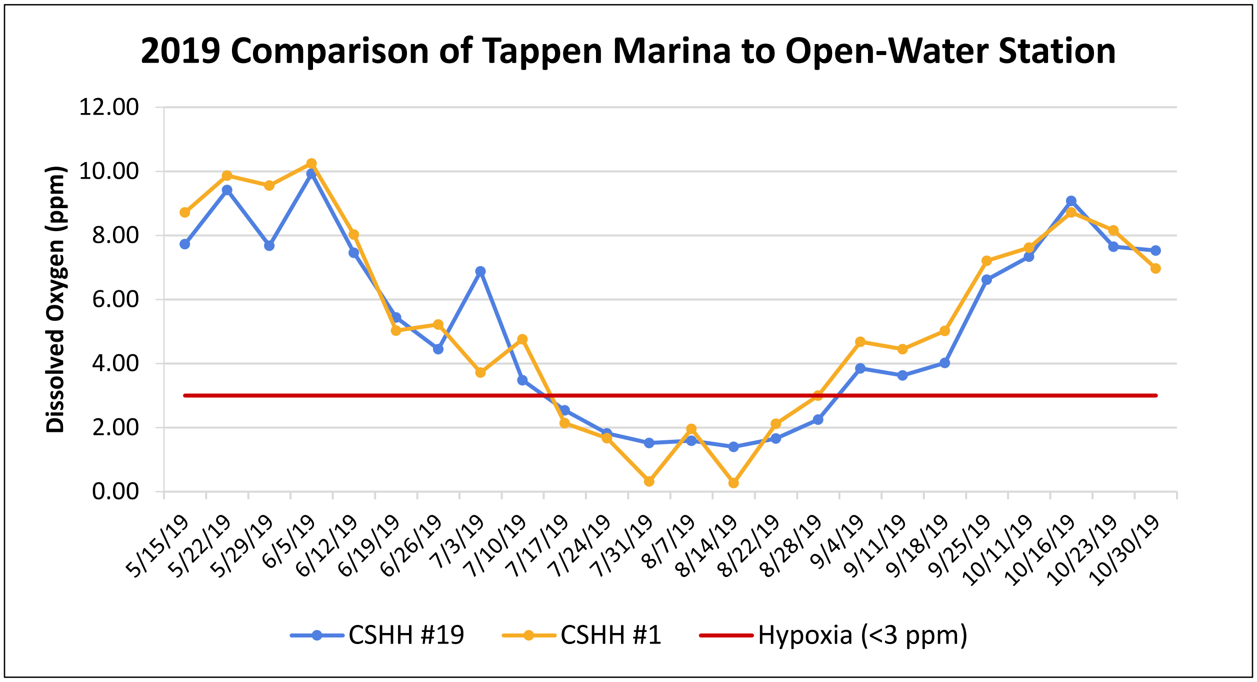
2021 Tappen Marina Monitoring Graphs—Dissolved Oxygen



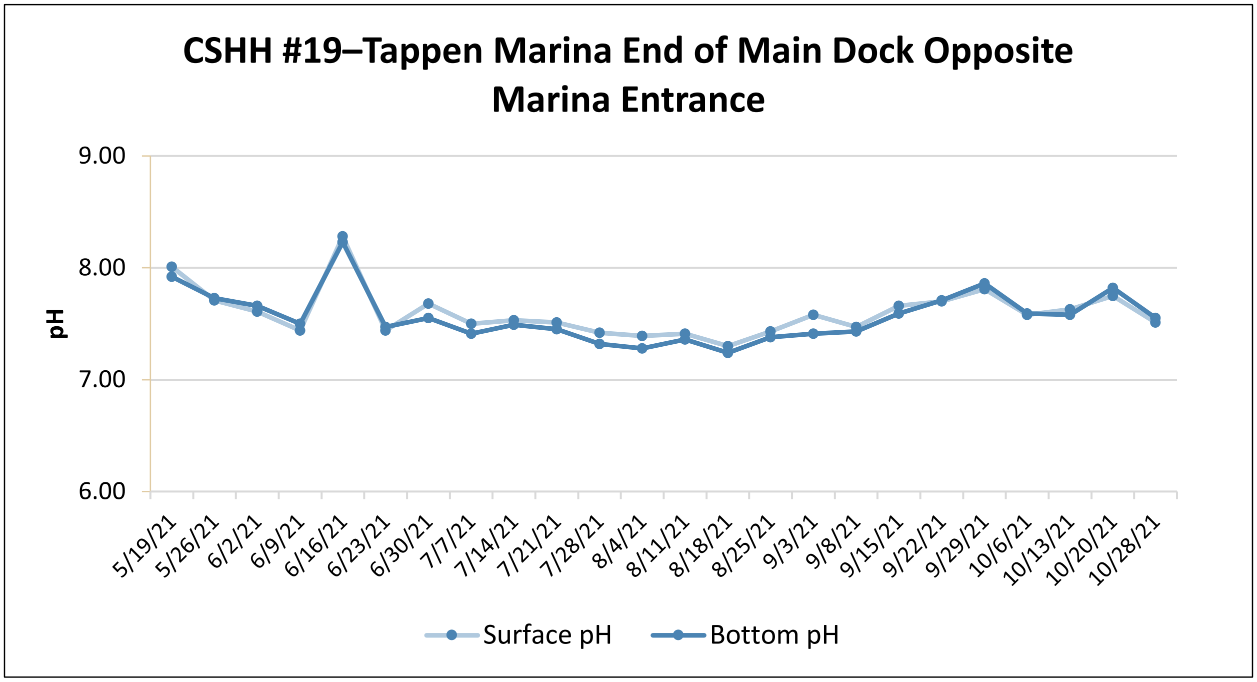


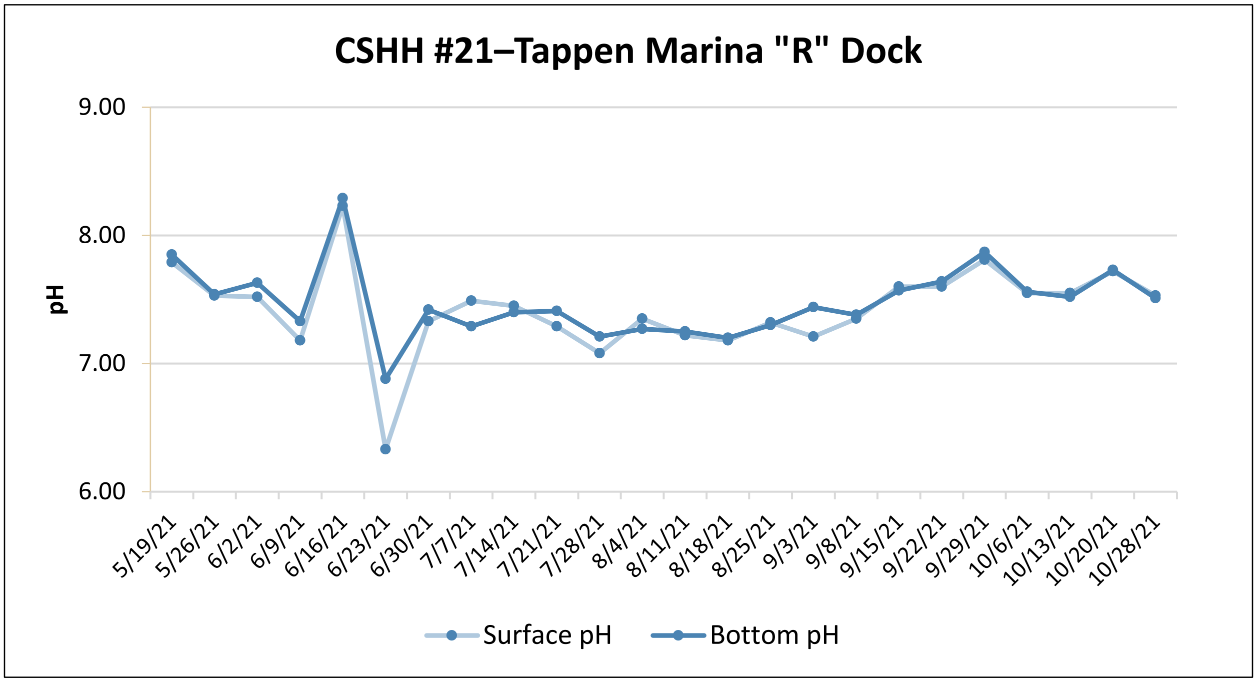
2021 Tappen Marina Monitoring Graphs—Dissolved Oxygen



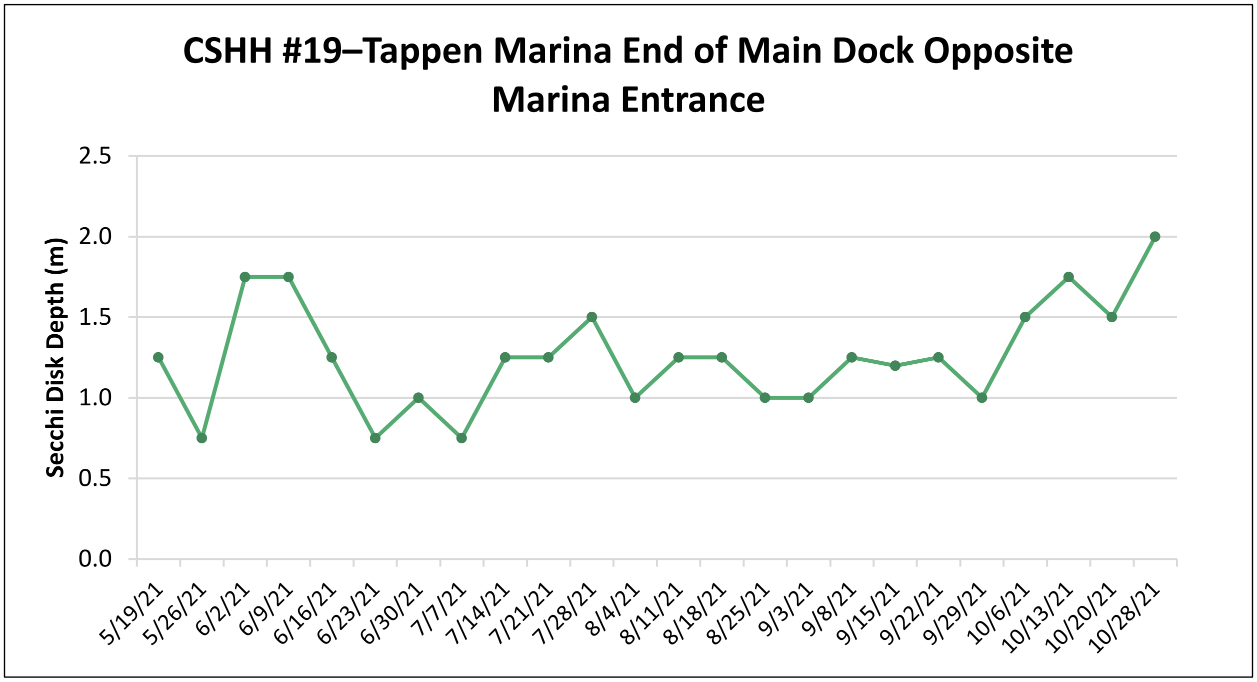


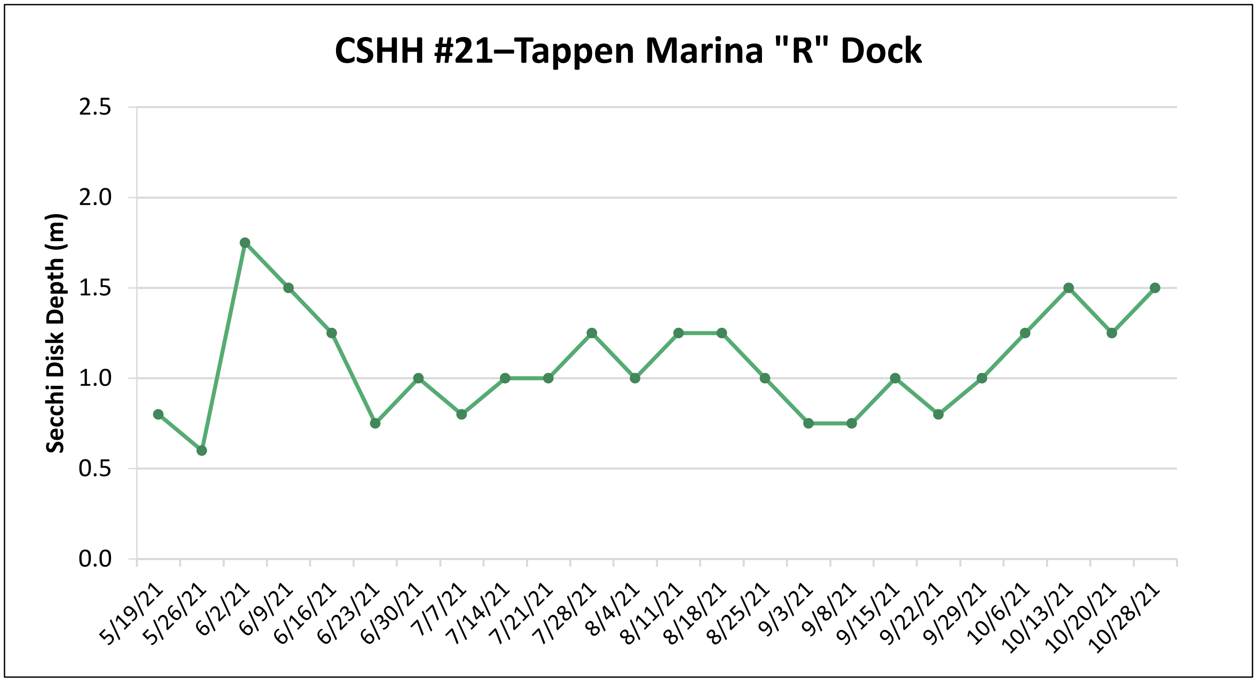
2021 Tappen Marina Monitoring Graphs—pH



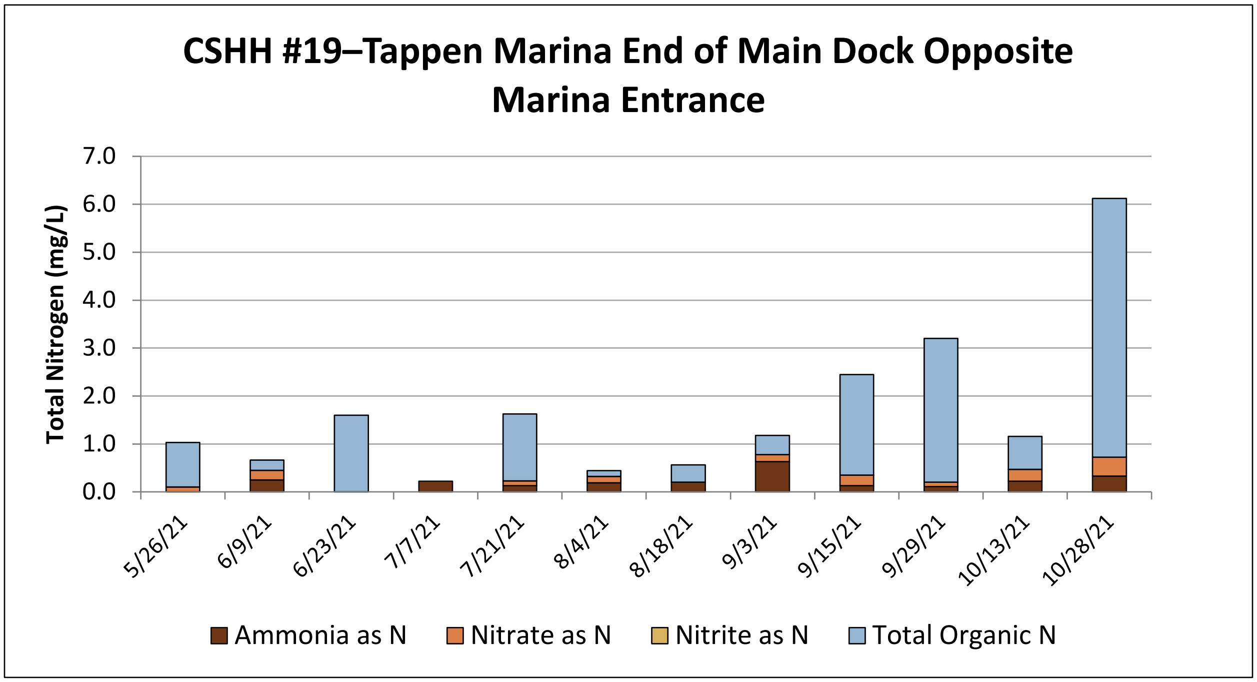


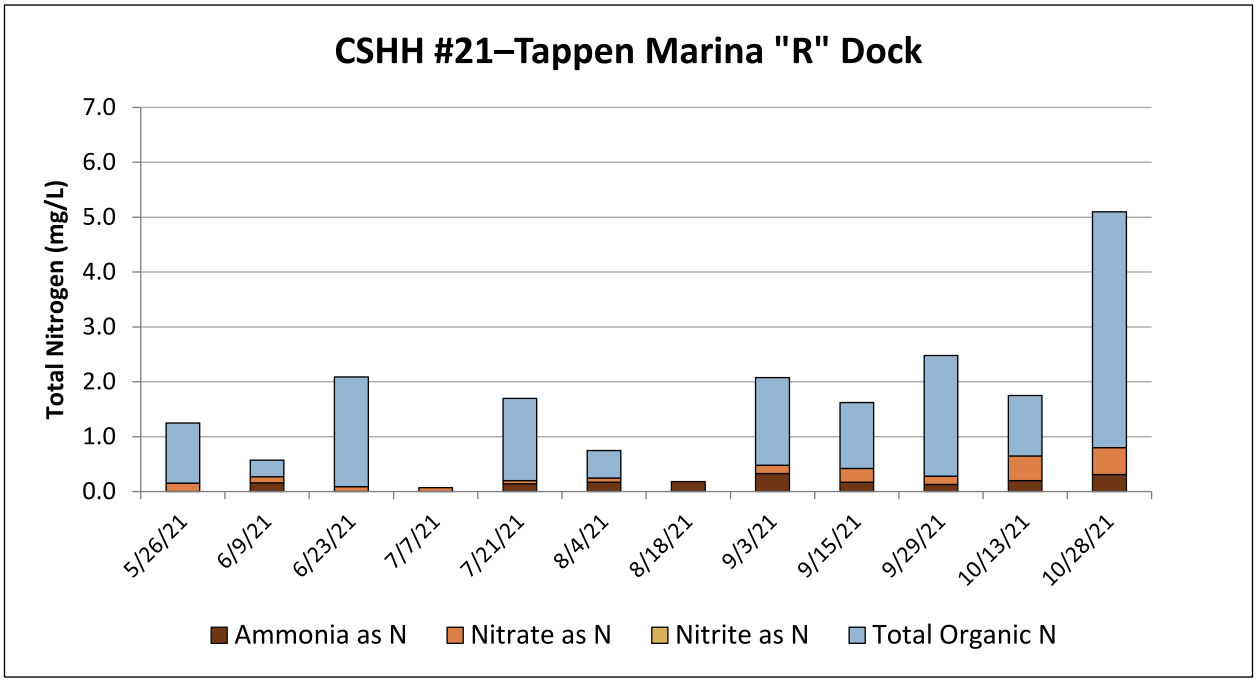
2021 Tappen Marina Monitoring Graphs—Water Clarity



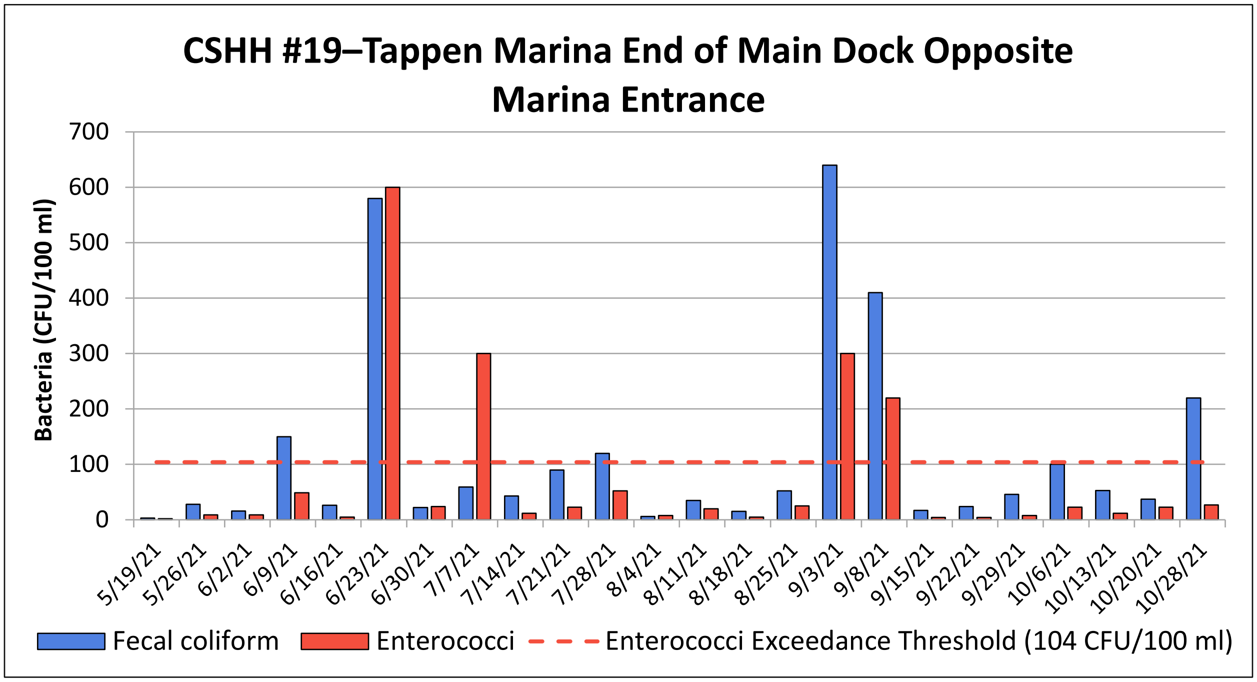


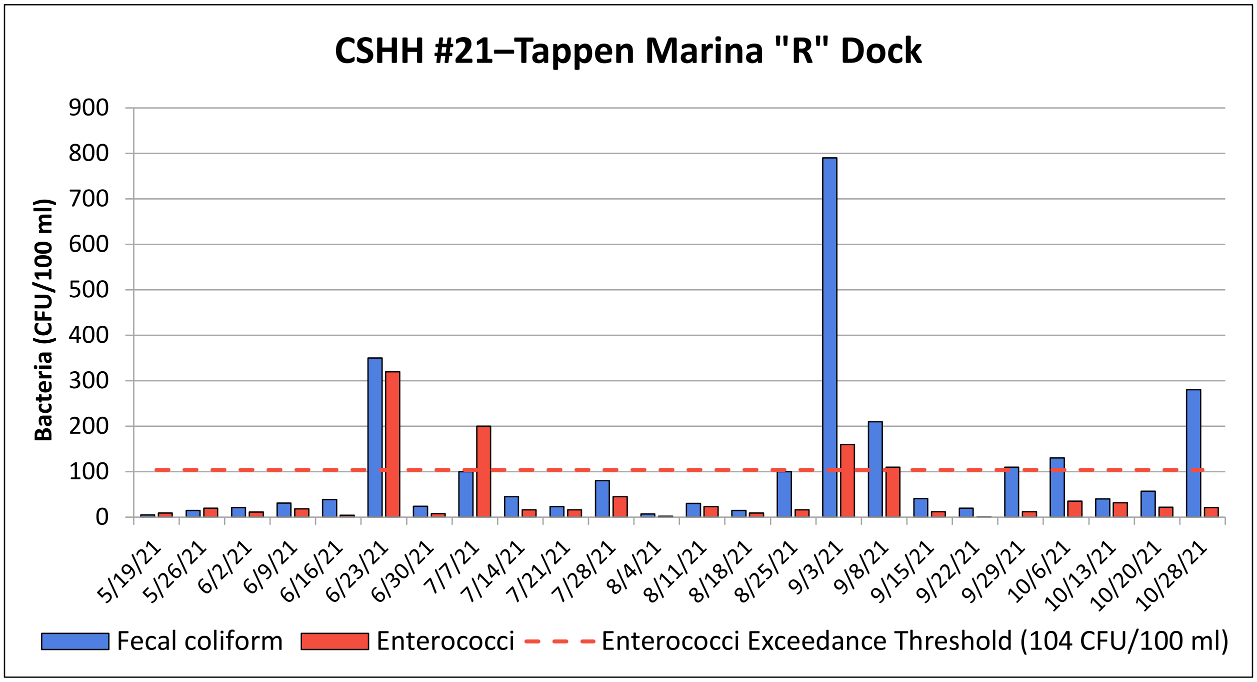
2021 Tappen Marina Monitoring Graphs—Total Nitrogen





2021 Tappen Marina Monitoring Graphs—Bacteria





Appendix F

2021 UWS Monitoring Data

May 17, 2021	Location	HEM-M-01 (CSHH #1)		HEM-M-02		HEM-M-03 (CSHH #3)		HEM-O-04 (CSHH #2)		HEM-O-05 (CSHH #16)		HEM-O-06 (CSHH #17)	
		Surface	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**
	Sample Depth (m)*	0.50	3.99	0.50	5.17	0.50	3.71	0.50	7.05	0.50	8.90	0.50	6.29
	Temperature (°C)	14.15	13.84	14.20	13.43	14.93	14.53	14.46	12.57	14.80	11.49	14.10	12.66
	Salinity (ppt)	23.06	23.29	23.23	23.56	23.07	23.36	23.22	23.70	23.27	24.05	23.44	23.81
	Dissolved Oxygen (%)	117.20	117.80	119.60	121.70	128.40	131.00	113.90	110.30	117.00	105.40	103.80	100.40
	Dissolved Oxygen (mg/L)	10.56	10.62	10.87	11.12	11.45	11.81	10.28	10.26	10.51	9.96	9.40	9.30
	Turbidity (NTU)	2.98	3.04	1.36	3.06	1.55	1.81	0.98	1.55	0.85	1.98	0.93	4.51
	Chlorophyll a (ug/L)	36.87	49.41	26.34	50.09	41.46	52.52	20.37	16.27	18.09	7.96	23.56	11.14
	Post-Corrected Chl a (ug/L)**	14.39	19.25	10.31	19.51	16.17	20.45	8.00	6.41	7.11	3.19	9.23	4.42

May 27, 2021	Location	HEM-M-01 (CSHH #1)		HEM-M-02		HEM-M-03 (CSHH #3)		HEM-O-04 (CSHH #2)		HEM-O-05 (CSHH #16)		HEM-O-06 (CSHH #17)	
		Surface	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**
	Sample Depth (m)*	0.50	2.77	0.50	3.36	0.50	2.40	0.50	6.52	0.50	8.04	0.50	5.48
	Temperature (°C)	15.94	15.59	15.84	15.23	16.35	15.47	15.10	14.03	15.55	13.63	15.83	14.70
	Salinity (ppt)	26.00	26.30	25.99	26.34	25.98	26.41	26.51	26.68	26.52	26.70	26.48	26.62
	Dissolved Oxygen (%)	92.60	92.10	96.80	97.50	110.50	110.10	105.70	99.70	108.60	102.70	108.90	108.40
	Dissolved Oxygen (mg/L)	7.83	7.84	8.25	8.34	9.39	9.40	9.10	8.75	9.26	9.04	9.22	9.35
	Turbidity (NTU)	3.48	3.03	3.33	2.90	1.47	1.30	7.25	8.31	0.19	2.55	0.52	2.96
	Chlorophyll a (ug/L)	51.37	52.60	85.70	75.98	44.21	62.00	32.10	60.31	11.87	18.78	9.77	25.15
	Post-Corrected Chl a (ug/L)**	50.73	51.95	84.89	75.22	43.60	61.31	31.55	59.62	11.42	18.29	9.33	24.63

*Surface readings are taken at half meter below the surface. Bottom readings are taken half meter above the harbor floor.

**Values represent Chlorophyll a levels read by the sonde at each station, corrected based on lab-analyzed Chlorophyll a filtrations for that day.

2021 UWS Monitoring Data

	Location	HEM-M-01 (CSHH #1)		HEM-M-02		HEM-M-03 (CSHH #3)		HEM-O-04 (CSHH #2)		HEM-O-05 (CSHH #16)		HEM-O-06 (CSHH #17)	
		Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
June 8, 2021	Sample Depth (m)*	0.50	2.67	0.50	4.24	0.50	3.32	0.50	6.84	0.50	8.99	0.50	6.71
	Temperature (°C)	17.82	16.52	17.79	14.83	18.32	17.03	17.57	14.58	17.96	13.80	19.27	14.56
	Salinity (ppt)	25.59	26.10	25.82	26.42	25.88	26.21	26.07	26.60	26.06	26.84	26.00	26.70
	Dissolved Oxygen (%)	82.70	77.20	89.50	71.80	103.60	103.50	107.30	93.00	107.00	84.10	124.90	104.10
	Dissolved Oxygen (mg/L)	6.80	6.48	7.37	6.09	8.48	8.58	8.87	8.10	8.75	7.35	10.06	9.06
	Turbidity (NTU)	2.67	3.61	1.95	2.53	1.46	0.72	1.16	1.03	0.76	3.50	0.78	2.90
	Chlorophyll a (ug/L)	21.67	17.52	27.30	8.01	31.29	24.74	36.94	7.09	21.27	5.40	25.83	7.14
	Post-Corrected Chl a (ug/L)**	12.24	9.88	15.45	4.47	17.72	13.99	20.94	3.94	12.02	2.98	14.61	3.97

	Location	HEM-M-01 (CSHH #1)		HEM-M-02		HEM-M-03 (CSHH #3)		HEM-O-04 (CSHH #2)		HEM-O-05 (CSHH #16)			HEM-O-06 (CSHH #17)	
		Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Mid	Bottom	Surface	Bottom
June 21, 2021	Sample Depth (m)*	0.50	4.43	0.50	5.94	0.50	5.02	0.50	9.18	0.50	5.40	10.55	0.50	7.20
	Temperature (°C)	19.81	16.82	19.83	16.25	20.84	17.18	19.33	15.65	20.30	18.82	15.13	20.92	15.78
	Salinity (ppt)	25.83	26.47	26.04	26.61	25.89	26.38	26.25	26.82	26.20	26.44	27.06	26.24	26.81
	Dissolved Oxygen (%)	93.40	71.30	109.30	78.50	125.60	101.00	111.80	73.90	114.20	86.70	89.07	132.40	99.50
	Dissolved Oxygen (mg/L)	7.31	5.83	8.54	6.51	9.69	8.28	8.80	6.07	8.87	7.03	7.51	10.15	8.23
	Turbidity (NTU)	3.52	2.20	2.87	1.82	2.59	1.41	1.33	2.48	1.59	1.30	2.58	1.81	2.65
	Chlorophyll a (ug/L)	100.82	61.80	62.73	44.12	64.35	40.03	27.44	47.75	19.30	34.29	26.70	23.02	19.30
	Post-Corrected Chl a (ug/L)**	68.17	41.18	41.82	28.95	42.94	26.12	17.41	31.46	11.78	22.15	16.90	14.35	11.78

2021 UWS Monitoring Data

	Location	HEM-M-01 (CSHH #1)		HEM-M-02		HEM-M-03 (CSHH #3)		HEM-O-04 (CSHH #2)			HEM-O-05 (CSHH #16)			HEM-O-06 (CSHH #17)	
		Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Mid	Bottom	Surface	Mid	Bottom	Surface	Bottom
July 6, 2021	Sample Depth (m)*	0.50	3.69	0.50	5.19	0.50	4.50	0.50	5.08	9.65	0.50	5.40	10.30	0.50	6.36
	Temperature (°C)	20.26	18.82	20.28	18.64	20.96	18.97	19.92	19.54	18.52	20.01	19.91	18.53	20.39	20.19
	Salinity (ppt)	26.11	26.75	26.40	26.96	26.41	26.85	26.82	26.81	26.94	26.80	26.80	26.99	26.82	26.85
	Dissolved Oxygen (%)	78.40	63.30	70.60	74.60	101.60	72.40	71.40	93.80	66.10	98.80	71.70	68.00	105.60	105.00
	Dissolved Oxygen (mg/L)	6.13	5.01	5.49	5.88	7.90	5.75	5.68	7.38	5.31	7.72	5.76	5.40	8.19	8.17
	Turbidity (NTU)	2.96	3.53	2.47	3.55	2.04	1.83	1.12	1.34	1.81	1.07	1.03	2.27	1.15	1.09
	Chlorophyll a (ug/L)	82.70	46.15	67.98	40.33	50.94	52.97	23.59	28.50	14.92	15.75	23.24	15.24	15.49	25.16
	Post-Corrected Chl a (ug/L)**	172.33	95.97	141.57	83.81	105.98	110.22	48.84	59.10	30.73	32.46	48.11	31.40	31.92	52.12

	Location	HEM-M-01 (CSHH #1)		HEM-M-02		HEM-M-03 (CSHH #3)		HEM-O-04 (CSHH #2)		HEM-O-05 (CSHH #16)			HEM-O-06 (CSHH #17)	
		Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Mid	Bottom	Surface	Bottom
July 20, 2021	Sample Depth (m)*	0.50	5.33	0.50	5.88	0.50	5.05	0.50	9.29	0.50	5.35	10.19	0.50	6.74
	Temperature (°C)	24.23	24.35	24.26	21.95	24.13	22.59	23.79	22.03	24.01	23.22	20.74	23.88	20.88
	Salinity (ppt)	25.22	25.42	25.31	26.15	25.00	25.94	25.44	26.02	25.37	25.50	26.33	25.48	26.36
	Dissolved Oxygen (%)	94.10	77.70	93.40	66.90	93.50	68.60	70.10	56.70	97.40	49.40	39.60	97.60	73.80
	Dissolved Oxygen (mg/L)	6.85	5.63	6.79	5.00	6.84	5.04	5.17	4.25	7.12	3.72	3.05	7.20	5.56
	Turbidity (NTU)	3.59	12.19	3.32	4.03	2.62	5.85	2.50	17.77	2.05	2.32	4.50	1.96	7.41
	Chlorophyll a (ug/L)	53.58	32.80	51.24	8.75	98.21	6.61	64.28	9.33	34.84	14.62	4.96	54.31	6.38
	Post-Corrected Chl a (ug/L)**	115.68	70.85	110.63	18.96	211.97	14.34	138.77	20.21	75.25	31.62	10.78	117.26	13.85

2021 UWS Monitoring Data

	Location	HEM-M-01 (CSHH #1)		HEM-M-02		HEM-M-03 (CSHH #3)		HEM-O-04 (CSHH #2)		HEM-O-05 (CSHH #16)			HEM-O-06 (CSHH #17)	
August 3, 2021		Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Mid	Bottom	Surface	Bottom
	Sample Depth (m)*	0.50	5.10	0.50	5.70	0.50	4.80	0.50	7.23	0.50	5.26	10.03	0.50	5.83
	Temperature (°C)	22.91	22.85	22.89	22.82	22.81	22.36	22.73	21.70	22.46	22.47	20.26	22.46	22.21
	Salinity (ppt)	25.50	26.12	25.75	26.21	25.90	26.28	26.24	26.51	26.20	26.24	27.00	26.22	26.35
	Dissolved Oxygen (%)	95.30	88.40	95.40	96.10	104.30	93.90	109.90	81.00	105.20	72.60	42.40	99.80	94.30
	Dissolved Oxygen (mg/L)	7.13	6.60	7.14	7.17	7.81	7.02	8.22	6.17	7.91	5.60	3.22	7.48	7.11
	Turbidity (NTU)	3.48	4.94	2.65	3.45	1.72	2.81	1.68	2.43	1.15	1.31	1.30	1.61	3.23
	Chlorophyll a (ug/L)	76.46	57.27	65.33	40.17	44.28	31.89	38.47	42.19	27.15	33.60	11.40	16.30	17.42
	Post-Corrected Chl a (ug/L)**	99.88	74.89	85.38	52.62	57.97	41.84	50.41	55.25	35.67	44.07	15.16	21.54	23.00

	Location	HEM-M-01 (CSHH #1)		HEM-M-02		HEM-M-03 (CSHH #3)		HEM-O-04 (CSHH #2)		HEM-O-05 (CSHH #16)			HEM-O-06 (CSHH #17)	
August 20, 2021		Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Mid	Bottom	Surface	Bottom
	Sample Depth (m)*	0.50	3.25	0.50	4.59	0.50	3.98	0.50	8.24	0.50	5.14	9.77	0.50	7.57
	Temperature (°C)	24.05	23.73	24.11	23.69	24.06	23.80	23.86	23.54	23.57	23.54	23.53	23.83	23.75
	Salinity (ppt)	26.27	26.66	26.31	26.78	26.25	26.76	26.89	26.93	26.92	26.90	26.90	26.82	26.87
	Dissolved Oxygen (%)	53.40	42.90	65.60	47.20	87.00	70.30	70.10	50.10	70.70	62.40	63.90	84.00	67.30
	Dissolved Oxygen (mg/L)	3.88	3.12	4.73	3.41	6.31	5.07	5.08	3.63	5.16	4.55	4.65	6.05	4.89
	Turbidity (NTU)	2.40	3.23	1.98	2.60	1.82	1.64	1.14	1.52	0.95	0.89	1.36	1.86	3.21
	Chlorophyll a (ug/L)	30.21	18.75	30.00	18.48	45.38	16.76	32.56	14.80	14.21	19.02	16.08	17.70	18.13
	Post-Corrected Chl a (ug/L)**	13.98	8.63	13.89	8.50	21.07	7.70	15.08	6.78	6.51	8.76	7.38	8.14	8.34

2021 UWS Monitoring Data

August 31, 2021	**Location**	**HEM-M-01 (CSHH #1)**		**HEM-M-02**		**HEM-M-03 (CSHH #3)**		**HEM-O-04 (CSHH #2)**		**HEM-O-05 (CSHH #16)**			**HEM-O-06 (CSHH #17)**	
		Surface	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Mid**	**Bottom**	**Surface**	**Bottom**
	Sample Depth (m)*	0.50	4.47	0.50	5.79	0.50	4.94	0.50	7.86	0.50	5.37	10.23	0.50	7.76
	Temperature (°C)	24.27	23.92	24.41	24.05	24.74	24.18	24.21	24.49	24.05	24.09	23.33	24.57	23.27
	Salinity (ppt)	25.15	25.84	25.43	23.73	25.03	25.58	25.67	25.98	25.71	25.94	26.28	25.84	26.47
	Dissolved Oxygen (%)	79.50	64.60	90.60	81.40	96.30	85.50	90.40	99.40	93.60	68.80	65.30	109.80	83.60
	Dissolved Oxygen (mg/L)	5.77	4.65	6.50	5.87	6.93	6.20	6.54	7.14	6.77	5.03	4.78	7.89	6.13
	Turbidity (NTU)	1.95	2.05	1.85	1.58	2.04	1.89	1.53	1.48	1.03	1.43	2.16	2.82	3.46
	Chlorophyll-*a* (ug/L)	60.81	43.22	57.41	53.04	86.53	46.04	41.50	50.64	32.03	39.60	12.35	59.73	11.89
	Post-Corrected Chl-*a* (ug/L)**	33.15	23.55	31.29	28.91	47.18	25.09	22.61	27.60	17.44	21.57	6.70	32.56	6.45

September 14, 2021	**Location**	**HEM-M-01 (CSHH #1)**		**HEM-M-02**		**HEM-M-03 (CSHH #3)**		**HEM-O-04 (CSHH #2)**		**HEM-O-05 (CSHH #16)**			**HEM-O-06 (CSHH #17)**	
		Surface	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Mid**	**Bottom**	**Surface**	**Bottom**
	Sample Depth (m)*	0.50	4.55	0.50	5.87	0.50	4.89	0.50	7.80	0.50	5.36	10.21	0.50	7.82
	Temperature (°C)	23.06	23.15	23.01	23.18	23.04	23.09	23.06	23.00	22.91	22.86	22.84	22.96	23.00
	Salinity (ppt)	24.83	25.10	24.96	25.34	24.57	25.38	25.50	25.56	25.54	25.67	25.78	25.66	25.76
	Dissolved Oxygen (%)	96.20	91.50	101.40	102.60	101.60	105.10	105.30	103.50	106.40	84.40	89.20	95.60	92.70
	Dissolved Oxygen (mg/L)	7.19	6.82	7.59	7.64	7.61	7.86	7.86	7.72	7.95	6.32	6.67	7.13	6.91
	Turbidity (NTU)	2.32	2.86	1.97	2.08	2.04	1.71	1.28	1.95	1.24	1.33	2.30	2.11	1.47
	Chlorophyll a (ug/L)	48.97	53.45	52.00	50.07	48.79	45.08	42.74	28.88	33.01	25.63	20.04	22.88	22.95
	Post-Corrected Chl a (ug/L)**	29.44	32.11	31.25	30.09	29.33	27.11	25.72	17.44	19.91	15.50	12.16	13.86	13.90

2021 UWS Monitoring Data

September 28, 2021	Location	HEM-M-01 (CSHH #1)		HEM-M-02		HEM-M-03 (CSHH #3)		HEM-O-04 (CSHH #2)		HEM-O-05 (CSHH #16)		HEM-O-06 (CSHH #17)	
		Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
	Sample Depth (m)*	0.50	3.88	0.50	5.40	0.50	3.93	0.50	8.09	0.50	9.13	—	—
	Temperature (°C)	21.55	22.13	21.58	22.07	21.76	22.05	21.90	21.81	22.17	22.19	—	—
	Salinity (ppt)	24.71	25.40	24.94	25.55	24.86	25.77	25.60	25.80	25.97	25.99	—	—
	Dissolved Oxygen (%)	102.40	104.90	110.90	112.10	121.50	121.40	125.60	109.30	103.10	101.10	—	—
	Dissolved Oxygen (mg/L)	7.83	7.91	8.48	8.43	9.23	9.14	9.60	8.25	7.72	7.58	—	—
	Turbidity (NTU)	3.16	2.44	2.08	2.77	2.34	2.10	1.73	1.83	1.08	1.11	—	—
	Chlorophyll a (ug/L)	31.29	44.31	36.90	43.02	68.08	53.21	54.91	33.95	20.40	23.82	—	—
	Post-Corrected Chl a (ug/L)**	17.34	25.20	20.72	24.42	39.56	30.58	31.61	18.94	10.76	12.82	—	—

October 15, 2021	Location	HEM-M-01 (CSHH #1)		HEM-M-02		HEM-M-03 (CSHH #3)		HEM-O-04 (CSHH #2)		HEM-O-05 (CSHH #16)			HEM-O-06 (CSHH #17)	
		Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Mid	Bottom	Surface	Bottom
	Sample Depth (m)*	0.50	4.84	0.50	6.18	0.50	5.32	0.50	8.79	0.50	5.67	10.83	0.50	7.86
	Temperature (°C)	20.17	20.44	20.33	20.39	20.39	20.34	20.33	20.32	20.23	20.27	20.26	20.19	20.19
	Salinity (ppt)	25.50	26.00	25.56	25.89	25.57	25.80	25.78	25.82	25.86	25.88	26.05	25.89	25.90
	Dissolved Oxygen (%)	101.40	98.90	105.10	104.20	111.20	116.00	100.40	96.40	92.20	87.20	88.20	95.80	92.20
	Dissolved Oxygen (mg/L)	7.89	7.66	8.17	8.07	8.70	9.01	7.80	7.49	7.16	6.77	6.84	7.44	7.18
	Turbidity (NTU)	1.40	1.68	1.50	1.02	1.39	1.06	0.51	0.42	0.58	0.98	0.98	0.62	0.85
	Chlorophyll a (ug/L)	37.53	45.45	39.03	31.05	46.00	30.18	16.09	18.77	9.25	9.61	7.74	9.15	9.32
	Post-Corrected Chl a (ug/L)**	19.05	23.14	19.82	15.70	23.42	15.25	7.96	9.35	4.43	4.61	3.64	4.37	4.46

2021 UWS Monitoring Data

	Location	HEM-M-01 (CSHH #1)		HEM-M-02		HEM-M-03 (CSHH #3)		HEM-O-04 (CSHH #2)		HEM-O-05 (CSHH #16)		HEM-O-06 (CSHH #17)	
		Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
October 25, 2021	Sample Depth (m)*	0.50	2.73	0.50	4.15	0.50	3.81	0.50	7.47	0.50	9.29	0.50	6.44
	Temperature (°C)	16.60	16.59	16.75	17.52	16.99	17.51	17.36	17.50	17.49	17.84	17.71	17.82
	Salinity (ppt)	24.60	24.65	25.00	25.91	23.92	26.00	25.94	26.03	26.00	26.22	26.15	26.26
	Dissolved Oxygen (%)	75.10	60.60	76.40	80.20	88.00	85.40	92.00	90.00	93.00	93.60	95.70	92.10
	Dissolved Oxygen (mg/L)	6.27	5.11	6.42	6.61	7.38	7.02	7.59	7.40	7.65	7.64	7.83	7.50
	Turbidity (NTU)	3.02	2.78	3.75	3.06	1.62	1.63	1.12	1.52	1.16	1.65	1.52	1.97
	Chlorophyll a (ug/L)	12.79	15.33	17.20	10.06	12.51	6.57	9.30	7.30	10.40	16.36	7.96	6.87
	Post-Corrected Chl a (ug/L)**	6.53	7.84	8.80	5.13	6.39	3.33	4.74	3.71	5.30	8.37	4.05	3.49

Appendix G

Hempstead Harbor Water-Quality Monitoring
2021 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.

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 2021 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 Standard Operating Procedures (SOP) (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. 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 QA 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 (surface), and water temperature (bottom), 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 24 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:

$$RPD = \frac{\left| Conc(p) - Conc(d) \right|}{(1/2)\,(Conc(p) + Conc(d))} * 100$$

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 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%	4	7/21 (33%) 8/18 (21%), 8/25 (22%), 9/3 (22%)
Dissolved Oxygen (bottom)	20%	0	N/A
pH (surface)	5%	0	N/A
pH (bottom)	5%	0	N/A
Turbidity (top)	20%	3**	6/2 (29%), 6/16 (33%), 10/13 (33%)
Turbidity (bottom)	20%	9**	6/2 (40%), 6/9 (28%), 6/30 (22%), 7/7 (21%), 8/11 (21%), 8/18 (34%), 8/25 (20%), 9/3 (29%), 10/6 (21%)
Depth	20%	0	N/A

*No duplicate profile on 9/29/21

**No duplicate profile for turbidity on 10/20/21

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 bottom DO results from the Eureka Manta+ 35 to a result obtained via Winkler titration.
    - Comparing surface pH results from the Eureka Manta+ 35 to a result obtained via LaMotte wide-range color-comparator.
    - Comparing bottom 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 24 monitoring events for vertical profiles, 12 events for nitrogen grab samples, and 24 events for bacteria grab samples. 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 24 event monitoring season. This goal was met, as each station was sampled at least seven times during the sampling period.

- Data collection was evaluated for completeness for vertical profiles at stations #1-3, #8, #13, and #16-17 which included the following parameters: water temperature, salinity, dissolved oxygen, pH, water clarity, and turbidity. All sampling events with the exception of 9/29 (43%) 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.
    - Data collection for stations #1, #3, #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 6/23 (75%) and 7/7 (75%).

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 2021 water-quality monitoring season can be considered appropriate for use for its intended purposes.

Appendix H

Water-Monitoring Data Sheet, Core Program

Collection Date: Wed. other _______________ ___/___ /2021 **Time**: _______________

GPS Land Reference: ____ **BP:** _________ **Depth:** ______

Monitor Name: Carol DiPaolo, Mark Ring, Michelle L. McAllister, Martha Braun____________________

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)

Rainfall:			Date	Amount
	Previous 24 hrs accumulation	______in	__________	__________
	Previous 48 hrs accumulation	______in	__________	__________
	Previous week's accumulation	______in	__________	__________

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
- ☐ odors
- ☐ oil slick
- ☐ dead fish
- ☐ sea weed
- ☐ floatables
- ☐ dead crabs
- ☐ bubbles
- ☐ ice
- ☐ algal bloom
- ☐ foam
- ☐ turbidity (suspended particles)

Plankton count _________ type _________ sample taken: ☐ surface ☐ ______ below surface

Comments____
____
____
____
____
____
____
____
____
____
____
____
____

Water-Monitoring Data Sheet

Date: ___ /___ /2021

Station: CSHH #________ 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: CSHH #___________ 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: CSHH #________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
☐ Bald Eagles ____________________	____________________
☐ Cormorants ____________________	____________________
☐ Ducks, Mallards __________ ducklings ______	__________ ducklings ______
☐ Egrets, Great ____________________	____________________
☐ Snowy ____________________	____________________
☐ Geese, Canada __________ goslings ______	__________ goslings ______
☐ Brandt ____________________	____________________
☐ Hooded Gulls ____________________	____________________
☐ Herons, Blue ____________________	____________________
☐ Black-Crowned Night ______________	____________________
☐ Green ____________________	____________________
☐ Belted Kingfisher ________________	____________________
☐ Ospreys __________ chicks ______	__________ chicks ______
☐ Plover-type, Killdeer ______________	____________________
☐ Swans, mute __________ cygnets ______	__________ cygnets ______
☐ Terns ____________________	____________________
☐ Other ____________________	____________________

Jellyfish

☐ Comb, Sea Walnuts ______________________________

    ☐ Sea Gooseberries ______________________________

☐ Lion’s Mane ______________________________

☐ Moon ______________________________

Fish

☐ Baitfish ______________________________

☐ Blue ______________________________

☐ Bunker ______________________________

☐ Striped Bass ______________________________

☐ Small Shrimp ______________________________

Crabs

☐ Asian shore ______________________________

☐ Blue-claw ______________________________

☐ Horseshoe ______________________________

Other Wildlife

____

Human Activities

☐ Barges/tugs, Pt. W gravel op.________ Gladsky ______________ Raison______________ DiNapoli ______________

Global Fuel ______________________________

☐ 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 ______________

☐ Styrofoam, cups _______ pieces _______ ☐ wood, boards _______ pieces ______ other ______________

☐ 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	2101H17	21c21070172	21B100108
Expiration	7/31/22	3/31/22	8/3/22

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	0276503	0128507
Expiration	10/31/22	11/7/21

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

Michelle Lapinel McAllister
COLLECTOR'S NAME **DATE**

THOMAS EDWARDS, LEAD TECHNICAL DIRECTOR; CONNIE IANNUCCI, MICROBIOLOGY TECHNICAL DIRECTOR TELEPHONE (516) 572-1202 FAX (516) 572-1206

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 COVE 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.

Page 1 of 2

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-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.

VERIFICATION REVIEW
Name: **Title:** **Date:**
Comments:

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:

Company: Coalition to Save Hempstead Harbor
Address: PO Box 159
Sea Cliff, NY 11579
Email: cshh.org@gmail.com
Phone: (516) 801-6792 Fax
Requested Due Date:

Section B
Required Project Information:

Report To: Carol DiPaolo
Copy To: cshh.org@gmail.com

Purchase Order #:
Project Name: HEMPSTEAD HARBOR MONITORING
Project #:

Section C
Invoice Information:

Attention:
Company Name:
Address:
Pace Quote:
Pace Project betty.harrison@pacelabs.com
Pace Profile #: 7288

Regulatory Agency

State / Location
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

SAMPLE ID

One Character per box. (A-Z, 0-9 / , -)
Sample Ids must be unique

Requested Analysis Filtered (Y/N)

ITEM #	**SAMPLE ID**	MATRIX CODE (see valid codes to	SAMPLE TYPE (G=GRAB C=CO	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	Preservatives H2SO4	Preservatives HNO3	Preservatives HCl	Preservatives NaOH	Preservatives Na2S2O3	Preservatives Methanol	Preservatives Other	**Y/N 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				
							TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Michelle Lapinel McAllister

SIGNATURE of SAMPLER:

DATE Signed:

UWS Field Datasheet

EMBAYMENT NAME(S): Hempstead Harbor________________________ **{AMPLE DATE:**______________________

PEOPLE: ψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψψ **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 - - 21

People M. L. McAllister, E. Neice, M. Braun

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 to sample depth									
GPS N	40.			40.			40.		
GPS W	73.			73.			73.		
	bottom (0.5 m off bottom)	**mid-depth** (if total depth > 10 m)	**surface** (0.5 m below surface)	**bottom** (0.5 m off bottom)	**mid-depth** (if total depth > 10 m)	**surface** (0.5 m below surface)	**bottom** (0.5 m off bottom)	**mid-depth** (if total depth > 10 m)	**surface** (0.5 m below surface)
Sample Depth (m) add 0.13 m			0.5			0.5			0.5
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 < 1.5 m, do only mid-depth.

data entry ______________ person checking ______________

Embayment Name	Hempstead Harbor
Sample Date	- - 21
People	M. L. McAllister, 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 to sample depth										
GPS N	40.			40.			40.		40.	
GPS W	73.			73.			73.		73.	
	bottom (0.5 m off bottom)	**mid-depth** (if total depth > 10 m)	**surface** (0.5 m below surface)	**bottom** (0.5 m off bottom)	**mid-depth** (if total depth > 10 m)	**surface** (0.5 m 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			0.5			0.5		0.5		0.5
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 < 1.5 m, do only mid-depth.

Chlorophyll Reference Check in Bucket (do once per day per embayment) **sonde reading**

date & time	Vol Filt. 60 mL-->	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) ____

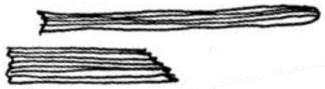
____

GPS location (in decimal degrees) __________________________N __________________________W

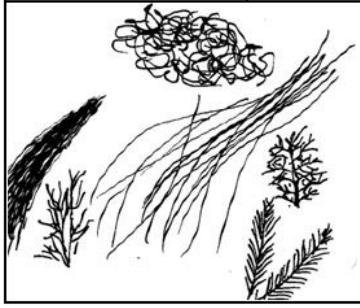
For rake toss, complete 6 tosses. For soft shoreline, provide an overview photo and close-up photos of algae types. Remember to include something for a size reference in soft shoreline close-up photos (shoe, keys, ruler, etc.).

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

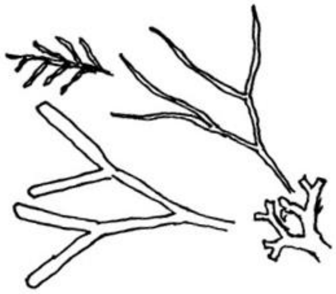


marsh grass
- no drawing, look at land plants along shore for comparison



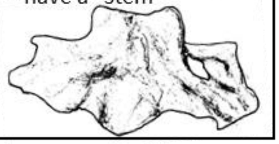
hair-like
- most of algae is the width of a hair
- may be slimy or dry
- may be tangled or straight
- *most lose shape when removed from water, but not all*

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"



prepared by

COALITION TO SAVE HEMPSTEAD HARBOR
EST. 1986

Report printed on recycled paper.