Hempstead Harbor Protection Committee

Long Island, New York

2016 Water-Quality Report Hempstead Harbor

2016 Water-Quality Report
(Full Report, Including Appendices)

prepared by

Coalition to Save Hempstead Harbor

FUSS & O'NEILL

Cover photos, left to right:
Humpback Whale—Erik Paterson;
Cownose Rays—Elaine Neice;
Humpback Whale—Erik Paterson;
(large background photo) Horseshoe Crab Shells—Sebastian Li

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Acknowledgments

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- US Environmental Protection Agency, Long Island Sound Study Office
- The United Civic Council of Glen Head and Glenwood Landing

HHPC Executive Director Eric Swenson, CSHH President Karen Papasergiou, and HHPC Chairman Tom Powell at the 2015 Long Island Sound Futures Fund awards ceremony (photo by Carol DiPaolo, 11/12/15)

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). 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 monitoring groups and agencies 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 (HHPC) (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), 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.)

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

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

Program Initiation

By 1990, there had been a history of chronic sewage spills from the failing wastewater treatment plants that were sited along Hempstead Harbor. 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. At the start, Hempstead Harbor's water-quality monitoring program, therefore, included dissolved oxygen as a critical monitoring parameter (among others).

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 restoration and construction work: coir banks for stream from upper pond (l) and new stormwater basin for country club cottages(r) (photos by Carol DiPaolo, 3/11/14)

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.

Winter view of Scudder's Pond, post-restoration (photo by Carol DiPaolo, 2/3/16)

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 will help us to understand what happens to bacteria levels during cold winter months as well as to examine changes in bacteria levels as construction work at the pond proceeded and following the completion of the restoration in June 2014. Although the final winter monitoring for Scudder's Pond ended with the 2015 program (in April 2016), samples were collected periodically to check on conditions as we continued winter monitoring of the powerhouse outfall.

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

Municipal Watershed-Based Management

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

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

CSHH and HHPC Profiles and Activities

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

CSHH

CSHH's mission, to identify and eliminate environmental threats to Hempstead Harbor and surrounding communities, is longstanding. When CSHH first formed in 1986, it was in response to reports of continued degradation of Hempstead Harbor on a number of fronts. CSHH joined with other community members and successfully prevented a new 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.)

In 1996, CSHH initiated the creation of the **Water-Monitoring Work Group**, a soundwide network of environmental agencies and nonprofits connected with water-monitoring programs around Long Island Sound. The 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. The soundwide network established as a result of the work group remains an important resource to determine the location and extent of various water conditions around the sound.

In 1998, CSHH published ***Hempstead Harbor: Its History, Ecology, and Environmental Challenges***. The book supports the goals of the water-monitoring program in encouraging community members to learn about Hempstead Harbor as an important 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 (as well as the economy) of surrounding communities.

In 2000, CSHH became a partner in **EPA's Environmental Monitoring for Public Awareness and Community Tracking** (EMPACT) program. CSHH worked with the Marine Sciences Department of the University of Connecticut to maintain a telemetry link at the EMPACT Web site at www.MYSound.uconn.edu, so that water-quality data from Hempstead Harbor could be viewed on the Web. The Town of Oyster Bay became an important partner in this project, having contributed the stationary probe and use of a boat and staff to assist with probe maintenance. In 2005, logistical problems and lack of funding to purchase and maintain necessary new equipment prevented the continuation of this program.

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.

More recently, CSHH has served on review committees for restoration-plan proposals such as the Scudder's Pond Restoration Program and Glenwood Road/Powerhouse Drain Stormwater Pollution Abatement Plan. In 2009, CSHH initiated a work group of local community organizations to focus on development of a townwide land-preservation plan. The work group considered various land-use planning vehicles. It also considered a proposal to review the Town of Oyster Bay's Groundwater and Open Space Protection Plan (2006) in light of current local land-use and harbor preservation efforts. A first step toward a broader land-use preservation plan is 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, which was charged with addressing climate change and ways to measure the impacts on Long Island Sound. (This was part of a bistate–New York and Connecticut–approach to understanding climate-change indicators for Long Island Sound and selecting appropriate sites to measure them. In 2011, the *Sentinel Monitoring for Climate Change in the Long Island Sound Estuarine and Coastal Ecosystems of New York and Connecticut* was completed; in 2013 a pilot program was implemented to monitor key climate change indices (sentinels) at locations within Long Island Sound and evolved into the current Climate Change and Sentinel Monitoring Program.)

In April 2011, CSHH organized an emergency cleanup of plastic disks that were 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. Throughout the rest of the season, disks continued to wash up on Hempstead Harbor beaches as well as along the shores of other bays around Long Island Sound. In September 2013, CSHH coordinated local activities as part of the International Coastal Cleanup, as it has for all but two years since 1992.

Volunteers at the International Coastal Cleanup at Tappen Beach (photos by Carol DiPaolo, 9/17/16)

CSHH continues to work with other environmental groups and agencies around Hempstead Harbor and Long Island Sound. For example, in November 2011, CSHH helped to scope out the density of blue mussels at a site in Hempstead Harbor; the site had been used as part of the National Status and Trends Mussel Watch program since 1986 (a project sponsored by the National Oceanic and Atmospheric Administration (NOAA)). In March 2012, CSHH was asked to scope out the density of ribbed mussels in Hempstead Harbor as part of another NOAA project.

CSHH has also participated on advisory committees that have been created to develop local revitalization plans for harbor communities. CSHH served as a member of the Glen Cove Creek Reclamation Committee, Glenwood Landing Steering Committee, the Roslyn Waterfront Committee, the Glen Cove Waterfront Citizens' Planning Committee, and the Glen Cove Master Plan Task Force, among others.

In 2013, CSHH and HHPC were 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 selected to have the first embayment report cards to serve as pilot projects to help launch the larger, soundwide report-card system. Both harbors were selected because of their longstanding and credible water-quality monitoring programs and availability of the necessary water-quality data. The project, developed by scientists from the University of Maryland and funded by a 2013 Long Island Sound Futures Fund grant award, was completed in 2015.

In 2016, CSHH was asked to participate 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 an embayment report card can be developed comparing conditions around Long Island Sound. Trial testing for the UWS began during the 2016 regular monitoring season.

CSHH's programs and activities are supported by special fund-raising events, member contributions, and grants–including those awarded from EPA's Long Island Sound Office, Long Island Sound Study, NY Sea Grant, The New York Community Bank Foundation, the North Country Garden Club, the New York Community Trust, Long Island Community Foundation, and local businesses.

HHPC

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

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

HHPC's municipal members include County of Nassau, 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. These ties and cooperative effort save each municipality expenses and provide a coordinated approach to solving harbor problems and a year-round focus on harbor issues.

The HHPC prepared **the Scudder's Pond Subwatershed Plan** (2006) and has 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 for the **Powerhouse Drain 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, 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. **Ongoing educational efforts** include 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; and the installation of pet-waste stations around 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.

Section of Hempstead Harbor shoreline trail (photo by Carol DiPaolo, 5/20/15)

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 to achieve this for the remaining portions of the harbor.

For more information or to request a copy of this report contact:

Carol DiPaolo, Programs Director and
Water-Monitoring Program Coordinator
Coalition to Save Hempstead Harbor
P.O. Box 159, Sea Cliff, NY 11579
Phone: 516-801-6792
E-mail: cshh@optonline.net
www.coalitiontosavehempsteadharbor.org

Eric Swenson, Executive Director
Hempstead Harbor Protection Committee
29 Spring Street
Oyster Bay, NY 11771
Phone: 516-677-5921; Fax: 516-677-5875
E-mail: e.swenson@hempsteadharbor.org
www.HempsteadHarbor.org

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 spills, sewage spills, toxic contamination, stormwater runoff, air pollution, and industrial discharges. The worst of these effects were noted in the mid-1980s.

Powerhouse drain at low tide adjacent to site where the brick building and power plant substation stood until 2015 (l) and view looking west at the Bar Beach sand spit (r) (photo by Carol DiPaolo, 3/3/16)

Efforts to restore the harbor resulted in the closure of a landfill, two incinerators, and a sewage treatment plant. 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 disinfection system was installed. (In 2008, Nassau County purchased the plant from the City of Glen Cove.)

The remediation of some hazardous waste sites has been completed, and remediation of others is still underway. Also, revitalization plans are being implemented for sections of the waterfront that suffered the most abuse, such as along Glen Cove Creek and the eastern shore in Glenwood Landing.



Wetland-restoration planting at Bar Beach lagoon in 2003 (l) and in 2005 (r) (photos by Kevin Braun) and view from the completed section of the shoreline trail (photo by Carol DiPaolo, 5/2/15)

Wetlands 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 trail along the western shore below the former Bar Beach was completed.

Despite the harbor's impaired condition during the 1980s, in 1987 New York State designated Hempstead Harbor a **Significant Coastal Fish and Wildlife Area**, extending from Mott Point on the west to the Glen Cove breakwater on the east at the northern section of the harbor south to the Roslyn viaduct. 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 Area was updated and extended in October 2005 to include the portion of the harbor south to the Roslyn viaduct.

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

Today, Hempstead Harbor continues to support many diverse uses and activities. Fuel is transported to the Glenwood Landing terminal (Global Partners LP) that is adjacent to a power plant that has operated since the early 1900s. Farther north, tugboats tow barges to and from a sand and gravel transfer station on the western shore of the harbor and into Glen Cove Creek, which flows from the harbor's eastern shore. In contrast to these commercial uses, the recreational uses continue to flourish and expand as the harbor's water quality improves. Marinas, yacht clubs, and fishing clubs, which are concentrated in the northern 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.

Sea Cliff boardwalk and beach, the Sea Cliff Yacht Club pier, and Garvies Point, Glen Cove (photo by Carol DiPaolo, 1/28/16)

A challenge that must be met in planning for the future of Hempstead Harbor is to balance these diverse and often competing interests. 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." Specific environmental challenges and priorities that remain for Hempstead Harbor include stormwater runoff abatement; continued improvements in water quality and reductions in bacteria 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 the full copy of this report and the electronic version compare parameters (such as rainfall and bacteria levels) that show expected correlations but also noticeable variability. The data collected over the years are a critical resource as we look for trends that point to the health of the harbor.

The story of Hempstead Harbor and Long Island Sound is a complicated one. There are many variables. Some things we can control–such as nitrogen discharges and other pollution from both point and nonpoint sources; other things we can't control–such as rainfall and temperature. However, all of these factors have critical relationships that have an impact on ecological health and survival and on human use of the waters, including swimming, fishing, and other recreational pursuits.

The data collected through the water-monitoring program help us learn about the interrelationships that occur in Hempstead Harbor. This information enables us to work with others on a harborwide and soundwide basis to discover causal effects of human activities, so that we can plan and implement best management practices to assure a healthy environment for the future.

2.1 Quality Assurance Project Plan

In 2006, a Quality Assurance Project Plan (QAPP) was prepared by the consulting engineering firm of Fuss & O'Neill, Inc., for the Hempstead Harbor Water-Monitoring Program, on behalf of the Coalition to Save Hempstead Harbor (CSHH) and the Hempstead Harbor Protection Committee. The QAPP documents the quality assurance and quality control (QA/QC) procedures implemented in the CSHH program. QAPP revisions were approved by EPA to reflect changes in the program in 2011 and 2014.

The approval of the QAPP by the US Environmental Protection Agency, Region 2, broadens the use of the program's data by additional outside organizations, enables the program to receive federal funding for future monitoring efforts, reiterates the ongoing commitment of CSHH to provide high-quality monitoring data for Hempstead Harbor, and demonstrates the reliability of the data presented in this and previous water-quality reports.

2.2 Location of Testing Stations

The principal CSHH stations that are sampled weekly during the monitoring season for all program parameters are located in the northern portion of the harbor, between the former Bar Beach sand spit (now part of the 36.2-acre North Hempstead Beach Park) and Long Island Sound, as well as stations in Glen Cove Creek. *Table 1* includes the latitude/longitude points for most of the monitoring stations.

Location of current CSHH stations along with the DEC stations that were sampled in 2009

Table 1
Latitude/Longitude Points for Monitoring Stations

Station ID	Latitude N		Longitude W	
	Degrees	Minutes	Degrees	Minutes
Upper-Harbor Stations				
CSHH #1, Beacon 11	40	49.540	73	39.120
CSHH #2, Bell 6	40	51.647	73	40.428
CSHH #3, Red channel marker	40	51.213	73	39.123
CSHH #8, Adjacent to STP outfall pipe	40	51.514	73	38.515
CSHH #9, 10 ft west of #8				
CSHH #10, 20 ft west of #8				
CSHH #11, 50 ft east of #8				
CSHH #12, 100 ft east of #8	40	51.561	73	38.430
CSHH #13, 60 ft from Mill Pond weir	40	51.706	73	38.139
CSHH #15, about 50 yds from Scudder's Pond outfall, north of Tappen Beach pool area	40	50.109	73	39.247
CSHH #15A, at Scudder's Pond outfall pipe, 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)	40	87.519	73	68.119
CSHH #17, outside Crescent Beach restricted area across from white beach house	40	53.010	73	39.010
CSHH #17A, within the restricted shellfishing area				
Lower-Harbor Stations				
CSHH #4, East of North Hempstead Beach Park (formerly Bar Beach) sand spit	40	49.688	73	39.001
CSHH #5, Mott's Cove	40	49.317	73	38.770
CSHH #6, East of Port Washington transfer station	40	48.688	73	39.080
CSHH #7, West of Bryant Landing (formerly site of oil dock)	40	48.474	73	38.923
CSHH #14, About 50 yds from powerhouse outfall	40	49.706	73	38.916
CSHH #14A, At powerhouse outfall				

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 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.

In 2009, the water-monitoring program was greatly expanded. CSHH and the NYS Department of Environmental Conservation worked together on a plan to survey mid- and lower portions of the harbor for bacteria levels relative to water-quality standards for shellfish harvesting. 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 (#1A, 14, 15, 15A, 15B). CSHH collected samples once or twice a week (depending on tidal cycles) at these points from August to early November, and the samples were delivered to the DEC lab for analysis. This component of the program was added to determine whether the opening of these areas of the harbor for shellfish harvesting would be feasible in the near future. Unfortunately, the results of this intensive sampling showed that all but two of the stations failed DEC shellfish standards on a regular basis.

Large school of bunker in Glen Cove Creek between Glen Cove ferry terminal and Brewer Marina (photo by Carol DiPaolo, 9/21/16)

Additional samples from stations #14, 15, 15A, and 15B were collected by CSHH for analysis by the Nassau County Department of Health (using water-quality standards for bathing beaches) as an alternative way to monitor discharges from the powerhouse drain and Scudder's Pond. 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 before, during, and after restoration of Scudder's Pond and will be used similarly for the powerhouse subwatershed.

In 2010, CSHH station #14A was established as an additional sampling site for the powerhouse-drain system. Samples from this station are taken directly from the large outfall at the bottom of Glenwood Road. The water samples are analyzed by the Nassau County Department of Health.

In 2015, CSHH stations #16, #17, and #17A were added to the monitoring program to further evaluate the water quality in the outer harbor.

CSHH #17A is off shore of the stream that flows alongside Crescent Beach and into Hempstead Harbor (photo by Carol DiPaolo, 10/29/15)

Upper-harbor CSHH 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 at the harbor mouth, east of Mott Point)
- CSHH #3, at the red channel marker C-1, at the mouth of Glen Cove Creek, between the Hempstead Harbor Club and Sea Cliff Beach
- CSHH #8, at the Glen Cove sewage treatment plant (STP) outfall pipe
- CSHH #9, about 10 ft west of CSHH #8
- CSHH #10, about 20 ft west of CSHH #8, at the end of the seawall
- CSHH #11, about 50 ft east of CSHH #8, at the end of the floating dock
- 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 feet from the Mill Pond weir
- CSHH #15, about 50 yds from Scudder's Pond outfall, at northwest corner of the Tappen Beach pool area
- CSHH #15A, at the Scudder's Pond outfall pipe, 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

Aerial view of Glen Cove Creek, Sea Cliff Beach (foreground), Sea Cliff Yacht Club and dock, Glen Cove marinas, and Glen Cove STP (7/08) (photo by Joel Ziev)

The five lower-harbor stations are often inaccessible during low tides and are monitored less frequently. The locations of the lower-harbor stations are as follows:

- CSHH #4, at the North Hempstead Beach Park (formerly Bar Beach) sand spit
- 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, the station farthest south in the harbor, on the east shore just before the walkway for the Sterling Glen and Horizon communities (totaling 208 senior rental units at Bryant Landing) 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 the Sterling Glen and Horizon buildings.)
- CSHH #14, about 50 yds from powerhouse outfall
- CSHH #14A, directly from the powerhouse outfall

The 19 DEC stations below that were monitored by CSHH in 2009 will not be monitored again until there are further water-quality improvements in areas of the mid- and lower harbor:

- DEC #1, same as CSHH #6
- DEC #1A, same as CSHH #7
- DEC #2, center of lower harbor
- DEC #3, pilings, near mouth of Mott's Cove and CSHH #5

- DEC #4, south of North Hempstead Beach Park (formerly Bar Beach) sand spit, near boat ramp
- DEC #5, same as CSHH #4
- DEC #6, northeast of Beacon 11, near CSHH #1
- DEC #7, near gravel pile, west shore
- DEC #8, near C-9 navigational marker
- DEC #9, south of Dock Hill/Sea Cliff Park and north of Tilley's boathouse
- DEC #10, west shore at end of private dock, in line with C-A navigational marker
- DEC #11, at C-A navigational marker
- DEC #12, same as CSHH #3, at red channel marker C-1
- DEC #13, outside of Glen Cove marina in Glen Cove Creek
- DEC #14, same as CSHH #14
- DEC #15, same as CSHH #15
- DEC #15A, same as CSHH #15A
- DEC #15B, same as CSHH #15B
- DEC STP, same as CSHH #8.

2.3 Frequency of Testing and Testing Parameters

Testing is conducted weekly for the regular monitoring season, from May through October, at each station, generally on the same day of the week and at the same time (beginning at approximately 7 AM and typically continuing for 5 hours). As part of the trial testing that was conducted in 2016 for the Unified Water Study, sampling began earlier, 6 AM, on three monitoring dates to assess variation in dissolved oxygen readings.

Beginning in 2013, weekly collection of water samples during the winter, from November through April, at CSHH #15A (outfall that drains from Scudder's Pond and Littleworth Lane, north of Tappen Pool), #15B (Scudder's Pond weir), and #14A (powerhouse outfall) was added to the monitoring program. The water samples were 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 purpose of the winter monitoring was to assess (1) changes to bacteria levels in the pond during cold weather and (2) the efficacy of the pond restoration work to reduce bacteria levels of water discharged from the pond to Hempstead Harbor. It also establishes a benchmark for future work that is anticipated for the powerhouse drain subwatershed to address similar problems of bacteria loading to Hempstead Harbor.

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 onboard testing and boat transportation to sampling sites. Water samples are collected (weather and tidal cycles permitting) from 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, #2, #3, #8, #13, #16, and #17 and every three to four weeks at CSHH #4, #5, #6, #7, #14, and #15. In 2016, nitrite, nitrate, and ammonia samples were collected weekly at CSHH #1, #2, #3, #8, and #13 and less frequently at CSHH #4, #5, #6, #7, #14, and #15 until September (when lab facilities that were used to analyze the samples were no longer available). A summary of the samples collected 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, salinity, water temperature, and pH are recorded with an electronic meter (YSI ProPlus model) at 1-meter depth increments at every station. A sample of bottom water is also tested for DO using the Winkler titration method at the first station that is monitored for the day (generally CSHH #1) as a quality-assurance check of the electronic meter. A quality assurance test is also performed for pH using a LaMotte test kit–a wide-range indicator that uses a color comparator.

Turbidity is measured with a LaMotte 2020e portable turbidity meter. Turbidity samples were taken at two depths–at a half-meter below the surface and at Secchi-disk depth–until the end of July 2016, when it was determined that turbidity should be measured at a half-meter depth only. At the same time, weekly chlorophyll a testing began, using a FluoroSense handheld fluorometer, at a half-meter depth during full surveys at CSHH #1-8 and #13, #14, #15, #16, and #17.

Water-monitoring crew members Michelle Lapinel and Mark Ring with assistance from Town of North Hempstead Constable Erik Paterson (photo by Carol DiPaolo, 8/17/16)

A LaMotte test kit is used to measure ammonia. (Previous years' test results for ammonia using both the Nessler and salicylate methods indicated that the salicylate method is more reliable for detecting ammonia in the harbor; beginning in 2012, only the salicylate method is used.) Technicians at the Town of Oyster Bay laboratory used an electronic kit (Hach) for measuring nitrite and nitrate levels.

Table 2
CSHH Monitoring–Program Parameters

Parameter	Location	Analyzer or Method	Location of Analysis
Dissolved Oxygen	Vertical profiles at 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	YSI ProPlus	Field
Dissolved Oxygen	One location for electronic meter validation	LaMotte 7414	Field
Water Temperature	Vertical profiles at 1-meter intervals at CSHH #1-8, 13,14, 15, 16, and 17	YSI ProPlus	Field
Water Temperature	One station for electronic meter validation	Calibrated Thermometer	Field
Air Temperature	One measurement at each station during monitoring	Calibrated Thermometer	Field
Salinity	Vertical profiles at 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	YSI ProPlus	Field
pH	Vertical profile at 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	YSI ProPlus	Field
pH	One station for electronic meter validation	LaMotte 2218 reagent	Field
Turbidity	Two vertical locations at 0.5 meter and Secchi depth at CSHH #1-8, 13, 14, 15, 16, and 17	LaMotte 2020e (USEPA 180.1)	Field
Clarity	CSHH #1-8, 13, 14, 15, 16, and 17	LaMotte Secchi Disk	Field
Chlorophyll a	CSHH #1-8, 13, 14, 15, 16, and 17	FluoroSense Handheld Fluorometer	Field
Ammonia	CSHH #1, 7, and 8, and other stations when the preceding tests detect ammonia	LaMotte 3304 (salicylate method)	Field
Nitrate	Grab sample at half-meter depth at CSHH #1-8, 13, 14, 15, 16, and 17	Hach 8192	Oyster Bay Town Lab
Nitrite	Grab sample at half-meter depth at CSHH #1-8, 13, 14, 15, 16, and 17	Hach 8507	Oyster Bay Town Lab
Fecal Coliform Bacteria	Grab sample half-meter depth at CSHH #1-13, 14, 15, 16, 17, and 17A and just below surface or from outfall flow at 14A, 15A, and 15B	Membrane filter	Nassau County Department of Health
Enterococci	Grab sample at half meter depth at CSHH #1-13, 14, 15, 16, 17, and 17A and just below surface or from outfall flow at 14A, 15A, and 15B	Membrane filter	Nassau County Department of Health
Precipitation	Village of Sea Cliff	Visually read rain gauge	Field

3 Monitoring Results

This section summarizes results of the CSHH sampling program. Where possible, data from the CSHH program from 1995-2015 are compared with 2016 data. *Appendices A, B, C,* and *D* include graphs and tables constructed with the data collected during this period.

3.1 Dissolved Oxygen

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

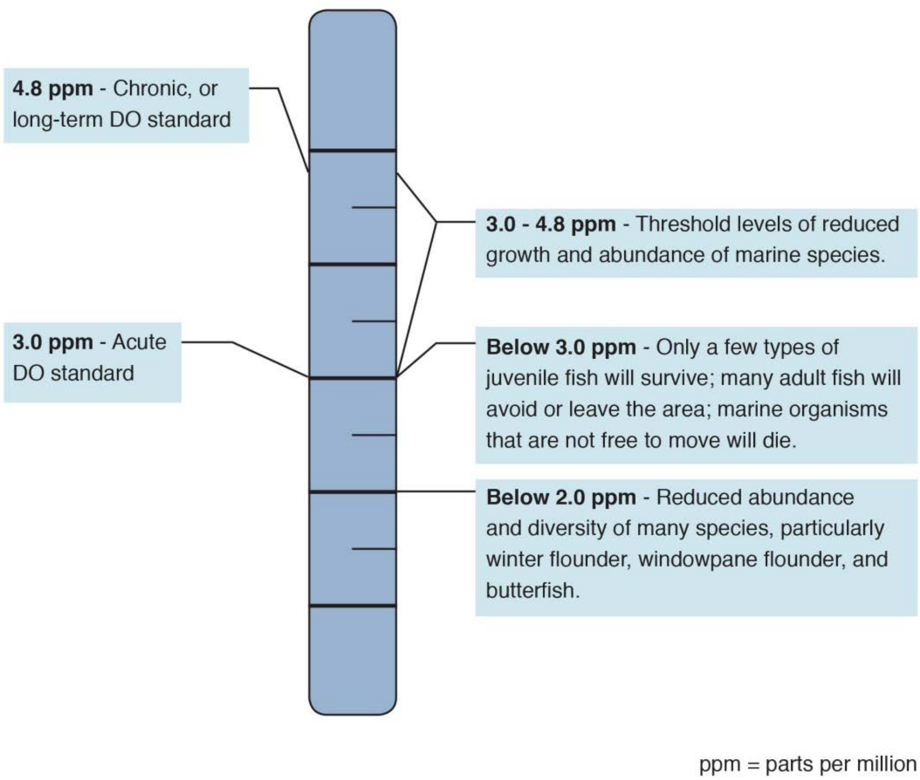
Although many algal species produce oxygen during their growth stage through photosynthesis, algal mortality and subsequent decay generally influence DO levels more strongly, especially later in the summer when more organic matter is decaying and rates of photosynthesis are declining. Therefore, productive aquatic ecosystems with larger nutrient loads are more prone to low DO levels. The impact of temperature and salinity on DO levels in these ecosystems is generally of secondary importance. Generally, as temperature and salinity increase, the dissolved oxygen concentration decreases. Because the majority of organic-matter decay occurs at the estuary bottom, DO levels tend to be higher at the surface and lower at the bottom of the water column. Density-dependent stratification, such as elevated salinity levels at the harbor bottom, inhibits mixing and exaggerates this effect.

Previously, 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.)

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

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.

Figure 1
DO Standards and Effects of Depleted DO on Marine Life



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 with abundant nutrients and organisms, such as Hempstead Harbor, dissolved oxygen levels near the surface can be oversaturated during the day (greater than 100%) due to photosynthesis by algae, and undersaturated at night (50% or lower) due to decay of dead organic matter (respiration).

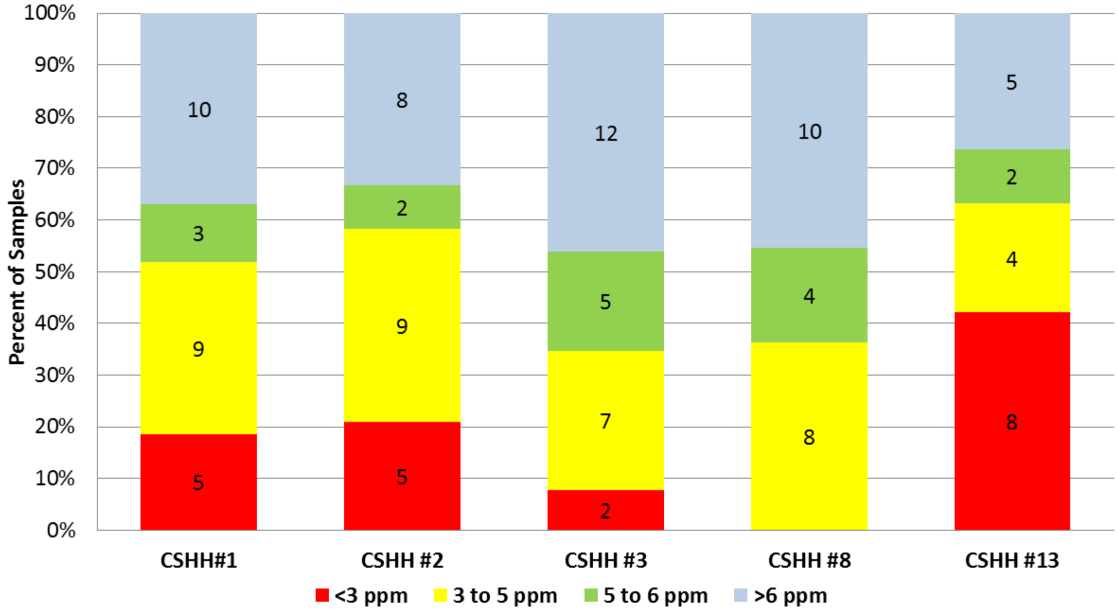
This report evaluates DO measurements collected at the bottom of Hempstead Harbor, which are considered critical because bottom-dwelling marine life have more difficulty than other marine species in trying to escape low DO conditions. Hypoxic conditions (low DO, interpreted to be less than 3.0 ppm in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

(No fish kills occurred during 2001 through 2004 despite extended periods of hypoxia. A clam kill occurred in 2005 south of Bar Beach, near CSHH #5, but this kill reportedly resulted from lunar/tidal effects and not hypoxia. A small, localized fish kill occurred in August 2006 from an unusual condition off of Morgan Beach–low DO and hydrogen sulfide produced by sulfur bacteria present in the decomposition of algal cells. No fish kills in Hempstead Harbor were observed or reported in 2007-2014. Two limited bunker kills occurred late in the season in 2015 when DO levels had increased–in October and November–and corresponded with the large bunker populations that remained in the harbor through the beginning of January 2016. Despite low DO levels during August 2016, there were no fish kills reported in Hempstead Harbor.)

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

The dissolved oxygen levels measured in 2016 at monitoring stations CSHH #1-3, #8, and #13 are summarized in the stacked bar graph in *Figure 2*. In *Figure 2*, the data are sorted into four groups based on DO concentrations; the different colors on a bar represent the percentages of samples in each DO range. The number of samples within each range for each station is also shown on the bar. The graph shows that CSHH #8 had no measured hypoxic conditions during the 2016 monitoring season, and over 50% of the measurements were above 5 ppm. In contrast, about 20% of the measurements taken at CSHH #1 and CSHH #2 were below the 3 ppm DO concentration that indicates hypoxic conditions. The similarity in results for CSHH #1 and CSHH #2 suggests that both the inner and outer harbor experience similar fluctuations in DO and periods of hypoxia. CSHH #8, near the outfall of the Glen Cove sewage treatment plant, is characterized by shallower depths and more opportunity for wind mixing and turbulence, which would encourage higher DO levels. The flow of the discharge from the plant also raises DO levels. CSHH #3, located at the red channel marker for Glen Cove Creek, also likely experiences greater mixing and therefore better conditions for DO than the deeper waters in the harbor.

Figure 2
2016 Average Bottom Dissolved Oxygen for Select Stations in Hempstead Harbor



The percentage of DO measurements with hypoxic conditions in 2016 (17% or 20 measurements) was relatively consistent with 2015 (16% or 18 measurements). Anoxic conditions (< 1 ppm) were observed for 6 readings in 2016, with two-thirds observed at CSHH #13. Review of all the DO data collected in 2016 (see *Appendix A*) shows that hypoxic and anoxic conditions were observed in July-September, consistent with periods of higher air and water temperatures when the solubility of oxygen in water decreases. The period of hypoxic and anoxic conditions may lengthen in the future based on climate projections for warmer overall air temperatures. A comparison of the number of days and months in which hypoxic conditions are observed may be a useful indicator of changing temperature conditions.

A review of the data in *Table 3* shows that at most locations average bottom DO has fluctuated between 4 ppm and 7 ppm over the period of record. 2013 is notable since average DO concentrations were greater than 6 ppm for the stations represented in the table.

Table 3
Average Monitoring–Season DO Levels in Hempstead Harbor

Average Bottom DO (ppm)	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
CSHH #1	5.02	5.66	4.83	6.42	4.46	5.64	5.55	6.09	5.50	4.99	5.76
CSHH #2	4.94	5.55	4.96	6.28	4.31	4.77	5.16	5.30	5.31	5.37	5.27
CSHH #3	5.82	6.46	5.74	7.49	5.54	6.87	6.41	6.72	6.35	6.02	6.80
CSHH #8	5.89	6.04	5.62	7.29	5.28	6.14	6.26	6.73	5.73	5.93	7.05

Average Bottom DO (ppm)	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
CSHH #16	4.94	5.58	--	--	--	--	--	--	--	--	--
CSHH #17	5.61	6.43	--	--	--	--	--	--	--	--	--

Average Bottom DO (ppm)	2005	2004	2003	2001	2000	1999	1998	1997	1996	1995
CSHH #1	4.59	5.36	4.63	5.16	5.64	5.85	5.17	4.39	5.90	4.60
CSHH #2	4.63	5.96	4.55	5.46	6.10	5.44	5.45	4.54	7.11	5.67
CSHH #3	5.09	6.17	5.21	6.47	6.54	6.32	6.48	5.15	7.45	5.26
CSHH #8	5.76	6.58	5.28	6.82	7.35	7.14	N/A	N/A	N/A	N/A

3.2 Temperature

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

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

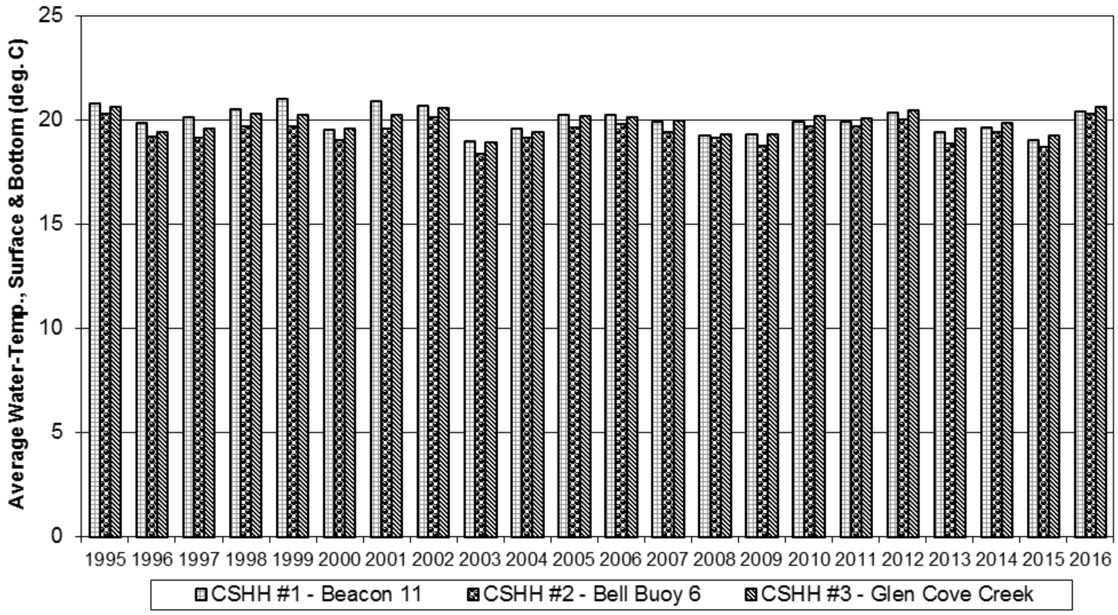
Additionally, temperature monitoring determines whether the water column is stratified or well mixed. Stratification is a naturally occurring condition whereby water at the surface is warmer while water at the bottom stays cold. Because the colder water is denser, it stays at the bottom and cannot mix 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.

Frozen Hempstead Harbor–snow-covered rocks near Tappen Beach pool and view looking north toward the outer harbor (photo by Carol DiPaolo, 2/18/15)

See *Figure 3* for average annual water temperature for each monitoring location for the period of record. Many factors affect water temperature, but it is representative more of conditions that occur over several days and is not heavily influenced by daily variation in air temperature.

Water temperatures at CSHH #2 were slightly lower than at the other monitoring locations during each year, although the temperature difference is generally less than 1ºC. CSHH #2 is located near the mouth of the harbor and is more significantly influenced by Long Island Sound's deeper and, thus, cooler water. In 2016, water temperature was warmer than in 2015. See *Appendix A* for additional air and water temperature monitoring data.

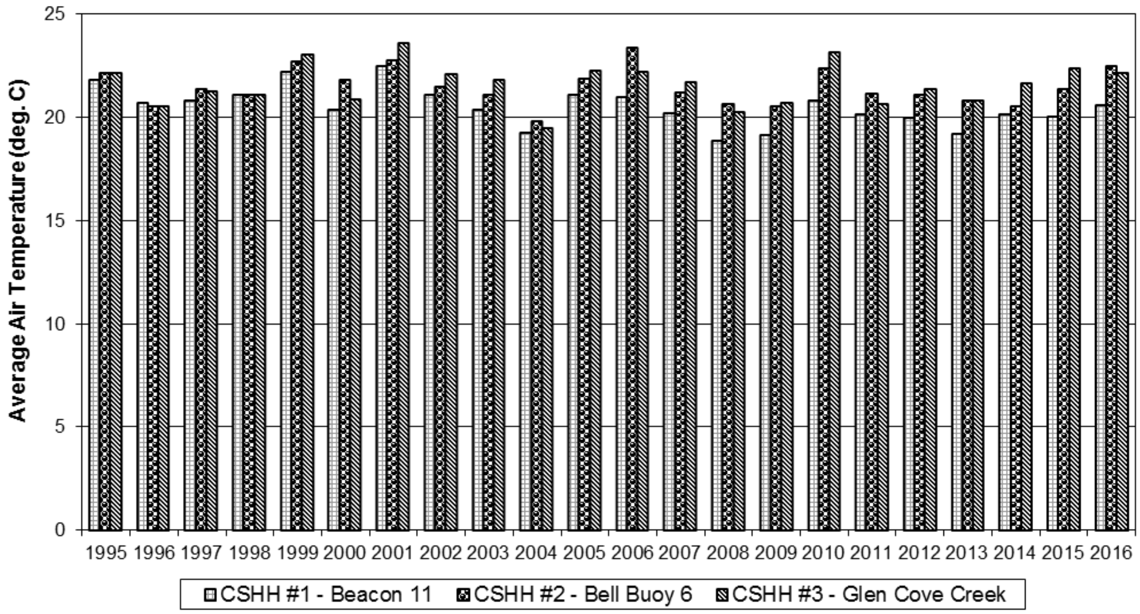
Figure 3
Average Water Temperature Recorded During Seasonal Monitoring Events



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

Figure 4 presents average monitoring-season air temperatures recorded at CSHH #1-3 for each year since 1995. Average air temperatures vary by approximately 5 degrees during the period of record. Between 1994 and 2015, the average air temperature at the three stations was approximately 21ºC. The 2004 monitoring season was the coolest on record, with an average temperature of 19.5ºC recorded at the three stations. Conversely, 1999 was, on average, the hottest at 22.7ºC. In 2016, the average air temperature at the three stations was near the average of all years and higher than in 2015 at stations CSHH #1 and #2 and slightly lower at CSHH #3, respectively.

Figure 4
Average Air Temperature Recorded During Seasonal Monitoring Events



From 2015 to 2016, water temperature increased and air temperature increased slightly if at all. However, over the long term, water temperature has remained relatively static, whereas air temperature has greater variability from year to year. No clear trend is indicated for either water temperature or air temperature in Hempstead Harbor over the last 20 years

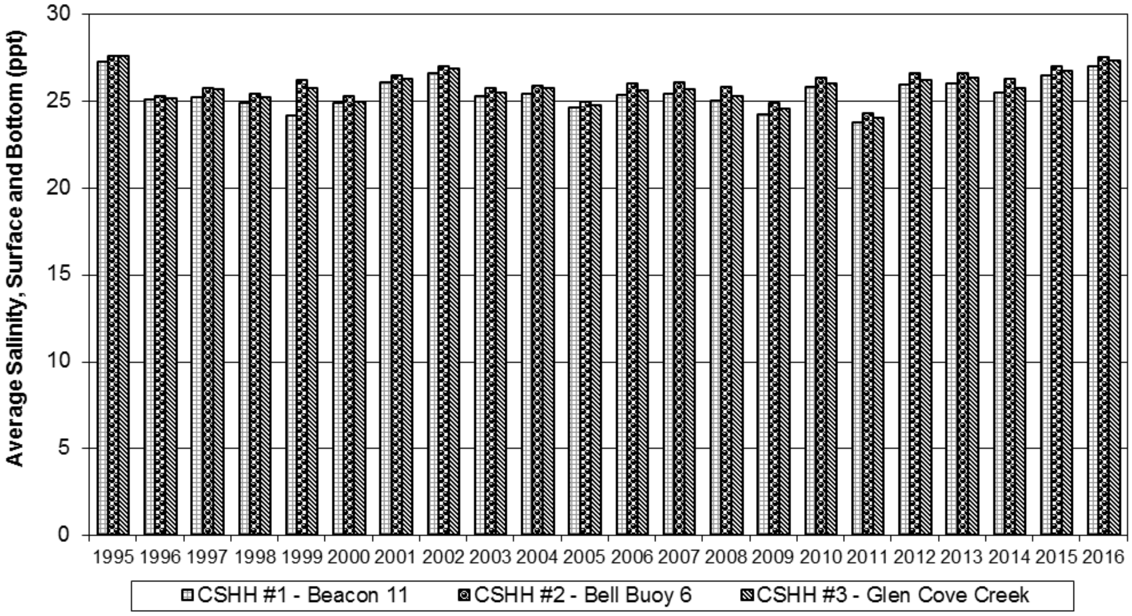
3.3 Salinity

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

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

Figure 5 presents average annual salinity levels at CSHH #1, #2, and #3 for the period of record. Salinity levels in Hempstead Harbor generally vary less than in the sound. During the 2016 testing season, salinity readings at these three stations within Hempstead Harbor range from approximately 25 ppt to 28 ppt, with lower readings generally observed in the spring and gradually increasing through the fall.

Figure 5
Measured Average Salinity in Hempstead Harbor

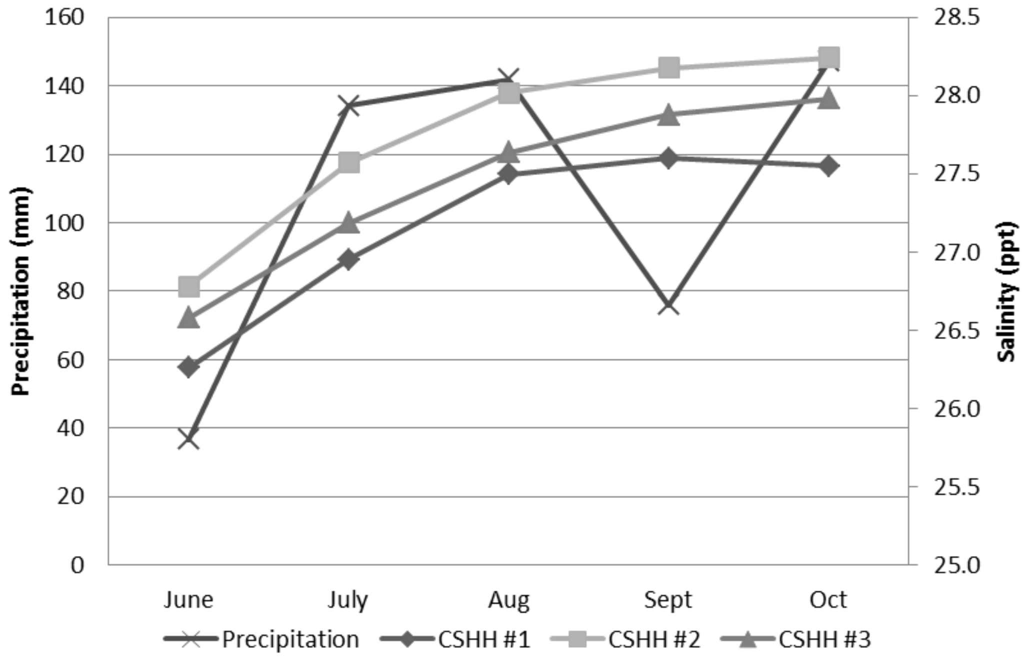


Additionally, salinity levels measured at the bottom of the harbor are generally higher than those near the surface, because high-salinity water is denser and tends to sink. Surface salinity levels are often approximately 1 ppt lower than those at the bottom, suggesting that slight stratification is occurring in the harbor.

In most years, average salinity levels within the harbor during the monitoring season were approximately 25 ppt (± 1 ppt). Average salinity levels at the three stations in 2016 (27.26 ppt) were notably higher than both the average levels recorded in the previous five years (25.81 ppt) and in all previous years of monitoring (25.66 ppt). See *Appendix A* for additional salinity data results.

The surface and bottom readings for salinity levels in June at CSHH #1-3 ranged from 25.52 ppt to 27.13 ppt, whereas readings in October for each station ranged from 27.14 ppt to 28.47 ppt–slightly higher. As shown in *Figure 6*, average salinity at CSHH #1-3 appears to increase regardless of the amount of precipitation. Although not supported by *Figure 6*, in general, there may be some effect on salinity (particularly surface salinity) in areas influenced (diluted) by stormwater discharges. The possible effects of dilution are noted at CSHH #8 (near the discharge from the sewage treatment plant) and CSHH #13 (near the large pipe that discharges a mix of stormwater and freshwater into Glen Cove Creek), where salinity measurements at the surface and 1 meter depth frequently varied significantly. Also, the most open-harbor sampling location compared in *Figure 6*, CSHH #2, consistently had the highest measured salinity levels of those shown. (Note that the three stations covered in *Figure 6* are not in the immediate vicinity of stormwater outfalls.)

Figure 6
2016 Average Monthly Salinity and Monthly Precipitation



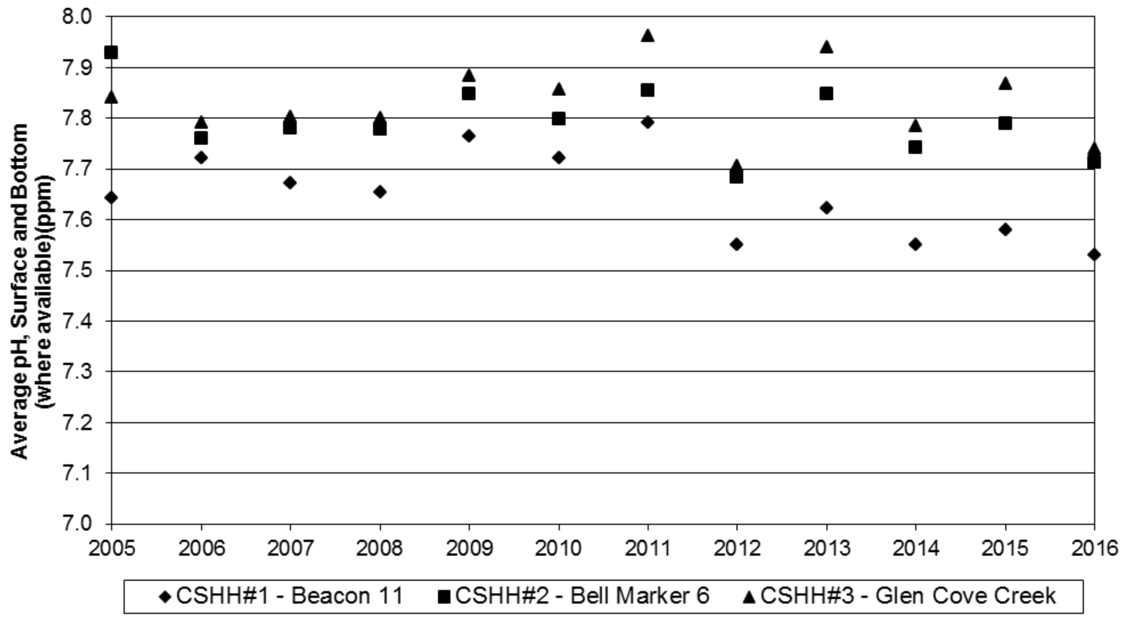
3.4 pH

Figure 7 presents averaged surface and bottom pH for CSHH #1-3 for years 2005-2016.

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

Measured average pH during the 2016 season was lower than that seen in 2015 and most of the previous eight monitoring seasons. The 2016 results appear to be most similar to those of the 2012 monitoring season. In 2016, the average pH at CSHH #1 continued to be lower than the other two stations and, of note, the lowest average of all stations since 2005.

Figure 7
Measured Average pH in Hempstead Harbor during Seasonal Monitoring Events



3.5 Turbidity/Water Clarity

In general, turbidity represents the clarity of the water. It is caused by suspended solids, dissolved organic matter, and plankton and may vary due to natural events such as tidal flux, rainfall, seasonal algae blooms, and ice melt. Human activities that cause eutrophication (excess nutrients) and sediment loading (e.g., from uncontrolled construction-site runoff) also increase turbidity.

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, and so Secchi readings are typically 1 to 2 meters for Hempstead Harbor during the summer months and from 0.25 to 3 meters during the monitoring season. For 2016, the range of Secchi readings (0.8 to 3.8 meters for CSHH #1-3) for the monitoring season indicated an improvement over typical readings and an improvement over the range of levels recorded in 2015 (0.5 to 2.7 meters). The large amount of plankton in the water gives the harbor its usual green to brown color.

3.5.2 Turbidity-Meter Measurements

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

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

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

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

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

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

Because of the previously cited significance of turbidity on the marine environment, turbidity sampling was initiated for Hempstead Harbor stations in July 2008. At each station monitored, turbidity is measured in nephelometric turbidity units (NTUs) using a LaMotte 2020e meter. (It should be noted that the results generated by the LaMotte 2020e (an EPA approved design) may be affected by color interferences from certain algal blooms.) Through July 27, 2016, turbidity samples were collected at two depths–at a half meter below the surface and at Secchi-disk depth; after that time, samples were collected and measured for turbidity at a half meter only.

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). In 2016, the turbidity ranged from 0.17 to 4.08 NTUs at the sampling depth of one-half meter (CSHH #1-3); for the preceding year, the range was 0.84 to

6.96 NTUs, and since 2008 (when turbidity monitoring began), the range has been 0.11 to 8.82 NTUs. See *Appendix A* for additional turbidity data.

3.6 Chlorophyll

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

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

Although CSHH began to collect field readings for Chl a in July 2016, the data is not complete as of the publishing of this report. The process to determine Chl a using the CSHH's FluoroSense handheld fluorometer is to record a field reading and then filter 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 and filters were collected and submitted to the program's laboratory, but, to date, the laboratory has not provided the results. The Chl a field readings are, thus, incomplete until these correlations are received and applied. The field readings have been included in *Appendix A* but should not be considered the monitoring results.

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 a marine ecosystem from the atmosphere (called fixation) and from the watershed. Nitrogen fixation is usually a smaller source of nitrogen than the watershed sources. Inputs of nitrogen from the watershed are in the form of ammonia, nitrite, or nitrate. (*Figure 8* presents a diagram of the nitrogen cycle in the water environment.)

Webb Institute on the east shore of Hempstead Harbor (photo by Carol DiPaolo, 11/6/13)

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

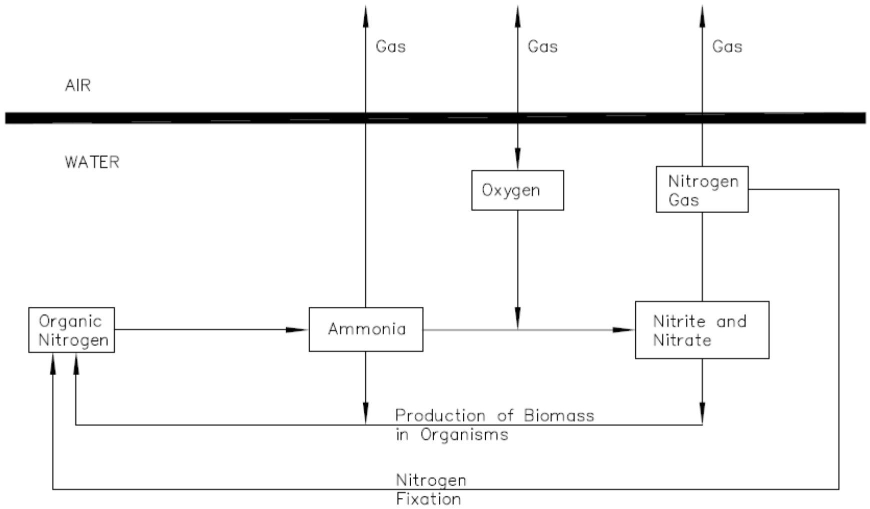
Ammonia and nitrate are important for organisms, which require nitrogen for growth and reproduction. Nitrogen forms amino acids, proteins, urea, and other compounds that are needed for life. These forms of nitrogen are referred to as organic nitrogen.

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

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, which is released to the atmosphere.

Figure 8
Nitrogen in Marine Environments

(Adapted from: Surface Water Quality Modeling, Steven Chapra, McGraw-Hill, 1997)



Sewage treatment plants can be upgraded to provide biological nutrient (nitrogen) removal. The Glen Cove 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.

3.7.2 Nitrogen Monitoring by CSHH

Through September 2016, CSHH collected samples weekly at CSHH #1, #2, #3, #8, #13, #16, and #17 and, when tidal and weather conditions allow, at CSHH #4-7, #14, and #15 to test for ammonia, nitrite, and nitrate. In 2004-2006, the samples that were sent to the town lab for analysis produced results that indicated interferences with the ammonia testing techniques from possibly the saltwater, turbidity, or water color. In 2008, September 2016, nitrite and nitrate samples continued to be analyzed at the Town of Oyster Bay lab, by Lockwood, Kessler and Bartlett, Inc., using an electronic Hach kit, but ammonia was measured in the field. Beginning in 2012, only the LaMotte testing kit for the salicylate method is used (rather than both the Nessler and salicylate methods as was used in previous years). Beginning in October 2016, nitrite and nitrate samples were no longer collected as a result of the closure of the town lab and the absence of resources for sample analysis. Ammonia testing continues to be performed in the field during monitoring season.

The presence of ***ammonia*** (***NH_3***) in the harbor can indicate nutrient enrichment. Ammonia is usually only detected when wastewater systems, including septic tanks, cesspools, and publicly owned treatment works (POTWs), are malfunctioning and discharging to the harbor. However, elevated ammonia levels can also be present in the harbor from stormwater discharges or may even indicate a large presence of fish. Typically, ammonia is measured at CSHH #1, #7, and #8. If ammonia is detected at CSHH #1, a midpoint in the harbor, ammonia levels are then measured at other locations. If ammonia is not detectable at CSHH #1, it is unlikely that ammonia will be detectable at other locations except CSHH #8 (due to the discharge from the Glen Cove STP).

As stated above, ammonia represents the end-product of protein metabolism, but what is important for water-quality concerns is whether it is 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, NH_4+, which is innocuous. The relative concentration of each form is pH and temperature dependent (and to a small extent the fraction of un-ionized ammonia is inversely related to salinity). Higher pH and temperature are associated with increased levels of the more toxic, free ammonia (NH_3). pH has the largest effect on increasing ammonia toxicity.

Nitrate (NO_3) and ***nitrite (NO_2)*** 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.

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 inputs, 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.

In 2016, ammonia was detected between June and November at various sampling locations in Hempstead Harbor. However, most of the occurrences of detectable ammonia were at CSHH #1. In past years, CSHH #8 typically had the most occurrences. In 2016, there were far more detections of ammonia during the monitoring season than in 2015: 106 at 14 monitoring stations in 2016 versus 74 at 13 stations in 2015.

Plots showing all years of nitrogen data have been prepared (see *Appendix C*). Overall, the data indicate that there is generally the same or more variability in **nitrate** results during the 2015 and 2016 monitoring seasons–3 stations with less variability, 7 with more, and 1 with the same). There was less or the same variability in **nitrite** during the 2016 monitoring season than in 2015. For all years, there was little variability in most locations in 2006-2009 and similarly significant variability in 2012-2013. Overall, nitrate is more variable than nitrite. In order to confirm any possible trends, nitrogen data should continue to be collected and analyzed with prior years' data.

3.8 Chlorine

Through 2008, CSHH's program included testing for total residual and free and available chlorine at CSHH #8 to monitor the amount of chlorine discharged from the STP into Glen

Cove Creek. However, chlorine testing ceased in June 2009, after a backup generator was installed at the STP to make the ultraviolet (UV) light disinfection system fully operational; the chlorine vats at the STP were emptied at this time. (On March 1, 2008, Nassau County purchased the plant from Glen Cove and in January 2015 United Water Long Island began operation of the plant along with other county-owned plants.)

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. However, in 2010, a power failure caused a series of system failures at the STP that resulted in a large discharge of sewage to the harbor. Another power failure on March 10, 2011, caused an estimated 89,373 gallons of untreated sewage to enter Glen Cove Creek. (See, also, *Section 3.9.3*.)

3.9 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 ***bacteria levels*** and other factors to determine whether beaches or shellfish beds require temporary or extended closures.

Tappen Beach Park and marina at eastern shore of Hempstead Harbor (7/08) (photo by Joel Ziev)

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

3.9.1 Beach-Closure Standards

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

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

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

Although coliform and enterococci are present in the human intestine and also in the intestines of warm-blooded animals and birds, 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.

3.9.2 Beach Monitoring for Bacteria Levels

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

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

However, in 2000, NCDH initiated a preemptive (or administrative) beach-closure program. This means that in addition to closing beaches based on high bacteria sample results, NCDH closes beaches as a precautionary measure following rain events that exceed a threshold level and duration of precipitation. That threshold is established at the beginning of each season based on previous sample results, but typically, the threshold is ½ inch or more of rain. Therefore, even though water quality has improved remarkably, beach closures started to increase because of the preemptive closures. In 2016, area beaches were closed as a precautionary measure on 14 days (based on threshold of ½-inch of precipitation over a 24-hour period). The dates of closure included: 5/30, 6/28, 7/2, 7/5, 7/8, 7/15, 7/26, 8/1, 8/11, 8/12, 8/20, 8/21, and 9/2. (Note that in calculating total beach-closure days 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, NCDH continues to monitor a private beach in Glen Cove, Crescent Beach, which has been closed since 2009 due to failing septic systems that are upland of the beach and that leach out bacteria to a stream that runs alongside the beach.)

Monthly average beach data is presented in *Table 4.* In addition, time series plots of bacteria-monitoring results are presented in *Appendix B.* These plots show a "snapshot" of conditions at the time of sampling. Given the inherent variability in microbial water quality, these data are most useful for determining whether certain monitoring locations have consistently higher or lower bacteria concentrations or whether a monitoring location is particularly influenced by rainfall, wind, and currents.

3.9.3 Monitoring CSHH Stations for Bacterial Levels

CSHH collects samples for bacteria analysis at 21 CSHH monitoring stations in Hempstead Harbor (14 stations on a weekly basis and others depending on weather and tidal conditions). Five of these sites (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. In 2015, 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.

Opaque flow from CSHH #10
(photo by Carol DiPaolo, 5/21/15)

Unusual discharges from some of the outfall pipes monitored in Glen Cove Creek were noted in 2004-2006 and were brought to the attention of Glen Cove city officials, NCDH, HHPC, NC Department of Public Works (DPW), and DEC. In 2006, representatives from Glen Cove, the city's consultants, and CSHH arranged a boat trip to view the discharge pipes along the creek. Also in 2006, Glen Cove received a NY Department of State grant to map and source the outfalls along both the north and south sides of the creek. As several water samples from the area continued to show high levels of fecal coliform and enterococci, further investigation was needed.

In 2007, a follow-up meeting prompted further testing by NCDPW and NCDH, but there were no definitive answers as to the source of the bacteria. In 2008, NCDPW further investigated the discharge pipes in question using a camera, and NCDH did dye testing at a possible source, but efforts by both county departments and the City of Glen Cove provided inconclusive results.

CSHH continues to monitor all of the stations in the creek and inform Glen Cove, NCDPW, NCDH, and NYS DEC of any unusual conditions. Occasionally, a white flow is observed from CSHH #10 and noted on both the CSHH data sheets and those delivered to NCDH with the bacteria samples. In 2015, NCDH further investigated possible sources of the white flow, but the source remains unknown.

Also, as mentioned previously, despite upgrades to the Glen Cove sewage treatment plant, power failures have caused system failures within the STP, resulting in sewage spills into Glen Cove Creek in June 2010 (900,000 gallons) and March 2011 (89,373 gallons). Corrective actions were taken to prevent future incidents. Also, in response to concerns about inadequate communication of sewage spills, Nassau County started an opt-in program whereby residents can request (through the county website) to be notified when sewage releases occur at county sewage treatment plants.

Other areas of concern that CSHH regularly monitors for bacteria levels are the outfalls 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 mentioned previously, these stations have been monitored since 2009 during the regular monitoring season, but were the focus of the winter monitoring conducted for the Hempstead Harbor water-monitoring program in 2013 through 2016.

Skating on Scudder's Pond (photo by Carol DiPaolo, 1/10/15)

In 2013, years of planning finally culminated in the implementation of the Scudder's Pond Subwatershed Plan (2006). The winter monitoring of CSHH #15A and #15B in 2013 was intended to help determine what happens to bacteria levels from the pond during cold winter months as well as observing levels during the construction period at the pond. Monitoring continued through 2016 to help determine whether the structural changes made to the pond help diminish stormwater runoff and are effective in decreasing bacteria loading to Hempstead Harbor. CSHH #14A was included in the winter monitoring program to address similar bacteria loading to Hempstead Harbor from the powerhouse drain subwatershed. The data from earlier monitoring of the sites has established a benchmark for comparison. See *Section 3.9.4* below.

3.9.4 Comparing Bacteria Data

Variability in bacteria concentrations from samples collected at individual beaches on a particular day is presented in the data contained in *Appendix B*. 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 coliform counts, as presented in *Appendix B* as well. 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 2016, monthly average bacteria results for enterococci at area beaches ranged from 0.25 CFU (colony forming units)/100 ml at North Hempstead Beach (north) in April to 622.72 CFU/100 ml at Sea Cliff Beach in June. (It should be noted that at Sea Cliff Beach June average is highly influenced by a single reading [6,001 CFU/100ml] that appears to be an anomaly. Excluding this reading the monthly average for June is 25.13 CFU/100ml and Crescent Beach in June becomes the highest monthly average.) Overall, in 2016, Crescent Beach had the highest average bacteria levels, whereas Tappen Beach had the lowest (see *Table 4* below; see *Appendix D* comparing previous years).

Table 4
Monthly Average for Beach Enterococci Data for 2016

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

**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.*
***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.*

The time series plots in *Appendix B* also show bacteria results for CSHH monitoring stations. In general, bacteria levels at CSHH #2, #4, #16, #17, and #17A are lower than other locations. CSHH #2, #16, and #17 are located in the outer harbor and are thus less influenced by discharges to the watershed, which are likely the largest source of bacteria to the harbor. The reason for the low levels at CSHH #4 is unclear, as it is well within the inner harbor. There were only 8-9 samples at CSHH #4, #5, #6, #7, #14, and #15, which makes seasonal evaluation using time series plots difficult.

For a few of the sampling events, concentrations of the two indicator organisms–fecal coliform and enterococci–were often noticeably different with low concentrations of one organism and high concentrations of the other (in 2016, examples include June 1 and July 27 at CSHH #3 and October 26 at CSHH #5 and #6). (This was also noted during the 2013-2015 monitoring seasons.) Although this difference in the behavior of the two indicator organisms is counterintuitive because one would expect that all indicators of fecal pollution should behave similarly, it is not uncommon. Scientific studies have found that though fecal coliform and enterococci are both used as fecal indicator organisms they are not highly correlated to each other. Both parameters indicate contamination, but the lack of correlation between the two may be related to bacteria source, the differing decay rates for the two species, and the possibility that they may have differing potential for regrowth in the watershed.

The Hempstead Harbor water-monitoring program has established levels of bacteria at various midharbor stations and stations in Glen Cove Creek during the regular season. The winter monitoring, which specifically targeted Scudder's Pond (CSHH #15A and #15B) and the powerhouse drain subwatershed (CSHH #14A) now has four years of data for comparison of bacteria levels.

The results of the analysis for winter water samples showed that the bacteria levels did not decline significantly solely as a result of the colder temperatures during the first winter season. Although there was some expectation that bacteria levels would decrease in the colder temperatures, there are factors that may have contributed to the continued higher numbers during the winter: lower temperatures and UV conditions during winter months promote slower decay and longer survival rates of the bacteria species. And while the exceedances in bacterial levels generally remained high throughout both winter and summer seasons at the powerhouse subwatershed outfall (where no improvements have been undertaken), the data indicates a significant improvement in conditions at the Scudder's Pond outfall as a result of the restoration. See *Table 5* below and the time series plots in *Appendix B.*

Table 5
Stations Exceeding Bacteria Standards–Summer and Winter Monitoring

CSHH Stations	#15A		#15B		#14A[1]	
% of CFU[2] Exceedances	FC[3]	EC[4]	FC	EC	FC	EC
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%	--[5]	--[5]
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%
Average–Summer Post-Restoration	10%	32%	14%	25%	59%	78%
Average–Winter Post-Restoration	9%	24%	16%	18%	59%	82%

[1]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.
[2]CFU: colony-forming units
[3]FC: fecal coliform
[4]EC: enterococci
[5]Only one sample collected during this period.

3.9.5 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 3.9.1* above).

In August 2007, DEC announced the release of a report on “Shellfish Pathogen TMDLs for 27 303(d)-listed Waters.” Under Section 303(d) of the federal Clean Water Act, states are required to develop plans to decrease the total maximum daily loads 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; 25 of these water bodies were included in a 2006 TMDL report, and 27, including Hempstead Harbor, were described in the 2007 report. Class SA is the highest classification given to marine and estuarine waters and is applied to waters that are considered to have ecological, social, scenic, economic, or recreational importance. Class SA waters are offered the highest level of protection and must, by law, be suitable for recreation in and on the water, fishing, aquaculture, propagation and harvesting of shellfish, and as habitat for fish and other marine life.

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

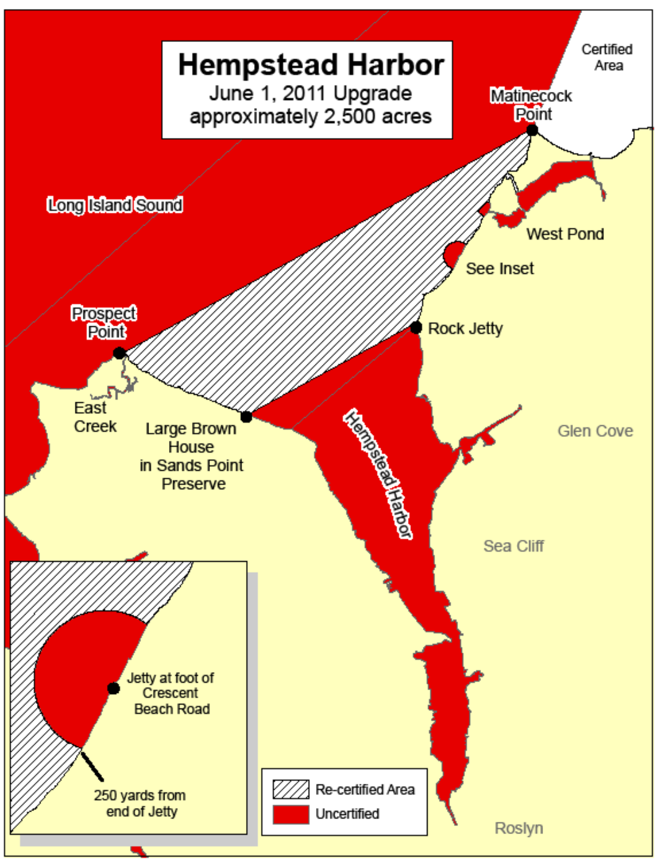
3.9.6 Monitoring Shellfish Growing Area

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; five stations were new to 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.

3.9.7 Certified Shellfish Beds in Outer Harbor

June 1, 2011, was opening day for the newly certified shellfish beds in Hempstead Harbor. After five years of rigorous water-quality testing, as well as testing of samples of hard-shell clams from the area, DEC and the NYS Department of Health determined that 2,500 acres of the outer portion of Hempstead Harbor could be reopened for shellfish harvesting year-round. For the first time in more than 40 years, clams, oysters, mussels, and scallops can 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. Additionally, a small semicircular area around Crescent Beach is closed to shellfishing. (As mentioned previously, Crescent Beach has been closed for swimming since 2009 due to high bacteria levels caused by failing septic systems that drain into a stream that runs alongside of the beach and empties into the harbor.)



NYSDEC's map of Hempstead Harbor showing the recertified and uncertified shellfishing areas

Aerial view of the Crescent Beach closure line (provided by NYSDEC, 2011)

The DEC will continue to monitor the water quality of the newly reopened shellfish area and make necessary changes to the area's classification as conditions warrant. The DEC follows a protocol for temporarily closing shellfish beds after a threshold (3 inches) and duration of rainfall, similar to that used by NCDH for closing beaches, to protect against health risks associated with high bacteria levels caused by stormwater runoff. There were no closures in 2016.

Since the opening of the shellfish beds in 2011, CSHH has visited the area during weekly water monitoring to record the number of boats harvesting clams throughout the season. In 2016, we saw about 8-17 clam boats on any of our sampling dates. Most of the clammers work the area near Matinecock Point and fewer are near Crescent Beach. We noticed clammers working the central portion of the certified beds in Hempstead Harbor more frequently than previously.

Clam boats in upper harbor (photo by Carol DiPaolo, 7/24/13)

According to an updated NYSDEC 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 (30) around Long Island, with an economic value of over $1.36 million. In 2015, the haul for hard clams from Hempstead Harbor had decreased to 9,421 bushels, with an economic value of nearly $860,000 (the fourth largest haul out of the 28 harvest areas). In 2016, the hard-clam haul for Hempstead Harbor decreased for a second year (to 4,446 bushels), but the soft-clam haul (39 bushels) and oyster haul (27 bushels) increased; this represented a total economic value of $384,439.

3.9.8 Bacteria Source Tracking

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

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

3.10 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.

CSHH collects precipitation data using a rain gauge located in Sea Cliff (note that 25.4 mm is equivalent to approximately 1 inch). *Table 6* presents monthly total precipitation for June through October 1997 through 2016.

The total precipitation that fell in June through October 2016 was 535.6 mm; the average of the rainfall totals for the previous 19 seasons is 627.9 mm. Typically, the distribution of precipitation varies from month to month. In 2016, June was the driest month (36.6 mm), whereas October was the wettest month of the monitoring season (147.1 mm).

Table 6
Monthly Rainfall Totals for the 1997-2016 Monitoring Seasons, in mm

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

4 Observations

The 2016 water-monitoring season for Hempstead Harbor began on April 20 with a reconnaissance trip to check out the condition and accessibility of monitoring stations; regular monitoring extended from May 11 through October 26. Our winter monitoring of shoreline outfalls ran from November 2, 2016, through April 26, 2017.

During all monitoring surveys, wildlife observations are noted. These observations along with information from local residents and formal fish surveys and reports help fill out the picture of the health of the harbor's habitat. Local residents help us by reporting what they see not only in and on the water, but also close to the harbor's shores. The section below offers an example of how our local fishing and wildlife reporters provide important information on conditions in Hempstead Harbor.


A 3-inch elver (juvenile eel) found in Scudder's Pond and a 15-inch black sea bass caught in an outer section of Hempstead Harbor (photo by Carol DiPaolo, 3/16/16, and Paul Boehm, 5/2/16, respectively)

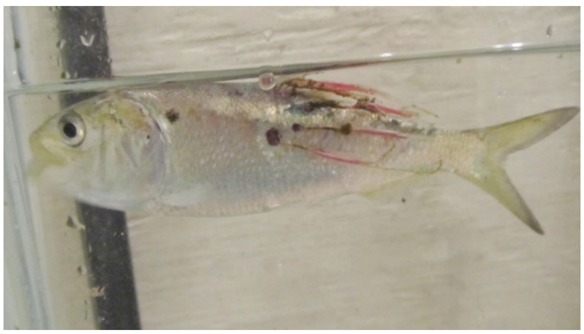
4.1 'Saladbacks'–A Local Phenomenon

In 2016, unusual conditions occurred early in the year with the large Atlantic menhaden (bunker) population. The mild 2015 autumn temperatures seemed to have kept the large population of bunker in the harbor much later than usual, and it was thought that some schools may have stayed the winter in Long Island Sound.

On an evening in December 2015, local resident and aquatic conservation biologist John Waldman first observed "mystery" fish in the dark, choppy water around the fishing pier at Tappen Beach Marina. On December 14, he managed to catch a dozen of the fish, which he described as having **"**parasitic copepods streaming off mid-flank, but a few were absolutely festooned with red algae and ulva that seem to be directly attached to the parasites." He referred to these fish as "saladbacks," and they were seen again in the same area on December 24, despite the drop in the temperature.

Prompted by John Waldman's observations, we continued to check conditions in Glen Cove Creek by the dock near the sewage treatment plant outfall, an area that also had a large bunker population in 2015. On January 4, 2016, most of the fish had left the creek, but between the bulkhead and the dock, a large number of bunker swam through the discharge of 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, just as John Waldman had described. Both groups also had parasitic copepods attached to them.

Photos and descriptions of the saladbacks were sent to a wide group of scientists, and the consensus was that this was a very weird phenomenon. CSHH arranged to meet NYSDEC 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.




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

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

> *Some of the specimens appeared normal. Others had one or more, red, tubular creatures attached to their bodies, heads, and even their mouths; a commonly seen parasite known as anchor worms. What was remarkable was that many had masses of algae growing off of the parasites' bodies.*
>
> *Back in my lab at Queens College, I found that two-thirds of the menhaden displayed anchor worms (some fish with as many as three parasites on them) and, of these, 69% had visible trailing algae, as long as twice the fish's body length. The seaweed was mainly of two kinds, a red algae that puffed out, and a green algae that trailed like a ribbon. This occurrence appears never to have been noted, based on the reactions from a number of marine scientists I showed photos to….. The fish "loses" both from the parasite feeding on it and the substantial water drag imposed by the algae; the parasite gains from feeding on the fish but is neutral concerning its serving as an algal attachment site; and the algae gains from obtaining an attachment site and, possibly, from being carried by a surface-dwelling fish that affords it sunlight for photosynthesis.*
>
> *I don't know exactly why this phenomenon occurred or if we'll ever see it again–but I can speculate. The year 2015 was unusual in two ways that may have interacted. There was extraordinary reproduction of menhaden in the northeast, including in Hempstead Harbor…; this abundance would have allowed the parasite to flourish.*

Infections by this parasite are reported to peak in September, and juvenile menhaden normally leave our harbor by late November as waters cool, but it's known from elsewhere that heavily parasitized and other aberrant individuals may not migrate at all, suffering whatever consequences befall them. El Nino brought on an extremely warm November and December which kept water temperatures far above normal through New Year's Day, which may have promoted algal growth on the parasite of a fish species that normally would have migrated elsewhere."

The bunker started to return to Hempstead Harbor in April 2016. A small number of the saladbacks were seen only in May at Tappen Marina and a few in Glen Cove Creek in early June. However, on June 27, 2016, about 65 dead juvenile bunker (about 4 inches) were in Tappen Marina following a week of brown and green algal blooms–most of the bunker had algae attached to them.

4.2 Fish-Survey Reports

4.2.1 Glenwood Power Station Entrainment and Impingement Monitoring Report

In 2015, the old powerhouse brick building was demolished, following the dismantling of the adjacent Substation 3 (in 2013) at the Glenwood Landing power plant. 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 Hempstead Harbor.

The one-year biological monitoring program that KeySpan Generation LLC was required to conduct from January 14, 2004, to January 5, 2005, found that a staggering number of fish and invertebrates were drawn into the plant's water intake. The "once-through cooling water system" to cool steam electric-generating units in the plant drew in various species of marine life that would become either trapped in the system or impinged on the intake screen. **Thirty-four types of fish and several other marine animals** were found in the samples that were collected weekly March through September and biweekly during the rest of 2004.

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). The EIS projected that the demolition of the plant would provide water-quality improvements by virtue of the elimination of the thermal discharge from the plant and 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. Also, it was 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 we are starting to see the results of this. Increased fish populations for Hempstead Harbor are noted in the following section.

4.2.2 A Study of the Striped Bass in the Marine District of New York State

Seine surveys for the NYDEC'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," which encompasses the information from the western Long Island beach-seine surveys and the Hudson River young-of-the-year striped-bass surveys.

The DEC has found that striped bass generally spend their first year of life in the lower Hudson River, but over recent years the nursery for young-of-the-year striped bass has been expanding. In spring, yearling fish can be found not only in the Hudson River, but also in bays around western Long Island. And 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 2016 catch totals for the harbor included in the table below were provided by Jesse Hornstein, Marine Biologist at the NYSDEC Bureau of Marine Resources, Diadromous Fisheries Unit. The numbers for many of the fish caught in Hempstead Harbor 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, which were not included the 2013 catch, were up to a stunning count of 203,932 in 2015 (the 2016 catch of 394 was similar to that of 2014). Other significant increases in catches in Hempstead Harbor since 2013 include those for blackfish, killifish, scup, silversides, and striped bass.

Table 7
NYSDEC Western Long Island Beach-Seine Survey–Hempstead Harbor 2016

Type	Common name	AGE*	Month						Total
			5	6	7	8	9	10	
Diadromous:	ALEWIFE	99						1	1
	HICKORY SHAD	99	1						1
	STRIPED BASS	0					1		1
	STRIPED BASS	1	4	25	19	7	4	2	61
Marine:	ATLANTIC MENHADEN	0	1	1	33	35	3	7	80
	ATLANTIC MENHADEN	1	312		1	1			314
	BAY ANCHOVY	99	1		1	2	36	139	179
	BLACK SEA BASS	99				24	4		28

Type	Common name	AGE*	Month 5	6	7	8	9	10	Total
	BLACKFISH (TAUTOG)	0				107	215	12	334
	BLACKFISH (TAUTOG)	1	23	14	8	3	3		51
	BLUEFISH	0		2	33	305	188	214	742
	BLUEFISH	1		3					3
	CUNNER	99	7	1	6				14
	FEATHER BLENNY	99					7		7
	GRUBBY SCULPIN	99	1						1
	NAKED GOBY	99		2			1		3
	NORTHERN KINGFISH	99				3	9		12
	NORTHERN PIPEFISH	99	11	5	15	15	3		49
	NORTHERN PUFFER	99			1	94	8		103
	NORTHERN SEAROBIN	99			2	1	3		6
	SCUP	99			6	300	156	2	464
	SEABOARD GOBY	99	1		1				2
	SILVERSIDE SPP.	99	3052	5442	1229	2092	4074	2231	18120
	SMALLMOUTH FLOUNDER	99	4	3					7
	SPOTTED HAKE	99	1						1
	STRIPED SEAROBIN	99			1	37	1		39
	SUMMER FLOUNDER	99		1	2				3
	WEAKFISH	99				9			9
	WHITE MULLET	99						59	59
	WINDOWPANE FLOUNDER	99	1						1
	WINTER FLOUNDER	0		3	23	3			29
	WINTER FLOUNDER	1	6	1					7
Estuarine:	KILLIFISH SPP.	99	15	76	99	222	240	155	807
Invertebrates:	CALICO (LADY) CRAB	99	9	29	17	11	17	9	92
	GREEN CRAB	99			1				1
	HORSESHOE CRAB	99	6	4	3				13
	ASIAN SHORE CRAB	99		3		1			4
	MUD CRAB	99	3	2	10	21	3		39
	SPIDER CRAB	99	17	14	87	8	2	12	140
	SEA STAR	99				1			1
		# of Hauls	6	6	6	6	6	6	36

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

4.3 Field Observations and Recreational-Fishing Reports

April

Early in the month, we received reports that dolphins and a humpback whale were seen in Long Island Sound. (On April 12, two dolphins were seen in Oyster Bay.) The whale sighting was reported on April 29 and occurred midsound between the outer section of Hempstead Harbor and the Rye/Westchester area of the sound. The season opened with what was anticipated as a repeat of the previous season's events–humpback whales visiting Hempstead Harbor.

On April 4, we received reports from NYS DEC that large numbers of Atlantic menhaden (bunker) entered the Peconic estuary from the ocean and that the schools were larger and in earlier than they were last year. On April 18, DEC reported that the bunker had crowded into the Peconic River, and some were displaying the whirling behavior noted in 2015 and later attributed to a virus. Only a few bunker were seen in Hempstead Harbor at this time, but ospreys (which had returned by late March) and gulls were seen with their bunker meals as well.

On the April 20 reconnaisance trip, we saw 7 active osprey nests and 12 ospreys. All stations were accessible, although the eastern portion of the docks in Glen Cove Creek that had been used to collect samples at the STP outfall and two adjacent outfalls further deteriorated. CSHH #11, at the eastern end of the broken-up docks, was accessible only by boat.

May

During two of the three May monitoring surveys (May 11, 19, and 25), we saw comb jellies in Hempstead Harbor–two on May 11 at CSHH #1 and many on May 25 (too numerous to count) at Tappen Marina but only five at CSHH #1. Since 2013, comb jellies have been decreasing in the harbor, possibly as a result of the increasing menhaden population since that time. As mentioned previously, while we saw increasing numbers of menhaden in Hempstead Harbor in May, we saw only a few of the "saladbacks"–bunker with algae trailing behind them.

On May 5, we received a report that two whales–one large, one small–were seen approximately one mile east of Prospect Point.

On May 19, one of our fishing reporters, Paul Boehm wrote about his catch on May 2, which included a striped bass (34 inches, 16 lbs) a black sea bass (15 inches) and a couple of spider crabs, all caught about a mile west of Webb Institute at about 6:30 pm:

Striped bass caught by Paul Boehm
(photo by Rich Boehm, 5/2/16)

> *This striper's belly was empty, but a few days later (5/7) got another striper almost a duplicate of this one (33 inches, 17 lbs) whose belly was crammed with large mantis shrimp. Also got a mess of sea robins on that day.*

In May, we saw the usual variety of birds that frequent the harbor during the spring and summer: cormorants, mallards, egrets, Canada geese, blue herons, ospreys, swans, and terns. Also, while collecting water samples at Scudder's Pond, a large snapping turtle was observed by the weir, and a red-wing blackbird was seen flying through the pond's shoreline vegetation.

June

There were five water-monitoring surveys in June (June 1, 8, 15, 22, and 29), and we observed comb jellies only at CSHH #1 on June 1 (too numerous to count). We saw a large school of juvenile menhaden (4-5 inches long) in Glen Cove Creek on June 1; a few had algae attached to them. During the same survey, we saw a fisherman reel in a sea robin and a fluke near Crescent Beach. Large schools of baitfish and bunker were observed in Glen Cove Creek on June 22, and bunker were breaking the surface in other parts of the harbor. Also, on June 22, about 65 dead bunker were in Tappen Marina following a week of noticeable brown and green algal blooms in the marina; most of the dead bunker (which were about 4 inches in length) had algae attached to them.

The usual variety of birds we see around the harbor were observed on all monitoring dates in June, and they included cormorants, mallards, egrets, and Canada geese, ospreys, swans, and terns. We noticed a large number of barn swallows in Glen Cove Creek, particularly near the ferry terminal, as was the case the previous season. A red-wing black bird was seen near the bulkhead in Glen Cove Creek. A large snapping turtle was seen near the Scudder's Pond weir.

July

Weekly monitoring surveys were conducted on July 6, 13, 20, and 27; a special survey was conducted on June 26, focusing on early morning DO levels (6-9 am) as a trial run for the planned Long Island Sound Unified Water Study for embayments. Comb jellies were observed on July 26 but only at Tappen Marina, where they were too numerous to count, and on July 27, where only three were seen at outer harbor stations.

Just as in the previous two seasons, large schools of baitfish and bunker were noticed breaking the surface of the water in July–often with larger fish under them. On July 6, there was a lot of activity with gulls working the water over large schools of baitfish and bunker. On July 8, CSHH fishing reporter Sebastian Li observed the following:

> *Looking out over the harbor as I write to you, the blues are striking fast and furious over a wide swath from 20th Ave to Sea Cliff Beach.* [Blues are] e*xploding out of the water so that you can see the entire body mid-air–it's a feeding frenzy.*

And on July 15:

> *Huge mass of bunker from 20th Avenue* [in Sea Cliff] *to Glen Cove Yacht Club. No blues striking at the moment.*

Also on monitoring dates, we saw a pipefish in Tappen Marina on July 26 and small fish breaking the surface at Scudder's Pond on July 6 and 13 along with a snapping turtle making an appearance on those dates. On July 27, we saw three fishing boats near CSHH #2, and a fisherman in one of them caught two small fluke.

The biggest news in July was the sighting of humpback whales. Stunning photos of a humpback whale seen July 21 outside of Hempstead Harbor near Execution Rock lighthouse circulated on social media. Town of North Hempstead Bay Constable Erik Paterson saw the same whale as he made his way from Hempstead Harbor to Manhasset Bay. On July 24, a humpback whale was seen inside Hempstead Harbor just north of the breakwater.

Humpback whale breaching through a school of bunker outside of Hempstead Harbor (photo by Billy Ingraham, according to online postings, 7/21/16)

The usual variety of birds we see around the harbor was observed on monitoring dates in July; they included cormorants, mallards, egrets, Canada geese, blue herons, ospreys, swans, blue herons, and a red-winged blackbird. On July 13, we saw two osprey fledglings attempt to leave their nest at the top of Beacon 11 (CSHH #1)–one made its first flight, and the other decided to linger a little longer. A peregrine falcon perched on a tall pole on July 6 near the Glenwood Landing power plant.

August

Survey dates were August 3, 17, 24, and 31; the August 10 midharbor survey was cancelled because of weather, but bacteria samples were collected at shoreline outfalls. A second of three special surveys was conducted on August 26, focusing on early morning DO levels (6-9 am) as preliminary work for the planned Long Island Sound Unified Water Study for embayments. Comb jellies were observed on August 24 at only one station (CSHH #2) and were too numerous to count; only a few were observed on August 26 (one at CSHH #1 and three at CSHH # 2).

Atlantic menhaden and small baitfish were observed in large schools throughout the harbor and in Glen Cove Creek on all August monitoring dates. Although the stage was set for a large fish kill over several weeks of August heat, low oxygen levels, and the large presence of predatory fish, we saw only a few dead bunker: three in Glen Cove Creek on August 17, six in the creek on August 24, and three in the lower harbor on August 31. (However, on August 26, an estimated 11,000 fish–juvenile and adult bunker–were reported to have died in Centerport after they entered Mill Pond and became trapped in a low oxygen area.)

Bunker finning in Hempstead Harbor at dusk (photo by Sebastian Li, 8/6/16)

On August 24, 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.

Long-claw porcelain crab (photo by Michelle Lapinel, 8/24/16)

The usual bird species we see around the harbor were observed on monitoring dates in August: cormorants, mallards, egrets, Canada geese, blue herons, ospreys, swans, and terns. However, on August 31, we observed three turkey vultures flying over the lower harbor.

September

During September monitoring dates (September 9, 14, 21, 28), no comb jellies were observed at any of the stations; none were observed on the last of the three special DO surveys conducted on September 20 as preparation for the planned 2017 Unified Water Study for Long Island Sound embayments. However, similar to conditions noted in the previous two monitoring seasons, large schools of baitfish, bluefish, and bunker were present throughout the harbor. Many of the bunker had wounds from larger predator fish (many also had copepods attached to them). On September 2, one of our fishing reporters, Sebastian Li, caught 36-inch bluefish in what he termed a “blues blitz.” On September 4 and 5, we received reports of wild action in Glen Cove Creek as bluefish came in chasing the bunker, and fisherman reeled in bluefish that were 2½ to 3 feet long.

On September 12, one of our fishing reporters, Kenny Neice, reported that he saw stingrays between the docks at Brewer Marina. There were 30-50 cownose stingrays in the brown, murky water (the water color was indicative of an algal bloom). The rays were about a foot and a half long with a very long, thin tail. NYS DEC marine biologist Jesse Hornstein later said that he saw hundreds of cownose stingrays in Jamaica Bay two weeks prior to their appearance in Hempstead Harbor. We had never seen anything like this in the harbor, although in 2013 one cownose stingray had been caught in the DEC’s August striped-bass beach-seine survey in Hempstead Harbor.

Cownose stingrays in Brewer Marina (photo by Elaine Neice, 9/12/16)

On September 17, a whale and dolphins were seen off of Matinecock Point.

The usual variety of birds were observed on monitoring dates in September; they included blue herons, cormorants, mallards, egrets, Canada geese, ospreys, swans, and terns. A lot of bird activity over the lower harbor was reported on September 14 and 17, as gulls and terns fished over large schools of small fish that were mixed in with bunker and bluefish.

Birds fishing in lower harbor (photo by Carol DiPaolo, 9/17/16)

October

During monitoring dates in October (October 5, 12, 19, and 26), the absence of comb jellies was again noted (as was the case for 2015). There were enormous schools of bunker (all sizes, peanut to adult) and baitfish present throughout the harbor as well as larger fish (bluefish and striped bass). On October 12, fishermen we met in nearby boats while conducting the monitoring survey said that the lower harbor was filled with striped bass and bluefish and that a big bluefish blitz on bunker had occurred the day before in Glen Cove Creek. While we were talking, one of the fishermen caught a short striped bass and released it. We also saw the DEC crew counting their seine haul at Tappen Beach while a fisherman reeled in two bluefish from the beach. On October 25, Sebastian Li reported:

> *Last Thursday I went down to Tappen at 8pm, and there were 30-40 people fishing from the pier to the pool. Each had at least 2 gorilla blues along with smaller sizes. Five guys fishing from the pier had 8-9 gorilla-size blues, one guy had 13. All caught mostly on popper jigs but some with bunk chunks. All in a two-hour window. I caught a 36" and two 24" bluefish from my kayak, fishing in front of Shore Road and over by the barges. The fish are everywhere. When I was at Duffy's* [bait and tackle shop], *a guy there said he caught a 54" bass off Pryibil. Now that the water is very clear, and if it's a calm day, I can see schools of bait from the deck, the small stuff, have not seen any larger bunker finning for some time now, but…* [a friend] *says he often sees them around the Tappen Marina.*

The usual variety of birds were observed on monitoring dates in September, including blue herons, cormorants, mallards, egrets, Canada geese, ospreys, swans, and terns. On October 5, we saw two kingfishers and a hawk at the head of Glen Cove Creek.

4.4 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.

Spider crabs (photo by Paul Boehm, 5/2/16)

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 some are swimmers, like the blue-claw crabs, which have back legs that are shaped like paddles. The Asian shore crab is an invasive species that started showing up around Long Island Sound in the late 1990s; it can tolerate a wide range of salinity and may be pushing out native species.


Blue-claw crabs from Hempstead Harbor (photos by Carol DiPaolo, 8/18/10)

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

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

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

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

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

Increasingly, mantis shrimp have been found in the bellies of striped bass caught by local fishermen. Paul Boehme noted on June 30, 2014:

> *The bass' stomachs are always full of mantis shrimp early in the season. In addition, I've caught fluke full of mantis shrimp, and one of the black sea bass I caught hit a plastic mantis shrimp. So the shrimp are a major, perhaps the major, forage species in the area.*

4.5 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 tail-like appendage that can be seen when they are up close to the surface. Comb jellies do not sting.

Comb jellies had usually appeared in large numbers in Hempstead Harbor in late June and through mid-October. In 2011, they were noted a little earlier in the season (in May) and were seen during monitoring dates for the last time on October 6. In 2012, we observed only a few comb jellies on each of two monitoring dates–the first on August 22 and the second and last time on September 7. The comb jellies were back in 2013 and were noted throughout the entire season. In 2014, there seemed to be a late arrival (July), fewer numbers over the season, and an early departure (no comb jellies were observed on any of the October monitoring dates). In 2015, no comb jellies were observed on monitoring dates, and in 2016, they were observed on only a few monitoring dates and at only a few monitoring stations. The large population of bunker in the harbor and around the sound may have had an impact on the comb-jelly population.

Two types of tentacled jellyfish that may be seen in the harbor are the purple-brown **lion's mane jellyfish**, with long tentacles that sting, and the round, bell-shaped **moon jellfyish** that has short tentacles around its rim that do not produce a stinging sensation**.** Moon jellies are easily identified by the four, whitish, horseshoe-shaped gonads on the top of the bell. Both types of jellyfish are usually observed earlier in the season in Hempstead Harbor. In 2013, we saw both lion’s mane jellyfish and moon jellies in Hempstead Harbor, but the lion’s mane had an orange coloring to them. Mixed among these, we saw hundreds of unfamiliar jellies that were identified as **salps**. In 2016, we didn’t see lion’s mane or moon jellyfish on monitoring dates.

Lion's mane jellyfish seen in Tappen Marina; the thin white lines visible at left are the internal structures in barrel-shaped salps (photos by Carol DiPaolo, 5/22/13)

4.6 Shellfish

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 incredible water-quality improvements that have been made in Hempstead Harbor.

Baymen with full bags of clams (l) from Hempstead Harbor and sorted clams on board (r) (photos by Carol DiPaolo, 6/1/11)

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. East Creek on the west shore near Prospect Point also remains closed. (See the map at *Section 3.9.7*.)

Falaise at Sands Point Preserve
(photo by Carol DiPaolo, 6/15/11)

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

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

In 1998, CSHH initiated the first step and worked with the Interstate Environmental Commission, DEC, Town of North Hempstead (TNH), and local baymen to conduct a **hard-clam density survey** to determine the extent and condition of the clam population; the survey showed a healthy population of hard clams. In 2004, DEC began collecting water samples in the outer portion of Hempstead Harbor, north of the Glen Cove breakwater, with good results. In 2007, DEC met with CSHH, HHPC, and Town of Oyster Bay (TOBAY) to discuss, among other things, water-sampling results and assistance with sampling from TOBAY staff. Water sampling was completed in 2008, and results were good. 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.

On September 28, 2009, DEC-Bureau of Marine Resources (BMR) in conjunction with the US Food and Drug Administration (FDA) undertook one of the remaining steps necessary toward recertification of the shellfish beds–they conducted a **hydrographic dye study** in Glen Cove Creek (see below) and Hempstead Harbor. The dye study provided information on the movement (dilution, dispersion, and time of travel) of the sewage effluent discharged by the Glen Cove STP. FDA produced a final report on the findings of the dye study in 2010. A shoreline survey of the harbor was also 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.

Hydrographic dye study in Glen Cove Creek (9/28/09) (photos by Carol DiPaolo)

Just three years after the opening of the Hempstead Harbor shellfish beds, NYSDEC reported that, for 2014, Hempstead Harbor took in the second largest number of hard clams out of all of the shellfishing areas (26) around Long Island, providing an economic benefit valued at over $1.36 million. In 2015, the number of hard clams taken commercially from Hempstead Harbor decreased, but the harbor remained a significant shellfish producer, having the fourth largest haul of hard clams out of 28 shellfishing areas around Long Island, representing an economic value of $857,409. In 2016, although the commercial hard-clam haul from Hempstead Harbor decreased again from preceding years (down to 4,446 bushels, with an economic value of $379,371), it was the sixth largest haul of hard clams out of 29 shellfish harvesting areas. Soft clams (39 bushels) and oysters (27 bushels) were also harvested in Hempstead Harbor in 2016. (See also http://www.dec.ny.gov/outdoor/36800.html for shellfish areas.)

4.6.1 Monitoring and Enforcement for Hempstead Harbor Recertified Shellfish Beds

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 count the number of boats in the area.

Concerns began to surface regarding the potential for overharvesting the area, the public's confusion over what area of the harbor had been recertified (some thought all of Hempstead Harbor had been recertified), and the difficulty of determining, from the water, exactly what area around Crescent Beach was closed to shellfishing. On June 20, 2011, a meeting coordinated by the HHPC brought all agency, municipal, and environmental representatives together to discuss, among other things:

- Jurisdiction–who can or should enforce?
- Area boundaries of shellfish beds (whether there is a need for markers)

- Regulations (hours, catch, equipment, permits, etc.) and measures that could ensure sustainability
- Communications (re: closures, etc.)
- Public education
- Interagency coordination and assistance

As a result of the meeting, signs were prepared to post along the shoreline in areas that remain uncertified, and buoy markers were placed outside of Crescent Beach to delineate the 250-yard radius around the beach that remained closed to shellfishing.

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

NYS DEC issues temporary closures of the shellfish beds (generally precautionary, following rain events of three inches or more), and releases that information through a recorded message available by phoning 631-444-0480, on its website http://www.dec.ny.gov/outdoor/7765. html, and through press releases to local media outlets. In 2014, the shellfish beds were closed twice–in May and December–following heavy rain. In 2015 and 2016, there were no temporary closures for Hempstead Harbor shellfish beds.

4.6.2 Shellfish-Seeding Projects

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

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

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

Following the opening of the shellfish beds in Hempstead Harbor in 2011, the prospect of reseeding the beds was raised as a measure of sustainability, but finding the necessary funding for such a project is problematic.

4.6.3 Surveys to Assess Survival of Seed Clams and Oysters

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

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

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

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

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

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

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

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


Blue mussels off of Village Beach Club of Sands Point (photos by Carol DiPaolo, 11/5/11)

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.


Ribbed-mussel colonies on the eastern shore of Hempstead Harbor (l) and close-up of mussels around spartina roots (photos by Carol DiPaolo, 3/30/12)

4.7 Birds

Over the last 20 years or so, we have seen a variety of birds that have become residents of or regular visitors to Hempstead Harbor. **Belted kingfishers, blue herons, cormorants, gulls, mallards, Canada geese, snowy and great egrets, ospreys, swans,** and **terns** 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. On monitoring dates in 2014-2016, red-winged blackbirds were noticed occasionally around the edges of Scudder's Pond and grassy areas on top of the bulkhead near the head of Glen Cove Creek.

Black-crowned night heron on Glen Cove Creek dock
(photo by Carol DiPaolo, 6/24/15)

Barn swallows are so common and in such large numbers around the shore and marina bulkheads that we don't report sightings of them. At the beginning of the 2010 season, however, they caught our attention as they built nests under beams in the bulkhead at Tappen Marina. There seemed to be more nests than usual, and we were able to see the tiny chicks inside. In 2014-2016, barn swallows seemed to be increasing along Glen Cove Creek.

Barn swallows at Tappen Marina on the railing of the monitoring boat (l) and on a nest under the marina bulkhead (r) (photos by Jim Moriarty, 5/16/12)

Each year we see new, young members of the harbor's duck, Canada goose, and swan populations. Although the adult Canada goose population remains high, we have seen fewer numbers of young birds over the last few years. We have also observed fewer swans than in previous years. In 2010, for example, approximately 30 swans were noted plus 11 cygnets on August 18, and 55 swans were noted in the lower harbor on October 20. In 2011-2016, we saw swans throughout the season, but generally there were not more than a dozen seen at one time or in one location around the harbor.

Observed less frequently during monitoring are **brants**, **green herons, black-crowned night herons, plover-type birds,** and **hawks** or **falcons**. Sightings of these are included in on weekly data sheets and also noted in the monthly field observations at *Section 4.3*.

A pair of Foster terns on an old piling (l) in the lower harbor and one of four sanderlings at Sea Isle (r) (photos by Jim Moriarty, 5/16/12

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.

There have been five to six osprey nests easily visible from our monitoring stations in Hempstead Harbor that have been established over more than 20 years. Since 2010, there have been some changes and increases in nesting sites. By May 2016, seven osprey nests were within easy view from monitoring stations around the harbor: (1) at Beacon 11, (2) on the large Gladsky crane, (3) on a cell tower behind the power plant, (4) on old pilings on the west shore near the cove of the former Bar Beach, (5) on a nesting platform on the western shore, (6) on another set of old pilings on the western shore, south of the platform, and (7) a private dock on the eastern shore of the lower harbor.

Since about 2004, **peregrine falcons**, a protected species, have been sighted at the Glenwood Landing power plant. On October 28, 2009, we saw a pair of falcons flying to and from a high ledge at the power plant. We did not see the falcons in 2010 or 2011 during monitoring dates, but we saw one flying by the power plant on October 10, 2012. In 2013, a special **nesting box** had been erected south of the Glenwood Landing power plant, to try to attract the falcons away from the top of the brick building that was slated for demolition. In May 2014, the falcons decided to build a nest in one of the white stacks on top of the brick building at the power plant, despite the noise and demolition work that was going on. In July 2016, a peregrine falcon was seen near the site of the old power plant. The nesting box has remained unoccupied.

Nesting box along the shoreline south of the powerplant and peregrine falcon on ledge of power plant building (photos by Carol DiPaolo, 4/28/14 and 7/23/14, respectively)

Although **red-tailed hawks** are seen often in wooded areas around Hempstead Harbor, we don't usually see them during water sampling. However, on November 3, 2010, three red-tailed hawks with striking coloration circled over the head of Glen Cove Creek and were seen in that location again on June 4 and 8, 2014.

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)

In May 2008, we had our first sighting of a **turkey vulture** flying over Glen Cove Creek. Since then, they have been seen frequently throughout the year near the eastern shore of the harbor, flying over East Hills, Greenvale, Roslyn Harbor, Mott's Cove, and Sea Cliff. In 2015, we saw turkey vultures flying over the harbor on monitoring dates in August and September; on September 25, we were amazed to see nine turkey vultures flying near the western shore of the lower harbor near CSHH #6. In August 2016, we saw three turkey vultures flying over the lower harbor.

There have been some unusual visitors over the years as well, such as the young **bald eagle** that was seen over Glen Cove and then landed on Tappen Beach in August of 2004, and the young (about 1 year old) **great horned owl** that was rescued from the water at the Glen Cove Marina in Glen Cove Creek on August 9, 2009. During 2011, there were also some unexpected visitors: on April 9, **2 northern gannets were seen on Tappen Beach; on August 28, a south polar skua (a dark, gull-like bird), showed up on Sea Cliff Beach, brought in with the hurricane winds; and in mid-December, a brown pelican was seen off of Sands Point at the Execution Rock lighthouse.**

Likely a juvenile bald eagle (photo by Sanjay Jain, 12/10/15)

Bald eagles have been moving west, and in 2015 we received several reports during the regular monitoring season that a bald eagle had been seen along the Sea Cliff shoreline. Also, a Roslyn Harbor resident saw an eagle perched in a tree on his property in December 2015; he initially identified it as a golden eagle, but it is more likely a juvenile bald eagle (it takes about four years for bald eagles to mature into their distinctive white and dark, brown-black coloration).

4.8 Diamondback Terrapins

Diamondback terrapins are the only turtle found in estuarine waters and generally grow up 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, and information about their presence in Hempstead Harbor was used to support efforts to extend Hempstead Harbor's designation as a "significant coastal fish and wildlife habitat" to include the area south of the Roslyn viaduct.

In 2006, dramatic changes occurred in the area near the viaduct with the construction of the senior communities at Bryant Landing and the start of construction for the new viaduct (which was completed in 2011). Although there were no diamondback sightings reported for the lower harbor since 2006, they have been seen in other parts of the harbor since then, particularly around Brewer's Marina and the Sea Isle sand spit.

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

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

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

4.9 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 recoded in spring and autumn. Lower Secchi-disk depths along with supersaturated DO levels are strong indicators of the presence of algal blooms. Algae absorbs more light and is present in greater quantities than other particulate material, and when it is in the growth phase it gives off oxygen. The dominant type of algae present in the harbor gives the water its color, which is typically brown or green.

In 2016, the range of Secchi depths was 0.75 to 3.8 m. In early spring, the harbor water was noticeably clear; marine biologist John Waldman observed on April 19:

> *No doubt you've noticed how extraordinarily clear LIS is this spring…. Looks positively Caribbean, dramatically better than I've ever seen it…. (It's also been noticed for the Chesapeake; several articles online about it.)*

On April 22, a Secchi-depth of 2.3 m was recorded at the Tappen Marina docks closest to the opening to the harbor. Secchi levels generally remained above 1.25 m at most stations for most of the 2016 monitoring period, with the highest Secchi levels recorded on October 12 at outer harbor stations (the highest reading was 3.8 m at the CSHH #2).

At the start of summer 2016, there were noticeable brown and green algal blooms in Hempstead Harbor. On June 27, water samples were taken from Tappen Marina, and the results showed cells of Dinophysis (which can cause a brown to rust color) and Eutreptiella spp. (a Euglenoid species of algae that causes a dark green color). (When Dinophysis cells are present in a high density, they can cause diarhhetic shellfish poisoning if shellfish taken from the affected area are ingested by humans.) Heterosigma akashiwo and Prorocentrum minimum are types of algae that also have been present in Hempstead Harbor, also can turn the water brown, and have been implicated in fish kills in many regions around the world. On July 7 and 20, the water in Tappen Marina had turned a dark green; samples taken on July 20 had a dominant presence of Eutreptiella spp., the type of algae that had been observed earlier in the season. On July 22, Sebastian Li, reported a "long band of green stretching from the gravel pits to Glen Cove Marina."


Western view of harbor (l) with long band of green water in center from an algal bloom and brown bloom in Tappen Marina (r) (photos by Sebastian Li, 7/22/16, and Carol DiPaolo, 6/24/16, respectively)

From about August 24-September 15, 2016, sections of Glen Cove Creek and Tappen Marina turned a dark, murky, brown, which was likely caused by an algal bloom. The large numbers of bunker and small baitfish present in the area seemed unaffected by the bloom.

There have been instances in previous seasons as well when algal blooms have caused unusual coloration or conditions in parts of Hempstead Harbor. One of the most dramatic appearances of a brown algal bloom in Hempstead Harbor occurred in May 2015. Decaying pollen mixed with algae cells created a mat on the water surface that some local residents had reported as "sludge."


Pollen slicks–not sludge–in Hempstead Harbor (photos by Carol DiPaolo, 5/7/15)

On May 7, 2015, a long, thick pollen slick stretched from an area just outside of Sea Cliff Beach to Hempstead Harbor Club. A water sample taken from the slick showed hardly detectable amounts of bacteria; no sewage or other spill was implicated in this event.

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

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.

Water-Monitoring Data Sheet

Collection Date : ______________________ **Time :** ______________________
Monitor Name : ______________________
Site Name : CSHH #1, Beacon 11 **Location :** Hempstead Harbor

Weather : ❑ fog/haze ❑ drizzle ❑ intermittent rain ❑ rain ❑ snow ❑ clear ❑ partly cloudy

% Clo d Cover : ❑ 0% ❑ 25% ❑ 50% ❑ 75% ❑ 100% other ________

Wind Direction : ❑ N ❑ NE ❑ NW ❑ S ❑ SE ❑ SW ❑ E ❑ W **Velocity :** ______ kt (mph)

		Date	Amount
Rainfall : Previous 24 hrs accumulation	_____.__ mm	________	________
Previous 48 hrs accumulation	_____.__ mm	________	________
Previous week's accumulation	_____.__ mm	________	________

Tidal Stage : ❑ incoming ❑ outgoing hours to high tide : ____________

Water Surface : ❑ calm ❑ ripple ❑ waves ❑ whitecaps

Water Color : ❑ normal : ❑ brown ❑ green other ________
❑ abnormal : ❑ brown ❑ green other ________

Water Observations : ❑ jelly fish ❑ dead fish ❑ dead crabs ❑ algal bloom
❑ odors ❑ sea weed ❑ bubbles ❑ foam
❑ oil slick ❑ floatables ❑ ice
❑ submerged aquatic vegetation (SAV) ❑ turbidity (suspended particles)

Comments ____
____
____
____
____

Plankton count ________ type ________ sample taken : ❑ surface ❑ below surface

Human Activities

☐ Barges/tugs, Pt. W. gravel op.__________ Gladsky__________ Raison__________
DiNapoli__________ Global/fuel__________ other__________

☐ Boats, power__________ sailboats__________ kayaks__________ crew__________

☐ 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____

Water Monitoring Data Sheet

Air Temperature : ________ **°C**

Station : **Time :** ______________ **Date:** ______________

Wind ______

Air °C ______

Depth (meters)	Temp °C	Salinity (ppt)	DO (ppm)	pH	Secchi (meters)	Nitrogen (ppm) NO_2	NO_3	NH_3
Surface								
0.5								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Station : **Time :** ______________

Wind ______

Air °C ______

Depth (meters)	Temp °C	Salinity (ppt)	DO (ppm)	pH	Secchi (meters)	Nitrogen (ppm) NO_2	NO_3	NH_3
Surface								
0.5								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Station : **Time :** ______________

Wind ______

Air °C ______

Depth (meters)	Temp °C	Salinity (ppt)	DO (ppm)	pH	Secchi (meters)	Nitrogen (ppm) NO_2	NO_3	NH_3
Surface								
0.5								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Water-Monitoring Data Sheet

Wildlife Observations

Date ____________

BIRDS

	Upper Harbor	Lower Harbor
☐ Cormorants	____________	____________
☐ Ducks, mallards	________ ducklings ______	________ ducklings ______
☐ Egrets, great	____________	____________
snowy	____________	____________
☐ Geese, Canada	________ goslings ______	________ goslings ______
brandts	____________	____________
☐ Gulls, hooded	____________	____________
☐ Herons, blue	____________	____________
night, green	____________	____________
☐ Kingfisher, belted	____________	____________
☐ Ospreys	____________	________ chicks ______
☐ Plover-type, killdeer	____________	____________
☐ Swans, mute	________ cygnets ______	________ cygnets ______
☐ Other	____________	____________

JELLIES/JELLYFISH

☐ Comb, sea walnuts: CSHH stations ☐#1_____ ☐#2_____ ☐#3_____ ☐#4_____ ☐#5_____ ☐#6____ ☐#7_____

☐#8-10_____ ☐#11____ ☐#12___ ☐#13____________

sea gooseberries: CSHH stations ☐#1_____ ☐#2_____ ☐#3_____ ☐#4_____ ☐#5_____ ☐#6____ ☐#7_____

☐#8-10_____ ☐#11____ ☐#12____ ☐#13____________

☐ Lion's mane: CSHH stations ☐#1_____ ☐#2_____ ☐#3_____ ☐#4_____ ☐#5_____ ☐#6____ ☐#7__________

☐ Moon: CSHH stations ☐#1_____ ☐#2_____ ☐#3_____ ☐#4_____ ☐#5_____ ☐#6____ ☐#7__________

FISH

☐ Baitfish ____________

☐ Blue ____________

☐ Bunker ____________

☐ Striped bass ____________

☐ Small shrimp ____________

CRABS

☐ Asian shore ____________

☐ Blue-claw ____________

☐ Horseshoe ____________

OTHER ____________

____

____

Nassau Co. DOH PHL 209 Main Street Hempstead, NY 11550	FORM NAME: □ QC □ Equip Maint □ Training □ Comp Doc □ Other	
LABORATORY SECTION □ Chemistry □ Environmental Microbiology □ Clinical Microbiology	Form. No.: Date:	Rev: 0 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
RODGER P. SILLETTI Ph.D., D (ABMM), DIRECTOR TELEPHONE (516) 572-1202 FAX (516) 572-1206

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	Enterococci	Comments
CSHH-1	10		5	BEACON ELEVEN										
CSHH-2	10		5	BELL BUOY 6										
CSHH-3	10		5	RED MARKER GLEN COVER CREEK										
CSHH-4	10		5	BAR BEACH SPIT										
CSHH-5	10		5	MOTT'S COVE										
CSHH-6	10		5	EAST OF FORMER TNH INCINERATOR										
CSHH-7	10		5	BRYANT LANDING										
CSHH-8	10		5	GLEN COVE STP										
CSHH-9			5	FIRST PIPE WEST OF STP OUTFALL										
CSHH-10			5	PIPE AT CORNER OF SEAWALL WEST OF STP OUTFALL										
CSHH-11			5	50 YARDS EAST OF STP OUTFALL										
CSHH-12			5	EAST OF STP OUTFALL BY BEND IN SEAWALL										
CSHH-13			5	60 FEET WEST OF MILL POND WEIR										

COMMENTS/REMARKS

*ESTIMATED COUNTES: ALL COUNTS ARE ABOVE UPPER ACCEPTANCE LIMIT (20-60), OR NO COUNTS WITHIN ACCEPTANCE LIMIT (20-60)
TNTC = "TOO NUMEROUS TO COUNT"

DATA ENTRY PROOFED

TEST	METHOD	CODE
Fecal Coliform/100 ml.	Membrane Filtration	SM-18-20 9222 D
Enterococci/100 ml	Membrane Filtration	EPA Method 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:

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 Date: 4/8/2011	Rev: 2 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

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-14	10			NW CORNER OF POWER PLANT ~ 50 YARDS FROM CEMENT OUTFALL										
CSHH-14A	10			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										
TRIP BLANK														

COMMENTS/REMARKS

REPORT TO: **RECREATIONAL FACILITIES**
200 COUNTY SEAT DRIVE
MINEOLA, NY 11501

***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-97, -11
Enterococci CFU/100 ml	MF-QN	EPA 1600

TEMP CONTROL: TIME RECEIVED: DATE ANALYZED:

DATE RECEIVED:

SAMPLE ACCEPTABLE: YES ☐ NO ☐ ANALYSIS SUCCESSFUL: YES ☐ NO ☐

LABORATORY ACCREDITATION NOTICE:
The results provided on this report have been produced in compliance with "NELAC" (National Environmental Laboratory Accreditation Conference) standards and relate only to the identified sample. Any deviations from the accepted "NELAC" collection requirements for non-potable samples are appropriately noted. This rpeort shall not be reproced except in full without the written approval of the laboratory. Current New York State laboratory certification status is maintained under ELAP ID #10339. **Page 1 of 2**

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

Appendix A

2016 CSHH Field-Monitoring Data
2016 Weekly Graphs for Water-Quality Parameters
2016 Turbidity and Secchi-Disk Transparency Graphs
1996-2016 Dissolved Oxygen Graphs

Coalition to Save Hempstead Harbor

FUSS & O'NEILL

2016 CSHH Field-Monitoring Data

CSHH Water-Monitoring Program 2016

Date	Water Temp (°C)			Salinity (ppt)			DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTUs) @ 0.5m	Turbidity (NTUs) @ Secchi	Chlor a	Depth (m)	Time
	Surface	Bottom	Ave	Surface	Bottom	Ave	Surface	Bottom	Surface	Bottom	Ave	(°C)	(m)			(µg/l)	(Bottom)	(AM)
CSHH #1 - Beacon 11																		
10/26/16	13.5	13.7	13.6	27.70	27.77	27.74	8.37	8.12	7.63	7.75	7.69	5.0	1.5	3.33		8	4.75	8:03
10/19/16	18.0	17.8	17.9	27.14	27.42	27.28	8.18	6.50	7.76	7.65	7.71	19.3	1.3	3.47		12	3.25	8:12
10/12/16	16.2	17.3	16.8	27.19	28.33	27.76	6.90	6.93	7.67	7.73	7.70	12.1	2.5	1.43		5	5.25	8:40
10/5/16	19.0	19.2	19.1	27.20	27.63	27.42	5.32	5.45	7.38	7.47	7.43	13.2	1.5	2.60		12	3.5	8:10
9/28/16	21.3	22.0	21.7	27.12	27.91	27.52	4.63	5.09	7.39	7.51	7.45	19.6	1.5	2.35		14	5.75	8:05
9/21/16	23.0	23.0	23.0	27.17	27.20	27.19	4.02	3.96	7.39	7.39	7.39	21.5	1.3	3.60		15	3.0	8:15
9/20/16 SP	22.7	22.7	22.7	27.38	27.38	27.38	3.91	3.94	7.48	7.46	7.47	21.6	0.8	N/A		N/A	3.5	6:55
9/14/16	23.2	23.5	23.4	27.69	28.01	27.85	5.95	4.91	7.51	7.49	7.50	23.1	1.3	2.97		28	4.75	8:00
9/9/16	23.5	23.1	23.3	27.58	28.54	28.06	4.60	3.80	7.41	7.44	7.43	27.1	1.8	1.96		N/A	4.5	7:45
8/31/16	25.4	24.5	25.0	27.51	28.10	27.81	4.79	1.74	7.42	7.21	7.32	25.3	0.8	2.96		N/A	4.25	8:45
8/26/16 SP	24.1	24.0	24.1	27.68	27.96	27.82	4.55	2.69	7.36	7.27	7.32	24.3	1.8	N/A		N/A	5.25	6:50
8/24/16	23.6	23.7	23.7	27.26	27.32	27.29	3.47	3.39	7.33	7.33	7.33	24.0	1.5	2.49		N/A	5.0	8:05
8/17/16	24.7	23.3	24.0	27.49	28.10	27.80	3.35	0.85	7.27	7.11	7.19	26.4	1.3	battery problem			3.8	8:15
8/3/16	23.4	23.3	23.4	26.72	26.84	26.78	3.49	2.65	7.24	7.21	7.23	21.0	1.4	2.93		N/A	3.2	8:06
7/27/16	24.5	23.9	24.2	27.59	27.87	27.73	5.50	4.05	7.42	7.33	7.38	23.8	1.4	2.87	3.30		4.5	8:10
7/26/16 SP	22.8	22.1	22.5	27.07	27.45	27.26	4.78	2.68	7.38	7.25	7.32	23.4	1.8	N/A	N/A		4.9	6:06
7/20/16	23.7	23.7	23.7	26.51	26.58	26.55	6.95	5.47	7.50	7.49	7.50	20.6	1.3	3.22	3.22		2.7	8:10
7/13/16	22.3	21.0	21.7	26.77	27.33	27.05	5.28	3.69	7.54	7.44	7.49	25.6	1.3	3.23	3.23		3.75	10:00
7/6/16	21.4	20.8	21.1	25.95	26.40	26.18	5.12	4.62	7.42	7.43	7.43	26.2	1.3	2.82	2.87		2.4	8:10
6/29/16	20.4	19.7	20.1	26.59	26.87	26.73	6.39	4.65	7.70	7.58	7.64	26.0	1.1	3.23	2.54		4.75	9:20
6/22/16	19.8	19.8	19.8	26.35	26.39	26.37	7.57	7.38	7.79	7.78	7.79	20.4	1.0	3.04	2.87		2.0	8:00
6/15/16	19.8	17.3	18.6	25.91	26.94	26.43	8.93	6.36	8.03	7.70	7.87	20.8	1.0	3.78	3.02		5.0	8:00
6/8/16	19.2	19.2	19.2	25.52	25.58	25.55	6.52	6.37	7.60	7.60	7.60	17.5	1.2	3.53	4.19		1.8	8:07

2016 CSHH Field-Monitoring Data

Date	Water Temp (°C)			Salinity (ppt)			DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTUs) @ 0.5m	Turbidity (NTUs) @ Secchi	Chlor a	Depth (m)	Time
	Surface	Bottom	Ave	Surface	Bottom	Ave	Surface	Bottom	Surface	Bottom	Ave	(°C)	(m)			(µg/l)	(Bottom)	(AM)
6/1/16	17.3	15.1	16.2	25.96	26.50	26.23	9.76	6.35	8.00	N/A*	8.00	19.9	1.3	2.42	2.43		5.25	8:05
5/25/16	15.3	14.9	15.1	25.41	25.86	25.64	7.22	6.76	7.50	N/A	7.50	20.1	1.5	2.32	2.62		3.0	7:55
5/19/16	13.9	12.6	13.3	25.45	26.11	25.78	9.95	8.38	7.99	7.86	7.93	15.9	1.6	1.32	1.11		4.2	8:18
5/11/16	13.3	13.2	13.3	25.29	25.33	25.31	8.47	8.67	7.72	7.72	7.72	13.0	1.4	2.03	1.88		3.0	7:55
*On 5/25 and 6/1, there were problems with the pH probe on the ProPlus; LaMotte kit used for below surface readings only.																		
**On 6/29, there were problems with the electronic thermometer for air temperature readings.																		
Red numbers indicate that the readings were unusually low or high but reflect station conditions.																		
{Date} SP	indicates special early-morning sample run for DO																	
CSHH #2 - Bell Marker 6																		
10/26/16	No survey--high wind and waves.																	
10/19/16	18.0	17.9	18.0	27.94	28.11	28.03	8.53	7.89	7.84	7.81	7.83	22.2	2.25	1.05		11	7.0	9:25
10/12/16	17.4	17.5	17.5	28.44	28.47	28.46	7.64	7.33	7.81	7.81	7.81	14.5	3.8	0.91		5	9.75	9:10
10/5/16	No survey--high wind and waves.																	
9/28/16	No survey--high wind and waves.																	
9/21/16	23.1	23.1	23.1	28.08	28.17	28.13	5.83	4.65	7.69	7.60	7.65	23.0	1.5	1.90		8	8.0	8:38
9/20/16 SP	22.8	23.1	23.0	27.90	28.26	28.08	5.70	5.09	7.70	7.65	7.68	21.5	1.5	N/A		N/A	8.5	7:05
9/14/16	23.8	23.4	23.6	28.07	28.14	28.11	8.02	5.55	7.90	7.70	7.80	24.7	1.5	2.26		26	10.5	10:10
9/9/16	23.9	23.2	23.6	28.18	28.60	28.39	6.33	4.58	7.71	7.55	7.63	27.3	1.6	1.40		N/A	9.5	8:30
8/31/16	24.8	24.0	24.4	28.12	28.30	28.21	5.69	2.12	7.63	7.29	7.46	25.8	1.4	2.32		N/A	10.2	9:15
8/26/16 SP	24.2	23.9	24.1	27.92	28.07	28.00	5.32	3.89	7.56	7.43	7.50	24.6	1.5	N/A		N/A	10.25	7:08
8/24/16	24.0	23.8	23.9	28.05	28.16	28.11	6.12	4.44	7.73	7.56	7.65	23.2	1.75	2.07		N/A	8.5	8:40
08/17/16	24.5	23.2	23.9	28.03	28.20	28.12	5.11	1.52	7.57	7.27	7.42	26.1	1.75	battery problem			9.75	8:50
8/3/16	22.9	23.0	23.0	27.58	27.74	27.66	4.86	4.15	7.56	7.54	7.55	21.3	1.6	2.23		N/A	8.5	8:40
7/27/16	24.2	20.8	22.5	28.11	28.54	28.33	6.24	1.49	7.72	7.19	7.46	24.0	2.1	1.50	1.05		9.8	8:45
7/26/16 SP	23.3	20.9	22.1	27.35	27.70	27.53	7.11	2.04	7.82	7.23	7.53	23.1	2.25	N/A	N/A		10.2	6:35
7/20/16	23.4	19.7	21.6	27.28	27.82	27.55	6.91	0.86	7.86	7.16	7.51	22.9	1.5	1.93	1.78		8.5	8:42
7/13/16	22.2	20.5	21.4	27.25	27.43	27.34	7.16	3.20	7.90	7.39	7.65	25.5	1.75	2.17	1.97		9.25	10:32

2016 CSHH Field-Monitoring Data

Date	Water Temp (°C)			Salinity (ppt)			DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTUs) @ 0.5m	Turbidity (NTUs) @ Secchi	Chlor a	Depth (m)	Time
	Surface	Bottom	Ave	Surface	Bottom	Ave	Surface	Bottom	Surface	Bottom	Ave	(°C)	(m)			(µg/l)	(Bottom)	(AM)
7/6/16	21.7	18.6	20.2	26.81	27.42	27.12	8.71	3.28	7.98	7.39	7.69	26.3	1.75	1.17	1.00		8.25	8:45
6/29/16	20.4	18.7	19.6	26.87	27.13	27.00	8.05	4.93	7.98	7.66	7.82	27.0	1.6	1.76	1.82		9.5	9:55
6/22/16	20.1	17.9	19.0	27.01	27.10	27.06	9.31	4.63	8.14	7.58	7.86	21.6	1.75	1.43	0.84		8.25	8:33
6/15/16	20.0	16.7	18.4	26.62	27.13	26.88	8.16	7.48	8.07	7.88	7.98	22.9	1.6	1.86	1.60		10.75	10:36
6/8/16	19.0	18.4	18.7	26.45	26.53	26.49	9.01	8.57	8.12	8.11	8.12	18.2	1.2	2.01	2.67		8.0	9:00
6/1/16	17.1	14.2	15.7	26.28	26.67	26.48	9.47	6.42	N/A*	N/A		19.4	2.0	1.73	1.06		10.5	8:40
5/25/16	15.1	12.9	14.0	26.36	26.84	26.60	8.97	7.42	7.80	N/A	7.80	20.3	2.50	-0.33	-0.10		8.25	8:40
5/19/16	13.5	12.1	12.8	25.88	26.38	26.13	11.45	8.41	8.17	7.92	8.05	16.2	1.7	0.17	0.46		8.8	8:55
5/11/16	13.8	12.4	13.1	25.97	26.15	26.06	11.26	8.50	8.11	7.87	7.99	18.1	2.0	0.79	0.57		8.1	11:00

*On 5/25 and 6/1, there were problems with the pH probe on the ProPlus; LaMotte kit used for below surface readings only.

**On 6/29, there were problems with the electronic thermometer for air temperature readings.

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

{Date} SP indicates special early-morning sample run for DO

indicates the reading is considered a meter error and was removed from analysis

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

Date	Water Temp (°C)			Salinity (ppt)			DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTUs) @ 0.5m	Turbidity (NTUs) @ Secchi	Chlor a	Depth (m)	Time
	Surface	Bottom	Ave	Surface	Bottom	Ave	Surface	Bottom	Surface	Bottom	Ave	(°C)	(m)			(µg/l)	(Bottom)	(AM)
10/26/16	No survey--high wind and waves.																	
10/19/16	18.2	17.9	18.1	28.05	28.17	28.11	8.32	7.52	7.88	7.79	7.84	21.7	2.1	1.66		18	8.75	9:50
10/12/16	17.6	17.7	17.7	28.52	28.62	28.57	7.59	7.28	7.87	7.84	7.86	16.0	3.0	0.97		8	11.0	9:30
10/5/16	No survey--high wind and waves.																	
9/28/16	No survey--high wind and waves.																	
9/21/16	23.3	23.1	23.2	28.18	28.22	28.20	6.35	4.86	7.72	7.61	7.67	23.2	1.75	1.81		13	8.5	8:58
9/20/16 SP	22.9	23.1	23.0	27.92	28.27	28.10	6.62	5.53	7.75	7.67	7.71	21.6	1.75	N/A		N/A	8.5	7:20
9/14/16	23.8	23.6	23.7	28.14	28.27	28.21	7.41	6.43	7.89	7.69	7.79	25.2	1.75	2.14		22	10.75	10:26
9/9/16	24.0	23.1	23.6	28.19	28.62	28.41	6.54	4.04	7.73	7.55	7.64	27.0	1.75	1.31		N/A	9.75	8:50
8/31/16	24.9	24.0	24.5	28.14	28.36	28.25	7.04	2.78	7.80	7.40	7.60	26.9	1.5	1.64		N/A	11.25	9:40
8/26/16 SP	24.2	23.7	24.0	27.98	28.18	28.08	5.49	2.85	7.56	7.38	7.47	24.6	1.75	N/A		N/A	10.75	7:25
8/24/16	24.4	24.0	24.2	27.80	28.29	28.05	6.83	3.77	7.73	7.52	7.63	23.9	1.5	1.85		N/A	9.0	9:15

2016 CSHH Field-Monitoring Data

Date	Water Temp (°C)			Salinity (ppt)			DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTUs) @ 0.5m	Turbidity (NTUs) @ Secchi	Chlor a	Depth (m)	Time
	Surface	Bottom	Ave	Surface	Bottom	Ave	Surface	Bottom	Surface	Bottom	Ave	(°C)	(m)			(µg/l)	(Bottom)	(AM)
08/17/16	24.2	24.0	24.1	28.06	28.09	28.08	5.50	4.49	7.57	7.50	7.54	25.8	2.25	battery problem			10?	9:00
8/3/16	23.1	22.9	23.0	27.76	27.80	27.78	5.88	4.19	7.70	7.57	7.64	21.8	1.7	2.11		N/A	9.8	9:00
7/27/16	24.1	20.2	22.2	28.25	28.71	28.48	8.40	1.81	7.99	7.27	7.63	25.0	2.4	1.19	1.51		10.0	9:05
7/26/16 SP	23.0	20.4	21.7	27.37	27.82	27.60	7.35	2.37	7.83	7.28	7.56	23.4	2.5	N/A	N/A		11.75	6:55
7/20/16	23.0	19.5	21.3	27.34	27.88	27.61	7.01	1.33	7.91	7.23	7.57	23.1	1.25	2.33	1.77		9.8	9:05
7/13/16	22.1	19.0	20.6	27.25	27.68	27.47	7.57	1.76	7.93	7.23	7.58	25.6	1.75	1.97	1.56		9.75	10:55
7/6/16	21.6	18.3	20.0	26.79	27.48	27.14	9.15	4.27	8.05	7.52	7.79	26.0	1.5	1.90	1.31		9.0	9:05
6/29/16	20.5	17.7	19.1	26.95	27.26	27.11	8.59	4.54	8.06	7.60	7.83	28.0	1.60	1.82	1.70		10.5	10:20
6/22/16	21.0	17.6	19.3	26.97	27.17	27.07	10.28	5.94	8.18	7.69	7.94	20.6	1.75	0.84	1.08		9.0	9:00
6/15/16	19.2	15.5	17.4	26.93	27.45	27.19	9.82	6.93	8.14	7.80	7.97	23.4	1.75	1.59	1.12		10.75	11:10
6/8/16	Ran out of time to conduct survey at this station.																	
6/1/16	18.1	12.9	15.5	26.36	26.91	26.64	9.55	6.48	8.0	N/A**	8.00	21.8	1.75	1.16	2.02		11.5	9:20
5/25/16	15.1	12.7	13.9	26.68	26.88	26.78	10.05	8.33	8.0	N/A*	8.00	19.7	2.75	0.30	0.39		10.5	9:10
5/19/16	13.5	11.5	12.5	25.92	26.67	26.30	11.79	7.48	8.22	7.91	8.07	16.3	1.75	0.61	0.72		11.25	9:35
5/11/16	14.1	12.3	13.2	25.81	26.18	26.00	10.92	8.58	8.09	7.86	7.98	20.3	2.25	0.39	0.24		8.75	11:20

*On 5/25 and 6/1, there were problems with the pH probe on the ProPlus; LaMotte kit used for below surface readings only.

**On 6/29, there were problems with the electronic thermometer for air temperature readings.

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

{Date} SP indicates special early-morning sample run for DO

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

10/26/16	No survey--high wind and waves.																	
10/19/16	18.1	18.1	18.1	28.05	28.09	28.07	8.60	8.03	7.87	7.84	7.86	22.0	2.25	1.39		14	6.5	10:05
10/12/16	18.2	17.9	18.1	28.84	28.80	28.82	7.42	7.14	7.84	7.81	7.83	16.4	3.25	0.91		4	9.0	9:50
10/5/16	19.4	19.3	19.4	28.38	28.42	28.40	6.65	6.37	7.76	7.74	7.75	13.7	1.5	2.79		6	6.75	9.05
9/28/16	No survey--high wind and waves.																	
9/21/16	23.2	23.2	23.2	28.19	28.26	28.23	5.88	5.10	7.70	7.64	7.67	23.0	1.75	2.30		11	5.75	9:12
9/20/16 SP	23.1	23.2	23.2	28.33	28.34	28.34	5.53	5.18	7.70	7.63	7.67	21.7	1.25	N/A		N/A	6.5	7:35

Coalition to Save Hempstead Harbor

FUSS & O'NEILL

2016 CSHH Field-Monitoring Data

Date	Water Temp (°C)			Salinity (ppt)			DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTUs) @ 0.5m	Turbidity (NTUs) @ Secchi	Chlor a	Depth (m)	Time
	Surface	Bottom	Ave	Surface	Bottom	Ave	Surface	Bottom	Surface	Bottom	Ave	(°C)	(m)			(µg/l)	(Bottom)	(AM)
9/14/16	24.0	23.7	23.9	26.44	28.24	27.34	8.37	6.36	7.92	7.78	7.85	25.5	1.25	3.53		23	8.5	10:46
9/9/16	24.0	23.2	23.6	28.14	28.60	28.37	7.94	4.68	7.89	7.58	7.74	26.7	1.5	2.02		N/A	6.25	9:15
8/31/16	24.9	24.6	24.8	28.07	28.18	28.13	6.99	4.86	7.77	7.56	7.67	27.1	1.5	1.98		N/A	9.0	10:05
8/26/16 SP	24.2	23.4	23.8	27.99	28.35	28.17	5.71	2.05	7.63	7.38	7.51	24.5	1.5	N/A		N/A	9.0	7:45
8/24/16	24.0	23.8	23.9	28.07	28.16	28.12	5.55	4.99	7.72	7.61	7.67	24.5	1.6	2.03		N/A	3.25	9:45
08/17/16	Abandoned--high wind and waves; no survey, just grabbed bacteria sample.																	
8/3/16	22.8	22.7	22.8	27.78	27.79	27.79	5.07	4.58	7.59	7.56	7.58	21.9	1.8	2.14		N/A	7.6	9:18
7/27/16	23.9	21.4	22.7	28.20	28.49	28.35	8.17	3.23	7.91	7.41	7.66	24.1	2.5	0.8	1.36		6.8	9:30
7/26/16 SP	23.4	20.4	21.9	27.35	27.85	27.60	7.39	2.62	7.90	7.33	7.62	23.5	2.8	N/A	N/A		7.6	7:20
7/20/16	23.1	19.9	21.5	27.42	27.80	27.61	7.46	1.33	7.89	7.22	7.56	23.6	1.5	1.72	1.97		7.75	9:28
7/13/16	22.6	20.8	21.7	27.20	27.50	27.35	7.46	5.62	7.98	7.73	7.86	27.1	1.7	2.36	3.07		6.0	11:15
7/6/16	22.6	19.0	20.8	26.94	27.40	27.17		5.40	8.14	7.64	7.89	27.4	1.6	2.46	1.64		6.8	9:40
6/29/16	21.2	17.7	19.5	26.96	27.30	27.13	8.70	4.91	8.09	7.58	7.84	27.0	1.5	1.70	1.72		7.0	10:45
6/22/16	20.1	18.8	19.5	27.12	27.12	27.12	9.12	7.49	8.08	7.96	8.02	20.9	1.5	1.32	1.32		6.75	9:25
6/15/16	19.0	16.0	17.5	26.68	27.31	27.00	9.11	6.14	8.12	7.7	7.91	24.7	1.75	1.91	2.09		7.0	11:38
6/8/16	Ran out of time to conduct survey at this station.																	
6/1/16	17.3	13.3	15.3	26.33	26.84	26.59	9.30	6.66	8.0	N/A*	8.00	22.0	2.0	2.13	1.70		9.5	9:45
5/25/16	15.1	13.2	14.2	26.59	26.86	26.73	10.16	8.50	8.0	N/A	8.00	20.9	2.5	0.51	0.70		7.75	9:45
5/19/16	13.5	11.7	12.6	26.11	26.66	26.39	11.89	8.36	8.27	7.96	8.12	16.2	1.75	1.27	0.94		8.4	10:07
5/11/16	13.8	12.6	13.2	26.10	26.19	26.15	10.82	9.48	8.06	7.95	8.01	20.2	2.25	0.49	0.64		7.0	11:46

*On 5/25 and 6/1, there were problems with the pH probe on the ProPlus; LaMotte kit used for below surface readings only.

**On 6/29, there were problems with the electronic thermometer for air temperature readings.

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

{Date} SP indicates special early-morning sample run for DO

2016 CSHH Field-Monitoring Data

Date	Water Temp (°C)			Salinity (ppt)			DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTUs) @ 0.5m	Turbidity (NTUs) @ Secchi	Chlor a	Depth (m)	Time
	Surface	Bottom	Ave	Surface	Bottom	Ave	Surface	Bottom	Surface	Bottom	Ave	(°C)	(m)			(µg/l)	(Bottom)	(AM)
CSHH #3 - Glen Cove Creek, Red Marker																		
10/26/16	14.2	14.2	14.2	28.12	28.12	28.12	8.45	8.36	7.82	7.82	7.82	7.60	1.75	2.28		9	5.0	10:12
10/19/16	18.3	17.8	18.1	27.47	27.91	27.69	7.80	7.42	7.85	7.80	7.83	22.9	2.2	1.03		14	4.0	10:33
10/12/16	16.9	17.5	17.2	27.34	28.45	27.90	6.84	7.27	7.79	7.82	7.81	17.1	2.5	1.29		5	5.5	10:20
10/5/16	19.5	19.7	19.6	28.16	28.26	28.21	6.17	6.08	7.71	7.69	7.70	14.7	1.75	2.09		9	3.75	9:35
9/28/16	21.8	21.9	21.9	27.67	27.70	27.69	5.73	5.73	7.67	7.66	7.67	19.7	1.75	2.08		12	2.25	10:13
9/21/16	23.4	23.3	23.4	27.67	28.14	27.91	5.53	5.02	7.64	7.63	7.64	23.1	1.25	2.42		14	3.5	9:38
9/20/16 SP	23.0	23.1	23.1	27.89	28.22	28.06	5.34	5.03	7.71	7.67	7.69	21.8	1.25	N/A		N/A	3.25	7:55
9/14/16	23.6	23.6	23.6	27.80	28.01	27.91	7.17	6.99	7.83	7.82	7.83	26.5	1.25	3.20		22	5.5	11:00
9/9/16	24.0	23.5	23.8	27.49	28.18	27.84	6.81	6.01	7.72	7.64	7.68	27.0	1.5	1.62		N/A	4.0	9:40
8/31/16	25.6	24.3	25.0	27.64	28.15	27.90	7.93	1.83	7.89	7.30	7.60	26.9	1.0	2.71		N/A	5.8	10:35
8/26/16 SP	24.2	24.1	24.2	27.22	27.92	27.57	5.83	4.22	7.59	7.50	7.55	24.7	1.5	N/A		N/A	5.5	8:10
8/24/16	24.4	23.9	24.2	27.35	28.03	27.69	5.55	4.35	7.64	7.57	7.61	25.5	1.75	2.35		N/A	3.25	10:08
08/17/16	24.9	24.4	24.7	27.60	27.78	27.69	4.39	3.51	7.47	7.39	7.43	25.7	1.7	battery problem			5.25	9:45
8/3/16	23.3	22.8	23.1	27.26	27.41	27.34	5.41	4.36	7.50	7.47	7.49	22.5	1.6	2.14		N/A	4.9	9:50
7/27/16	24.7	24.1	24.4	27.69	27.99	27.84	7.05	5.68	7.78	7.67	7.73	24.9	2.0	2.01	1.91		3.75	10:00
7/26/16 SP	23.4	21.9	22.7	26.72	27.60	27.16	5.64	3.29	7.60	7.39	7.50	24.4	2.0	N/A	N/A		4.7	7:50
7/20/16	23.9	20.8	22.4	26.89	27.62	27.26	9.94	1.13	8.15	7.21	7.68	24.2	0.75	2.65	3.85		5.0	9:55
7/13/16	22.8	21.4	22.1	26.42	27.28	26.85	6.64	4.89	7.77	7.60	7.69	27.2	1.3	3.59	3.15		3.9	11:45
7/6/16	22.2	19.8	21.0	26.44	27.19	26.82	9.48	4.68	8.03	7.54	7.79	28.1	1.25	1.91	2.14		4.0	10:08
6/29/16	20.3	19.8	20.1	26.75	26.98	26.87	6.08	5.59	7.74	7.68	7.71	N/A**	1.6	2.78	2.84		3.75	11:20
6/22/16	20.8	19.4	20.1	26.77	26.95	26.86	10.70	8.30	8.24	8.00	8.12	21.0	1.75	1.46	0.64		3.80	9:50
6/15/16	Ran out of time to conduct survey at this station.																	
6/8/16	19.4	19.1	19.3	26.36	26.46	26.41	9.27	8.77	8.14	8.12	8.13	19.3	1.25	4.08	3.42		3.20	10:05
6/1/16	17.6	14.9	16.3	25.82	26.55	26.19	9.63	6.32	8.0	N/A*	8.00	23.0	1.5	1.70	1.91		5.25	10:16
5/25/16	15.6	15.5	15.6	26.90	26.22	26.56	8.89	9.04	7.5	N/A	7.50	24.9	1.6	0.92	1.09		3.5	10:20

2016 CSHH Field-Monitoring Data

Date	Water Temp (°C)			Salinity (ppt)			DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTUs) @ 0.5m	Turbidity (NTUs) @ Secchi	Chlor a	Depth (m)	Time
	Surface	Bottom	Ave	Surface	Bottom	Ave	Surface	Bottom	Surface	Bottom	Ave	(°C)	(m)			(µg/l)	(Bottom)	(AM)
5/19/16	14.7	12.5	13.6	25.59	26.20	25.90	11.55	9.22	8.18	7.99	8.09	17.8	1.6	0.92	1.09		5.3	10:45
5/11/16	13.6	12.9	13.3	25.89	26.16	26.03	9.87	8.24	8.00	7.90	7.95	13.10	1.8	1.41	1.33		3.25	8:55
*On 5/25 and 6/1, there were problems with the pH probe on the ProPlus; LaMotte kit used for below surface readings only.																		
**On 6/29, there were problems with the electronic thermometer for air temperature readings.																		
Red numbers indicate that the readings were unusually low or high but reflect station conditions.																		
{Date} SP	indicates special early-morning sample run for DO																	
CSHH #8 - Glen Cove Sewage Treatment Plant Outfall																		
10/26/16	14.5	14.2	14.4	25.31	27.78	26.55	7.63	7.68	7.73	7.76	7.75	7.5	1.0	5.0		12	3.75	10:35
10/19/16	19.2	18.1	18.7	20.21	27.44	23.83	7.43	7.13	7.73	7.78	7.76	25.2	1.8	1.9		10	3.25	10:55
10/12/16	17.9	16.8	17.4	26.35	27.65	27.00	5.91	7.02	7.70	7.74	7.72	18.9	1.75	2.68		7	3.75	10:55
10/5/16	19.3	19.9	19.6	26.74	28.16	27.45	5.80	5.52	7.62	7.63	7.63	15.5	1.5	2.12		7	2.75	10:10
9/28/16	21.6	21.7	21.7	24.63	27.36	26.00	3.38	5.03	7.31	7.52	7.42	21.5	1.25	2.52		14	4.5	10:43
9/21/16	22.5	23.4	23.0	23.32	27.50	25.41	4.59	4.62	7.45	7.52	7.49	24.1	1.25	2.83		15	2.0	10:05
9/20/16 SP	N/A																	
9/14/16	24.1	23.7	23.9	23.64	27.45	25.55	7.13	6.69	7.80	7.79	7.80	27.8	1.0	4.05		29	4.25	11:30
9/9/16	23.6	23.6	23.6	27.12	27.96	27.54	3.15	5.00	7.40	7.56	7.48	29.9	1.75	2.65		N/A	1.5	10:10
8/31/16	25.4	25.6	25.5	23.74	27.64	25.69	5.87	6.61	7.57	7.79	7.68	29.1	0.8	3.72		N/A	4.8	10:55
8/26/16 SP	N/A																	
8/24/16	24.3	24.2	24.3	21.33	27.29	24.31	4.94	4.32	7.52	7.51	7.52	26.6	1.2	2.47		N/A	2.25	10:35
08/17/16	26.0	25.7	25.9	21.20	27.18	24.19	4.43	4.30	7.42	7.50	7.46	27.0	1.25	battery problem			4.5	10:15
8/3/16	22.7	22.7	22.7	24.70	27.13	25.92	2.61	3.92	7.26	7.42	7.34	23.2	1.6	2.44		N/A	4.25	10:10
7/27/16	24.6	23.9	24.3	25.78	27.79	26.79	4.59	3.12	7.46	7.38	7.42	27.0	1.6	1.48	1.74		2.6	10:30
7/26/16 SP	N/A																	
7/20/16	23.6	23.6	23.6	24.84	26.87	25.86	6.99	5.62	7.81	7.68	7.75	24.8	1.25	3.08	2.80		4.25	10:30
7/13/16	Ran out of time to conduct survey at this station.																	
7/6/16	22.3	20.5	21.4	24.03	26.95	25.49	8.84	4.69	7.95	7.56	7.76	28	1.2	3.05	2.91		3.25	10:34
6/29/16	20.7	20.3	20.5	23.26	26.64	24.95	5.44	4.50	7.58	7.58	7.58	N/A**	1.5	3.08	3.17		2.6	11:45

2016 CSHH Field-Monitoring Data

Date	Water Temp (°C)			Salinity (ppt)			DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTUs) @ 0.5m	Turbidity (NTUs) @ Secchi	Chlor a	Depth (m)	Time
	Surface	Bottom	Ave	Surface	Bottom	Ave	Surface	Bottom	Surface	Bottom	Ave	(°C)	(m)			(µg/l)	(Bottom)	(AM)
6/22/16	21.1	19.2	20.2	24.34	26.83	25.59	9.20	4.71	8.07	7.60	7.84	24.5	1.5	1.31	1.85		3.25	10:20
6/15/16	Ran out of time to conduct survey at this station.																	
6/816	20.6	20.4	20.5	19.25	25.75	22.50	8.22	7.47	7.85	7.95	7.90	19.6	1.25	2.97	3.34		1.25	10:30
6/1/16	18.5	17.0	17.8	25.19	26.22	25.71	9.50	7.08	8.0	N/A*	8.00	26.2	1.4	2.72	2.67		2.75	10:55
5/25/16	16.5	14.8	15.7	21.99	26.35	24.17	8.40	6.41	N/A			24.4	1.3	1.93	1.74		2.75	10:55
5/19/16	14.8	14.0	14.4	23.00	25.66	24.33	10.20	9.65	8.08	8.11	8.10	17.9	1.3	1.93	1.74		4.25	11:10
5/11/16	14.3	13.8	14.1	25.04	25.64	25.34	9.46	8.38	7.96	7.89	7.93	17.3	1.3	2.28	2.12		2.25	9:30
*On 5/25 and 6/1, there were problems with the pH probe on the ProPlus; LaMotte kit used for below surface readings only.																		
**On 6/29, there were problems with the electronic thermometer for air temperature readings.																		
Red numbers indicate that the readings were unusually low or high but reflect station conditions.																		
{Date} SP	indicates special early-morning sample run for DO																	
CSHH #13 - 60' West of the Mill Pond Weir																		
10/26/16	14.9	15.0	15.0	20.54	26.84	23.69	6.60	6.28	7.43	7.56	7.50	7.6	1.0	7.51		5	2.25	10:55
10/19/16	17.7	18.0	17.9	18.99	27.21	23.10	6.34	6.25	7.52	7.58	7.55	25.1	2.0	3.47		5	2.25	11:15
10/12/16	17.3	17.9	17.6	23.61	27.77	25.69	5.30	5.24	7.56	7.59	7.58	18.6	1.5	3.15		2	2.25	11:10
10/5/16	19.7	19.9	19.8	26.79	28.07	27.43	4.76	4.63	7.54	7.52	7.53	15.9	1.5	3.00		5	2.0	10:28
9/28/16	20.6	21.8	21.2	20.77	26.77	23.77	0.72	0.60	7.18	7.17	7.18	20.6	1.25	2.52		8	3.5	11:02
9/21/16	21.6	23.1	22.4	20.06	27.26	23.66	3.46	3.35	7.34	7.35	7.35	24.0	1.0	5.11		14	1.25	10:26
9/20/16 SP	N/A																	
9/14/16	23.9	24.3	24.1	24.40	27.40	25.90	5.44	5.79	7.55	7.66	7.61	28.1	1.25	5.67		12	3.5	11:50
9/9/16	21.2	23.3	22.3	16.04	27.51	21.78	2.99	0.86	7.18	7.10	7.14	29.3	1.25	4.05		N/A	1.5	10:38
8/31/16	No time for survey here.																	
8/26/16 SP	N/A																	
8/24/16	21.6	23.8	22.7	15.53	26.60	21.07	4.48	1.47	7.26	7.15	7.21	27.7	0.75	7.20		N/A	1.25	11:00
8/17/16	26.1	26.3	26.2	23.48	26.91	25.20	1.88	0.39	7.16	7.15	7.16	26.9	1.25	battery problem			3.6	10:32
8/3/16	21.6	22.8	22.2	25.25	27.60	26.43	1.58	0.83	7.22	7.16	7.19	24.0	1.25	4.7		N/A	3.7	10.37
7/27/16	24.3	23.9	24.1	25.69	27.59	26.64	2.71	1.71	7.27	7.23	7.25	28.9	1.5	5.30	4.96		2.2	10.55

Coalition to Save Hempstead Harbor

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2016 CSHH Field-Monitoring Data

Date	Water Temp (°C)			Salinity (ppt)			DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTUs) @ 0.5m	Turbidity (NTUs) @ Secchi	Chlor a	Depth (m)	Time
	Surface	Bottom	Ave	Surface	Bottom	Ave	Surface	Bottom	Surface	Bottom	Ave	(°C)	(m)			(µg/l)	(Bottom)	(AM)
7/26/16 SP	N/A																	
7/20/16	23.1	23.7	23.4	23.49	26.93	25.21	5.37	2.88	7.48	7.38	7.43	24.6	0.8	6.00	5.36		3.4	10:53
7/13/16	Ran out of time to conduct survey at this station.																	
7/6/16	21.7	20.8	21.3	23.46	26.71	25.09	7.32	2.03	7.70	7.22	7.46	28.6	1.0	4.46	5.73		2.9	10:55
6/29/16	Ran out of time to conduct survey at this station.																	
6/22/16	20.4	19.6	20.0	23.37	26.58	24.98	10.91	3.53	8.08	7.43	7.76	26.2	0.75	4.27	3.85		3.0	10:50
6/15/16	Ran out of time to conduct survey at this station.																	
6/8/16	20.3	19.4	19.9	22.82	25.73	24.28	8.77	3.30	7.89	7.44	7.67	21.7	1.25	3.54	6.54		2.25	11:00
6/1/16	18.4	17.6	18.0	25.58	26.02	25.80	5.98	6.94	7.5	N/A		25.5	1.25	3.63	3.44		2.5	11:15
5/25/16	Ran out of time to conduct survey at this station.																	
5/19/16	15.3	13.8	14.6	23.38	25.48	24.43	6.41	7.16	7.61	7.81	7.71	19.6	1.5	4.64	4.28		2.25	11:40
5/11/16	14.1	14.0	14.1	23.74	25.12	24.43	7.15	6.80	7.63	7.62	7.63	18.4	1.0	10.84	6.56		0.8	10:00

*On 5/25 and 6/1, there were problems with the pH probe on the ProPlus; LaMotte kit used for below surface readings only.

**On 6/29, there were problems with the electronic thermometer for air temperature readings.

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

{Date} SP indicates special early-morning sample run for DO

CSHH #14 - 50 yds from Powerhouse Drain

Date	WT Surface	WT Bottom	WT Ave	Sal Surface	Sal Bottom	Sal Ave	DO Surface	DO Bottom	pH Surface	pH Bottom	pH Ave	Air Temp	Secchi	Turbidity @ 0.5m	Turbidity @ Secchi	Chlor a	Depth	Time
10/26/16	12.9	13.0	13.0	27.24	27.30	27.27	8.13	7.76	7.74	7.74	7.74	6.90	1.25	3.54		9	2.25	9:25
9/28/16	21.9	21.9	21.9	27.69	27.79	27.74	5.00	4.89	7.59	7.56	7.58	20.0	1.25	7.27		13	2.25	8:26
9/14/16	23.60	23.50	23.6	27.77	27.86	27.82	5.04	4.84	7.64	7.59	7.62	24.1	1.25	5.6		11	2.5	9:50
8/31/16	No time for survey or grab sample here.																	
8/17/16	Abandoned--high wind and waves--just grabbed bacteria sample.																	
7/13/16	22.4	21.6	22.0	26.52	26.98	26.75	6.12	4.72	7.58	7.50	7.54	25.9	1.25	2.68	3.36		3.8	9:18
6/15/16	19.3	17.6	18.5	26.18	26.83	26.51	8.62	6.16	8.03	7.72	7.88	22.4	1.2	4.01	4.09		5.5	9:42

2016 CSHH Field-Monitoring Data

Date	Water Temp (°C)			Salinity (ppt)			DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTUs) @ 0.5m	Turbidity (NTUs) @ Secchi	Chlor a	Depth (m)	Time
	Surface	Bottom	Ave	Surface	Bottom	Ave	Surface	Bottom	Surface	Bottom	Ave	(°C)	(m)			(µg/l)	(Bottom)	(AM)
CSHH #15 - 50 yds from Scudder's Pond Outfall, North of Tappen Pool																		
10/26/16	13.0	13.7	13.4	27.21	27.87	27.54	8.33	8.13	7.79	7.79	7.79	7.90	1.5	3.21		5	2.5	9:50
9/28/16	22.0	21.9	22.0	25.65	27.87	26.76	5.40	4.74	7.60	7.57	7.59	20.1	1.5	2.85		14	2.5	9:50
9/14/16	No time for survey or grab sample here.																	
8/31/16	No time for survey or grab sample here.																	
8/17/16	Abandoned--high wind and waves--just grabbed bacteria sample.																	
7/13/16	Ran out of time to conduct survey at this station.																	
6/15/16	19.8	18.1	19.0	26.23	26.83	26.53	8.59	6.59	8.09	7.78	7.94	23.4	1.4	2.94	3.51		2.75	10:20
CSHH #4 - Bar Beach Spit																		
10/26/16	13.3	13.4	13.4	27.45	27.55	27.50	8.07	8.12	7.76	7.75	7.76	7.79	1.25	3.38		5	5.5	9:35
9/28/16	21.7	21.6	21.7	27.41	27.44	27.43	4.89	4.94	7.55	7.54	7.55	20.1	1.5	3.27		15	2.0	8:40
9/14/16	23.4	23.4	23.4	26.00	27.87	26.94	6.02	5.33	7.68	7.62	7.65	25.0	1.25	3.66		21	5.0	9:38
8/31/16	No time for survey but grabbed bacteria sample.																	
8/17/16	24.9	23.8	24.4	27.73	27.93	27.83	4.61	2.03	7.50	7.26	7.38	27.6	2.2	battery problem			7.5	11:50
7/13/16	21.8	21.3	21.6	26.82	27.19	27.01	4.93	4.04	7.49	7.45	7.47	26.0	1.25	3.21	3.26		3.25	9:25
6/15/16	20.6	17.9	19.3	25.82	26.78	26.30	10.10	6.64	8.15	7.78	7.97	23.4	1.25	3.70	3.24		2.25	9:55
CSHH #5 - Mott's Cove																		
10/26/16	11.7	12.7	12.2	25.84	27.00	26.42	8.22	7.93	7.62	7.67	7.65	6.70	1.25	3.14		7	1.75	9:12
09/28/16	21.3	21.7	21.5	26.59	27.42	27.01	3.68	4.08	7.44	7.46	7.45	18.8	1.25	4.87		14	2.25	9:00
9/14/16	23.3	23.3	23.3	27.36	27.52	27.44	4.12	4.86	7.55	7.54	7.55	23.6	1.0	5.89		16	2.0	9:23
8/31/16	No time for survey but grabbed bacteria sample.																	
8/17/16	24.5	24.4	24.5	27.27	27.53	27.40	3.67	4.17	7.39	7.41	7.40	27.8	1.6				2.0	11:40
7/13/16	21.4	21.3	21.4	26.11	26.79	26.45	3.81	3.37	7.30	7.29	7.30	24.6	0.8	3.31	3.16		1.5	9:00
6/15/16	19.8	18.7	19.3	24.24	26.12	25.18	7.96	6.51	7.89	7.71	7.80	22.9	1.0	5.67	4.60		1.75	9:20

Coalition to Save Hempstead Harbor

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2016 CSHH Field-Monitoring Data

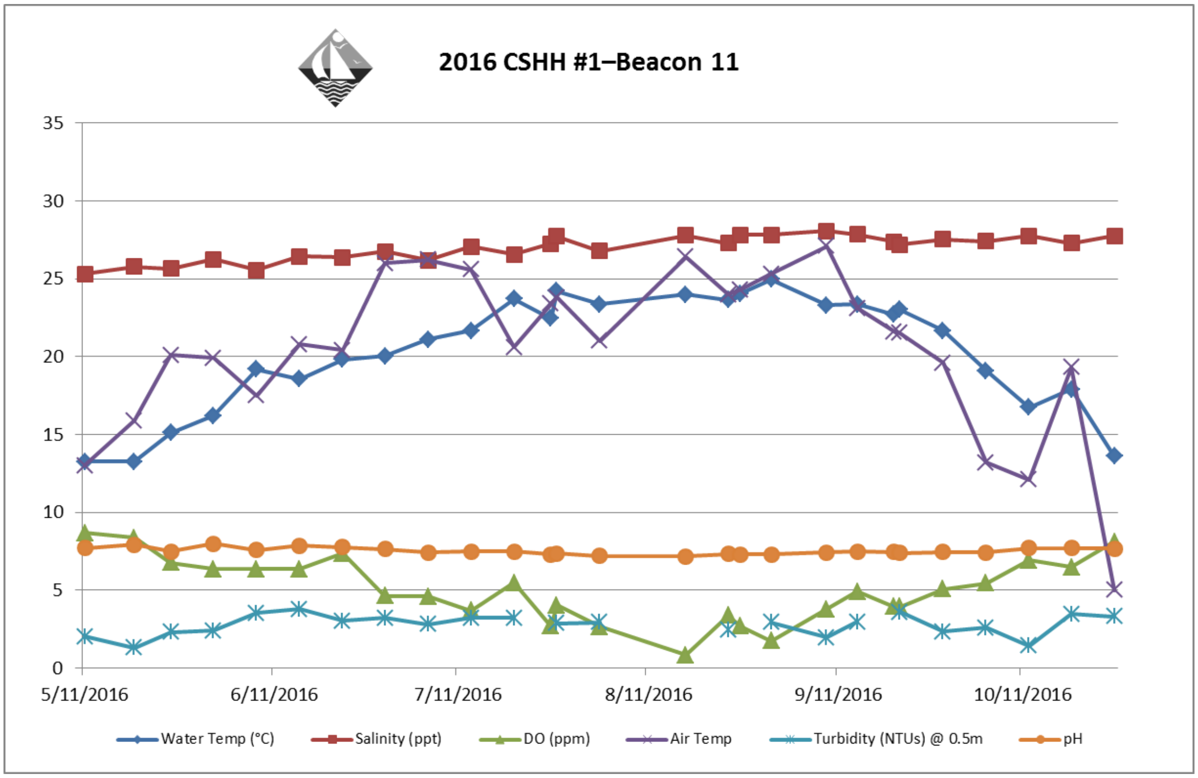
Date	Water Temp (°C)			Salinity (ppt)			DO (ppm)		pH			Air Temp	Secchi	Turbidity (NTUs) @ 0.5m	Turbidity (NTUs) @ Secchi	Chlor a	Depth (m)	Time
	Surface	Bottom	Ave	Surface	Bottom	Ave	Surface	Bottom	Surface	Bottom	Ave	(°C)	(m)			(µg/l)	(Bottom)	(AM)
CSHH #6 - East of Former Incinerator Site																		
10/26/16	12.0	12.6	12.3	25.67	26.74	26.21	7.65	7.71	7.59	7.64	7.62	5.8	1.25	3.82		6	2.25	8:50
09/28/16	21.5	21.5	21.5	26.62	26.85	26.74	3.20	3.58	7.36	7.36	7.36	20.7	1.25	4.33		14	3.75	9:30
9/14/16	23.0	23.2	23.1	26.83	27.32	27.08	4.11	4.84	7.50	7.52	7.51	23.8	1.0	5.90		10	2.5	9:05
8/31/16	No time for survey but grabbed bacteria sample.																	
8/17/16	25.3	24.7	25.0	27.31	27.44	27.38	6.59	4.39	7.66	7.47	7.57	27.8	1.25	battery problem			2.4	11:28
7/13/16	22.1	21.5	21.8	26.38	27.05	26.72	4.57	3.79	7.37	7.38	7.38	24.5	1.25	3.66	3.51		2.25	8:36
6/15/16	20.4	19.1	19.8	25.44	26.22	25.83	9.27	6.86	8.02	7.85	7.94	22.6	1.0	4.40	5.93		2.2	9:00
CSHH #7 - West of Bryant Landing (formerly site of oil dock)																		
10/26/16	10.7	11.5	11.1	24.33	25.29	24.81	7.33	7.32	7.50	7.51	7.51	5.70	0.75	7.25		3	1.5	8:35
09/28/16	21.2	21.4	21.3	26.36	26.59	26.48	2.13	2.67	7.39	7.33	7.36	19.2	1.25	5.47		7	2.25	9:20
9/14/16	22.9	23.1	23.0	26.74	27.03	26.89	2.44	2.93	7.33	7.31	7.32	23.5	1.0	5.81		6	1.75	8:45
8/31/16	25.7	25.7	25.7	26.53	26.98	26.76	3.26	2.17	7.50	7.25	7.38	29.1	1.0	3.84		N/A	2.0	11:35
8/17/16	25.7	25.5	25.6	27.12	27.17	27.15	7.62	5.14	7.74	7.50	7.62	26.8	1.0	battery problem			1.75	11:20
7/13/16	22.4	22.4	22.4	26.45	26.53	26.49	3.54	2.96	7.24	7.17	7.21	24.0	1.25	3.99	5.25		1.4	8:15
6/15/16	20.2	20.3	20.3	25.11	25.36	25.24	6.95	6.95	7.79	7.82	7.81	22.3	1.0	4.21	3.20		1.75	8:40
*On 5/25 and 6/1 problems with the pH probe on the ProPlus; LaMotte kit used for below surface readings only.																		
**On 6/29, there were problems with the electronic thermometer for air temperature readings.																		
Red numbers indicate hypoxic conditions or other readings that were unusually low or high.																		

**All chlorophyll a field readings are incomplete. The monitoring process includes correcting fluorometer field readings with a laboratory-generated correlation between a field reading and a laboratory analysis of a filter of algae from a sample collected with the field reading. As of the publishing of this report, the laboratory has not provided this correlation.

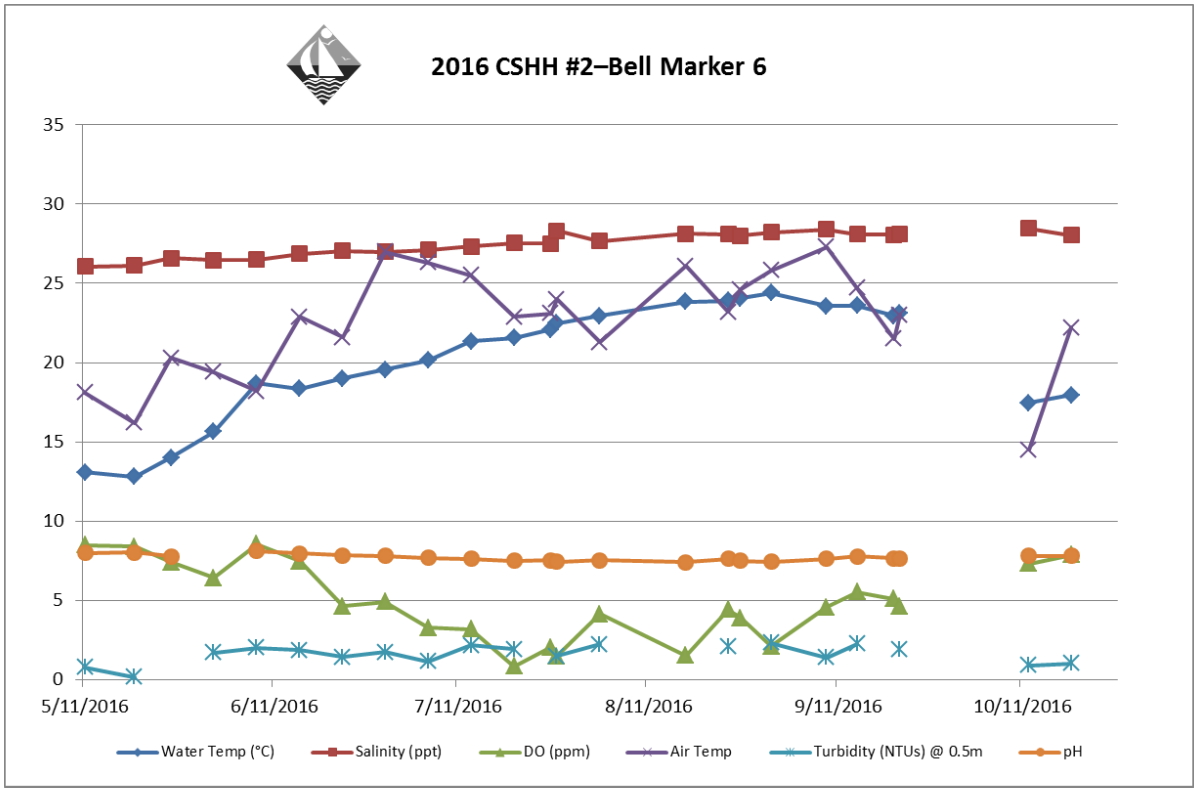
2016 Weekly Graphs for Water-Quality Parameters

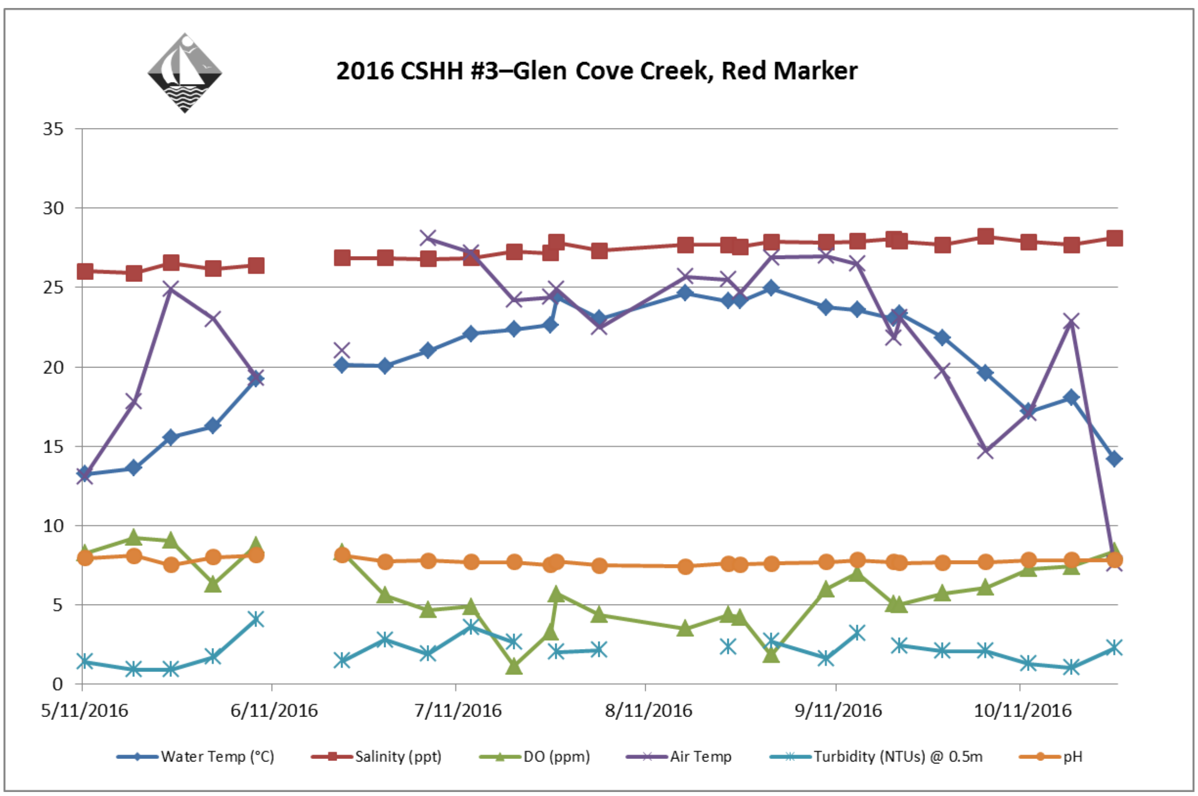
Note: The values graphed below are:

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

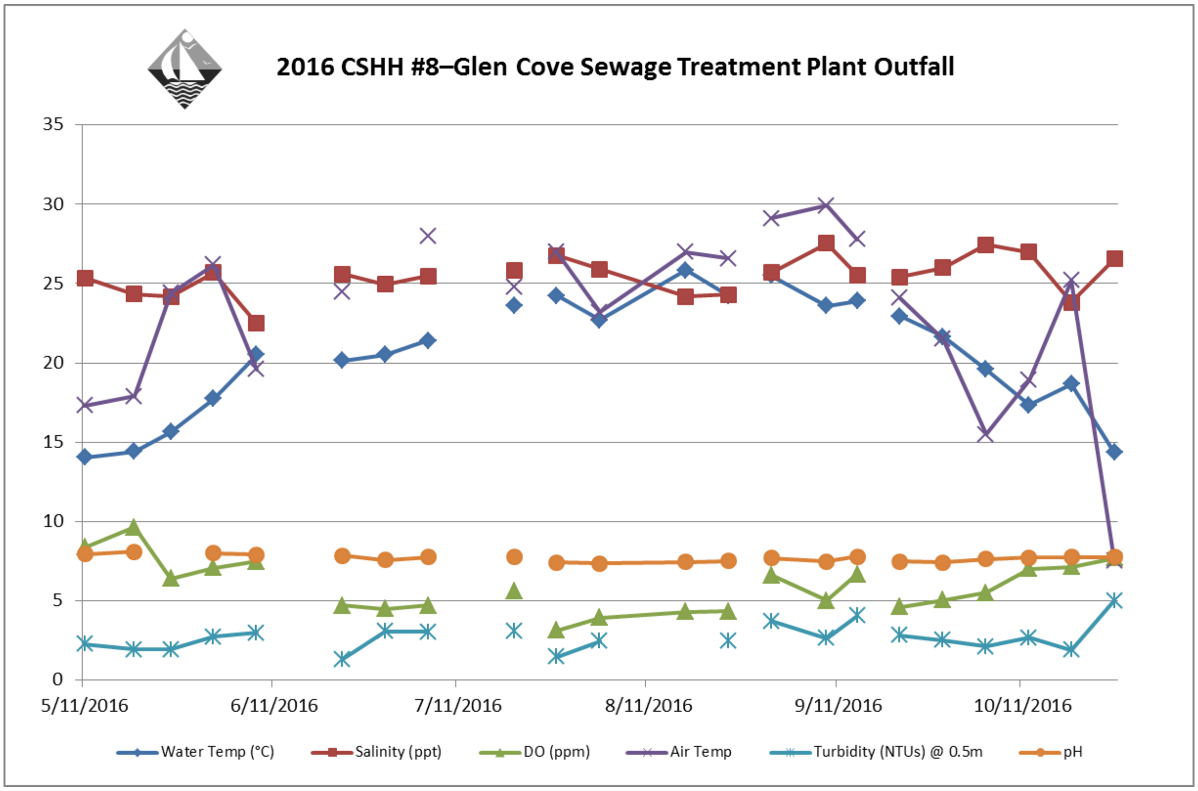


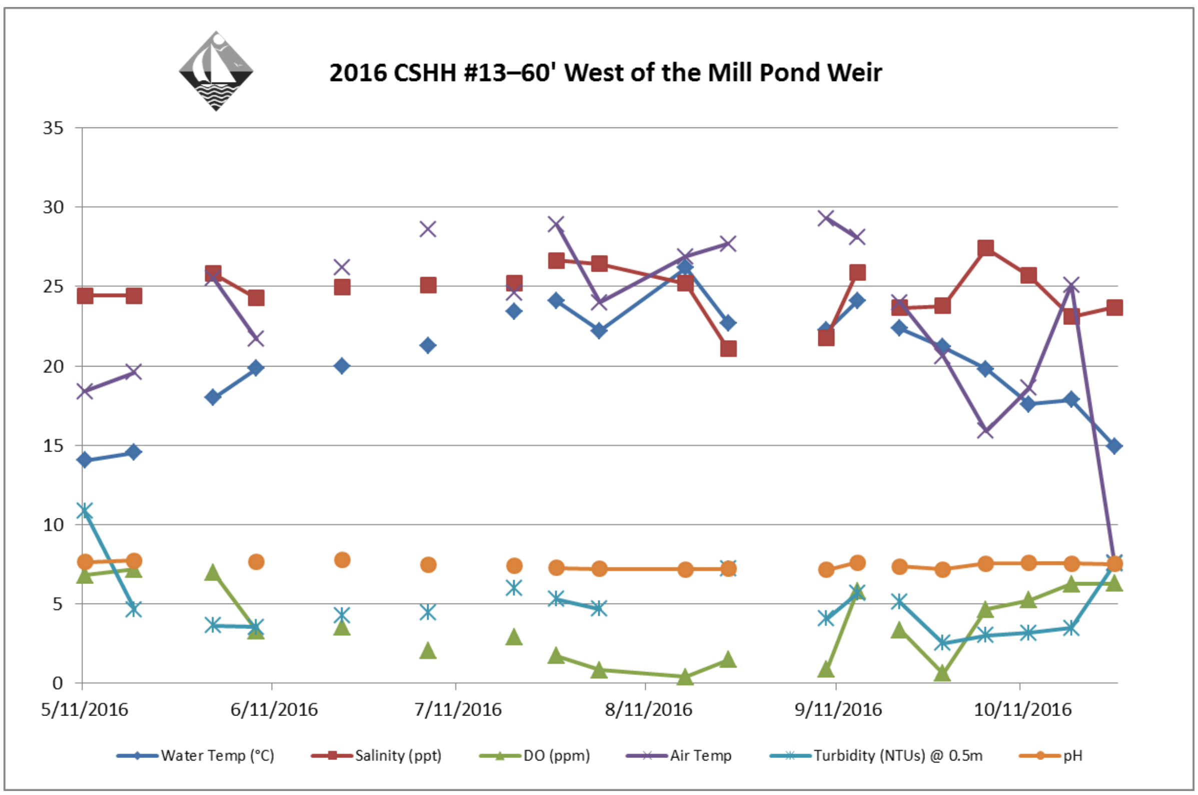
2016 Weekly Graphs for Water-Quality Parameters



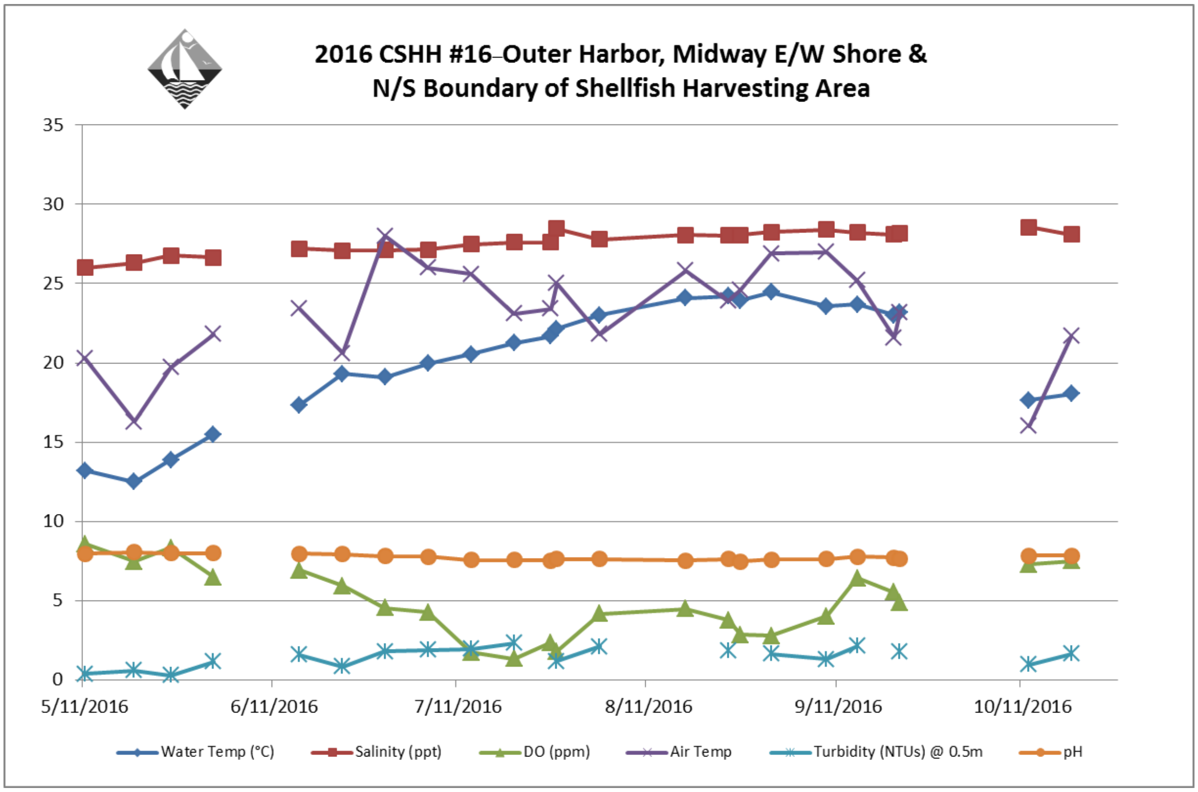


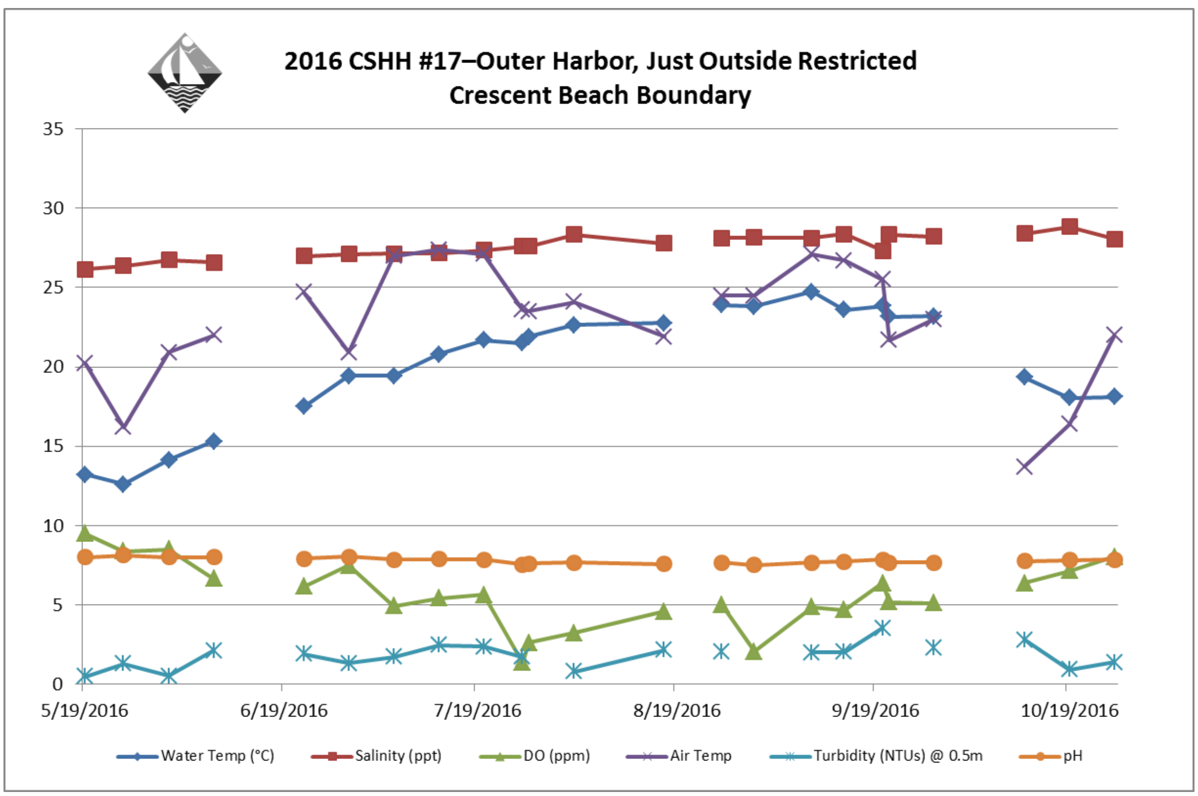
2016 Weekly Graphs for Water-Quality Parameters





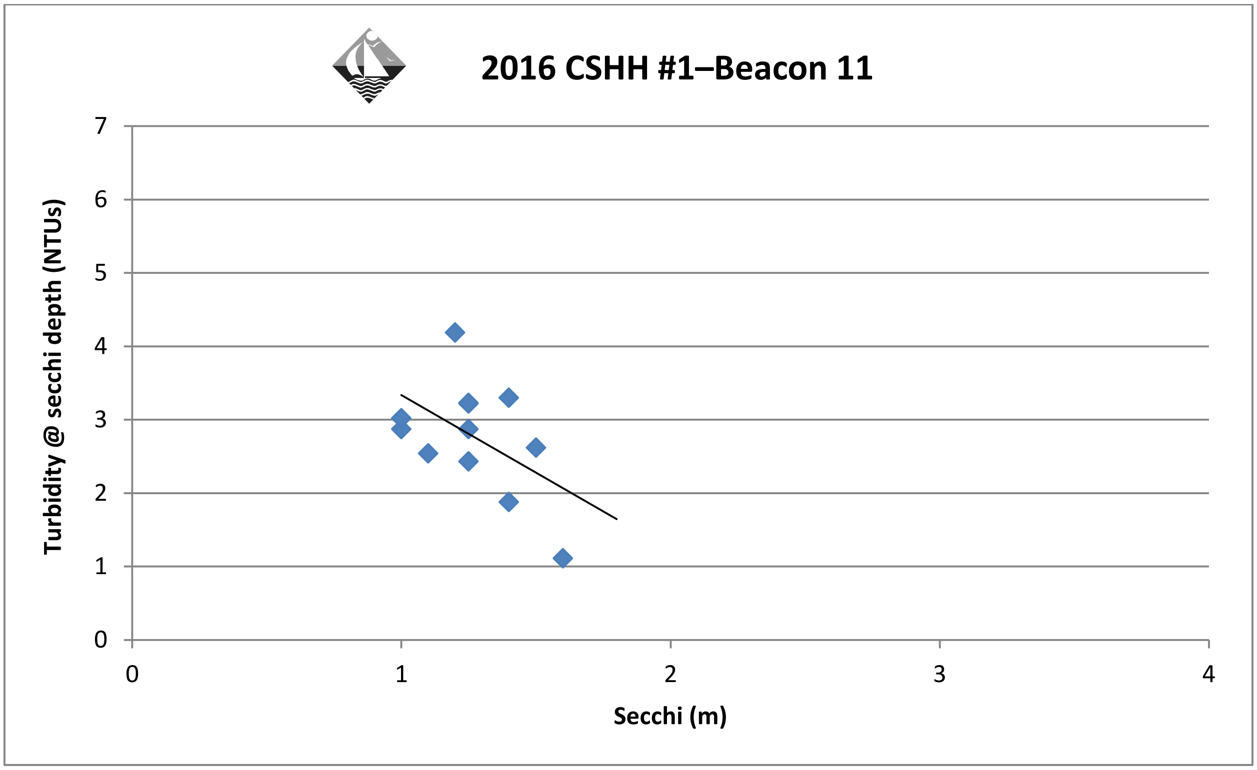
2016 Weekly Graphs for Water-Quality Parameters



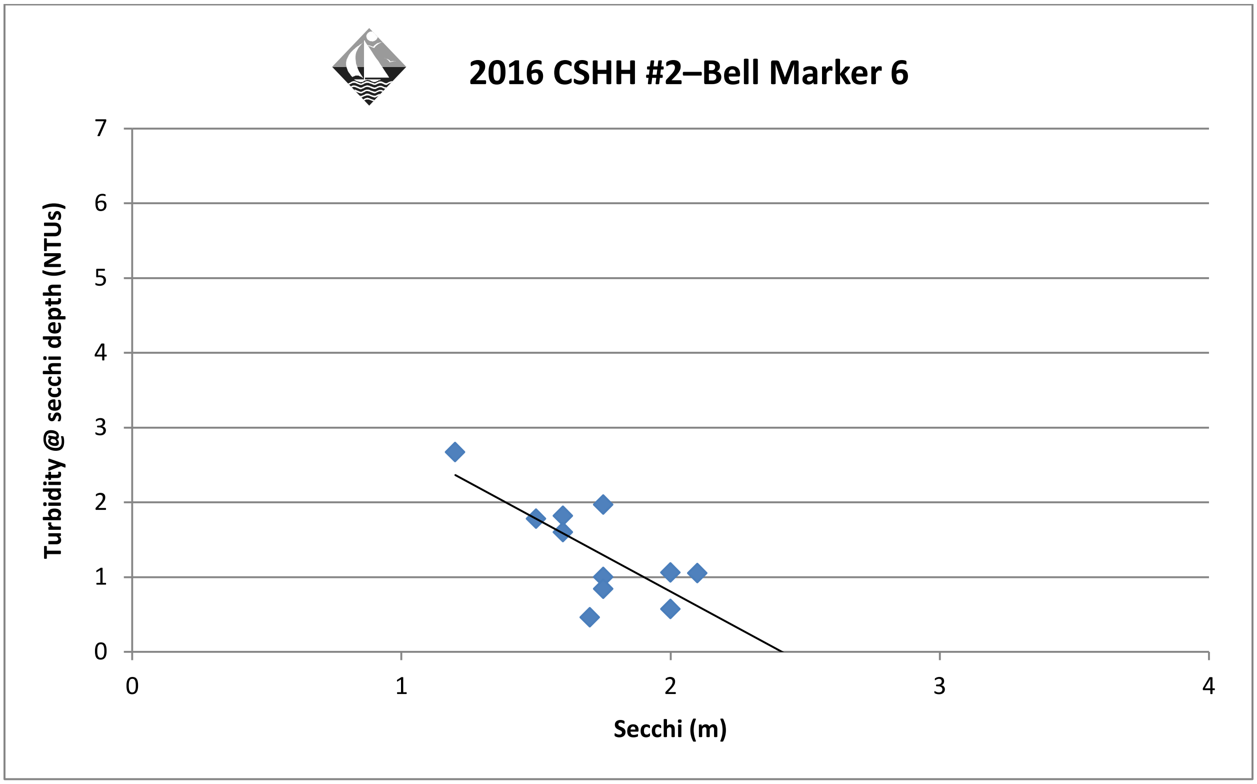


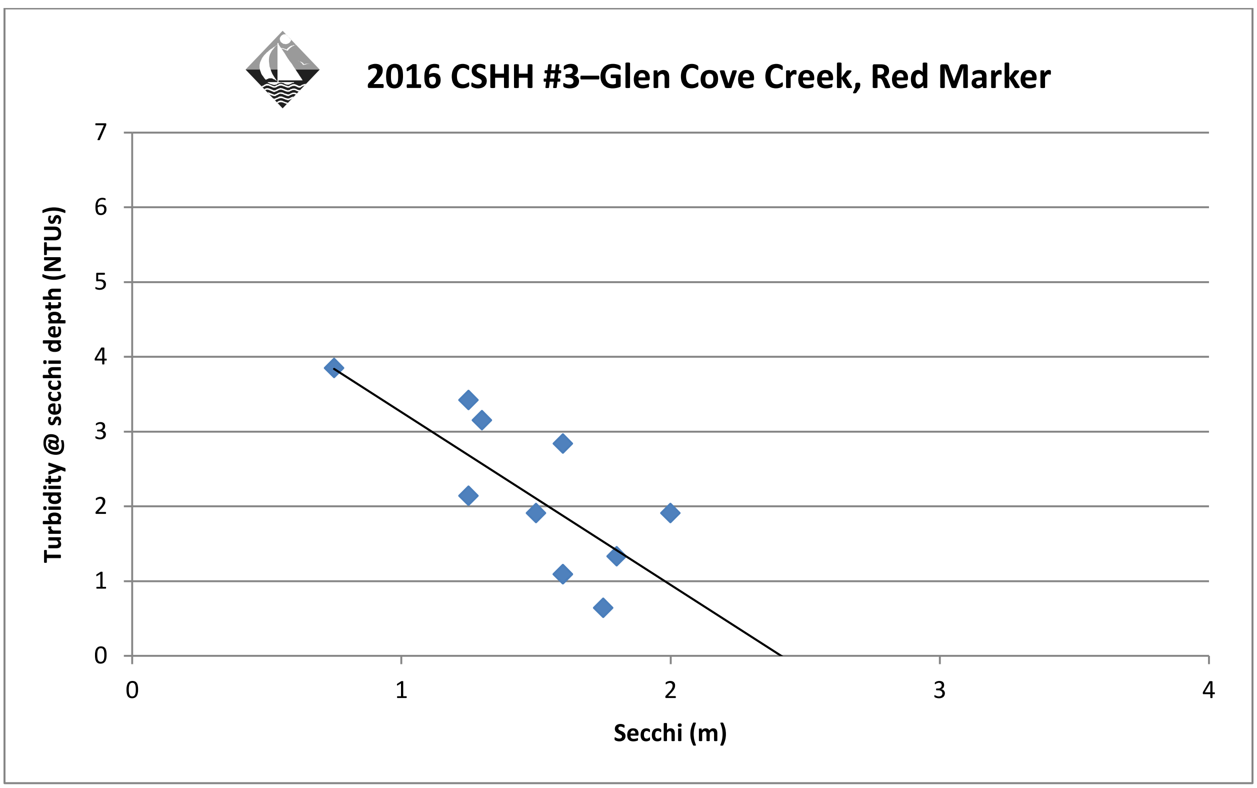
2016 Turbidity and Secchi-Disk Transparency Graphs

Note: A liner relationship line, generated by Microsoft Excel, is shown for each graph. This line shows the inverse relationship between Secchi-disk depth and turbidity levels (NTUs) at Secchi-disk depth (represented by ♦). As the turbidity increases, the Secchi-disk depth decreases.

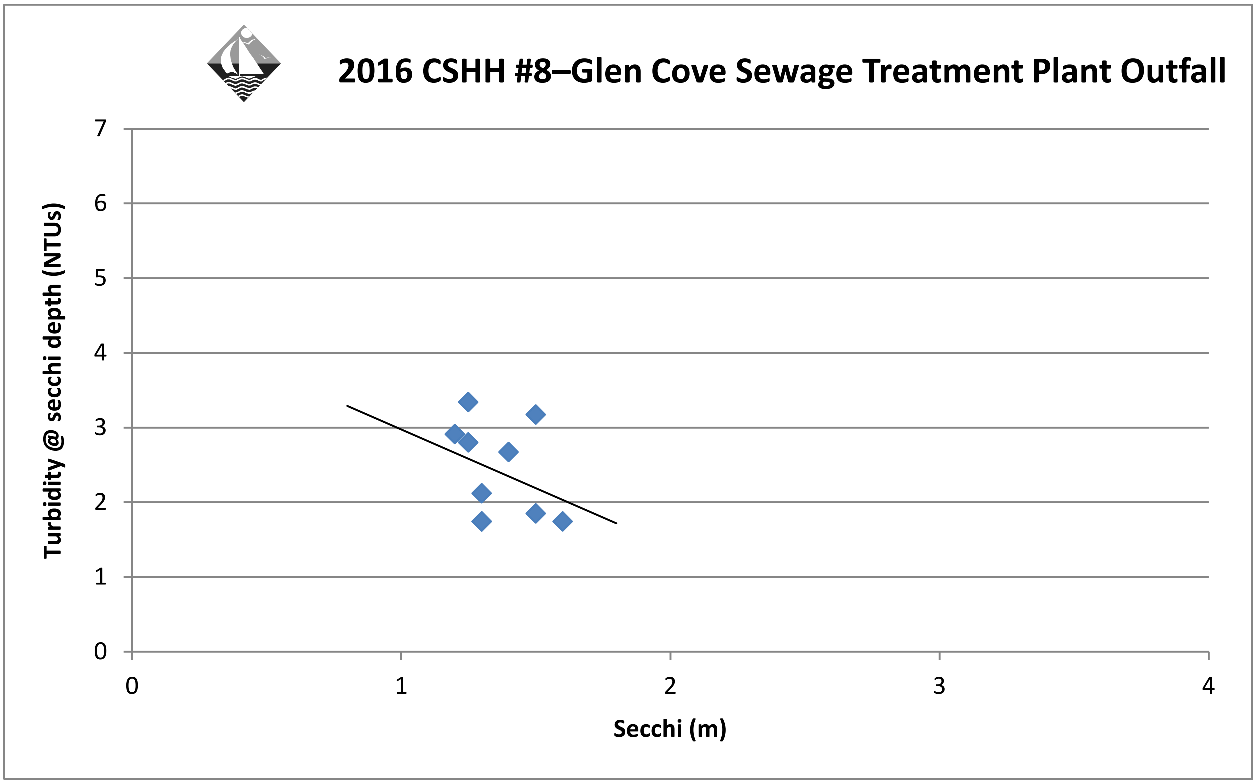


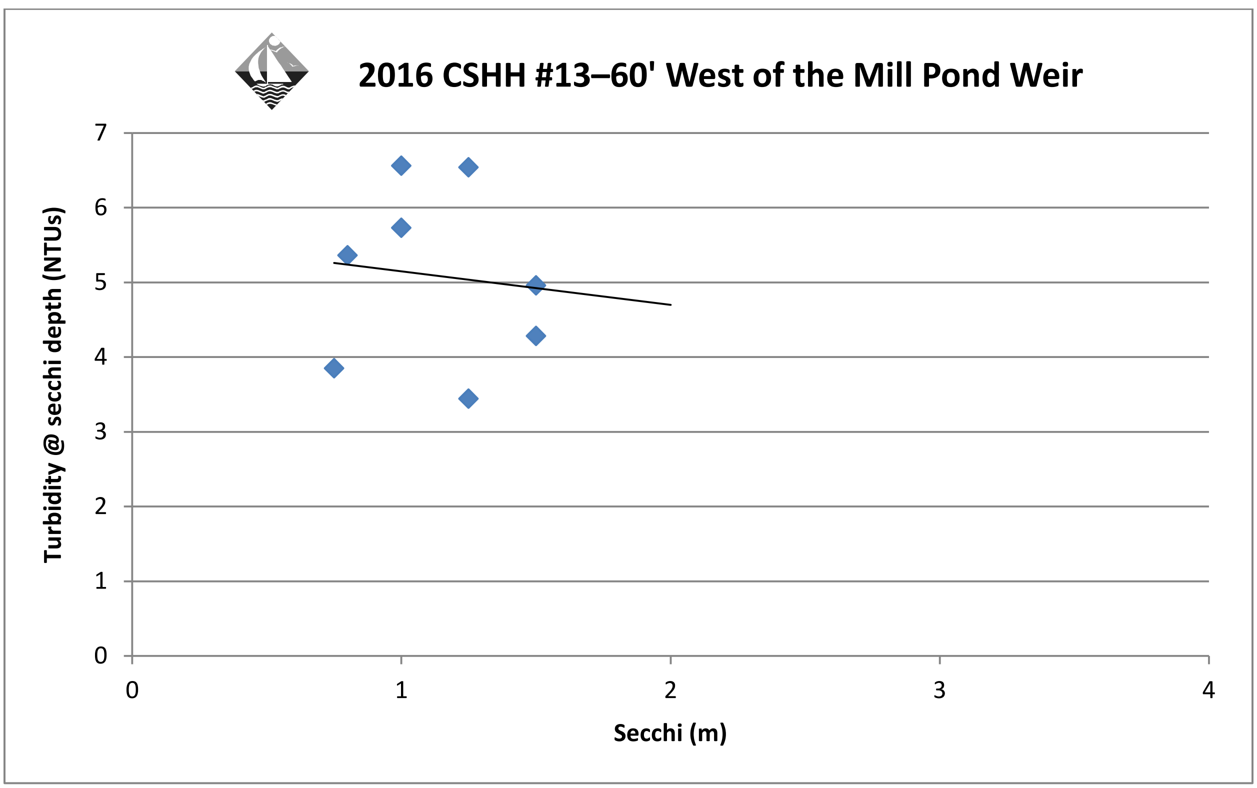
2016 Turbidity and Secchi-Disk Transparency Graphs



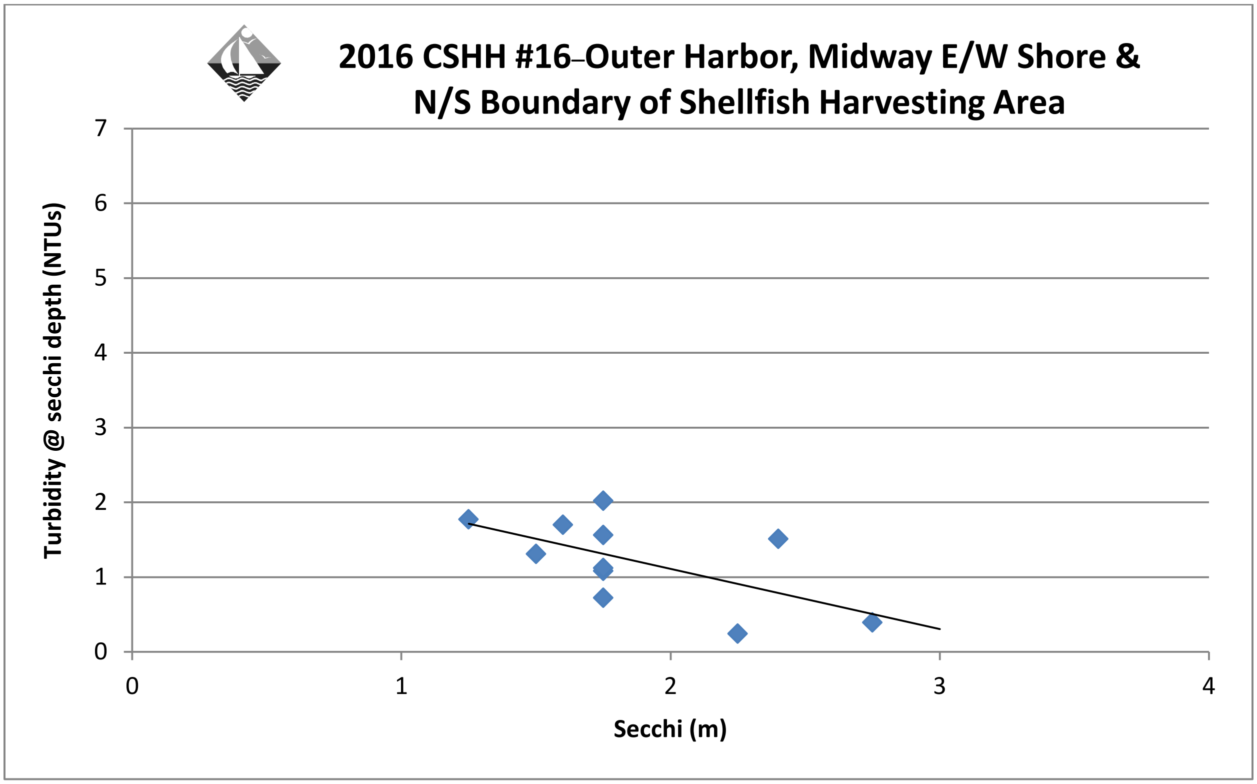


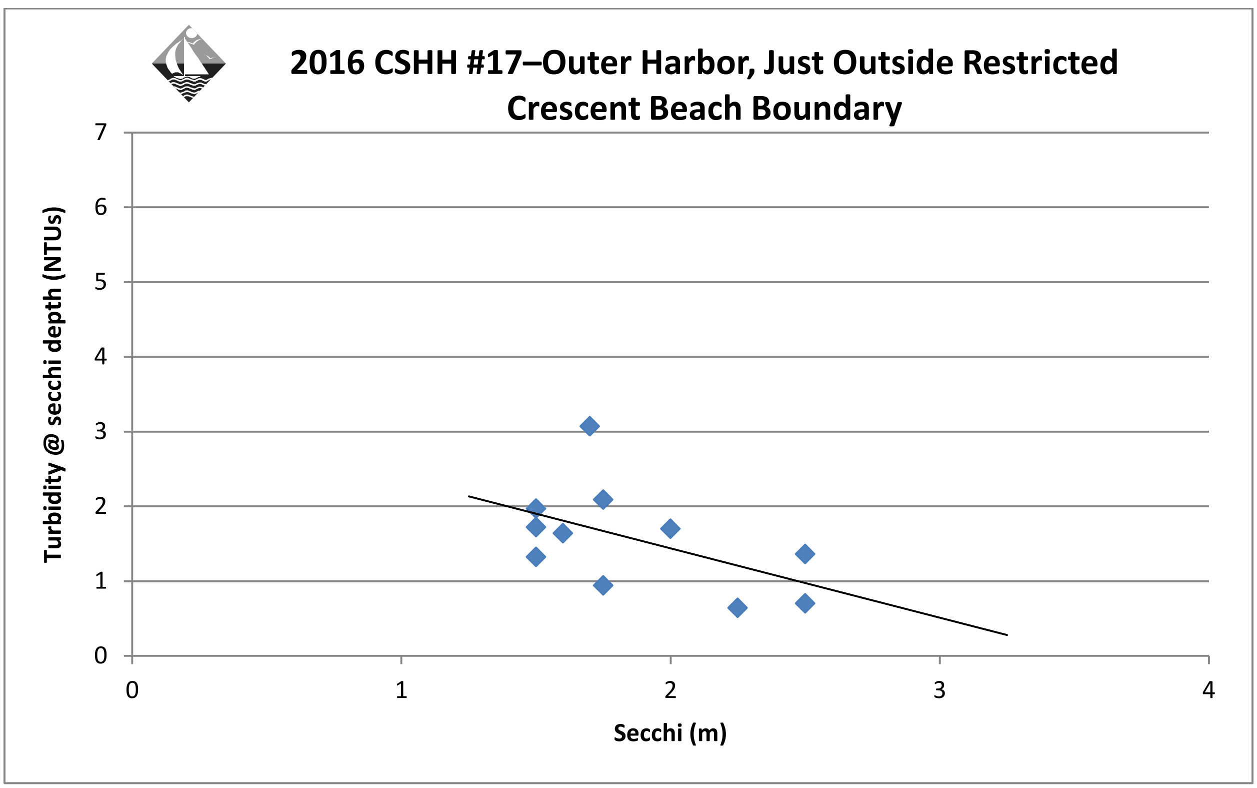
2016 Turbidity and Secchi-Disk Transparency Graphs





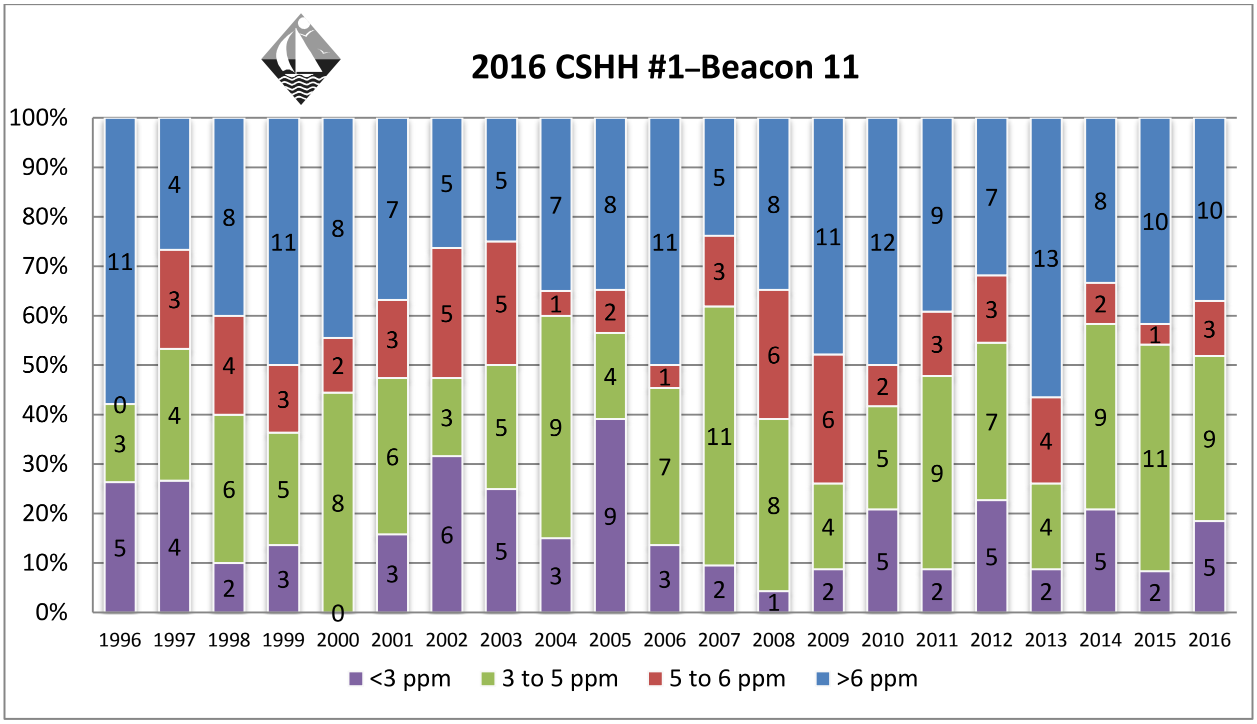
2016 Turbidity and Secchi-Disk Transparency Graphs



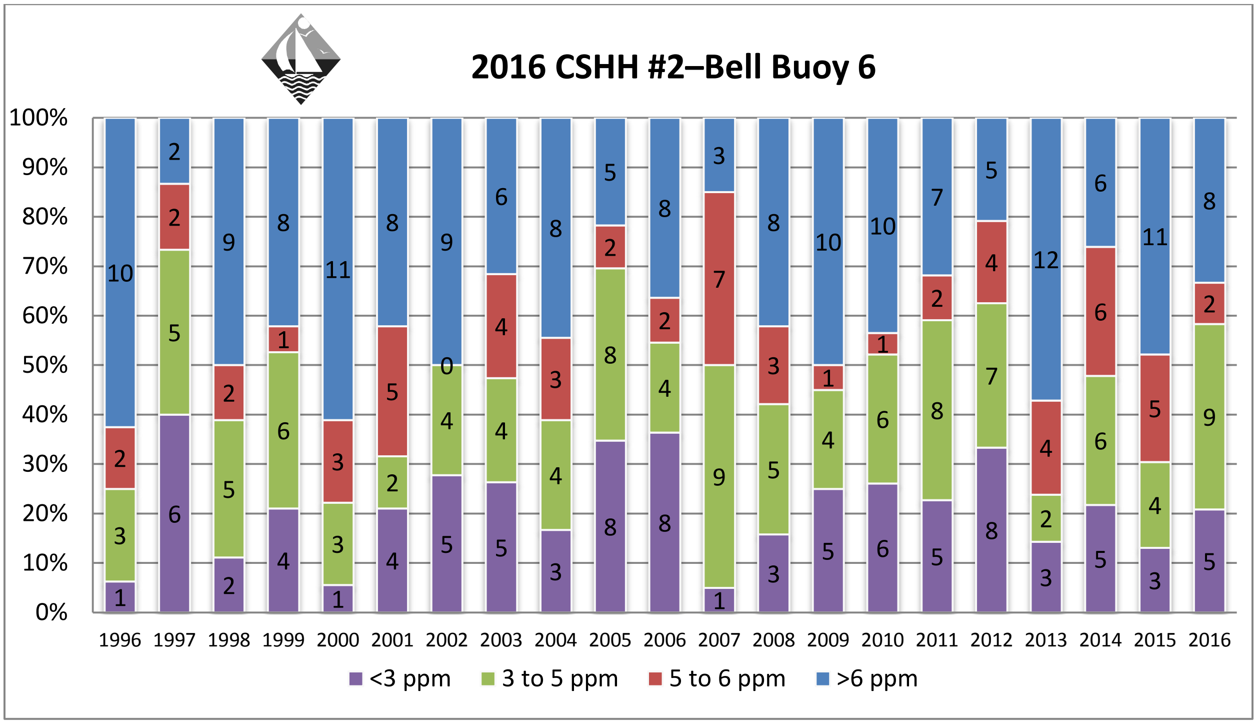


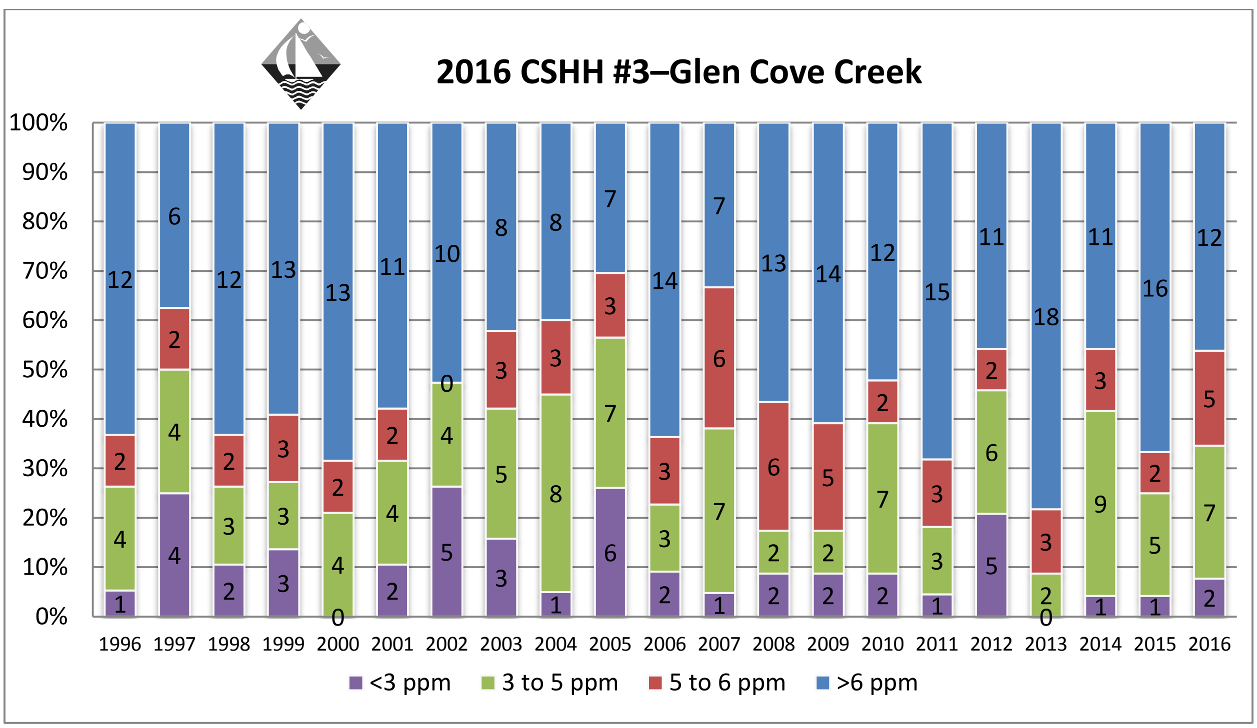
2016 Dissolved Oxygen Graphs

The bar graphs below represent the distribution of results during each monitoring year. The results are arranged into four DO levels, each represented by a different color. The number within each colored section represents the number of sampling dates that DO levels fell within a particular range during the monitoring year. As stated in *Section 3.1*, dissolved oxygen results below 3 ppm are considered hypoxic and those above 5 ppm are considered healthy conditions.

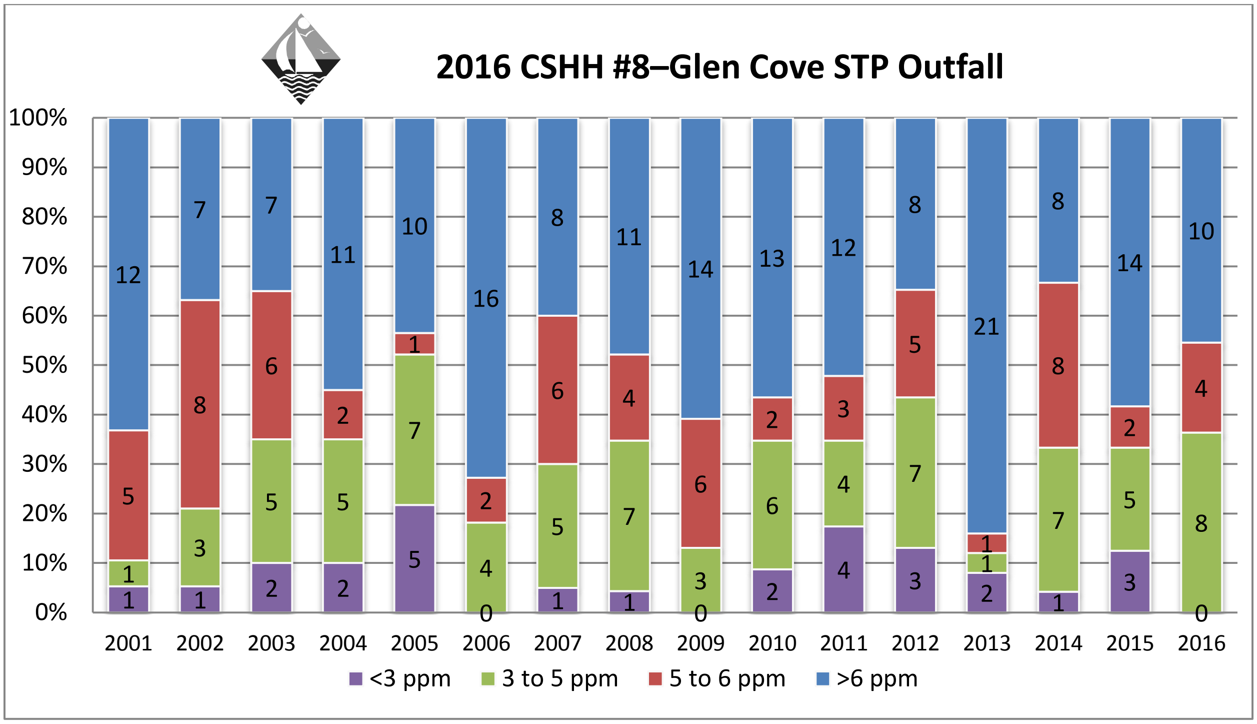


2016 Dissolved Oxygen Graphs





2016 Dissolved Oxygen Graphs



Appendix B

2016 In-Harbor Bacteria Data
2016 In-Harbor Bacteria Graphs
2016 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Data
2016 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Graphs
2016-2017 Scudder's Pond and Powerhouse Drain Outfalls Winter-Monitoring Bacteria Data
2016 Beach-Monitoring Bacteria Data
2016 Sea Cliff Precipitation Data
2017 Sea Cliff Precipitation Data (partial)
1997-2016 Monthly Precipitation

2016 In-Harbor Bacteria Data

CSHH #1–Beacon 11

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
5/11/16	26.00	0.00	4.00	0.00
5/19/16	5.00	11.40	0.10	0.63
5/25/16	280.00	33.14	15.00	1.82
6/1/16	73.00	40.37	10.00	2.78
6/8/16	48.00	41.80	22.00	4.21
6/15/16	25.00	41.47	0.10	2.01
6/22/16	20.00	54.72	5.00	4.40
6/29/16	30.00	35.01	3.00	3.19
7/6/16	60.00	33.66	15.00	3.46
7/13/16	20.00	28.25	0.10	1.18
7/20/16	32.00	29.68	5.00	2.57
7/27/16	45.00	34.91	10.00	2.95
8/3/16	18.00	31.52	4.00	3.13
8/17/16	100.00	40.12	25.00	8.41
8/24/16	33.00	40.43	13.00	10.68
8/31/16	11.00	28.43	0.10	3.38
9/9/16	13.00	26.21	13.00	4.53
9/14/16	10.00	21.62	2.00	3.85
9/21/16	100.00	21.62	22.00	3.75
9/28/16	21.00	19.75	8.00	3.40
10/5/16	43.00	25.94	10.00	8.55
10/12/16	13.00	25.94	7.00	7.56
10/19/16	580.00	58.43	22.00	12.21
10/26/16	21.00	42.76	10.00	10.43

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 In-Harbor Bacteria Data

CSHH #2–Bell Marker 6

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
5/11/16	0.10	0.00	0.10	0.00
5/19/16	0.10	0.10	0.10	0.10
5/25/16	260.00	1.38	9.00	0.45
6/1/16	4.00	1.80	0.10	0.31
6/8/16	5.00	2.20	0.10	0.25
6/15/16	3.00	4.35	0.10	0.25
6/22/16	3.00	8.59	0.10	0.25
6/29/16	1.00	2.83	1.00	0.16
7/6/16	15.00	3.68	0.10	0.16
7/13/16	2.00	3.06	0.10	0.16
7/20/16	5.00	3.39	0.10	0.16
7/27/16	7.00	4.02	2.00	0.29
8/3/16	2.00	4.62	0.10	0.18
8/17/16	0.10	1.63	0.10	0.21
8/24/16	3.00	1.43	0.10	0.21
8/31/16	0.10	0.49	0.10	0.10
9/9/16	0.10	0.23	0.10	0.10
9/14/16	0.10	0.20	0.10	0.10
9/21/16	22.00	0.58	0.10	0.10
10/5/16	1.00	0.68	0.10	0.10
10/12/16	0.10	0.68	0.10	0.10
10/19/16	12.00	2.27	0.10	0.10

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 In-Harbor Bacteria Data

CSHH #3–Glen Cove Creek

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
5/11/16	2.00	0.00	1.00	0.00
5/19/16	2.00	2.00	0.10	0.32
5/25/16	73.00	6.63	7.00	0.89
6/1/16	220.00	15.92	3.00	1.20
6/8/16	55.00	20.40	11.00	1.87
6/22/16	4.00	43.36	0.10	2.19
6/29/16	120.00	49.09	3.00	1.77
7/6/16	51.00	34.06	1.00	1.35
7/13/16	82.00	37.64	0.10	0.42
7/20/16	10.00	28.88	0.10	0.31
7/27/16	210.00	63.76	1.00	0.50
8/3/16	4.00	32.29	0.10	0.25
8/17/16	33.00	22.95	5.00	0.47
8/24/16	23.00	28.26	1.00	0.84
8/31/16	14.00	14.36	0.10	0.47
9/9/16	29.00	23.56	0.10	0.47
9/14/16	3.00	15.60	0.10	0.35
9/21/16	24.00	14.64	11.00	0.41
9/28/16	13.00	13.06	2.00	0.47
10/5/16	10.00	12.21	2.00	0.85
10/12/16	11.00	10.06	1.00	1.34
10/19/16	17.00	14.23	1.00	2.13
10/26/16	4.00	9.94	1.00	1.32

CSHH #4–East of North Hempstead Beach Park (S)(former Bar Beach) Sand Spit

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
6/15/16	11.00	0.00	3.00	0.00
6/29/16	33.00	19.05	5.00	3.87
7/13/16	29.00	21.92	3.00	3.56
8/3/16	7.00	14.25	0.10	0.55
8/17/16	270.00	43.47	36.00	1.90
8/31/16	11.00	27.50	0.10	0.71
9/14/16	14.00	34.64	1.00	1.53
9/28/16	14.00	12.92	2.00	0.58
10/12/16	8.00	11.62	2.00	1.59
10/26/16	20.00	13.08	8.00	3.17

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 In-Harbor Bacteria Data

CSHH #5–Mott's Cove

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
6/15/16	15.00	0.00	1.00	0.00
6/29/16	300.00	67.08	26.00	5.10
7/13/16	21.00	45.55	7.00	5.67
8/3/16	20.00	20.49	7.00	7.00
8/17/16	136.00	52.15	28.00	14.00
8/31/16	73.00	58.34	0.10	2.70
9/14/16	82.00	93.37	0.10	0.65
9/28/16	155.00	97.53	36.00	0.71
10/12/16	40.00	79.81	7.00	2.93
10/26/16	260.00	117.25	7.00	12.08

CSHH #6–East of the Former Incinerator Site

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
6/15/16	14.00	0.00	1.00	0.00
6/29/16	80.00	33.47	6.00	2.45
7/13/16	31.00	32.62	0.10	0.84
8/3/16	8.00	15.75	2.00	0.45
8/17/16	38.00	17.44	2.00	2.00
8/31/16	18.00	17.62	0.10	0.74
9/14/16	64.00	35.24	0.10	0.27
9/28/16	39.00	35.55	11.00	0.48
10/12/16	33.00	43.51	4.00	1.64
10/26/16	270.00	70.30	2.00	4.45

CSHH #7–West of Old Oil Dock

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
6/15/16	49.00	0.00	3.00	0.00
6/29/16	130.00	79.81	43.00	11.36
7/13/16	30.00	57.60	0.10	2.35
8/3/16	20.00	24.49	0.10	0.10
8/31/16	64.00	35.78	1.00	0.32
9/14/16	73.00	68.35	0.10	0.32
9/28/16	48.00	60.75	5.00	0.79
10/12/16	91.00	68.32	48.00	2.88
10/26/16	270.00	105.65	***160.00***	33.74

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 In-Harbor Bacteria Data

CSHH #8–Glen Cove STP Outfall

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
5/11/16	48.00	0.00	26.00	0.00
5/19/16	14.00	25.92	4.00	10.20
5/25/16	200.00	51.22	44.00	16.60
6/1/16	550.00	92.72	49.00	21.76
6/8/16	173.00	105.04	23.00	22.00
6/2/16	39.00	89.05	9.00	18.96
6/29/16	190.00	162.95	43.00	25.70
7/6/16	***1400.00***	***515.75***	***400.00***	***131.15***
7/20/16	20.00	174.57	3.00	***37.23***
7/27/16	290.00	198.19	31.00	***35.56***
8/3/16	310.00	***223.99***	25.00	31.05
8/17/16	240.00	144.13	59.00	19.25
8/24/16	82.00	***205.09***	32.00	34.78
8/31/16	32.00	118.20	5.00	22.04
9/9/16	136.00	96.20	17.00	20.01
9/14/16	26.00	74.05	10.00	17.42
9/21/16	73.00	58.37	27.00	14.90
9/28/16	45.00	51.77	10.00	11.81
10/5/16	30.00	51.10	15.00	14.71
10/12/16	14.00	32.43	17.00	14.71
10/19/16	49.00	36.81	16.00	16.16
10/26/16	47.00	33.71	28.00	16.28

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 In-Harbor Bacteria Data

CSHH #9–First Pipe West of STP Outfall

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
5/11/16	59.00	0.00	22.00	0.00
5/19/16	18.00	32.59	2.00	6.63
5/25/16	350.00	71.90	39.00	11.97
6/1/16	300.00	102.76	***150.00***	22.52
6/8/16	136.00	108.69	35.00	24.60
6/22/16	46.00	160.09	4.00	30.08
6/29/16	570.00	180.85	***280.00***	***49.24***
7/6/16	440.00	199.02	***310.00***	***59.04***
7/20/16	36.00	142.76	4.00	34.33
7/27/16	210.00	***208.67***	25.00	***54.28***
8/3/16	430.00	194.47	35.00	32.27
8/17/16	480.00	198.75	70.00	22.25
8/24/16	73.00	***237.17***	29.00	***36.51***
8/31/16	47.00	163.13	7.00	26.56
9/9/16	57.00	98.43	11.00	19.88
9/14/16	44.00	83.79	17.00	19.27
9/21/16	82.00	58.85	18.00	14.69
9/28/16	47.00	53.88	9.00	11.62
10/5/16	35.00	50.80	12.00	12.95
10/12/16	19.00	40.78	10.00	12.70
10/19/16	51.00	42.00	13.00	12.04
10/26/16	80.00	41.79	27.00	13.05

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 In-Harbor Bacteria Data

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

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
5/11/16	58.00	0.00	72.00	0.00
5/19/16	32.00	43.08	5.00	18.97
5/24/16	59.00	47.84	42.00	24.73
6/1/16	***1700.00***	116.81	***550.00***	***53.70***
6/8/16	210.00	131.35	54.00	***53.76***
6/22/16	82.00	***203.86***	12.00	***62.20***
6/29/16	590.00	***362.52***	***1220.00***	***144.40***
7/6/16	470.00	***262.87***	***300.00***	***124.10***
7/20/16	31.00	***162.94***	1.00	***45.78***
7/27/16	***4100.00***	***433.29***	***1400.00***	***150.45***
8/3/16	300.00	***365.88***	30.00	***59.58***
8/17/16	470.00	***365.88***	57.00	***39.34***
8/24/16	270.00	***628.55***	***150.00***	***137.66***
8/31/16	34.00	189.68	13.00	***42.73***
9/9/16	91.00	140.77	23.00	***39.99***
9/14/16	47.00	113.04	8.00	28.98
9/21/16	164.00	91.57	***230.00***	***38.31***
9/28/16	49.00	65.09	14.00	23.84
10/5/16	39.00	66.90	13.00	23.84
10/12/16	26.00	52.08	15.00	21.89
10/19/16	46.00	51.85	26.00	27.71
10/26/16	90.00	45.99	32.00	18.67

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 In-Harbor Bacteria Data

CSHH #11–50 Yards East of STP Outfall

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
5/11/16	28.00	0.00	4.00	0.00
5/19/16	90.00	50.20	2.00	2.83
5/25/16	510.00	108.72	***420.00***	14.98
6/1/16	***4300.00***	***272.65***	10.00	13.54
6/8/16	***1400.00***	***378.19***	84.00	19.50
6/22/16	***4300.00***	***1906.16***	3.00	32.07
6/29/16	600.00	***1985.20***	***580.00***	34.77
7/6/16	360.00	***1067.86***	45.00	***50.64***
7/20/16	29.00	***405.12***	1.00	16.73
7/27/16	***3900.00***	***395.35***	12.00	23.66
8/3/16	209.00	***303.72***	29.00	11.19
8/17/16	***5900.00***	***611.10***	***330.0***	18.41
8/24/16	420.00	***1192.14***	37.00	***45.40***
9/9/16	***8100.00***	***2717.66***	26.00	***68.22***
9/21/16	82.00	***653.41***	16.00	24.88
9/28/16	118.00	***427.95***	31.00	23.45
10/5/16	136.00	***321.31***	62.00	29.90
10/12/16	210.00	128.93	10.00	23.55
10/19/16	90.00	119.99	17.00	22.06
10/26/16	59.00	112.34	30.00	25.02

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 In-Harbor Bacteria Data

CSHH #12–Bend in Seawall East of STP Outfall

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
5/11/16	23.00	0.00	10.00	0.00
5/19/16	360.00	90.99	1.00	3.16
5/25/16	390.00	147.81	***140.00***	11.19
6/1/16	***4100.00***	***339.21***	28.00	14.07
6/8/16	***2100.00***	***488.45***	42.00	17.51
6/22/16	***1400.00***	***1472.48***	14.00	***38.96***
6/29/16	530.00	***1589.83***	5.00	16.94
7/6/16	590.00	***979.19***	80.00	22.02
7/20/16	200.00	***543.97***	1.00	8.65
7/27/16	***5500.00***	***765.83***	27.00	10.19
8/3/16	350.00	***690.36***	21.00	14.59
8/17/16	***5500.00***	***1206.30***	***130.00***	16.48
8/24/16	310.00	***1345.98***	27.00	***37.56***
9/9/16	645.00	***1032.19***	7.00	29.07
9/21/16	240.00	***363.39***	26.00	17.00
9/28/16	100.00	***249.22***	17.00	14.57
10/5/16	49.00	165.96	21.00	15.97
10/12/16	57.00	90.48	5.00	14.68
10/19/16	57.00	82.50	28.00	16.70
10/26/16	58.00	62.10	28.00	16.95

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 In-Harbor Bacteria Data

CSHH #13–60 Feet Downstream of Mill Pond Weir

	Fecal Coliform		Enterococci	
Date	CFU/100ml	Log AvgFC	CFU/100ml	Log AvgEnt
5/11/16	33.00	0.00	37.00	0.00
5/19/16	55.00	42.60	5.00	13.60
6/1/16	500.00	96.82	***140.00***	29.59
6/8/16	***1600.00***	195.21	81.00	***38.06***
6/22/16	136.00	***477.39***	18.00	***58.88***
7/6/16	420.00	***450.44***	***160.00***	***61.56***
7/20/16	100.00	***178.76***	4.00	22.58
7/27/16	***1500.00***	***397.91***	53.00	32.37
8/3/16	220.00	***343.12***	29.00	31.49
8/17/16	***5800.00***	***661.43***	***320.00***	***37.45***
8/24/16	580.00	***1026.46***	***170.00***	***95.62***
9/9/16	100.00	***695.48***	11.00	***84.27***
9/14/16	200.00	***509.30***	13.00	***52.81***
9/21/16	310.00	***244.88***	70.00	***36.12***
9/28/16	118.00	164.46	80.00	29.91
10/5/16	145.00	160.37	14.00	25.70
10/12/16	10.00	101.19	39.00	33.10
10/19/16	160.00	96.77	59.00	***44.80***
10/26/16	150.00	83.69	58.00	***43.14***

CSHH #14–NW Corner of Power Plant ≈50 yards from Cement Outfall

	Fecal Coliform		Enterococci	
Date	CFU/100ml	Log AvgFC	CFU/100ml	Log AvgEnt
6/15/16	8.00	0.00	0.10	0.00
6/29/16	59.00	21.73	3.00	0.55
7/13/16	31.00	24.46	1.00	0.67
8/3/16	5.00	12.45	1.00	1.00
8/17/16	51.00	15.97	6.00	2.45
9/14/16	24.00	34.99	6.00	6.00
9/28/16	25.00	24.49	14.00	9.17
10/12/16	13.00	19.83	34.00	14.19
10/26/16	440.00	52.29	59.00	30.40

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 In-Harbor Bacteria Data

CSHH #15–NW Corner of Tappen Pool

	Fecal Coliform		Enterococci	
Date	CFU/100ml	Log AvgFC	CFU/100ml	Log AvgEnt
5/19/16	13.00	0.00	5.00	0.00
6/15/16	360.00	68.41	1.00	2.24
8/3/16	11.00	0.00	0.10	0.00
8/17/16	28.00	17.55	1.00	0.32
9/14/16	54.00	38.88	1.00	1.00
9/28/16	55.00	54.50	15.00	3.87
10/12/16	11.00	31.97	5.00	4.22
10/26/16	24.00	24.40	16.00	10.63

CSHH #16–Outer Harbor Midway E/W Shore

	Fecal Coliform		Enterococci	
Date	CFU/100ml	Log AvgFC	CFU/100ml	Log AvgEnt
5/11/16	1.00	0.00	0.10	0.00
5/19/16	0.10	0.32	0.10	0.10
5/25/16	0.10	0.22	11.00	0.48
6/1/16	6.00	0.49	0.10	0.32
6/8/16	0.10	0.36	0.10	0.26
6/15/16	0.10	0.23	0.10	0.26
6/22/16	0.10	0.23	0.10	0.26
6/29/16	7.00	0.53	0.10	0.10
7/6/16	26.00	0.71	1.00	0.16
7/13/16	5.00	1.56	0.10	0.16
7/20/16	27.00	4.77	0.10	0.16
7/27/16	4.00	9.97	0.10	0.16
8/3/16	0.10	4.26	0.10	0.16
8/17/16	2.00	2.16	0.10	0.10
8/24/16	0.10	0.53	0.10	0.10
8/31/16	0.10	0.21	0.10	0.10
9/9/16	0.10	0.21	0.10	0.10
9/14/16	0.10	0.18	0.10	0.10
9/21/16	5.00	0.22	0.10	0.10
10/5/16	0.10	0.27	0.10	0.10
10/12/16	0.10	0.27	0.10	0.10
10/19/16	2.00	0.56	1.00	0.18

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 In-Harbor Bacteria Data

CSHH #17–Outside Crescent Beach Restricted Area

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
5/11/16	0.10	0.00	0.10	0.00
5/19/16	2.00	0.45	1.00	0.32
5/25/16	1.00	0.58	22.00	1.30
6/1/16	11.00	1.22	0.10	0.68
6/8/16	9.00	1.82	3.00	0.92
6/15/16	0.10	1.82	0.10	0.92
6/22/16	0.10	1.00	0.10	0.58
6/29/16	1.00	1.00	0.10	0.20
7/6/16	13.00	1.03	1.00	0.31
7/13/16	3.00	0.83	0.10	0.16
7/20/16	6.00	1.88	3.00	0.31
7/27/16	14.00	5.05	0.10	0.31
8/3/16	1.00	5.05	0.10	0.31
8/17/16	1.00	3.03	0.10	0.23
8/24/16	4.00	2.74	0.10	0.10
8/31/16	0.10	0.80	0.10	0.10
9/9/16	2.00	0.95	0.10	0.10
9/14/16	0.10	0.60	0.10	0.10
9/21/16	6.00	0.86	1.00	0.16
10/5/16	12.00	1.95	5.00	0.47
10/12/16	59.00	4.54	0.10	0.47
10/19/16	6.00	12.64	1.00	0.84

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

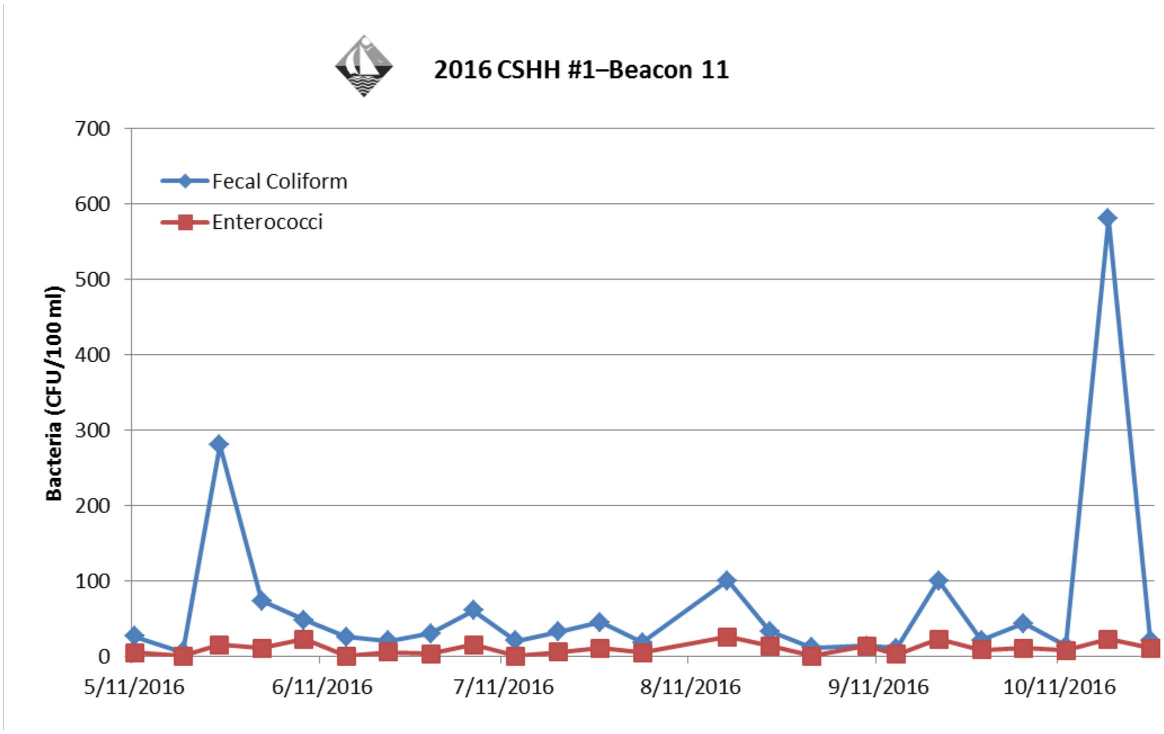
2016 In-Harbor Bacteria Data

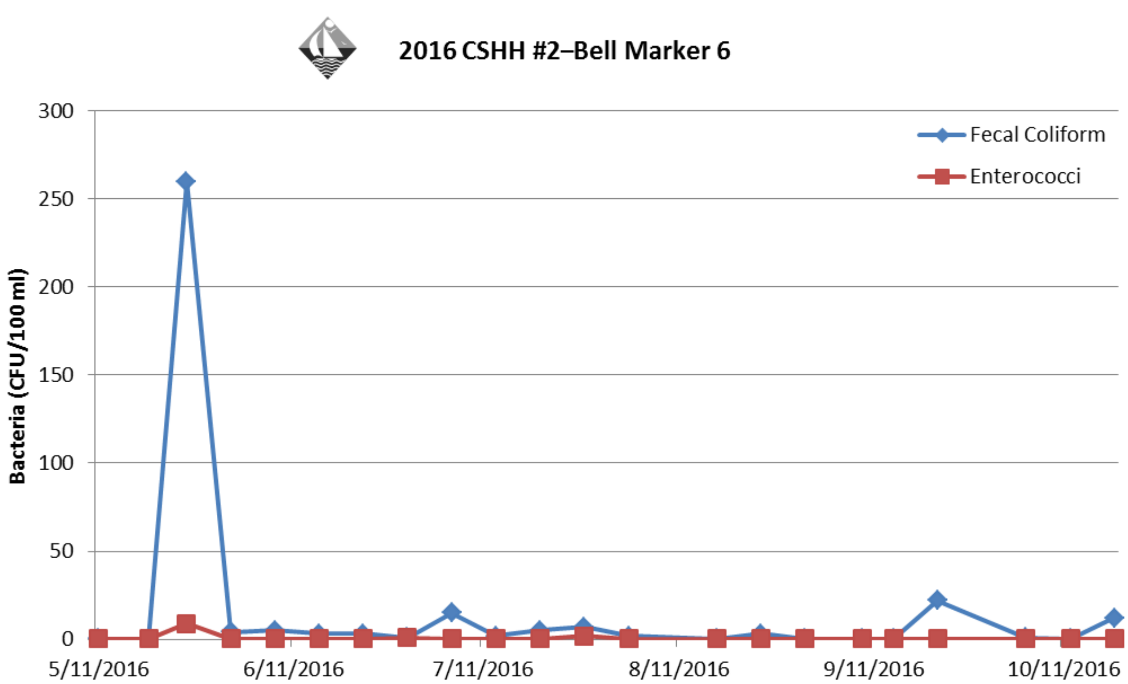
CSHH #17A–Within Crescent Beach Restricted Area

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
5/25/16	3.00	0.00	13.00	0.00
6/1/16	13.00	6.24	5.00	8.06
6/22/16	10.00	7.31	0.10	1.87
6/29/16	1.00	5.07	0.10	0.37
7/6/16	27.00	6.46	1.00	0.22
7/20/16	7.00	6.59	0.10	0.18
7/27/16	29.00	8.60	5.00	0.47
8/3/16	11.00	15.67	6.00	1.32
8/24/16	2.00	8.61	0.10	1.44
9/9/16	3.00	2.45	0.10	0.10
9/21/16	8.00	3.63	2.00	0.27
10/5/16	12.00	6.60	0.10	0.27
10/12/16	109.00	--	--	--
10/19/16	34.00	--	8.00	--

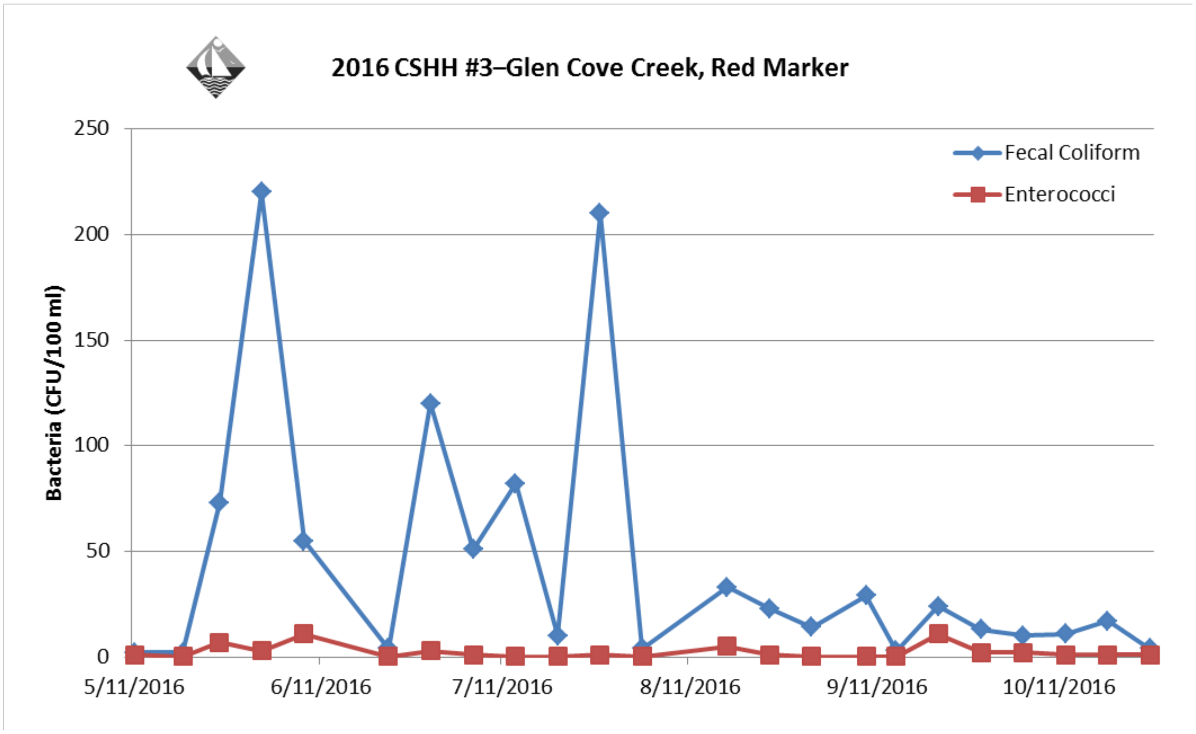
Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

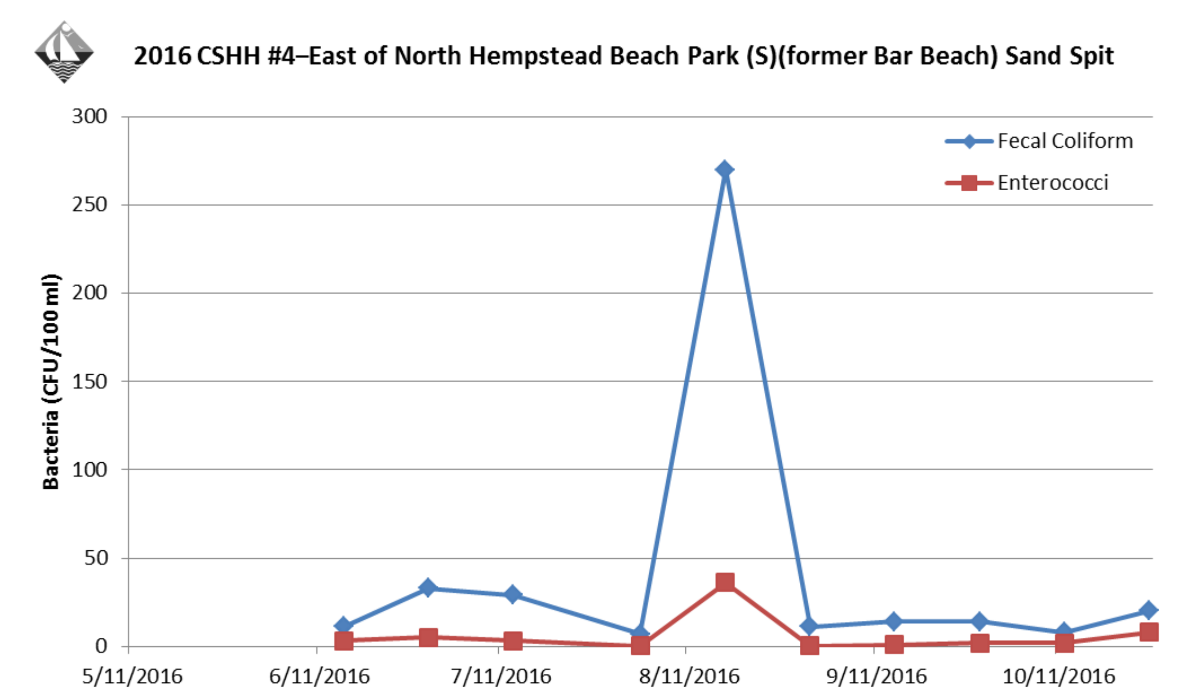
2016 In-Harbor Bacteria Graphs



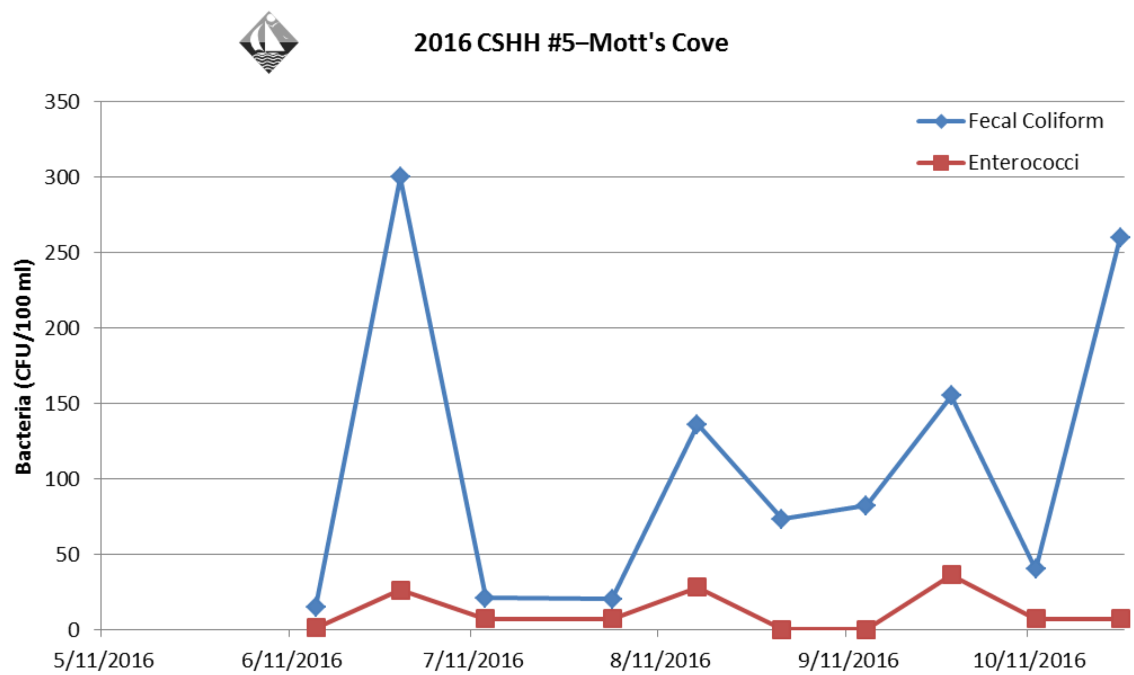


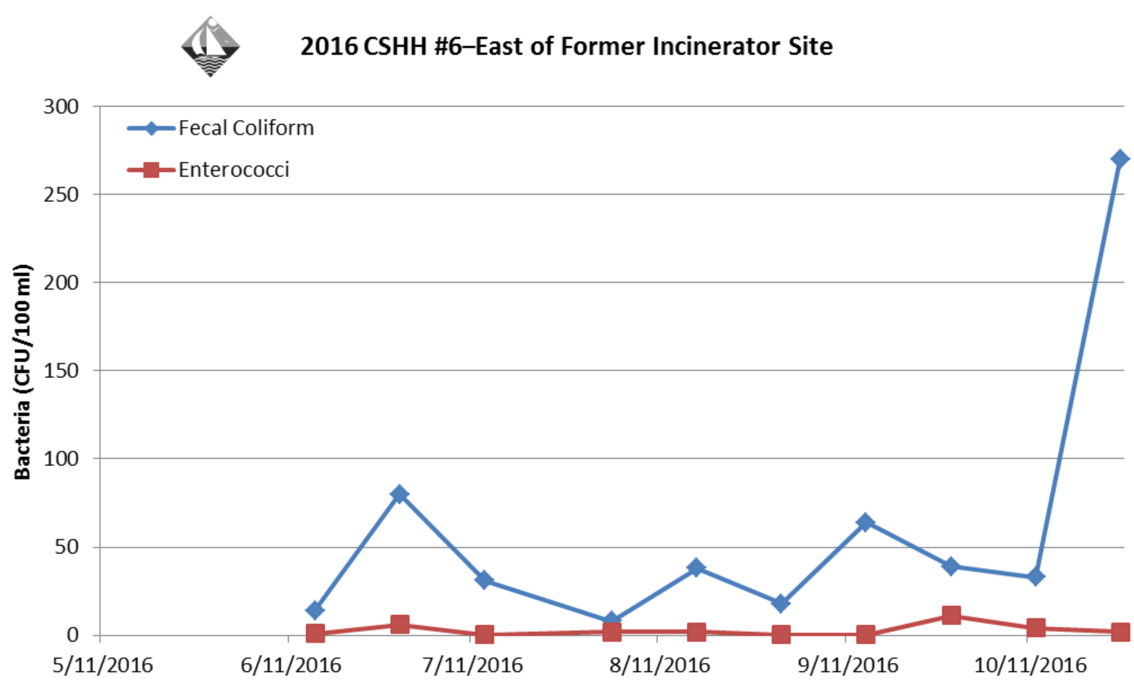
2016 In-Harbor Bacteria Graphs



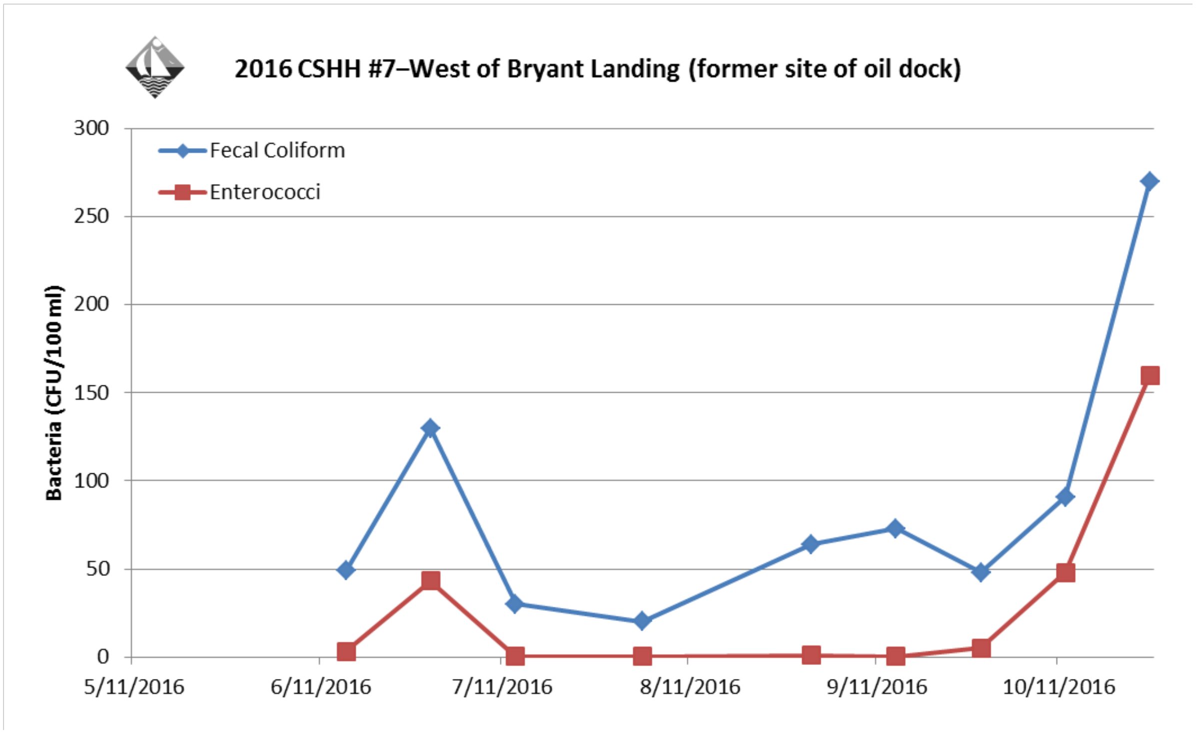


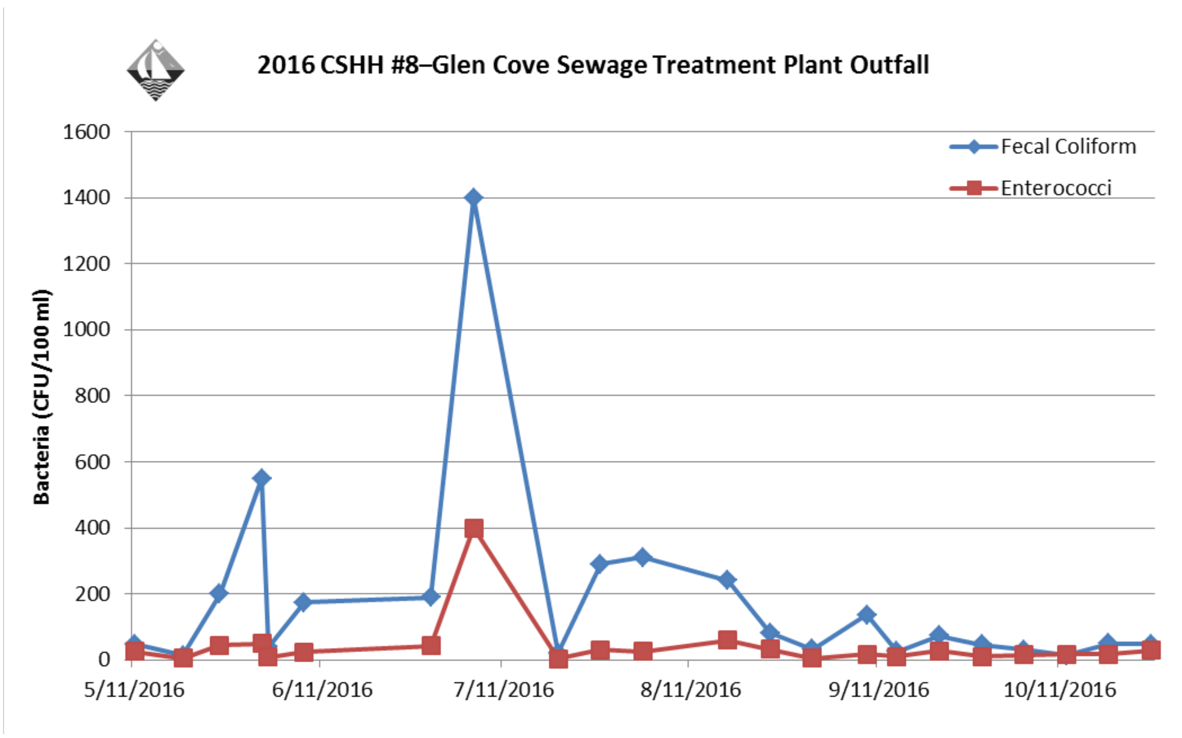
2016 In-Harbor Bacteria Graphs



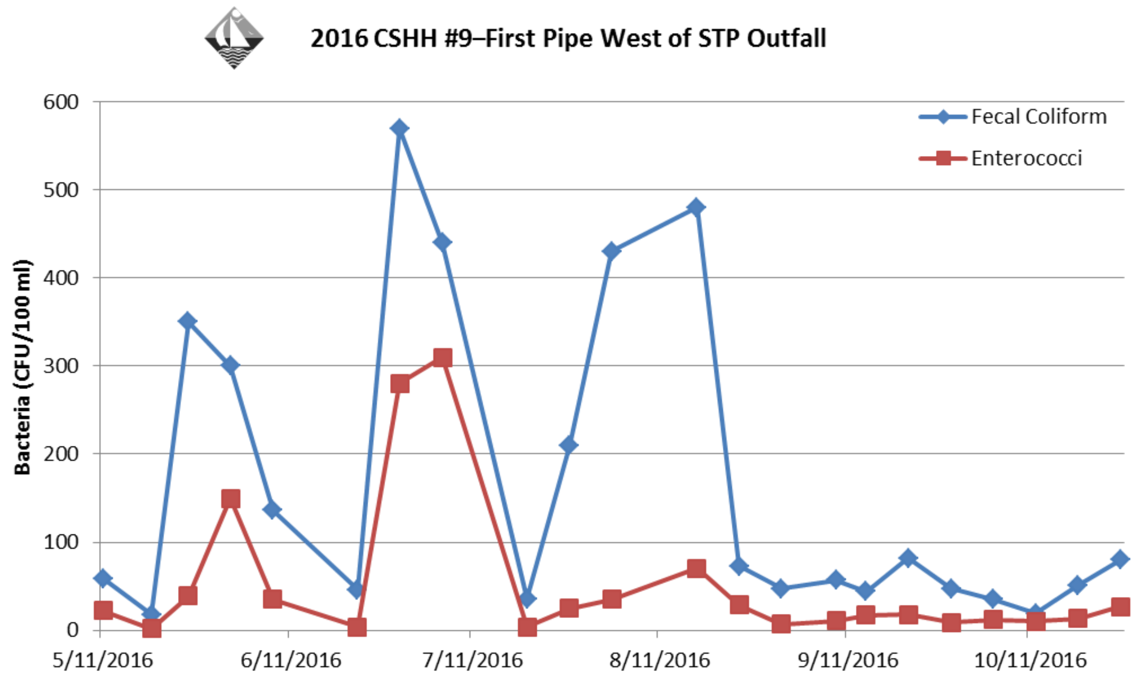


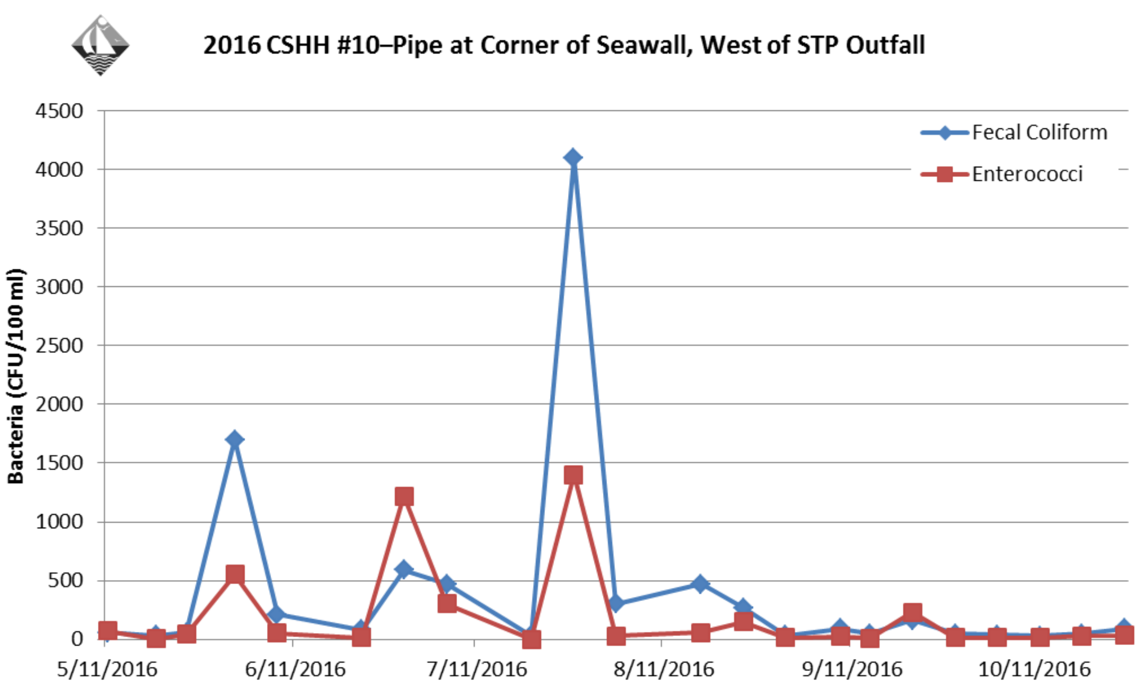
2016 In-Harbor Bacteria Graphs



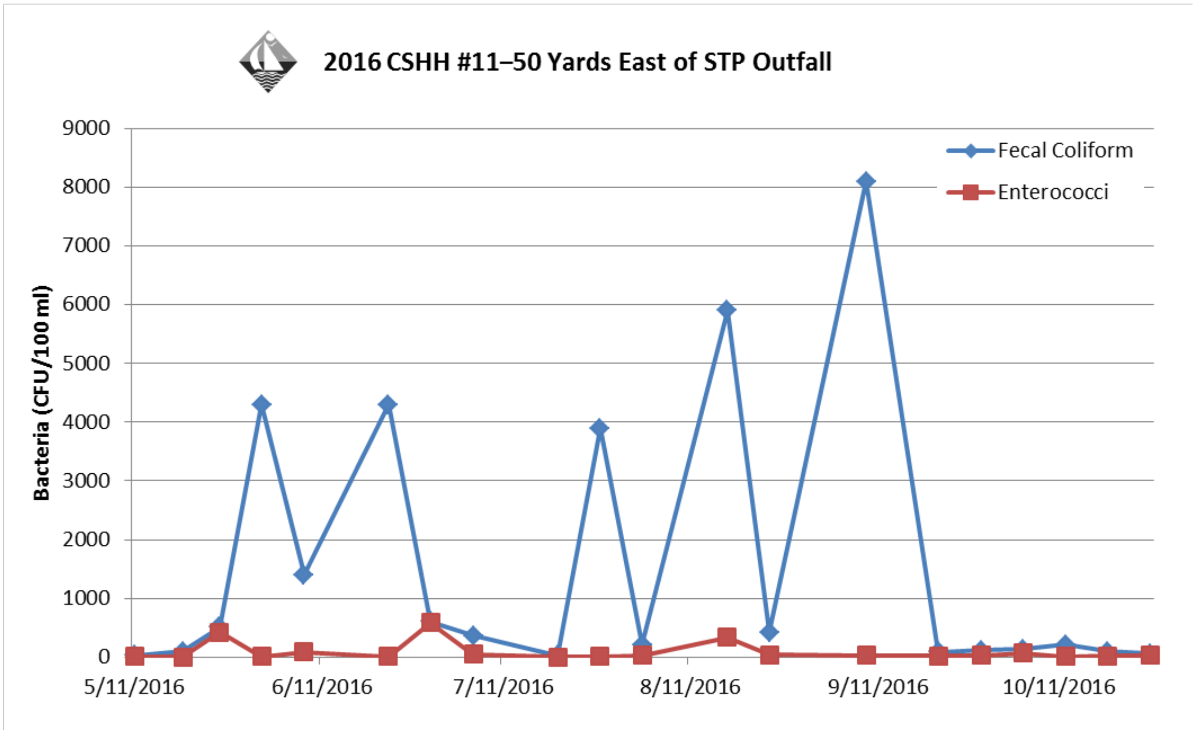


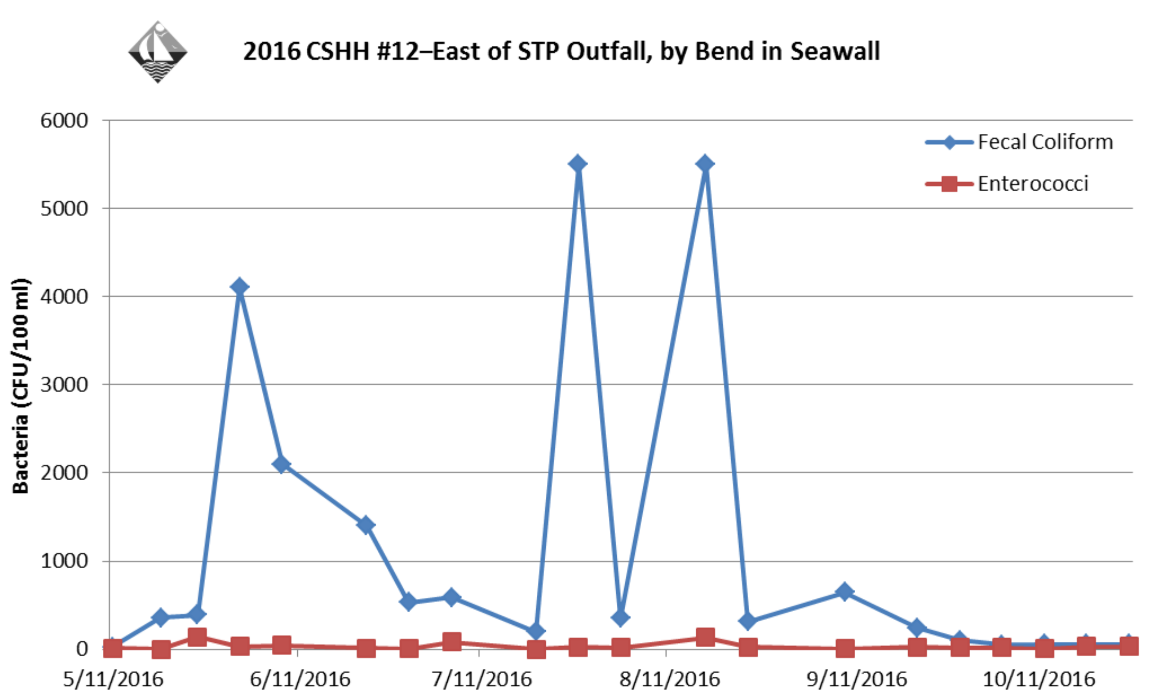
2016 In-Harbor Bacteria Graphs



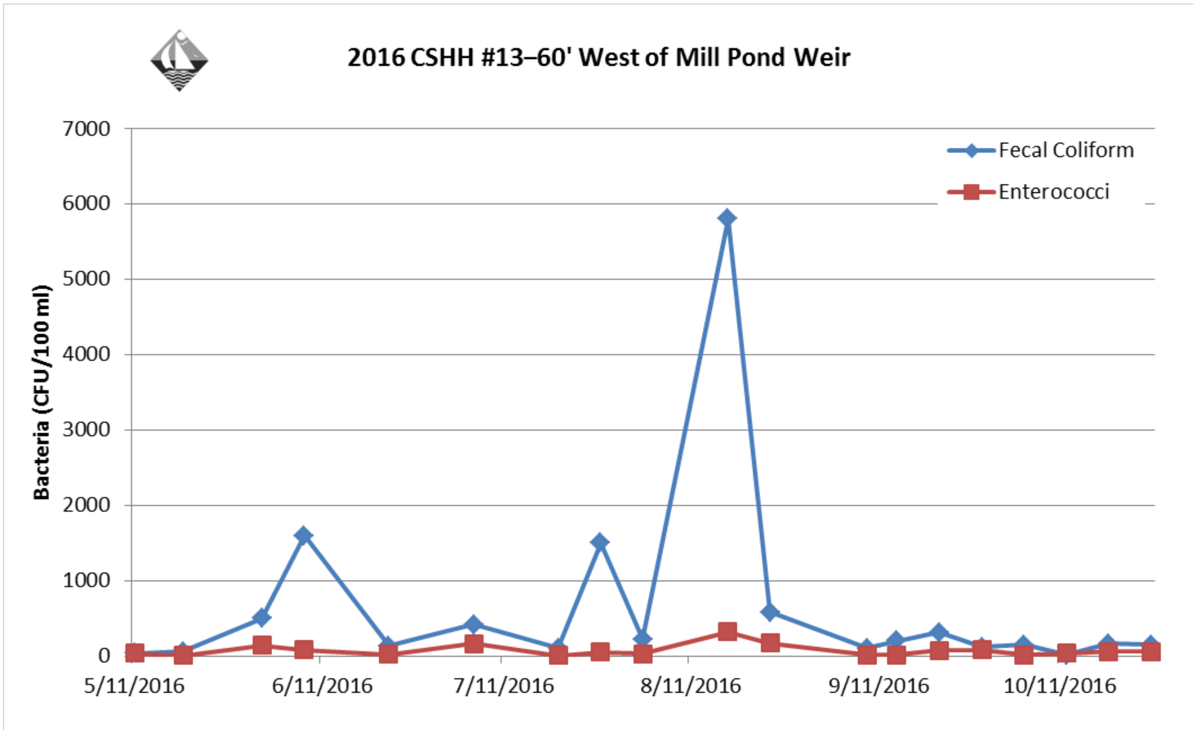


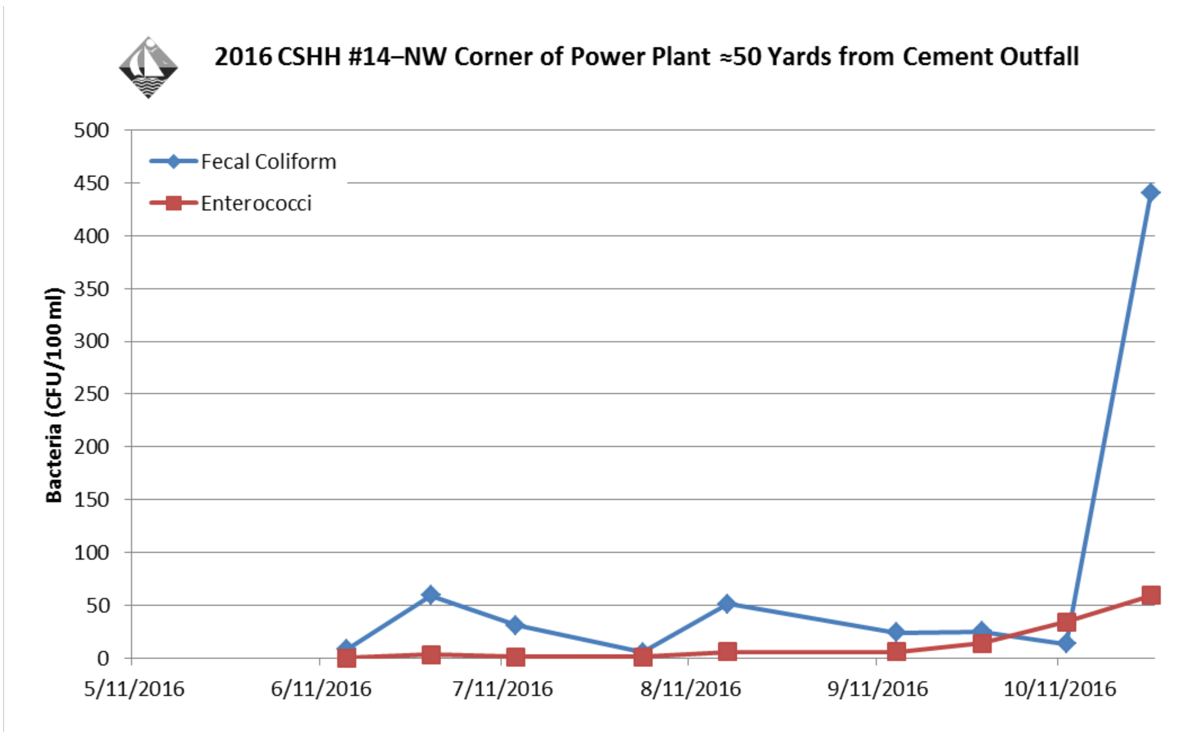
2016 In-Harbor Bacteria Graphs



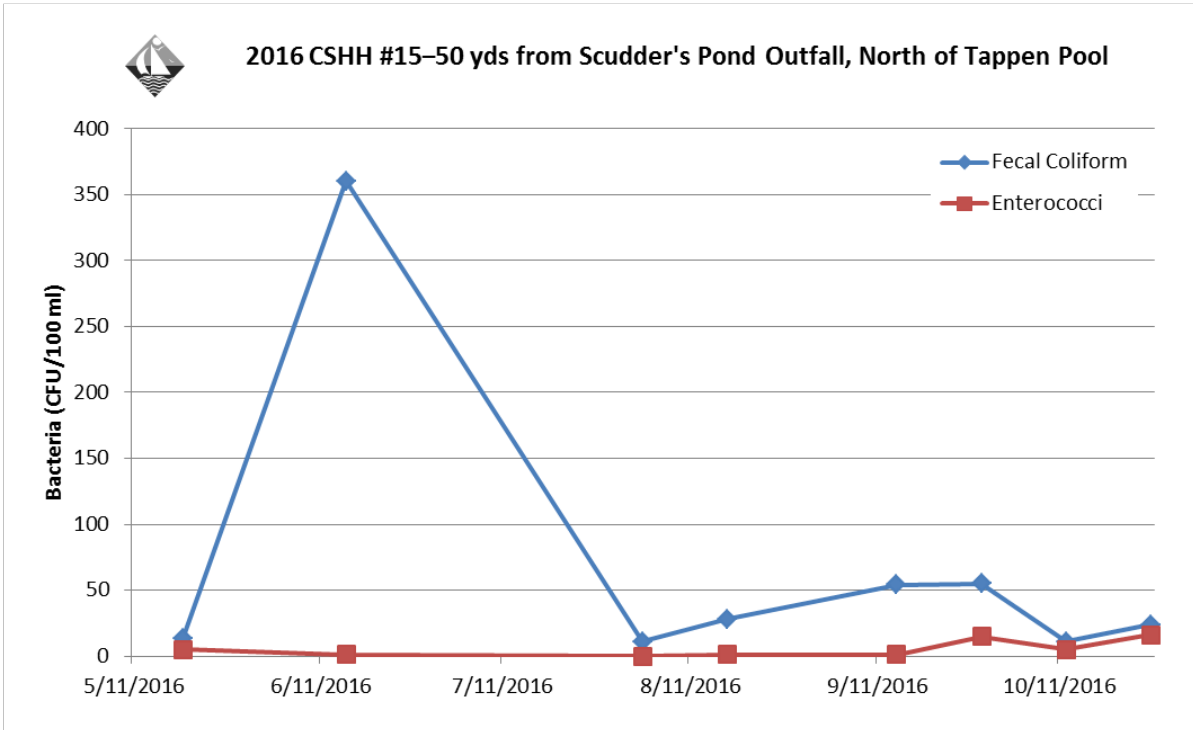


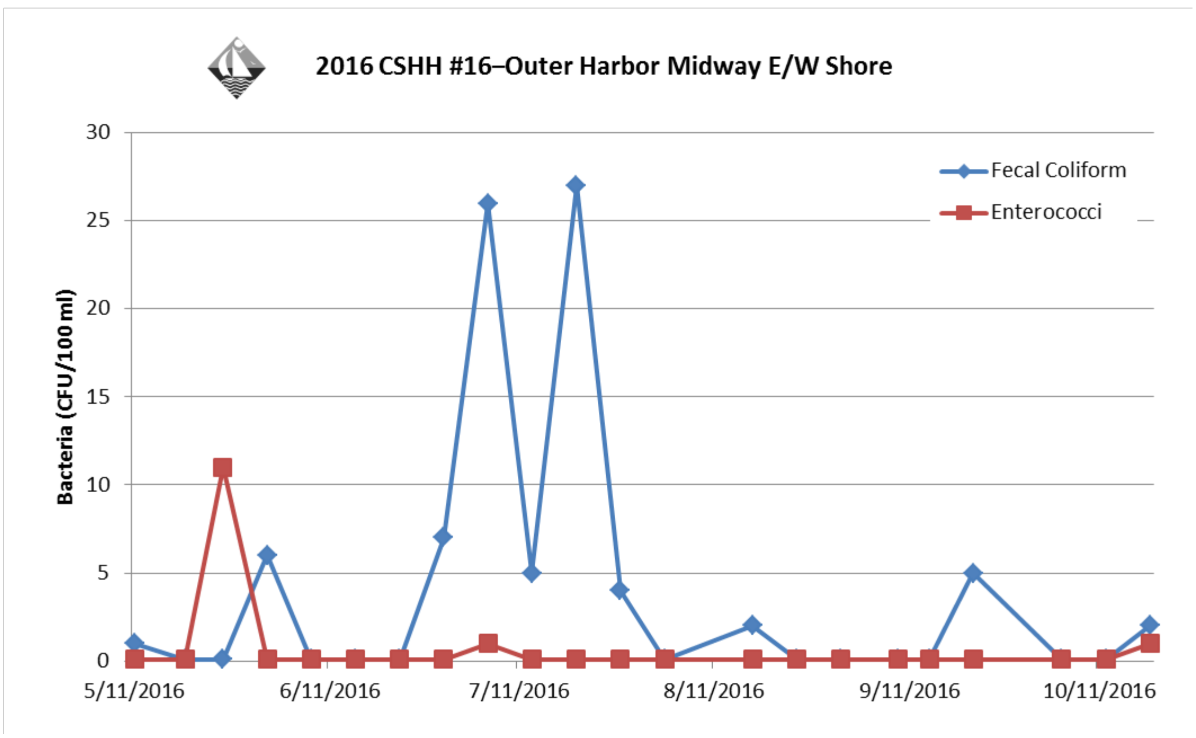
2016 In-Harbor Bacteria Graphs



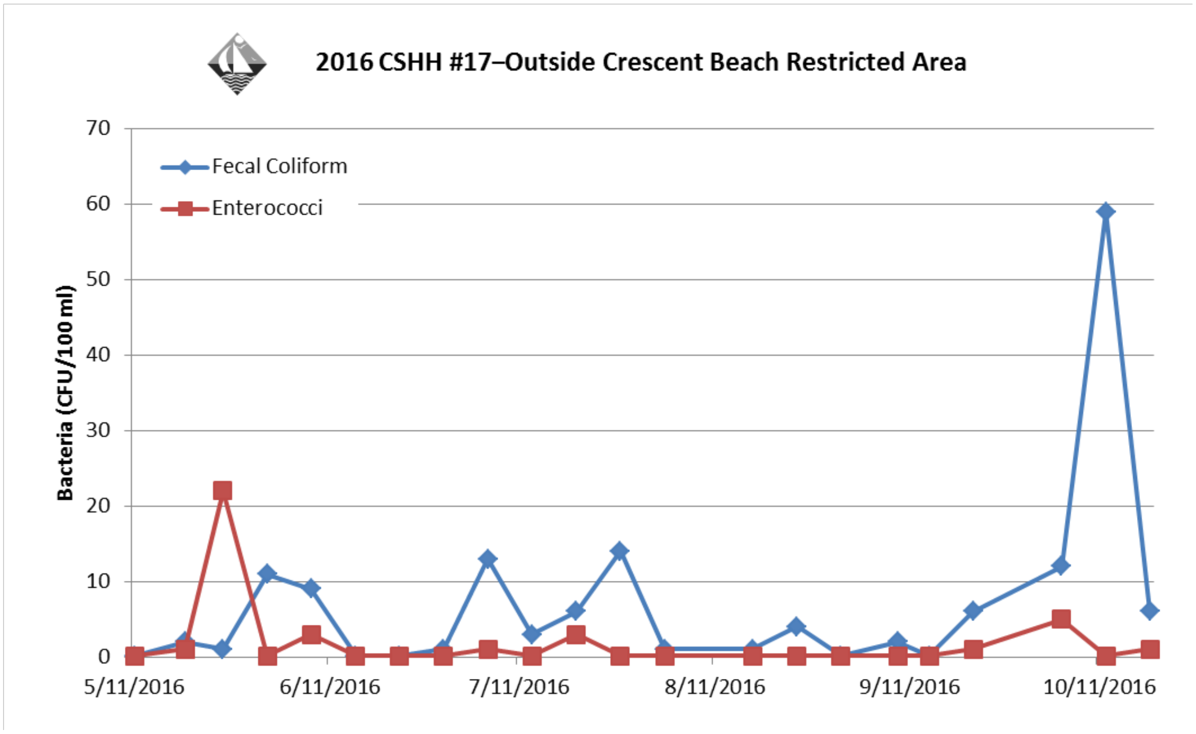


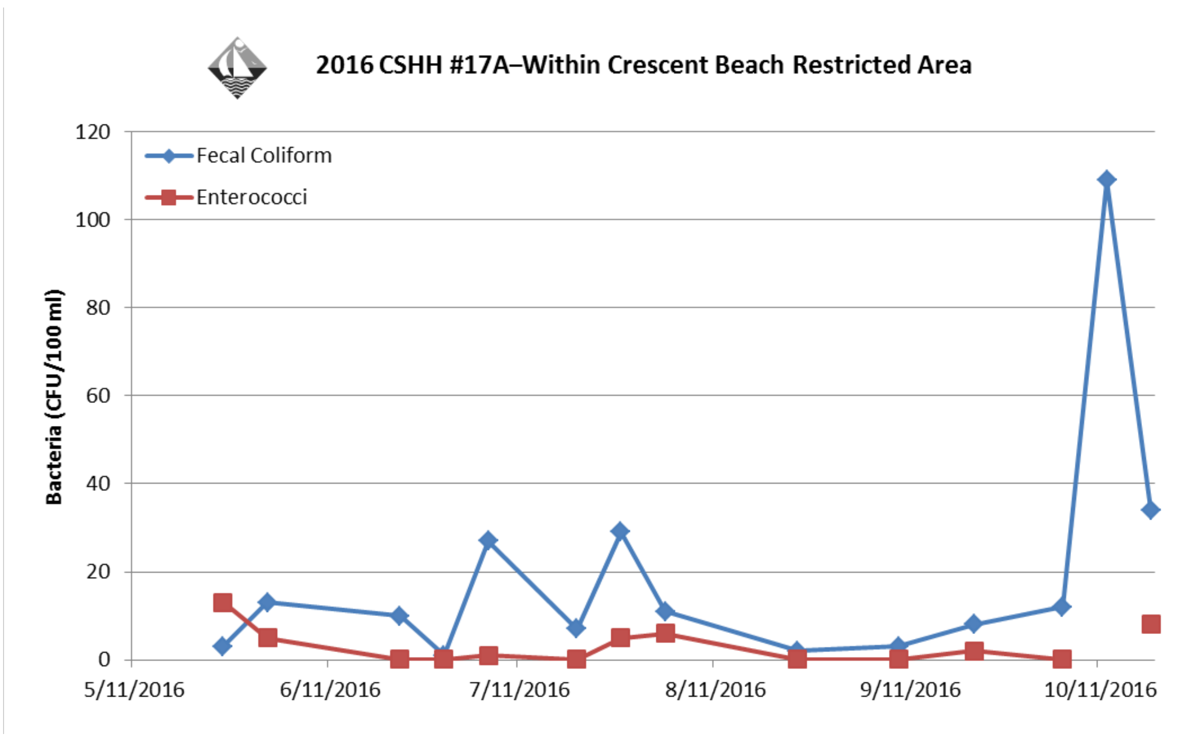
2016 In-Harbor Bacteria Graphs





2016 In-Harbor Bacteria Graphs





2016 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Data

CSHH #14A–Cement Outfall Adjacent to Power Plant

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
5/11/16	520.00	0.00	68.00	0.00
5/19/16	820.00	***652.99***	90.00	78.23
5/25/16	900.00	***726.70***	***340.00***	***127.67***
6/1/16	800.00	***744.37***	***550.00***	***183.93***
6/8/16	***2700.00***	***963.17***	***280.00***	***200.06***
6/15/16	27.00	***533.06***	***110.00***	***220.26***
6/22/16	***6001.00***	***793.70***	***460.00***	***305.23***
6/29/16	630.00	***739.05***	***150.00***	***259.15***
7/6/16	***5300.00***	***1078.73***	***450.00***	***248.96***
7/13/16	700.00	***823.49***	***130.00***	***213.54***
7/20/16	***3800.00***	***2214.85***	80.00	***200.36***
7/27/16	320.00	***1232.34***	90.00	***144.58***
8/3/16	***6300.00***	***1953.12***	***460.00***	***180.90***
8/10/16	800.00	***1338.11***	***1400.00***	***227.00***
8/17/16	***5300.00***	***2005.99***	***700.00***	***317.88***
8/24/16	550.00	***1362.84***	***900.00***	***515.81***
8/31/16	***4900.00***	***2352.09***	***600.00***	***753.83***
9/9/16	62.00	***933.39***	34.00	***447.73***
9/14/16	***1400.00***	***1043.93***	100.00	***264.12***
9/21/16	***6001.00***	***1070.19***	***240.00***	***213.21***
9/28/16	***4000.00***	***1591.48***	100.00	***137.39***
10/5/16	***4800.00***	***1584.93***	***110.00***	***97.86***
10/12/16	20.00	***1263.97***	100.00	***121.43***
10/19/16	660.00	***1087.48***	***160.00***	***133.40***
10/26/16	540.00	***671.82***	***260.00***	***135.55***
11/2/16	***2600.00***	***616.36***	***140.00***	***144.98***

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Data

CSHH #15A–Scudder's Pond Outfall at Seawall North of Tappen Pool

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
5/11/16	28.00	0.00	13.00	0.00
5/19/16	150.00	64.81	70.00	30.17
5/25/16	240.00	100.27	***170.00***	***53.68***
6/1/16	460.00	146.74	54.00	***53.76***
6/15/16	155.00	***225.09***	15.00	***55.72***
6/22/16	73.00	188.00	48.00	***50.70***
6/29/16	620.00	***238.34***	59.00	***38.92***
7/6/16	370.00	***225.72***	***270.00***	***58.20***
7/13/16	64.00	175.42	38.00	***53.44***
7/20/16	220.00	188.15	18.00	***55.42***
7/27/16	310.00	***251.25***	31.00	***50.78***
8/3/16	73.00	163.79	29.00	***44.06***
8/10/16	24.00	94.78	6.00	20.58
8/17/16	300.00	129.09	***570.00***	***35.37***
8/24/16	210.00	127.89	***180.00***	***56.05***
8/31/16	118.00	105.43	17.00	***49.71***
9/9/16	77.00	106.56	6.00	***36.27***
9/14/16	55.00	125.78	18.00	***45.19***
9/21/16	570.00	143.01	47.00	27.43
9/28/16	191.00	140.32	46.00	20.88
10/5/16	390.00	178.22	70.00	27.71
10/12/16	41.00	157.12	***110.00***	***49.58***
10/19/16	410.00	***234.81***	***190.00***	***79.44***
10/26/16	520.00	***230.53***	***250.00***	***110.97***

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

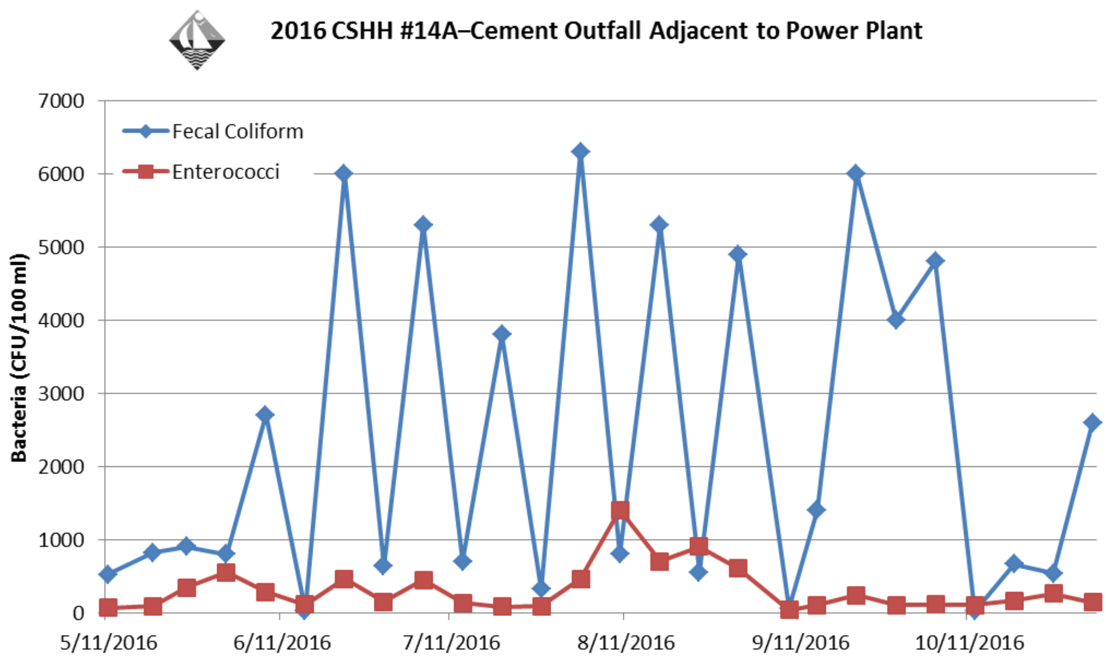
2016 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Data

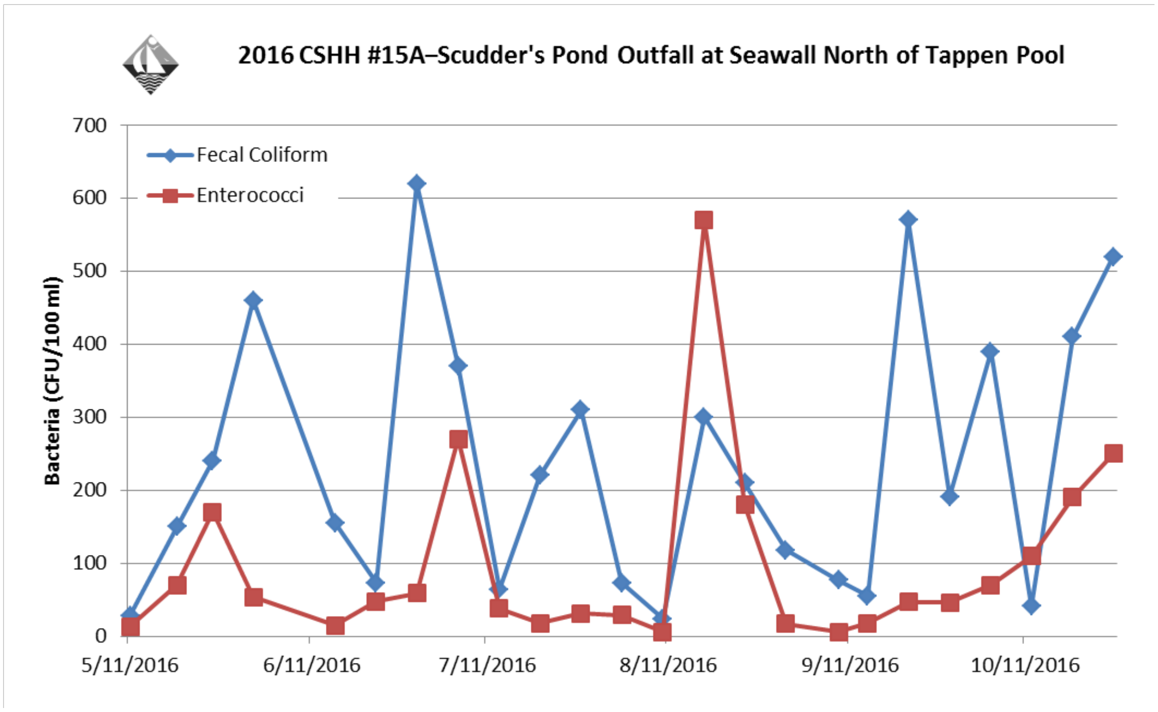
CSHH #15B–Scudder's Pond Weir

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
5/11/16	150.00	0.00	14.00	0.00
5/19/16	150.00	150.00	52.00	26.98
5/25/16	800.00	***262.07***	***150.00***	***47.80***
6/1/16	118.00	***214.68***	26.00	***41.05***
6/8/16	210.00	***213.73***	48.00	***42.35***
6/15/16	59.00	177.35	9.00	***38.77***
6/22/16	59.00	147.16	9.00	27.30
6/29/16	650.00	141.17	***190.00***	28.62
7/6/16	580.00	194.11	***210.00***	***43.47***
7/13/16	82.00	160.83	1.00	20.04
7/20/16	109.00	181.84	1.00	12.91
7/27/16	164.00	***223.09***	14.00	14.11
8/3/16	23.00	114.35	31.00	9.82
8/10/16	7.00	47.27	23.00	6.31
8/17/16	300.00	61.27	***590.00***	22.60
8/24/16	191.00	68.54	51.00	***49.61***
8/31/16	64.00	56.78	19.00	***52.73***
9/9/16	91.00	74.76	11.00	***42.86***
9/14/16	155.00	138.91	36.00	***46.88***
9/21/16	600.00	159.57	30.00	25.84
9/28/16	230.00	165.61	47.00	25.42
10/5/16	340.00	***231.28***	53.00	31.21
10/12/16	37.00	193.19	15.00	33.20
10/19/16	460.00	***240.14***	***180.00***	***45.81***
10/26/16	580.00	***238.52***	***490.00***	***80.09***

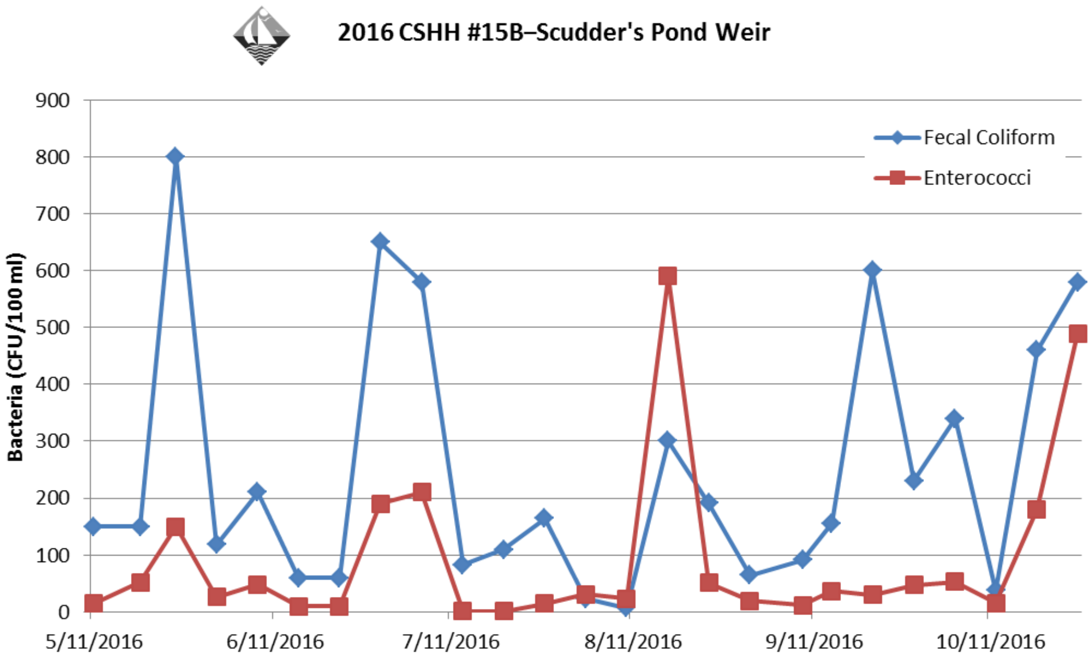
Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Graphs





2016 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Graphs



2016-2017 Scudder's Pond and Powerhouse Drain Outfalls Winter-Monitoring Bacteria Data

CSHH #14A–Cement Outfall Adjacent to Power Plant

	Fecal Coliform		***Enterococci***	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
11/9/2016	540.00	0.00	1.00	0.00
11/16/2016	210.00	**336.75**	36.00	6.00
11/23/2016	145.00	**254.29**	**280.00**	21.60
11/30/2016	550.00	**308.38**	**370.00**	**43.95**
12/7/2016	**1300.00**	**411.20**	**4300.00**	**109.91**
12/14/2016	118.00	**303.36**	**110.00**	**281.39**
12/22/2016	**2800.00**	**509.26**	**1400.00**	**585.15**
1/4/2017	91.00	**444.64**	**280.00**	**656.20**
1/11/2017	**2500.00**	**523.61**	**180.00**	**296.82**
1/18/2017	**5800.00**	**1386.41**	**260.00**	**368.03**
1/25/2017	**6001.00**	**1677.48**	**250.00**	**239.24**
2/1/2017	**4200.00**	**2015.47**	**6001.00**	**455.74**
2/10/2017	**1300.00**	**3430.50**	**460.00**	**503.31**
2/16/2017	**2400.00**	**3402.60**	**350.00**	**574.90**
2/22/2017	280.00	**1855.91**	90.00	**464.99**
3/2/2017	290.00	**1012.49**	**150.00**	**419.83**
3/10/2017	360.00	**619.44**	**190.00**	**210.47**
3/16/2017	**4200.00**	**783.18**	90.00	**151.87**
3/23/2017	**3900.00**	**863.05**	**100.00**	**118.21**
3/29/2017	240.00	**836.85**	16.00	**83.68**
4/5/2017	**1300.00**	**1129.68**	**240.00**	**91.93**
4/12/2017	**3300.00**	**1759.53**	**1100.00**	**130.62**
4/19/2017	800.00	**1262.89**	**390.00**	**175.13**
4/26/2017	300.00	**756.09**	**250.00**	**210.35**

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016-2017 Scudder's Pond and Powerhouse Drain Outfalls Winter-Monitoring Bacteria Data

CSHH #15A–Scudder's Pond Outfall at Seawall N. of Tappen Pool

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
11/16/16	1000.00	0.00	**110.00**	0.00
12/14/16	182.00	**426.61**	70.00	**87.75**
1/4/17	82.00	122.16	**140.00**	**98.99**
1/25/17	173.00	119.10	90.00	**112.25**
2/10/17	1.00	13.15	1.00	9.49
2/22/17	5.00	9.53	1.00	4.48
3/2/17	34.00	5.54	3.00	1.44
3/10/17	21.00	7.73	10.00	2.34
3/29/17	20.00	24.26	6.00	5.65
4/5/17	57.00	28.82	14.00	9.44
4/12/17	73.00	43.66	4.00	6.95
4/19/17	220.00	65.41	10.00	7.61
4/26/17	360.00	92.00	**210.00**	14.78

CSHH #15B–Scudder's Pond Weir

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
11/16/16	**1300.00**	0.00	60.00	0.00
12/14/16	10.00	114.02	56.00	**57.97**
1/4/17	**2400.00**	154.92	100.00	**74.83**
1/25/17	109.00	**511.47**	70.00	**83.67**
2/10/17	0.10	3.30	1.00	8.37
2/22/17	3.00	3.20	27.00	12.36
3/2/17	35.00	2.19	0.10	1.39
3/10/17	15.00	3.54	2.00	1.52
3/29/17	173.00	44.95	7.00	1.12
4/5/17	73.00	57.43	**210.00**	14.33
4/12/17	230.00	142.68	6.00	20.66
4/19/17	270.00	167.35	4.00	13.71
4/26/17	**1700.00**	**266.06**	320.00	25.74

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2016 Beach-Monitoring Bacteria Data

Village Club of Sands Point (Formerly IBM Beach)

	Enterococci	
Date	CFU/100ml	Log AvgEnt
4/11/16	0.10	0.00
4/13/16	3.00	0.55
4/18/16	0.10	0.31
4/20/16	0.10	0.23
4/25/16	0.10	0.20
4/27/16	0.10	0.18
5/4/16	47.00	0.39
5/9/16	0.10	0.33
5/11/16	0.10	0.29
5/16/16	2.00	0.31
5/18/16	10.00	0.46
5/23/16	10.00	0.99
5/25/16	100.00	1.66
6/1/16	11.00	4.23
6/6/16	19.00	3.78
6/8/16	4.00	3.81
6/13/16	1.00	8.00
6/15/16	0.10	4.91
6/20/16	1.00	4.12
6/22/16	2.00	3.81
6/27/16	0.10	1.42
6/29/16	3.00	1.55
7/6/16	25.00	1.69
7/11/16	32.00	1.62
7/13/16	7.00	1.91
7/18/16	18.00	3.96
7/20/16	3.00	3.84
7/25/16	3.00	4.78
7/27/16	1.00	4.02
8/1/16	***990.00***	13.16
8/3/16	5.00	11.82
8/8/16	5.00	9.88
8/10/16	3.00	8.77
8/15/16	4.00	7.14
8/17/16	13.00	7.58
08/22/16	42.00	9.23
8/24/16	0.10	5.87
8/29/16	1.00	6.33
8/31/16	70.00	8.04

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

2016 Beach-Monitoring Bacteria Data

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

	Enterococci	
Date	**CFU/100ml**	**Log AvgEnt**
04/11/16	0.10	0.00
04/13/16	0.10	0.10
04/18/16	0.10	0.10
04/20/16	0.10	0.10
04/25/16	0.10	0.10
04/27/16	1.00	0.15
05/02/16	0.10	0.14
05/04/16	51.00	0.29
05/09/16	0.10	0.26
05/11/16	0.10	0.23
05/16/16	0.10	0.26
05/18/16	1.00	0.30
05/23/16	1.00	0.43
05/25/16	3.00	0.52
06/01/16	15.00	0.85
06/06/16	1.00	0.68
06/08/16	3.00	0.80
06/13/16	1.00	1.38
06/15/16	0.10	1.03
06/20/16	4.00	1.65
06/22/16	15.00	2.10
06/27/16	0.10	1.51
06/29/16	11.00	1.88
07/06/16	6.00	1.70
07/11/16	1.00	1.58
07/13/16	0.10	1.17
07/18/16	4.00	1.88
07/20/16	7.00	2.18
07/25/16	46.00	2.32
07/27/16	1.00	2.12
08/01/16	93.00	4.05
08/03/16	***120.00***	5.90
08/08/16	1.00	4.83
08/10/16	3.00	4.61
08/15/16	9.00	9.00
08/17/16	16.00	9.53
08/22/16	100.00	14.11
08/24/16	0.10	8.60
08/29/16	0.10	5.53
08/31/16	2.00	4.99

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

2016 Beach-Monitoring Bacteria Data

North Hempstead Beach Park (S) (Formerly Bar Beach)

	Enterococci	
Date	**CFU/100ml**	**Log AvgEnt**
4/11/16	1.00	0.00
4/13/16	0.10	0.32
4/18/16	0.10	0.22
4/20/16	2.00	0.38
4/25/16	0.10	0.29
4/27/16	0.10	0.24
5/2/16	1.00	0.30
5/4/16	5.00	0.42
5/9/16	0.10	0.36
5/11/16	0.10	0.32
5/16/16	71.00	0.58
5/18/16	0.10	0.48
5/23/16	1.00	0.53
5/25/16	3.00	0.63
6/1/16	3.00	1.14
6/6/16	4.00	1.12
6/8/16	9.00	1.42
6/13/16	4.00	3.13
6/15/16	1.00	2.76
6/20/16	1.00	2.45
6/22/16	0.10	1.72
6/27/16	0.10	1.20
6/29/16	4.00	1.37
7/6/16	6.00	1.48
7/11/16	3.00	1.14
7/13/16	1.00	1.12
7/18/16	2.00	1.05
7/20/16	15.00	1.41
7/25/16	3.00	2.25
7/27/16	18.00	2.83
8/1/16	35.00	5.64
8/3/16	0.10	3.60
8/8/16	4.00	3.44
8/10/16	3.00	3.40
8/15/16	14.00	4.62
8/17/16	***260.00***	6.91
8/19/16	36.00	9.22
8/22/16	48.00	10.36
8/24/16	0.10	6.80
8/29/16	0.10	4.39
8/31/16	1.00	3.84

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

2016 Beach-Monitoring Bacteria Data

Tappen Beach

	Enterococci	
Date	CFU/100ml	Log AvgEnt
04/11/16	1.00	0.00
04/13/16	0.10	0.32
04/18/16	0.10	0.22
04/20/16	2.00	0.38
04/25/16	2.00	0.53
04/27/16	0.10	0.40
05/02/16	1.00	0.45
05/04/16	7.00	0.64
05/09/16	4.00	0.78
05/11/16	0.10	0.64
05/16/16	16.00	1.07
05/18/16	2.00	1.14
05/23/16	3.00	1.56
05/25/16	6.00	1.78
06/01/16	12.00	2.99
06/06/16	9.00	3.54
06/08/16	25.00	4.40
06/13/16	1.00	5.94
06/15/16	1.00	4.88
06/20/16	7.00	4.91
06/22/16	1.00	4.12
06/27/16	0.10	2.57
06/29/16	3.00	2.61
07/06/16	1.00	1.98
07/11/16	5.00	1.34
07/13/16	0.10	1.01
07/18/16	11.00	1.36
07/20/16	4.00	1.53
07/25/16	2.00	1.38
07/27/16	1.00	1.33
08/01/16	48.00	2.60
08/03/16	1.00	2.34
08/08/16	1.00	2.34
08/10/16	3.00	2.40
08/15/16	0.10	2.21
08/17/16	16.00	2.70
08/22/16	***250.00***	3.65
08/24/16	1.00	3.21
08/29/16	0.10	2.62
08/31/16	2.00	2.55

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

2016 Beach-Monitoring Bacteria Data

Sea Cliff Village Beach

	Enterococci	
Date	CFU/100ml	Log AvgEnt
04/11/16	2.00	0.00
04/13/16	1.00	1.41
04/18/16	0.10	0.58
04/20/16	0.10	0.38
04/25/16	0.10	0.29
04/27/16	0.10	0.24
05/02/16	1.00	0.30
05/04/16	6.00	0.43
05/09/16	3.00	0.54
05/11/16	0.10	0.45
05/16/16	0.10	0.30
05/18/16	0.10	0.27
05/23/16	0.10	0.30
05/25/16	8.00	0.41
06/01/16	57.00	0.98
06/06/16	12.00	1.06
06/08/16	***6001.00***	2.78
06/10/16	2.00	2.66
06/13/16	***140.00***	5.94
06/15/16	9.00	6.19
06/20/16	0.10	9.79
06/22/16	0.10	6.19
06/27/16	4.00	9.07
06/29/16	2.00	7.79
07/06/16	3.00	5.81
07/11/16	2.00	2.23
07/13/16	0.10	1.58
07/18/16	32.00	1.06
07/20/16	1.00	1.05
07/25/16	6.00	2.35
07/27/16	0.10	1.65
08/01/16	9.00	1.79
08/03/16	***120.00***	2.85
08/05/16	8.00	3.16
08/08/16	24.00	3.89
08/10/16	10.00	4.24
08/15/16	2.00	6.17
08/17/16	32.00	7.16
08/22/16	89.00	9.66
08/24/16	15.00	10.06
08/29/16	0.10	10.59
08/31/16	15.00	10.93

**6/8/16 enterococci result may be an anomaly.

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

2016 Beach-Monitoring Bacteria Data

Crescent Beach

	Enterococci	
Date	**CFU/100ml**	**Log AvgEnt**
4/12/16	2.00	0.00
4/12/16	1.00	1.41
4/12/16	1.00	1.26
4/19/16	2.00	1.41
4/19/16	0.10	0.83
4/19/16	1.00	0.86
4/26/16	0.10	0.63
4/26/16	1.00	0.67
4/26/16	0.10	0.54
5/2/16	7.00	0.70
5/2/16	9.00	0.88
5/2/16	9.00	1.07
5/3/16	72.00	1.48
5/3/16	***380.00***	2.20
5/3/16	26.00	2.59
5/4/16	41.00	3.08
5/4/16	36.00	3.56
5/4/16	80.00	4.23
5/9/16	***210.00***	5.20
5/9/16	***170.00***	6.19
5/9/16	***150.00***	7.20
5/10/16	0.10	5.93
5/10/16	4.00	5.83
5/10/16	24.00	6.18
5/11/16	1.00	5.75
5/11/16	4.00	5.67
5/16/16	24.00	7.27
5/16/16	13.00	7.44
5/16/16	79.00	8.15
5/17/16	47.00	8.69
5/17/16	31.00	9.10
5/17/16	13.00	9.21
5/18/16	7.00	9.12
5/18/16	12.00	9.21
5/18/16	***170.00***	10.08
5/24/16	***250.00***	14.92
5/24/16	***400.00***	16.59
5/24/16	***290.00***	18.14
5/25/16	2.00	16.97

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

2016 Beach-Monitoring Bacteria Data

Crescent Beach (cont.)

5/25/16	18.00	17.00
5/25/16	7.00	16.57
5/31/16	49.00	25.42
5/31/16	31.00	25.57
5/31/16	28.00	25.63
6/1/16	43.00	26.00
6/1/16	***200.00***	27.48
6/1/16	***170.00***	28.83
6/6/16	***6100.00***	33.06
6/6/16	***5200.00***	***38.92***
6/6/16	***4600.00***	***45.18***
6/7/16	7.00	***42.70***
6/7/16	10.00	***40.91***
6/7/16	40.00	***40.89***
6/8/16	***220.00***	***42.84***
6/8/16	***250.00***	***44.94***
6/8/16	***3200.00***	***50.27***
6/13/16	16.00	***71.81***
6/13/16	13.00	***68.08***
6/13/16	10.00	***64.23***
6/14/16	1.00	***56.83***
6/14/16	1.00	***50.64***
6/14/16	8.00	***48.11***
6/21/16	21.00	***56.50***
6/21/16	9.00	***53.03***
6/21/16	23.00	***51.58***
6/22/16	1.00	***45.42***
6/22/16	1.00	***40.31***
6/22/16	1.00	***36.04***
6/27/16	0.10	27.98
6/27/16	0.10	23.04
6/27/16	0.10	19.22
6/28/16	4.00	18.27
6/28/16	2.00	17.05
6/28/16	6.00	16.52
6/29/16	70.00	17.23
6/29/16	20.00	17.31
6/29/16	16.00	17.27
7/5/16	48.00	13.90
7/5/16	***160.00***	15.00
7/5/16	66.00	15.69
7/6/16	17.00	15.72
7/6/16	23.00	15.90

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

2016 Beach-Monitoring Bacteria Data

Crescent Beach (cont.)

7/6/16	5.00	15.39
7/11/16	33.00	5.81
7/11/16	16.00	6.02
7/11/16	17.00	6.23
7/12/16	0.10	5.45
7/12/16	2.00	5.29
7/12/16	0.10	4.69
7/13/16	1.00	4.48
7/13/16	0.10	4.02
7/13/16	10.00	4.12
7/18/16	3.00	3.92
7/18/16	1.00	3.76
7/18/16	1.00	3.61
7/19/16	8.00	3.70
7/19/16	2.00	3.63
7/19/16	4.00	3.64
7/20/16	10.00	3.74
7/20/16	1.00	3.61
7/20/16	1.00	3.50
7/25/16	45.00	3.67
7/25/16	23.00	3.87
7/25/16	15.00	4.02
7/26/16	***240.00***	4.49
7/26/16	***1600.00***	5.24
7/26/16	***230.00***	5.78
7/27/16	11.00	5.87
7/27/16	4.00	5.81
7/27/16	19.00	5.98
8/1/16	39.00	8.26
8/1/16	42.00	8.66
8/1/16	55.00	9.11
8/2/16	13.00	9.20
8/2/16	17.00	9.35
8/2/16	4.00	9.15
8/3/16	90.00	9.69
8/3/16	***160.00***	10.37
8/3/16	***110.00***	10.97
8/8/16	5.00	9.05
8/8/16	4.00	8.86
8/8/16	17.00	9.01
8/10/16	7.00	8.95
8/10/16	2.00	8.63
8/10/16	5.00	8.52

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

2016 Beach-Monitoring Bacteria Data

Crescent Beach (cont.)

8/15/16	18.00	13.18
8/15/16	29.00	13.48
8/15/16	24.00	13.70
8/16/16	89.00	14.41
8/16/16	26.00	14.63
8/16/16	***230.00***	15.70
8/17/16	80.00	16.36
8/17/16	***330.00***	17.60
8/17/16	***250.00***	18.75
8/22/16	46.00	33.48
8/22/16	36.00	33.55
8/22/16	38.00	33.67
8/23/16	3.00	31.54
8/23/16	1.00	28.80
8/23/16	1.00	26.42
8/24/16	5.00	25.34
8/24/16	3.00	24.06
8/24/16	4.00	23.05
8/29/16	10.00	18.61
8/29/16	9.00	18.23
8/29/16	11.00	17.98
8/30/16	10.00	17.70
8/30/16	29.00	17.93
8/30/16	2.00	16.95
8/31/16	70.00	17.56
8/31/16	90.00	18.27
8/31/16	***110.00***	19.07
9/7/16	15.00	15.90
9/7/16	17.00	15.93
9/7/16	11.00	15.77
9/14/16	21.00	19.61
9/14/16	11.00	19.26
9/14/16	21.00	19.31
9/21/16	0.10	9.81
9/21/16	0.10	8.22
9/21/16	0.10	6.98

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

2016 Beach-Monitoring Bacteria Data

Morgan Memorial Beach

	Enterococci	
Date	**CFU/100ml**	**Log AvgEnt**
4/12/16	6.00	0.00
4/19/16	***178.00***	32.68
4/26/16	7.00	19.55
5/2/16	0.10	5.23
5/3/16	36.00	7.69
5/4/16	2.00	6.14
5/9/16	36.00	7.91
5/10/16	21.00	8.94
5/11/16	6.00	8.55
5/16/16	5.00	8.38
5/17/16	0.10	5.38
5/18/16	1.00	4.62
5/24/16	4.00	3.27
5/25/16	2.00	3.14
5/31/16	12.00	3.28
6/1/16	21.00	3.79
6/6/16	22.00	5.34
6/7/16	8.00	5.52
6/8/16	43.00	6.47
6/13/16	14.00	5.37
6/14/16	1.00	4.67
6/21/16	0.10	5.41
6/22/16	3.00	5.13
6/27/16	4.00	5.63
6/28/16	48.00	6.84
6/29/16	16.00	7.34
7/5/16	5.00	6.16
7/6/16	10.00	6.42
7/11/16	9.00	4.75
7/12/16	5.00	4.77
7/13/16	13.00	5.18
7/18/16	1.00	4.74
7/19/16	13.00	5.15
7/20/16	0.10	3.81
7/25/16	6.00	5.46
7/26/16	17.00	5.96
7/27/16	1.00	5.24
8/1/16	53.00	4.93
8/2/16	8.00	5.12

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

2016 Beach-Monitoring Bacteria Data

Morgan Memorial Beach

8/3/16	3.00	4.92
8/8/16	4.00	4.58
8/9/16	20.00	5.09
8/10/16	3.00	4.92
8/15/16	23.00	4.90
8/16/16	18.00	5.37
8/17/16	***590.00***	7.35
8/18/16	***310.00***	10.78
8/19/16	***105.00***	12.39
8/22/16	27.00	17.99
8/23/16	1.00	15.02
8/24/16	2.00	13.34
8/29/16	2.00	14.50
8/30/16	2.00	12.81
8/31/16	10.00	12.62

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

Coalition to Save Hempstead Harbor

FUSS & O'NEILL

2016 Sea Cliff Precipitation Data

CSHH 2016 (JANUARY-DECEMBER) PRECIPITATION DATA FOR SEA CLIFF																	
MO/DAY	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**
JAN			**MARCH**			**MAY**			**JULY**			**SEPT**			**NOV**		
10	31.8	1.25	1	1.0	0.04	1	5.3	0.21	1C	30.7	1.21	1	7.4	0.29	9	0.3	0.01
14**	2.5	0.10	2	5.3	0.21	3	20.8	0.82	2†	0.0	0.0	6	3.8	0.15	15	25.7	1.01
16	9.4	0.37	4**	2.5	0.10	5	1.8	0.07	4	1.0	0.04	7	6.4	0.25	20	13.7	0.54
17**	0.8	0.03	11	5.1	0.20	6	18.3	0.72	5A†	32.5	1.28	10	8.4	0.33	21Tsnow	0.0	0
23**blizzard	53.3	2.10	14	8.9	0.35	8	4.6	0.18	7	4.3	0.17	14	12.2	0.48	24	2.8	0.11
			15	1.3	0.05	13	6.9	0.27	8	1.0	0.04	19	14.2	0.56	25	1.0	0.04
			21**	5.1	0.20	14	0.8	0.03	9	2.0	0.08	22-27	15.0	0.59	29	52.3	2.06
			25	1.3	0.05	21	1.3	0.05	10	1.0	0.04	29	2.0	0.08	30	33.5	1.32
			28	18.8	0.74	22	5.3	0.21	13	2.5	0.10	30	6.6	0.26			
						23	0.5	0.02	14	10.7	0.42						
						24	8.1	0.32	15†	1.3	0.05						
						30†	30.7	1.21	16T	0.0	0.00						
						31	0.5	0.02	18	5.8	0.23						
TOTAL	**97.8**	**3.85**	**TOTAL**	**49.3**	**1.94**	**TOTAL**	**104.9**	**4.13**	25	14.0	0.55	**TOTAL**	**75.9**	**2.99**	**TOTAL**	**129.3**	**5.09**
									29†	18.0	0.71						
									30	5.8	0.23						
									31	3.3	0.13						
									TOTAL	**134.1**	**5.28**						
MO/DAY	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**
FEB			**APRIL**			**JUNE**			**AUGUST**			**OCT**			**DEC**		
1	0.8	0.03	1	1.5	0.06	3	1.0	0.04	6	2.5	0.10	1	1.0	0.04	5	5.3	0.21
3	18.5	0.73	2	5.8	0.23	4	2.5	0.10	10C	14.2	0.56	2	0.3	0.01	6	11.7	0.46
4	0.8	0.03	3	9.1	0.36	5	9.7	0.38	11A†	20.8	0.82	8	11.4	0.45	7	3.0	0.12
5*	35.6	1.40	4	14.0	0.55	7	0.3	0.01	12†	10.2	0.40	9	19.8	0.78	11*	2.5	0.10
8**	8.9	0.35	7	2.5	0.10	8	8.9	0.35	14	1.5	0.06	13	0.5	0.02	12	14.7	0.58
10**T	0.0	0.0	8T	0.0	0	10T	0.0	0	16	0.12	0.02	21	24.6	0.97	15T*	0.0	0
11**T	0.0	0.0	9	2.3	0.09	11T	0.0	0	18	0.5	3.50	22	11.9	0.47	17*	11.2	0.44
15*	21.6	0.85	11	0.5	0.02	16	2.0	0.08	20B***	88.9	0.12	24	1.0	0.04	18	4.6	0.18
16	14.0	0.55	12	6.4	0.25	27	2.5	0.10	21	3.0		27	48.3	1.90	24	12.7	0.50
21	2.3	0.09	23	5.6	0.22	28	9.1	0.36				30	28.2	1.11	26T	0.0	0
23	6.4	0.25	26	12.2	0.48	29	0.5	0.02							29	16.0	0.63
24	29.5	1.16	29	1.3	0.05										30T	0.0	0
25	2.8	0.11															
26	0.5	0.02															
29	2.3	0.09															
TOTAL	**143.8**	**5.66**	**TOTAL**	**61.2**	**2.41**	**TOTAL**	**36.6**	**1.44**	**TOTAL**	**141.9**	**5.48**	**TOTAL**	**147.1**	**5.79**	**TOTAL**	**81.7**	**3.22**

Note: Precipitation recorded from midnight to midnight; snow recorded in inches, converted to approximate liquid equivalent (see below). "A" designates that about 12.5 mm of rain fell and 8 AM; "B" designates that the first 12.5 mm of rain fell between midnight 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.

†Advisory/closure for rain dates (7-11; Crescent Beach closed all season.):

*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.).

***Morgan Beach closed for high bacteria levels; beach reopened on 8/25. Other beaches had 2-day preemptive closures.

2017 Sea Cliff Precipitation Data (partial)

CSHH 2017 (JANUARY-APRIL) PRECIPITATION DATA FOR SEA CLIFF					
MO/DAY	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**
JAN			**MARCH**		
2	7.6	0.30	1	3.3	0.13
3	11.7	0.46	7	2.5	0.10
4	1.8	0.07	8	2.0	0.08
6**	2.5	0.10	10*	7.6	0.30
7**	17.8	0.70	14*	40.6	1.60
11	13.0	0.51	15T	0.0	0.00
12	2.3	0.09	18*	2.5	0.10
14**	2.5	0.10	24	0.3	0.01
21	1.8	0.07	25	0.5	0.02
23	14.0	0.55	26	1.3	0.05
24	25.9	1.02	27	6.6	0.26
26	1.3	0.05	28	23.1	0.91
31**	2.5	0.10	31	45.7	1.80
TOTAL	**104.6**	**4.12**	**TOTAL**	**136.1**	**5.36**
MO/DAY	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**
FEB			**APRIL**		
7	7.4	0.29	1	0.5	0.02
9*	33.0	1.30	4	39.6	1.56
12	12.7	0.5	6	20.1	0.79
15	0.5	0.02	7	0.8	0.03
22T	0.0	0	12	0.8	0.03
25	7.1	0.28	19	0.8	0.03
			20	9.4	0.37
			21	10.9	0.43
			22	2.8	0.11
			25	13.2	0.52
			26	3.8	0.15
			27	2.0	0.08
			28	1.0	0.04
			29	1.0	0.04
TOTAL	**60.7**	**2.39**	**TOTAL**	**106.7**	**4.2**

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.

†Advisory/closure for rain dates ( ):

*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.).

1997-2016 Monthly Precipitation

Total Precipitation Per Month

	June	July	August	September	October
2016	36.6 mm	134.1 mm	141.9mm	75.9 mm	147.1 mm
2015	130.3	75.7	76.2	75.2	156.5
2014	81	78.5	93.5	59.5	112
2013	235	69	59	75.5	8.5
2012	175.5	140.5	140.5	117.5	92.5
2011	127.5	48.5	381.5	163	122
2010	50.5	103.5	61.5	97	146
2009	294	150.5	83	69	175
2008	9.5	91	205.5	177.5	118
2007	159.5	198.5	132.5	36.5	136
2006	262	148	89	105	166.5
2005	45	81	41	28.5	460.5
2004	95	214	91	310.5	40
2003	291.5	87	88	194.5	134
2002	180.5	22.5	175.5	116.5 (9/15-9/30)	180
2001	167	70.5	165	94	19.5
2000	146	159	158	125	6
1999	31	21	135	323	92
1998	191	59	145	90	97
1997	47	232	141	84	27 (10/1-15)

Appendix C

2004-2016 Nitrogen Data
2016 Nitrogen Graphs (Nitrate, Nitrite, Ammonia)
2004-2016 Nitrogen Range Graphs

2016 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#12**	**CSHH#13**	**CSHH#14**	**CSHH#14a**	**CSHH#15**	**CSHH#15a**	**CSHH#15b**	**CSHH#16**	**CSHH#17**
5/11/2016	0.01	0.03	0.06					0.23		0.00						0.02	0.02
5/19/2016		0.01	0.01					0.01	0.23	0.00			0.03		0.55	0.02	0.01
5/25/2016	0.08	0.01	0.01					0.00							0.29	0.01	0.00
6/1/2016	0.00	0.02	0.07					0.19	0.18	0.19		0.55			0.55	0.01	0.02
6/8/2016	0.08	0.02	0.02					0.39		0.55		0.55			0.55	0.01	0.00
6/15/2016	0.00	0.02		0.00	0.09	0.06	0.00					0.55	0.01	0.55	0.55	0.01	0.01
6/22/2016	0.00	0.04	0.01					0.30		0.49				0.34	0.55	0.00	0.03
6/29/2016	0.02	0.04	0.00	0.01	0.08	0.03	0.07	0.33			0.00	0.04		0.55	0.55	0.01	0.02
7/6/2016	0.06	0.02	0.01					0.27		0.55		0.55		0.55	0.55	0.01	0.02
7/13/2016	0.02	0.03	0.07	0.02	0.01	0.02	0.01				0.01	0.55		0.55	0.55	0.01	0.02
7/20/2016	0.05	0.02	0.01					0.20		0.55		0.55		0.05	0.55	0.01	0.02
7/27/2016	0.02	0.01	0.01					0.34	0.17	0.55		0.52		0.43	0.55	0.01	0.02
8/3/2016	0.07	0.03	0.02	0.04	0.07	0.51	0.07	0.18		0.37	0.03	0.55	0.02	0.55	0.55	0.01	0.02
8/10/2016												0.55		0.55	0.55		
8/17/2016	0.05	0.05	0.04		0.15	0.07	0.07	0.27		0.55	0.07	0.55	0.04	0.55	0.07	0.05	0.03
8/24/2016	0.08	0.07	0.07					0.27		0.45		0.55		0.40	0.55	0.01	0.03
8/31/2016	0.11	0.03	0.01	0.03	0.13	0.09	0.11	0.14				0.55		0.55	0.55	0.03	0.03
9/9/2016	0.12	0.12	0.16					0.37		0.55						0.03	0.07
9/14/2016	0.10	0.08	0.09	0.10	0.14	0.14	0.14	0.26		0.55	0.13	0.25	0.12	0.02	0.04	0.09	0.06
9/21/2016	0.09	0.08	0.10					0.03		0.23		0.55		0.55	0.55	0.10	0.08
	0.55	>0.55															

2016 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#12	CSHH#13	CSHH#14	CSHH#14a	CSHH#15	CSHH#15a	CSHH#15b	CSHH#16	CSHH#17
5/11/2016	0.011	0.004	0.003					0.006		0.004						0.005	0.009
5/19/2016		0.003	0.003					0.003	0.005	0.006			0.006		0.047	0.004	0.002
5/25/2016	0.005	0.004	0.004					0.007							0.053	0.003	0.001
6/1/2016	0.001	0.002	0.005					0.006	0.005	0.008		0.010			0.058	0.003	0.001
6/8/2016	0.002	0.002	0.000					0.007		0.019		0.074			0.071	0.000	0.000
6/15/2016	0.002	0.001		0.003	0.003	0.002	0.005					0.008	0.001	0.059	0.055	0.001	0.000
6/22/2016	0.001	0.003	0.005					0.010		0.007				0.073	0.069	0.000	0.002
6/29/2016	0.001	0.000	0.005	0.002	0.003	0.000	0.000	0.008			0.000	0.006		0.034	0.065	0.001	0.002
7/6/2016	0.001	0.001	0.010					0.012		0.007		0.081		0.037	0.043	0.001	0.001
7/13/2016	0.001	0.001	0.002	0.002	0.002	0.002	0.021				0.003	0.028		0.048	0.045	0.001	0.001
7/20/2016	0.001	0.001	0.002					0.001		0.010		0.133		0.055	0.040	0.001	0.002
7/27/2016	0.003	0.002	0.001					0.006	0.002	0.015		0.011		0.048	0.054	0.002	0.003
8/3/2016	0.006	0.003	0.005	0.005	0.006	0.008	0.005	0.007		0.006	0.005	0.119	0.005	0.045	0.056	0.003	0.003
8/10/2016												0.051		0.054	0.045		
8/17/2016	0.013	0.016	0.018		0.016	0.017	0.010	0.011		0.021	0.014	0.151	0.011	0.049	0.051	0.014	0.012
8/24/2016	0.009	0.008	0.021					0.010		0.008		0.051		0.033	0.047	0.005	0.010
8/31/2016	0.021	0.012	0.003	0.012	0.021	0.022	0.026	0.013				0.337		0.038	0.051	0.004	0.005
9/9/2016	0.018	0.029	0.024					0.022		0.007						0.023	0.014
9/14/2016	0.029	0.024	0.021	0.028	0.058	0.053	0.028	0.015		0.012	0.032	0.212	0.025	0.023	0.020	0.026	0.017
9/21/2016	0.021	0.026	0.022					0.017		0.016		0.165		0.023	0.031	0.033	0.027

2016 Nitrogen Data

Ammonia-Nitrogen																	
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#14a**	**CSHH#15**	**CSHH#15a**	**CSHH#15b**	**CSHH#16**	**CSHH#17**
5/11/2016	0.25	0	0					0		0.25						0.10	
5/19/2016	0.25	0	0					0.10		0.25						0	0.05
5/25/2016	0.25	0.25	0.25					0.10								0.10	0.10
6/1/2016	0.10	0.10	0.25					0.25									0.10
6/8/2016	0.25	0.10	0.10					0.25		0.10							
6/15/2016	0.25	0.25		0.25	0.25	0.25	0.30					0.25	0.25			0.25	
6/22/2016	0.25	0.25						0.50								0.25	0.25
6/29/2016	0.25	0.25	0.25													0.25	0.25
7/6/2016	0.10							0.10									
7/13/2016	0.00	0.00	0.00	0.00	0.10	0.10	0.25				0.00					0.00	0.00
7/20/2016	0.00		0.05					0.00		0.05							0.05
7/27/2016	0.00	0.05	0.00					0.10		0.25						0.00	0.05
8/3/2016	0.25	0.10	0.00					0.25		0.50						0.25	0.10
8/10/2016																	
8/17/2016	0.25	0.25	0.25				0.25	0.50		0.50						0.25	
8/24/2016	0.25	0.25	0.25					0.50		0.50						0.25	0.25
8/31/2016	0.25	0.25	0.25				0.50	0.25								0.25	0.25
9/9/2016	0.50	0.25	0.25					0.50		0.50						0.25	0.25
9/14/2016	0.25	0.25	0.25	0.25	0.50	0.25	0.25	0.25		0.50	0.25					0.25	
9/21/2016	0.50	0.25	0.25					0.25		0.50						0.25	0.25

2016 Nitrogen Data

Total Inorganic Nitrogen (TIN)																		
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#14a**	**CSHH#15**	**CSHH#15a**	**CSHH#15b**	**CSHH#16**	**CSHH#17**	
5/11/2016	0.27	0.03	0.06					0.24		0.25						0.13		
5/19/2016		0.01	0.01					0.11		0.26						0.02	0.06	
5/25/2016	0.34	0.26	0.26					0.11								0.11	0.10	
6/1/2016	0.10	0.12	0.33					0.45									0.12	
6/8/2016	0.33	0.12	0.12					0.65		0.67								
6/15/2016	0.25	0.27		0.25	0.34	0.31							0.26			0.26		
6/22/2016	0.25	0.29						0.81								0.25	0.28	
6/29/2016	0.27	0.29	0.26													0.26	0.27	
7/6/2016	0.16							0.38										
7/13/2016	0.02	0.03	0.07	0.02	0.11	0.12					0.01					0.01	0.02	
7/20/2016	0.05		0.06					0.20		0.61							0.07	
7/27/2016	0.02	0.06	0.01					0.45		0.82						0.01	0.07	
8/3/2016	0.33	0.13	0.03					0.44		0.88						0.26	0.12	
8/10/2016																		
8/17/2016	0.31	0.32	0.31					0.78		1.07						0.31		
8/24/2016	0.34	0.33	0.34					0.78		0.96						0.27	0.29	
8/31/2016	0.38	0.29	0.26					0.40								0.28	0.29	
9/9/2016	0.64	0.40	0.43					0.89		1.06						0.30	0.33	
9/14/2016	0.38	0.35	0.36	0.38	0.70	0.44		0.53		1.06	0.41					0.37		
9/21/2016	0.61	0.36	0.37					0.30		0.75						0.38	0.36	

2016 Nitrogen Data

Total Inorganic Nitrogen (TIN)*																	
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#14a**	**CSHH#15**	**CSHH#15a**	**CSHH#15b**	**CSHH#16**	**CSHH#17**
5/11/2016	0.27	0.03	0.06					0.24		0.25						0.13	
5/19/2016		0.01	0.01					0.11		0.26						0.02	0.06
5/25/2016	0.34	0.26	0.26					0.11								0.11	0.10
6/1/2016	0.10	0.12	0.33					0.45									0.12
6/8/2016	0.33	0.12	0.12					0.65		0.67							
6/15/2016	0.25	0.27		0.25	0.34	0.31							0.26			0.26	
6/22/2016	0.25	0.29						0.81								0.25	0.28
6/29/2016	0.27	0.29	0.26													0.26	0.27
7/6/2016	0.16							0.38									
7/13/2016	0.02	0.03	0.07	0.02	0.11	0.12					0.01					0.01	0.02
7/20/2016	0.05		0.06					0.20		0.61							0.07
7/27/2016	0.02	0.06	0.01					0.45		0.82						0.01	0.07
8/3/2016	0.33	0.13	0.03					0.44		0.88						0.26	0.12
8/10/2016																	
8/17/2016	0.31	0.32	0.31					0.78		1.07						0.31	
8/24/2016	0.34	0.33	0.34					0.78		0.96						0.27	0.29
8/31/2016	0.38	0.29	0.26					0.40								0.28	0.29
9/9/2016	0.64	0.40	0.43					0.89		1.06						0.30	0.33
9/14/2016	0.38	0.35	0.36	0.38	0.70	0.44		0.53		1.06	0.41					0.37	
9/21/2016	0.61	0.36	0.37					0.30		0.75						0.38	0.36

* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)

2015 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#12**	**CSHH#13**	**CSHH#14**	**CSHH#15**	**CSHH#16**	**CSHH#17**
5/7/2015	0.03	0.01	0.00					0.01		0.00			0.01	0.01
5/13/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.03	0.00		0.00	0.00
5/21/2015	0.04	0.02	0.00					0.00		0.04			0.01	0.01
5/27/2015	0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.01		0.01	0.01		0.02	0.01
6/3/2015	0.09	0.02	0.06					0.48		0.12			0.01	0.01
6/10/2015	0.01	0.01	0.03					0.20		0.55			0.01	0.01
6/17/2015	0.02	0.01	0.00					0.13		0.18			0.02	0.01
6/24/2015	0.03	0.00	0.01					0.29		0.55			0.00	0.00
7/1/2015	0.01	0.00	0.00	0.00	0.01	0.01	0.00				0.00	0.02	0.00	0.00
7/8/2015	0.01	0.02	0.04					0.34					0.02	0.01
7/16/2015	0.02	0.02	0.04					0.13		0.19			0.01	0.00
7/22/2015	0.00	0.02	0.01					0.55		0.01			0.01	0.02
7/29/2015	0.01	0.02	0.03	0.01	0.03	0.02	0.01	0.12		0.39	0.02	0.00	0.02	0.01
8/5/2015	0.07	0.01	0.01					0.20					0.02	0.06
8/13/2015	0.07	0.02	0.01					0.24		0.55			0.01	0.01
8/19/2015	0.02	0.02	0.02					0.01		0.00			0.03	0.00
9/2/2015	0.00	0.00	0.00					0.16		0.00			0.00	0.00
9/9/2015	0.07	0.03	0.04					0.26		0.55			0.04	0.02
9/25/2015	0.02	0.10	0.11	0.03	0.03	0.01	0.02	0.50		0.09	0.03	0.01	0.12	
10/1/2015	0.03	0.07	0.03					0.07		0.02				
10/7/2015	0.12	0.11	0.11	0.09	0.17	0.18	0.32	0.35	0.29	0.29	0.22	0.23	0.14	0.08
10/14/2015	0.18	0.13	0.13					0.23		0.35			0.12	0.12
10/21/2015	0.23	0.24	0.27					0.41		0.43			0.15	0.16
10/29/2015	0.23	0.03	0.18							0.37			0.18	0.14
11/4/2015	0.22	0.04	0.18					0.26		0.52			0.03	0.02

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2015 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#12	CSHH#13	CSHH#14	CSHH#15	CSHH#16	CSHH#17
5/7/2015	0.002	0.004	0.004					0.001		0.008			0.004	0.004
5/13/2015	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.035		0.000			0.000	0.002
5/21/2015	0.011	0.003	0.003					0.016		0.045			0.008	0.009
5/27/2015	0.006	0.006	0.004	0.005	0.016	0.005	0.006	0.012		0.023	0.004		0.006	0.007
6/3/2015	0.002	0.001	0.004					0.012		0.001			0.002	0.003
6/10/2015	0.005	0.002	0.004					0.007		0.026			0.004	0.013
6/17/2015	0.006	0.007	0.003					0.015		0.013			0.006	0.000
6/24/2015	0.016	0.004	0.007					0.047		0.033			0.004	0.002
7/1/2015	0.004	0.004	0.002	0.010	0.002	0.005	0.006				0.004	0.002	0.002	0.002
7/8/2015	0.005	0.003	0.006					0.028					0.006	0.004
7/16/2015	0.006	0.000	0.004					0.002		0.017			0.006	0.000
7/22/2015	0.005	0.004	0.005					0.016		0.037			0.000	0.002
7/29/2015	0.005	0.003	0.005	0.001	0.005	0.004	0.008	0.008		0.009	0.001	0.003	0.012	0.002
8/5/2015	0.015	0.001	0.001					0.010					0.005	0.004
8/13/2015	0.012	0.003	0.001					0.009		0.025			0.002	0.003
8/19/2015	0.013	0.002	0.002					0.008		0.007			0.005	0.005
9/2/2015	0.003	0.005	0.001					0.008		0.010			0.005	0.002
9/9/2015	0.020	0.019	0.014					0.012		0.010			0.015	0.013
9/25/2015	0.066	0.065	0.066	0.069	0.062	0.063	0.059	0.059		0.067	0.065	0.063	0.065	
10/1/2015	0.049	0.060	0.057					0.029		0.025				
10/7/2015	0.033	0.038	0.032	0.032	0.031	0.036	0.039	0.032	0.026	0.036	0.043	0.033	0.052	0.034
10/14/2015	0.040	0.045	0.045					0.036		0.024			0.049	0.050
10/21/2015	0.056	0.030	0.049					0.041		0.032			0.074	0.068
10/29/2015	0.061	0.078	0.066							0.028			0.072	0.071
11/4/2015	0.069	0.073	0.071					0.056		0.048			0.073	0.068

2015 Nitrogen Data

Ammonia-Nitrogen														
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#15**	**CSHH#16**	**CSHH#17**
5/7/2015	0													
5/13/2015	0							0						
5/21/2015	0													
5/27/2015	0						0	0						
6/3/2015	0							0						
6/10/2015	0							0						
6/17/2015	0.50	0						0						
6/24/2015	0							0						
7/1/2015	0							0.5						
7/8/2015	0							0						
7/16/2015														
7/22/2015	0													
7/29/2015	0						0.5	0.5						
8/5/2015	0.25		0					0.25						0
8/13/2015	0.50	0.1						0.1		0.5			0.1	0.25
8/19/2015	0.50	0.25	0.25					0.5		0.25				
9/2/2015	0	0.1	0.25							0.25			0.25	0.25
9/9/2015	0.50	0.5	0.5					0.5		0.5			0.25	0.25
9/25/2015	0.50	0.5	0.5	0.5	0.5	0.5	0.1	0.5			0.5	0.5		
10/1/2015	1.00	0.5						1		1				
10/7/2015	1.00	0.5	0.5	0.5	0.5	1	1	0.5			0.5	0.5	0.5	0.5
10/14/2015	0.50	0.5	0.5					0.5		1			0.5	0.5
10/21/2015	0.50	0.5	0.5					0.5		0.5				0.5
10/29/2015	0.25	0	0							0.25			0	0
11/4/2015	0.10	0	0.25					0.1		0.5			0	0

2015 Nitrogen Data

Total Inorganic Nitrogen (TIN)*														
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#15**	**CSHH#16**	**CSHH#17**
5/7/2015	0.03													
5/13/2015	0.00							0.04						
5/21/2015	0.05													
5/27/2015	0.03						0.02	0.02						
6/3/2015	0.09							0.49						
6/10/2015	0.02							0.21						
6/17/2015	0.53	0.02						0.15						
6/24/2015	0.05							0.34						
7/1/2015	0.01													
7/8/2015	0.02							0.37						
7/16/2015														
7/22/2015	0.01													
7/29/2015	0.02						0.52	0.63						
8/5/2015	0.34		0.01					0.46						
8/13/2015	0.58	0.12						0.35						
8/19/2015	0.53	0.27	0.27					0.52						
9/2/2015	0.00	0.11	0.25											
9/9/2015	0.59	0.55	0.55					0.77						
9/25/2015	0.59	0.67	0.68	0.60	0.59	0.57	0.18	1.06		0.66	0.60			
10/1/2015	1.08	0.63						1.10						
10/7/2015	1.15	0.65	0.64	0.62	0.70	1.22	1.36	0.88		0.83	0.76	0.76		
10/14/2015	0.72	0.68	0.68					0.77						
10/21/2015	0.79	0.77	0.82					0.95						
10/29/2015	0.54	0.11	0.25											
11/4/2015	0.39	0.11	0.50					0.42						
* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)														

2014 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#13**	**CSHH#14**	**CSHH#15**
5/21/2014	0.04	0.04	0.03					0.15	0.03		
5/28/2014	0.03	0.02	0.03					0.03	0.04		
6/4/2014	0.05	0.03	0.05					0.09	0.16		
6/11/2014	0.05	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.06	0.04	0.03
6/18/2014	0.05	0.02	0.04					0.41	0.55		
6/26/2014	0.02	0.03	0.02	0.02	0.03	0.03	0.08	0.35	0.50	0.02	0.02
7/2/2014	0.03	0.02	0.02					0.54	0.55		
7/9/2014	0.03	0.01	0.02	0.04	0.10	0.03	0.04	0.41	0.55	0.02	0.02
7/17/2014	0.02	0.02	0.02					0.18	0.03		
7/23/2014	0.05	0.04	0.02	0.02	0.03	0.03	0.04	0.32	0.55	0.01	0.01
7/30/2014	0.04	0.05	0.05					0.03	0.04		
8/6/2014	0.04	0.02	0.02	0.03	0.04	0.05	0.05	0.02	0.02	0.04	0.03
8/14/2014	0.10	0.05	0.07					0.30	0.09		
8/21/2014	0.03	0.03	0.03	0.03	0.06	0.06	0.11	0.20	0.28	0.04	0.04
8/27/2014	0.05	0.03	0.05					0.12	0.50		
9/4/2014	0.03	0.03	0.06					0.06	0.28		
9/10/2014	0.03	0.04	0.05					0.03	0.04		
9/17/2014	0.04	0.03	0.02	0.03	0.05	0.06	0.07	0.08	0.05	0.04	
9/24/2014	0.03	0.04	0.05					0.03	0.04		
10/1/2014	0.10	0.06	0.07					0.20	0.22		
10/9/2014	0.11	0.04	0.03	0.05	0.08	0.07	0.08	0.32	0.45	0.22	0.04
10/15/2014	0.17	0.15	0.20					0.34	0.35		
10/29/2014	0.03	0.02	0.02					0.03	0.03		
11/5/2014	0.22	0.16	0.16	0.15	0.21	0.22	0.01	0.55	0.55		0.12

2014 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#13**	**CSHH#14**	**CSHH#15**
5/21/2014	0.007	0.006	0.005					0.015	0.011		
5/28/2014	0.011	0.006	0.005					0.008	0.007		
6/4/2014	0.007	0.003	0.007					0.008	0.011		
6/11/2014	0.008	0.007	0.006	0.010	0.035	0.026	0.041	0.011	0.009	0.007	0.006
6/18/2014	0.008	0.003	0.008					0.012	0.010		
6/26/2014	0.011	0.009	0.008	0.007	0.009	0.009	0.012	0.007	0.010	0.013	0.004
7/2/2014	0.006	0.003	0.006					0.009	0.008		
7/9/2014	0.006	0.005	0.003	0.007	0.008	0.008	0.010	0.010	0.013	0.008	0.007
7/17/2014	0.007	0.008	0.004					0.006	0.010		
7/23/2014	0.030	0.002	0.003	0.022	0.008	0.029	0.040	0.018	0.017	0.004	0.007
7/30/2014	0.012	0.012	0.008					0.010	0.013		
8/6/2014	0.007	0.002	0.006	0.007	0.008	0.011	0.010	0.008	0.010	0.006	0.005
8/14/2014	0.023	0.011	0.018					0.018	0.010		
8/21/2014	0.007	0.004	0.005	0.008	0.010	0.013	0.011	0.008	0.013	0.008	0.007
8/27/2014	0.008	0.002	0.005					0.008	0.009		
9/4/2014	0.007	0.005	0.013					0.014	0.013		
9/10/2014	0.012	0.012	0.008					0.010	0.013		
9/17/2014	0.007	0.006	0.005	0.010	0.034	0.026	0.040	0.012	0.008	0.007	
9/24/2014	0.011	0.012	0.008					0.010	0.012		
10/1/2014	0.02	0.012	0.017					0.018	0.015		
10/9/2014	0.013	0.01	0.004	0.014	0.015	0.014	0.013	0.008	0.017	0.018	0.010
10/15/2014	0.053	0.053	0.041					0.046	0.037		
10/29/2014	0.021	0.013	0.02					0.023	0.014		
11/5/2014	0.023	0.024	0.015	0.026	0.022	0.017	0.020	0.027	0.012		0.019

2014 Nitrogen Data

	Ammonia-Nitrogen										
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/21/2014	0							0			
5/28/2014	0							0			
6/4/2014	0										
6/11/2014	0							0			
6/18/2014											
6/26/2014	0							0			
7/2/2014	0							0			
7/9/2014	0							0			
7/17/2014	0							0			
7/23/2014	0.25	0.25					0.25	0			
7/30/2014	0							0			
8/6/2014	0						0	0			
8/14/2014	0							0.25			
8/21/2014	0						0	0			
8/27/2014	0							0			
9/4/2014	0							0			
9/10/2014	0							0			
9/17/2014	0						0	0.25			
9/24/2014	0							0			
10/1/2014	0							0			
10/9/2014	0							0			
10/15/2014	0							0			
10/29/2014	0							0			
11/5/2014	0						0	0			

2014 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	CSHH#1	CSHH#2	CSHH#3	CSHH#4	CSHH#5	CSHH#6	CSHH#7	CSHH#8	CSHH#13	CSHH#14	CSHH#15
5/21/2014	0.05							0.17			
5/28/2014	0.04							0.04			
6/4/2014	0.06										
6/11/2014	0.06							0.10			
6/18/2014											
6/26/2014	0.03							0.36			
7/2/2014	0.04							0.55			
7/9/2014	0.04							0.42			
7/17/2014	0.03							0.19			
7/23/2014	0.33	0.29					0.33	0.34			
7/30/2014	0.05							0.04			
8/6/2014	0.05						0.06	0.03			
8/14/2014	0.12							0.57			
8/21/2014	0.04						0.12	0.21			
8/27/2014	0.06							0.13			
9/4/2014	0.04							0.07			
9/10/2014	0.04							0.04			
9/17/2014	0.05						0.11	0.34			
9/24/2014	0.04							0.04			
10/1/2014	0.12							0.22			
10/9/2014	0.12							0.33			
10/15/2014	0.22							0.39			
10/29/2014	0.05							0.05			
11/5/2014	0.24						0.03	0.58			
* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)											

2013 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#13**	**CSHH#14**	**CSHH#15**
5/10/2013		0.008	0.007					0.010	0.017		
5/15/2013	0.011	0.005	0.007					0.011	0.014		
5/31/2013	0.008	0.008	0.008					0.008	0.009		
6/5/2013	0.007	0.005	0.004	0.008	0.007	0.008	0.011	0.009		0.024	
6/12/2013	0.005	0.003	0.005					0.020	0.032	0.021	
6/19/2013	0.006	0.003	0.005	0.004	0.005	0.006	0.017	0.005	0.008	0.002	
6/26/2013	0.003	0.002	0.003					0.026	0.010		
7/3/2013	0.005	0.007	0.007	0.009	0.009	0.002	0.008	0.008	0.019	0.007	0.009
7/17/2013	0.002	0.003	0.003					0.006	0.011		
7/24/2013	0.007	0.005	0.006					0.019	0.026		
7/31/2013	0.005	0.005	0.005	0.005	0.008	0.009	0.012	0.022	0.019	0.010	
8/8/2013	0.026		0.022	0.015	0.024	0.019	0.021	0.013	0.024	0.019	0.021
8/14/2013	0.009		0.008					0.016	0.016		
8/21/2013	0.006		0.005					0.009	0.010		
8/28/2013	0.007	0.005	0.005					0.006	0.007		
9/4/2013	0.011	0.007	0.008					0.010	0.011		
9/18/2013	0.030	0.020	0.028	0.027	0.027	0.025	0.031	0.029	0.027	0.026	0.026
9/25/2013	0.020	0.007	0.011					0.010	0.012		
10/1/2013	0.013	0.009	0.003	0.014	0.016	0.013	0.013	0.007	0.016	0.017	0.009
10/8/2013	0.021	0.013	0.018					0.017	0.016		
10/15/2013	0.024	0.020	0.021	0.027	0.023	0.025	0.027	0.023	0.018	0.024	0.023
10/22/2013	0.035	0.040	0.035					0.033	0.019		
10/29/2013	0.034	0.038	0.040	0.035	0.035	0.031	0.032	0.032	0.033	0.037	0.037
11/6/2013	0.033	0.036	0.035					0.030	0.022		
11/13/2013	0.032			0.029	0.026	0.029	0.034	0.025	0.021		

2013 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#13**	**CSHH#14**	**CSHH#15**
5/10/2013		0.04	0.04					0.03	0.03		
5/15/2013	0.04	0.04	0.04					0.03	0.03		
5/31/2013	0.04	0.02	0.03					0.13	0.05		
6/5/2013	0.03	0.03	0.03	0.04	0.04	0.05	0.04	0.13		0.04	
6/12/2013	0.04	0.02	0.02					0.54	0.54	0.54	
6/19/2013	0.01	0.02	0.03	0.02	0.02	0.03	0.27	0.25	0.02	0.01	
6/26/2013	0.02	0.03	0.01					0.03	0.01		
7/3/2013	0.04	0.02	0.02	0.03	0.06	0.06	0.04	0.38	0.21	0.05	0.02
7/17/2013	0.02	0.01	0.02					0.15	0.12		
7/24/2013	0.03	0.01	0.02					0.23	0.39		
7/31/2013	0.03	0.03	0.04	0.03	0.03	0.03	0.05	0.35	0.20	0.07	
8/8/2013	0.06		0.03	0.03	0.02	0.03	0.03	0.32	0.54	0.03	0.04
8/14/2013	0.03		0.02					0.30	0.47		
8/21/2013	0.04		0.03					0.03	0.08		
8/28/2013	0.03	0.02	0.01					0.02	0.16		
9/4/2013	0.04	0.03	0.03					0.36	1.06		
9/18/2013	0.13	0.11	0.08	0.03	0.11	0.03	0.12	0.23	0.17	0.08	0.02
9/25/2013	0.08	0.04	0.06					0.10	0.04		
10/1/2013	0.11	0.04	0.02	0.05	0.09	0.06	0.09	0.32	0.46	0.22	0.04
10/8/2013	0.10	0.06	0.08					0.21	0.23		
10/15/2013	0.16	0.15	0.10	0.11	0.14	0.17	0.28	0.28	0.48	0.09	0.07
10/22/2013	0.16	0.15	0.10					0.11	0.14		
10/29/2013	0.15	0.14	0.13	0.16	0.10	0.12	0.11	0.13	0.11	0.13	0.13
11/6/2013	0.18	0.11	0.18					0.40	0.72		
11/13/2013	0.21			0.18	0.43	0.24	0.49	0.29	0.26		
>0.55 = 0.54											

2013 Nitrogen Data

Ammonia-Nitrogen											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/10/2013	0	0									
5/15/2013	0							0			
5/31/2013	0							0			
6/5/2013	0							0			
6/12/2013	0							0			
6/19/2013	0							0			
6/26/2013	0								0		
7/3/2013	0.15						0.15	0.25			0.15
7/17/2013	0							0			
7/24/2013	0							0			
7/31/2013	0							0			
8/8/2013	0.5	0.25	0.25	0.25	0.25		0.5	0.5	0.25		
8/14/2013	2.5							0.15			
8/21/2013	0.1		0.25					0.25	0.25		
8/28/2013	0.04	0						0			
9/4/2013	0	0.25	0								
9/18/2013	0.25		0.25			0.25		0.25	0.25	0.25	
9/25/2013	0							0			
10/1/2013	0							0			
10/8/2013	0.25		0.25					0	0.25		
10/15/2013	0						0	0			
10/22/2013	0							0.25			
10/29/2013	0							0			
11/6/2013	0							0			
11/13/2013								0			
<0.05 = 0.04											

2013 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/10/2013		0.05									
5/15/2013	0.05							0.04			
5/31/2013	0.05							0.14			
6/5/2013	0.04							0.14			
6/12/2013	0.05							0.56			
6/19/2013	0.02							0.26			
6/26/2013	0.02								0.02		
7/3/2013	0.20						0.20	0.64			0.18
7/17/2013	0.02							0.16			
7/24/2013	0.04							0.25			
7/31/2013	0.04							0.37			
8/8/2013	0.59		0.30	0.30	0.29		0.55	0.83	0.81		
8/14/2013	2.54							0.47			
8/21/2013	0.15		0.29					0.29	0.34		
8/28/2013	0.08	0.03						0.03			
9/4/2013	0.05	0.29	0.04								
9/18/2013	0.41		0.36			0.31		0.51	0.45	0.36	
9/25/2013	0.10							0.11			
10/1/2013	0.12							0.33			
10/8/2013	0.37		0.35					0.23	0.50		
10/15/2013	0.18						0.31	0.30			
10/22/2013	0.20							0.39			
10/29/2013	0.18							0.16			
11/6/2013	0.21							0.43			
11/13/2013								0.32			

* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)

2012 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#13**	**CSHH#14**	**CSHH#15**
5/30/2012											
6/6/2012											
6/13/2012	0.008	0.005	0.007	0.008	0.010	0.015	0.024	0.011	0.023	0.014	
6/20/2012	0.006	0.003	0.003					0.005	0.013		
6/27/2012	0.008	0.008	0.007					0.011	0.020		
7/3/2012	0.007	0.005	0.006	0.005	0.006	0.008	0.007	0.007	0.013	0.006	0.003
7/11/2012	0.008	0.008	0.008					0.009	0.012		
7/18/2012	0.006	0.005	0.004	0.006	0.007	0.005	0.014	0.009	0.010	0.008	0.005
7/25/2012	0.007	0.007	0.005					0.011	0.009		
8/1/2012	0.010	0.004	0.009	0.007	0.008	0.021	0.019	0.010	0.014	0.011	0.008
8/8/2012	0.012	0.004	0.004					0.012	0.011		
8/16/2012	0.015	0.010	0.010	0.011	0.016	0.013	0.018	0.014	0.015	0.017	NA
8/22/2012	0.026	0.024	0.021					0.024	0.019		
8/29/2012	0.016	0.030	0.023	0.018	0.021	0.024	0.032	0.023	0.015	0.018	0.018
9/7/2012	0.025	0.030	0.022					0.021	0.029		
9/12/2012	0.040	0.040	0.034	0.045	0.036	0.037	0.107		0.028	0.048	0.033
9/20/2012	0.052	0.055	0.055					0.050	0.046		
10/5/2012	0.054	0.051	0.046					0.051	0.020		
10/12/2012	0.075	0.078	0.075					0.064	0.026		
10/18/2012	0.086	0.107	0.090					0.065	0.060		
10/25/2012	0.088	0.093	0.089					0.076	0.024		

2012 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#13	CSHH#14	CSHH#15
5/30/2012											
6/6/2012											
6/13/2012	0.02	0.01	0.02	0.02	0.04	0.04	0.06	0.03	0.05	0.02	
6/20/2012	0.05	0.06	0.05					0.06	0.07		
6/27/2012	0.04	0.03	0.02					0.2	0.37		
7/3/2012	0.02	0.02	0.02	0.03	0.04	0.03	0.05	0.1	0.27	0.03	0.02
7/11/2012	0.02	0.02	0.02					0.02	0.02		
7/18/2012	0.02	0.02	0.03	0.02	0.06	0.02	0.11	0.4	0.27	0.03	0.02
7/25/2012	0.04	0.03	0.02					0.08	0.26		
8/1/2012	0.04	0	0.01	0.02	0.03	0.06	0.19	0.05	0.2	0.03	0.02
8/8/2012	0.03	0.02	0.03					0.16	0.12		
8/16/2012	0.08	0.03	0.07	0.07	0.09	0.05	0.06	0.04	0.51	0.07	NA
8/22/2012	0.03	0.03	0.04					0.04	0.04		
8/29/2012	0.04	0.07	0.08	0.06	0.14	0.07	0.07	0.14	0.1	0.06	0.04
9/7/2012	0.1	0.07	0.08					0.2	0.36		
9/12/2012	0.09	0.11	0.07	0.11	0.13	0.13	0.23		0.37	0.14	0.09
9/20/2012	0.03	0.03	0.02					0.02	0.02		
10/5/2012	0.12	0.1	0.14					0.47	0.02		
10/12/2012	0.15	0.13	0.18					0.48	0.55		
10/18/2012	0.22	0.19	0.27					0.55	0.28		
10/25/2012	0.17	0.16	0.22					0.38	0.55		

2012 Nitrogen Data

	Ammonia-Nitrogen										
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/30/2012	0.05	1.00	0.05					0.00	0.00		
6/6/2012	0.25	0.10	0.25					0.25	0.25		
6/13/2012	0.00						0.00	0.00			
6/20/2012	0.00	0.00						0.00			
6/27/2012	0.00							0.00			
7/3/2012	0.00	0.00	0.00				0.00	0.00			
7/11/2012	0.25	0.25	0.25					0.25	0.00		
7/18/2012	0.25	0.25	0.00	0.00	0.00		0.25	0.25	0.00	0.25	0.25
7/25/2012	0.25	0.25	0.25					0.25	0.25		
8/1/2012	0.25	0.25	0.25					0.25	0.25		0.25
8/8/2012	0.50	0.25	0.25					0.50	0.15		
8/16/2012	0.50		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
8/22/2012	0.25	0.25	0.25					0.50	0.25		
8/29/2012	0.50	0.25		0.50	0.25		0.00	0.25	0.25	0.25	0.25
9/7/2012	0.50	0.25	0.50					0.50			
9/12/2012	0.25	0.25	0.50	0.25	0.25		0.25	0.25		0.25	0.25
9/20/2012	0.50	0.50	0.50					0.50			
10/5/2012	1.00								0.50		
10/12/2012	0.00	0.00	0.00								
10/18/2012	0.00	0.25	0.00					0.00	0.25		
10/25/2012	0.25	0.25	0.25					0.25	0.00		

2012 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/30/2012											
6/6/2012											
6/13/2012	0.03						0.08	0.04			
6/20/2012	0.06	0.06						0.07			
6/27/2012	0.05							0.21			
7/3/2012	0.03	0.03	0.03				0.06	0.11			
7/11/2012	0.28	0.28	0.28					0.28	0.03		
7/18/2012	0.28	0.28	0.03	0.03	0.07		0.37	0.66	0.28	0.29	0.28
7/25/2012	0.30	0.29	0.28					0.34	0.52		
8/1/2012	0.30	0.25	0.27					0.31	0.46		0.28
8/8/2012	0.54	0.27	0.28					0.67	0.28		
8/16/2012	0.60		0.33	0.33	0.36	0.31	0.33	0.30	0.78	0.34	
8/22/2012	0.31	0.30	0.31					0.56	0.31		
8/29/2012	0.56	0.35		0.58	0.41		0.10	0.41	0.37	0.33	0.31
9/7/2012	0.63	0.35	0.60					0.72			
9/12/2012	0.38	0.40	0.60	0.41	0.42		0.59			0.44	0.37
9/20/2012	0.58	0.59	0.58					0.57			
10/5/2012	1.17								0.54		
10/12/2012	0.23	0.21	0.26								
10/18/2012	0.31	0.55	0.36					0.62	0.59		
10/25/2012	0.51	0.50	0.56					0.71	0.57		

* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)

2011 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#13**	**CSHH#14**	**CSHH#15**
5/26/2011	0.018	0.024	0.017	0.018	0.015	0.018	0.017	0.018	0.016	0.018	0.017
6/1/2011	0.007	0.002	0.009					0.007			
6/8/2011	0.007	0.004	0.009					0.010	0.010		
6/15/2011	0.006	0.002	0.009	0.008				0.010	0.008	0.008	
6/22/2011	0.005	0.005	0.013					0.009	0.021		
6/29/2011	0.011	0.007	0.005	0.012	0.009	0.005	0.015	0.011	0.011	0.027	0.004
7/6/2011	0.007	0.007	0.006					0.011	0.008		
7/14/2011	0.008	0.005	0.007	0.009	0.008	0.014	0.018	0.011	0.011	0.008	0.011
7/21/2011	0.006	0.003	0.007					0.008	0.010		
7/27/2011	0.007	0.006	0.004	0.014	0.006	0.007	0.018	0.029	0.012	0.003	0.008
8/3/2011	0.008	0.007	0.007					0.011	0.017		
8/17/2011	0.016	0.008	0.009					0.013	0.018		
8/24/2011	0.005	NA	0.007	0.007	0.009	0.012	0.011	0.010	0.010	0.006	0.007
8/31/2011	0.021	0.020	0.020					0.021	0.020		
9/14/2011	0.028	0.034	0.032					0.032	0.017		
9/21/2011	0.017	0.024	0.013					0.013	0.016		
9/28/2011	0.022	0.019	0.016	0.015	0.019	0.022	0.028	0.023	0.023	0.017	0.017
10/6/2011	0.034	0.032	0.030	0.035	0.035	0.043	0.039	0.038	0.032	0.036	0.035
10/12/2011	0.013	0.022	0.028					0.026	0.009		
10/20/2011	0.035	0.041	0.045					0.026	0.016		
10/26/2011	0.016	0.049	0.016	0.018	0.030	NA	0.023	0.032	0.034	0.032	0.024
11/2/2011	0.043	0.038	0.031					0.044	0.035		
11/9/2011	0.038	NA	0.038	0.037	0.035	0.035	0.035	0.021	0.020	0.036	0.034

2011 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#13**	**CSHH#14**	**CSHH#15**
5/26/2011	0.03	0.02	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.04	0.03
6/1/2011	0.04	0.02	0.03					0.03			
6/8/2011	0.02	0.02	0.02					0.03	0.03		
6/15/2011	0.03	0.01	0.03	0.02				0.03	0.03	0.03	
6/22/2011	0.02	0.02	0.01					0.01	0.01		
6/29/2011	0.05	0.03	0.03	0.04	0.03	0.03	0.06	0.03	0.02	0.06	0.03
7/6/2011	0.03	0.03	0.03					0.03	0.03		
7/14/2011	0.03	0.03	0.02	0.05	0.03	0.04	0.07	0.12	0.21	0.03	0.04
7/21/2011	0.02	0.02	0.03					0.09	0.54		
7/27/2011	0.03	0.03	0.04	0.04	0.04	0.02	0.25	0.27	0.25	0.01	0.02
8/3/2011	0.02	0.03	0.03					0.04	0.06		
8/17/2011	0.05	0.04	0.03					0.03	0.04		
8/24/2011	0.03	NA	0.04	0.02	0.03	0.04	0.03	0.02	0.01	0.03	0.02
8/31/2011	0.08	0.05	0.06					0.16	0.18		
9/14/2011	0.03	0.03	0.03					0.03	0.02		
9/21/2011	0.04	0.08	0.07					0.07	0.11		
9/28/2011	0.07	0.07	0.06	0.02	0.03	0.02	0.06	0.13	0.20	0.02	0.03
10/6/2011	0.04	0.03	0.04	0.03	0.04	0.04	0.04	0.05	0.03	0.03	0.03
10/12/2011	0.04	0.06	0.06					0.02	0.02		
10/20/2011	0.08	0.14	0.08					0.38	0.54		
10/26/2011	0.05	0.12	0.05	0.07	0.12	NA	0.09	0.18	0.36	0.02	0.07
11/2/2011	0.02	0.02	0.04					0.02	0.01		
11/9/2011	0.17	NA	0.12	0.11	0.17	0.04	0.28	0.21	0.03	0.11	0.04
>0.55 = 0.54											

2011 Nitrogen Data

Ammonia-Nitrogen											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/26/2011	0										
6/1/2011	0										
6/8/2011	0							0			
6/15/2011	0							0			
6/22/2011	0							0			
6/29/2011	0						0	0			
7/6/2011	0										
7/14/2011			0					0			
7/21/2011	0							0			
7/27/2011	0						0	0			
8/3/2011	0							0			
8/17/2011	0							0			
8/24/2011	0						0	0			
8/31/2011	0							0			
9/14/2011	0.25	0	0					0			
9/21/2011	0							0.25			
9/28/2011	0.25	0.25	0.25		0.25		0.5	0.25	0.25		
10/6/2011	0.25	0	0	0	0.1	0.25	0.25	0	0		0
10/12/2011	0							0.25			
10/20/2011	0							0			
10/26/2011	0						0	0.25			
11/2/2011	0							0.25			
11/9/2011	0						0	0			
**Salicylate result											

2011 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/26/2011	0.05										
6/1/2011	0.05										
6/8/2011	0.03							0.04			
6/15/2011	0.04							0.04			
6/22/2011	0.03							0.02			
6/29/2011	0.06						0.08	0.04			
7/6/2011	0.04										
7/14/2011			0.03					0.13			
7/21/2011	0.03							0.10			
7/27/2011	0.04						0.27	0.30			
8/3/2011	0.03							0.05			
8/17/2011	0.07							0.04			
8/24/2011	0.04						0.04	0.03			
8/31/2011	0.10							0.18			
9/14/2011	0.31	0.06	0.06					0.06			
9/21/2011	0.06							0.33			
9/28/2011	0.34	0.34	0.33		0.30		0.59	0.40	0.47		
10/6/2011	0.32	0.06	0.07	0.07	0.18	0.33	0.33	0.09	0.06		0.07
10/12/2011	0.05							0.30			
10/20/2011	0.12							0.41			
10/26/2011	0.07						0.11	0.46			
11/2/2011	0.06							0.31			
11/9/2011	0.21						0.32	0.23			
* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)											

2010 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#13**	**CSHH#14**	**CSHH#15**
5/20/2010	0.017	0.024	0.015					0.019			
5/26/2010	0.030	0.010	0.010					0.015			
6/2/2010	0.011	0.007	0.008					0.011	0.012		
6/9/2010	0.008	NA	0.007					0.005	0.007		
6/16/2010	0.008	0.003	0.007					0.006	0.010		
6/23/2010	0.008	0.003	0.005					0.012	0.019		
6/30/2010	0.009	0.013	0.002					0.008	0.012		
7/7/2010	0.005	0.005	0.002					0.007	0.004		
7/15/2010	0.007	0.025	0.004					0.005			
7/21/2010	0.005	0.004	0.005					0.007	0.010		
7/28/2010	0.007	0.005	0.005					0.011	0.011		
8/4/2010	0.008	0.004	0.005					0.009	0.005		
8/11/2010	0.012	0.007	0.007					0.009	0.015		
8/18/2010	0.013	0.005	0.008					0.008	0.012		
8/26/2010	0.030	0.018	0.021	.				0.018	0.017		
9/2/2010	0.012	0.020	0.011					0.018	0.011		
9/8/2010	0.043	0.033	0.039	0.038	0.040	0.042	0.044	0.037		0.035	0.038
9/15/2010	0.039	0.061	0.039					0.023	0.015		
9/22/2010	0.024	0.029	0.021					0.013	0.018		
9/29/2010	0.027	0.024	0.025					NA	0.013		
10/13/2010	0.058	0.058	0.056					0.035	0.042		
10/20/2010	0.075	0.069	0.070					0.059	0.051		
10/28/2010	0.053	0.051	0.056					0.031	0.013		
11/3/2010	0.053	0.050	0.052	0.054	0.050	0.052	0.049	0.047	0.024	0.051	0.050

2010 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#13**	**CSHH#14**	**CSHH#15**
5/20/2010	0.01	0.01	0.09					0.01			
5/26/2010	0.02	0.02	0.03					0.02			
6/2/2010	0.03	0.02	0.03					0.05	0.04		
6/9/2010	0.04	NA	0.03					0.04	0.04		
6/16/2010	0.02	0.01	0.01					0.06	0.02		
6/23/2010	0.03	0.02	0.03					0.01	0.55		
6/30/2010	0.03	0.03	0.03					0.02	0.01		
7/7/2010	0.02	0.02	0.02					0.02	0.02		
7/15/2010	0.03	0.03	0.03					0.03			
7/21/2010	0.03	0.02	0.03					0.03	0.03		
7/28/2010	0.07	0.02	0.03					0.04	0.02		
8/4/2010	0.02	0.02	0.01					0.02	0.03		
8/11/2010	0.04	0.02	0.04					0.02	0.04		
8/18/2010	0.04	0.04	0.05					0.05	0.05		
8/26/2010	0.02	0.02	0.02					0.02	0.01		
9/2/2010	0.05	0.03	0.04					0.04	0.02		
9/8/2010	0.03	0.01	0.02	0.02	0.02	0.02	0.03	0.02		0.05	0.02
9/15/2010	0.03	0.01	0.03					0.03	0.02		
9/22/2010	0.02	0.02	0.01					0	0.01		
9/29/2010	0.01	0	0.01					NA	0		
10/13/2010	0.03	0.03	0.02					0.02	0.03		
10/20/2010	0.03	0.02	0.02					0.02	0.04		
10/28/2010	0.03	0.01	0.01					0.03	0.01		
11/3/2010	0.02	0.02	0.01	0.03	0.02	0.01	0.02	0.02	0.01	0.02	0.02

2010 Nitrogen Data

Ammonia-Nitrogen											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/20/2010	0	0.2	0					0			
5/26/2010	0	0	0					0			
6/2/2010	0		0					0	0		
6/9/2010	0						0	0			
6/16/2010	0	0						0			
6/23/2010	1	0						0	0		
6/30/2010	0							0	NA		
7/7/2010	0							0.10	0.05		
7/15/2010	0.1	0						0			
7/21/2010	0	0					0	0	0		
7/28/2010	0							0			
8/4/2010	0							0			
8/11/2010	0						0	0	NA		NA
8/18/2010	0	0						0	0		
8/26/2010	0							0			
9/2/2010	0		0					0			
9/8/2010	0						0	NA	NA		
9/15/2010	0							0			
9/22/2010	0							0	0		
9/29/2010	0							0	0		
10/13/2010	0							0	NA		
10/20/2010	0							0	0		
10/28/2010	0							NA	NA		
11/3/2010	0	NA	NA		NA	NA	0	0			
**Salicylate result											

2010 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/20/2010	0.03	0.23	0.11					0.03			
5/26/2010	0.05	0.03	0.04					0.04			
6/2/2010	0.04		0.04					0.06	0.05		
6/9/2010	0.05							0.05			
6/16/2010	0.03	0.01						0.07			
6/23/2010	1.04	0.02						0.02	0.57		
6/30/2010	0.04							0.03			
7/7/2010	0.03							0.13	0.07		
7/15/2010	0.14	0.06						0.04			
7/21/2010	0.04	0.02						0.04	0.04		
7/28/2010	0.08							0.05			
8/4/2010	0.03							0.03			
8/11/2010	0.05							0.03			
8/18/2010	0.05	0.05						0.06	0.06		
8/26/2010	0.05							0.04			
9/2/2010	0.06		0.05					0.06			
9/8/2010	0.07						0.07				
9/15/2010	0.07							0.05			
9/22/2010	0.04							0.01	0.03		
9/29/2010	0.04								0.01		
10/13/2010	0.09							0.06			
10/20/2010	0.11							0.08	0.09		
10/28/2010	0.08										
11/3/2010	0.07						0.07	0.07			
* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)											

2009 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#13**	**CSHH#14**	**CSHH#15**	**CSHH#10A**
5/13/2009	0.003	0	0					0	0.001			
5/20/2009	0.009	0.006	0.008					0.008	0.014			
5/27/2009	0.012	0.020	0.009					0.010	0.008			
6/3/2009	0.031	0.010	0.011					0.018	0.016			
6/10/2009	0.010	0.009	0.008					0.012	0.016			
6/17/2009	0.006	0.006	0.005					0.008	0.015			
6/24/2009	0.009	0.005	0.012					0.014	0.016			
7/1/2009	0.008	0.004	0.005					0.009	0.007			
7/8/2009	0.005	0.010	0.005					0.031	0.018			
7/15/2009	0.008	0.003	0.014					0.013	0.012			0.014
7/22/2009	0.006	0.005	0.006					0.005	0.008			
7/29/2009	0.006	0.004	0.006					0.011	0.013			
8/5/2009	0.008	0.003	0.004					0.010	0.008			
8/12/2009	0.016	0.004	0.014					0.013	NA			
8/19/2009	0.010	0.006	0.009					0.011	0.014			
8/26/2009	0.003	0.005	0.007					0.006	0.016			
9/2/2009	0.006	0.010	0.004					0.010	0.010	0.007	0.009	
9/9/2009	0.019	0.015	0.008					0.008	0.011			
9/16/2009	0.032	NA	0.025					0.017	0.017	0.025	0.017	
9/23/2009	0.064	0.068	0.038					0.021	0.020			
9/30/2009	0.037	NA	0.044					0.020	0.012			
10/8/2009	0.046	NA	0.052					0.017	0.014			
10/14/2009	0.037	0.048	0.051					0.043	0.046			
10/21/2009	0.034	0.036	0.030					0.033	0.025			
10/30/2009	0.045	0.036	0.042					0.036	0.041		NA	

2009 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#13	CSHH#14	CSHH#15	CSHH#10A
5/13/2009	0	0	0					0	0			
5/20/2009	0.04	0.03	0.04					0.03	0.02			
5/27/2009	0.06	0.05	0.05					0.04	0.04			
6/3/2009	0.03	0.03	0.04					0.03	0.03			
6/10/2009	0.05	0.03	0.04					0.02	0.02			
6/17/2009	0.03	0.02	0.02					0.03	0.03			
6/24/2009	0.03	0.03	0.03					0.02	0.02			
7/1/2009	0.02	0.02	0.02					0.03	0.01			
7/8/2009	0.03	0.03	0.03					0.06	0.04			
7/15/2009	0.04	0.03	0.03					0.04	0.02			0.03
7/22/2009	0.03	0.02	0.02					0.02	0			
7/29/2009	0.01	0.02	0.02					0.01	0.01			
8/5/2009	0.03	0.02	0.04					0.01	0.02			
8/12/2009	0.03	0.03	0.04					0.03	NA			
8/19/2009	0.04	0.04	0.03					0.05	0.05			
8/26/2009	0.04	0.02	0.02					0.03	0.03			
9/2/2009	0.04	0.02	0.03					0.02	0.03	0.04	0.04	
9/9/2009	0.05	0.04	0.05					0.05	0.06			
9/16/2009	0.02	NA	0.01					0.02	0.02	0.02	0.02	
9/23/2009	0.02	0.02	0.02					0.01	0.03			
9/30/2009	0.01	NA	0.03					0.01	0.01			
10/8/2009	0.03	NA	0.02					0.02	0.01			
10/14/2009	0.05	0.02	0.03					0.06	0.07			
10/21/2009	0.07	0.02	0.07					0.01	0.01			
10/30/2009	0.02	0.02	0.03					0.02	0.02		NA	

2009 Nitrogen Data

Ammonia-Nitrogen												
Date	CSHH#1	CSHH#2	CSHH#3	CSHH#4	CSHH#5	CSHH#6	CSHH#7	CSHH#8	CSHH#13	CSHH#14	CSHH#15	CSHH#10A
5/13/2009	0	0	0					0	NA			
5/20/2009	0	0	0					0.025	NA			
5/27/2009	0.25	0.1	0.1					0.1	0.25			
6/3/2009	0	0.05	0					0	NA			
6/10/2009	0	0	0					0.25	0.25			
6/17/2009	0	0	0					0	0			
6/24/2009	0	0	0					0	0			
7/1/2009	1	0	NA					1	NA			
7/8/2009	0	0	0					0	NA			
7/15/2009	0	0	0					6.1	0			0.5
7/22/2009	0	0	0					NA	0			
7/29/2009	0	0	0					0	0			
8/5/2009	0	0	0					0	0			
8/12/2009	0	0	0					0	0			
8/19/2009	0	0	0					0	0.25			
8/26/2009	0	0	NA					0	0			
9/2/2009	0	0	0					0	NA	0	0	
9/9/2009	0	0	0					0.25	NA			
9/16/2009	0	NA	NA					0.25	NA	NA	0	
9/23/2009	0	0	0					0.10	0			
9/30/2009	0	NA	0					0	0			
10/8/2009	0.25	NA	0					0.25	0.25			
10/14/2009	0	0	0					0	0.10			
10/21/2009	0.25	0	0					0	0			
10/30/2009	0	0.05	0.10					0	0		0.25	

2009 Nitrogen Data

	Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**	**CSHH#10A**
5/13/2009	0.00	0.00	0.00					0.00				
5/20/2009	0.05	0.04	0.05					0.06				
5/27/2009	0.32	0.17	0.16					0.15	0.30			
6/3/2009	0.06	0.09	0.05					0.05				
6/10/2009	0.06	0.04	0.05					0.28	0.29			
6/17/2009	0.04	0.03	0.03					0.04	0.05			
6/24/2009	0.04	0.04	0.04					0.03	0.04			
7/1/2009	1.03	0.02						1.04				
7/8/2009	0.04	0.04	0.04					0.09				
7/15/2009	0.05	0.03	0.04					6.15	0.03			0.54
7/22/2009	0.04	0.03	0.03						0.01			
7/29/2009	0.02	0.02	0.03					0.02	0.02			
8/5/2009	0.04	0.02	0.04					0.02	0.03			
8/12/2009	0.05	0.03	0.05					0.04				
8/19/2009	0.05	0.05	0.04					0.06	0.31			
8/26/2009	0.04	0.03						0.04	0.05			
9/2/2009	0.05	0.03	0.03					0.03		0.05	0.05	
9/9/2009	0.07	0.06	0.06					0.31				
9/16/2009	0.05							0.29			0.04	
9/23/2009	0.08	0.09	0.06					0.13	0.05			
9/30/2009	0.05		0.07					0.03	0.02			
10/8/2009	0.33		0.07					0.29	0.27			
10/14/2009	0.09	0.07	0.08					0.10	0.22			
10/21/2009	0.35	0.06	0.10					0.04	0.04			
10/30/2009	0.07	0.11	0.17					0.06	0.06			

* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)

2008 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#13**	**CSHH#14**	**CSHH#15**
5/21/2008	0.140	NA	0.012	0.016	NA	NA	NA	NA			
6/11/2008	NA	0.011	0.009	NA	NA	NA	NA	0.008			
6/19/2008	0.014	0.009	0.008	NA	NA	NA	NA	0.017			
6/25/2008	0.009	0.009	0.009	NA	NA	NA	NA	0.008			
7/2/2008	0.008	0.010	0.008	NA	NA	NA	NA	0.011			
7/9/2008	0.006	0.007	0.009	NA	NA	NA	NA	0.006			
7/17/2008	0.008	0.004	0.006	NA	NA	NA	NA	0.010			
7/30/2008	NA	0.009	0.007	NA	NA	NA	NA	0.006			
8/6/2008	0.011	0.011	0.011	NA	NA	NA	NA	0.007	0.017		
8/13/2008	0.012	0.005	0.007	NA	NA	NA	NA	0.011	0.013		
8/20/2008	0.011	0.008	0.007	NA	NA	NA	NA	0.009	0.008		
8/27/2008	0.01	0.005	NA	NA	NA	NA	NA	0.008	0.007		
9/3/2008	0.011	0.008	0.008	NA	NA	NA	NA	0.008	0.013		
9/10/2008	0.01	0.006	0.009	NA	NA	NA	NA	0.008	0.012		
9/17/2008	0.02	0.016	0.016	NA	NA	NA	NA	0.006	0.011		
9/24/2008	0.006	0.007	0.006	NA	NA	NA	NA	0.010	0.009		
10/2/2008	0.035	NA	0.009	NA	NA	NA	NA	0.015	NA		
10/8/2008	0.043	0.065	0.049	NA	NA	NA	NA	0.039	0.015		
10/16/2008	0.069	0.075	0.073	NA	NA	NA	NA	0.035	0.031		
10/22/2008	0.049	NA	0.046	NA	NA	NA	NA	0.024	0.015		
10/31/2008	0.035	0.038	0.038	NA	NA	NA	NA	0.037	0.012		
11/5/2008	0.036	0.039	0.033	NA	NA	NA	NA	0.025	0.026		

2008 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#13**	**CSHH#14**	**CSHH#15**
5/21/2008	0.02	NA	0.03	0.04	NA	NA	NA	NA			
6/11/2008	NA	0.03	0.04	NA	NA	NA	NA	0.03			
6/19/2008	0.03	0.04	0.04	NA	NA	NA	NA	0.04			
6/25/2008	0.04	0.04	0.03	NA	NA	NA	NA	0.15			
7/2/2008	0.05	0.05	0.04	NA	NA	NA	NA	0.04			
7/9/2008	0.03	0.03	0.04	NA	NA	NA	NA	0.02			
7/17/2008	0.05	0.03	0.02	NA	NA	NA	NA	0.03			
7/30/2008	NA	0.06	0.03	NA	NA	NA	NA	0.04			
8/6/2008	0.05	0.03	0.04	NA	NA	NA	NA	0.03	0.02		
8/13/2008	0.05	0.03	0.03	NA	NA	NA	NA	0.03	0.03		
8/20/2008	0.06	0.04	0.05	NA	NA	NA	NA	0.03	0.04		
8/27/2008	0.04	0.03	NA	NA	NA	NA	NA	0.03	0.03		
9/3/2008	0.05	0.03	0.04	NA	NA	NA	NA	0.03	0.02		
9/10/2008	0.03	0.03	0.03	NA	NA	NA	NA	0.03	0.04		
9/17/2008	0.03	0.03	0.04	NA	NA	NA	NA	0.03	0.03		
9/24/2008	0.04	0.07	0.04	NA	NA	NA	NA	0.04	0.04		
10/2/2008	0.03	NA	0.04	NA	NA	NA	NA	0.04	NA		
10/8/2008	0.02	0.02	0.02	NA	NA	NA	NA	0.02	0.02		
10/16/2008	0.04	0.02	0.03	NA	NA	NA	NA	0.02	0.02		
10/22/2008	0.05	NA	0.04	NA	NA	NA	NA	0.03	0.02		
10/31/2008	0.03	0.02	0.03	NA	NA	NA	NA	0.02	0.01		
11/5/2008	0.02	0.02	0.03	NA	NA	NA	NA	0.02	0.02		

**There are no ammonia-nitrogen readings and, thus, no calculated total inorganic nitrogen (TIN) in 2008.

2007 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#13**	**CSHH#14**	**CSHH#15**
6/21/2007	0.011	0.007	0.007	NA	NA	NA	NA	0.013			
6/27/2007	0.013	0.010	0.012	NA	NA	NA	NA	0.014			
7/5/2007	0.009	0.004	0.011	NA	NA	NA	NA	0.028			
7/16/2007	0.006	0.007	0.004	NA	NA	NA	NA	0.006			
7/20/2007	0.008	0.003	0.012	NA	NA	NA	NA	0.011			
7/25/2007	0.011	NA	0.024	NA	NA	NA	NA	0.009			
8/15/2007	0.008	0.006	0.008	NA	NA	NA	NA	0.010			
8/22/2007	0.016	0.018	0.016	NA	NA	NA	NA	0.014			
8/29/2007	0.016	0.027	0.018	NA	NA	NA	NA	0.011			
9/5/2007	0.013	0.011	0.011	NA	NA	NA	NA	0.010			
9/13/2007	0.029	0.029	0.024	NA	NA	NA	NA	0.025			
9/19/2007	0.038	0.056	0.046	NA	NA	NA	NA	0.040			
9/27/2007	0.052	0.056	0.051	NA	NA	NA	NA	0.026			
10/3/2007	0.039	0.035	0.030	NA	NA	NA	NA	0.025			
10/10/2007	0.032	0.028	0.028	NA	NA	NA	NA	0.029			
10/17/2007	0.021	0.019	0.026	NA	NA	NA	NA	0.016			
10/24/2007	0.024	0.024	0.037	NA	NA	NA	NA	0.021			
10/31/2007	0.021	0.024	0.024	NA	NA	NA	NA	0.018			

2007 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#13	CSHH#14	CSHH#15
6/21/2007	0.04	0.04	0.04	NA	NA	NA	NA	0.66			
6/27/2007	0.04	0.04	0.04	NA	NA	NA	NA	0.23			
7/5/2007	0.02	0.03	0.03	NA	NA	NA	NA	0.07			
7/16/2007	0.02	0.03	0.04	NA	NA	NA	NA	0.29			
7/20/2007	0.04	0.03	0.03	NA	NA	NA	NA	0.07			
7/25/2007	0.03	NA	0.04	NA	NA	NA	NA	0.03			
8/15/2007	0.04	0.02	0.02	NA	NA	NA	NA	0.04			
8/22/2007	0.02	0.02	0.02	NA	NA	NA	NA	0.02			
8/29/2007	0.03	0.02	0.03	NA	NA	NA	NA	0.02			
9/5/2007	0.04	0.03	0.03	NA	NA	NA	NA	0.02			
9/13/2007	0.03	0.02	0.02	NA	NA	NA	NA	0.02			
9/19/2007	0.03	0.04	0.04	NA	NA	NA	NA	0.03			
9/27/2007	0.04	0.03	0.03	NA	NA	NA	NA	0.03			
10/3/2007	0.02	0.02	0.02	NA	NA	NA	NA	0.02			
10/10/2007	0.02	0.02	0.02	NA	NA	NA	NA	0.04			
10/17/2007	0.12	0.10	0.11	NA	NA	NA	NA	0.17			
10/24/2007	0.09	0.08	0.11	NA	NA	NA	NA	0.27			
10/31/2007	0.12	0.07	0.15	NA	NA	NA	NA	0.02			

**There was only one ammonia-nitrogen reading (6/21/07) and, thus, only one date of calculated total inorganic nitrogen (TIN) in 2007.

2006 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#13	CSHH#14	CSHH#15
6/1/2006	0.002	0.005	0.003	NA	NA	NA	NA	0.001			
6/8/2006	0.016	0.025	0.010	NA	NA	NA	NA	0.015			
6/15/2006	0.014	0.016	0.015	NA	NA	NA	NA	0.016			
6/22/2006	0.006	0.013	0.007	NA	NA	NA	NA	0.003			
6/29/2006	0.015	0.009	0.001	NA	NA	NA	NA	0.005			
7/7/2006	0.009	0.013	0.007	NA	NA	NA	NA	0.015			
7/13/2006	0	0	0.001	NA	NA	NA	NA	0.012			
7/20/2006	0.014	0.014	0.006	NA	NA	NA	NA	0.010			
7/27/2006	0.008	0.005	0.006	NA	NA	NA	NA	0.005			
8/2/2006	0.010	0.006	0.007	NA	NA	NA	NA	0.003			
8/10/2006	0.010	0.013	0.015	NA	NA	NA	NA	0.022			
8/17/2006	0.004	0.004	0.013	NA	NA	NA	NA	0.002			
8/24/2006	0.008	0.013	0.008	NA	NA	NA	NA	0.008			
8/31/2006	0.030	NA	0.018	NA	NA	NA	NA	0.016			
9/7/2006	0.029	0.014	0.024	NA	NA	NA	NA	0.014			
9/14/2006	0.012	0.012	0.013	NA	NA	NA	NA	0.015			
9/21/2006	0.010	0.008	0.010	0.009	0.011	0.010	0.016	NA			
9/28/2006	0.009	0.015	0.011	NA	NA	NA	NA	0.013			
10/5/2006	0.010	0.009	0.008	NA	NA	NA	NA	0.008			
10/12/2006	0.008	0.007	0.009	NA	NA	NA	NA	0.011			

2006 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#13**	**CSHH#14**	**CSHH#15**
6/1/2006	0.04	0.06	0.06	NA	NA	NA	NA	0.09			
6/8/2006	0.07	0.07	0.07	NA	NA	NA	NA	0.11			
6/15/2006	0.09	0.01	0.02	NA	NA	NA	NA	0.82			
6/22/2006	0.03	0.02	0.01	NA	NA	NA	NA	0.31			
6/29/2006	0.15	0.07	0.12	NA	NA	NA	NA	0.48			
7/7/2006	0.03	0.04	0.03	NA	NA	NA	NA	0.83			
7/13/2006	0.05	0.04	0.05	NA	NA	NA	NA	0.02			
7/20/2006	0.05	0.07	0.03	NA	NA	NA	NA	0.10			
7/27/2006	0.02	0.05	0.03	NA	NA	NA	NA	0.04			
8/2/2006	0.04	0.05	0.08	NA	NA	NA	NA	0.72			
8/10/2006	0.03	0.03	0.08	NA	NA	NA	NA	0.94			
8/17/2006	0.06	0.03	0.05	NA	NA	NA	NA	0.19			
8/24/2006	0.07	0.02	0.09	NA	NA	NA	NA	0.31			
8/31/2006	0.04	NA	0.01	NA	NA	NA	NA	0.04			
9/7/2006	0.05	0.07	0.05	NA	NA	NA	NA	0.01			
9/14/2006	0.04	0.03	0.08	NA	NA	NA	NA	0.38			
9/21/2006	0.04	0.03	0.14	0.04	0.06	0.02	0.10	NA			
9/28/2006	0.03	0.03	0.03	NA	NA	NA	NA	0.32			
10/5/2006	0.03	0.04	0.17	NA	NA	NA	NA	0.29			
10/12/2006	0.07	0.03	0.05	NA	NA	NA	NA	0.25			

2006 Nitrogen Data

Ammonia-Nitrogen											
Date	CSHH#1	CSHH#2	CSHH#3	CSHH#4	CSHH#5	CSHH#6	CSHH#7	CSHH#8	CSHH#13	CSHH#14	CSHH#15
6/1/2006	2.72	4.24	2.72	NA	NA	NA	NA	1.52			
6/8/2006	1.20	1.28	1.12	NA	NA	NA	NA	0.96			
6/15/2006	1.44	2.32	1.12	NA	NA	NA	NA	1.44			
6/22/2006	2.56	1.68	2.64	NA	NA	NA	NA	1.68			
6/29/2006	2.00	1.68	2.56	NA	NA	NA	NA	0.88			
7/7/2006	2.24	1.36	2.08	NA	NA	NA	NA	2.16			
7/13/2006	1.92	2.32	2.56	NA	NA	NA	NA	1.36			
7/20/2006	1.36	1.60	2.00	NA	NA	NA	NA	1.92			
7/27/2006	2.32	1.92	2.40	NA	NA	NA	NA	1.12			
8/2/2006	2.40	2.80	2.88	NA	NA	NA	NA	1.76			
8/10/2006	0.96	2.64	1.68	NA	NA	NA	NA	1.68			
8/17/2006	2.16	1.52	2.16	NA	NA	NA	NA	1.52			
8/24/2006	1.84	2.00	1.52	NA	NA	NA	NA	1.60			
8/31/2006	2.16	NA	2.40	NA	NA	NA	NA	1.52			
9/7/2006	2.40	2.80	2.16	NA	NA	NA	NA	1.60			
9/14/2006	2.56	2.56	2.80	NA	NA	NA	NA	1.84			
9/21/2006	2.40	1.84	2.32	2.48	2.72	2.40	2.48	NA			
9/28/2006	2.32	2.00	3.12	NA	NA	NA	NA	2.08			
10/5/2006	1.84	2.00	2.00	NA	NA	NA	NA	1.60			
10/12/2006	2.64	2.40	2.00	NA	NA	NA	NA	1.76			

2006 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
6/1/2006	2.76	4.31	2.78					1.61			
6/8/2006	1.29	1.38	1.20					1.09			
6/15/2006	1.54	2.35	1.16					2.28			
6/22/2006	2.60	1.71	2.66					1.99			
6/29/2006	2.17	1.76	2.68					1.37			
7/7/2006	2.28	1.41	2.12					3.01			
7/13/2006	1.97	2.36	2.61					1.39			
7/20/2006	1.42	1.68	2.04					2.03			
7/27/2006	2.35	1.98	2.44					1.17			
8/2/2006	2.45	2.86	2.97					2.48			
8/10/2006	1.00	2.68	1.78					2.64			
8/17/2006	2.22	1.55	2.22					1.71			
8/24/2006	1.92	2.03	1.62					1.92			
8/31/2006	2.23		2.43					1.58			
9/7/2006	2.48	2.88	2.23					1.62			
9/14/2006	2.61	2.60	2.89					2.24			
9/21/2006	2.45	1.88	2.47	2.53	2.79	2.43	2.60				
9/28/2006	2.36	2.05	3.16					2.41			
10/5/2006	1.88	2.05	2.18					1.90			
10/12/2006	2.72	2.44	2.06					2.02			
* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)											

2005 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#13**	**CSHH#14**	**CSHH#15**
6/2/2005	0.011	0.009	0.012	0.019	0.011	0.017	0.011	0.019			
6/9/2005	0	0	0.006	NA	NA	NA	NA	0.007			
6/16/2005	0.004	0.010	0.017	NA	NA	NA	NA	NA			
6/23/2005	0.017	0.011	0.010	NA	NA	NA	NA	0.032			
6/30/2005	0.015	0.006	0.011	NA	NA	NA	NA	0.025			
7/7/2005	0.005	0	0.004	NA	NA	NA	NA	0			
7/14/2005	0.005	0.001	0.002	NA	NA	NA	NA	0.005			
7/21/2005	0.014	0.015	0.004	NA	NA	NA	NA	0.011			
7/28/2005	0.002	0.002	0.003	NA	NA	NA	NA	0			
8/11/2005	0.013	0.006	0.010	0.018	NA	NA	NA	0.007			
8/18/2005	0.004	0	0	NA	NA	NA	NA	0.003			
8/25/2005	0.025	NA	0.011	NA	NA	NA	NA	0.008			
9/1/2005	0.015	0.018	0.019	0.011	0.028	0.020	0.016	0.021			
9/8/2005	0.010	0.007	0	NA	NA	NA	NA	0.006			
9/22/2005	0.024	0.017	0.017	NA	NA	NA	NA	0.023			
9/29/2005	0.021	0.016	0.021	NA	NA	NA	NA	0.010			
10/6/2005	0.036	0.032	0.021	NA	NA	NA	NA	0.019			
10/20/2005	0.023	0.031	0.024	NA	NA	NA	NA	0.020			
10/27/2005	0.038	0.047	0.039	NA	NA	NA	NA	0.028			
11/3/2005	0.053	0.066	0.053	NA	NA	NA	NA	0.040			

2005 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#13	CSHH#14	CSHH#15
6/2/2005	0.03	0.07	0.09	0.02	0.10	0.09	0.09	0.23			
6/9/2005	0.01	0.06	0.03	NA	NA	NA	NA	0.07			
6/16/2005	0.02	0.04	0.01	NA	NA	NA	NA	NA			
6/23/2005	0.01	0.03	0	NA	NA	NA	NA	0.07			
6/30/2005	0.03	0.01	0.05	NA	NA	NA	NA	0.19			
7/7/2005	0.01	0.02	0.01	NA	NA	NA	NA	0.24			
7/14/2005	0.02	0	0.22	NA	NA	NA	NA	0.28			
7/21/2005	0.03	0	0	NA	NA	NA	NA	0.38			
7/28/2005	0.05	0.03	0.06	NA	NA	NA	NA	0.30			
8/11/2005	0	0	0.09	0.01	NA	NA	NA	0.40			
8/18/2005	0	0.03	0	NA	NA	NA	NA	0.23			
8/25/2005	0.07	NA	0.07	NA	NA	NA	NA	0.33			
9/1/2005	0.04	0.05	0	0.04	0.03	0.07	0.01	0.55			
9/8/2005	0.04	0.03	0.04	NA	NA	NA	NA	0.10			
9/22/2005	0.11	0.09	0.13	NA	NA	NA	NA	0.45			
9/29/2005	0.09	0.05	0.07	NA	NA	NA	NA	0.16			
10/6/2005	0.05	0.07	0.10	NA	NA	NA	NA	0.12			
10/20/2005	0.03	0.01	0.04	NA	NA	NA	NA	0.01			
10/27/2005	0.02	0.03	0.01	NA	NA	NA	NA	1.20			
11/3/2005	0	0.03	0.19	NA	NA	NA	NA	0.56			

2005 Nitrogen Data

Ammonia-Nitrogen											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
6/2/2005	0.40	1.12	0.56	1.04	1.52	0.56	0.72	1.04			
6/9/2005	1.12	0.80	0.88	NA	NA	NA	NA	0.96			
6/16/2005	0.40	1.12	0.72	NA	NA	NA	NA	NA			
6/23/2005	1.20	0.64	1.12	NA	NA	NA	NA	1.36			
6/30/2005	1.28	1.12	1.84	NA	NA	NA	NA	1.60			
7/7/2005	0.16	0.48	0.64	NA	NA	NA	NA	1.28			
7/14/2005	0.64	0.24	0.64	NA	NA	NA	NA	0.56			
7/21/2005	0.80	0.56	1.12	NA	NA	NA	NA	1.12			
7/28/2005	1.28	1.20	1.20	NA	NA	NA	NA	1.68			
8/11/2005	0.96	1.76	0.96	1.36	NA	NA	NA	0.80			
8/18/2005	0.72	0.80	1.44	NA	NA	NA	NA	1.12			
8/25/2005	0.88	NA	0.40	NA	NA	NA	NA	1.04			
9/1/2005	2.24	1.28	1.68	1.76	2.00	2.00	1.92	1.68			
9/8/2005	0.24	0.64	0.32	NA	NA	NA	NA	0.96			
9/22/2005	1.28	1.12	1.28	NA	NA	NA	NA	0.88			
9/29/2005	0.8	1.04	1.36	NA	NA	NA	NA	0.88			
10/6/2005	1.04	1.52	0.64	NA	NA	NA	NA	1.6			
10/20/2005	1.6	1.52	0.96	NA	NA	NA	NA	1.60			
10/27/2005	1.76	1.36	1.12	NA	NA	NA	NA	1.68			
11/3/2005	0.16	0.96	0.40	NA	NA	NA	NA	0.96			

2005 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
6/2/2005	0.44	1.20	0.66	1.08	1.63	0.67	0.82	1.29			
6/9/2005	1.13	0.86	0.92					1.04			
6/16/2005	0.42	1.17	0.75								
6/23/2005	1.23	0.68	1.13					1.46			
6/30/2005	1.33	1.14	1.90					1.82			
7/7/2005	0.18	0.50	0.65					1.52			
7/14/2005	0.67	0.24	0.86					0.85			
7/21/2005	0.84	0.58	1.12					1.51			
7/28/2005	1.33	1.23	1.26					1.98			
8/11/2005	0.97	1.77	1.06	1.39				1.21			
8/18/2005	0.72	0.83	1.44					1.35			
8/25/2005	0.98		0.48					1.38			
9/1/2005	2.30	1.35	1.70	1.81	2.06	2.09	1.95	2.25			
9/8/2005	0.29	0.68	0.36					1.07			
9/22/2005	1.41	1.23	1.43					1.35			
9/29/2005	0.91	1.11	1.45					1.05			
10/6/2005	1.13	1.62	0.76					1.74			
10/20/2005	1.65	1.56	1.02					1.63			
10/27/2005	1.82	1.44	1.17					2.91			
11/3/2005	0.21	1.06	0.64					1.56			
* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)											

2004 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#13	CSHH#14	CSHH#15
6/3/2004	0.003	0.019	0.007	0.009	0.009	0.003	0.002	0.019			
6/10/2004	0.017	0.017	0.012	0.017	0.018	0.021	0.014	0.011			
6/18/2004	0.008	0.003	0.019	0.006	0.008	0.009	0.013	0.007			
6/24/2004	0.012	0.006	0.001	NA	NA	NA	NA	0.013			
7/14/2004	0.021	0.007	0.003	0.009	0.018	0.007	0.025	0.011			
7/22/2004	0.009	0.015	0.006	NA	NA	NA	NA	0.007			
7/29/2004	0.005	0.008	0.002	0.008	0.002	0.009	0.017	0.015			
8/5/2004	0.008	0.012	0.008	NA	NA	NA	NA	0.007			
8/11/2004	0.007	0.006	0.001	NA	NA	NA	NA	0.008			
8/19/2004	0.002	0	0.009	NA	NA	NA	NA	0.006			
8/26/2004	0.003	0.015	0.010	0.002	0.015	0.004	0.007	0.002			
9/2/2004	0.012	0.006	0.009	NA	NA	NA	NA	0.011			
9/8/2004	0.012	NA	0.021	NA	NA	NA	NA	0.035			
9/15/2004	0.016	0.016	0.020	0.012	0.019	0.023	0.022	0.011			
9/22/2004	0.024	0.032	0.020	NA	NA	NA	NA	0.023			
9/30/2004	0.005	0.005	0.004	NA	NA	NA	NA	0.010			
10/7/2004	0.020	0.019	0.031	NA	NA	NA	NA	0.046			
10/14/2004	0.014	0.014	0.016	NA	NA	NA	NA	0.024			
10/21/2004	0.015	0.008	0.011	NA	NA	NA	NA	0.011			
10/28/2004	0.014	NA	0.016	NA	NA	NA	NA	0.020			
11/4/2004	0.025	0.018	0.028	NA	NA	NA	NA	0.012			
11/10/2004	0.019	0.028	0.019	NA	NA	NA	NA	0.019			

2004 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#13**	**CSHH#14**	**CSHH#15**
6/3/2004	0.12	0.05	0.04	0.08	0.11	0.09	0.11	0.84			
6/10/2004	0.11	0.05	0.19	0.1	0.25	0.15	0.47	0.94			
6/18/2004	0.05	0.05	0.01	0.1	0.07	0.08	0.07	0.48			
6/24/2004	0.07	0.01	0.06	NA	NA	NA	NA	0.48			
7/14/2004	0.03	0.06	0.02	0.05	0.08	0.15	0.55	0.20			
7/22/2004	0.05	0.03	0.01	NA	NA	NA	NA	0.22			
7/29/2004	0.08	0.05	0.08	0.06	0.20	0.03	0.01	0.03			
8/5/2004	0.03	0.04	0.02	NA	NA	NA	NA	0.12			
8/11/2004	0.03	0.04	0.01	NA	NA	NA	NA	0.09			
8/19/2004	0.07	0.03	0.02	NA	NA	NA	NA	0.39			
8/26/2004	0.01	0.01	0.08	0.02	0.65	0.04	0.27	0.07			
9/2/2004	0.06	0.02	0	NA	NA	NA	NA	0.38			
9/8/2004	0.04	NA	0.07	NA	NA	NA	NA	0.11			
9/15/2004	0.11	0.05	0.08	0.09	0.05	0.06	0.07	0.38			
9/22/2004	0.12	0.16	0.11	NA	NA	NA	NA	0.43			
9/30/2004	0.14	0.15	0.16	NA	NA	NA	NA	0.74			
10/7/2004	0	0.07	0.11	NA	NA	NA	NA	0.22			
10/14/2004	0.11	0.04	0.11	NA	NA	NA	NA	0.23			
10/21/2004	0.15	0.05	0.04	NA	NA	NA	NA	0.53			
10/28/2004	0.09	NA	0.03	NA	NA	NA	NA	0.05			
11/4/2004	0.06	0.07	0.12	NA	NA	NA	NA	0.53			
11/10/2004	0	0.07	0.05	NA	NA	NA	NA	0.71			

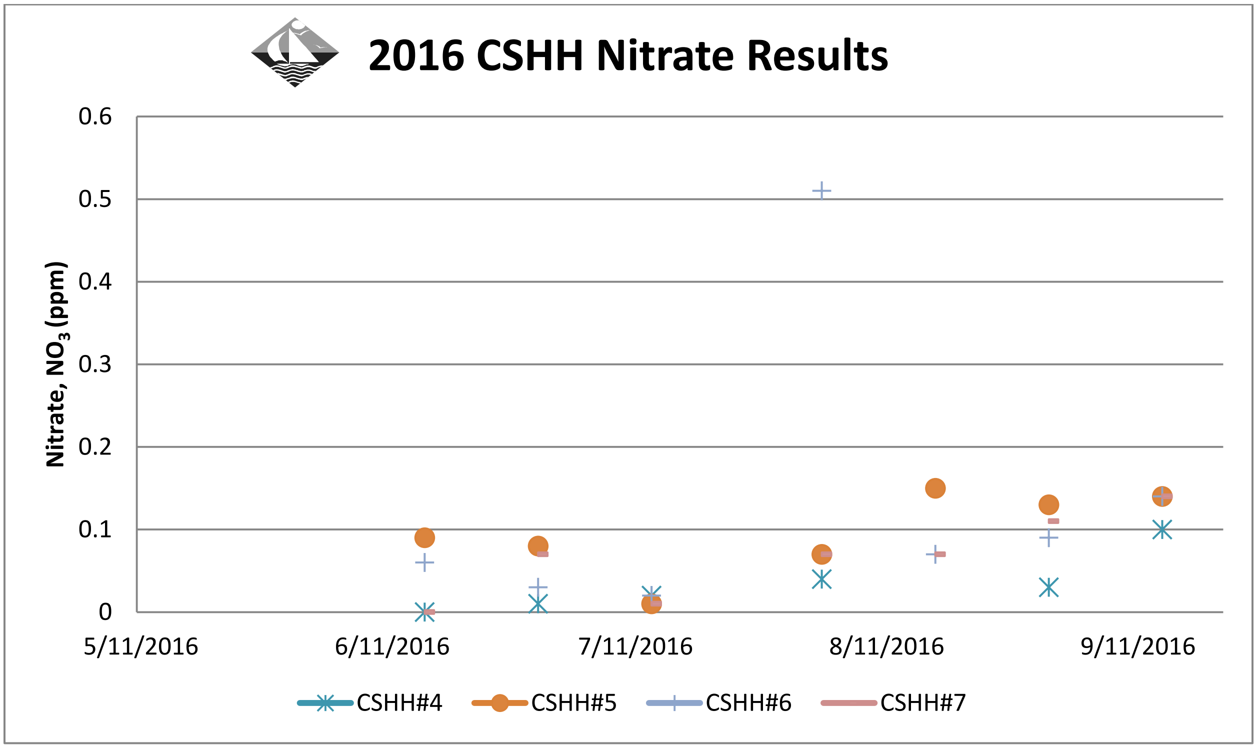
2004 Nitrogen Data

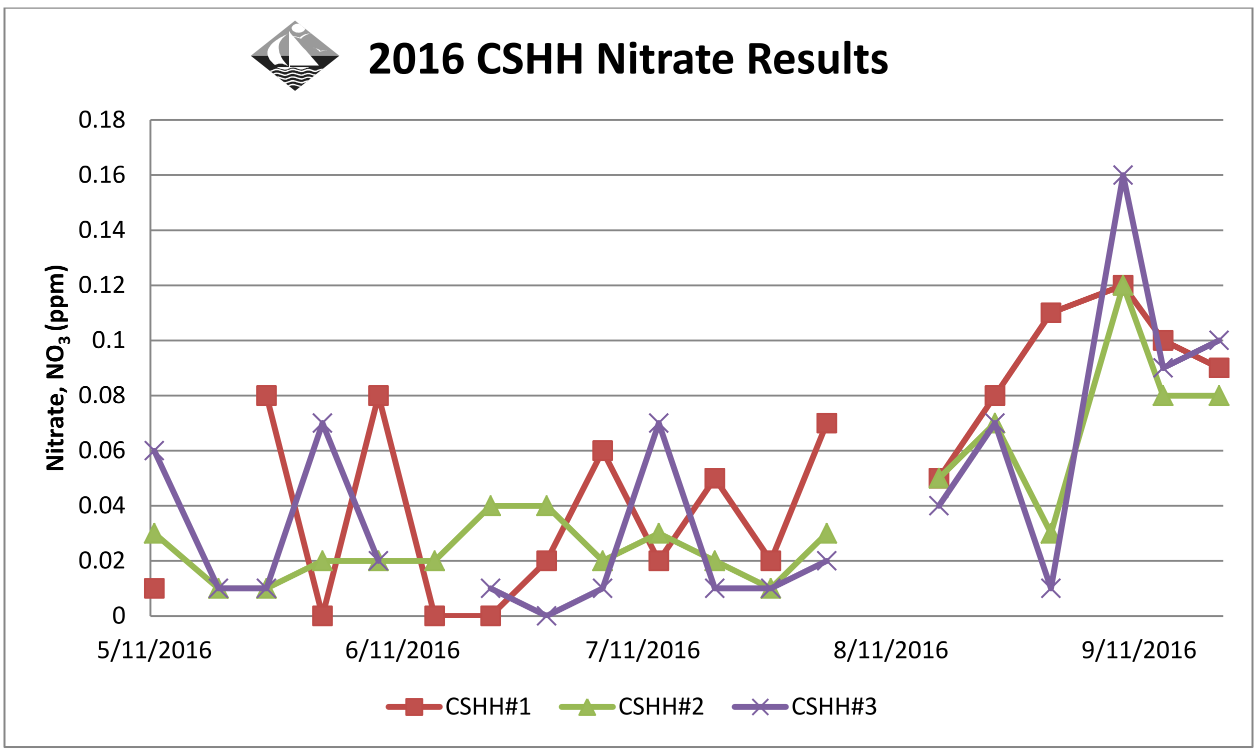
Ammonia-Nitrogen											
Date	CSHH#1	CSHH#2	CSHH#3	CSHH#4	CSHH#5	CSHH#6	CSHH#7	CSHH#8	CSHH#13	CSHH#14	CSHH#15
6/3/2004	2.16	1.92	1.68	1.68	1.68	1.52	2	2.08			
6/10/2004	1.60	1.44	1.60	1.44	1.20	1.28	1.52	1.44			
6/18/2004	1.12	1.12	0.88	0.96	0.64	0.96	1.04	0.96			
6/24/2004	NA	NA	NA	NA	NA	NA	NA	NA			
7/14/2004	1.92	1.84	1.52	2.00	1.84	2.32	2.56	2.24			
7/22/2004	NA	NA	NA	NA	NA	NA	NA	NA			
7/29/2004	0.88	0.24	1.60	1.44	1.60	1.76	2.24	1.12			
8/5/2004	1.52	1.28	1.76	NA	NA	NA	NA	1.52			
8/11/2004	0.56	0.88	0.96	NA	NA	NA	NA	1.12			
8/19/2004	1.44	1.52	1.52	NA	NA	NA	NA	0.96			
8/26/2004	0.72	0.48	0.96	0.72	0.96	0.88	1.36	1.28			
9/2/2004	1.04	1.28	1.36	NA	NA	NA	NA	1.6			
9/8/2004	1.52	NA	1.60	NA	NA	NA	NA	1.20			
9/15/2004	0.96	0.88	0.88	0.88	0.88	0.96	0.48	0.72			
9/22/2004	1.76	1.36	2.08	NA	NA	NA	NA	1.52			
9/30/2004	1.52	0.48	1.28	NA	NA	NA	NA	0.96			
10/7/2004	2.16	1.28	1.28	NA	NA	NA	NA	1.44			
10/14/2004	1.28	1.04	1.04	NA	NA	NA	NA	1.44			
10/21/2004	1.52	1.52	1.28	NA	NA	NA	NA	2.16			
10/28/2004	1.20	NA	1.52	NA	NA	NA	NA	0.88			
11/4/2004	1.20	0.64	1.28	NA	NA	NA	NA	1.04			
11/10/2004	0.88	1.12	1.12	NA	NA	NA	NA	1.68			

2004 Nitrogen Data

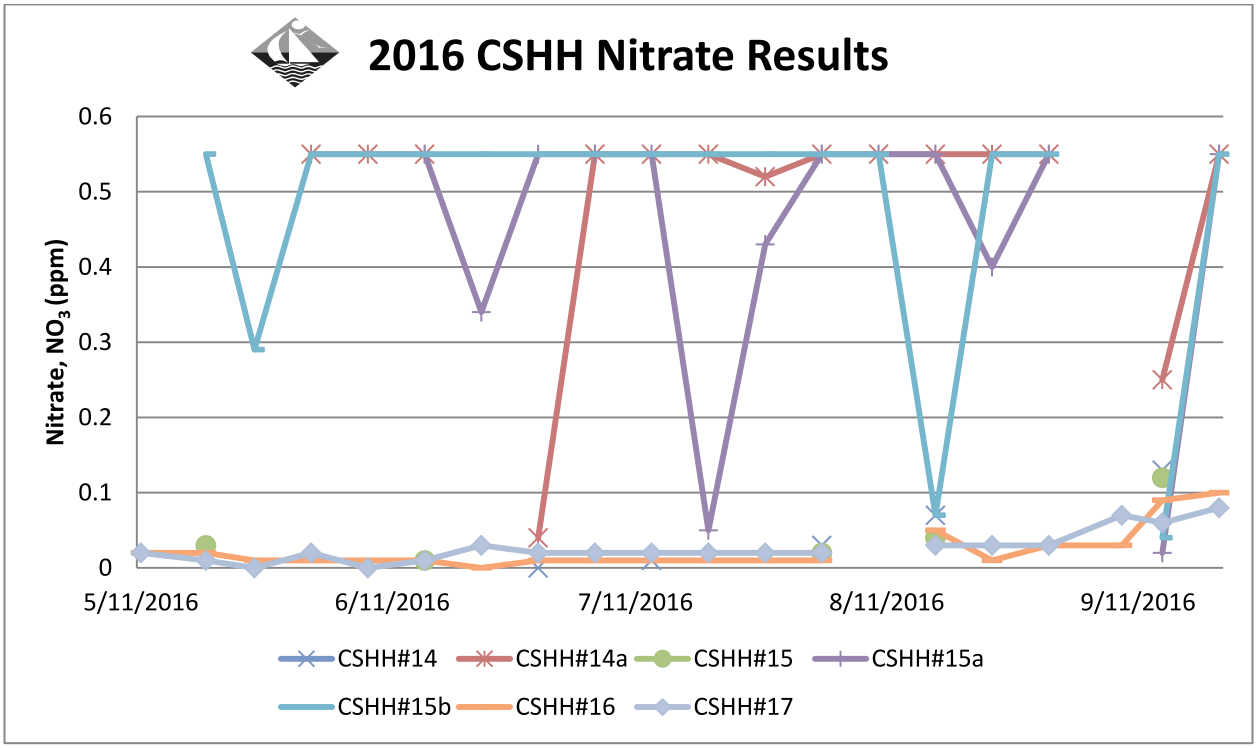
Total Inorganic Nitrogen (TIN)*											
Date	CSHH#1	CSHH#2	CSHH#3	CSHH#4	CSHH#5	CSHH#6	CSHH#7	CSHH#8	CSHH#13	CSHH#14	CSHH#15
6/3/2004	2.28	1.99	1.73	1.77	1.80	1.61	2.11	2.94			
6/10/2004	1.73	1.51	1.80	1.56	1.47	1.45	2.00	2.39			
6/18/2004	1.18	1.17	0.91	1.07	0.72	1.05	1.12	1.45			
6/24/2004											
7/14/2004	1.97	1.91	1.54	2.06	1.94	2.48	3.14	2.45			
7/22/2004											
7/29/2004	0.97	0.30	1.68	1.51	1.80	1.80	2.27	1.17			
8/5/2004	1.56	1.33	1.79					1.65			
8/11/2004	0.60	0.93	0.97					1.22			
8/19/2004	1.51	1.55	1.55					1.36			
8/26/2004	0.73	0.51	1.05	0.74	1.63	0.92	1.64	1.35			
9/2/2004	1.11	1.31	1.37					1.99			
9/8/2004	1.57		1.69					1.35			
9/15/2004	1.09	0.95	0.98	0.98	0.95	1.04	0.57	1.11			
9/22/2004	1.90	1.55	2.21					1.97			
9/30/2004	1.67	0.64	1.44					1.71			
10/7/2004	2.18	1.37	1.42					1.71			
10/14/2004	1.40	1.09	1.17					1.69			
10/21/2004	1.69	1.58	1.33					2.70			
10/28/2004	1.30		1.57					0.95			
11/4/2004	1.29	0.73	1.43					1.58			
11/10/2004	0.90	1.22	1.19					2.41			

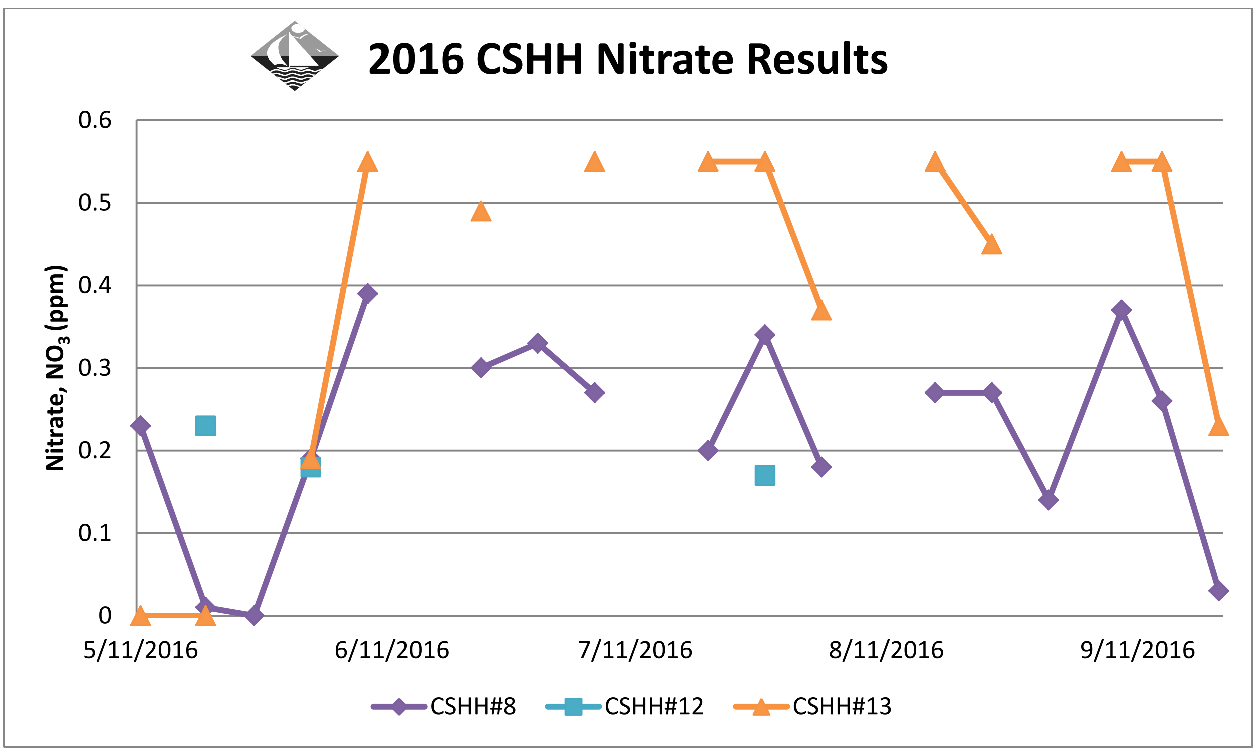
2016 Nitrogen Graphs





2016 Nitrogen Graphs





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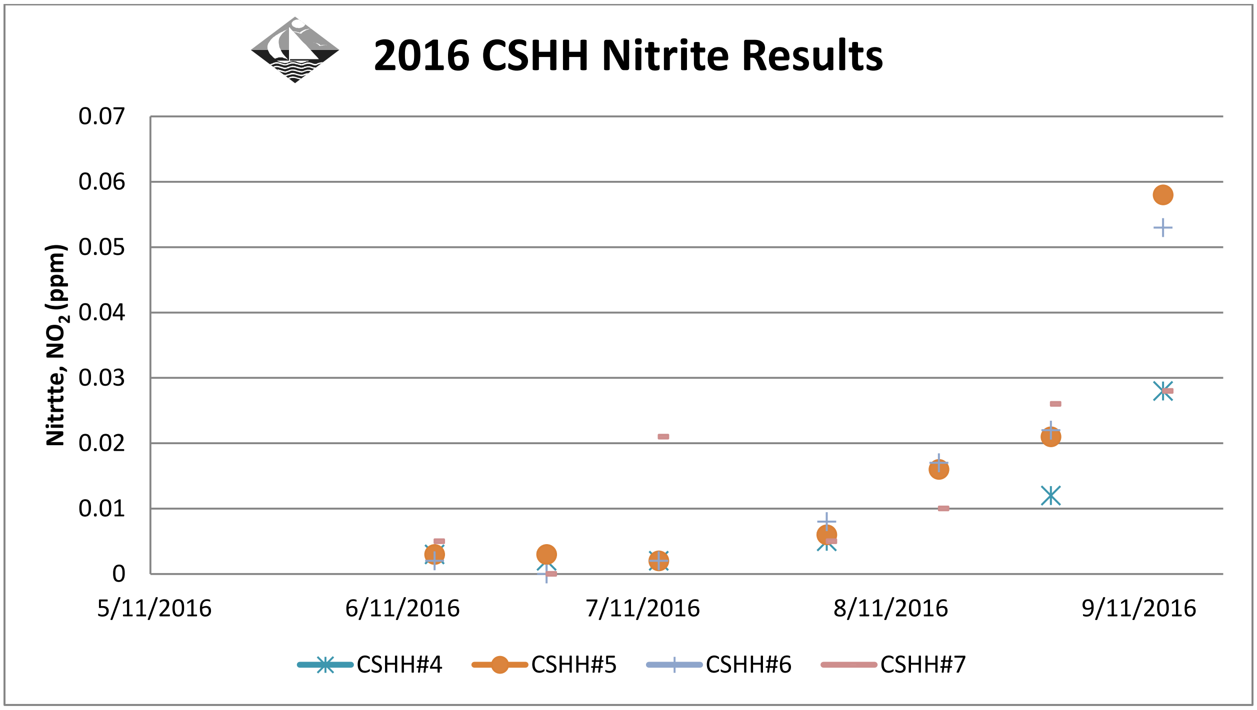

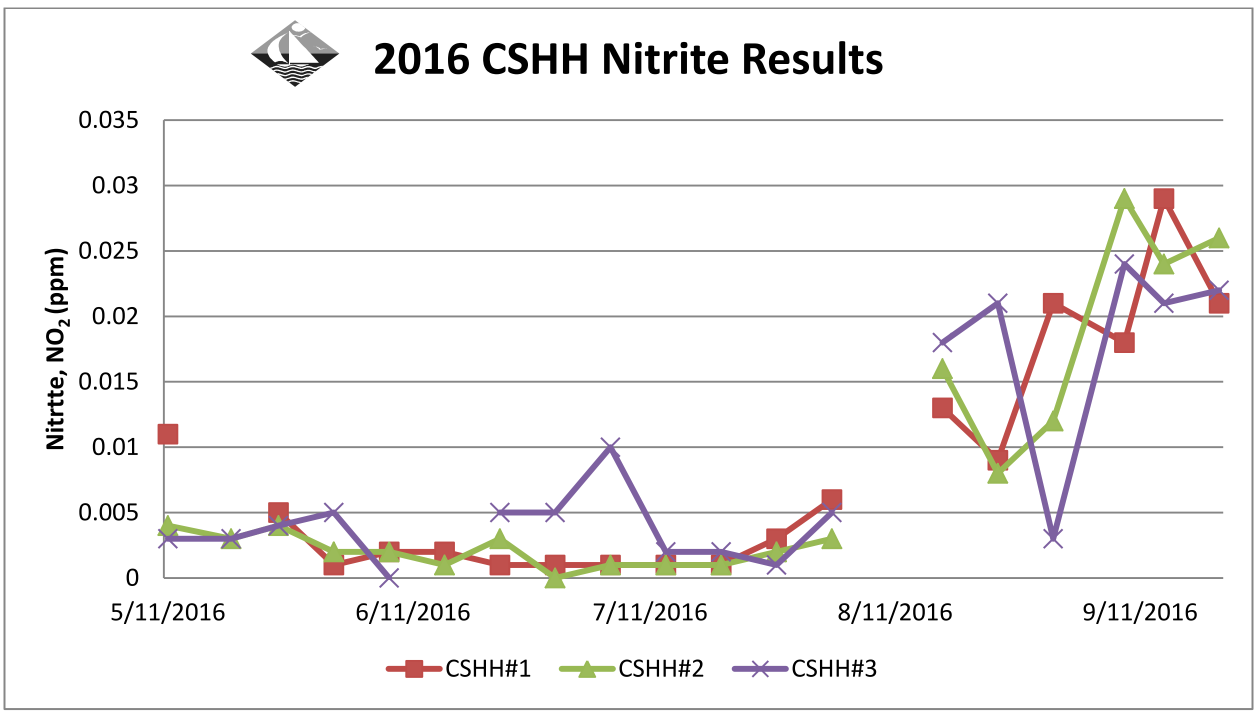

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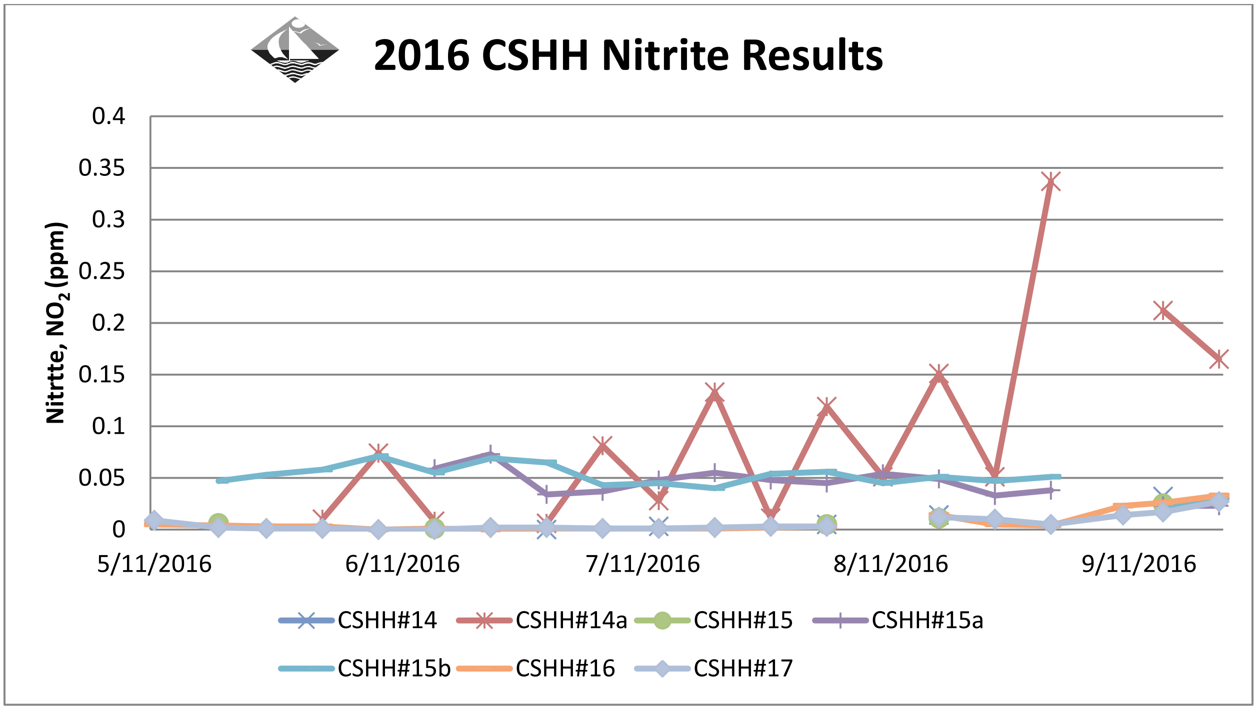

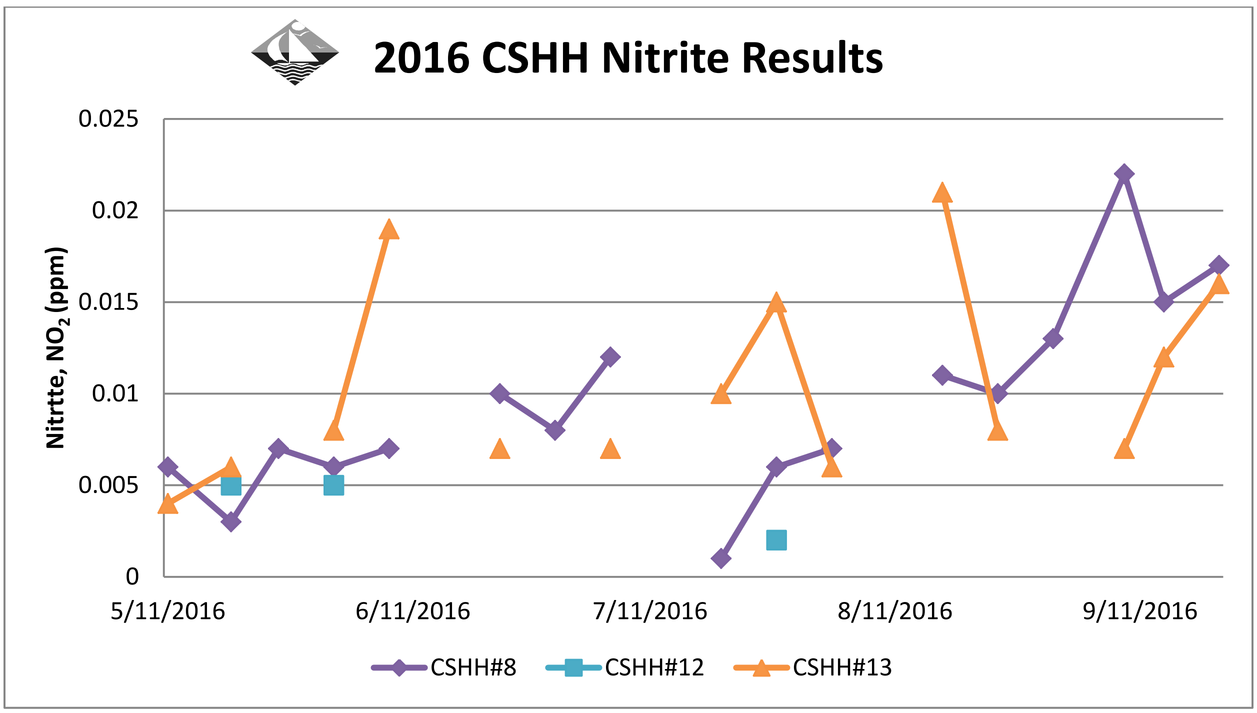

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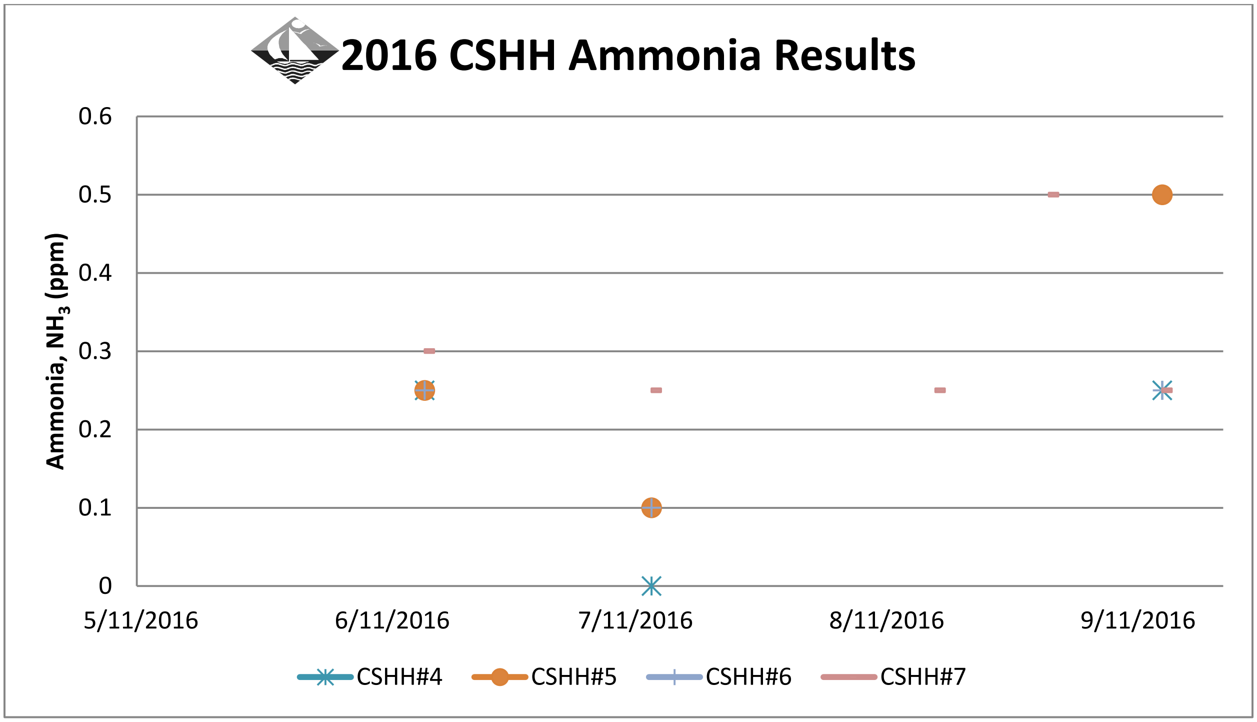

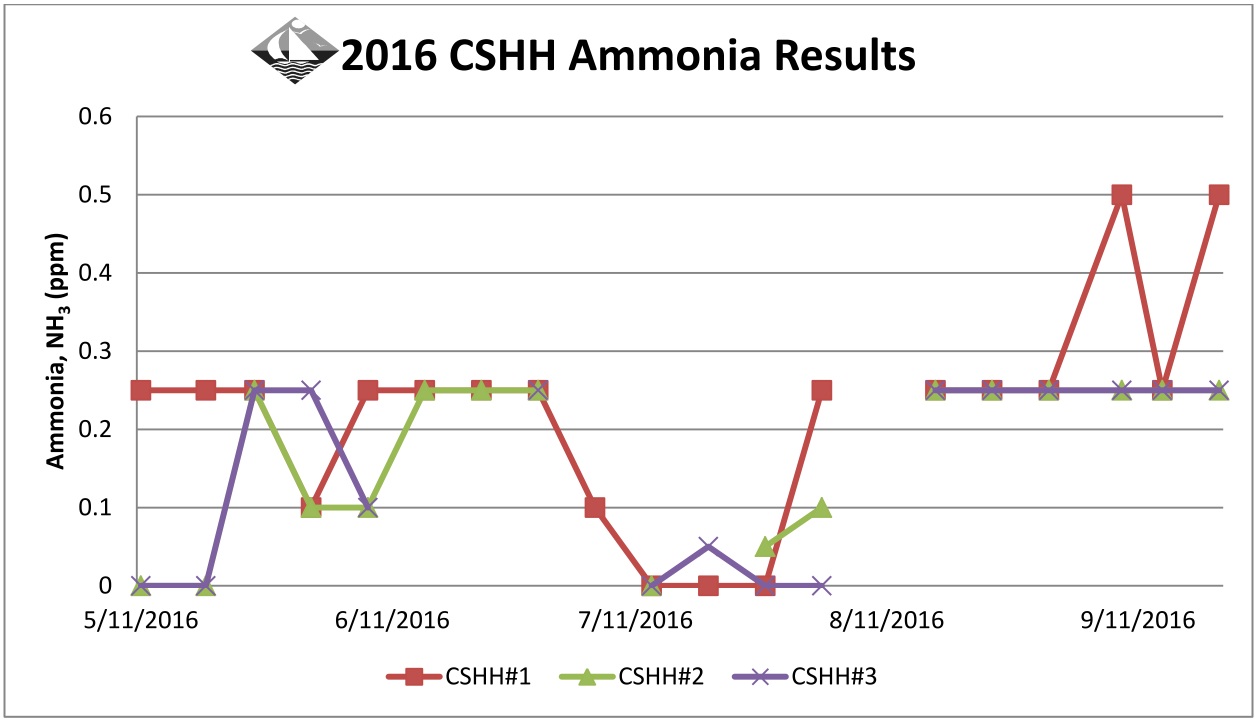

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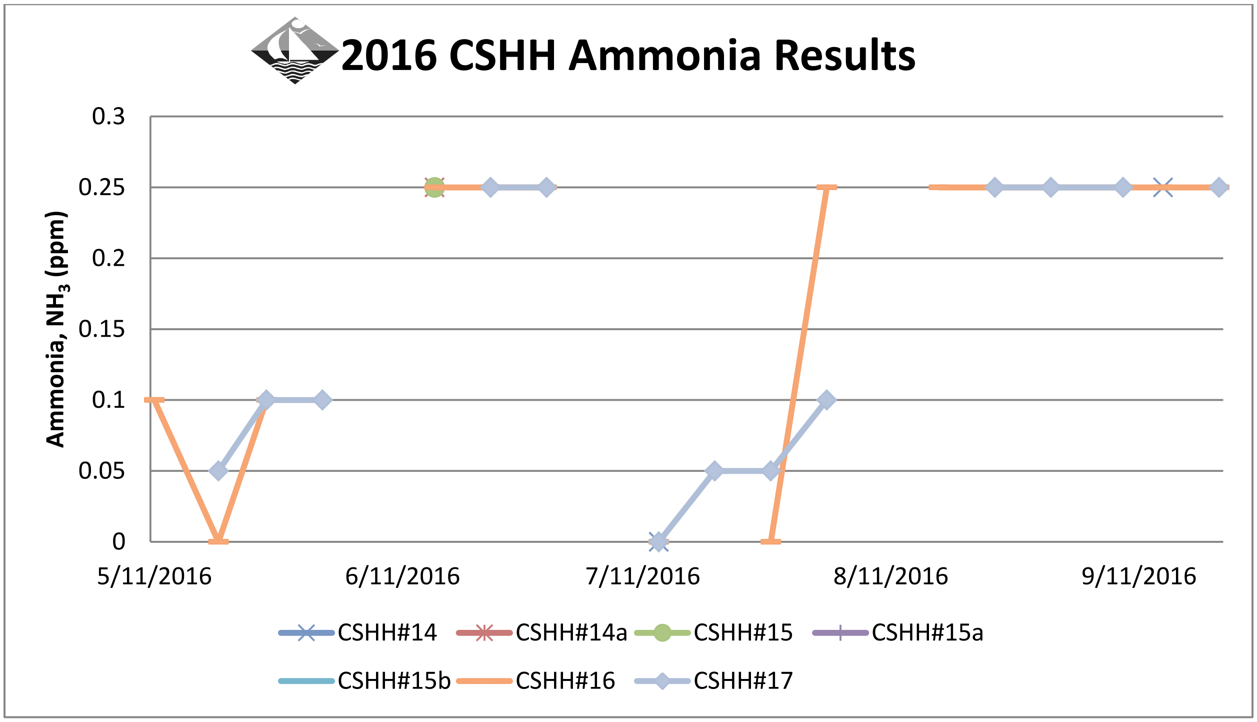

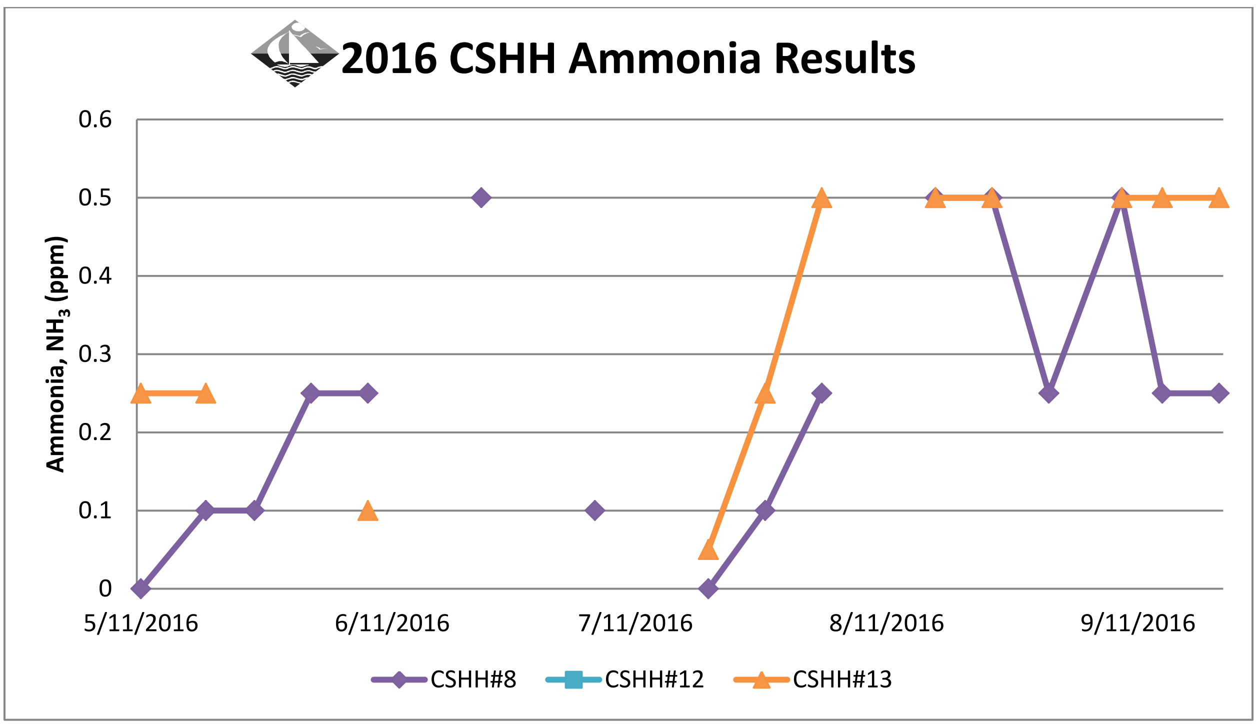

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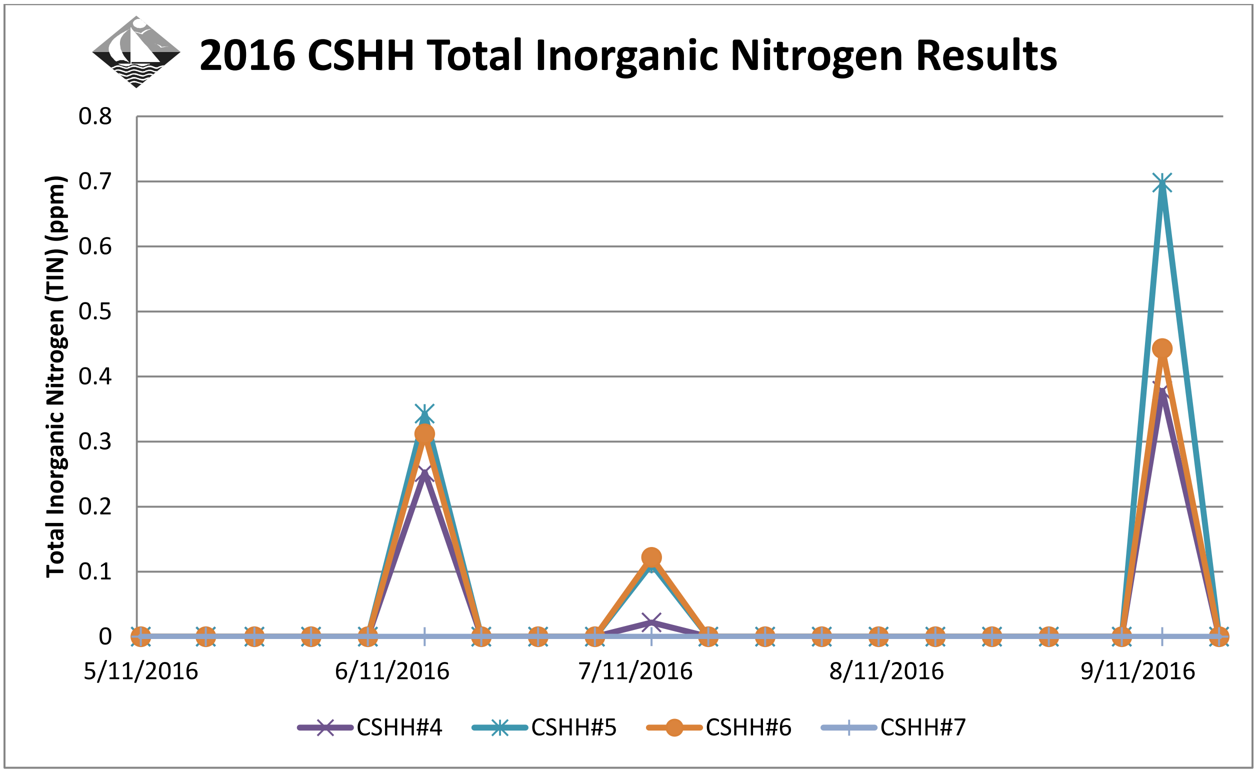

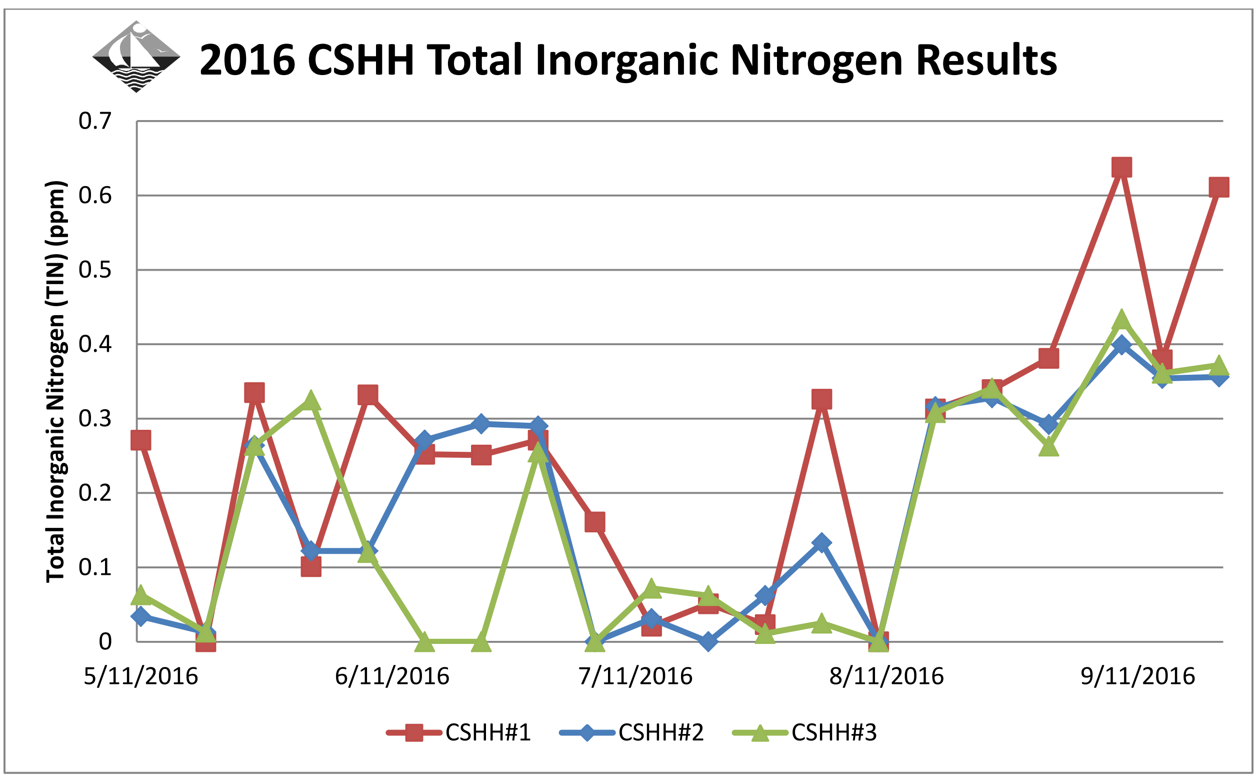

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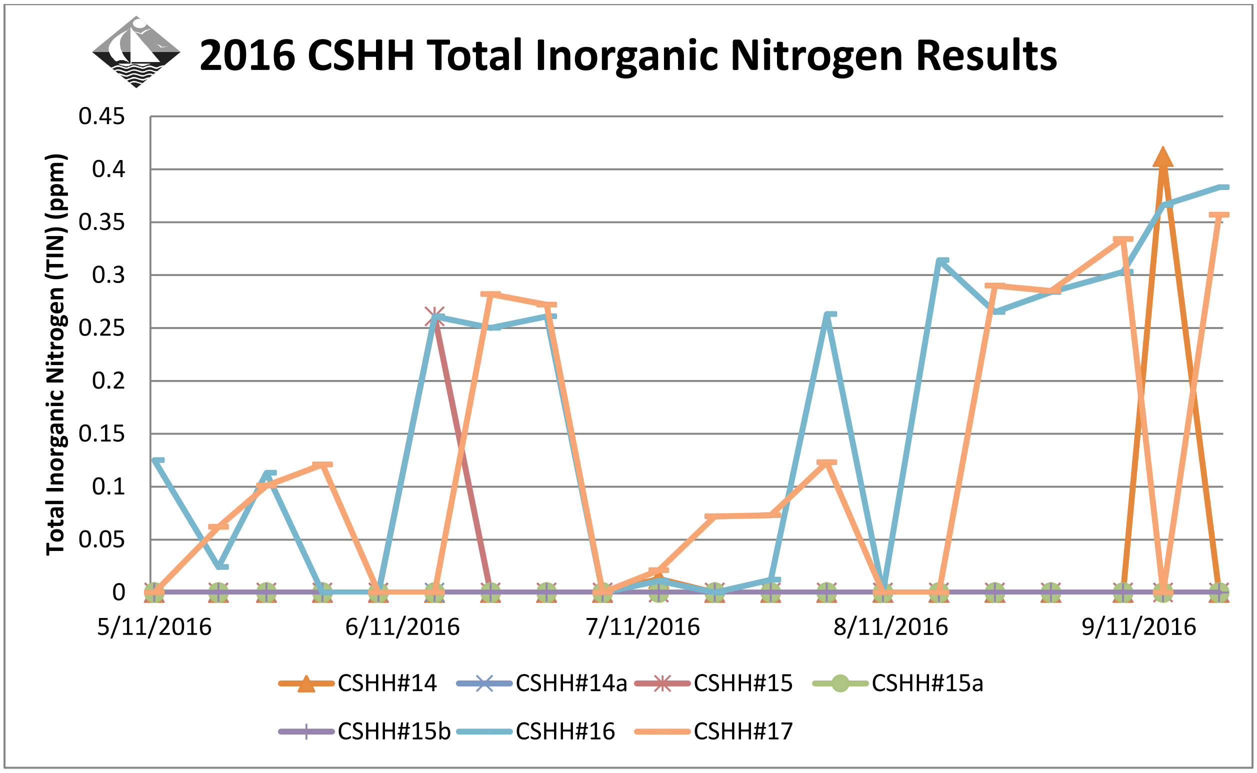
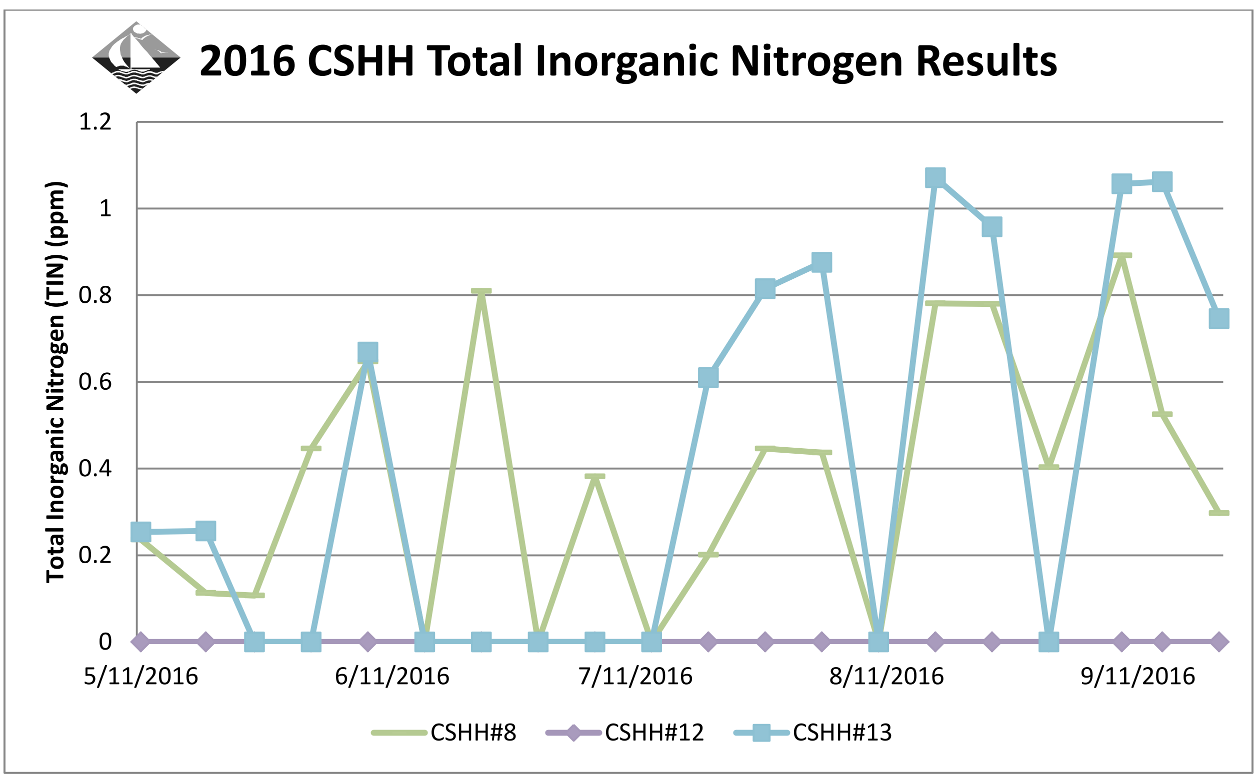
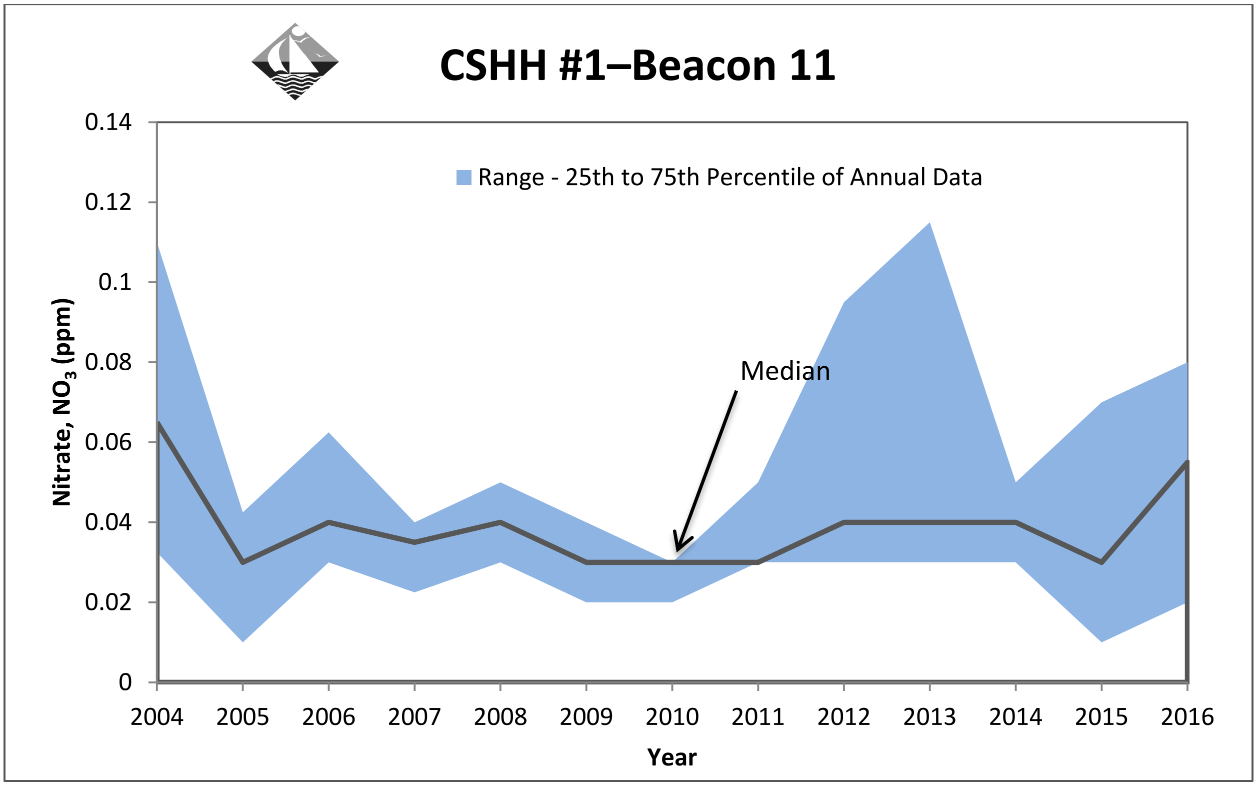
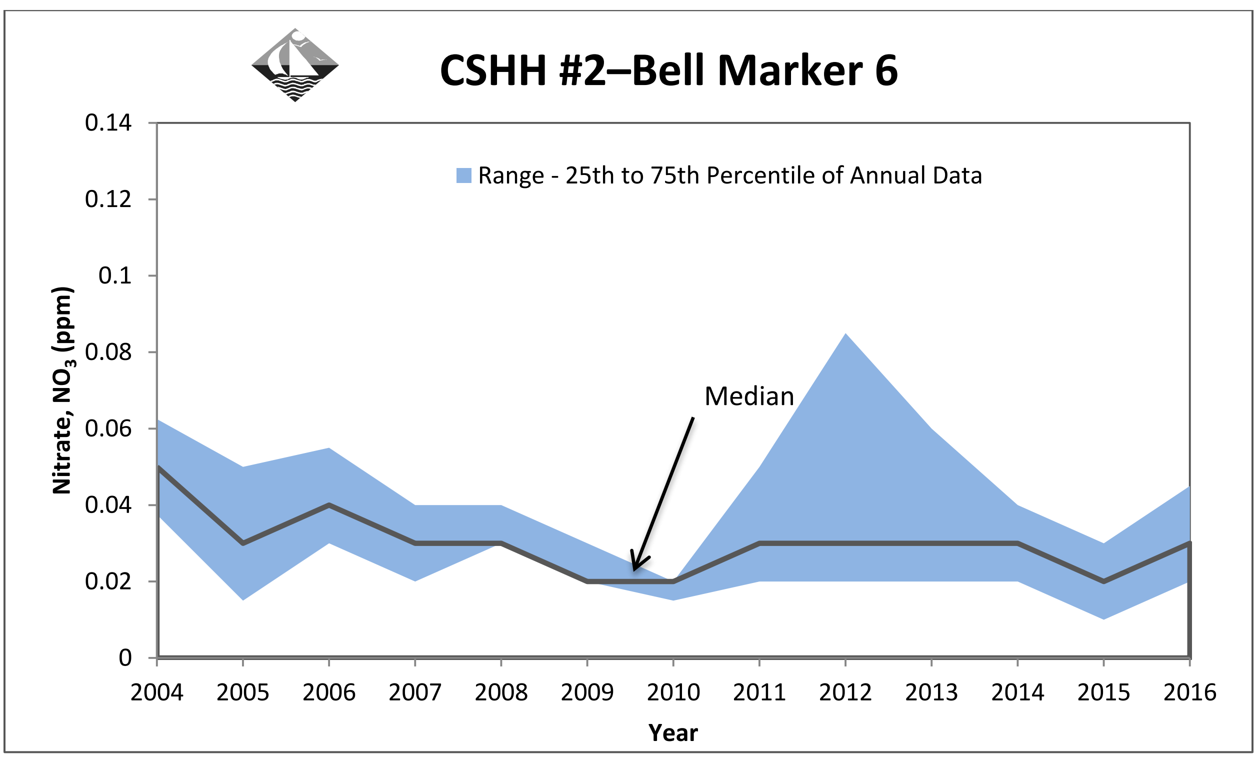




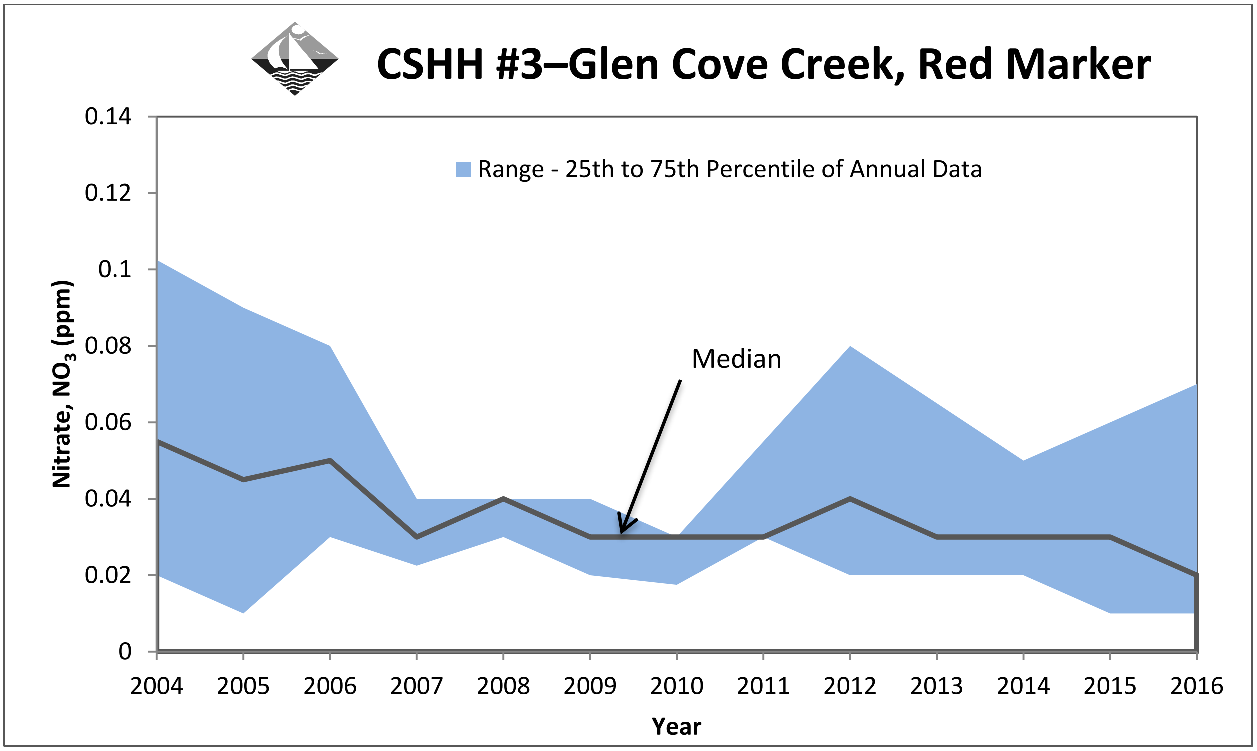
2004-2016 Nitrogen Range Graphs

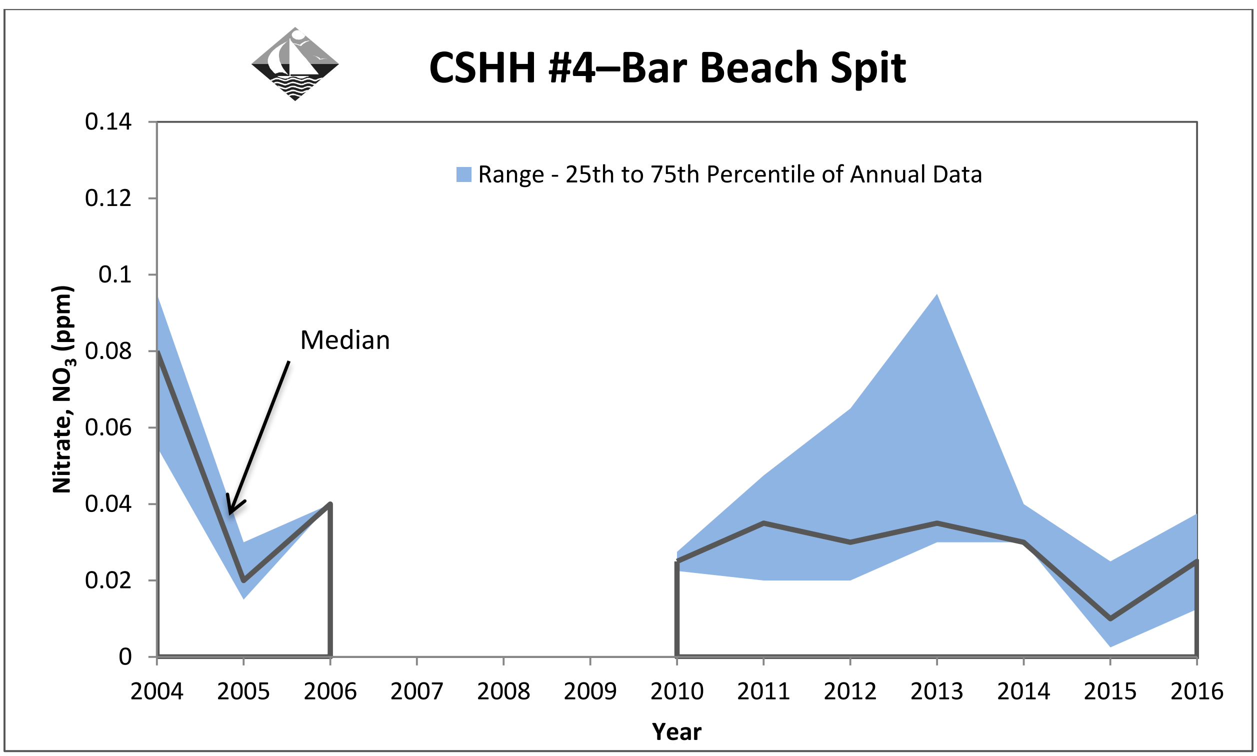
Nitrate



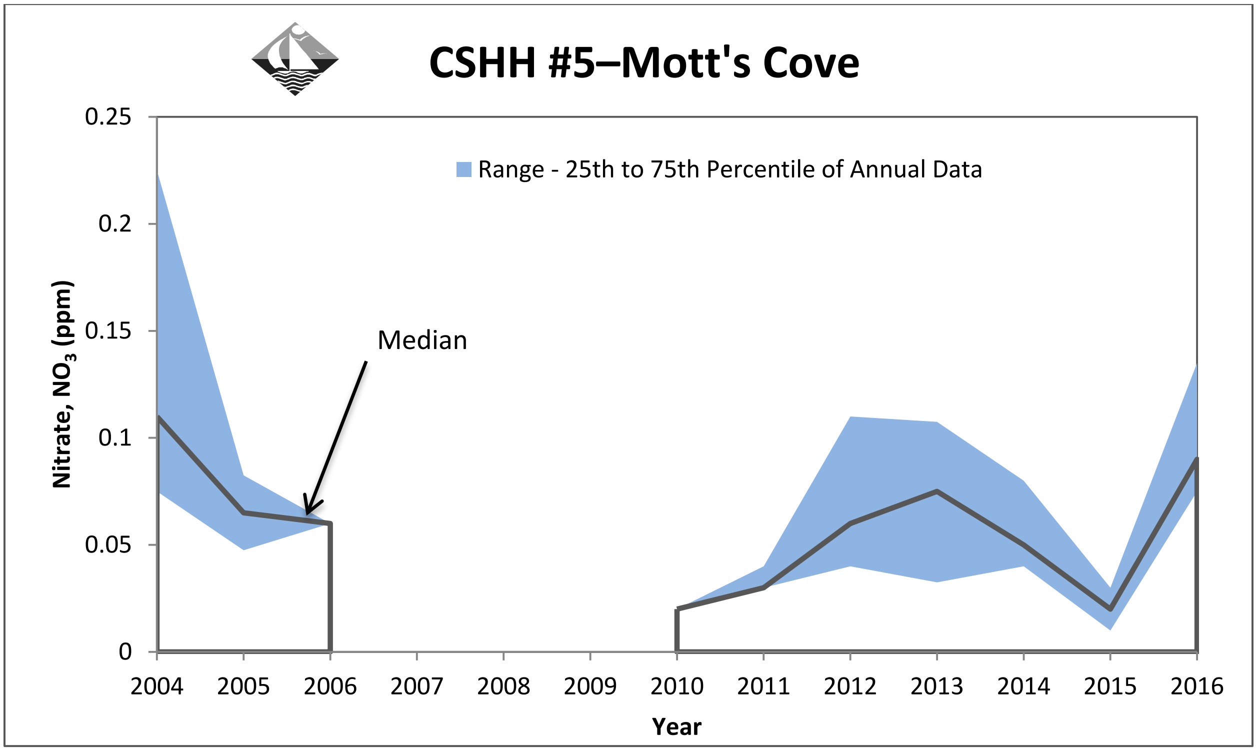


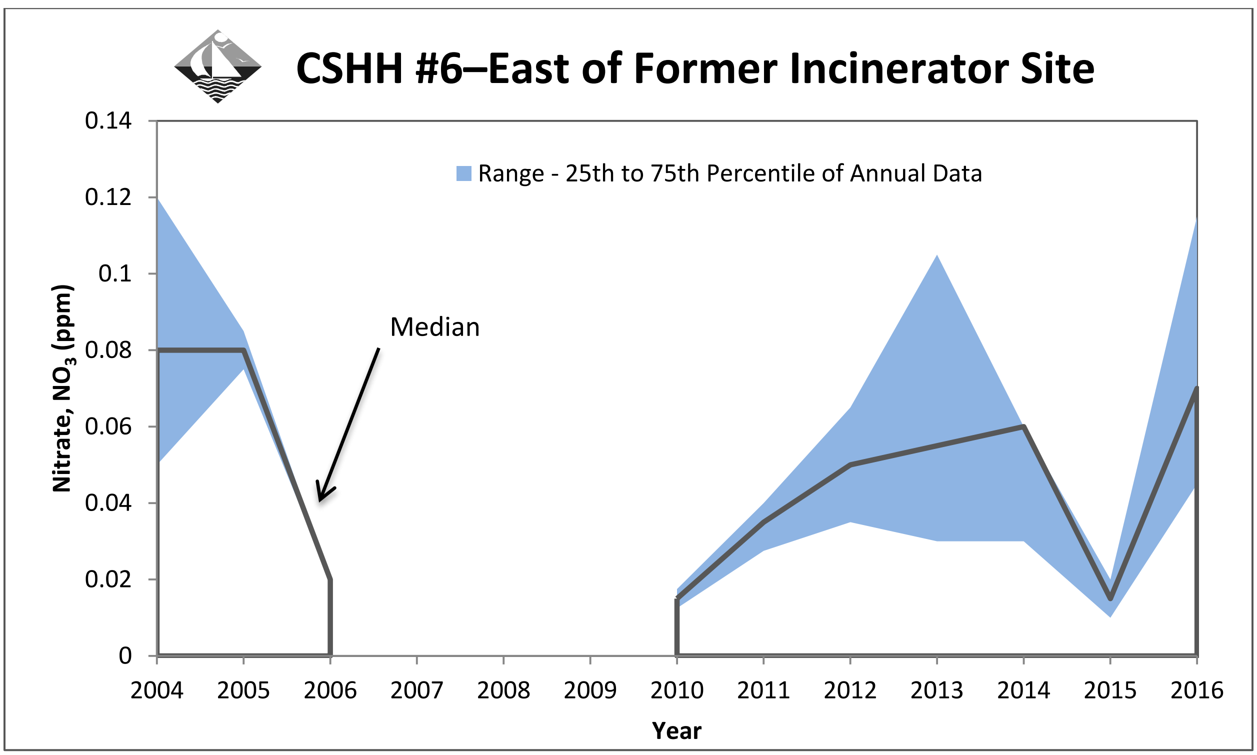
2004-2016 Nitrogen Range Graphs



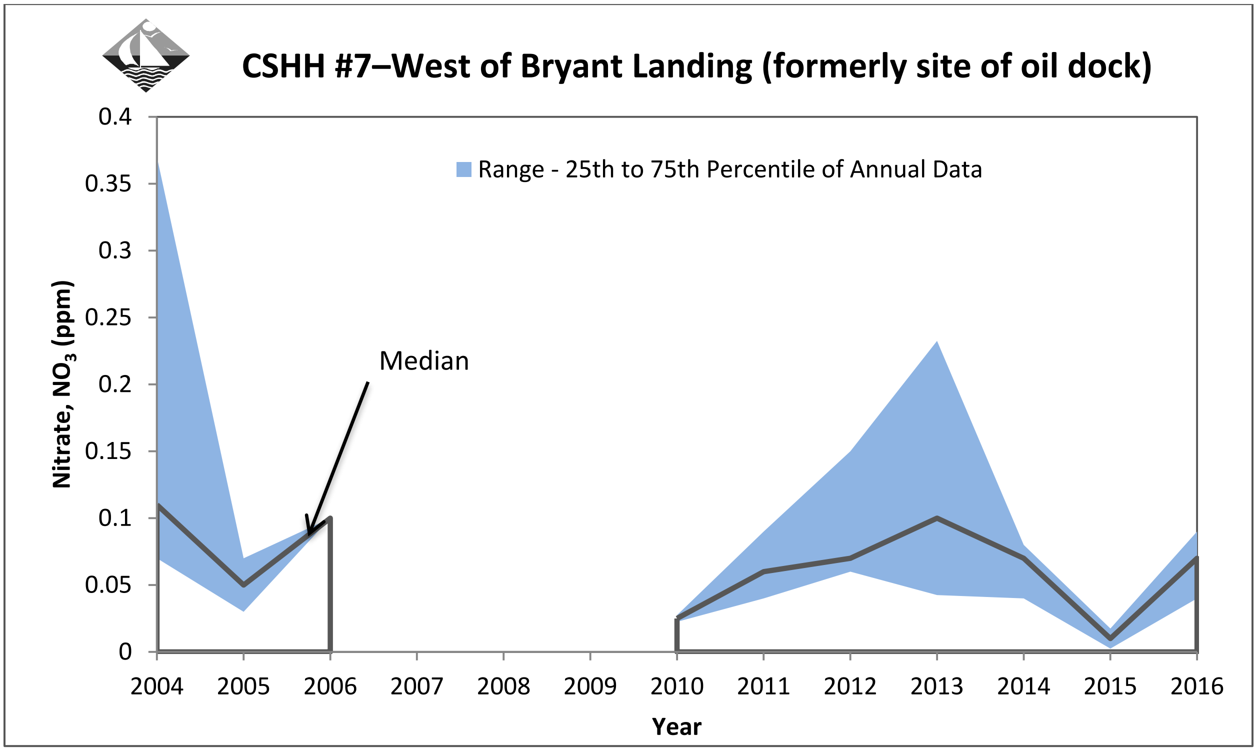


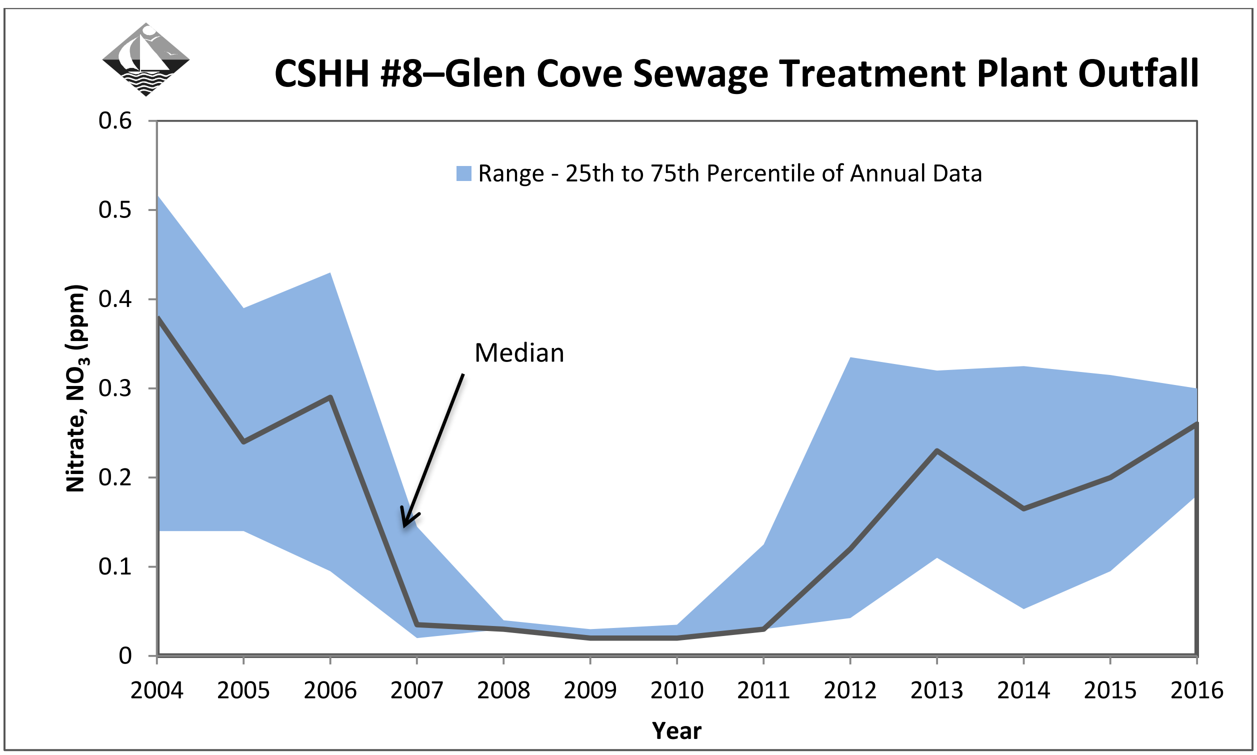
2004-2016 Nitrogen Range Graphs



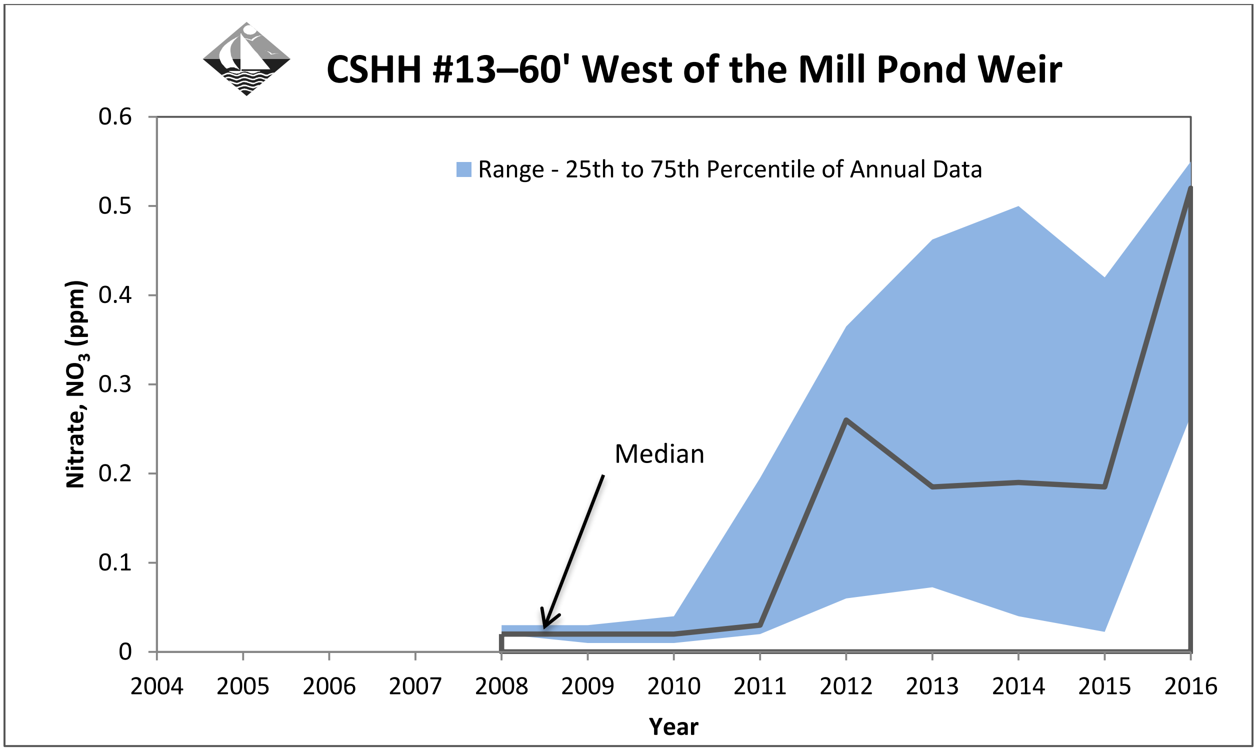


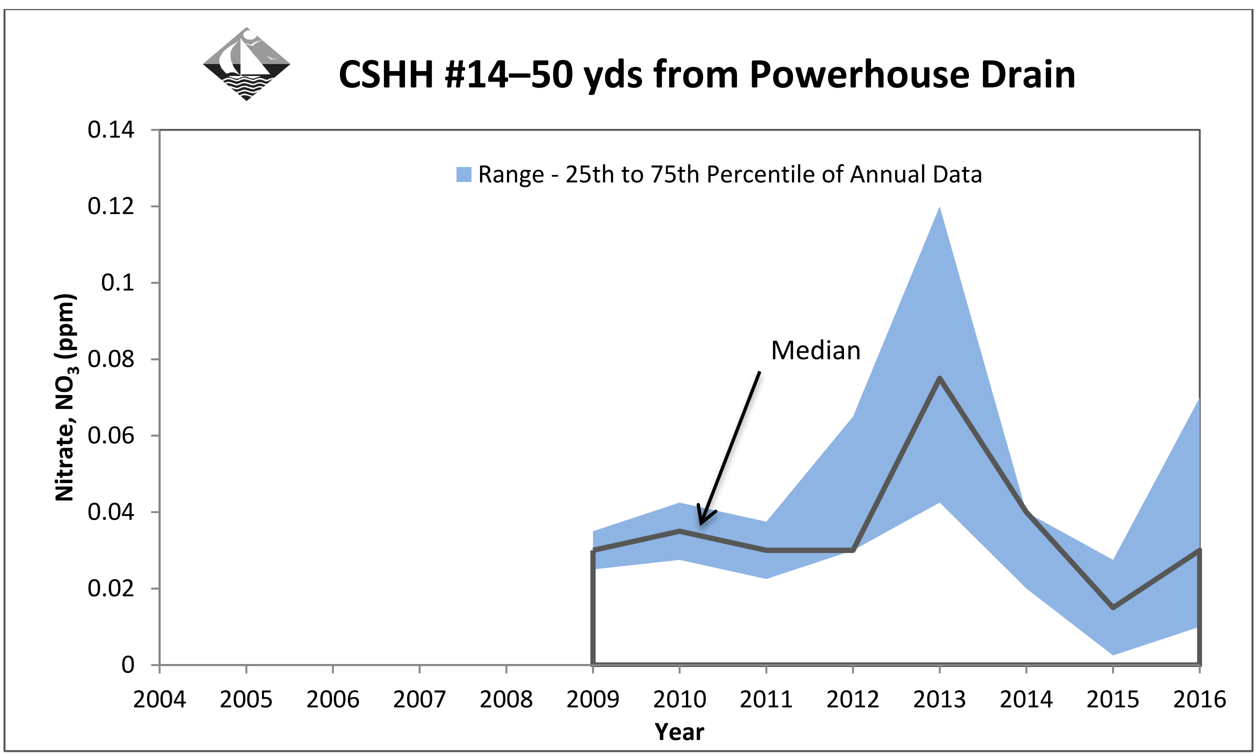
2004-2016 Nitrogen Range Graphs



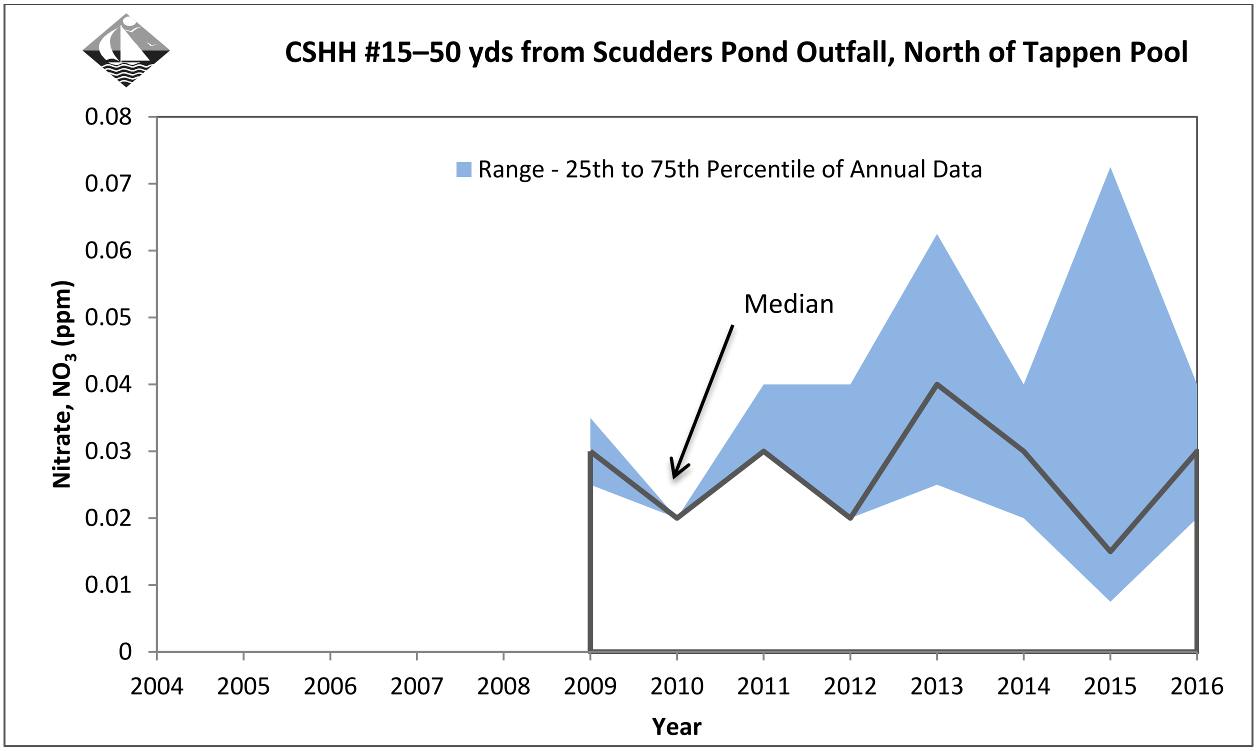


2004-2016 Nitrogen Range Graphs

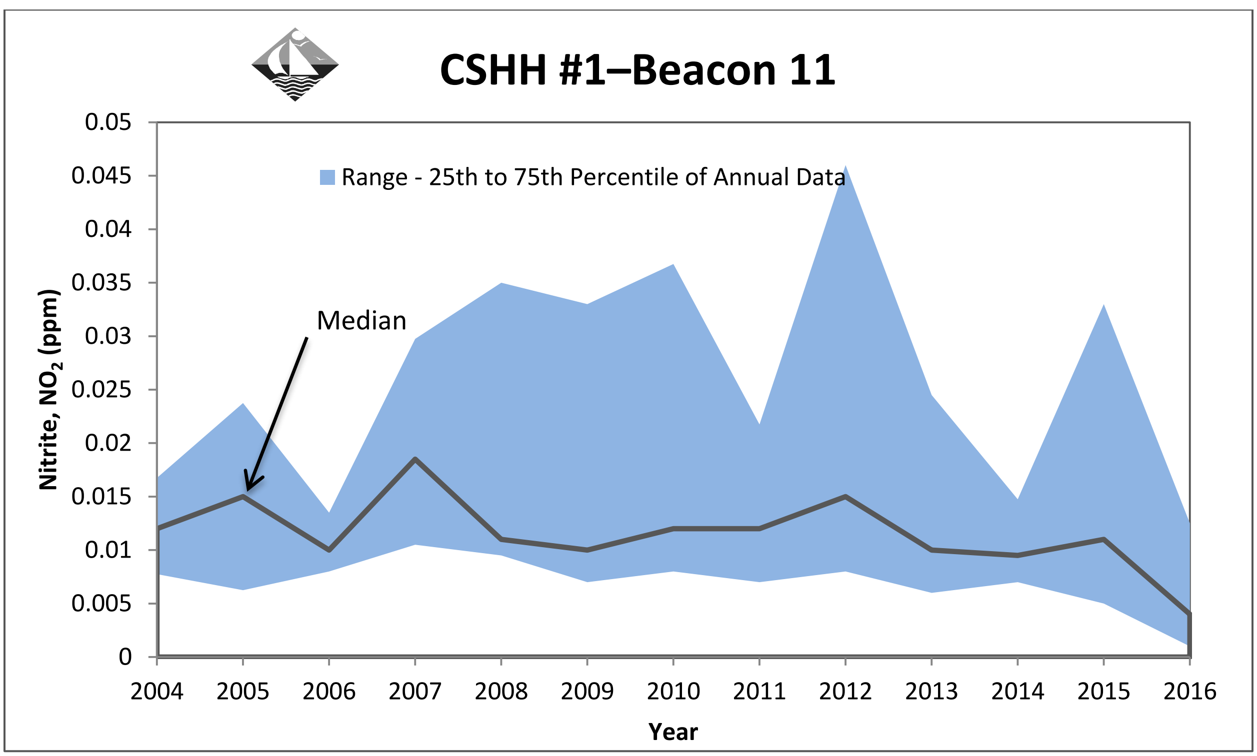




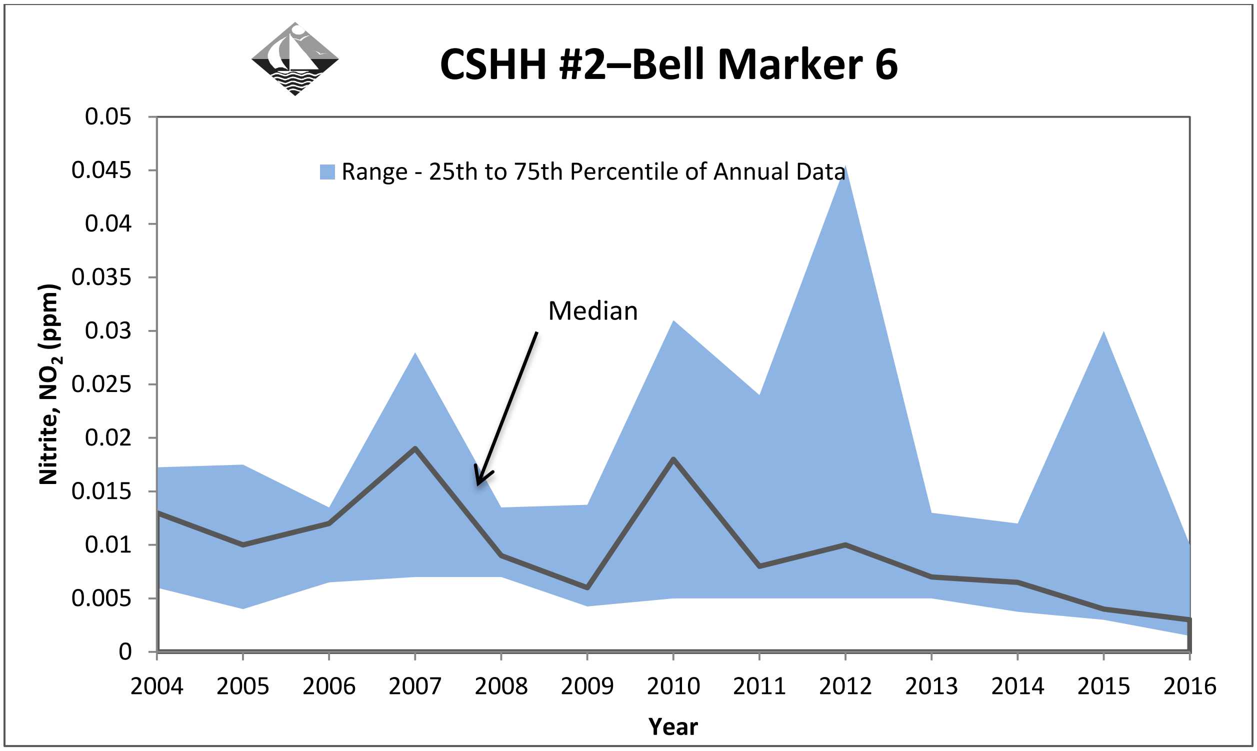
2004-2016 Nitrogen Range Graphs

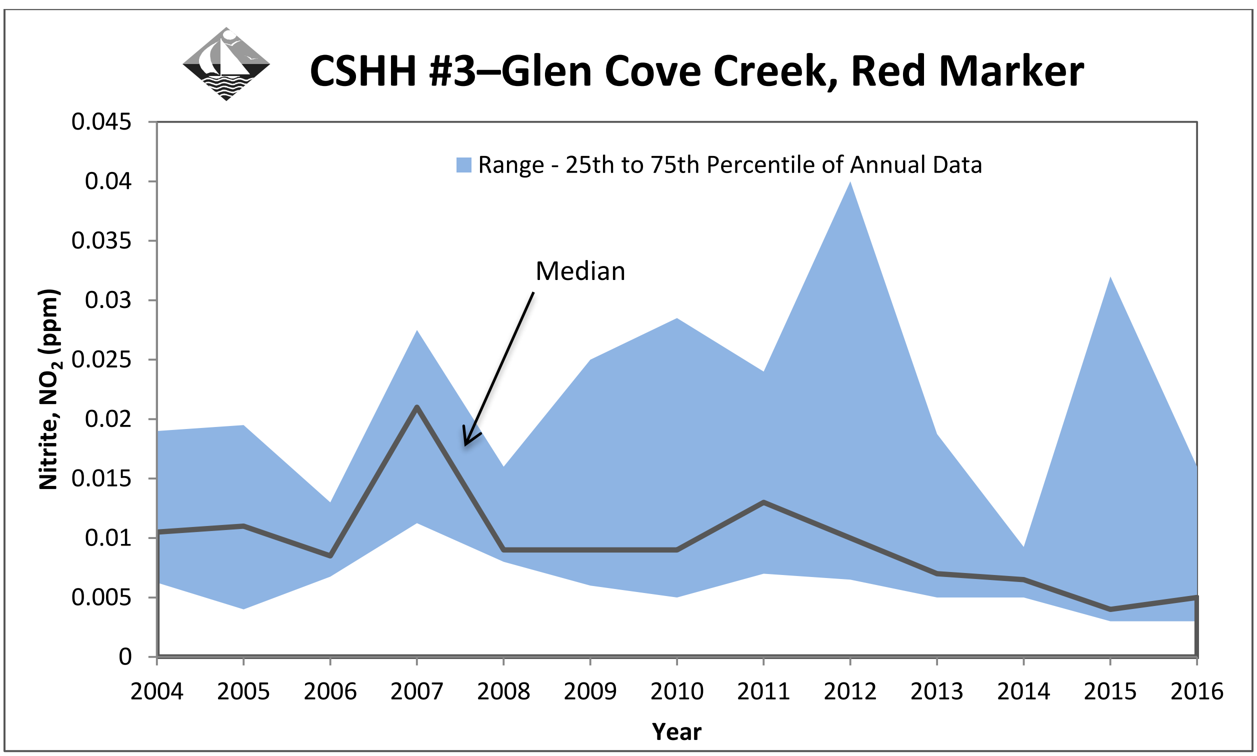


Nitrite

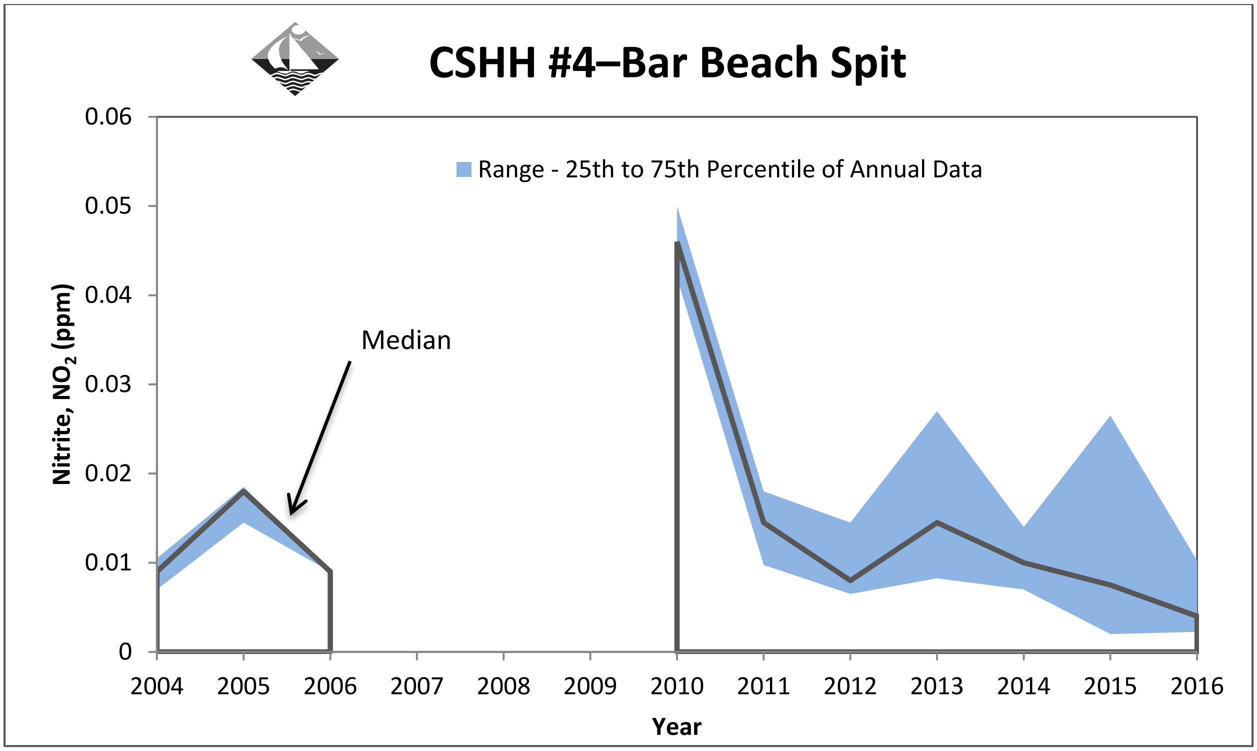


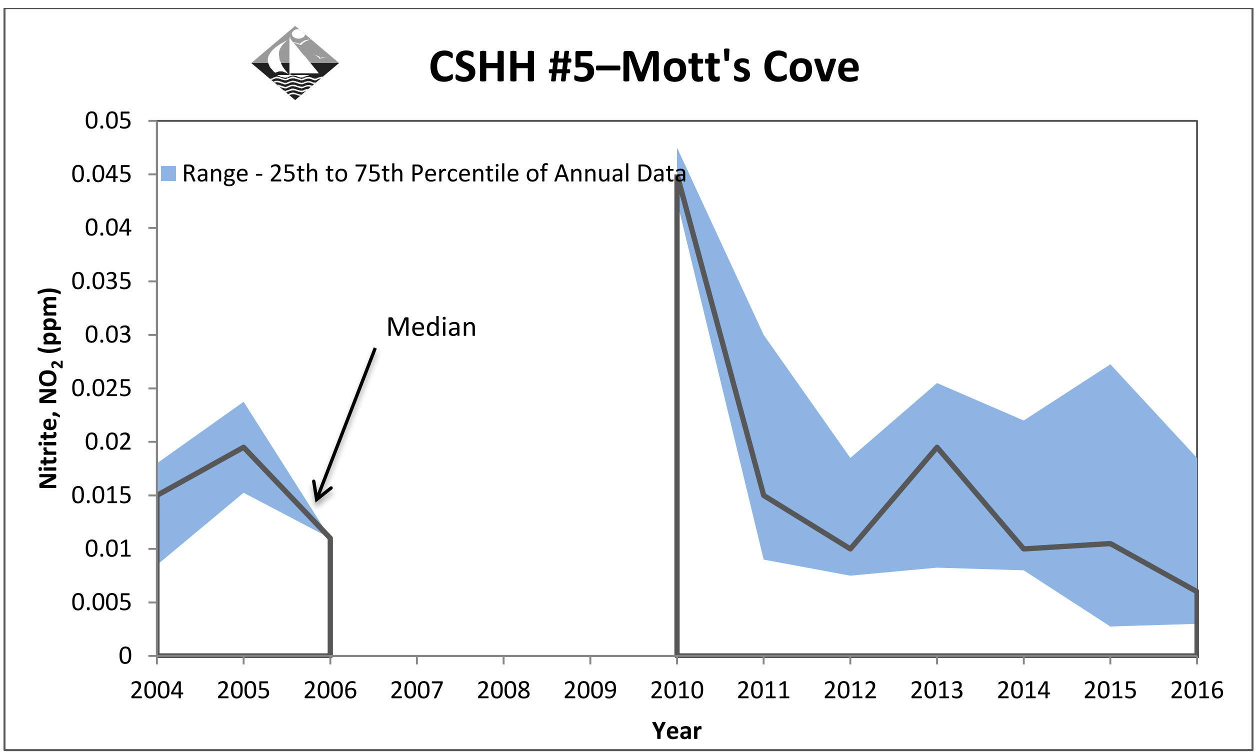
2004-2016 Nitrogen Range Graphs



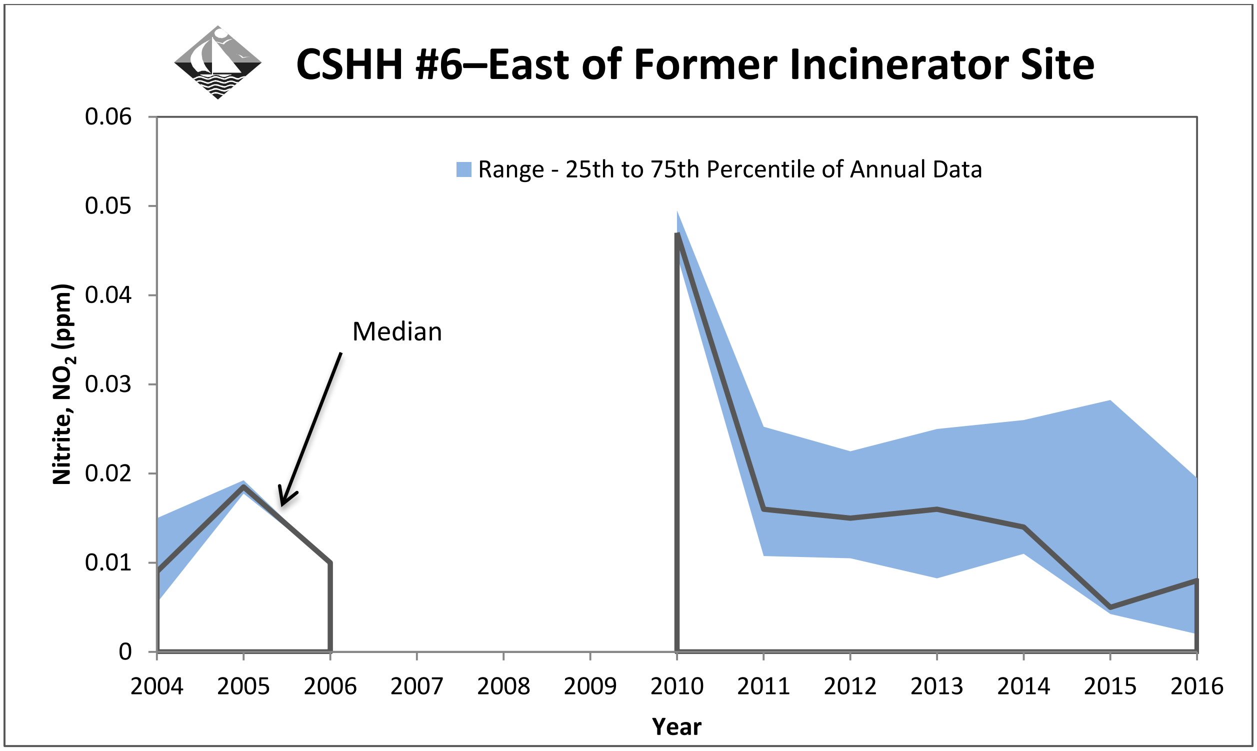


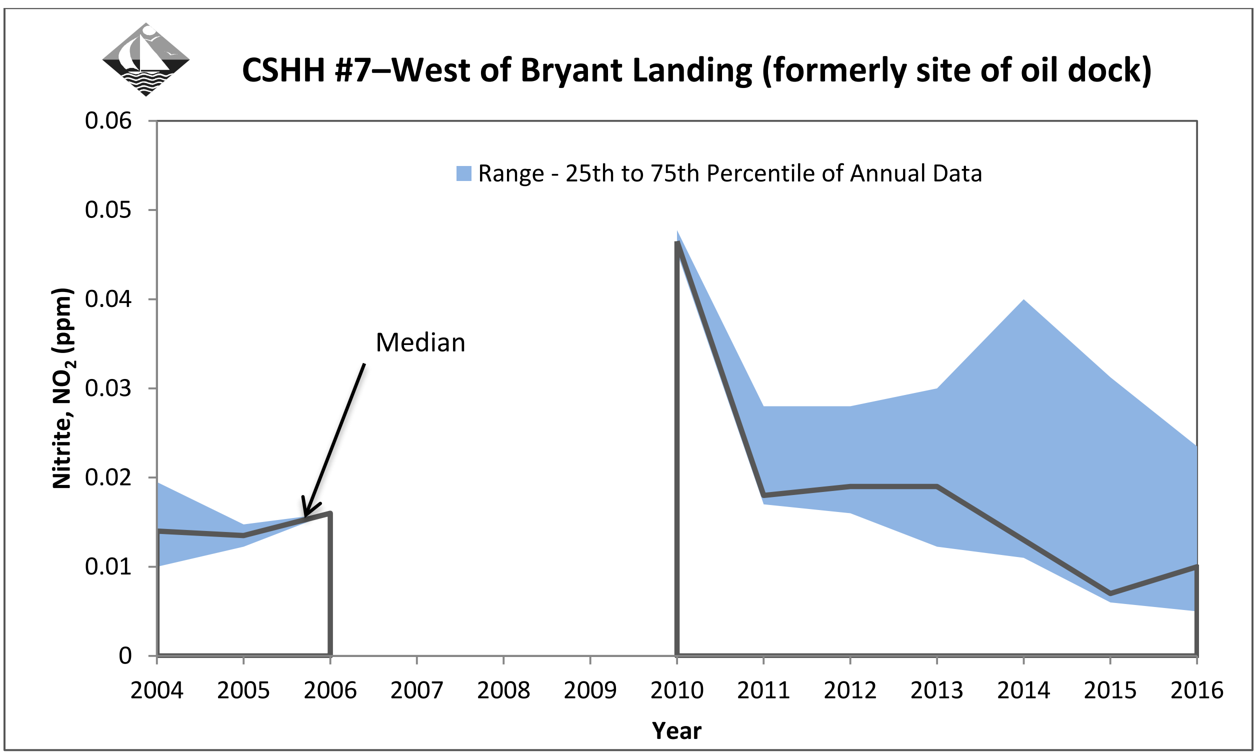
2004-2016 Nitrogen Range Graphs



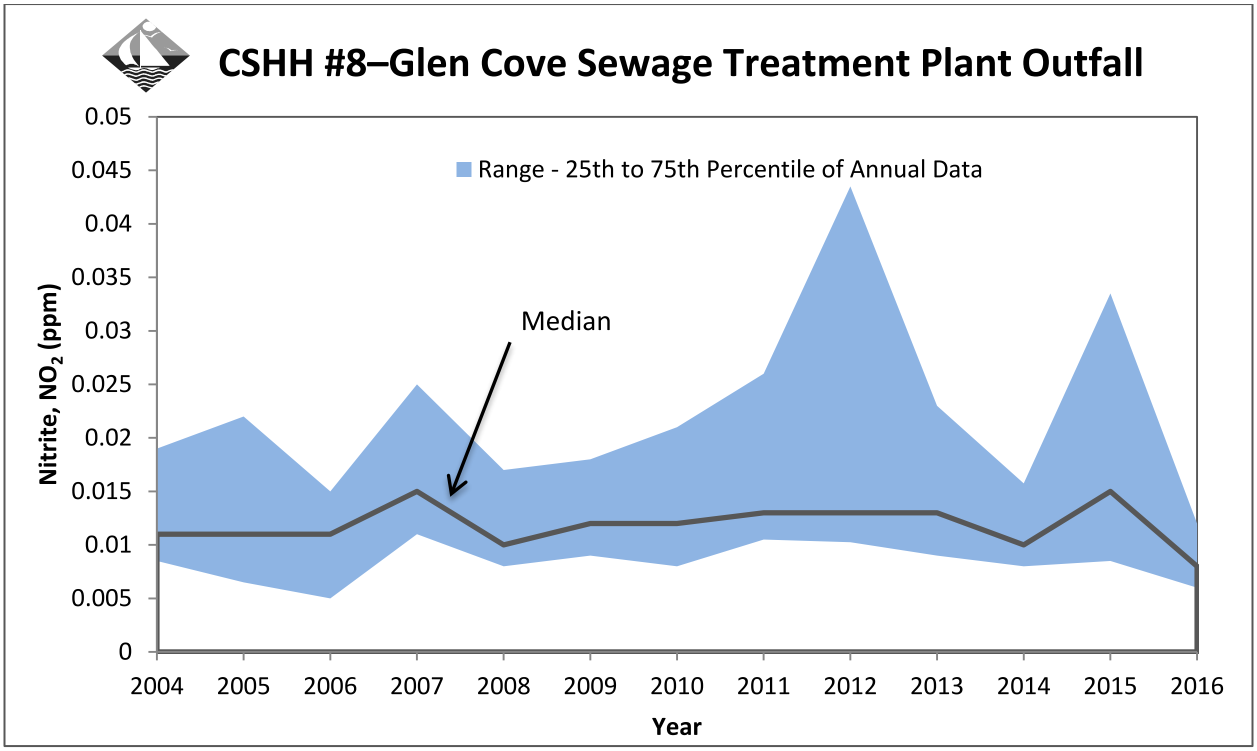


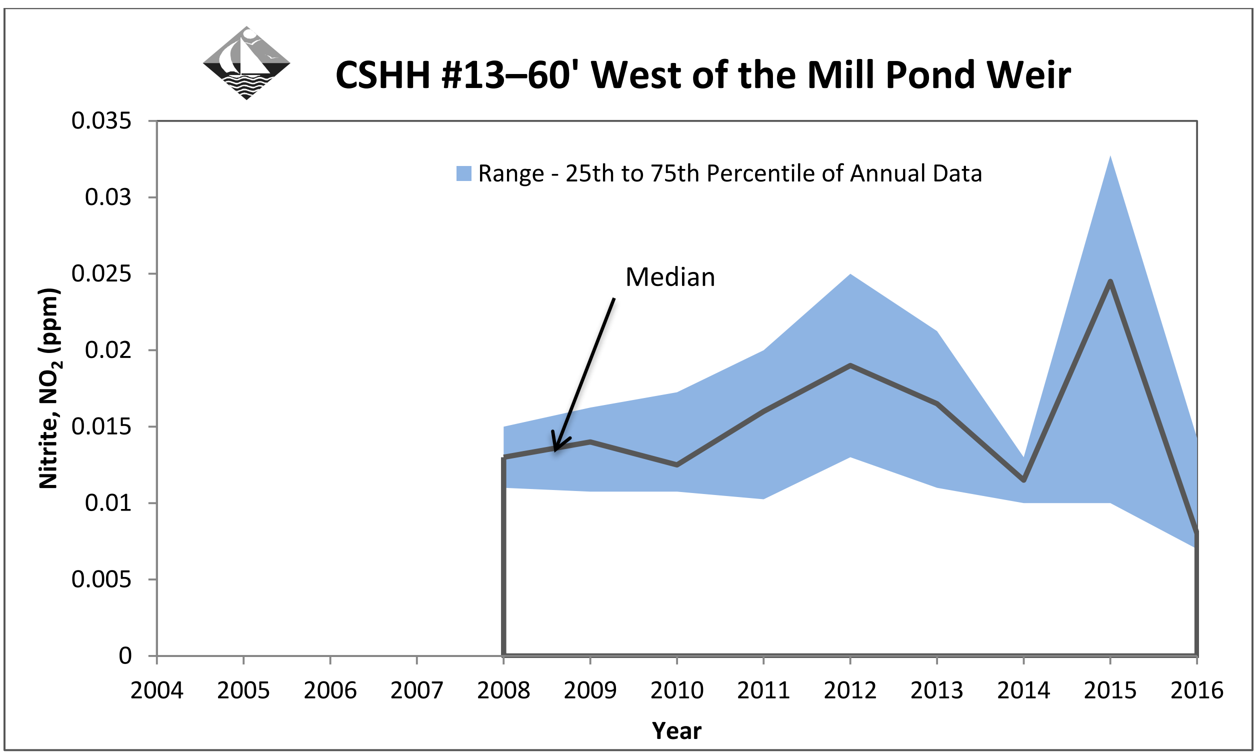
2004-2016 Nitrogen Range Graphs



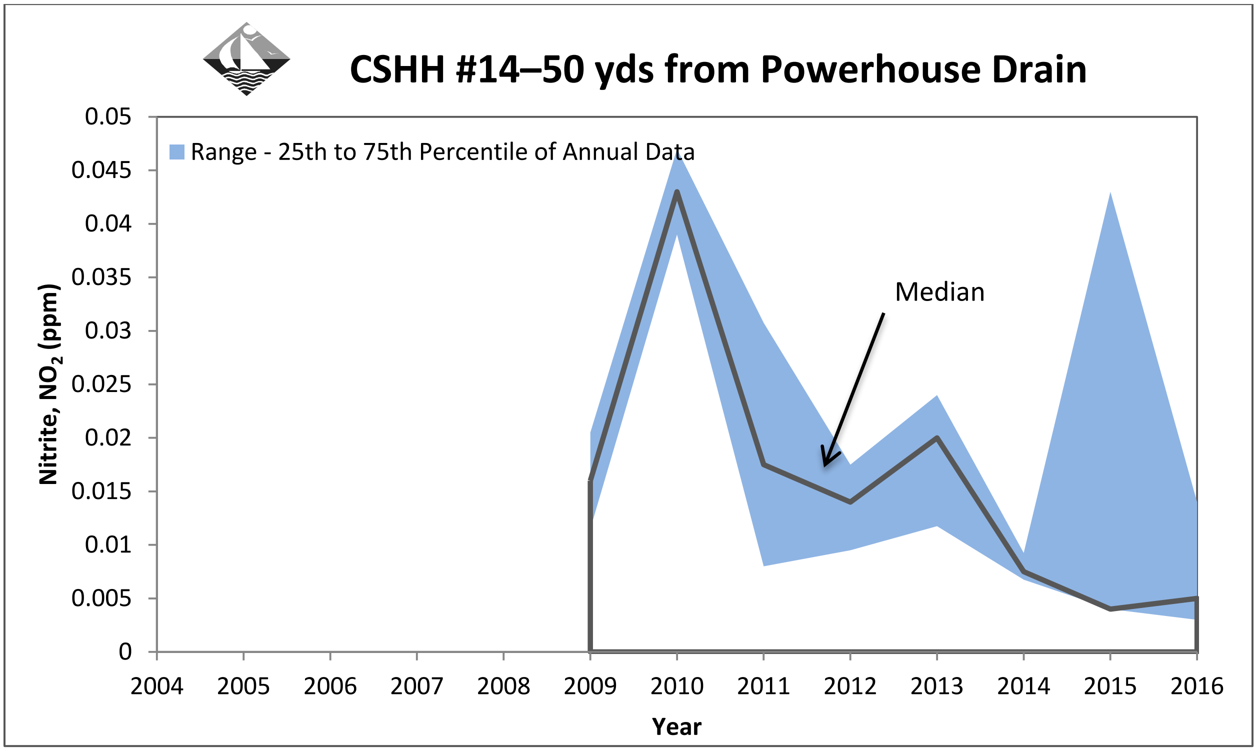


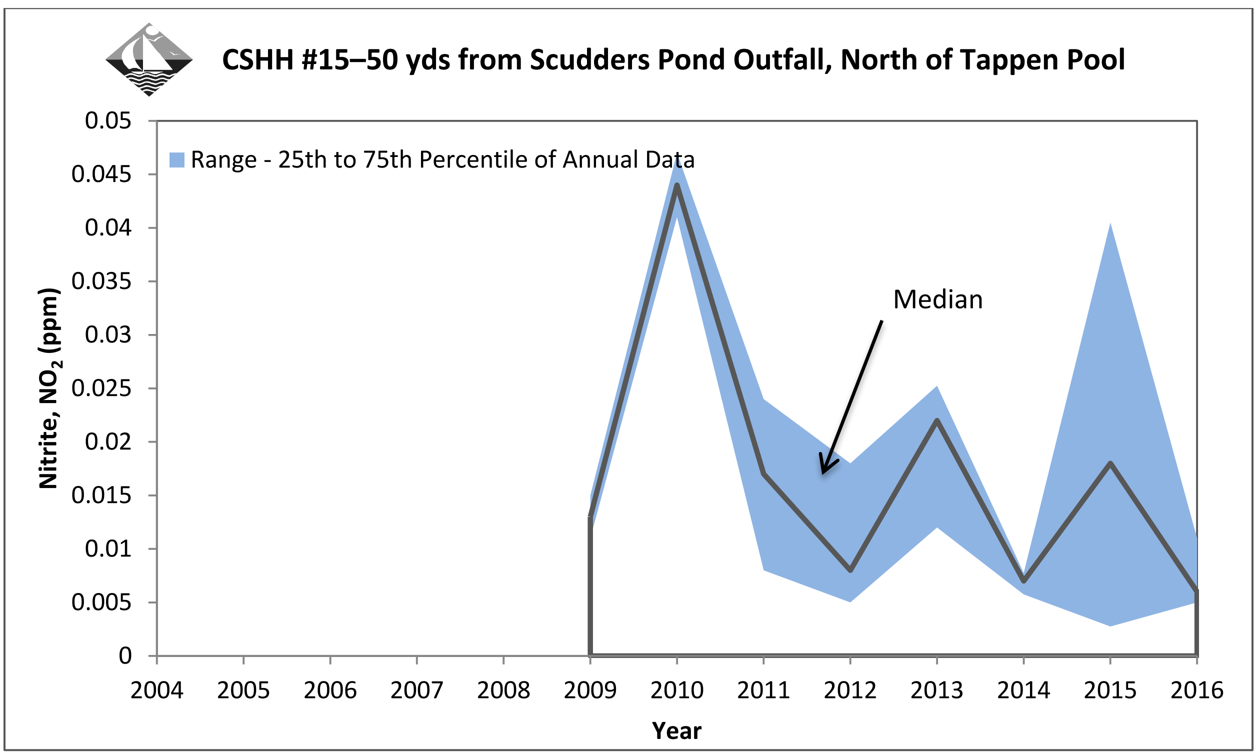
2004-2016 Nitrogen Range Graphs





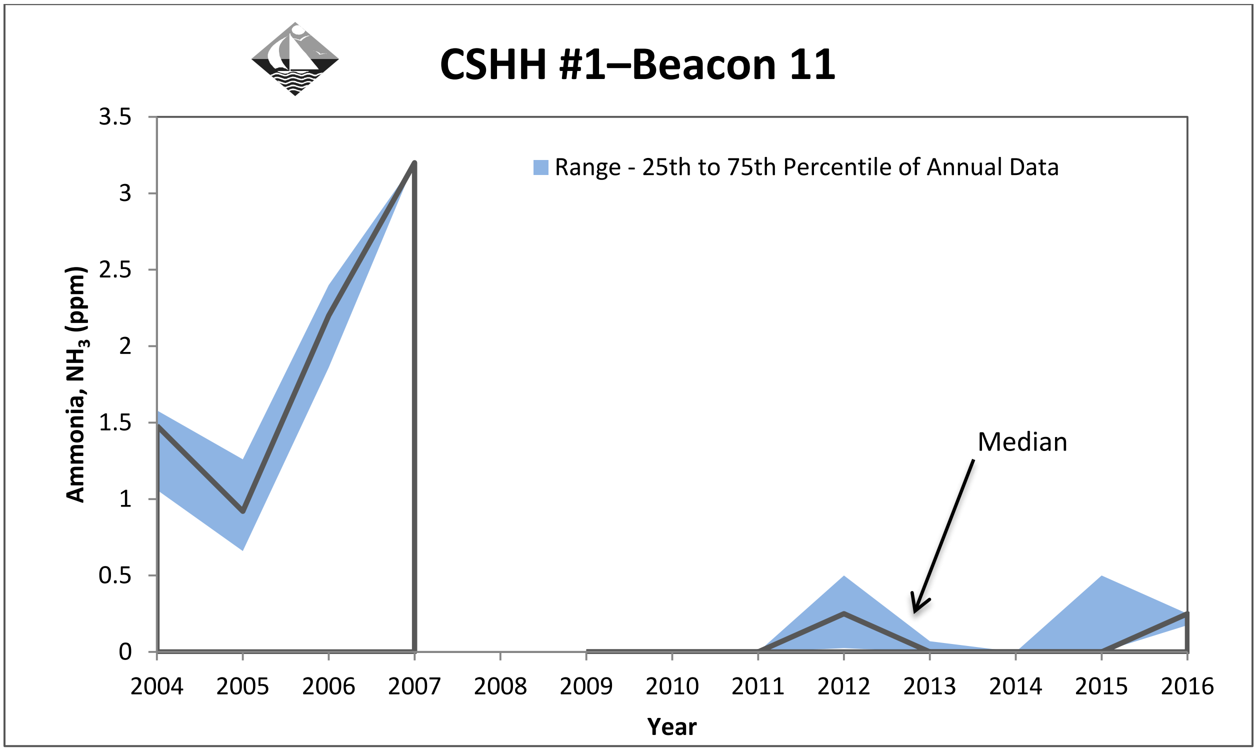
2004-2016 Nitrogen Range Graphs

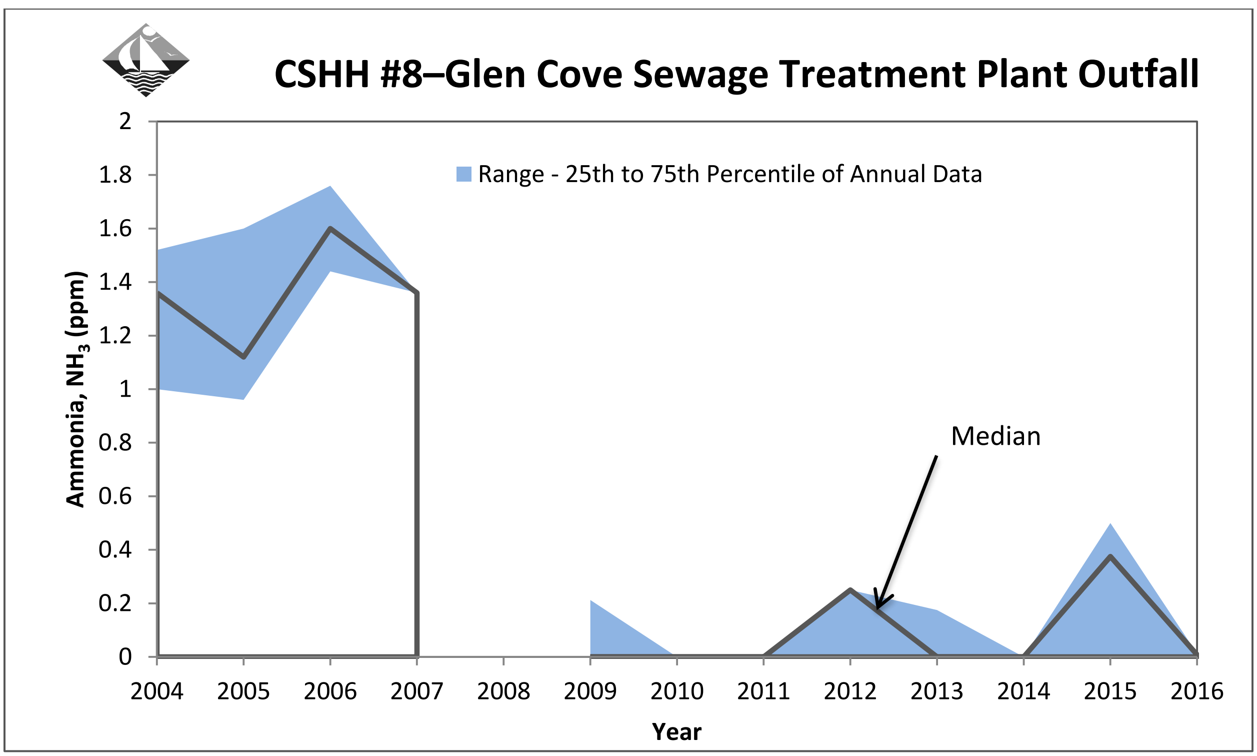




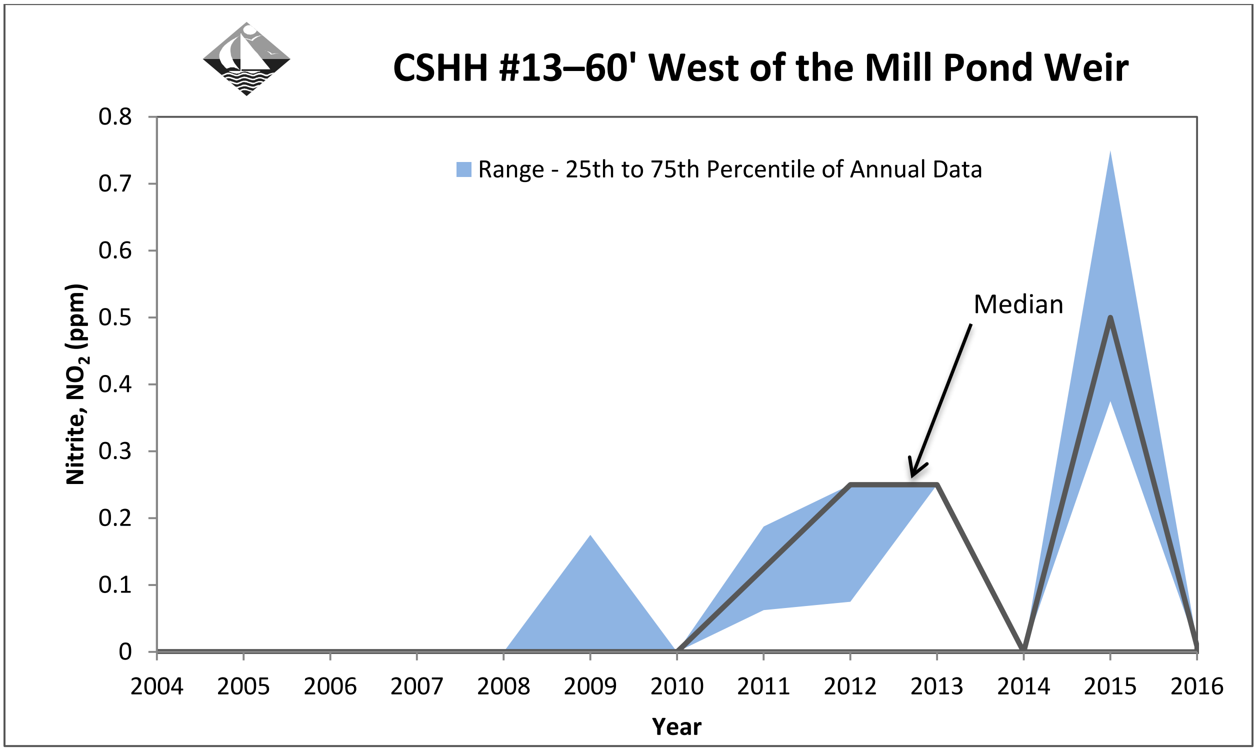
2004-2016 Nitrogen Range Graphs

Ammonia





2004-2016 Nitrogen Range Graphs



Appendix D

Comparison of Averaged Indicator Bacteria Data for Beaches
1995-2016 Water-Quality Data Summary
Seasonal Averages for Selected Water-Quality Parameters

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	Crescent Beach	Morgan Memorial Beach
April	Enterococci	0.58	0.25	0.57	0.88	0.57	0.92	63.67
May	Enterococci	24.17	7.05	10.16	4.89	2.30	76.97	10.43
June	Enterococci	4.58	5.58	2.91	6.57	622.72**	614.04	16.37
July	Enterococci	12.71	9.30	6.86	3.44	6.31	79.28	7.28
August	Enterococci	113.31	34.42	36.48	32.22	29.46	50.57	69.47
September	Enterococci	--	--	--	--	--	10.70	--
Season Averages*	*Enterococci*	*36.82*	*12.94*	*13.66*	*11.25*	*157.55*	*172.69*	*32.54*

*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	Crescent Beach	Morgan Memorial Beach
April	Enterococci	0.26	1.28	1.66	24.46	10.62	2.79	1.26
May	Enterococci	27.44	8.00	19.03	23.87	22.47	12.76	24.29
June	Enterococci	680.51	257.39	60.24	68.33	26.67	86.57	80.87
July	Enterococci	20.90	17.69	34.81	18.01	15.34	28.41	21.37
August	Enterococci	12.13	7.46	7.92	4.76	26.44	15.92	36.17
September	Enterococci	4.00*	11.00*	8.00*	0.10*	4.00*	6.47	1.00*
Season Averages*	*Enterococci*	*152.28*	*60.48*	*27.10*	*28.33*	*20.76*	*32.65*	*38.05*

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

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	Crescent Beach	Morgan Memorial Beach
April	Enterococci	20.83	16.05	7.20	8.85	7.55	224.55	14.84
May	Enterococci	223.16	39.91	34.31	37.41	10.33	9.43	14.57
June	Enterococci	103.79	221.71	91.92	74.00	395.65	470.85	78.67
July	Enterococci	8.02	13.68	17.22	24.44	31.44	78.19	865.13
August	Enterococci	139.26	83.51	74.58	96.75	125.79	461.83	41.32
September	Enterococci	na	na	na	na	na	15.02	na
Season Averages*	*Enterococci*	*97.63*	*84.60*	*50.49*	*50.89*	*140.11*	*238.04*	*263.23*

*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	Crescent Beach	Morgan Memorial Beach
April	Enterococci	2.55	1.30	22.80	8.03	6.80	2.13	2.05
May	Enterococci	20.03	10.57	38.76	23.90	20.38	17.39	25.51
June	Enterococci	36.38	6.65	73.12	79.33	20.88	53.47	40.62
July	Enterococci	63.00	21.75	5.11	10.42	5.00	87.59	51.35
August	Enterococci	4.13	7.13	16.13	19.01	15.75	23.53	18.08
September	Enterococci	na	na	na	na	na	129.63	na
Season Averages*	*Enterococci*	*29.85*	*11.00*	*31.78*	*30.61*	*14.03*	*55.43*	*32.67*

*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	Crescent Beach	Morgan Memorial Beach
April	Enterococci	2.73	9.48	3.63	9.90	12.17	142.11	16.33
May	Enterococci	568.26	21.00	11.13	16.78	12.14	391.34	5.37
June	Enterococci	148.00	72.14	98.01	60.26	76.88	122.06	37.58
July	Enterococci	81.38	26.01	8.89	8.64	6.40	271.13	12.85
August	Enterococci	737.67	199.56	53.22	24.67	50.79	134.05	32.01
Season Averages*	*Enterococci*	*334.27*	*73.59*	*36.22*	*24.42*	*32.64*	*223.67*	*21.65*

*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	Crescent Beach	Morgan Memorial Beach
April	Enterococci	6.50	20.75	92.50	31.60	14.20	12.89	2.67
May	Enterococci	410.40	40.88	89.63	325.63	48.51	458.09	49.50
June	Enterococci	22.60	24.11	72.30	10.46	29.11	209.16	103.07
July	Enterococci	74.50	113.90	63.30	13.44	19.59	50.28	54.24
August	Enterococci	21.22	49.23	28.41	7.52	19.81	199.22	63.44
Season Averages*	*Enterococci*	*122.96*	*52.14*	*64.93*	*77.60*	*27.14*	*223.31*	*65.64*

*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	Crescent Beach	Morgan Memorial Beach
April	Enterococci	6.82	9.42	12.44	22.60	2.24	24.22	0.10
May	Enterococci	17.88	14.50	8.14	30.89	23.65	338.19	42.01
June	Enterococci	94.37	12.48	17.02	14.01	56.85	78.69	87.34
July	Enterococci	65.00	19.22	14.11	88.23	54.55	286.52	76.10
August	Enterococci	104.34	89.23	77.12	44.13	159.64	113.02	86.84
September	Enterococci	na	7.00*	13.00*	1.00*	11.00*	369.83	0.10*
Season Averages **	*Enterococci*	*65.22*	*29.61*	*26.22*	*40.19*	*67.48*	*208.47*	*68.40*

na = not analyzed
* Only one data point collected in September.
**Averages of all of the data points collected during the monitoring season.

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	Crescent Beach	Morgan Memorial Beach
April	Enterococci	2.20	1.52	1.53	2.52	9.70	4.03	3.73
May	Enterococci	6.78	5.16	4.14	4.03	5.78	20.29	3.74
June	Enterococci	104.24	47.22	290.88	247.31	21.46	634.65	23.86
July	Enterococci	31.03	102.89	206.46	23.24	26.62	231.47	46.34
August	Enterococci	84.00	86.24	16.82	7.37	70.36	282.44	79.14
September	Enterococci	4.00*	120*	90.00*	0.10*	11.00*	19.86	3.00
Season Averages **	*Enterococci*	*48.69*	*54.70*	*109.23*	*65.02*	*29.97*	*290.61*	*40.35*

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

Comparison of Averaged Indicator Bacteria Data for Beaches

2008*

	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*

*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	**8.82**	**14.22**	**12.42**	**89**	**5.64**
May	Enterococci	16.22	35.91	26.36	43.92	9.49
	Fecal	**29.36**	**157**	**84.68**	**49.89**	**17.8**
June	Enterococci	38.39	45.11	46.44	14.89	10.57
	Fecal	**27.38**	**438.56**	**219**	**130.67**	**73.33**
July	Enterococci	143.89	51.33	36.4	16.4	10.52
	Fecal	**890.25**	**877**	**581**	**519.6**	**193.70**
August	Enterococci	297	188.44	68.56	17.78	72.78
	Fecal	**166.11**	**1173**	**272.8**	**248.44**	**358.33**
Season Averages	*Enterococci*	*100.62*	*65.92*	*38.56*	*25.76*	*35.35*
	Fecal	***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	**7**	**0.6**	**1**	**5**	**0.6**
May	Enterococci	7	16	35	333	73
	Fecal	**16**	**9**	**100**	**20**	**14**
June	Enterococci	6	27	30	33	12
	Fecal	**9**	**98**	**107**	**73**	**68**
July	Enterococci	68	46	40	35	47
	Fecal	**259**	**567**	**154**	**150**	**277**
August	Enterococci	120	46	76	11	65
	Fecal	**106**	**97**	**100**	**94**	**51**
Season Averages	*Enterococci*	*40*	*27*	*36*	*83*	*39*
	Fecal	***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	**12**	**60**	**289**	**19**	**43**
May	Enterococci	8	29	33	19	13
	Fecal	**15**	**89**	**120.23**	**21**	**18**
June	Enterococci	9	20	9	5	3
	Fecal	**77**	**330**	**118**	**87**	**86**
July	Enterococci	17	26	6	15	39
	Fecal	**176**	**561**	**159**	**472**	**596**
August	Enterococci	186	50	79	20	18
	Fecal	**265**	**166**	**256**	**346**	**239**
Season Averages	*Enterococci*	*44.2*	*26*	*32*	*14.2*	*14.8*
	Fecal	***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	57	76	36	265	161
	Fecal	**4**	**71**	**29**	**66**	**25**
May	Total	140	1137	1910	851	22029
	Fecal	**46**	**141**	**822**	**210**	**3859**
June	Total	168	1179	560	701	864
	Fecal	**44**	**615**	**167**	**557**	**298**
July	Total	146	2353	571	790	624
	Fecal	**43**	**460**	**341**	**301**	**222**
August	Total	634	993	445	414	727
	Fecal	**375**	**905**	**383**	**313**	**442**
September	Total	*700*	*22*	*17*	*80*	*230*
	Fecal	***500***	***17***	***11***	***80***	***130***
Season Averages	*Total*	*268*	*1582*	*701*	*682*	*3574*
	Fecal	***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	13	140	159	155	19
	Fecal	**8**	**44**	**152**	**19**	**5**
May	Total	161	122	130	154	1277
	Fecal	**62**	**35**	**47**	**88**	**143**
June	Total	197	1747	478	724	915
	Fecal	**80**	**136**	**64**	**255**	**111**
July	Total	239	781	1237	517	1810
	Fecal	**65**	**539**	**874**	**203**	**304**
August	Total	347	678	804	2117	22364
	Fecal	**81**	**344**	**334**	**1904**	**3114**
September	Total	*6567*	*3500*	*1033*	*910*	*1820*
	Fecal	***977***	***1090***	***177***	***274***	***110***
Season Averages	*Total*	*632*	*949*	*816*	*1097*	*8735*
	Fecal	***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	160	326	157	728	163
	Fecal	**44**	**39**	**11**	**658**	**53**
May	Total	130	145	127	282	194
	Fecal	**76**	**124**	**78**	**169**	**46**
June	Total	560	674	431	1604	750
	Fecal	**123**	**559**	**168**	**1016**	**154**
July	Total	613	1921	964	2770	4779
	Fecal	**246**	**810**	**831**	**1367**	**210**
August	Total	4773	3277	6202	1625	1832
	Fecal	**2593**	**2971**	**2130**	**1278**	**839**
Season Averages	*Total*	*1226*	*1969*	*3096*	*1463*	*1626*
	Fecal	***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	26	239	68	194	86
	Fecal	**9**	**85**	**36**	**103**	**43**
May	Total	559	486	364	944	1689
	Fecal	**21**	**83**	**106**	**555**	**274**
June	Total	2373	974	1091	1045	494
	Fecal	**157**	**488**	**451**	**365**	**60**
July	Total	242	6025	11526	1308	1501
	Fecal	**44**	**3458**	**11297**	**566**	**399**
August	Total	2183	3360	2594	12230	24148
	Fecal	**124**	**1000**	**1872**	**10285**	**1623**
September	Total	468	348	570	1500	1100
	Fecal	**53**	**110**	**116**	**1308**	**300**
Season Averages	***Total***	***1143***	***2848***	***4187***	***4513***	***9080***
	Fecal	***75***	***1325***	***3754***	***3559***	***717***

1995-2016 Water-Quality Data Summary

CSHH #1–Beacon 11

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

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

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

* Average based on less than full month

1995-2016 Water-Quality Data Summary

CSHH #1–Beacon 11

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

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

	2006				2005			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.35	6.81	25.22	22.42	17.19	4.5	22.94	20.22
July	20.78	3.77	25.79	24.18	23.19	4.22	24.52	24.3
Aug.	23.64	3.29	25.64	23.78	23.73	1.85	25.36	24.4
Sept.	20.58	7.28	25.4	18.9	22.54	4.85	26.49	23.6
Oct.	16.41	7.98	25.56	14.78	16.3	7.36	25.09	13.3

* Average based on less than full month

1995-2016 Water-Quality Data Summary

CSHH #1–Beacon 11

	2004				2003			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.3	5.38	25	23.6	17	5.82	23.67	24.6
July	20.87	4.28	25.9	24	18.74	3.6	24.97	21.9
Aug.	22.33	3.86	26.31	24	21.75	2.1	25.79	23.6
Sept.	22.14	3.67	26.15	20.4	21.6	4.32	26.4	22.2
Oct.	16.53	7.66	25.21	12.9	16.49	6.73	25.23	12.8

	2002				2001			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.85	4.82	26.42	24.1	20.31	6.62	24.78	24.1
July	21.28	2.31	26.55	25	19.4	3.8	25.68	25.2
Aug.	24.02	2.91	26.89	25	23.25	2.96	26.19	25.4
Sept.	21.98	5.7	26.5	20.3	22.56	5.45	26.7	20.5
Oct.	17.12	7.13	26.38	13.5	17.05	7.86	26.79	15.8

	2000				1999			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.1	5.63	24.43	22.2	19.66	7.07	24.89	23
July	21.8	5.27	25.03	22.2	21.72	3.42	25.78	30
Aug.	22.53	6.41	24.7	24.2	24.35	4.6	25.99	25
Sept.	20.99	4.9	25.07	20.9	21.9	5.57	25.72	22
Oct.	16.78	6.02	25.24	13.2	17.76	8.29	24.7	12

* Average based on less than full month

1995-2016 Water-Quality Data Summary

CSHH #1–Beacon 11

	1998				1997			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.24	6.24	24.18	21.33	18.1	7.01	23.71	24.33
July	21.23	4.89	24.66	24.6	20.83	4.34	24.78	23.5
Aug.	23.95	3.66	24.84	24.5	21.85	1.96	25.96	21.5
Sept.	22.02	4.57	25.48	20.5	22.13	3.26	25.81	19.5
Oct.	17.19	6.84	25.27	13.75	17.45	5.83	26.06	13.67

	1996				1995			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	19	8.35	N/A	23.25	17.78	5.3	26.27	19.67
July	20.04	3.74	24.66	22.75	20.77	2.66	26.53	25.25
Aug.	21.75	2.88	25.13	22.25	23.78	4.56	27.56	24.7
Sept.	21.7	5.14	25.48	19.83	21.72	4.34	28.05	20.5
Oct.	17.34	9.21	24.97	15.25	17.71	6.9	27.34	16.5

* Average based on less than full month

1995-2016 Water-Quality Data Summary

CSHH #2–Bell Marker 6

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

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

	2012					2011				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	18.08	5.53	25.06	22.30	1.62	14.70	7.64	23.34	19.6	0.57
June	19.32	5.02	25.20	21.90	1.03	16.95	4.95	24.11	22.8	1.18
July	21.94	2.99	26.03	25.30	1.92	19.88	3.39	24.79	24.8	0.83
Aug.	23.26	2.11	26.91	25.72	1.66	22.03	2.86	25.59	23.3	1.93
Sept.	22.92	4.20	27.41	21.10	1.40	21.47	3.91	24.38	22.3	1.48
Oct.	17.68	5.57	27.31	15.25	0.88	18.11	6.93	24.35	16.2	1.71
Nov.*	9.30	9.19	27.33	8.55	1.10	13.75	8.15	24.42	7.2	-

* Average based on less than full month

1995-2016 Water-Quality Data Summary

CSHH #2–Bell Marker 6

	2010					2009				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	13.07	8.76	24.34	23.80	1.21	12.90	7.94	25.16	16.40	1.88
June	16.88	5.89	25.51	21.60	1.78	16.79	6.58	24.73	19.50	2.45
July	20.21	1.84	26.59	27.95	1.54	18.93	3.80	24.90	23.84	1.39
Aug.	22.09	2.66	27.21	24.70	1.54	21.43	1.34	25.28	25.78	1.94
Sept.	21.69	5.39	27.07	23.22	2.37	21.70	6.17	25.16	21.53	2.38
Oct.	16.82	7.54	27.06	15.00	0.78	14.66	7.90	25.64	12.47	1.58
Nov.*	12.66	10.14	27.43	9.6	1.05	-	-	-	-	-

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

	2006				2005			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	16.93	7.74	25.89	22.72	16.8	5.22	23.21	21.9
July	18.67	3.99	26.51	25.5	21.78	4.59	23.03	24.4
Aug.	21.91	1.91	26.42	26.53	23.13	2.07	25.58	26.6
Sept.	20.41	5.98	26.24	20.33	22.8	2.98	27.01	24.2
Oct.	17.66	7.3	26.32	18.89	17.01	6.84	25.91	13.9

* Average based on less than full month

1995-2016 Water-Quality Data Summary

CSHH #2–Bell Marker 6

	2004 Avg. Water Temp. (°C) (Bottom)	2004 Avg. DO (ppm) (Bottom)	2004 Avg. Salinity (ppt) (Bottom)	2004 Avg. Air Temp. (°C)	2003 Avg. Water Temp. (°C) (Bottom)	2003 Avg. DO (ppm) (Bottom)	2003 Avg. Salinity (ppt) (Bottom)	2003 Avg. Air Temp. (°C)
June	16.38	5.92	25.41	22.5	15.58	6.35	24.26	22.4
July	19.82	5.11	26.24	24.8	17.16	2.93	25.35	22.9
Aug.	21.47	3.04	26.62	24.1	21.01	1.74	26.14	23.6
Sept.	21.96	6.17	26.33	20.7	21.2	5.38	26.55	22
Oct.	17.37	8.16	25.63	14.3	17.19	6.47	26.03	15

	2002 Avg. Water Temp. (°C) (Bottom)	2002 Avg. DO (ppm) (Bottom)	2002 Avg. Salinity (ppt) (Bottom)	2002 Avg. Air Temp. (°C)	2001 Avg. Water Temp. (°C) (Bottom)	2001 Avg. DO (ppm) (Bottom)	2001 Avg. Salinity (ppt) (Bottom)	2001 Avg. Air Temp. (°C)
June	18.06	6.13	26.55	23.4	16.67	4.97	25.36	23.2
July	19.91	1.81	26.87	27.4	18.45	5.32	26	26.2
Aug.	22.85	3.08	27.23	25.4	22.33	3.83	26.46	26
Sept.	21.97	5.84	26.89	21.4	21.88	5.8	27.07	21.1
Oct.	17.74	7.68	27.25	13.9	16.94	8.55	27.24	15.9

	2000 Avg. Water Temp. (°C) (Bottom)	2000 Avg. DO (ppm) (Bottom)	2000 Avg. Salinity (ppt) (Bottom)	2000 Avg. Air Temp. (°C)	1999 Avg. Water Temp. (°C) (Bottom)	1999 Avg. DO (ppm) (Bottom)	1999 Avg. Salinity (ppt) (Bottom)	1999 Avg. Air Temp. (°C)
June	16.45	6.29	24.77	22.4	17.13	6.41	25.42	23
July	20.19	4.8	25.38	22.7	19.62	2.87	26.23	27
Aug.	22.08	6.46	24.95	24.7	22.88	4.29	26.8	25
Sept.	20.89	6.08	25.54	22.3	22.15	5.75	26.84	26
Oct.	16.86	7.18	26.07	16.3	17.18	8.46	26.3	13

* Average based on less than full month

1995-2016 Water-Quality Data Summary

CSHH #2–Bell Marker 6

	1998				1997			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	16.39	6.9	24.45	21.33	16.7	9.12	24.14	24.5
July	19.88	4.78	25.13	24.6	18.32	3.12	25.33	23.25
Aug.	22.88	3.3	25.27	24.5	21.12	2.86	26.41	21.37
Sept.	21.62	6.03	25.82	20.5	21.33	3.18	26.79	19.75
Oct.	17.18	6.9	26.27	13.75	18.02	5.22	26.59	14.5

	1996				1995			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.5	7.8	N/A	22	17.61	7.78	26.5	21.25
July	19.15	5.17	24.92	24.5	20.09	4.19	26.93	24.87
Aug.	21.1	4.29	24.99	23.17	22.9	4.87	27.77	25.12
Sept.	22.05	8	25.73	20.17	21.73	5.27	28.44	21.5
Oct.	16.95	9.11	25.34	15.75	17.48	7.72	27.8	15.83

* Average based on less than full month

1995-2016 Water-Quality Data Summary

CSHH #3–Glen Cove Creek

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

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

	2012					2011				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	19.39	7.39	24.87	22.60	1.93	15.51	8.16	23.28	23.7	0.16
June	19.63	5.94	24.72	22.30	2.06	19.01	8.17	23.90	25.0	1.39
July	22.64	3.02	25.78	26.13	2.19	21.53	5.81	24.55	24.6	1.31
Aug.	23.91	3.82	26.56	25.50	1.95	22.60	4.10	25.13	24.1	2.18
Sept.	22.92	5.37	26.93	21.23	1.44	21.78	6.55	23.69	23.3	2.02
Oct.	17.56	8.06	26.78	15.88	0.59	17.91	8.16	23.96	12.8	1.96
Nov.*	9.64	9.29	27.19	8.30	1.28	13.04	9.20	24.03	9.3	0.91

* Average based on less than full month

1995-2016 Water-Quality Data Summary

CSHH #3–Glen Cove Creek

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

	2008					2007			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
May*	12.82	8.58	23.69	15.15	-	-	-	-	-
June	18.23	7.53	24.89	21.60	-	16.82	8.47	24.15	21.98
July	19.39	3.83	25.89	26.33	1.62	19.19	4.75	25.40	24.25
Aug.	23.12	6.08	25.68	24.15	-	22.67	5.98	26.16	23.20
Sept.	22.47	5.74	25.93	21.45	-	21.87	5.18	26.63	22.13
Oct.	16.43	7.25	26.17	13.58	1.67	19.31	4.7	27.59	17.7
Nov.*	12.60	7.49	26.36	15.60	-	-	-	-	-

	2006				2005			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.37	8.35	25.6	23.38	17.46	5.46	23.08	22.32
July	20.32	4.51	25.98	25.25	22.32	4.29	24.82	24.8
Aug.	23.19	5.13	26.13	25.46	23.53	2.16	25.67	25.3
Sept.	20.58	7.5	26	19.85	22.76	5.23	26.8	24.8
Oct.	16.91	8.55	26.17	16.03	16.66	8.14	25.58	14.3

* Average based on less than full month

1995-2016 Water-Quality Data Summary

CSHH #3–Glen Cove Creek

	2004				2003			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.67	7.36	25.23	23.4	16.47	7.02	23.97	23.9
July	20.39	4.96	26.15	25.1	18.41	4.25	25.08	22.8
Aug.	22	4.3	26.48	22.8	21.26	3.74	25.92	23.6
Sept.	22.02	4.66	26.34	21.3	21.48	4.81	26.49	22.4
Oct.	16.86	7.62	25.97	13.1	16.97	6.58	25.61	15.6

	2002				2001			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	19.05	6.36	26.48	23.7	18.45	7.63	25.23	24.4
July	20.71	2.61	26.69	25.4	18.55	4.53	25.92	26
Aug.	23.36	2.49	27.1	26.9	23.09	4.83	26.34	27.7
Sept.	21.78	6.49	26.71	22	22.1	6.92	26.88	21.3
Oct.	17.7	7.98	27.05	14.7	17.02	9.01	27.12	16.3

	2000				1999			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.69	6.6	24.35	21.6	18.43	6.32	25.09	23
July	21.16	5.87	25.26	23	21.57	5.02	25.89	30
Aug.	22.66	6.44	24.68	23.5	23.82	4.87	26.44	26
Sept.	21.45	6.13	24.99	20.5	21.8	6.16	26.25	23
Oct.	16.69	7.5	25.52	16.7	16.74	8.7	25.81	14

* Average based on less than full month

1995-2016 Water-Quality Data Summary

CSHH #3–Glen Cove Creek

	1998				1997			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.23	7.25	24.27	21.33	17.36	8.32	24.11	26.5
July	21.03	6.34	24.76	24.6	20.2	6.21	25.07	23.37
Aug.	23.39	3.87	25.14	24.5	21.34	2.29	26.29	21.5
Sept.	21.88	5.76	25.75	20.5	21.61	3.12	26.67	20
Oct.	16.9	7.79	25.88	13.75	17.12	5.69	26.69	13.67

	1996				1995			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.25	9.35	N/A	22.12	17.82	5.4	26.58	21.5
July	20.32	7.1	24.46	23.67	20.74	4.5	26.87	25
Aug.	21.45	3.2	25.29	22.87	23.24	4.79	27.94	24.7
Sept.	22.09	6.85	25.69	20.83	21.61	4.78	28.22	21
Oct.	16.61	9.88	25.12	15.4	17.4	7.54	27.57	16.5

* Average based on less than full month

1999-2016 Water-Quality Data Summary

CSHH #8–Glen Cove Creek STP Outfall

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

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

	2012					2011				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	20.17	6.16	24.14	24.50	3.14	16.64	8.22	22.95	26.1	0.26
June	20.21	5.00	22.43	23.83	2.28	18.75	7.56	23.51	25.5	2.08
July	23.36	4.90	23.87	27.50	2.26	21.96	3.66	24.38	26.0	2.30
Aug.	24.16	4.29	24.44	26.73	2.44	22.99	3.50	24.78	24.9	2.62
Sept.	23.07	4.54	24.95	22.43	2.97	22.17	5.48	23.40	23.6	2.59
Oct.	17.72	5.99	23.93	17.33	1.31	18.01	7.68	23.74	17.2	2.09
Nov.*	9.86	9.18	26.36	8.55	2.01	13.14	9.70	23.86	9.4	1.46

* Average based on less than full month

1999-2016 Water-Quality Data Summary

CSHH #8–Glen Cove Creek STP Outfall

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

	2008					2007			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
May*	13.22	6.81	23.67	19.30	-	-	-	-	-
June	19.08	8.34	24.55	23.80	4.75	17.69	8.75	24.03	22.83
July	20.53	4.83	25.64	28.80	3.02	19.76	4.46	25.26	26.50
Aug.	23.23	4.49	25.46	24.13	2.89	22.76	5.27	25.84	24.33
Sept.	22.67	4.04	25.84	20.80	2.74	22.17	6.05	26.27	21.75
Oct.	16.68	6.67	26.17	13.38	2.14	19.3	5.13	27.59	17.76
Nov.*	12.47	6.34	25.96	15.80	1.53	-	-	-	-

	2006				2005			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.21	7.98	25.27	24.52	18.9	7.1	22.25	23.72
July	21.43	5.08	25.51	26.33	23.07	5.48	24.5	25.5
Aug.	24	8.85	25.71	25.18	24.32	3.45	25.32	27.2
Sept.	20.65	8.25	25.36	20.2	23.24	5.07	26.42	25.2
Oct.	17.12	8.18	25.97	15.57	16.98	7.31	25.28	14

* Average based on less than full month

1999-2016 Water-Quality Data Summary

CSHH #8–Glen Cove Creek STP Outfall

	2004				2003			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	19.38	8.14	24.8	26.3	17.01	5.92	23.7	25.7
July	21.26	4.52	25.39	27	18.94	4.03	24.94	24.4
Aug.	22.78	5.98	25.89	24.4	22.51	5.23	25.51	26.1
Sept.	22.22	4.66	25.62	22.1	21.58	4.87	25.99	23.5
Oct.	16.6	7.79	25.72	13.4	16.49	6.49	25.1	14.6

	2002				2001			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	19.89	7.65	26.12	25.5	20.11	7.61	24.57	26.6
July	22.13	4.33	26.27	26.8	20.18	5.56	25.31	27.1
Aug.	24.64	4.85	26.67	27.7	23.82	6.16	25.86	29.2
Sept.	21.91	6.01	26.41	23	22.45	5.74	26.58	22.1
Oct.	17.67	7.69	26.77	16.4	16.67	9.56	26.54	16.7

	2000				1999			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.66	7.13	23.59	23.8	19.99	9.11	24.71	23
July	21.99	6.51	24.93	24.1	22.7	6.03	25.53	30
Aug.	23.58	7.75	24.18	24.5	24.28	5.32	26.19	26
Sept.	21.17	8.63	24.81	23.6	21.78	6.14	25.84	24
Oct.	17.25	7.17	24.87	15.3	16.63	8.63	25.53	15

* Average based on less than full month

Seasonal Averages for Selected Water-Quality Parameters

Salinity Averages

	Beacon 11 CSHH #1	Bell 6 CSHH #2	Red Channel Marker, Near Glen Cove Creek, CSHH #3	Glen Cove STP Outfall, CSHH #8
2016	26.98 ppt	27.49 ppt	27.32 ppt	25.46 ppt
2015	26.43	26.99	26.74	24.01
2014	25.48	26.22	25.72	23.48
2013	26.01	26.59	26.34	24.45
2012	25.90	26.56	26.19	24.15
2011	23.71	24.27	23.99	23.18
2010	25.77	26.32	26.00	24.94
2009	24.22	24.87	24.54	23.68
2008	25.01	25.78	25.28	24.29
2007	25.41	26.07	25.62	24.30
2006	25.3	26.0	25.6	24.3
2005	24.60	24.95	24.71	23.66
2004	25.73	26.06	26.04	25.50
2003	25.25	25.70	25.45	25.09
2002	26.56	26.99	26.83	26.47
2001	26.02	26.41	26.27	25.76
2000	24.87	25.28	24.94	24.40
1999	24.15	26.21	25.49	25.49
1998	24.88	25.40	25.16	N/A
1997	25.20	25.69	25.66	N/A

Bottom Dissolved Oxygen Averages

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

Seasonal Averages for Selected Water-Quality Parameters

Turbidity at 0.5m Averages

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

Water Temperature Averages

	Beacon 11 CSHH #1	Bell 6 CSHH #2	Red Channel Marker, Near Glen Cove Creek, CSHH #3	Glen Cove STP Outfall, CSHH #8
2016	20.4ºC	20.3ºC	20.6ºC	20.6ºC
2015	19.00	18.68	19.25	19.4
2014	19.60	19.41	19.84	20.26
2013	19.39	18.84	19.58	19.66
2012	20.32	20.03	20.43	20.32
2011	19.92	19.70	20.04	20.25
2010	19.90	19.68	20.15	20.60
2009	19.31	18.75	19.27	19.68
2008	19.25	19.15	19.32	19.63
2007	19.9	19.4	19.96	20.53
2006	20.2	19.8	20.1	20.63
2005	20.24	19.63	20.19	21.1
2004	19.55	19.14	19.41	N/A
2003	18.94	18.37	18.9	N/A
2002	20.67	20.13	20.53	N/A
2001	20.90	19.58	20.23	N/A
2000	19.49	19.03	19.59	N/A
1999	21.01	19.67	20.2	N/A
1998	20.52	19.66	20.28	N/A
1997	20.1	19.12	19.55	N/A
1996	19.87	19.2	19.43	N/A
1995	20.8	20.3	20.59	N/A

Seasonal Averages for Selected Water-Quality Parameters

Air Temperature Averages

	Beacon 11 CSHH #1	Bell 6 CSHH #2	Red Channel Marker, Near Glen Cove Creek, CSHH #3	Glen Cove STP Outfall, CSHH #8
2016	20.6ºC	22.5ºC	22.1ºC	23.1ºC
2015	20.04	21.40	22.36	23.4
2014	20.18	20.57	21.68	22.44
2013	19.20	20.80	20.85	21.47
2012	20.00	21.12	21.38	20.0
2011	20.18	21.15	20.64	22.42
2010	20.81	22.40	23.18	23.9
2009	19.18	20.52	20.69	21.7
2008	18.88	20.68	20.27	21.20
2007	20.22	21.24	21.69	22.31
2006	21	23.4	22.2	22.92
2005	21.1	21.91	22.28	23.2
2004	19.24	19.8	19.48	N/A
2003	20.4	21.1	21.8	N/A
2002	21.1	21.5	22.1	N/A
2001	22.5	22.8	23.6	N/A
2000	20.4	21.8	20.9	N/A
1999	22.22	22.73	23.04	N/A
1998	21.1	21.1	21.1	N/A
1997	20.81	21.37	21.25	N/A
1996	20.71	20.53	20.55	N/A
1995	21.84	22.16	22.18	N/A