March 31, 2004

MISSION AND PROFILE

The Coalition to Save Hempstead Harbor (CSHH) is a volunteer, nonprofit organization, founded in 1986. CSHH is dedicated to identifying and eliminating environmental threats to Hempstead Harbor and surrounding communities. Its objective is to advance the public interest in protecting and restoring our local environment to its full ecological and economic potential.

The fundamental force behind CSHH's efforts is the belief that concerned and informed citizens can make a difference in events that shape the future. CSHH's education and outreach programs foster an increased awareness of environmental issues generally and greater appreciation of the local environment in particular. Most important, the public is encouraged to participate in local conservation efforts.

When CSHH was formed over 17 years ago, Hempstead Harbor was suffering from air, water, and land-based problems that resulted from past industrial activities that were sited along the harbor's shores. The priorities during the early years of CSHH's existence were preventing increased air pollution from proposed and existing incinerators and ensuring the cleanup of toxic waste sites that were degrading the harbor's water quality. CSHH with other community members 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 as an alternative solution to solid-waste management and became a critical watchdog for the harbor as remediation plans were formulated to clean up contaminated sites.

In the early 1990s, as efforts grew to improve Long Island Sound and have it designated as an estuary of national significance, CSHH was already focused on the water-quality issues of Hempstead Harbor. CSHH recognized that the priorities that were established under the Long Island Sound Study's Comprehensive Conservation and Management Plan were the same priorities that needed to be addressed for Hempstead Harbor, even if to differing degrees.

ACTIVITIES

CSHH's **Citizens Water-Monitoring Program** was established in 1992 to encourage all who live, work, and recreate around Hempstead Harbor to renew their interest in conditions around the harbor as well as Long Island Sound and to participate in restoration efforts. An important component of the program is 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. Over the years, the scope of the program has expanded, as has the network of partners that have supported it. The program has achieved soundwide recognition.

In 1996, CSHH initiated the creation of the **Water-Monitoring Work Group**, a soundwide network of environmental agencies and nonprofits, to provide a forum for analyzing current testing parameters, methodologies, and equipment used by members and for examining testing results in a broader context. The soundwide network remains an important resource to check the location and extent of various water conditions around the sound. In addition, the **Long Island Sound Mapping Project** was completed in July 1998 through a grant awarded to CSHH by EPA/Long Island Sound Study. The project was undertaken on behalf of the Water-Monitoring Work Group and achieved the group's goal of mapping sites that are being monitored around Long Island Sound and identifying the agencies or other organizations that are responsible for testing at those sites.

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 economy) of surrounding communities.

In 2000, CSHH became a partner in **EPA's Environmental Monitoring for Public Awareness and Community Tracking (EMPACT)** program. CSHH is working 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 can be viewed on the Web. The Town of Oyster Bay also is an important partner in this project, having contributed the stationary probe and use of a boat and staff to assist with probe maintenance.

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 EPA Long Island Sound Study Office to plan and coordinate a **Storm-Water Workshop** to help prepare Long Island communities to meet the requirements of the EPA Phase II Storm Water 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.

CSHH continues to work with other environmental groups and agencies around Hempstead Harbor and Long Island Sound. In 1995, the nine municipalities that have jurisdiction over Hempstead Harbor formed the Hempstead Harbor Protection Committee (HHPC), and CSHH became the first environmental organization to sit on the committee as a technical advisor. CSHH has worked with the committee in planning and implementing its Water Quality Improvement Plan (1998) and planning for its Harbor Management Plan (due to be completed in 2004). CSHH has also participated on every advisory committee that has been created around the harbor to develop various revitalization plans, such as the Glen Cove Creek Reclamation Committee, Glenwood Landing Steering Committee, the Roslyn Waterfront Committee, and the Glen Cove Waterfront Citizens' Planning Committee. CSHH is a long-standing member of the

Long Island Sound Study's Citizens Advisory Committee and serves as chair of its Communications Subcommittee.

Annually, since 1992, CSHH has coordinated local activities as part of the International Coastal Cleanup. CSHH 's Row & Paddle has become a favorite event in the community, offering residents an opportunity to see the entire harbor from a unique perspective. CSHH's annual Dinner Dance and Dance Journal are major fund-raising events that also afford opportunities to recognize business leaders and public officials who have worked to improve the local environment. These events, member contributions, and grants that CSHH has been awarded throughout the years from the NY Department of State, EPA's Long Island Sound Office, the Rauch Foundation, Long Island Community Foundation, and local businesses have supported CSHH's programs and activities.

If you would like more information about CSHH's activities, or to request another copy of this report, contact:

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CSHH office, MiniMart 2003 (Photo: Carol DiPaolo)

ACKNOWLEDGMENTS

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

We also acknowledge the special efforts of individuals who have helped us maintain our water-monitoring program, including monitoring volunteers, Mark Ring and Ted Reyling; CSHH fish-survey leader and Hudson River Foundation researcher, Dr. John Waldman; Town of Oyster Bay's Department of Environmental Resources, especially Superintendent of Environmental Control Eric Swenson and staff member Michael Caputo; Town of Oyster Bay's Department of Parks staff at Tappen Beach Marina; Nassau County Department of Health Bureau of Environmental Sanitation director, John Jacobs; Interstate Environmental Commission engineer, Peter Sattler; University of Connecticut Marine Sciences Department oceanographic specialists, David Cohen and Kay Howard-Strobel; Marine 1 police officers and members of the Underwater Search and Rescue Team of the Nassau County Police Department; and CSHH water-monitoring report technical adviser and Excel wizard, Victor Stannish.

CSHH extends special thanks to New York Department of State, Division of Coastal Resources, for the $35,000 grant that was awarded in 2000, which has helped fund CSHH's water-monitoring program expansions. The program expansions were proposed specifically to implement the water-monitoring recommendations under the Hempstead Harbor Protection Committee's Water Quality Improvement Plan.

CSHH is also grateful to Ambient Water Treatment Consulting Group, Inc., Ambient Group, Inc., Tweezerman, and the Village of Roslyn Harbor for donating funds for repair and replacement of needed monitoring equipment over the years covered by this report; to Dr. Andrew Lichtman and Robert Porter, Nassau County Department of Health Labs, for the analyses of heavy metals and volatile organics samples.

Brownie troop helps at International Coastal Cleanup *(Photo: Carol DiPaolo)*

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STATE OF THE HARBOR REPORT 2001-2003

HARBOR OVERVIEW

Hempstead Harbor is a deep, V-shaped harbor that 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 harbor is about 5 miles long from mouth to head and its shoreline extends 14 miles from Sands Point on the west at its mouth to Mattinecock 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, storm-water runoff, air pollution, and industrial discharges. The worst of these effects were noted in the mid-1980s.

Efforts to restore the harbor resulted in the closure of a landfill, two incinerators, and a sewage treatment plant. The remediation of some hazardous waste sites has been completed, and remediation of others is still underway. One sewage treatment plant remains and in 2003 was upgraded, using a biological process to remove nitrogen from its discharge. This is an important step in improving the harbor's water quality. Revitalization plans are being implemented for sections of the waterfront that suffered the most abuse, such as along Glen Cove Creek and the shore in Glenwood Landing.

Over the last 15 years, the harbor has experienced a dramatic turnaround, with a vastly improved ecosystem containing a diversity of marine life and water birds. Wetland grasses have re-covered a large portion of the lower harbor south of the Bar Beach sandspit, once again providing a nursery and healthy habitat for marine species and bird populations. Hempstead Harbor has been designated a **significant coastal fish and wildlife habitat**.

A view of the lower harbor *(Photo by Carol DiPaolo)*

Today, Hempstead Harbor continues to support many diverse uses and activities. Fuel is transported to a Glenwood Landing oil terminal that is adjacent to a power plant that has operated since the early 1900s. Further north, tug boats tow barges to and from a sand and gravel transfer station on the west shore of the harbor and into Glen Cove Creek on the east side. 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. Five bathing beaches are located along the harbor's shore, and approximately 80% of the shoreline is made up of open space and parkland. As the harbor environment continues to improve, there will be more pressure to develop the increasingly valuable properties along the shoreline, which in time could exacerbate the problems that are currently being mitigated.

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 so that the municipalities that share Hempstead Harbor can "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 storm-water runoff abatement; prevention of inappropriate land use and development, particularly along the shore; continued improvements in water quality; and continued remediation of contamination from former industrial activities.

PROGRAM PARTNERS

The program's success can be measured in terms of community support as well as the financial, staff, and service support of local municipalities and state and local agencies. In February 2000, **New York Department of State** awarded a second grant to help support the CSHH's monitoring efforts to implement that portion of the **HHPC**'s Water Quality Improvement Plan. (The committee is a consortium of nine municipalities that have jurisdiction over Hempstead Harbor.) The $35,000 state grant, which was matched by the in-kind support of CSHH volunteers and committee members, concludes with this report.

Since 1998, the **Town of Oyster Bay** has contributed the use of a boat and staff to assist with weekly monitoring and retrieval and redeployment of the town-purchased stationary probe (1999), which records data from the harbor 24/7. In 2002, the town's new Environmental Control boat was put in service to more easily handle all monitoring stations in the harbor under a wide range of weather conditions.

TOBAY Enivronmental Control boat (Photo: Carol DiPaolo)

In summer 2000, the Coalition became a partner in **EPA**'s EMPACT (Environmental Monitoring for Public Awareness and Community Tracking) program and started working with members of the **Marine Sciences Department of the University of Connecticut** (UCONN) to incorporate Hempstead Harbor water-quality data into the university's MYSound project. The goal of both programs is to make timely water-quality data available to the public via the Internet.

The UCONN project team was anxious to expand MYSound stations and contacted CSHH about setting up a station in Hempstead Harbor. A number of factors made Hempstead Harbor an attractive candidate for the project. At the top of the list, however, was the fact that CSHH had an established monitoring program and already maintained stationary probe, which matches the equipment used at other stations in the project.

In September 2000, the necessary transmission equipment was donated and installed by the UCONN project team at the CSHH #1 monitoring station. Near real-time data (within about 15 minutes of the actual reading) from Hempstead Harbor became available on the MYSound Web site at http://www.MYSound.uconn.edu. The data is collected at 15-minute intervals on a 24-hour basis. The stationary probe reads and stores DO levels, water temperature, pH, and depth. Periodically, the probe is retrieved, the data is uploaded to the CSHH office computer and saved onto a disk, and then the probe is redeployed. The readings from the probe show that Hemptead Harbor has a very dynamic system that fluctuates with changes in tide and water temperature.

CSHH has consulted with the **Nassau County Department of Health** (NCDH) since the inception of the water-monitoring program. The NCDH previously conducted midharbor sample collection for coliform analysis, but this was discontinued in 1991 due to county budget cuts. Since 1998, CSHH has worked with NCDH to reinstate some of the midharbor coliform sampling by collecting samples at all eight CSHH stations, following NCDH protocols. The NCDH lab performs the analysis on these samples as well as on those collected by NCDH staff at local beaches and by the Interstate Environmental Commission (IEC).

As part of its broad Long Island Sound Study survey, the **Interstate Environmental Commission** monitors at two stations within Hempstead Harbor. CSHH has worked with IEC and other environmental agencies and organizations around Long Island Sound within the context the Water-Monitoring Work Group network, which CSHH initiated in 1996. CSHH has shared data with work group members, and in particular uses IEC data to give a broader picture of water conditions in Hempstead Harbor.

The **Nassau County Police Department's Underwater Search and Rescue Team,** which maintains police boats at Tappen Marina in Hempstead Harbor, has provided divers to assist with the stationary probe installation, retrieval and redeployment, and relocation. The team has enthusiastically supported CSHH monitoring efforts and has even helped with weekly sampling when we had no other means of reaching our stations.

CSHH is also grateful to and continues to rely on **long-time volunteers**, **members of local fishing clubs**, **local beach and marina managers**, **boaters and sailors**, and **other members of the community** to report on harbor conditions and to help us maintain monitoring stations. Working collaboratively with members of all the above has helped CSHH develop and sustain a long-standing, credible water-monitoring program.

WATER-MONITORING CHALLENGES

Since its inception, CSHH's water-monitoring program has grown, and water-quality improvements in the harbor have become increasingly evident. More than ever before, there is widespread acknowledgment of the importance of conducting water-monitoring programs in tandem with implementing pollution-abatement strategies so that benchmarks can be established and improvements can be measured.

In 2003, the Citizens Advisory Committee for the Long Island Sound Study determined that water monitoring should be a fundable priority. Also in 2003, in formulating priorities under its Harbor Management Plan, the HHPC members gave continued water-quality monitoring in Hempstead Harbor a number-one priority ranking. Despite this unprecedented support, water-quality monitoring programs can be difficult to maintain, particularly for nonprofit organizations, because of current inadequate funding and technical and research resources.

Sensitive Technology

There are also the day-to-day challenges of dealing with increasingly sensitive and complicated monitoring equipment, boat availability, data management and analysis, record keeping, and inclement weather. For example, in 2001, we experienced many technical difficulties with the phone lines that were transmitting data from our stationary probe to UCONN, so we converted to wireless service, which has been (surprisingly) more reliable. The computer that was dedicated to communicating with the stationary probe failed and had to be replaced. Between 2001and 2003, temperature and DO sensors had to be replaced, as these have only a limited shelf life; the sonde for weekly testing had to be completely overhauled; and the display unit for the same had to be replaced.

Early in the 2001 sampling season, the boats we had been using previously were not available, and it was difficult to schedule sampling for all stations. However, we managed to maintain our weekly monitoring, as volunteers, the town, and the Nassau County Marine Police came to the rescue.

Barge Collision

In March 2002, barges from the sand and gravel transfer business that were anchored off of the west shore of the harbor broke loose during high winds and traveled south, colliding into Beacon 11, the navigational light on which the stationary probe gear had been fastened, and into the Bar Beach fishing pier. Fortunately, the probe had been removed days before for servicing, but the PVC sleeve for the probe and the cable, solar panel, and transmitter were now at an angle pointing east, as the beacon was left leaning to one side.

Beacon 11 *(Photo: Carol DiPaolo)*

Months passed before we could get a decision from the U.S. Coast Guard as to whether it was safe to approach the beacon to redeploy the probe, which we were finally able to do. However, wind and ice flows in the harbor during early 2003, destroyed the already weakened PVC sleeve that was attached to the beacon. Therefore, plans were made to relocate the stationary probe to the Tappen Marina seawall, but that could not be accomplished until July 2003. Things were operating smoothly for a while, until it was time to retrieve the probe in late November. Then, high winds, snow, and ice prevented us from going the short distance to the seawall to retrieve the probe until March 2004. The probe continued to pick up data, even as water temperature hovered around 30°F.

Data Analysis

It is difficult to draw direct relationships among all the variables that enter into the water-quality scenario, and this is the challenge presented every year in attempting to analyze the past season's water-quality data. The graphs presented in the electronic portion of this report compare parameters that historically show correlations, but we also see significant variability. The data archived over the years is 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 interrelationships that have an impact on whether marine and other organisms will survive and whether local waters are safe for swimming, fishing, and other recreational pursuits.

The data collected through CSHH's 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 that will assure a healthy environment for the future.

LOCATION OF TESTING STATIONS

CSHH's water-monitoring program includes eight midharbor testing stations. Four of the stations are north of the Bar Beach spit:

- CSHH #1 at Beacon 11 (between Tappen Beach Marina on the east shore and Bar Beach on the west shore);
- CSHH #2 at Bell 6 (a stationary marker at the mouth of the harbor, east of Mott Point);
- CSHH #3 at the red channel marker near the mouth of Glen Cove Creek, between the Hempstead Harbor Club (which is adjacent to Garvies Point) and Sea Cliff Beach; and
- CSHH #8, the newest station, added in 1999, at the Glen Cove sewage treatment plant (STP) outfall pipe.

The four stations located in the lower harbor are:

- CSHH #4 at the Bar Beach spit;
- CSHH #5 at Mott's Cove;
- CSHH #6 at a point east of the site of the former Town of North Hempstead incinerator; and
- CSHH #7, the station farthest south in the harbor, at a point west of the old oil dock that was located on the east shore.

FREQUENCY OF TESTING AND TESTING PARAMETERS

Testing is conducted weekly, from May to November, at each station, generally on the same day of the week and at the same time (beginning at about 8 AM until about 12 noon). CSHH continues to rely on volunteers as well as town staff to assist with sampling and to provide boats to get to the midharbor stations.

Water samples are collected by CSHH weekly from all eight testing stations for coliform analysis by the Nassau County Department of Health. In addition, tests for dissolved oxygen (DO), salinity, water temperature, pH, nitrite, nitrate, and ammonia are conducted weekly at the four upper-harbor stations and monthly at the four lower-harbor stations. Chlorine testing is conducted at CSHH #8, near the outfall of the Glen Cove sewage treatment plant.

Dissolved oxygen, salinity, and water temperature are measured with an electronic meter (YSI Model 600 sonde with 650 MDS display unit) at 1-meter increments within the water column at every station. A DO reading for bottom water is also taken using the Winkler titration method at the first testing station as a quality assurance check to make sure that the electronic meter is working properly. The water samples taken at every station are grabbed within a half meter below the water surface. Titration kits (LaMotte) are used to conduct tests for pH, ammonia, and chlorine; lab technicians at the Town of Oyster Bay Lab use an electronic kit (Hach) for nitrite and nitrate test. Periodically, samples are also collected for plankton analysis by the Department of Health.

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.

Water turbidity, or clarity, is measured by lowering a Secchi disk and recording the distance between the water surface and the depth at which the disk disappears from sight. The average Secchi reading for Hempstead Harbor during the summer months is about 1 meter, due to the large amount of plankton in the water, which gives the harbor its usual green to brown color.

Heavy Metals and VOCs

In September 2001, CSHH conducted special sampling in the water column for heavy metals, petroleum hydrocarbons, and volatile organic compounds (VOCs) (levels for pH, phosphorous, and total suspended solids were also checked in these samples). Such testing was recommended under the HHPC's Water Quality Improvement Plan. Four of the eight CSHH stations were selected after consulting NCDH staff and laboratory specialists. CSHH #2 was used as a control station because of its location at the mouth of the harbor, away from industrial activities. The other stations, CSHH #4, by the Bar Beach spit (which is also near the KeySpan power plant and Mobil oil terminal), CSHH #6, near the old Port Washington incinerator site (and capped landfill), and CSHH #8, near the outfall of the Glen Cove STP (in Glen Cove Creek), were selected because of proximity to past or present industrial activities.

Analyses were completed for two to three samples at each of the four stations, including samples from the top, midsection, and bottom of the water column. Levels were measured for 23 metals: antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silicon, silver, sodium, thallium, vanadium, and zinc. Results for all but one element in all stations were less the minimum reportable concentrations available for those tests. Manganese results averaged between 129 parts per billion (ppb) at the mouth of the harbor and 171 ppb at the lower harbor station near the old Port Washington incinerator site. The level at the Bar Beach station averaged 157 ppb and averaged 129 ppb at the Glen Cove STP outfall. It would be unusual to find large concentrations of many of these metals in the water column, because they tend to sink into the sediments. Because of the very low test results, we would consider sediment testing next, rather than retesting the water column.

The test results for the petroleum hydrocarbons and volatile organics also came in at very low levels—nearly all showed levels at less than minimum reportable concentrations for drinking water standards (less than 0.5 ppm). Of the 58 volatile organics analyzed, the one organic that showed up in the surface water at all stations in levels above the minimum reportable concentration was Methyl-t-Butyl Ether (MTBE), the gasoline additive that is now banned. The MTBE levels found were 0.6 ppb at the mouth of the harbor; 0.8 ppb near the Bar Beach spit; 0.8 ppb near the old Port Washington incinerator site (2.0 ppb of Bromoform was also found there); and 1.4 ppb near the Glen Cove STP outfall. The expectation was that a larger number of organics at higher levels would be detected in the surface water near the STP outfall, because of the variety of industrial and commercial activities that discharge to it. However, samples of surface water taken near the STP showed only three organics in addition to MTBE that were at levels above the minimum reportable concentrations: c-1,2-Dichloroethylene, 0.7 ppb; Chloroform, 1.7 ppb; Tetrachloroethylene, 1.9 ppb. (See **Appendix 1** for a description of Bromoform, Dichloroethylene, Chloroform, and Tetgrachloroethylene.)

Sampling at Discharge Points

Circumstances that occurred in 2001-2003 led to additional sampling by the Glen Cove STP and several other discharge points. For example, **chlorine testing** (using a LaMotte test kit) was added to the program in 2001, following KeySpan's announcement that it would be adding chlorine to the water drawn in from and then discharged back into the harbor for the power plant's noncontact cooling system. Algae and other organisms from the harbor were clogging things up in the cooling system, and small amounts of chlorine are now injected periodically during the course of the day to curtail any growth of marine organisms. Additional samples were taken near discharge pipes from the power plant to check whether there were any detectable levels of chlorine. None were found, so that sampling went on only through the 2001 and part of the 2002 season.

Glen Cove STP discharge (left); other outfall pipes (Photo: Carol DiPaolo)

Also in 2001, we began testing for chlorine by the outfall of the Glen Cove STP. Chlorine is used for the disinfection process at the STP, and by-products of chlorine can have an adverse impact on marine life, so it was important to add this test to the others that are conducted at this station. Often, chlorine odors were evident, particularly discharge from the outfall.

Over the course of the sampling 2001 season, we measured a wide range of levels, from no detectable amounts to 0.8 parts per million (ppm) for total and residual chlorine. The permit limitation is 2.0 ppm, but whenever levels were near the top of the range, we notified the NCDH, Glen Cove Public Works Department, and the STP operator. This trend was repeated in 2002 and 2003, with up to 2.0 ppm total and residual chlorine measured in the fall of 2003 as the STP was

getting ready to go on-line with its new bio-nutrient removal system. The plant is scheduled to go to an ultraviolet system for disinfection, which will eliminate the use of chlorine.

In June 2003, a confluence of events made us aware of discharge pipes that hadn't been previously noticed. While sampling at CSHH #8 during a very low tide, we saw what seemed to be old **storm-water drainage pipes** protruding from the same seawall as the STP outfall pipe. The location of these pipes and the fact that there was a heavy flow from them, prompted us to take additional samples for coliform analysis. The results showed high coliform counts, which led the NCDH to make a site visit. The source could not be determined, and the pipes did not appear on the new GIS map that had been recently completed for discharge pipes around Hempstead Harbor (undertaken by the county for the HHPC). Sampling at three additional discharge pipes continued for the rest of the season and were checked against rain events. The coliform levels varied. A plan is now in place to tour the harbor during low tide in the spring of 2004 and check off the outfall pipes that have been included on the GIS map and add any that may be missing. A water-sampling plan for these pipes then will be determined for the 2004 sampling season.

TESTING RESULTS

The tables at **Appendix 2** provide monthly and seasonal averages for water temperature, DO, salinity, and air temperature for the four upper-harbor stations for years 1995-2003. This information is also presented in a bar graph at Section

Temperature

Temperature is an important factor for marine organisms. Changes in water temperature can have an impact on migration patterns of certain species and can affect their metabolic rates. It also plays a role in DO.

Overall, the **average air temperature** (which affects water temperature) recorded for June-October 2001 was about 25°C (about 77°F) as compared with the preceding year's average of about 22°C (72°F). August 2001 had the three-year (2001-2003) average high of 29°C (about 85°F). Average air temperature for 2002 was closer to that of 2001; average air temperature for 2003 was cooler than for the preceding two years.

Average water temperatures recorded for June-October 2001 and 2002 were similar—about 21°C (about 70°F). In 2003, average water temperatures were the coolest recorded over the last five years (about 19°C, 66°F). Changes in water temperature can have an impact on the health of marine life, particularly for species that inhabit waters that are at the extreme boundaries of their normal range, as is the case for the lobsters living in Long Island Sound and its embayments.

Salinity

Salinity, along with temperature, has an effect on DO levels as well as on marine organisms. The salinity of water in the open ocean is generally measured at 35 parts per thousand (ppt), whereas esturine water has lower salinity readings because the ocean water is diluted by fresh water from rivers. In Long Island Sound, salinity can range between 21 ppt and 28 ppt. Variations in salinity are more noticeable in some areas around the sound than in others; for example, near the Connecticut shoreline, the large rivers that flow from that region into Long Island Sound can lower salinity in that area. Salinity values may also be affected by rainfall. There are also variations in salinity between surface water and bottom water.

During the testing season, salinity readings in Hempstead Harbor usually range from 23 ppt to 28 ppt, with lower readings generally observed in the spring, and gradually increasing through the fall. In 2001, we noticed a wider range of variability, with salinity readings of 23 ppt to 27ppt. In contrast, salinity readings for 2002 and 2003 remained within a narrow range, 26-27 ppt for 2002 and 25-27 for 2003. (See the tables below and the weekly data tables at **Section 4a** on the CD ROM portion of the report.) Average salinity readings for bottom water at the four upper-harbor testing stations in Hempstead Harbor are included in the table below for years 1997-2003.

Salinity Averages

	Beacon 11	**Bell 6**	**Red Channel Marker, Near Glen Cove Creek**	**Glen Cove STP Outfall**
2003	25.25 ppt	25.70 ppt	25.45 ppt	25.09 ppt
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

Precipitation

Precipitation has an impact on water conditions, primarily because of the resulting surge in storm-water runoff, which washes chemicals, bacteria, and other pollutants into the harbor. Total rainfall amounts for 2003 and 2002 testing seasons were greater than they were for the preceding five years. See the table below for monthly and seasonal comparisons. (Our rainfall data are collected using a rain gage in Sea Cliff. Amounts are record in millimeters (mm); for shortcut estimates in inches, 25 mm is equivalent to about 1 inch.)

Monthly Rainfall Totals for 1997-2003

	June	**July**	**August**	**September**	**October**	**Total**
2003	291.5 mm	87 mm	88 mm	194.5 mm	134 mm	795 mm
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+

Dissolved Oxygen

DO is one of the most important indicators of the health of the marine environment. It is this form of oxygen that all marine life needs to survive. It is measured in parts per million (ppm) (or the equivalent milligrams per liter, mg/l). Generally, levels above 5 ppm are considered healthy; levels below 5 ppm begin to cause various adverse impacts (e.g., related to growth and reproduction) for aquatic species. Critical levels—below 3.0 ppm—can be lethal.

DO levels tend to be higher at the surface and lower at the bottom of the water column. This report compares bottom readings, which are considered critical because bottom-dwelling marine life have more difficulty than other marine species in trying to escape low DO (**hypoxic**) conditions. Hypoxic and **anoxic** (no DO) can cause death for certain fish and other marine life, depending on the duration of the event and the distance over which it occurs. Historically, hypoxia has been implicated in fish kills, particularly of bunker but also of juvenile flounder and other species. Fortunately, there were no fish kills over the past three years, despite extended periods of hypoxia.

It is difficult to draw conclusions about trends related to DO testing results. There are many variables that affect DO, including climatic factors, such as temperature, precipitation, and wind.Human activities, such as nitrogen discharges from sewage treatment plants and overuse of fertilizers in agriculture, home gardening, and golf course maintenance also have an impact. Over the short term, fluctuations in DO levels can be observed; the challenge is to determine the period over which a legitimate trend exists and whether it can help forecast certain events.

The seasonal averages for DO, as well as the fluctuations in DO between testing stations, are reflected in the table below. So, we can see that overall, DO averages for 2002-2003 were lower (worse) than they were in preceding years. See also the fish graphs at **Section 3** of the CD ROM portion of this report.

Dissolved Oxygen Averages (2002) (June–October) Averages for Bottom DO	***2003 (ppm)***	***2002 (ppm)***	***2001***	***2000***	***1999***	***1998***	***1997***	***1996***
Beacon 11	4.63	4.64	5.16	5.64	5.85	5.17	4.39	5.90
Bell 6	4.55	5.11	5.46	6.10	5.44	5.45	4.54	7.11
Glen Cove Creek, Red Channel Marker	5.21	5.20	6.47	6.54	6.32	6.48	5.15	7.45
Glen Cove STP Outfall	5.28	6.11	6.82	7.35	7.14	N/A	N/A	N/A

The table below shows the number and percentage of days that DO was at specific levels.

Number and Percentage of Testing Dates (June-October)
At Which DO Tested at Specific Levels

	>6 ppm		**5 through 6 ppm**		**3 to 5 ppm**		**<3 ppm**	
			Beacon 11					
1996	11	58**%**	—	—%	3	16**%**	5	26**%**
1997	4	27	3	20	4	27	4	27
1998	8	40	4	20	6	30	2	10
1999	11	50	3	14	5	23	3	14
2000	8	44	2	11	8	44	0	0
2001	7	37	3	16	6	31	3	16
2002	5	26	5	26	3	16	6	32
2003	5	25	5	25	5	25	5	25
			Bell Marker 6					
1996	10	63**%**	2	13**%**	3	19**%**	1	6**%**
1997	2	13	2	13	5	33	6	40
1998	9	50	2	15	5	28	2	11
1999	8	42	1	5	6	32	4	21
2000	11	61	3	17	3	17	1	6
2001	8	42	5	26	2	10	4	21
2002	9	50	0	0	4	22	5	28
2003	6	32	4	21	4	21	5	26
			Glen Cove Creek					
1996	12	63**%**	2	11**%**	4	21**%**	1	5**%**
1997	6	38	2	13	4	25	4	25
1998	12	63	2	11	3	16	2	11
1999	13	59	3	14	3	14	3	14
2000	13	68	2	11	4	21	0	0
2001	11	58	2	10	4	21	2	10
2002	10	53	0	0	4	21	5	26
2003	8	42	3	16	5	26	3	16
			Glen Cove STP Outfall					
1999	12	57%	4	19%	5	24%	0	0%
2000	17	94	1	6	0	0	0	0
2001	12	63	5	26	1	5**%**	1	5
2002	7	37	8	42	3	16	1	5
2003	7	35	6	30	5	25	2	10

The table above shows that for 2001-2003, the levels of DO fell lower (<3 ppm) a greater percentage of the time than they had in the three preceding years. This decline reflects conditions that also occurred in Long Island Sound. However, DO levels in Hempstead Harbor were generally higher (better) than DO levels in the sound.

Coliform

Coliform is a bacteria that is used as an indicator organism to determine whether other bacteria may be present in local waters that could pose a risk to human health. **Fecal coliform** is found in the intestine of warm-blooded animals and birds; and **total coliform** is more widely present, for example, it is found in soil. Coliform sampling is conducted by the Nassau County Department of Health at the five beaches around Hempstead Harbor. Samples are collected twice a week from mid-April through mid-September.

As part of the CSHH's expanded water-monitoring program, four stations were designated in the lower harbor specifically for coliform sampling and phytoplankton analysis, although a full survey of testing is conducted at these stations on a monthly basis. Samples are collected for coliform testing at the four upper-harbor stations as well. These samples are delivered to the Tappen Beach dock master's building, picked up by a county staff person, and brought to the county lab for testing; all NCDH protocols are followed for sample collection and storage.

During the 1980s, there were chronic raw sewage spills into Hempstead Harbor, which caused elevated levels of pathogen contamination, 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.

During the early years of CSHH's water-monitoring program, there was a significant drop-off in beach closures, and over the last 15 years, water quality has improved remarkably. One of the important benchmarks that supports this observation is that the summer of 2003 was the tenth consecutive beach season in which there were no beach closings due to high coliform counts. However, in 2000, the NCDH announced **preemptive (or administrative) beach closings** all around the county, including for Hempstead Harbor, following certain rain events. These closings, based on amount of rainfall and duration, assume that there will be high bacteria levels resulting from the rush of **storm water** into coastal waters. These preemptive closings highlight the importance of implementing best management practices for storm-water runoff abatement. Preemptive closings in Hempstead Harbor occurred on August 28 and 29, 2000, following a rainfall of nearly 3 inches. In 2001, there were two other preemptive beach closings around the harbor—August 24 and 28—in each case following about a half-inch rainfall.

NCDH measures both fecal coliform and total coliform in "most probable numbers" (MPN). The NCDH also calculates 30-day "log averages" to prevent skewing of straight averages due to very high or very low MPNs. Beginning in 2002, NCDH began measuring another indicator organism, **enterococcus**. (See the Nassau County Department of Health Beach Data included in the tables at **Appendix 3**.)

The tables below compare average (monthly and seasonal) total and fecal coliform MPNs for samples taken by the NCDH at the five beaches around Hempstead Harbor. Note, however, that the averages below are calculated as straight averages, not log averages as used by the NCDH. Also, the tables for 2002 and 2003 include MPNs for enterococcus, the indicator organism that was recommended by the EPA for use in beach closure decisions (see the section below on New Beach Closure Standards). (Also, note that the Sands Point Golf Club mentioned in the tables is the site of what was formerly referred to as IBM Beach.)

The tables below show wide variations in monthly and seasonal averages as well as among the five beaches. (A goose or flock of geese that may have just landed nearby can affect sampling results.) No clear trends are evident. It is also difficult to see clear and consistent influences from rainfall when rainfall dates are plotted against coliform counts, as they are in **Section 6** of the CD ROM portion of this report.

Comparison of Coliform and Enterococci MPN Averages

2001

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

2002

	Average Coliform MPN	Tappen Beach	Sea Cliff Beach	Bar Beach	Hempstead Harbor Beach	Sands Point Gulf Club
April	Total	728	163	157	326	160
	Fecal	**658**	**53**	**11**	**39**	**44**
	Enterococci	**183**	**63**	**32**	**33**	**14**
May	Total	282	194	127	145	130
	Fecal	**169**	**46**	**78**	**124**	**76**
	Enterococci	**57**	**54**	**24**	**44**	**41**
June	Total	1604	750	431	674	560
	Fecal	**1016**	**154**	**168**	**559**	**123**
	Enterococci	**163**	**34**	**65**	**163**	**73**
July	Total	2770	4779	964	1921	613
	Fecal	**1367**	**210**	**831**	**810**	**246**
	Enterococci	**439**	**121**	**138**	**553**	**206**
August	Total	1625	1832	6202	3277	4773
	Fecal	**1278**	**839**	**2130**	**2971**	**2593**
	Enterococci	**364**	**219**	**322**	**248**	**751**
Season Averages	*Total*	*1463*	*1626*	*3096*	*1969*	*1226*
	Fecal	***1008***	***451***	***1133***	***1637***	***605***
	Enterococci	***276***	***137***	***184***	***222***	***214***

2003

	Average Coliform MPN	Tappen Beach	Sea Cliff Beach	Bar Beach	Hempstead Harbor	Sands Point Gulf

					Beach	Club
April	Total	155	19	159	140	13
	Fecal	**19**	**5**	**152**	**44**	**8**
	Enterococci	**54**	**9**	**108**	**37**	**9**
May	Total	154	1277	130	122	161
	Fecal	**88**	**143**	**47**	**35**	**62**
	Enterococci	**26**	**33**	**13**	**45**	**17**
June	Total	724	915	478	1747	197
	Fecal	**255**	**111**	**64**	**136**	**80**
	Enterococci	**265**	**129**	**83**	**142**	**46**
July	Total	517	1810	1237	781	239
	Fecal	**203**	**304**	**874**	**539**	**65**
	Enterococci	**45**	**139**	**230**	**128**	**99**
August	Total	2117	22364	804	678	347
	Fecal	**1904**	**3114**	**334**	**344**	**81**
	Enterococci	**177**	**119**	**147**	**108**	**60**
September	Total	*910*	*1820*	*1033*	*3500*	*6567*
	Fecal	***274***	***110***	***177***	***1090***	***977***
	Enterococci	***215***	***696***	***106***	***716***	***718***
Season Averages	*Total*	*1097*	*8735*	*816*	*949*	*632*
	Fecal	***809***	***1222***	***421***	***370***	***126***
	Enterococci	***133***	***142***	***147***	***141***	***104***

New Beach Closure Standards

In October 2000, Congress enacted the **Beaches Environmental Assessment and Coastal Act of 2000** (BEACH Act), which gave 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. Anticipating that the new standards would require using a different indicator organism in analyzing water samples, the NCDH began doing parallel testing in 2002, using the state's current indicator—coliform (both total and fecal)—along with the proposed indicator—enterococcus. Both coliform and enterococcus are naturally present in the human intestine and, therefore, could indicate the presence of other potentially harmful organisms. (Both coliform and enterococci are present also in the intestines of warm-blooded animals and birds.) EPA considers the enterococcal standard to be more closely correlated with gastrointestinal illnesses and, therefore, more protective of human health. However, there have been only limited studies as to the effectiveness of using the enterococcal standard. A primary advantage in switching to the new standard is that it takes only 24 hours to obtain results, whereas it takes 48 hours to obtain results using the coliform standard.

Through December 2003, the New York State Sanitary Code allowed either of two coliform standards to be used to determine whether beaches remain open, described below.

Total Coliform: The 30-day logarithmic average should not exceed 2,400 organisms/100 ml, *and*

20% or more of the samples in a 30-day period should not exceed 5,000 organisms/100 ml.

or

Fecal Coliform: The 30-day logarithmic average should not exceed 200 organisms/100 ml, *and*
No one sample should exceed 1,000 organisms/100 ml.

Nassau County has relied primarily on the total coliform standard.

The **proposed EPA standard** would rely solely on the presence of enterococci, whereby:
The 30-day logarithmic average should not exceed 35 organisms/100 ml, and
No one sample should exceed 104 organisms/100 ml.

Tests conducted at beaches around Hempstead Harbor had widely disparate results between the two standards. The total and fecal coliform tests did not result in any beach closures in 2002 and 2003; however, had the enterococcal standard been the determining standard, the same beaches over the same two-year period would have been closed 56 and 46 days, respectively (including preemptive closures, which would require that the beaches remain closed for 72 hours following more than a ¼-inch rainfall in a 24-hour period).

In 2002, CSHH alerted HHPC members about the new BEACH standard and recommended that the NCDH meet with the committee so that community members would understand the full effect of using the new standard. Because the New York State Department of Health postponed its final decision to adopt the new standard, the meeting between the committee and the local health department did not take place until February 2004, when members were given the results of the 2002 and 2003 testing and the potential for closing beaches for half of the 2004 season. CSHH reviewed the BEACH Act legislation and the studies cited, contacted local environmental agencies to discuss the NCDH findings, and worked with the HHPC to request that the New York State Department of Health postpone its decision until:

- appropriate local studies can be conducted to determine whether the new standard is truly more protective of human health than the old standard, given the fact that there have been significant water quality improvements and there has been no evidence that large numbers of bathers are becoming ill from contact with local waters;
- new methodologies are developed to specifically identify the sources of the indicator organisms (i.e., whether the source is from water birds, such as ducks or geese, or from humans);
- beach closure standards can be coordinated with standards for closing shellfish beds.

In March 2004, the New York Department of Health rescinded its decision to use the enterococcus indicator solely, following discussions with EPA and input from New York Department of Environmental Conservation regarding conflicts with standards for closing shellfish beds. As a result, for the 2004 beach season, the NCDH will be able to continue using total and fecal coliform to determine beach closures but will also do sampling analysis to check levels of enterococci.

Nitrogen

Excess nitrogen can enter local waters through storm-water runoff (rain washes animal wastes and fertilizers from lawns and gardens into roadways, down into storm drains, and eventually into the harbor) and through discharges from sewage treatment plants. Nitrogen acts as a catalyst in the growth of algae, which has an impact on water quality (see the previous section on Algal Blooms). As the algal cells decompose, they use up available dissolved oxygen, which can have adverse impacts on marine life (see the previous section on Dissolved Oxygen).

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 storm-water inputs is more complicated because the sources of nitrogen and other pollutants are so diffuse.

CSHH takes samples weekly at upper harbor stations (CSHH 1, 2, 3, and 8) and approximately monthly at lower harbor stations to test for all elements in the nitrogen cycle--nitrite (NO_2), nitrate (NO_3), and ammonia (NH_3). Nitrite and nitrate samples are currently analyzed at the Town of Oyster Bay lab using an electronic Hach kit. Ammonia is testing on board at the different stations using a LaMotte testing kit.

In 2003, we started entering the data that was collected into spreadsheets to begin comparing nitrogen levels at different stations over different years (see Appendix 2 for nitrite and nitrate data for 2003). This is particularly important because of the upgrades made at the **Glen Cove sewage treatment plant** to a **biological nutrient removal system**, which was fully on line in October 2003. Because CSHH sampling is conducted near the outfall pipe of the plant, we will be able to compare the nitrogen levels in the water column before and after the new bio-nutrient removal system went on line. We will look for broader effects as well, as we compare nitrogen levels at other stations.

The Glen Cove STP operator conducts sampling within the plant and reported that aggregate nitrogen discharges had been reduced from 639 lb per day in February 2001 to 531 lb per day in January 2003, a 17% reduction as the plant began the changeover to the bio-nutrient removal system. In October 2003, the aggregate nitrogen discharge had dropped to 258 lb per day, about a 60% reduction from the February 2001 level. CSHH's continued monitoring will help track the effects of these improvements on the marine environment.

Stationary Probe Data

As mentioned previously, a YSI electronic probe, purchased by the Town of Oyster Bay, was deployed in Hempstead Harbor in July 1999. In September 2000, the stationary probe was upgraded to include telemetry equipment so that data can be transmitted to a building at Tappen Marina, sent to UCONN for processing, and incorporated into the MYSound Web site at http://www.MYSound.uconn.edu. The data can then be viewed with only a short delay from the time the probe actually measures the water temperature, DO, salinity, pH, and depth.

Initially, the probe was inserted in a PVC pipe that was attached to a leg of Beacon 11, located between Bar Beach and Tappen Beach. In summer 2003, the probe was relocated to the Tappen Marina seawall following a barge collision with the beacon in 2002 and further deterioration of the structure during the winter of 2003. The probe is set at approximately a half

a meter above the harbor bed and is programmed to read and store data 24 hours a day at 15-minute intervals. It records changes in depth, temperature, salinity, pH, and DO.
During the first several months of operation, the following dramatic correlations were evident between:

- tide and DO
- tide and water temperature
- water temperature and DO

. . . so that for daily cycles, no matter what time of day:

- highest tide would coincide with lowest DO
- lowest tide would coincide with highest DO

Also:

- highest tide would coincide with lowest water temperature
- lowest tide would coincide with highest water temperature

And:

- highest water temperature would coincide with highest DO
- lowest water temperature would coincide with lowest DO

These trends have been observed throughout the probe's operation. Hempstead Harbor appears to be a very dynamic system that is unlike other EMPACT sites.

BIOLOGICAL SURVEYS AND OBSERVATIONS

Fish Surveys

Fish surveys are conducted to add formal biological information to the other types of data we collect. The surveys do not fully reflect the quantity or diversity of all the fish in Hempstead Harbor, but they often provide information that would not otherwise be available to us. Tidal cycle, water temperature, weather conditions, time of day, season, and location can all affect the catch during a survey.

Fish surveys were conducted June 9, 2002; June 24, 2003; and September 13, 2003. For each survey, a seine net was dragged at three sites around the harbor. All fish that are caught during the surveys are quickly counted by the shoreline, with the largest and smallest measured and recorded, and all are quickly released back into the water.

In June 2002, we had a surprise catch of nearly a thousand **sand eels** (about 2¾" long) at the station near the entrance of Glen Cove Creek, on the south shore, east of the Sea Cliff Yacht Club! This was compared with three sand eels at Bar Beach Cove. We also caught, counted, and measured the usual bait fish, such as **spearing** (silversides**)** and **mummichugs**, and **sand shrimp** that we are accustomed to seeing. We observed depressions left in the sand by horseshoe crabs for egg laying and found eggs in one of them. There were also lots of snail egg casings on seaweed. The first week of June was very productive for marine life in the harbor, and other surprises were noted (see the Observations section below).

The June 2003 fish survey was scheduled for 7PM in the evening, a change from the usual morning seines. Our catch yielded the usual spearing, sand shrimp, and **stripped killifish**, but in low numbers. A large school of tiny spearing swam right through the seine net. A sizable **American eel** (about 2½' in length) was seen near the small jetty by the Sea Cliff Yacht Club. A couple of pairs of horseshoe crabs were also seen on the shore mating.

During the September 2003 survey, scheduled in the morning, hundreds of silversides were caught at every station—900 at Tappen Beach—along with some stripped killifish and mummichugs. At Tappen Beach there were also 5 **small striped bass**—2½"-5" long. It was a surprise to see such young stripers, which were spawned in the Hudson River, make it all the way to Hempstead Harbor. Another rarity was to see a 3¼" **weakfish.** Fishermen had reported continued good fishing around the harbor with catches of good-sized fluke, bluefish, and striped bass.

Recreational Fishing Reports

Over the last several years, fishermen have reported great fishing in the harbor. Fishing has been so good that a party boat, *Sea Otter West*, based in Glen Cove Creek, does brisk business. During summer 2003, the boat and its owners were featured on a local TV station for its regular fishing segments, during which tips on catching striped bass were given with Hempstead Harbor in the background. Members of local fishing clubs wax poetic about the bounty in the harbor. We rely on their reports to give us a better picture of all that is in the harbor.

Fluke and lobsters *(Photo: Peter Sattler)*

Below are excerpts of two E-mails from Peter Emmerich of the Hempstead Harbor Anglers. On September 24, 2003, Pete wrote:

> *I went out for a couple of hours Monday after work. The entire harbor is LOADED with peanut bunker, and the bluefish are going wild. It is already like the fall feed. Tons of birds working the small bait the blues are pushing to the surface, and the blues are just rolling on the bait. I caught four blues with no effort by the barges; the amount of peanut bunker they threw up on the deck was incredible…. My friends tell me they hit larger blues in Glen Cove Creek Saturday morning and that the larger bunker have been all around the barges in the mornings. Real good news is there are many bass being caught while blue fishing. We await the smaller schoolie bass to join the blues on that peanut bunker.*

On October 1, 2003 he wrote:

> *It continues to be a bonanza in the harbor. Peanut bunker everywhere, and small bluefish all over them. I fished a very serious blitz off Mott's Point and the Elephant Herd [rocks on the west shore near the mouth of the harbor] for an hour before dark last night. Blues hit the plug almost before it hits the water…. Had a friend tell me about the fluke he caught last week deep in the harbor. I am sure this was just a last shot, but it was interesting to see how far they came in. Blackfish season starts today, so my time will be spent in the sound, less in the harbor now. I have set a trap and a holding pen so I can gather green crabs as bait. The holding pen allows me to keep crabs I bought for another day rather than discarding them. So in my trap this week I have found green crabs, 1 blue claw crab, many baby sea robins, and some small porgies. Fish are released unharmed.*

In July 2001, fishermen reported lots of **fluke** (6-7 lb size) along with **weakfish** and **sea bass**. During the August 30, 2001, sampling, a lobsterman in Glen Cove Creek said he saw lots of larger (2 lb) **lobsters** again—he said his catch was about a quarter of what it was at the height of the lobster population in 1999.

During the first week of June 2002, just before our fish survey (see above), a member of the Hempstead Harbor Club found a **sea horse** on the beach by the club. There were also reports of large **mackerel** being caught in the harbor (which hadn't been reported since the 1970s). Large **American eels** and **striped bass** were being caught as well. In July 2002, Peter Sattler, engineer for the Interstate Environmental Commission and recreational diver, spotted an unusual **feathered blenny** on one of his dives near the Glen Cove breakwater. On October 10, 2002, large schools of **bunker** were seen "finning" (dorsal fins showing at the surface of the water), feeding on plankton.

Feathered blenny *(Photo: Peter Sattler)*

Atlantic bonito *(Photo: Nick Basilion)*

In August 2003, we again noted large schools of **bunker** finning. On August 7, 2003, we saw a fisherman reel in a 14" fluke by Bell 6. In September 2003, a member of the Sea Cliff Yacht Club found a **sea horse** on a boat mooring line. Another member of the club caught a 10-14 lb Atlantic **bonito** in Hempstead Harbor!

Jellies

Moon jellies were not sighted on weekly tours of the harbor in 2001-2003 (making it six consecutive seasons of not seeing them in numbers noted previously). **Comb jellies** were observed in each of the three years of this report, appearing in July and staying around as late as November in 2001; in 2002 and 2003, they were last seen in September. On July 22, 2001, thousands of comb jellies were observed in Long Island Sound, and by August 2 the large numbers had made their way into Hempstead Harbor.

The comb jellies we see in Hempstead Harbor include two varieties: 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. Neither moon jellies nor comb jellies have stinging tentacles.

Lion's mane jellyfish were noted on sampling tours of the harbor in the summer 2002 and 2003, but only one or two in each season. These jellyfish do have stinging tentacles.

Seals

On June 14, 2001, CSHH member David North discovered a male **hooded seal** pup beached on the shore of the former Lowe Estate in Glen Cove, now the Legend Yacht and Beach Club. The seal was approximately 5-6 weeks old, under 50 lb, and about 3' long. Marine Rescue of the Riverhead Foundation tried to nurse the seal back to health, but it did not survive—it was underweight, malnourished, and dehydrated. Also, the seal had ingested 8-9 pounds of rocks (something that seems to be peculiar to the arctic species seals that have been rescued), and the rocks had perforated its stomach.

We learned from the Riverhead Foundation that seals have a loose social structure and that pups are weaned in four days and put on their own, making their survival difficult. The arctic species (harp seals and hooded seals) are not frequently seen in Long Island waters, and it was also unusual to see a young pup so late in the season. The most common seals seen in this area are the harbor seals and gray seals.

In July 2003, a **harbor seal** was reported to be trying to climb onto the platform of Bell 6, a navigational aid near the mouth of the harbor and one of the CSHH sampling stations.

Birds

The **ospreys** continue to return to Hempstead Harbor. In spring 2000, there were at least eight active nests, and those continued to be occupied in 2001-2003. In spring 2002, even after Beacon 11 had been hit by the barges and left leaning to one side, the ospreys managed to build another nest at the top of the beacon and compensate for its new angle. Young ospreys were seen in the nest in early May. They returned again in 2003, and in May we noted ospreys on a new nest on the top of Beacon 11 and in the lower harbor on nests on two platforms, on a nest on old pilings, and another nest at the end of a dock. This is an important indicator of improving water-quality conditions and habitat in the harbor. Ospreys are frequently seen flying over all areas of the harbor, diving for fish, and feeding their young.

Osprey taking fish to nest (Photo: Carol DiPaolo)

The **swan** population in Hempstead Harbor also continues to swell. Adult swans and their cygnets were observed in all areas of the harbor and Glen Cove Creek throughout the testing seasons. Up to 20 in 2001 and over 30 in 2002, were seen congregating north of Hempstead Harbor Beach and Tappen Beach. Numerous **cormorants**, **egrets**, **herons**, **Canada geese**, **terns**, **mallards**, and **gulls** were noted throughout the harbor as well during each of the testing seasons. In 2002, we noted **kingfishers** on the north side of Glen Cove Creek, just east of Captain's Cove and also south of Tappen Marina. Hempstead Harbor is an important flyway for migrating birds, and in late winter and early spring many different water birds, such as **mergansers**, **buffleheads**, and **goldeneyes**, can be seen, and some, such as **scaups**, can be observed in rafts of hundreds.

Algal Blooms

Phytoplankton, or **algae,** are microscopic plants that drift through the water. These plants can experience growth spurts, or "blooms," in which the density of the plants can create low visibility, reduce the light that filters through the water to larger bottom-growing plants, and affect the supply of dissolved oxygen that is needed by all marine life to survive. Hempstead Harbor, like other areas around Long Island Sound, experiences frequent and prolonged algal blooms, which are particularly noticeable during the summer months. These blooms can also change the color of the harbor's water, ranging from shades of green and brown to red.

Green tide evident in boat wake (Photo: Carol DiPaolo)

The "normal" colors for the harbor are in the green and brown shades, although there can be abnormally bright or opaque greens and very dark, thick browns.

In 2001, we classified sections of the harbor's water color as abnormal on four sampling days: June 14 (dark brown); July 3 and July 10 (thick green); and August 9 (the water in Tappen Marina was an abnormal brownish red). During much of the summer there was a high level of turbidity (lots of particles in the water) and low visibility (.5-.7 m measure with the Secchi disk)

In 2002, we classified sections of the harbor's water color as abnormal on three sampling days: August 22 (brownish red); October 3 (brown, accompanied by unusually high DO, which meant the we caught the bloom in a growth stage; when the algae cells die and decompose, they use up oxygen and cause hypoxic (low oxygen) or anoxic (no oxygen) events); November 14 (green).

In 2003, we classified sections of the harbor's water color as abnormal on three sampling days: On June 19, we noticed that the water was very green but hesitated to call it "abnormal." When we saw dead shrimp on the surface of the water at the Tappen Marina, we took plankton samples, which were analyzed by the NCDH. The plankton was identified as prorocentrum minimum, which is known to be a toxin producer. On June 25, there was a very bright green tide throughout the harbor, which made the boat wake noticeably green; we took plankton samples, and the NCDH identified the presence of a type of euglenaphyte plankton. On July 2, a brown tide accompanied low DO levels. The brown tide was so noticeable that we received reports of a possible sewage spill, and we made an extra tour of the harbor and traveled into the sound, across to Mamaroneck to follow the noticeably dark patches of brown. We took coliform samples; NCDH's analysis confirmed an algal bloom.

Swan family in Glen Cove Creek *(Photo: Carol DiPaolo)*

APPENDIX 1. Description of Selected Volatile Organic Compounds

The following information was obtained from the Agency for Toxic Substances and Disease Registry (ATSDR) on-line ToxFAQs profiles.

Bromoform

Bromoform (also known as tribromomethane) and dibromochloromethane are colorless to yellow, heavy, nonburnable liquids with a sweetish odor. These chemicals are possible contaminants of drinking water that has been chlorinated to kill bacteria and viruses that could cause serious waterborne infectious diseases. Bromoform and dibromochloromethane may form when chlorine reacts with other naturally occurring substances in water, such as decomposing plant material. Plants in the ocean also produce small amounts of these chemicals.
In the past, bromoform was used by industry to dissolve dirt and grease and to make other chemicals, and it was also used in the early part of this century as a medicine to help children with whooping cough get to sleep. Currently, bromoform is produced in only small amounts for use in laboratories and in geological and electronics testing. Dibromochloromethane was used in the past to make other chemicals such as fire extinguisher fluids, spray can propellants, refrigerator fluid, and pesticides. It is now used only on a small scale in laboratories.

Bromoform and dibromochloromethane enter the environment through the disposal of water that has been disinfected with chlorine or as vapors emitted from chlorinated water. These chemicals are also made naturally by plant-like organisms called algae in the oceans. Some part of bromoform and dibromochloromethane that enters the air is taken out of the air in rain. What is left in the air takes about one to two months for half of it to degrade. In water, bromoform and dibromochloromethane are slowly broken down at the water surface where oxygen is available but break down much faster in deep water and in water that is underground where there is a lot less oxygen. Bromoform and dibromochloromethane are mobile in soils and may seep into groundwater. Bromoform and dibromochloromethane do not appear to concentrate in fish.

Chloroform

Chloroform is also known as trichloromethane or methyltrichloride. It is a colorless liquid with a pleasant, nonirritating odor and a slightly sweet taste. Most of the chloroform found in the environment comes from industry. It will burn only when it reaches very high temperatures. Chloroform was one of the first inhaled anesthetics to be used during surgery, but it is not used for anesthesia today. Nearly all the chloroform made in the United States today is used to make other chemicals, but some is sold or traded to other countries. We also import chloroform.

Chloroform enters the environment from chemical companies and paper mills. It is also found in wastewater from sewage treatment plants and drinking water to which chlorine has been added. Chlorine is added to most drinking water and many wastewaters to destroy bacteria. Small amounts of chloroform are formed as an unwanted product during the process of adding chlorine to water. Chloroform can enter the air directly from factories that make or use it and by evaporating from water and soil that contain it. It can enter water and soil when wastewater that contains chlorine is released into water or soil. It may enter water and soil from spills and by leaks from storage and waste sites. There are many ways for chloroform to enter the environment, so small amounts of it are likely to be found almost everywhere.

1,2 Dichloroethylene

1,2-Dichloroethylene is also called 1,2-dichloroethene or 1,2-DCE. It is a highly flammable, colorless liquid with a sharp, harsh odor. You can smell very small amounts of 1,2-dichloroethene in air (beginning at a level of about 17 ppm). There are two forms of 1,2-dichloroethene; one form is called cis-1,2-dichloroethene and the other is called trans- 1,2-dichloroethene. Sometimes both forms are present as a mixture. 1,2-Dichloroethene is used most often to produce solvents and in chemical mixtures.

1,2-Dichloroethene enters the environment through industrial activity of people. This chemical has been found in air, water, and soil. 1,2-Dichloroethene is released to the environment from chemical factories that make or use this chemical, from landfills and hazardous waste sites containing this chemical, from chemical spills, from burning of objects made of vinyl, and from breakdown of other chlorinated chemicals.

1,2-Dichloroethene evaporates rapidly. When released to moist soil surfaces or to lakes, rivers, and other bodies of water, most of it evaporates into the air. Once in the air, it usually takes about 5-12 days for half of any amount of it to break down (half-life in air). 1,2-Dichloroethene that is below soil surfaces in landfills or hazardous waste sites may dissolve in water, seep deeper into the soil, and possibly contaminate groundwater. Some 1,2-dichloroethene may escape as a vapor. Once in groundwater, it takes about 13-48 weeks for half of a given amount to break down (half-life in water). There is a slight chance that small amounts of the 1,2-dichloroethene found in landfills will eventually break down into vinyl chloride, which is believed to be a more hazardous chemical.

Tetrachloroethylene

Tetrachloroethylene is a synthetic chemical that is widely used for dry cleaning of fabrics and for metal-degreasing operations. It is also used as a starting material (building block) for making other chemicals and is used in some consumer products. Other names for tetrachloroethylene include perchloroethylene, PCE, pert, tetrachloroethene, perclene and perchlor. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part in 1 million parts of air (ppm) or more. In an experiment, some people could smell tetrachloroethylene in water at a level of 0.3 ppm.

Tetrachloroethylene enters the environment mostly by evaporating into the air during use. It can also get into water supplies and the soil during disposal of sewage sludge and factory waste and when leaking from underground storage tanks. It may also get into the air, soil, or water by leaking or evaporating from storage and waste sites. It can stay in the air for several months before it is broken down into other chemicals or is brought back down to the soil and water by rain. Much of the tetrachloroethylene that gets into water and soil will evaporate into the air. However, because tetrachloroethylene can travel through soils quite easily, it can get into underground drinking water supplies. If it gets into underground water, it may stay there for many months without being broken down. If conditions are right, bacteria will break down some of it and some of the chemicals formed may also be harmful. Under some conditions, tetrachloroethylene may stick to the soil and stay there. It does not seem to build up in animals that live in water, such as fish, clams, and oysters. It is not known whether it builds up in plants grown on land.

APPENDIX 2. MONTHLY AND SEASONAL AVERAGES FOR WATER TEMPERATURE, DO, SALINITY, AND AIR TEMPERATURE

CSHH #1- Beacon 11

	2003				2002			
	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	17.00	5.82	23.67	24.6	18.85	4.82	26.42	24.1
July	18.74	3.60	24.97	21.9	21.28	2.31	26.55	25.0
August	21.75	2.10	25.79	23.6	24.02	2.91	26.89	25.0
September	21.60	4.32	26.40	22.2	21.98	5.70	26.50	20.3
October	16.49	6.73	25.23	12.8	17.12	7.13	26.38	13.5
Averages	18.94	4.63	25.25	20.4	20.67	4.64	26.56	21.1

	2001				2000			
	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	20.31	6.62	24.78	24.1	17.10	5.63	24.43	22.2
July	19.40	3.80	25.68	25.2	21.80	5.27	25.03	22.2
August	23.25	2.96	26.19	25.4	22.53	6.41	24.70	24.2
September	22.56	5.45	26.70	20.5	20.99	4.90	25.07	20.9
October	17.05	7.86	26.79	15.8	16.78	6.02	25.24	13.2
Averages	20.90	5.16	26.02	22.5	19.49	5.64	24.87	20.4

CSHH #1- Beacon 11

	1999				1998			
	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	19.66	7.07	24.89	23	17.24	6.24	24.18	21.33
July	21.72	3.42	25.78	30	21.23	4.89	24.66	24.6
August	24.35	4.60	25.99	25	23.95	3.66	24.84	24.5
September	21.90	5.57	25.72	22	22.02	4.57	25.48	20.5
October	17.76	8.29	24.70	12	17.19	6.84	25.27	13.75
Averages	21.01	5.85	24.15	22.22	20.52	5.17	24.88	21.1

	1997				1996			
	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	18.10	7.01	23.71	24.33	19.00	8.35	N/A	23.25
July	20.83	4.34	24.78	23.50	20.04	3.74	24.66	22.75
August	21.85	1.96	25.96	21.5	21.75	2.88	25.13	22.25
September	22.13	3.26	25.81	19.5	21.70	5.14	25.48	19.83
October	17.45	5.83	26.06	13.67	17.34	9.21	24.97	15.25
Averages	20.10	4.39	25.20	20.81	19.87	5.90	25.03	20.71

	1995			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.78	5.30	26.27	19.67
July	20.77	2.66	26.53	25.25
August	23.78	4.56	27.56	24.70
September	21.72	4.34	28.05	20.50
October	17.71	6.90	27.34	16.50
Averages	20.80	4.60	27.21	21.84

CSHH #2 – Bell Marker 6

2003 **2002**

	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	15.58	6.35	24.26	22.4	18.06	6.13	26.55	23.4
July	17.16	2.93	25.35	22.9	19.91	1.81	26.87	27.4
August	21.01	1.74	26.14	23.6	22.85	3.08	27.23	25.4
September	21.20	5.38	26.55	22.0	21.97	5.84	26.89	21.4
October	17.19	6.47	26.03	15.0	17.74	7.68	27.25	13.9
Averages	18.37	4.55	25.70	21.1	20.13	5.11	26.99	21.5

2001 **2000**

	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	16.67	4.97	25.36	23.2	16.45	6.29	24.77	22.4
July	18.45	5.32	26.00	26.2	20.19	4.80	25.38	22.7
August	22.33	3.83	26.46	26.0	22.08	6.46	24.95	24.7
September	21.88	5.80	27.07	21.1	20.89	6.08	25.54	22.3
October	16.94	8.55	27.24	15.9	16.86	7.18	26.07	16.3
Averages	19.58	5.46	26.41	22.8	19.03	6.10	25.28	21.8

CSHH #2 – Bell Marker 6

1999

	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.13	6.41	25.42	23
July	19.62	2.87	26.23	27
August	22.88	4.29	26.80	25
September	22.15	5.75	26.84	26
October	17.18	8.46	26.30	13
Averages	19.67	5.44	26.21	22.73

1998

	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	16.39	6.90	24.45	21.33
July	19.88	4.78	25.13	24.6
August	22.88	3.30	25.27	24.5
September	21.62	6.03	25.82	20.5
October	17.18	6.9	26.27	13.75
Averages	19.66	5.45	25.40	21.1

1997

	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	16.7	9.12	24.14	24.5
July	18.32	3.12	25.33	23.25
August	21.12	2.86	26.41	21.37
September	21.33	3.18	26.79	19.75
October	18.02	5.22	26.59	14.5
Averages	19.12	4.54	25.69	21.37

1996

	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
July	19.15	5.17	24.92	24.5
August	21.1	4.29	24.99	23.17
September	22.05	8.0	25.73	20.17
October	16.95	9.11	25.34	15.75
Averages	19.20	7.14	25.28	20.53

1995

	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C) (Bottom)
June	17.61	7.78	26.5	21.25
July	20.09	4.19	26.93	24.87
August	22.9	4.87	27.77	25.12
September	21.73	5.27	28.44	21.5
October	17.48	7.72	27.80	15.83
Averages	20.30	5.67	27.53	22.16

CSHH #3 – Glen Cove Creek, Red Channel Marker

	2003				2002			
	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	16.47	7.02	23.97	23.9	19.05	6.36	26.48	23.7
July	18.41	4.25	25.08	22.8	20.71	2.61	26.69	25.4
August	21.26	3.74	25.92	23.6	23.36	2.49	27.10	26.9
September	21.48	4.81	26.49	22.4	21.78	6.49	26.71	22.0
October	16.97	6.58	25.61	15.6	17.70	7.98	27.05	14.7
Averages	18.90	5.21	25.45	21.8	20.53	5.20	26.83	22.1

	2001				2000			
	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	18.45	7.63	25.23	24.4	17.69	6.60	24.35	21.6
July	18.55	4.53	25.92	26.0	21.16	5.87	25.26	23.0
August	23.09	4.83	26.34	27.7	22.66	6.44	24.68	23.5
September	22.10	6.92	26.88	21.3	21.45	6.13	24.99	20.5
October	17.02	9.01	27.12	16.3	16.69	7.50	25.52	16.7
Averages	20.23	6.47	26.27	23.6	19.59	6.54	24.94	20.9

CSHH #3 – Glen Cove Creek, Red Channel Marker

	1999				1998			
	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	18.43	6.32	25.09	23	17.23	7.25	24.27	21.33
July	21.57	5.02	25.89	30	21.03	6.34	24.76	24.6
August	23.82	4.87	26.44	26	23.39	3.87	25.14	24.5
September	21.80	6.16	26.25	23	21.88	5.76	25.75	20.5
October	16.74	8.70	25.81	14	16.9	7.79	25.88	13.75
Averages	20.20	6.32	25.74	23.04	20.28	6.16	25.16	21.1

	1997				1996			
	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	17.36	8.32	24.11	26.5	18.25	9.35	N/A	22.12
July	20.2	6.21	25.07	23.37	20.32	7.10	24.46	23.67
August	21.34	2.29	26.29	21.5	21.45	3.20	25.29	22.87
September	21.61	3.12	26.67	20	22.09	6.85	25.69	20.83
October	17.12	5.69	26.69	13.67	16.61	9.88	25.12	15.4
Averages	19.55	5.14	25.66	21.25	19.43	7.44	25.15	20.55

	1995			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C) (Bottom)
June	17.82	5.4	26.58	21.5
July	20.74	4.50	26.87	25
August	23.24	4.79	27.94	24.7
September	21.61	4.78	28.22	21
October	17.4	7.54	27.57	16.5
Averages	20.59	5.26	27.55	22.18

CSHH #8 – Glen Cove Creek, STP Outflow

	2003				2002			
	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	17.01	5.92	23.70	25.7	19.89	7.65	26.12	25.5
July	18.94	4.03	24.94	24.4	22.13	4.33	26.27	26.8
August	22.51	5.23	25.51	26.1	24.64	4.85	26.67	27.7
September	21.58	4.87	25.99	23.5	21.91	6.01	26.41	23.0
October	16.49	6.49	25.10	14.6	17.67	7.69	26.77	16.4
Averages	19.10	5.28	25.09	22.1	21.29	6.11	26.47	23.4

	2001				2000			
	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	20.11	7.61	24.57	26.6	18.66	7.13	23.59	23.8
July	20.18	5.56	25.31	27.1	21.99	6.51	24.93	24.1
August	23.82	6.16	25.86	29.2	23.58	7.75	24.18	24.5
September	22.45	5.74	26.58	22.1	21.17	8.63	24.81	23.6
October	16.67	9.56	26.54	16.7	17.25	7.17	24.87	15.3
Averages	21.05	6.82	25.76	24.8	20.40	7.35	24.40	21.9

	1999			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	19.99	9.11	24.71	23
July	22.70	6.03	25.53	30
August	24.28	5.32	26.19	26
September	21.78	6.14	25.84	24
October	16.63	8.63	25.53	15
Averages	21.02	7.14	25.49	23.70

APPENDIX 3. NASSAU COUNTY DEPARTMENT OF HEALTH BEACH DATA

2001 Total and Fecal Coliform Levels – Harry Tappen Beach

Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Date	Total Coliform (MPN)	Fecal Coliform (MPN)
4/17/2001	230.00	50.00	8/20/2001	230.00	50.00
4/19/2001	17.00	2.00	8/21/2001	160000.00	160000.00
4/25/2001	300.00	130.00	8/21/2001	11000.00	1400.00
4/27/2001	230.00	230.00	8/23/2001	800.00	110.00
5/1/2001	300.00	300.00	8/28/2001	2300.00	300.00
5/3/2001	1300.00	1300.00	8/28/2001	500.00	300.00
5/8/2001	300.00	230.00	8/28/2001	300.00	130.00
5/10/2001	13.00	13.00	8/28/2001	500.00	300.00
5/15/2001	130.00	23.00	8/30/2001	800.00	130.00
5/17/2001	300.00	300.00	9/4/2001	2300.00	2300.00
5/22/2001	5000.00	3000.00	9/6/2001	300.00	130.00
5/24/2001	1300.00	170.00	9/11/2001	1700.00	1100.00
5/29/2001	300.00	80.00	9/13/2001	1700.00	1700.00
5/31/2001	500.00	130.00			
6/5/2001	500.00	130.00			
6/7/2001	3000.00	1300.00			
6/12/2001	300.00	50.00			
6/14/2001	230.00	22.00			
6/19/2001	3000.00	800.00			
6/21/2001	230.00	230.00			
6/26/2001	800.00	220.00			
6/28/2001	300.00	170.00			
7/3/2001	700.00	50.00			
7/5/2001	800.00	500.00			
7/10/2001	1300.00	800.00			
7/12/2001	300.00	80.00			
7/17/2001	1300.00	1300.00			
7/19/2001	800.00	800.00			
7/24/2001	800.00	220.00			
7/24/2001	800.00	500.00			
7/26/2001	230.00	230.00			
7/27/2001	170.00	110.00			
7/27/2001	500.00	500.00			
7/31/2001	8000.00	1700.00			
8/2/2001	800.00	300.00			
8/7/2001	1300.00	70.00			
8/7/2001	2300.00	2300.00			
8/9/2001	80.00	50.00			
8/14/2001	24000.00	8000.00			
8/16/2001	2200.00	1300.00			
8/20/2001	300.00	80.00			
8/20/2001	500.00	33.00			

2001 Total and Fecal Coliform Levels – Sea Cliff Beach

Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Date	Total Coliform (MPN)	Fecal Coliform (MPN)
4/17/2001	30.00	8.00	8/21/2001	500.00	230.00
4/19/2001	70.00	50.00	8/21/2001	800.00	300.00
4/25/2001	230.00	110.00	8/23/2001	800.00	170.00
4/27/2001	13.00	4.00	8/28/2001	160000.00	7000.00
5/1/2001	50.00	50.00	8/28/2001	160000.00	17000.00
5/3/2001	2300.00	230.00	8/28/2001	50000.00	500.00
5/8/2001	1300.00	500.00	8/29/2001	1300.00	220.00
5/10/2001	500.00	130.00	8/29/2001	1300.00	130.00
5/15/2001	230.00	22.00	8/29/2001	23.00	23.00
5/17/2001	80.00	50.00	8/30/2001	230.00	50.00
5/22/2001	1300.00	170.00	9/4/2001	800.00	230.00
5/24/2001	3000.00	1300.00	9/6/2001	500.00	300.00
5/29/2001	130.00	7.00	9/11/2001	2300.00	500.00
5/31/2001	8000.00	280.00	9/13/2001	800.00	170.00
6/5/2001	130.00	7.00			
6/7/2001	130.00	50.00			
6/12/2001	2400.00	170.00			
6/14/2001	230.00	23.00			
6/19/2001	500.00	23.00			
6/21/2001	230.00	130.00			
6/26/2001	300.00	50.00			
6/28/2001	30.00	30.00			
7/3/2001	300.00	11.00			
7/5/2001	500.00	500.00			
7/10/2001	500.00	230.00			
7/12/2001	5000.00	500.00			
7/17/2001	1300.00	1300.00			
7/19/2001	1300.00	500.00			
7/24/2001	800.00	500.00			
7/27/2001	3000.00	300.00			
7/27/2001	2200.00	70.00			
7/31/2001	110.00	80.00			
8/2/2001	2300.00	2300.00			
8/7/2001	230.00	230.00			
8/7/2001	800.00	300.00			
8/9/2001	30.00	23.00			
8/14/2001	2300.00	800.00			
8/16/2001	2800.00	1100.00			
8/20/2001	1400.00	300.00			
8/20/2001	50000.00	50.00			
8/20/2001	24000.00	110.00			

2001 Total and Fecal Coliform Levels – Sands Point Golf Club

Date	Total Coliform (MPN)	Fecal Coliform (MPN)
4/17/2001	13.00	8.00
4/19/2001	8.00	1.00
4/25/2001	80.00	23.00
4/27/2001	2.00	2.00
5/1/2001	7.00	8.00
5/3/2001	50.00	23.00
5/8/2001	17.00	13.00
5/10/2001	34.00	6.00
5/15/2001	17.00	4.00
5/17/2001	23.00	2.00
5/22/2001	5000.00	130.00
5/24/2001	300.00	22.00
5/29/2001	8.00	2.00
5/31/2001	130.00	1.00
6/5/2001	500.00	50.00
6/7/2001	230.00	80.00
6/12/2001	16000.00	700.00
6/14/2001	500.00	50.00
6/19/2001	300.00	50.00
6/21/2001	1300.00	300.00
6/26/2001	80.00	13.00
6/28/2001	70.00	14.00
7/3/2001	50.00	23.00
7/5/2001	230.00	1.00
7/10/2001	23.00	13.00
7/12/2001	30.00	2.00
7/17/2001	80.00	23.00
7/19/2001	1300.00	230.00
7/24/2001	50.00	30.00
7/31/2001	170.00	30.00
8/2/2001	300.00	50.00
8/7/2001	300.00	50.00
8/9/2001	230.00	80.00
8/14/2001	9000.00	700.00
8/16/2001	800.00	50.00
8/20/2001	500.00	80.00
8/21/2001	230.00	50.00
8/23/2001	1300.00	23.00
8/28/2001	9000.00	80.00
8/30/2001	170.00	80.00
9/4/2001	230.00	50.00
9/6/2001	140.00	50.00
9/11/2001	800.00	80.00
9/13/2001	700.00	30.00

2001 Total and Fecal Coliform Levels—Hempstead Harbor Beach					
Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Date	Total Coliform (MPN)	Fecal Coliform (MPN)
4/17/2001	23.00	8.00	8/21/2001	800.00	50.00
4/19/2001	4.00	2.00	8/21/2001	300.00	80.00
4/25/2001	130.00	30.00	8/23/2001	3000.00	80.00
4/27/2001	800.00	300.00	8/23/2001	13000.00	30.00
5/1/2001	13.00	2.00	8/28/2001	230.00	230.00
5/3/2001	50.00	30.00	8/28/2001	230.00	80.00
5/8/2001	170.00	80.00	8/28/2001	1300.00	800.00
5/10/2001	30.00	30.00	8/30/2001	500.00	130.00
5/15/2001	27.00	13.00	9/4/2001	130.00	50.00
5/17/2001	21.00	4.00	9/6/2001	230.00	80.00
5/22/2001	3000.00	500.00	9/11/2001	800.00	230.00
5/24/2001	1300.00	110.00	9/13/2001	230.00	80.00
5/29/2001	170.00	11.00			
5/31/2001	80.00	50.00			
6/5/2001	230.00	130.00			
6/7/2001	800.00	230.00			
6/12/2001	300.00	50.00			
6/14/2001	500.00	170.00			
6/19/2001	500.00	110.00			
6/21/2001	5000.00	3000.00			
6/26/2001	230.00	80.00			
6/28/2001	230.00	130.00			
7/3/2001	300.00	80.00			
7/5/2001	2300.00	2300.00			
7/10/2001	130.00	80.00			
7/12/2001	230.00	23.00			
7/17/2001	500.00	300.00			
7/19/2001	90000.00	50000.00			
7/24/2001	30.00	17.00			
7/24/2001	27.00	27.00			
7/24/2001	30.00	17.00			
7/24/2001	80.00	50.00			
7/24/2001	80.00	80.00			
7/26/2001	1300.00	1300.00			
7/26/2001	500.00	500.00			
7/27/2001	500.00	300.00			
7/27/2001	170.00	170.00			
7/31/2001	230.00	80.00			
8/2/2001	50.00	50.00			
8/7/2001	130.00	50.00			
8/7/2001	23.00	13.00			
8/14/2001	30000.00	13000.00			
8/16/2001	1300.00	500.00			
8/20/2001	1300.00	280.00			
8/20/2001	800.00	500.00			
8/20/2001	800.00	130.00			

2001 Total and Fecal Coliform Levels – Bar Beach

Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Date	Total Coliform (MPN)	Fecal Coliform (MPN)
4/17/2001	30.00	30.00	8/14/2001	30000.00	24000.00
4/19/2001	4.00	1.00	8/16/2001	5000.00	5000.00
4/25/2001	130.00	80.00	8/20/2001	230.00	130.00
4/27/2001	110.00	33.00	8/20/2001	500.00	50.00
5/1/2001	27.00	9.00	8/20/2001	500.00	170.00
5/3/2001	500.00	300.00	8/21/2001	1300.00	300.00
5/8/2001	300.00	130.00	8/21/2001	300.00	80.00
5/10/2001	23.00	8.00	8/23/2001	3000.00	80.00
5/15/2001	20.00	17.00	8/28/2001	1700.00	1100.00
5/17/2001	8.00	4.00	8/28/2001	300.00	300.00
5/22/2001	2300.00	300.00	8/28/2001	230.00	80.00
5/24/2001	300.00	230.00	8/30/2001	230.00	30.00
5/29/2001	30.00	8.00	9/4/2001	110.00	30.00
5/31/2001	130.00	50.00	9/6/2001	300.00	17.00
6/5/2001	300.00	130.00	9/11/2001	1300.00	300.00
6/7/2001	1300.00	80.00			
6/12/2001	800.00	220.00			
6/14/2001	500.00	500.00			
6/19/2001	230.00	80.00			
6/21/2001	2300.00	2300.00			
6/26/2001	3000.00	130.00			
6/28/2001	300.00	170.00			
7/3/2001	70.00	17.00			
7/5/2001	160000.00	160000.00			
7/10/2001	170.00	130.00			
7/12/2001	80.00	23.00			
7/17/2001	1300.00	280.00			
7/19/2001	8000.00	8000.00			
7/24/2001	70.00	13.00			
7/24/2001	30.00	11.00			
7/24/2001	13.00	4.00			
7/24/2001	30.00	17.00			
7/24/2001	50.00	30.00			
7/26/2001	8000.00	8000.00			
7/26/2001	5000.00	3000.00			
7/27/2001	300.00	230.00			
7/27/2001	500.00	500.00			
7/31/2001	800.00	500.00			
8/2/2001	300.00	230.00			
8/7/2001	130.00	30.00			
8/7/2001	80.00	80.00			
8/9/2001	130.00	130.00			
8/9/2001	170.00	33.00			

2002 Total and Fecal Coliform and Enterococci Levels – Harry Tappen Beach

Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)	Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)
04/16/02	230.00	80.00	20.00	08/21/02	500.00	500.00	20.00
04/18/02	50.00	50.00	9.00	08/22/02	1300.00	300.00	2006.00
04/23/02	3000.00	***3000.00***	782.00	08/22/02	***24000.00***	***24000.00***	306.00
04/25/02	130.00	80.00	64.00	08/22/02	50.00	17.00	20.00
04/30/02	230.00	80.00	42.00	08/26/02	300.00	130.00	124.00
05/02/02	130.00	30.00	75.00	08/26/02	2200.00	170.00	2006.00
05/07/02	230.00	230.00	178.00	08/26/02	500.00	80.00	137.00
05/10/02	11.00	7.00	64.00	08/27/02	800.00	500.00	42.00
05/14/02	1100.00	500.00	99.00	08/27/02	500.00	230.00	53.00
05/16/02	500.00	500.00	64.00	08/27/02	300.00	50.00	53.00
05/21/02	30.00	8.00	9.00				
05/23/02	500.00	230.00	9.00				
05/28/02	13.00	13.00	9.00				
05/30/02	27.00	4.00	9.00				
06/04/02	500.00	300.00	31.00				
06/06/02	300.00	300.00	207.00				
06/11/02	3000.00	***3000.00***	697.00				
06/13/02	2300.00	***1300.00***	111.00				
06/18/02	230.00	230.00	87.00				
06/20/02	500.00	500.00	99.00				
06/25/02	3000.00	***1700.00***	31.00				
06/27/02	3000.00	800.00	42.00				
07/02/02	300.00	300.00	192.00				
07/09/02	800.00	800.00	478.00				
07/11/02	800.00	230.00	238.00				
07/16/02	130.00	30.00	20.00				
07/18/02	130.00	80.00	87.00				
07/23/02	***17000.00***	***8000.00***	2006.00				
07/25/02	230.00	130.00	53.00				
08/01/02	80.00	50.00	53.00				
08/06/02	1300.00	800.00	591.00				
08/08/02	230.00	80.00	659.00				
08/12/02	230.00	230.00	429.00				
08/15/02	80.00	50.00	31.00				
08/15/02	130.00	50.00	10.00				
08/15/02	230.00	17.00	10.00				
08/19/02	230.00	230.00	429.00				
08/19/02	230.00	80.00	1184.00				
08/19/02	5000.00	***3000.00***	384.00				
08/20/02	300.00	300.00	75.00				
08/20/02	1300.00	500.00	87.00				
08/20/02	300.00	300.00	111.00				
08/21/02	300.00	50.00	178.00				
08/21/02	230.00	230.00	111.00				

2002 Total and Fecal Coliform and Enterococci Levels – Sea Cliff Beach

Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)
04/16/02	50.00	30.00	99.00
04/18/02	50.00	50.00	9.00
04/23/02	500.00	170.00	178.00
04/25/02	80.00	2.00	9.00
04/30/02	130.00	11.00	20.00
05/02/02	11.00	4.00	9.00
05/07/02	230.00	50.00	64.00
05/10/02	4.00	1.00	9.00
05/14/02	500.00	230.00	207.00
05/16/02	800.00	30.00	20.00
05/21/02	27.00	22.00	150.00
05/23/02	23.00	8.00	9.00
05/28/02	17.00	17.00	10.00
05/30/02	130.00	50.00	9.00
06/04/02	230.00	30.00	9.00
06/06/02	500.00	500.00	10.00
06/11/02	230.00	80.00	20.00
06/13/02	1300.00	80.00	31.00
06/18/02	230.00	80.00	10.00
06/20/02	110.00	80.00	9.00
06/25/02	1700.00	80.00	150.00
06/27/02	1700.00	300.00	31.00
07/02/02	800.00	500.00	64.00
07/09/02	500.00	230.00	111.00
07/11/02	800.00	300.00	124.00
07/16/02	***30000.00***	80.00	254.00
07/18/02	50.00	23.00	164.00
07/23/02	800.00	170.00	64.00
07/25/02	500.00	170.00	64.00
08/01/02	130.00	80.00	20.00
08/06/02	5000.00	***1300.00***	64.00
08/08/02	300.00	130.00	75.00
08/12/02	***14000.00***	***14000.00***	364.00
08/15/02	170.00	30.00	164.00
08/15/02	70.00	4.00	20.00
08/15/02	3500.00	30.00	31.00
08/19/02	300.00	300.00	75.00
08/19/02	3000.00	500.00	87.00
08/19/02	800.00	500.00	42.00
08/20/02	3000.00	500.00	1652.00
08/20/02	5000.00	***1700.00***	2005.00
08/20/02	***8000.00***	800.00	75.00
08/21/02	500.00	130.00	222.00
08/21/02	230.00	230.00	31.00
08/21/02	220.00	30.00	87.00
08/22/02	300.00	300.00	87.00
08/22/02	170.00	110.00	150.00
08/22/02	80.00	80.00	111.00
08/26/02	300.00	30.00	20.00
08/26/02	50.00	50.00	9.00
08/26/02	130.00	50.00	42.00
08/27/02	130.00	13.00	10.00
08/27/02	300.00	50.00	20.00
08/27/02	130.00	23.00	9.00

2002 Total and Fecal Coliform and Enterococci Levels – Sands Point Golf Club

Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)
04/16/02	30.00	2.00	9.00
04/18/02	230.00	80.00	9.00
04/23/02	300.00	130.00	31.00
04/25/02	70.00	2.00	9.00
04/30/02	170.00	7.00	10.00
05/02/02	130.00	22.00	64.00
05/07/02	13.00	1.00	10.00
05/10/02	30.00	17.00	9.00
05/14/02	800.00	580.00	238.00
05/16/02	130.00	8.00	9.00
05/21/02	8.00	4.00	9.00
05/23/02	4.00	2.00	10.00
05/28/02	30.00	30.00	9.00
05/30/02	22.00	22.00	9.00
06/04/02	500.00	230.00	53.00
06/06/02	1700.00	80.00	10.00
06/11/02	170.00	50.00	111.00
06/13/02	1300.00	300.00	87.00
06/18/02	30.00	4.00	10.00
06/20/02	500.00	230.00	178.00
06/25/02	230.00	80.00	124.00
06/27/02	50.00	13.00	10.00
07/02/02	50.00	50.00	31.00
07/09/02	230.00	130.00	150.00
07/11/02	1100.00	***1100.00***	478.00
07/16/02	130.00	30.00	31.00
07/18/02	80.00	50.00	254.00
07/23/02	300.00	130.00	288.00
07/25/02	2400.00	230.00	207.00
08/01/02	230.00	2.00	87.00
08/06/02	***16001.00***	***9000.00***	2006.00
08/08/02	230.00	23.00	624.00
08/12/02	500.00	23.00	364.00
08/15/02	230.00	30.00	75.00
08/20/02	***16000.00***	***9000.00***	2004.00
08/22/02	220.00	70.00	99.00

2002 Total and Fecal Colfiorm and Enterococci Levels – Hempstead Harbor Beach

Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)	Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)
04/16/02	23.00	13.00	9.00	08/20/02	5000.00	***5000.00***	124.00
04/18/02	8.00	4.00	53.00	08/20/02	5000.00	***5000.00***	478.00
04/23/02	1300.00	130.00	64.00	08/20/02	5000.00	***3000.00***	945.00
04/25/02	70.00	30.00	20.00	08/21/02	300.00	80.00	254.00
04/30/02	230.00	17.00	20.00	08/21/02	500.00	110.00	64.00
05/02/02	300.00	300.00	64.00	08/21/02	500.00	230.00	306.00
05/07/02	30.00	30.00	42.00	08/22/02	80.00	80.00	20.00
05/10/02	80.00	80.00	42.00	08/22/02	70.00	70.00	31.00
05/14/02	230.00	130.00	64.00	08/22/02	50.00	30.00	9.00
05/16/02	80.00	11.00	9.00	08/26/02	230.00	23.00	42.00
05/21/02	8.00	4.00	9.00	08/26/02	230.00	23.00	42.00
05/23/02	30.00	13.00	137.00	08/26/02	130.00	50.00	31.00
05/28/02	500.00	500.00	20.00	08/27/02	2300.00	500.00	75.00
05/30/02	50.00	50.00	10.00	08/27/02	500.00	230.00	20.00
06/04/02	230.00	50.00	10.00	08/27/02	300.00	130.00	9.00
06/06/02	300.00	80.00	10.00				
06/11/02	30.00	8.00	10.00				
06/13/02	800.00	500.00	87.00				
06/18/02	230.00	230.00	9.00				
06/20/02	3000.00	***3000.00***	831.00				
06/25/02	500.00	300.00	324.00				
06/27/02	300.00	300.00	20.00				
07/02/02	130.00	130.00	42.00				
07/09/02	110.00	110.00	9.00				
07/11/02	5000.00	***3000.00***	1652.00				
07/16/02	30.00	30.00	31.00				
07/18/02	130.00	80.00	124.00				
07/23/02	50.00	17.00	9.00				
07/25/02	***8000.00***	***2300.00***	2006.00				
08/01/02	800.00	500.00	53.00				
08/06/02	***50000.00***	***50000.00***	2005.00				
08/08/02	170.00	130.00	271.00				
08/08/02	800.00	230.00	99.00				
08/08/02	1300.00	230.00	150.00				
08/12/02	500.00	500.00	20.00				
08/15/02	50.00	11.00	9.00				
08/15/02	30.00	7.00	9.00				
08/15/02	130.00	50.00	20.00				
08/19/02	800.00	500.00	192.00				
08/19/02	***13000.00***	***13000.00***	1184.00				
08/19/02	700.00	500.00	222.00				

2003 TotalandFecal Coliform and Enterococci Levels – Bar Beach

Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)	Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)
04/16/02	80.00	4.00	9.00	08/21/02	500.00	300.00	406.00
04/18/02	23.00	8.00	9.00	08/21/02	500.00	170.00	111.00
04/23/02	300.00	30.00	124.00	08/21/02	230.00	30.00	87.00
04/25/02	80.00	2.00	9.00	08/22/02	23.00	23.00	10.00
04/30/02	300.00	11.00	9.00	08/22/02	500.00	110.00	9.00
05/02/02	80.00	4.00	20.00	08/22/02	50.00	30.00	9.00
05/07/02	17.00	8.00	20.00	08/26/02	300.00	230.00	53.00
05/10/02	230.00	230.00	75.00	08/26/02	500.00	300.00	99.00
05/14/02	300.00	130.00	53.00	08/26/02	500.00	300.00	75.00
05/16/02	130.00	4.00	9.00	08/27/02	1300.00	500.00	64.00
05/21/02	50.00	13.00	9.00	08/27/02	800.00	500.00	10.00
05/23/02	80.00	80.00	9.00	08/27/02	300.00	130.00	75.00
05/28/02	23.00	4.00	10.00				
05/30/02	230.00	230.00	9.00				
06/04/02	800.00	130.00	64.00				
06/06/02	350.00	80.00	20.00				
06/11/02	130.00	23.00	31.00				
06/13/02	300.00	230.00	42.00				
06/18/02	300.00	300.00	53.00				
06/20/02	1100.00	500.00	164.00				
06/25/02	170.00	34.00	137.00				
06/27/02	300.00	50.00	9.00				
07/02/02	230.00	130.00	53.00				
07/09/02	130.00	30.00	42.00				
07/11/02	5000.00	***5000.00***	624.00				
07/16/02	800.00	300.00	20.00				
07/18/02	230.00	230.00	178.00				
07/23/02	130.00	50.00	9.00				
07/25/02	230.00	80.00	42.00				
08/01/02	220.00	140.00	20.00				
08/06/02	***90000.00***	***22000.00***	2006.00				
08/08/02	***50000.00***	***24000.00***	1184.00				
08/12/02	27.00	11.00	9.00				
08/15/02	230.00	50.00	42.00				
08/15/02	300.00	300.00	31.00				
08/15/02	80.00	23.00	31.00				
08/19/02	800.00	500.00	254.00				
08/19/02	500.00	500.00	207.00				
08/19/02	800.00	500.00	560.00				
08/20/02	1300.00	***1300.00***	222.00				
08/20/02	3000.00	800.00	1184.00				
08/20/02	2300.00	500.00	1298.00				

Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)	Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)
4/29/03	230.00	30.00	99.00	8/8/03	1700.00	500.00	87.00
4/30/03	80.00	8.00	9.00	8/8/03	***9000.00***	***13000.00***	238.00
5/2/03	30.00	17.00	9.00	8/8/03	***9000.00***	***9000.00***	238.00
5/5/03	23.00	8.00	9.00	8/12/03	800.00	800.00	20.00
5/14/03	110.00	50.00	9.00	8/14/03	800.00	500.00	64.00
5/22/03	230.00	50.00	20.00	8/14/03	800.00	800.00	53.00
5/27/03	230.00	230.00	99.00	8/14/03	3000.00	***3000.00***	306.00
5/29/03	300.00	170.00	10.00	8/15/03	130.00	80.00	9.00
6/3/03	300.00	50.00	20.00	8/15/03	230.00	230.00	9.00
6/5/03	2300.00	500.00	2006.00	8/15/03	300.00	230.00	10.00
6/6/03	1700.00	170.00	178.00	8/19/03	230.00	230.00	31.00
6/10/03	300.00	130.00	20.00	8/21/03	230.00	230.00	9.00
6/12/03	500.00	220.00	87.00	8/21/03	500.00	500.00	10.00
6/17/03	80.00	23.00	31.00	8/21/03	500.00	500.00	10.00
6/19/03	230.00	230.00	111.00	8/26/03	230.00	230.00	164.00
6/25/03	230.00	230.00	75.00	8/26/03	800.00	80.00	222.00
6/26/03	800.00	500.00	20.00	8/26/03	***13000.00***	***8000.00***	1298.00
6/29/03	800.00	500.00	99.00	8/28/03	700.00	700.00	178.00
7/1/03	800.00	230.00	10.00	9/2/03	2300.00	500.00	560.00
7/3/03	230.00	23.00	20.00	9/4/03	300.00	300.00	75.00
7/8/03	80.00	80.00	10.00	9/8/03	130.00	23.00	9.00
7/10/03	230.00	130.00	53.00				
7/11/03	1700.00	130.00	111.00				
7/11/03	3000.00	500.00	178.00				
7/11/03	800.00	800.00	111.00				
7/15/03	130.00	50.00	9.00				
7/17/03	300.00	170.00	9.00				
7/17/03	230.00	130.00	9.00				
7/17/03	50.00	30.00	9.00				
7/22/03	500.00	30.00	31.00				
7/24/03	230.00	130.00	31.00				
7/25/03	300.00	230.00	42.00				
7/25/03	230.00	80.00	9.00				
7/25/03	130.00	23.00	10.00				
7/29/03	800.00	800.00	111.00				
7/29/03	230.00	130.00	31.00				
7/29/03	230.00	230.00	87.00				
7/31/03	130.00	130.00	10.00				
8/1/03	500.00	300.00	207.00				
8/1/03	3000.00	***1700.00***	306.00				
8/1/03	2300.00	***2300.00***	478.00				
8/5/03	130.00	80.00	10.00				
8/7/03	800.00	800.00	111.00				

2003 Total and Fecal Coliform and Enterococci Levels – Harry Tappen Beach

2003 Total and Fecal Coliform Enterococci Levels – Sea Cliff Beach

Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)	Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)
4/29/03	30.00	8.00	9.00	8/5/03	***24000.00***	***1700.00***	137.00
4/30/03	8.00	1.00	9.00	8/7/03	1300.00	300.00	42.00
5/2/03	1.00	1.00	9.00	8/8/03	***160001.00***	***3000.00***	1445.00
5/5/03	80.00	23.00	9.00	8/8/03	***160001.00***	***50000.00***	324.00
5/14/03	50.00	23.00	9.00	8/8/03	***160001.00***	***13000.00***	238.00
5/22/03	5000.00	300.00	64.00	8/12/03	800.00	800.00	31.00
5/27/03	2300.00	500.00	99.00	8/14/03	300.00	300.00	9.00
5/29/03	230.00	13.00	9.00	8/14/03	500.00	500.00	10.00
6/3/03	300.00	8.00	9.00	8/14/03	50.00	50.00	20.00
6/5/03	800.00	300.00	306.00	8/15/03	800.00	300.00	9.00
6/6/03	1300.00	130.00	192.00	8/15/03	500.00	230.00	20.00
6/10/03	500.00	80.00	20.00	8/15/03	300.00	30.00	20.00
6/12/03	800.00	50.00	207.00	8/19/03	230.00	80.00	53.00
6/17/03	50.00	23.00	20.00	8/21/03	230.00	30.00	9.00
6/19/03	800.00	130.00	150.00	8/21/03	700.00	220.00	9.00
6/25/03	3000.00	130.00	20.00	8/21/03	90.00	23.00	10.00
6/26/03	300.00	130.00	20.00	8/26/03	230.00	30.00	20.00
6/29/03	1300.00	130.00	344.00	8/26/03	2300.00	300.00	9.00
7/1/03	230.00	130.00	20.00	8/26/03	500.00	300.00	20.00
7/3/03	13.00	4.00	10.00	8/28/03	700.00	300.00	178.00
7/8/03	500.00	230.00	53.00	9/2/03	5000.00	230.00	2005.00
7/10/03	230.00	50.00	31.00	9/4/03	230.00	50.00	53.00
7/11/03	***11000.00***	700.00	429.00	9/8/03	230.00	50.00	31.00
7/11/03	2300.00	230.00	591.00				
7/11/03	2300.00	***1300.00***	364.00				
7/15/03	300.00	50.00	75.00				
7/17/03	300.00	170.00	9.00				
7/17/03	5000.00	130.00	10.00				
7/17/03	300.00	30.00	10.00				
7/22/03	***13000.00***	***3000.00***	1013.00				
7/24/03	230.00	130.00	31.00				
7/24/03	500.00	50.00	10.00				
7/24/03	1300.00	170.00	238.00				
7/25/03	300.00	50.00	9.00				
7/25/03	500.00	30.00	20.00				
7/25/03	300.00	80.00	87.00				
7/29/03	130.00	50.00	9.00				
7/29/03	230.00	50.00	20.00				
7/29/03	800.00	23.00	10.00				
7/31/03	50.00	30.00	9.00				
8/1/03	300.00	30.00	20.00				
8/1/03	500.00	80.00	42.00				
8/1/03	50.00	23.00	53.00				

2003 Total and Fecal Coliform Enterococci Levels – Sands Point Golf Club

Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)
4/29/03	23.00	13.00	9.00
4/30/03	2.00	2.00	9.00
5/2/03	2.00	2.00	9.00
5/5/03	4.00	2.00	10.00
5/14/03	2.00	2.00	9.00
5/22/03	500.00	130.00	42.00
5/27/03	230.00	230.00	10.00
5/29/03	230.00	8.00	20.00
6/3/03	30.00	2.00	42.00
6/5/03	800.00	230.00	150.00
6/6/03	23.00	8.00	31.00
6/10/03	230.00	4.00	10.00
6/12/03	130.00	4.00	31.00
6/17/03	8.00	2.00	9.00
6/19/03	30.00	13.00	9.00
6/25/03	80.00	13.00	10.00
6/26/03	140.00	23.00	150.00
6/29/03	500.00	500.00	20.00
7/1/03	30.00	30.00	20.00
7/3/03	80.00	23.00	10.00
7/8/03	80.00	8.00	9.00
7/10/03	500.00	50.00	178.00
7/11/03	500.00	170.00	254.00
7/11/03	300.00	70.00	271.00
7/11/03	130.00	130.00	478.00
7/15/03	130.00	13.00	10.00
7/17/03	110.00	23.00	10.00
7/22/03	50.00	23.00	9.00
7/24/03	230.00	30.00	75.00
7/28/03	130.00	23.00	75.00
7/28/03	230.00	17.00	42.00
7/28/03	230.00	22.00	31.00
7/29/03	800.00	300.00	87.00
7/31/03	300.00	110.00	31.00
8/5/03	300.00	13.00	42.00
8/7/03	50.00	30.00	9.00
8/12/03	500.00	50.00	87.00
8/14/03	500.00	30.00	20.00
8/14/03	230.00	230.00	42.00
8/14/03	80.00	80.00	42.00
8/15/03	800.00	80.00	10.00
8/19/03	230.00	50.00	150.00
8/21/03	500.00	2.00	64.00
8/26/03	500.00	300.00	164.00
8/28/03	130.00	23.00	31.00
9/2/03	2400.00	300.00	531.00
9/4/03	1300.00	230.00	178.00

9/8/03	***16000.00***	***2400.00***	1445.00

2003 Total and Fecal Coliform and Enterococci Levels – Hempstead Harbor Beach

Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)	Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)
4/29/03	230.00	80.00	42.00	8/8/03	5000.00	800.00	271.00
4/30/03	50.00	8.00	31.00	8/8/03	2200.00	***1300.00***	738.00
5/2/03	80.00	50.00	9.00	8/8/03	1700.00	800.00	306.00
5/5/03	23.00	4.00	9.00	8/12/03	230.00	230.00	10.00
5/14/03	50.00	13.00	10.00	8/14/03	300.00	300.00	87.00
5/22/03	300.00	50.00	192.00	8/15/03	300.00	80.00	20.00
5/27/03	230.00	80.00	42.00	8/15/03	130.00	50.00	10.00
5/29/03	50.00	13.00	10.00	8/15/03	80.00	50.00	10.00
6/3/03	230.00	30.00	20.00	8/19/03	23.00	23.00	10.00
6/5/03	***7000.00***	220.00	1184.00	8/21/03	130.00	80.00	10.00
6/6/03	***8000.00***	50.00	20.00	8/21/03	50.00	50.00	9.00
6/10/03	1300.00	500.00	20.00	8/21/03	50.00	50.00	9.00
6/12/03	300.00	230.00	124.00	8/26/03	800.00	800.00	42.00
6/17/03	8.00	2.00	9.00	8/26/03	230.00	230.00	75.00
6/19/03	300.00	230.00	20.00	8/26/03	1300.00	***1300.00***	87.00
6/25/03	80.00	23.00	9.00	8/28/03	300.00	110.00	178.00
6/26/03	170.00	50.00	9.00	9/2/03	5000.00	800.00	2006.00
6/29/03	80.00	23.00	9.00	9/4/03	500.00	170.00	99.00
7/1/03	80.00	30.00	10.00	9/8/03	5000.00	***2300.00***	42.00
7/3/03	1700.00	170.00	9.00				
7/8/03	130.00	80.00	20.00				
7/10/03	300.00	300.00	178.00				
7/11/03	2200.00	***2200.00***	137.00				
7/11/03	800.00	800.00	364.00				
7/11/03	500.00	500.00	238.00				
7/15/03	300.00	230.00	9.00				
7/17/03	230.00	130.00	9.00				
7/17/03	130.00	130.00	9.00				
7/17/03	130.00	80.00	9.00				
7/22/03	130.00	30.00	42.00				
7/24/03	130.00	50.00	20.00				
7/25/03	300.00	80.00	31.00				
7/25/03	500.00	500.00	222.00				
7/25/03	230.00	130.00	31.00				
7/29/03	2300.00	***2300.00***	504.00				
7/29/03	230.00	230.00	478.00				
7/29/03	5000.00	***2300.00***	222.00				
7/31/03	300.00	500.00	20.00				
8/1/03	230.00	230.00	111.00				
8/1/03	230.00	130.00	75.00				
8/1/03	500.00	300.00	99.00				
8/5/03	230.00	80.00	10.00				
8/7/03	230.00	230.00	111.00				

2003 Total, Fecal and Enterococci Coliform Levels – Bar Beach

Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)	Date	Total Coliform (MPN)	Fecal Coliform (MPN)	Enterococci (MPN)
4/29/03	300.00	300.00	207.00	8/14/03	80.00	23.00	10.00
4/30/03	17.00	4.00	9.00	8/14/03	800.00	170.00	10.00
5/2/03	30.00	7.00	9.00	8/14/03	800.00	110.00	9.00
5/5/03	30.00	4.00	9.00	8/15/03	80.00	23.00	9.00
5/14/03	50.00	22.00	9.00	8/15/03	800.00	50.00	9.00
5/22/03	300.00	170.00	20.00	8/15/03	230.00	50.00	10.00
5/27/03	300.00	70.00	20.00	8/19/03	230.00	14.00	10.00
5/29/03	70.00	8.00	10.00	8/18/03	900.00	300.00	150.00
6/3/03	80.00	23.00	31.00	8/18/03	5000.00	***1300.00***	1652.00
6/5/03	3000.00	300.00	624.00	8/18/03	3000.00	800.00	192.00
6/6/03	700.00	80.00	87.00	8/21/03	30.00	30.00	31.00
6/10/03	300.00	50.00	9.00	8/21/03	30.00	23.00	9.00
6/12/03	300.00	2.00	9.00	8/21/03	50.00	50.00	9.00
6/17/03	7.00	1.00	9.00	8/26/03	500.00	220.00	207.00
6/19/03	230.00	130.00	31.00	8/26/03	230.00	230.00	64.00
6/25/03	23.00	13.00	9.00	8/26/03	3000.00	***3000.00***	288.00
6/26/03	13.00	13.00	10.00	8/28/03	300.00	230.00	306.00
6/29/03	130.00	30.00	10.00	9/2/03	300.00	230.00	254.00
7/1/03	80.00	50.00	9.00	9/4/03	2300.00	170.00	53.00
7/3/03	80.00	80.00	42.00	9/8/03	500.00	130.00	10.00
7/8/03	230.00	50.00	111.00				
7/10/03	230.00	130.00	164.00				
7/11/03	***13000.00***	***8000.00***	560.00				
7/11/03	3000.00	***1700.00***	945.00				
7/11/03	500.00	500.00	271.00				
7/15/03	80.00	30.00	9.00				
7/17/03	230.00	130.00	9.00				
7/17/03	230.00	230.00	9.00				
7/17/03	230.00	230.00	10.00				
7/22/03	130.00	80.00	53.00				
7/24/03	300.00	80.00	9.00				
7/25/03	300.00	170.00	75.00				
7/25/03	130.00	80.00	31.00				
7/25/03	50.00	17.00	9.00				
7/29/03	2300.00	***2300.00***	1298.00				
7/29/03	2300.00	***2300.00***	782.00				
7/29/03	1300.00	***1300.00***	192.00				
7/31/03	30.00	23.00	9.00				
8/1/03	230.00	34.00	75.00				
8/1/03	300.00	230.00	111.00				
8/1/03	500.00	220.00	164.00				
8/5/03	300.00	50.00	9.00				
8/7/03	300.00	300.00	20.00				
8/12/03	800.00	230.00	20.00				

APPENDIX 4. Nitrite and Nitrate Data 2003 (Measured in ppm)

	1	2	3	4	5	6	7	8
5/22/2003	0.1	0	0.5					0
5/29/2003	0.013	0.012	0.01	0.002	0.011	0.011	0.009	0.012
6/12/2003	1.4	1.7	0.9					2.1
6/19/2003	0.011	0.014	0.032					0.198
6/26/2003	0.019	0.014	0.013					0.038
7/3/2003	0.012	0.002	0.003					0.032
7/10/2003	0.008	0.004	0	0	0.005	0	0.006	0.011
7/17/2003	0	0	0					0
7/24/2003	0.009	0.006	0.003					0.001
7/31/2003	0	0.002	0.01					0.005
8/7/2003	0.003	0	0.007					0.006
8/12/2003	0.015	0.014	0.002					0.003
8/28/2003	0.003	0	0					0.007
9/4/2003	0.009	0.016	0.021					0.032
9/11/2003	0.014	0.013	0.008					0.026
9/25/2003	0.031	0.049	0.039	0.034	0.034	0.04	0.042	0.041
10/1/2003	0.04	0.035	0.045					0.036
10/9/2003	0.05	0.039	0.053					0.035
10/16/2003	0.033	0.024	0.028					0.025
10/23/2003	0.045							0.03
10/30/2003	0.059	0.032	0.045					0.031
11/6/2003	0.038	0.037	0.034	0.04	0.04	0.044	0.042	0.046

				NO_3				
	1	2	3	4	5	6	7	8
5/22/2003	0.07	0.018	0.013					0.009
5/29/2003	0.013	2.3	2.5	0.5	2.1	1.9	2.5	1.5
6/12/2003	0.029	0.018	0.018					0.046
6/19/2003	0	0	0					0
6/26/2003	1.6	0.8	1.9					0.5
7/3/2003	0.7	1.8	0.7					1.1
7/10/2003	2.3	0.8	0	2.1	1.4	1.5	1.6	0.4
7/17/2003	1.2	0	0					1.2
7/24/2003	1.1	0.9	0					0.5