Friends of the Bay
Volunteer Water Quality Monitoring Program
2001 Annual Report

Friends OF THE Bay
Working to keep the oyster in Oyster Bay

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Acknowledgments

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Carolina Skiff - In 2000**,** Carolina Skiff provided a brand new 19' Carolina Skiff Semi-V Hull boat at a 50% discount. The "semi-v" hull provides a stable work platform for volunteers to conduct water quality monitoring, education programs, harbor clean-ups, and for members of the press to photograph events.

Evinrude -Evinrude through its government sales office enabled Friends of the Bay to purchase the 70 horsepower 4-stroke engine for 40% off the regular price. The more environmentally friendly 4-stroke engine, which burns 31% less fuel than a 2-stroke engine, does not discharge oil into the bay and meets the EPA 2006 emissions regulations.

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Volunteers -

★Paul Amundson ★Penn Berens ★Brad Boehringer ★ OJ Donovan ★Oliver Downey
★Caroline Dubois ★ Biagio Guigliotta ★Scott Gurney ★ Sandra Hayes ★Colin Lindsey
★Colin McCubbin ★Audie O'Connor ★Margaret Rendich ★Susan Schechter
★ Jamie Van Dyke ★Ken Weydig

Executive Summary

Friends of the Bay's volunteer water quality monitoring program is an important component of our efforts to preserve the Oyster Bay – Cold Spring Harbor ecosystem while serving to increase public awareness of local threats to water quality. This program was developed in cooperation with the United States Environmental Protection Agency, New York State Department of Environmental Conservation, local governments, and other volunteer monitoring groups around Long Island Sound.

Friends of the Bay monitors dissolved oxygen, salinity, temperature, and water clarity at six locations, and coliform bacteria at nine locations, throughout Oyster Bay and Cold Spring Harbor. Each of the sites is tested one day each week (just after sunrise). The sites tested include: Mill Neck Creek; Oyster Bay (West Harbor, Roosevelt Beach, and Plum Point); and two sites in Cold Spring Harbor. As part of the Bayville Cesspool Study, Friends of the Bay Bayville monitored sixteen additional sites in Mill Neck Creek for coliform bacteria to identify failing septic systems along Bayville's shoreline. Dissolved oxygen is important as all aquatic life depend upon the availability of dissolved oxygen. Coliform bacteria is used as an indicator of potential human pathogens (disease causing organisms) in the water.

In 1984, high bacteria levels forced the New York State Department of Environmental Conservation to close Mill Neck Creek to shellfishing. It has since been discovered that malfunctioning septic systems in the area are a major cause of the high levels of coliform bacteria. In response, the Village of Bayville obtained a grant to study, identify, and alleviate specific causes of septic system pollution in Mill Neck Creek. Assisting the Village of Bayville, Friends of the Bay monitored 16 additional sites in Mill Neck Creek in order to identify areas of septic system malfunction.

Overall, water quality in Oyster Bay and Cold Spring Harbor is very good. Applying the Bathing Water Quality Standards used by the Nassau County Department of Health in their annual water quality assessments to Friends of the Bay's coliform data indicates that six of the nine monitoring locations are very good to excellent. However, this year two stations dropped a rating, one from excellent to very good and the other from very good to good. Although, all of Mill Neck Creek is closed to shellfishing due to high coliform bacteria levels, two hot spots are the branches of Mill Neck Creek where the bacteria levels are just passable for swimming (see report for a complete description).

Dissolved oxygen data shows that every site failed to meet the New York State Dissolved Oxygen Standard of 5.0 mg/L at least once during the monitoring season and three of the seven stations were hypoxic (dissolved oxygen less than 3.0 mg/L) at least once. Cold Spring Harbor conformed to the NYS Dissolved Oxygen Standard 47% of the sampling days, a seven percentage point decrease from the previous season. Oyster Bay showed improvements in dissolved oxygen levels conforming 81% of the time in 2001 as compared to 74% in 2000.

The Bayville Cesspool Study results showed that all the shoreline stations should be further investigated for septic system malfunctions, as all the stations failed to meet the New York State Coliform Bacteria Standards for shellfishing. The area of highest concern is Oak Neck Creek which is bordered by The Birches housing development and The Strip, a stretch of restaurants and a hotel suspected for their septic system malfunctions. The study shows this area had significantly higher fecal coliform levels indicating severe septic system malfunction and should be the first area remedied. Being village property, the Creek Beach Marina which had the highest coliform levels in Mill Neck Creek, should be a primary focus for septic system study and remediation.

In its entirety, this season proved very successful by supplying another year of data to the baseline, identifying septic system malfunctions in Bayville, and fulfilling our overall goals of the Volunteer Water Quality Monitoring study. Friends of the Bay looks forward to a successful 2002 season by continuing to work with volunteers, government agencies, and fellow not-for-profit organizations. Together we will

continue to improve and expand our monitoring program while providing a link to show how investment in water quality protection is improving Oyster Bay and Cold Spring Harbor.

Introduction

Last year, the Village of Bayville, as part of its *Local Waterfront Revitalization Program*, aggressively implemented measures to prevent contaminated run-off from entering the bay in the Bayville Park Boulevard neighborhood and elsewhere. Nassau County plans to install a small sewage treatment plant in Mill Neck Creek using funding from the New York State Clean Water/Clean Air Bond Act. The Oyster Bay Sewage Treatment Plant has also received Clean Water/Clean Air Bond Act funding to upgrade its facility to remove nitrogen. How will these changes affect water quality? Friends of the Bay monitors water quality once a week from April through October to find out.

Started in 1987 as a small group of citizens concerned about the impact of a proposed massive development on Oyster Bay's waterfront, Friends of the Bay has grown into a powerful voice representing over 2,000 area residents and businesses. "Working to keep the oyster in Oyster Bay", we are committed to the preservation of Oyster Bay and Cold Spring Harbor and our surrounding upland communities. Specifically, our mission is to promote community awareness of the need to preserve water quality and marine life in the estuary, assure the aesthetic, economic and recreational value of Oyster Bay and Cold Spring Harbor and to ensure that development in the watershed is compatible with the needs of a healthy ecosystem. As a representative of the local citizenry, we have developed a wide range of programs that expand public knowledge concerning issues in the bay. One of our most important programs is the volunteer water quality monitoring program.

Friends of the Bay has initiated a volunteer water quality testing program to fill the void left by county cutbacks. This program was developed in cooperation with the United States Environmental Protection Agency, New York State Department of Environmental Conservation, local governments and other volunteer monitoring groups around Long Island Sound. Friends of the Bay considers the program a necessary component in the effort to preserve the Oyster Bay – Cold Spring Harbor ecosystem, and hopes to increase public awareness of local threats to water quality. The water quality program of Friends of the Bay is being conducted to:

1. Provide high quality data to continue the dissolved oxygen-testing baseline established by the Nassau County Department of Health in 1972
2. Screen for water quality impairments
3. Determine long-term water quality trends
4. Educate and involve citizens in surface water quality protection
5. Document effects of water quality improvements
6. Act as a watchdog for harbor activities
7. Assist local, state, and federal agencies in harbor management

This program enables trained volunteers working along side environmental scientists to monitor various components of the marine ecosystem. Volunteers track a number of features in the bay including water temperature, clarity, salinity, dissolved oxygen and coliform bacteria. Measuring these parameters enables Friends of the Bay to better understand changes within the local marine ecosystem.

Methods

The parameters measured by Friends of the Bay include dissolved oxygen, salinity, water temperature, water clarity, and coliform bacteria. Dissolved oxygen, salinity, and water temperature are measured using a Yellow Springs Instruments (YSI) Model 85. Water clarity is measured using a Secchi Disk. Coliform bacteria samples are collected by Friends of the Bay and analyzed by the Nassau County Department of Health (NCDH) laboratory. The following is a summary of a water quality testing methods, a more complete description can be found in our Standard Operating Procedures and Draft Quality Assurance Project Plan.

Dissolved Oxygen - The Long Island Sound Study (LISS), a cooperative effort of the federal, state and local governments concluded that low dissolved oxygen (hypoxia) is the most serious threat to the health of the ecosystem. As part of budgetary cutbacks, the Nassau County Department of Health eliminated all dissolved oxygen and bacterial testing from their water-testing program that was not required to monitor bathing beaches in 1992. The New York State Department of Environmental Conservation still monitors bacteria levels to ensure the safety of shellfishing areas.

Friends of the Bay monitors dissolved oxygen as all aquatic life depend upon its availability. oxygen. The level of dissolved oxygen present in a body of water determines the diversity of life that can be sustained. Most dissolved oxygen found in the water is provided by the atmosphere through the action of waves and wind. A secondary (but no less important) source of dissolved oxygen is aquatic plants, which provide oxygen through the process of photosynthesis. Dissolved oxygen is consumed by all aquatic life. Many factors influence the amount of dissolved oxygen found in a particular body of water including:

- Cooler water holds more oxygen, so the warm summer waters can be particularly stressful for marine organisms.
- More saline water(s) also result(s) in lower DO capacity.
- Poor water clarity prevents sunlight from reaching oxygen producing aquatic plants lower in the water column or at the bottom of the bay.
- Excess nutrients can cause an algal bloom, which blocks sunlight from aquatic vegetation lower in the water column. When the algae dies and sinks to the bottom the bacteria involved in decay of the plant material consumes a significant amount of dissolved oxygen reducing the amount available for fish and other benthic (bottom dwelling) organisms.

Dissolved oxygen readings are taken at each station one half-meter above the bay bottom, one-half meter below the water's surface, and at one meter intervals between the top and bottom. It is measured in milligrams per liter (mg/L), which is equivalent to parts per million (ppm). Table 1 explains the consequences of low dissolved oxygen levels.

Table 1: Consequences of Low Dissolved Oxygen

Dissolved Oxygen	Consequences
> 5.0 mg/L	**Meets NYS Standard** for dissolved oxygen – few adverse effects on marine life
4.0 mg/L	Reduces survival of crab and lobster larvae by 30%
3.0 mg/L	**Hypoxia** – affects the growth of crabs and lobsters. Fish avoid the area.
2.5 mg/L	Growth reduced in grass shrimp, summer flounder and lobster.
2.0 mg/L	Sharply reduced growth. Lowest safe dissolved oxygen level for many juvenile organisms
1.5 mg/L	Very high lethal effects on fish, shrimp and lobster.
0.0 mg/L	**Anoxia** – Intolerable environment for nearly all marine organisms (Zimmer 1996)

Salinity - Salinity is the measurement of the concentration of dissolved salts in the water. Salinity is expressed in parts per thousand (ppt). The waters of Oyster Bay and Cold Spring Harbor typically range from 24 to 27 ppt; by comparison the open ocean averages about 35 ppt. Salinity is another important factor in determining the diversity of a marine environment. Higher saline waters are more dense, causing them to sink to the bottom, producing a stratification of the water column referred to as a halocline.

Water Temperature - During the warmer summer months the increase in water temperature can result in a temperature stratification of the water column. In a thermocline, the cooler more dense waters sink to the bottom and the warmer less dense waters rise to the surface. Depending upon the depth of the water, the difference in surface and bottom temperatures can be quite dramatic. The temperature of water has a direct affect upon the amount of dissolved oxygen that water can contain. Cooler water has a higher capacity for dissolved oxygen than warm water. Temperature can also have a wide reaching affect on physical processes and rates of chemical and biological reaction.

Water Clarity - The clarity of water can be affected by a variety of sources including suspended solids such as silt from runoff and plankton. In shallow areas, wind generated waves and boating activity can churn up bottom sediments. Water with poor clarity can block sunlight from reaching aquatic vegetation on the bay bottom or lower in the water column, which need the sunlight for photosynthesis. Friends of the Bay measures water clarity with a Secchi disk, which is an 8-inch diameter disk divided into four alternating black and white quadrants. The disk is lowered (on the shaded side of the boat), the point at which the disk becomes completely obscured is noted, the disk is raised and the point at which the disk becomes visible again is noted. The average of these two numbers is the Secchi Depth - recorded to the nearest tenth of a meter (decimeter).

Coliform Bacteria - The Nassau County Department of Health and the New York State Department of Environmental Conservation use coliform bacteria levels to certify swimming beaches and shellfish beds respectively. Coliform bacteria are not by themselves harmful, but levels are used as an indicator of the possible presence of human pathogens (disease causing organisms) to gauge sanitary quality.

Water samples are collected by Friends of the Bay in plastic *Whirl-Packs*, stored in a cooler with ice and transported immediately to the Nassau County Department of Health's laboratory in Hempstead where they are analyzed. Information collected at the time of each sample includes: time sample was taken; water temperature (degrees Celsius); air temperature (degrees Celsius); wind direction (1 of 8 directions); wind speed (estimate in 5 mph increments); wave height (0.5' increments); weather conditions (on a predetermined 1-6 scale); and, any unusual conditions (i.e. odors, fish kills, water color). The NCDH uses the process of "Multiple Tube Fermentation" in determining the level of total and fecal coliform bacteria in a water sample, expressed as the most probable number (MPN).

To ensure proper temperature standards are met, an additional water sample is collected at the first station and designated as the temperature control (TC). It is placed in the cooler with the ice and upon arrival at the NCDH laboratory, the TC temperature is immediately recorded. If the TC temperature exceeds 10°C, the data datasheet is stamped, indicating that the data maybe compromised.

As part of the Bayville Cesspool Study, 16 water samples were taken every two weeks and analyzed by the NCDH using the Colilert 18 test to determine total and fecal coliform (E-coli) levels. The samples were collected on a high slack tide, in at least a foot of water along the shoreline of Bayville, approximately every two weeks between August 1 and October 17, 2001. The same collection and storage procedures were used in this study as in our weekly monitoring program.

Oyster Bay and Cold Spring Harbor are classified as "SA" waters which means the best intended use for these waters is shellfishing. This is the highest classification established by New York State and means that these waters must have a logarithmic average (or geometric mean) total coliform concentration of 70 MPN/100 ml or less to meet the bacteria standards for this classification. Being held to the strictest classification means that if the waters conform to this standard or are "open" for harvesting shellfish, all other uses such as swimming and boating will also be permitted.

Table 2: Coliform Bacteria Standards

	Shellfishing Open	Swimming Open
Total Coliform	LOG AVG 30 days < 70mpn/100ml or If < 10% of samples do not exceed 5,000 *mpn/100 ml*	LOG AVG 30 days < 2,400mpn/100ml
Fecal Coliform	LOG AVG 30 days <14 mpn/100 ml or if no one sample is > 1,000 *mpn/100 ml*	LOG AVG 30 days < 200mpn/100ml

Establishing baseline bacteria conditions will be particularly important to measure changes following the installation of a new package wastewater treatment plant for twenty-three homes within the Birches housing development in Oak Neck Creek and other efforts to improve water quality. The goal of this effort is to identify and correct pollution sources and thereby obtain a water quality level that supports a certified shellfishing area.

Monitoring Locations - Friends of the Bay monitors six sites throughout Oyster Bay and Cold Spring Harbor for dissolved oxygen, temperature, salinity, water clarity, and bacteria, and three more for bacteria only. Each site is monitored one day per week starting at 6 a.m. The dissolved oxygen monitoring locations include two sites in Cold Spring Harbor (FB-1 & FB-2); Buoy "4" near Plum Point at the entrance to Oyster Bay and Cold Spring Harbor (FB-3); Roosevelt Beach two hundred yards north off of the flag pole in Roosevelt Park (FB-4); West Harbor midway between the east and west shores (FB-5); and, the main channel of Mill Neck Creek (FB-6). An additional site located at Flower Oyster Company Hatchery (FMFH) was added this year and monitored only for only dissolved oxygen, salinity and water temperature. These sites are indicated on the map found in Appendix 1.

Nine water samples are collected to test for bacteria including: one from each of the six dissolved oxygen monitoring sites mentioned above, as well as one at the confluence of the two branches of Mill Neck and Oak Neck Creek (FB-7), one as close to Beaver Dam (south) as possible to reach with the tide (FB-8) and one as far north in Oak Neck Creek as possible with the tide (FB-9).

In 1984, high bacteria levels forced the New York State Department of Environmental Conservation to close Mill Neck Creek to shellfishing. It has since been determined that failing septic systems installed during the drought of the 1960's is the main cause of this pollution. After the drought subsided, groundwater levels returned to normal, flooding the septic systems.

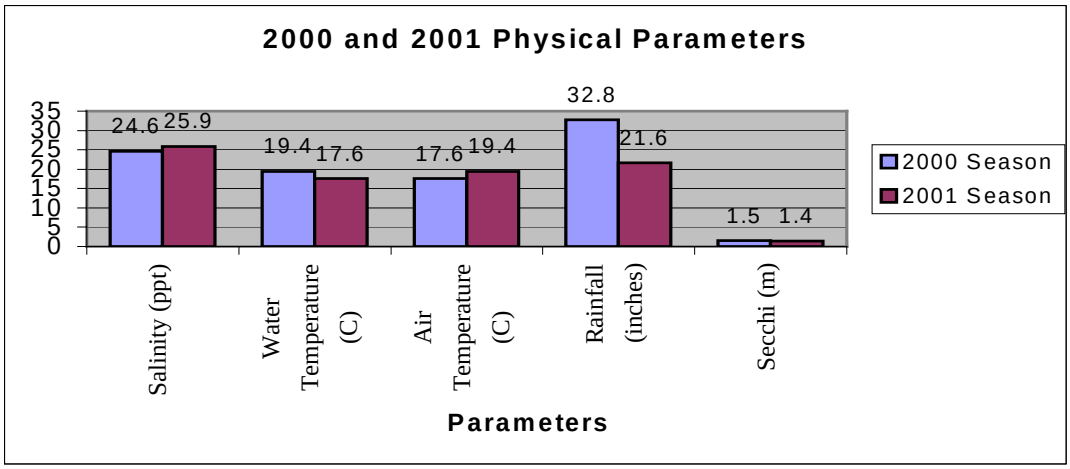
Although it is suspected that septic systems are malfunctioning, definite areas and the severity of the malfunctions have yet to be identified. In response, the Village of Bayville obtained a grant (the Bayville Cesspool Study), to identify and rectify septic system malfunctions in Mill Neck Creek. Friends of the Bay donated its services to the Village of Bayville by monitoring sixteen additional sites in Mill Neck Creek in an attempt to pinpoint areas of septic system malfunction along Bayville's shoreline. Twelve of the sites follow the shoreline of Oak Neck Creek and continue east along the northern shoreline of Mill Neck Creek while the remaining four sites are located in the open waters of Mill Neck Creek. The sites are identified on the map in Appendix 2.

Results, Analysis, & Discussion

As stated in the introduction, one of the goals of the water quality program of Friends of the Bay is to provide high quality data to continue the dissolved oxygen-testing baseline established by the Nassau County Department of Health from 1972 - 1991. In this, Friends of the Bay's third annual water quality monitoring report, we continue to modify how we report the results and analyze the data to make comparisons with historical county data simpler. It should be noted, that there are some important differences between the historical county data and Friends of the Bay data that prevent making direct comparisons. Using the same benchmarks however, such as the number of samples below the NYS Standard for Dissolved Oxygen (5.0 mg/L), provide a rationale for our analysis.

Physical Parameters

Graph 1



Salinity, temperature, and rainfall are important parameters to measure as they naturally affect dissolved oxygen, clarity, and coliform bacteria levels in the water column. Graph 1 shows the average physical parameter values for both 2000 and 2001 season. Overall, the 2001 monitoring season proved to be slightly warmer and drier than the 2000 season.

Rainfall event totals are important to monitor as rainfall directly influences dissolved oxygen, salinity, coliform bacteria, water clarity, and water temperatures. This year had approximately 11.2 inches less rainfall than in the 2000 season. The difference in rainfall and warmer water temperatures may be responsible for the increase in salinity this season

A decrease in secchi disc depths may indicate an increase in turbidity from suspended solids or planktonic bloom caused by rainfall, water temperatures, and nutrients, specifically nitrogen. However, the difference in secchi depths of a tenth of a meter between 2000 and 2001, shown on graph 1, does not appear to be a significant difference. In order to identify a trend, the baseline of data for secchi disc depths needs to be continued. This will be accomplished as each monitoring season passes, however the parameters responsible for water clarity impairments such as nitrogen and chlorophyll a should be incorporated into the study to identify the impacts they are having on water clarity.

As noted above, physical parameters influence water quality, both in the short and long term. However, it is impossible to identify a parameter's influence or a trend within the water column, with only two consistent years of data. Thus, it is essential for Friends of the Bay to maintain our weekly monitoring study, in order to determine a parameter's influence within the aquatic system and to make improvements to our monitoring processes.

The installation of a weather station at The Waterfront Center or F.M. Flowers Oyster Hatchery would facilitate such an improvement by providing data on physical conditions such as temperature highs and lows, wind speed, and rainfall on a regular basis. It would also allow for the creation of a consistent, accurate data baseline which we would use to identify these trends and impacts within the environment. Once natural cycles and trends are understood, then the degree of human impacts on Oyster Bay and Cold Spring Harbor can be more readily determined.

Coliform Bacteria

Coliform bacteria levels are reported as logarithmic average (also known as the geometric mean). This lessens the impact of a few particularly high or low readings on the overall average. The geometric mean for total and fecal coliform bacteria in Cold Spring Harbor, Oyster Bay and Mill Neck Creek presented in Table 4 highlights the elevated bacteria levels in Mill Neck Creek. Nassau County used to combine Mill Neck Creek with Oyster Bay. Since we have different and far fewer sampling points we have separated the two data sets. This prevents the four Mill Neck Creek sampling points with elevated numbers from skewing the three sampling points within Oyster Bay.

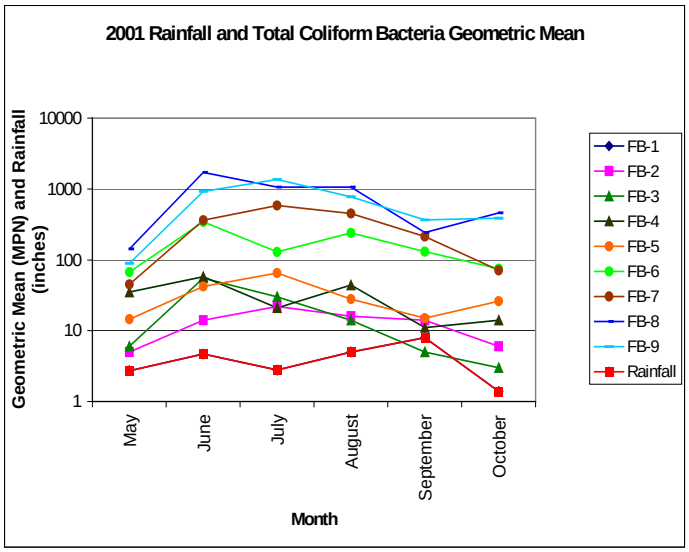
Table 3: Geometric Mean of Coliform Bacteria

Embayment	2001 Geometric Mean for Total Coliform (MPN/100mL)	2000 Geometric Mean for Total Coliform (MPN/100mL)	NCDH 1982-91 Total Coliform Average	2001 Geometric Mean for Fecal Coliform (MPN/100mL)	2000 Geometric Mean for Fecal Coliform (MPN/100mL)	NCDH 1982-91 Fecal Coliform Average
Cold Spring Harbor	37	31	35	13	12	19
Oyster Bay	19	21	25	5	6	12
Mill Neck Creek	294	237		99	74	
Rainfall (inches)	21.6	32.8				
Water temperature (C)	17.6	19.4				

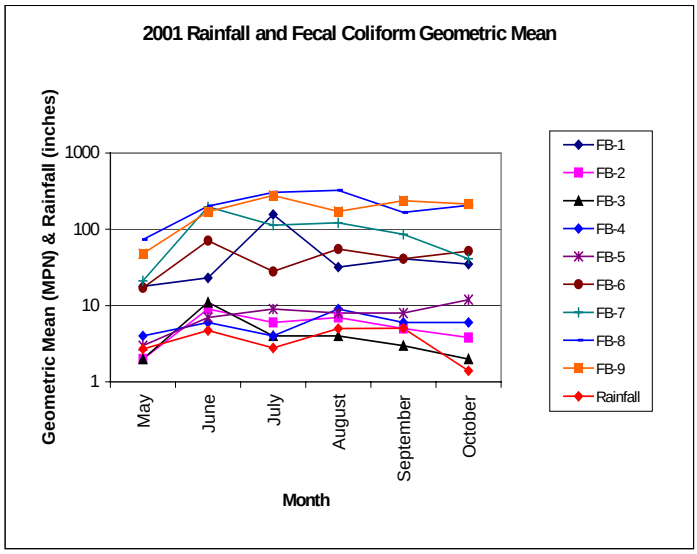
On a seasonal basis, the geometric mean in Mill Neck Creek is clearly higher than the shellfishing standard (total coliform geometric mean of 70 MPN/100mL and fecal coliform geometric mean of 14 MPN/100mL). Comparing this season with last season shows that both total and fecal coliform levels increased within both Mill Neck Creek and Cold Spring Harbor. It appears that Friends of the Bay's 2001 and 2000 results are not significantly different from the ten-year average reported by Nassau County for the period between

1982-1991. Although these areas do meet the standards to allow swimming (see Table 2 & 4), the comparison indicates that the coliform bacteria levels of Oyster Bay and Cold Spring are not readily improving.

Graph 2



Graph 3



Graph 2 represents the 2001 monthly rainfall and total coliform bacteria geometric means for each station while Graph 3 represents 2001 monthly rainfall and fecal coliform geometric mean in Oyster Bay and Cold Spring Harbor. Both graphs concur that Mill Neck Creek has the highest total and fecal coliform levels of the sites monitored within the Oyster Bay - Cold Spring Harbor estuary. When compared with rainfall, the general observable trend on the graphs indicates that rainfall may be influencing both total and fecal coliform levels. From May through August, total bacteria levels increased and decreased as per rainfall at a majority of the sites, however, an inverse relationship occurred with the onset of September and October. The correlation between total monthly rainfall and coliform bacteria proved both insignificant and misleading.

The raw coliform bacteria data of Appendix 5 shows five heavy, two moderate, and three light rainfall events occurring within 24 hours prior to a monitoring run this season. Both total and fecal coliform bacteria levels were significantly higher after these rainfall events indicating that runoff from rainfall is contributing to the high levels of coliform bacteria, specifically in Mill Neck Creek and Cold Spring Harbor.

As compared with all the stations (Graph 3), fecal coliform levels were the highest in Mill Neck Creek. Station FB - 8 had the highest overall fecal and total coliform bacteria geometric mean while Station FB - 9

had the second highest levels. The high levels at all the stations in Mill Neck Creek supports the New York State Department of Environmental Conservation's decision to keep Mill Neck Creek closed to shellfishing. This data also supports the theory that fecal coliform bacteria pollution is caused by failing septic systems in that area and influenced by runoff. The Bayville Cesspool study summation which can be found in the following section, identifies areas contributing coliform bacteria at FB-9, however further investigation should be completed to identify the sources of coliform bacteria specifically within the southern fork of Mill Neck Creek and Beaver Lake.

Table 4: Bathing Water Quality Standards

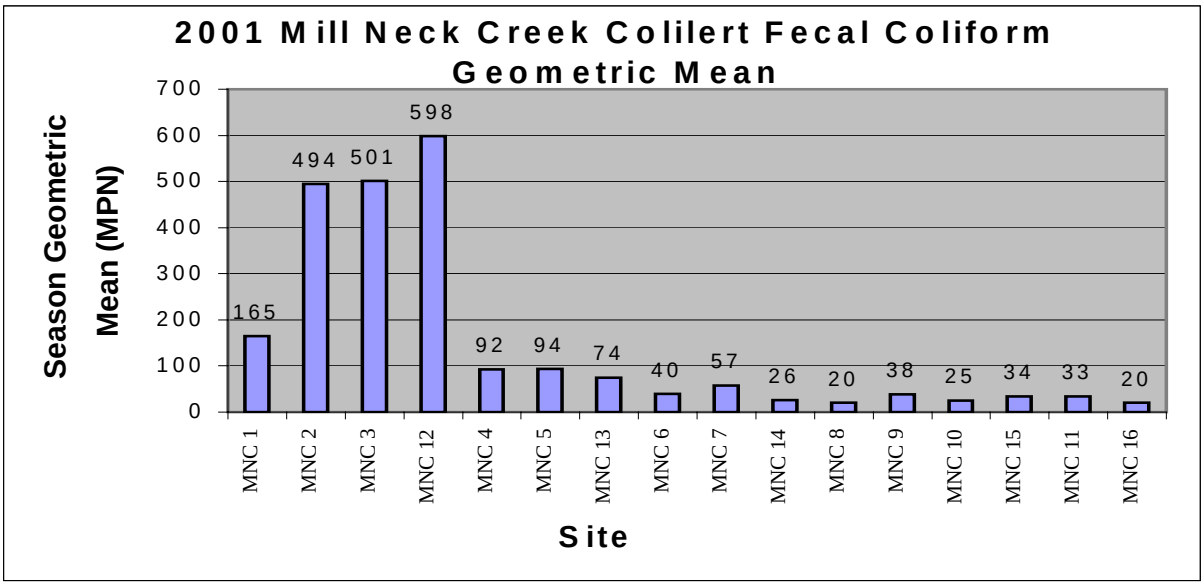
Location	Rating
Cold Spring Harbor South (FB-1)	**Very Good**
Cold Spring Harbor North (FB-2)	**Excellent**
Plum Point (FB-3)	**Excellent**
Roosevelt Beach (FB-4)	**Excellent**
West Harbor (FB-5)	**Very Good***
Mill Neck Creek - East (FB-6)	**Very Good**
Mill Neck Creek - West (FB - 7)	**Good***
Mill Neck Creek - South (FB - 8)	**Passable**
Mill Neck Creek - North (FB-9)	**Passable**

Table 4 applies the Bathing Water Quality Standards used by the Nassau County Department of Health in their annual water quality assessments to Friends of the Bay's data (Appendix 3). Overall, in reference to Table 4, Oyster Bay and Cold Spring Harbor bathing waters are very good while Mill Neck Creek is good. Compared to last season, stations FB-5 and FB-7 declined a rating from excellent to very good and from very good to good respectively. Although rainfall totals were less this season than last, monitoring ten times within twenty four hours of a rainfall event, may be responsible for the heightened levels. Aside from these rainfall events, the data shows that Oyster Bay and Cold Spring Harbor remain threatened by coliform bacteria loading, as reflected by the most lenient water quality evaluation standards.

As with any aquatic ecosystem, it is difficult to identify the source of pollution and the parameters that influence an aquatic ecosystem. It is equally difficult to pinpoint pollution sources within this study, as each of the stations are monitored in open waters far from a tributary or outfall. If Friends of the Bay incorporates the outfalls and tributaries of Cold Spring Harbor/Oyster Bay estuary into our study, we will be more effective in identifying sources of coliform bacteria pollution and showing the effectiveness of pollution abatement technologies.

Bayville Cesspool Study

Graph 4



Only E-coli bacteria results are represented Graph 4, as it was indicated after the fact by the Colilert test manufacturers that this test should be used to measure only E-coli MPN's. The extremely high total coliform bacteria readings support the theory that the Colilert test incorporates high numbers of non-target organisms into the total coliform bacteria readings, creating inaccurate results.

Stations 13, 14, 15, and 16 were monitored to identify e-coli coliform levels in open waters while the remaining stations monitored shoreline e-coli bacteria levels. As Graph 4 displays, station 13, 14, and 16 all had lower e-coli bacteria concentrations than their corresponding shoreline stations. Only station 10, a shoreline station, had a lower e-coli bacteria concentration than its open water station 15. The higher concentrations along the shoreline indicates they are a significant source of the e-coli bacteria in Mill Neck Creek.

The Oak Neck Creek stations (1, 2, 3, 4, 5, 12, 13) appear to have the greatest septic system malfunctions as they have the highest fecal coliform bacteria levels in this study. Station 12 has the highest E-coli coliform level and is located near the Birches housing development already identified as having severely malfunctioning septic systems and failed contact chlorination chamber. The high levels of coliform bacteria support the theory that the Birches is responsible for contributing a large load of fecal coliform bacteria within Mill Neck Creek.

The Oak Neck Creek stations had the highest fecal coliform bacteria levels as compared with the other sites in this study. Although coliform bacteria levels may have been influenced in Oak Neck Creek by a lower volume of water, The Birches housing development and The Strip, a highly developed restaurant and hotel area also known for its septic system malfunctions should be the first areas rehabilitated.

Friends of the Bay also recommends that all the shoreline stations be further investigated, as all the stations in this study failed to meet the New York State Coliform Bacteria Standards for shellfishing. Station 7 in particular, located at Creek Beach, on Creek Road, should be tested as it had high e-coli bacteria readings within Mill Neck Creek. Restrooms are located on this site and the data indicates that the septic system maybe failing. Being the Village of Bayville property, any septic system malfunction should be identified and corrected.

Location	Total # of Samples	Average Surface (mg/L)	Average Bottom (mg/L)	#/% of 2001 Bottom Samples Above NYS Standard (5.0 mg/L)	#/% of 2000 Bottom Samples Above NYS Standard (5.0 mg/L)	#/% of 1999 Bottom Samples Above NYS Standard (5.0 mg/L)	#/% of 2001 Bottom Samples Above Hypoxia (3.0 mg/L)	#/% of 2000 Bottom Samples Above Hypoxia (3.0 mg/L)
Cold Spring Harbor South (FB-1)	24	6.64	4.56	11/46%	13/52%	6/38%	18/75%	19/76%
Cold Spring Harbor North (FB-2)	24	7.99	5.15	12/50%	14/56%	7/44%	22/92%	23/92%
Plum Point (FB-3)	24	6.92	6.00	20/83%	20/80%	12/75%	23/96%	24/96%
Roosevelt Beach (FB-4)	24	6.61	5.88	18/75%	18/72%	12/75%	24/100%	25/100%
West Harbor (FB-5)	24	7.37	5.97	20/83%	18/72%	14/88%	24/100%	24/96%
Mill Neck Creek (FB-6)	24	6.36	5.57	17/71%	18/72%	14/88%	24/100%	25/100%
Flowers Oyster Company	20	6.00	5.99	19/90%	N/A	N/A	20/100%	N/A
Cold Spring Harbor Average (FB 1 & 2)	48	7.56	4.85	23/47%	27/54%	13/41%	40/83%	42/84%
Oyster Bay Average (FB 3-6 & FMFH)	116	6.81	5.88	94/81%	74/74%	52/83%	115/99%	98/98%
Overall Average	164	7.02	5.59					

Table 4: 2001 Dissolved Oxygen Summary

Dissolved Oxygen

Dissolved oxygen is a good indicator of the overall condition of the water, although no single test can accurately give a complete picture of the health of this complex ecosystem. The average bottom dissolved oxygen level for both Oyster Bay and Cold Spring Harbor was 5.59 mg/L, a tenth of a mg/L less than the year 2000's readings. Although this is not a great difference, NCDH reported the dissolved oxygen levels of Oyster Bay as 8.5 mg/L and 9.0 mg/L for Cold Spring from 1982-1991. This shows a trend of decreasing water quality.

Friends of the Bay's monitoring indicates that the average bottom dissolved oxygen level was 4.85 mg/L in Cold Spring Harbor and 5.88 mg/L in Oyster Bay, while the average surface dissolved oxygen was 7.56 mg/L and 6.81 mg/L respectively. Although the average surface dissolved oxygen levels were higher in Cold Spring Harbor, the lower bottom dissolved oxygen levels indicate that Cold Spring Harbor is more stressed by oxygen depletion than is Oyster Bay.

Expressed as a percentage of conformance to the NYS Dissolved Oxygen Standard, Cold Spring Harbor had the lowest dissolved oxygen levels and the lowest single dissolved oxygen reading for the second consecutive season (see Table 4). The reading of 0.36 mg/L on September 4th, is almost one whole mg/L less than last year.

Every site of the study failed to meet the New York State Dissolved Oxygen Standard of 5.0 mg/L at least once during the monitoring season and three of the seven stations were hypoxic (dissolved oxygen less than 3.0 mg/L) at least once (see Table 4). Cold Spring Harbor conformed to the NYS Dissolved Oxygen Standard 47% of the sampling days, a seven percentage point decrease from the previous season. Oyster Bay had higher dissolved oxygen levels, conforming 81% of the time in 2001 as compared to 74% in 2000. Because, both water bodies failed to exceed the 5.0mg/L reading 100% of the time, further studies should be done to determine the cause of low dissolved oxygen levels and identify annual climatic variation.

As Table 4 shows, there were slight differences between the 2000 and 2001 season dissolved oxygen readings which may be attributable to more than varying weather conditions. This season the YSI model 58 was used in place of the YSI 85 while it was being repaired. Although comparative studies between the instruments showed a slight difference (0.06 mg/L) in readings, the difference may have affected the overall readings. Secondly, the difference in the average reported by the NCDH and Friends of the Bay is likely to be attributable to the county factoring in sampling during winter months (November - March) when dissolved oxygen levels are normally significantly higher than warmer summer months. A third factor possibly influencing the dissolved oxygen levels may be the time at which the samples are taken. As routine, Cold Spring Harbor (South and North) are the first stations sampled (usually shortly after sunrise). The dissolved oxygen levels will be the lowest at these stations as they are monitored approximately two hours before the last station. This span of time could be responsible for the signifigant difference in dissolved oxygen levels between Cold Spring Harbor (FB-1) and Flowers Oyster Hatchery. FB-1 is the first station monitored and had the lowest dissolved oxygen levels, while Flowers Oyster Hatchery was the last station monitored (four hours later) and had the highest dissolved oxygen levels.

Program Recommendations

Continue Partnerships

The Nassau County Department of Health, volunteers, and Friends of the Bay's college intern, Jennifer Casler were invaluable this monitoring season. The partnership with Nassau County Department of Health continued to make it possible to examine water quality at all our sites and has added more credibility to our efforts while volunteers facilitated taking samples, and provided a fun, educational opportunity for individuals to get involved in protecting the estuary.

Although we have a great volunteer base, all of our volunteers reside in Oyster Bay. This indicates that Friends of the Bay is not extending our reach into Cold Spring Harbor and inviting citizens to become involved in our monitoring program. Reflecting upon this, efforts should be made to invite Cold Spring Harbor residents to join us aboard the Baywatch II during the 2002 season.

Take Action

Friends of the Bay needs to continue initiating water quality improvement programs by participating in studies and applying for grants to reduce pollution threats in Oyster Bay and Cold Spring Harbor. Our participation in the Bayville Cesspool Study last year and our Bilge Sock Education program slated to begin in May 2002 continue to facilitate such efforts. However, such programs should continue and more effort should be focused in Cold Spring Harbor in order to identify and alleviate its low dissolved oxygen levels.

Providing data useful to a variety of users enables us to share the results from the season with many focused groups who may join us in protecting Cold Spring Harbor and Oyster Bay. We distribute this report to any interested entity and automatically supply this report to the parties listed in the acknowledgments, as well as the following organizations:

U.S. Environmental Protection Agency
NY Department of Environmental Conservation
Connecticut Department of Environmental Protection
Town of Huntington
Suffolk County Department of Health
Oyster Bay Sewer District
Nassau County Soil and Water Conservation District
New York State Sea Grant
North Shore Bayman's Association
BOCES Outdoor Information Education Center
Cold Spring Harbor Fish Hatchery
U.S. Fish and Wildlife Service
U.S. Army Corps of Engineers
Town of Oyster Bay
Cold Spring Harbor Civic Association
Long Island Sound Watershed Alliance
Save the Sound
American Littoral Society
Coalition to Save Hempstead Harbor
Interstate Sanitation Commission
Harbor and River Watch

We feel that it is important for these organizations to be aware of the water quality monitoring program and its results, as their organization or business is affiliated with and can be affected by the water quality conditions in Oyster Bay and Cold Spring Harbor.

Look to the Future

To further refine our understanding of our local waters, Friends of the Bay is considering additional sites and parameters for testing.

Stationary Probe - Real Time Monitoring- Cold Spring Harbor South, FB-1, has the lowest dissolved oxygen readings of Cold Spring Harbor and Oyster Bay and is the first station monitored with in our monitoring study. Installing a stationary probe will allow for us to constantly monitor fluctuations of dissolved oxygen, salinity, and water temperature at FB-1. Such an instrument would also allow us to identify how long FB-1 remains hypoxic and to compare dissolved oxygen readings with the other stations' readings.

Additional Sites- Being an environmental organization, it is important for Friends of the Bay to focus our study on areas such as coves and outfalls, to determine their impacts on Oyster Bay and Cold Spring Harbor. The results of VWQM study over the last three years indicates dissolved oxygen and coliform bacteria impairments, however our current monitoring sites only indicate a wide area of impairment. In hopes of identifying the source of pollution, we hope to expand our monitoring sites to include tributaries, sewage treatment plant outfalls, and areas of high boat activity.

Apparent color - Apparent color is an easy way to get general information about what material is dissolved or suspended in the water. Water with very little dissolved or suspended material appears blue in color. The presence of dissolved organic matter such as decaying plant matter can result in water color of yellow or brown. The presence of dinoflagellates can produce a reddish or deep yellow color. Water that is rich in phytoplankton and algae appears green. Runoff can result in a variety of colors including yellow, red, brown or gray.

Chlorophyll a - In addition to measuring apparent color, it is ideal to measure chlorophyll a levels within Oyster Bay and Cold Spring Harbor. A chlorophyll a test would measure the concentration of algae in the water column, thus identifying if water clarity is being influenced by algae blooms.

Nutrients - In a training manual issued by the Environmental Protection Agency and The Center for Marine Conservation it is stated that "From mid-July through September each year, up to half of Long Island Sound experiences dissolved oxygen levels insufficient to support healthy populations of marine life. Nitrogen loads are estimated to be more than twice those of pre-colonial times with 57 percent of the nitrogen entering the Sound each year attributable to human activities." (Ohrel & Register) As Cold Spring Harbor and Oyster Bay experience this oxygen depletion, it is essential to investigate the causes of low dissolved oxygen levels specifically through testing nitrogen levels.

Nutrients, specifically nitrogen which exists in several forms including ammonia (NH_3), nitrates (NO_3), and nitrites (NO_2), are important to the ecosystem. Nitrates are essential plant nutrients but in excess can be detrimental to water quality by causing dramatic increases in plant growth, changing the types of plants and animals, and ultimately creating hypoxic conditions within the water body. A few of the possible sources of excess nitrates include wastewater treatment plants, failing on-site septic systems, animal wastes, and runoff from fertilized lawns.

Testing these nitrogen forms would establish a nitrogen baseline while identifying areas of high nitrogen input in Oyster Bay and Cold Spring Harbor. To ensure accurate nitrogen readings, a certified laboratory must analyze these samples. The laboratory costs associated with analyzing nitrogen species is very expensive, making it difficult for non - profit organizations to carry this financial burden. In responding to this need, Friends of the Bay is seeking the donation of laboratory testing from a certified laboratory or a substantial financial donation to test this parameter. Such donations will enable Friends of the Bay to add nitrogen testing to our weekly monitoring program and document its effect within the environment.

Wildlife Populations - Being on the water at sunrise, for six hours a week allows us many opportunities to observe and identify wildlife undisturbed by human activities. Osprey, hawks, terns, egrets, herons, ducks, swans, geese, Diamondback Terripan turtles, Moon, Comb and Lion's Mane jellies, and Horseshoe Crabs are generally the wildlife we observe. Turtles, fish, jellies, and birds, being indicator species, are the first to exhibit the effects of environmental change. Acknowledging this, Friends of the Bay will add wildlife monitoring to our weekly monitoring study. Not only will this allow our volunteers to become more familiar with the environment around them, but will also create an additional baseline of information, providing further indications of environmental stress in the Oyster Bay - Cold Spring Harbor Estuary.

Education and Public Awareness- A means of sharing the results of the VWQM study with the public on a weekly basis should be established in order to foster an understanding of water quality impairments. It is especially important to share this information with those who use the waters of Oyster Bay and Cold Spring Harbor on a regular basis. A display containing an outlined map of the Oyster Bay - Cold Spring Harbor estuary and our monitoring sites posted at the piers and boat launches of Oyster Bay and Cold Spring Harbor would provide this outreach. At the conclusion of the weekly monitoring run, the dissolved oxygen and coliform bacteria data for each site would be recorded on the displays along with a colored fish indicator depicting whether the reading was good, fair, or poor. Expressing the data in both forms will allow everyone to comprehend the information for each location.

To further increase public awareness and contact, the telephone numbers for Friends of the Bay and the New York State Environmental Conservation Police should also be listed on each board. This would allow the public to contact us and to report any activities they feel maybe threatening the Cold Spring Harbor or Oyster Bay. To increase public awareness of fishing regulations, a separate display listing the current NYSDEC recreational fishing standards should also be posted with the VWQM data board. As a final means to reach those not frequenting these areas, a weekly column should be posted in the local newspapers about Friends of the Bay and our weekly monitoring data.

Continue to Invest in Equipment

Investment in the maintenance of Friends of the Bay's monitoring equipment is important to obtaining accurate readings. This year the YSI 85 was sent for maintenance during the monitoring season and the YSI 58 was used in place. Thus, both meters (Model 58 and Model 85) should be maintained periodically by YSI during the off-season.

Equipment and services on the Friends of the Bay water quality monitoring program "wish list" which would enable us to add the above mentioned parameters and improve the monitoring program include:

- ★ Nitrogen testing
- ★ New or used computer (laptop preferable) and color printer
- ★ Apparent Color meter
- ★ Depth finder
- ★ 2 3'x2' Dry Erase Boards
- ★ Binoculars
- ★ Large flip top cooler (2' x 1')
- ★ 55 feet of 1/4 inch stainless steel cable
- ★ Bird Identification Books
- ★ Large plastic storage containers with lids
- ★ Weather station instrumentation (automated rainfall gauge, high and low thermometer, barometer, wind direction and speed)

Conclusion

Exciting things are happening around Oyster Bay and Cold Spring Harbor. In the spring of 2002, Friends of the Bay will initiate Bilge Sock Education program by distributing bilge socks and educational pamphlets to inboard motor boat owners in the hope of preventing oil pollution in Oyster Bay and Cold Spring Harbor. In an effort to identify failing septic systems on the perimeter of Mill Neck Creek, Friends of the Bay completed additional coliform bacteria testing for the Village of Bayville during the fall of 2001. As part of the Bayville Cesspool Study, the Village of Bayville will use this data to identify and rectify septic systems malfunctions, in hopes of reopening Mill Neck year round to shellfishing.

This season proved to be our most successful monitoring season with a total of 24 weeks of data being collected from 9 stations between May 7, 2001 and October 29, 2001 in Oyster Bay and Cold Spring Harbor. The data identified that both Oyster Bay and Cold Spring Harbor remain threatened by hypoxia and high coliform bacteria levels. However, Cold Spring Harbor is most threatened by low dissolved oxygen levels, while Oyster Bay is threatened by coliform bacteria.

In assisting the Village of Bayville, six additional weeks of coliform bacteria data were collected from 16 sites in Mill Neck Creek. During this time frame, two weeks of data were not collected due to poor weather conditions and small boat advisories. This study identified that all the areas in Mill Neck Creek were threatened by fecal coliform bacteria pollution, with Oak Neck Creek and Creek Beach having the highest fecal coliform bacteria levels.

During the 2001 Friends of the Bay strengthened our baseline data and completed additional monitoring study. Through the expansion of the monitoring sites in Mill Neck Creek, we were able to supply information to a government agency for a pollution abatement project, thereby satisfying one of our goals. This season also provided insight into what the monitoring program needs to focus on, in order to make study more informative, accurate, and efficient.

Friends of the Bay looks forward to working with volunteers, government agencies, and fellow not-for-profit organizations in the 2002 monitoring season. Together, we will be able to continue to improve and expand our monitoring efforts. Hopefully, these efforts will provide a link to show how investment in water quality protection is improving Oyster Bay and Cold Spring Harbor.

For further information about Friends of the Bay's Volunteer Water Quality Monitoring Program or other Friends of the Bay activities, contact Polly Weigand at (516) 922- 6666 or e-mail: bay@friendsofthebay.org .

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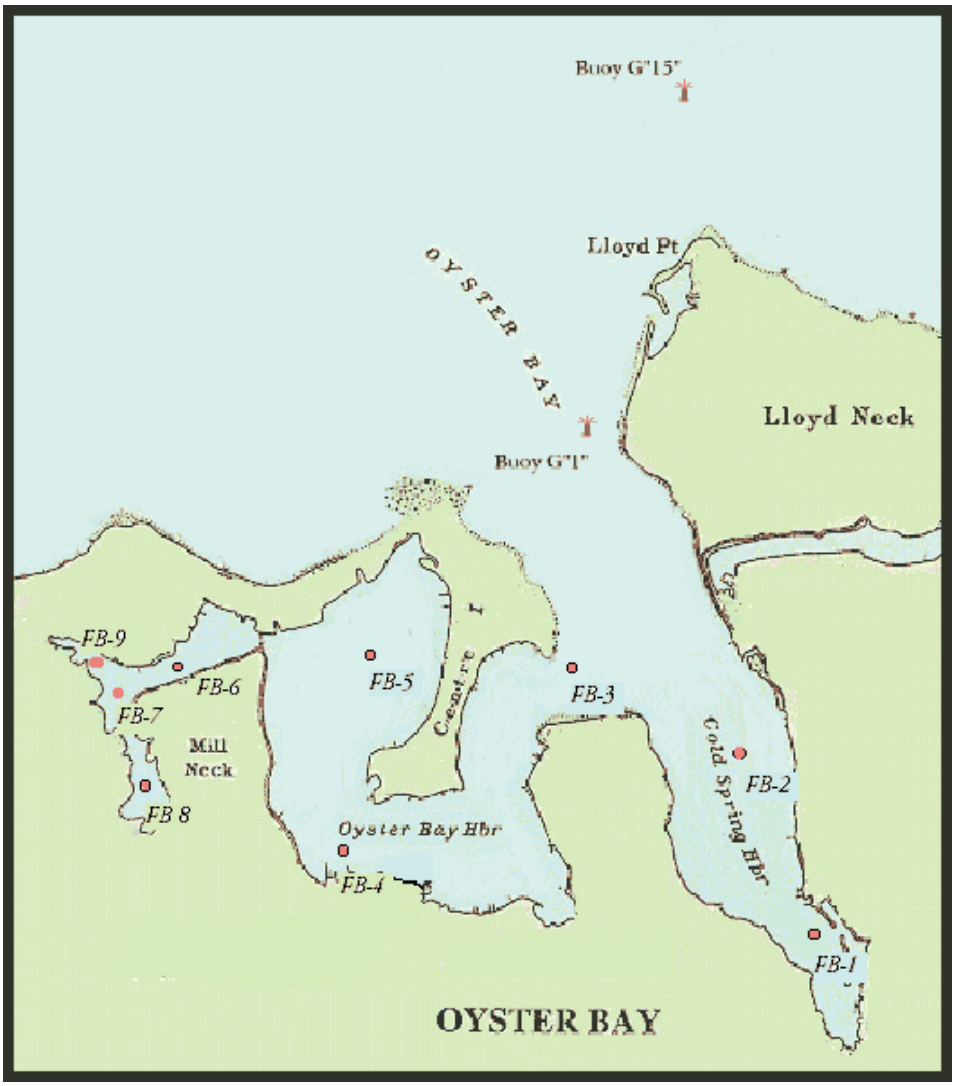
Appendix 1: Map of Monitoring Locations



Appendix 2: Map of Bayville Cesspool Study Sites

Appendix 3: Bathing Water Quality Standards

(from Nassau County Department of Health *1974 Surface Water Quality Assessment Report)*

The following rating criteria were applied to the bathing waters of Nassau County in 1974.

EXCELLENT - To obtain this rating a bathing beach must have a cumulative (seasonal) log average of total coliform not greater than 70, and individual total coliform counts of greater than 330 shall not have appeared in more than 10 percent of the total number of samples.

VERY GOOD - To obtain this rating a bathing beach must meet the following: (a) its cumulative (seasonal) log average of total coliform must not be greater than 240 - (b) no 30 day running log average result of total coliform shall be greater than 500 - (c) individual total coliform counts shall not be greater than 5,000 for more than 20 percent of the total number of samples.

GOOD - To obtain this rating a beach shall: (a) have a cumulative log average of total coliform not greater than 240 - (b) individual total coliform counts shall not be greater than 5,000 for more than 20 percent of the total number of samples.

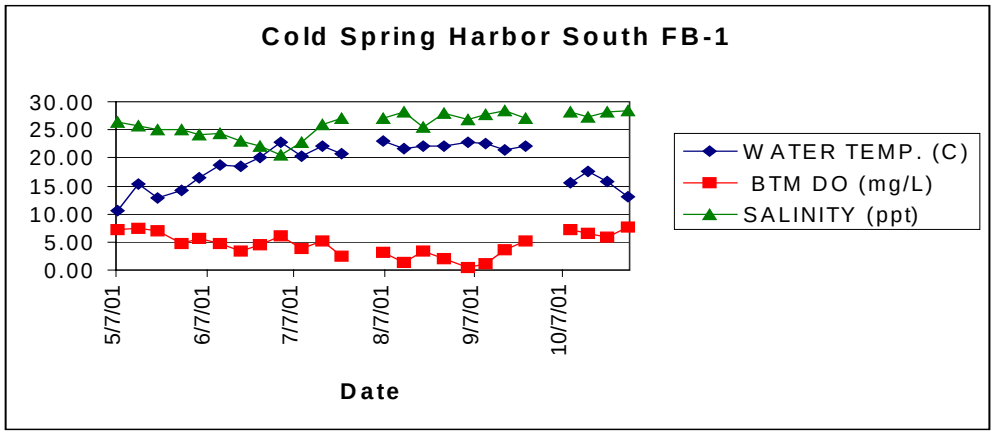
*FAIR - To obtain this rating a beach must have the following: (a) no 30 day fecal coliform log average shall be greater than 200 (b) no 30 day total coliform log average shall be greater than 2,400 - (c) individual total coliform counts shall not be greater than 5,000 for more than 20 percent of the total number of samples.

*PASSABLE - Meets "Fair" rating, but has a 30 day fecal coliform log average exceeding 200.

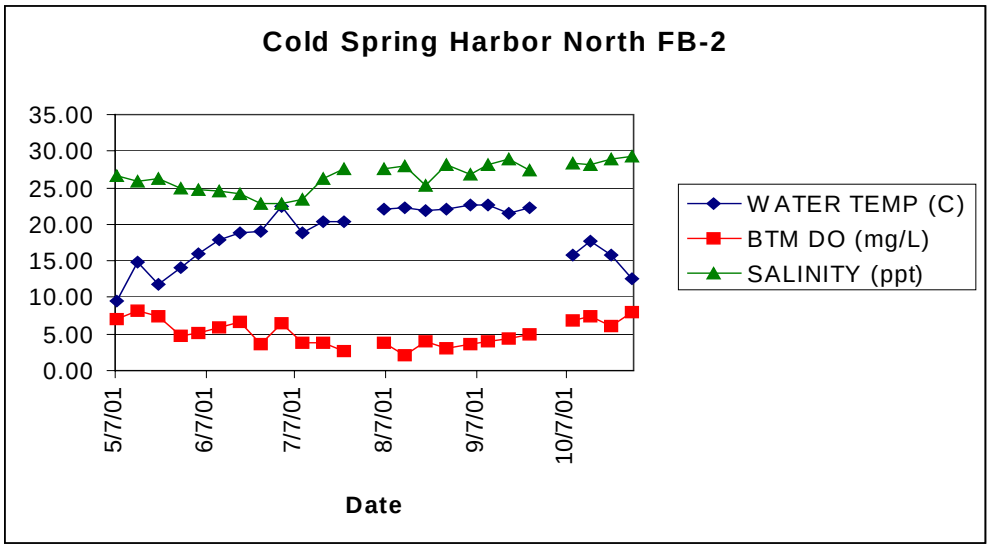
*EXCEEDS NEW YORK STATE HEALTH DEPARTMENT STANDARDS FOR BATHING WATER QUALITY - A beach receives this rating when the 30 day log average for total coliform goes over 2,400 at any time during the bathing season, or when more than 20 percent of the samples taken in the- season contain total coliform counts in excess of 5,000.

*Fecal coliform test used in evaluation of beaches not attaining at least "Good" water quality.

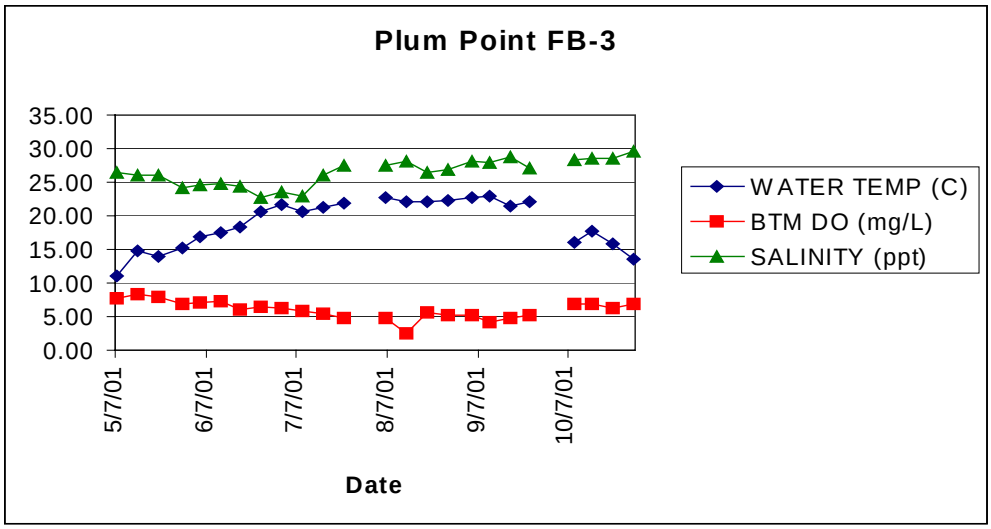
Appendix 4: Dissolved Oxygen Data & Graphs



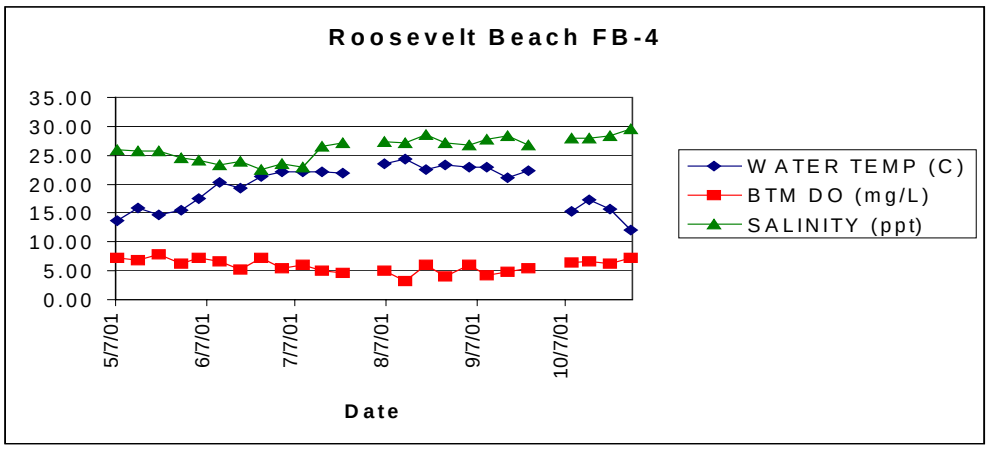
Cold Spring Harbor (South) FB-1						
DATE	WATER TEMP.	BTM DO	SALINITY	SECCHI DEPTH	BTM DEPTH	AIR TEMP.
	(C)	(mg/L)	(ppt)	(meters)	(meters)	(C)
5/7/01	10.70	7.12	26.40	1.50	4.00	7.00
5/14/01	15.30	7.50	25.70	1.70	7.00	10.00
5/21/01	12.80	7.03	25.10	1.20	6.00	10.00
5/29/01	14.20	4.84	25.00	0.95	6.00	18.00
6/4/01	16.50	5.54	24.20	1.30	4.00	17.00
6/11/01	18.70	4.68	24.40	1.60	7.00	21.00
6/18/01	18.60	3.30	23.00	1.30	6.00	18.00
6/25/01	20.10	4.59	22.00	1.00	5.00	22.00
7/2/01	22.70	5.98	20.60	1.20	8.00	17.00
7/9/01	20.20	3.88	22.70	1.30	4.00	22.00
7/16/01	22.20	5.12	26.00	1.20	7.00	19.00
7/23/01	20.80	2.59	27.00	1.30	4.00	25.00
7/30/01						
8/6/01	22.90	3.14	27.00	1.00	2.00	23.00
8/13/01	21.70	1.46	28.20	1.50	6.00	24.00
8/20/01	22.20	3.40	25.50	1.00	4.00	22.00
8/27/01	22.00	1.95	27.90	1.30	6.00	24.00
9/4/01	22.70	0.36	26.80	1.10	5.00	18.00
9/10/01	22.60	1.06	27.70	1.10	7.00	23.00
9/17/01	21.50	3.62	28.50	1.30	4.00	15.00
9/24/01	22.00	5.09	27.00	1.20	6.00	19.00
10/1/01						
10/9/01	15.60	7.14	28.10	1.00	7.00	4.00
10/15/01	17.60	6.55	27.40	3.00	6.00	14.00
10/22/01	15.90	5.76	28.30	2.40	6.00	15.00
10/29/01	13.10	7.72	28.40	1.20	5.00	7.00
Average	18.86	4.56	25.95	1.36	5.50	17.25



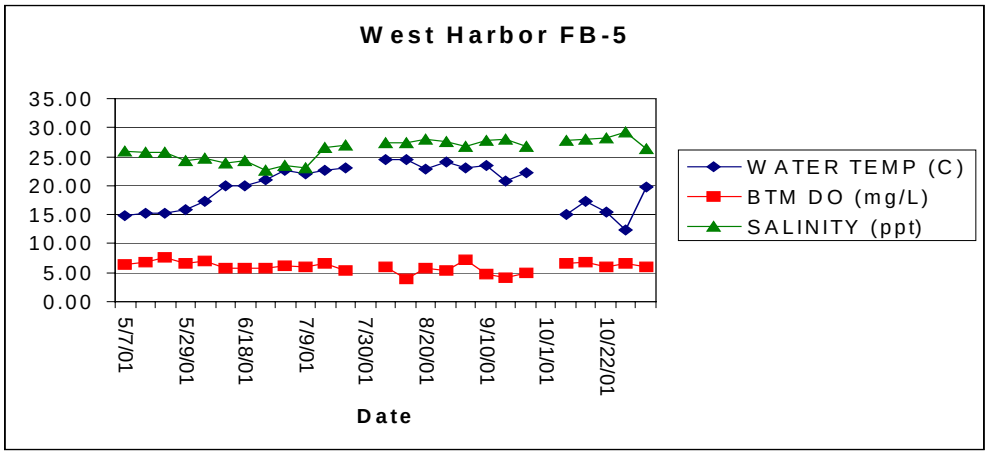
COLD SPRING HARBOR (NORTH)- BOTTOM DO FB-2						
DATE	WATER TEMP (C)	BTM DO (mg/L)	SALINITY (ppt)	SECCHI DEPTH (meters)	BTM DEPTH (meters)	AIR TEMP (C)
5/7/01	9.50	7.10	26.70	1.50	5.00	8.00
5/14/01	14.80	8.14	25.90	1.30	6.00	11.00
5/21/01	11.70	7.43	26.30	1.50	6.00	11.00
5/29/01	14.00	4.85	25.00	0.90	9.00	18.00
6/4/01	15.90	5.16	24.70	1.90	7.00	17.00
6/11/01	17.80	5.95	24.50	2.50	7.00	24.00
6/18/01	18.90	6.59	24.20	1.50	6.00	20.00
6/25/01	19.10	3.57	22.80	1.30	7.00	23.00
7/2/01	22.50	6.52	22.90	1.90	9.00	18.00
7/9/01	18.90	3.77	23.40	1.40	5.00	23.00
7/16/01	20.30	3.79	26.20	1.70	8.00	22.50
7/23/01	20.30	2.61	27.50	1.50	5.00	25.00
7/30/01						
8/6/01	22.00	3.73	27.60	1.40	5.00	24.00
8/13/01	22.20	2.10	27.90	2.00	7.00	23.00
8/20/01	21.80	3.90	25.30	1.50	5.00	23.00
8/27/01	22.10	3.06	28.20	1.60	7.00	24.00
9/4/01	22.60	3.68	26.80	1.90	5.00	19.00
9/10/01	22.70	4.02	28.20	1.40	6.00	23.00
9/17/01	21.50	4.34	28.90	1.30	5.00	15.00
9/24/01	22.20	4.94	27.40	1.80	7.00	23.00
10/1/01						
10/9/01	15.70	6.90	28.30	1.90	6.00	4.00
10/15/01	17.60	7.46	28.10	2.00	6.00	15.00
10/22/01	15.80	6.13	28.90	2.10	6.00	15.00
10/29/01	12.50	7.91	29.30	1.50	6.00	7.00
Average	18.43	5.15	26.46	1.64	6.29	18.15



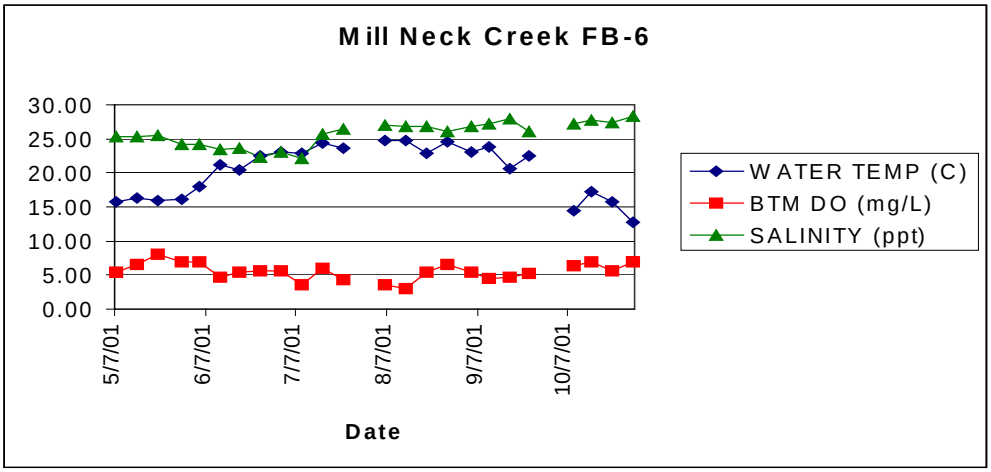
PLUM POINT- BOTTOM DO- FB 3						
DATE	WATER TEMP (C)	BTM DO (mg/L)	SALINITY (ppt)	SECCHI DEPTH (meters)	BTM DEPTH (meters)	AIR TEMP (C)
5/7/01	11.00	7.70	26.50	1.40	10.00	9.00
5/14/01	14.80	8.29	26.00	1.30	8.00	12.00
5/21/01	13.90	7.92	26.00	1.30	10.00	11.00
5/29/01	15.20	6.78	24.20	0.90	10.00	18.00
6/4/01	16.90	7.17	24.50	1.60	10.00	15.50
6/11/01	17.60	7.19	24.80	1.90	10.00	29.00
6/18/01	18.30	6.14	24.30	2.00	10.00	27.00
6/25/01	20.60	6.51	22.80	1.10	10.00	24.00
7/2/01	21.70	6.21	23.50	1.40	10.00	17.00
7/9/01	20.70	5.78	22.90	1.50	10.00	24.00
7/16/01	21.30	5.32	26.10	1.50	10.00	23.00
7/23/01	21.80	4.72	27.50	1.40	10.00	25.00
7/30/01						
8/6/01	22.70	4.89	27.60	1.00	10.00	26.00
8/13/01	22.10	2.56	28.10	1.60	10.00	23.00
8/20/01	22.00	5.62	26.50	1.30	8.00	24.00
8/27/01	22.20	5.15	26.80	2.00	8.00	24.00
9/4/01	22.80	5.23	28.20	1.50	8.00	20.00
9/10/01	22.90	4.16	28.00	1.60	10.00	25.00
9/17/01	21.40	4.76	28.70	1.50	10.00	19.00
9/24/01	22.10	5.26	27.00	2.00	10.00	23.00
10/1/01						
10/9/01	16.00	6.78	28.30	1.90	10.00	8.00
10/15/01	17.70	6.90	28.50	3.00	9.00	15.00
10/22/01	15.90	6.22	28.50	1.80	10.00	15.00
10/29/01	13.60	6.78	29.60	1.50	10.00	7.00
Average	18.97	6.00	26.45	1.58	9.63	19.31



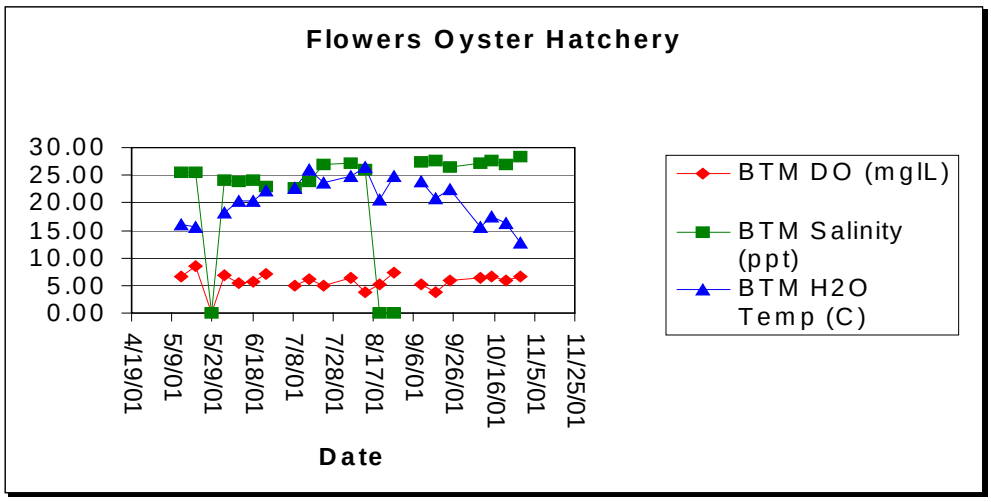
ROOSEVELT BEACH- BOTTOM DO - FB-4						
DATE	WATER TEMP (C)	BTM DO (mg/L)	SALINITY (ppt)	SECCHI DEPTH (meters)	BTM DEPTH (meters)	AIR TEMP (C)
5/7/01	13.70	7.31	26.00	1.50	2.00	10.00
5/14/01	15.80	6.86	25.80	1.05	3.00	14.50
5/21/01	14.60	7.85	25.80	1.10	4.00	13.00
5/29/01	15.50	6.26	24.50	0.90	9.00	18.00
6/4/01	17.60	7.32	24.20	1.60	4.00	17.00
6/11/01	20.40	6.62	23.40	1.20	2.00	27.00
6/18/01	19.40	5.20	23.90	1.10	5.00	25.00
6/25/01	21.30	7.30	22.60	1.25	1.25	21.00
7/2/01	22.10	5.40	23.60	1.10	9.00	17.00
7/9/01	22.20	6.03	22.90	1.50	2.00	28.00
7/16/01	22.10	5.00	26.60	1.10	10.00	27.00
7/23/01	22.00	4.55	27.10	1.50	1.50	28.00
7/30/01						
8/6/01	23.60	4.95	27.40	1.20	2.00	30.00
8/13/01	24.40	3.23	27.10	1.90	3.00	24.00
8/20/01	22.50	6.10	28.50	1.40	2.00	24.00
8/27/01	23.40	4.00	27.20	1.80	3.00	25.00
9/4/01	23.00	6.04	26.80	1.60	2.00	23.00
9/10/01	23.00	4.29	27.80	1.80	3.00	25.50
9/17/01	21.20	4.83	28.40	2.00	4.00	15.00
9/24/01	22.30	5.41	26.70	2.10	3.00	24.00
10/1/01						
10/9/01	15.30	6.51	27.90	2.20	2.00	8.00
10/15/01	17.20	6.71	27.90	1.70	4.00	17.00
10/22/01	15.60	6.23	28.30	2.10	3.00	15.00
10/29/01	12.00	7.16	29.60	3.00	3.00	14.00
Average	19.59	5.88	26.25	1.57	3.61	20.42



		WEST HARBOR- BOTTOM - FB-5				
DATE	WATER TEMP (C)	BTM DO (mg/L)	SALINITY (ppt)	SECCHI DEPTH (meters)	BTM DEPTH (meters)	AIR TEMP (C)
5/7/01	14.90	6.30	25.90	1.40	4.00	11.00
5/14/01	15.30	6.76	25.70	1.10	4.00	15.00
5/21/01	15.20	7.57	25.70	1.30	6.00	11.00
5/29/01	15.90	6.62	24.30	0.95	4.00	17.00
6/4/01	17.30	6.96	24.70	1.00	4.00	18.00
6/11/01	20.00	5.82	23.90	1.80	2.00	21.00
6/18/01	20.00	5.72	24.20	1.00	4.00	25.00
6/25/01	21.00	5.77	22.70	1.20	2.00	22.00
7/2/01	22.70	6.09	23.50	1.20	7.00	17.00
7/9/01	22.00	5.90	23.00	1.60	2.00	27.00
7/16/01	22.70	6.67	26.60	1.20	4.00	24.00
7/23/01	23.00	5.38	27.00	1.60	2.00	28.00
7/30/01						
8/6/01	24.40	5.90	27.40	1.00	2.00	28.00
8/13/01	24.40	3.91	27.30	1.40	4.00	24.00
8/20/01	22.80	5.86	27.90	1.30	3.00	25.00
8/27/01	24.00	5.29	27.60	1.30	4.00	26.00
9/4/01	23.00	7.11	26.80	1.10	2.00	27.00
9/10/01	23.40	4.69	27.70	1.20	3.00	25.00
9/17/01	20.70	4.16	28.10	1.50	2.00	18.00
9/24/01	22.20	4.92	26.70	1.90	3.00	23.00
10/1/01						
10/9/01	15.10	6.64	27.80	2.00	2.00	8.00
10/15/01	17.20	6.81	28.00	1.50	5.00	17.00
10/22/01	15.40	5.95	28.30	1.20	2.00	15.00
10/29/01	12.30	6.58	29.30	3.50	4.00	11.00
Average	19.79	5.97	26.25	1.43	3.38	20.13



		MILL NECK CREEK- BOTTOM DO -FB- 6				
DATE	WATER TEMP (C)	BTM DO (mg/L)	SALINITY (ppt)	SECCHI DEPTH (meters)	BOTTOM DEPTH (meters)	AIR TEMP (C)
5/7/01	15.70	5.40	25.30	1.00	3.00	14.00
5/14/01	16.40	6.57	25.40	0.80	3.00	17.00
5/21/01	15.90	8.12	25.50	1.00	6.00	12.00
5/29/01	16.10	6.97	24.10	0.70	3.00	20.00
6/4/01	18.00	6.92	24.10	0.90	4.00	17.50
6/11/01	21.10	4.60	23.50	0.65	2.00	20.00
6/18/01	20.50	5.43	23.70	1.10	4.00	25.00
6/25/01	22.50	5.66	22.30	0.90	2.00	24.00
7/2/01	23.00	5.67	23.00	0.90	6.00	19.00
7/9/01	22.90	3.58	22.10	1.00	2.00	26.00
7/16/01	24.30	6.05	25.70	1.20	4.00	25.00
7/23/01	23.60	4.33	26.40	1.60	2.00	28.00
7/30/01						
8/6/01	24.80	3.62	27.00	0.90	3.00	30.00
8/13/01	24.80	3.08	26.90	1.00	6.00	24.00
8/20/01	22.90	5.39	26.80	0.60	3.00	29.00
8/27/01	24.60	6.51	26.10	1.40	4.00	28.00
9/4/01	23.00	5.52	26.80	0.50	2.00	24.00
9/10/01	23.80	4.49	27.20	0.65	2.00	26.00
9/17/01	20.70	4.60	27.90	1.30	3.00	20.00
9/24/01	22.50	5.31	26.10	0.90	2.00	24.00
10/1/01						
10/9/01	14.40	6.38	27.10	1.00	2.00	9.00
10/15/01	17.20	6.88	27.70	1.50	5.00	17.00
10/22/01	15.80	5.68	27.30	1.50	2.00	15.00
10/29/01	12.70	6.96	28.40	3.20	3.00	9.00
Average	20.30	5.57	25.68	1.09	3.25	20.94



F.M. Flowers Oyster Hatchery						
Date	Surface DO (mg/L)	Surface Salinity (ppt)	Surface H2O Temp (C)	BTM DO (mglL)	BTM Salinity (ppt)	BTM H2O Temp (C)
5/7/01	5.25	25.30	15.60			
5/14/01	6.50	25.70	15.90	6.70	25.60	16.00
5/21/01	8.05	25.40	15.90	8.42	25.60	15.70
5/29/01	7.06	21.90	19.10			
6/4/01	7.09	24.30	17.10	6.89	24.10	18.10
6/11/01	5.97	23.20	20.90	5.45	23.80	20.40
6/18/01	5.70	23.80	21.10	5.77	24.20	20.20
6/25/01	6.76	22.70	21.90	7.00	23.00	22.10
7/30/01						
7/9/01	5.46	22.50	22.40	5.03	22.70	22.60
7/16/01	6.14	23.80	26.10	6.24	23.90	26.10
7/23/01	5.17	26.70	24.40	5.00	27.00	23.60
8/6/01	5.98	27.10	24.90	6.32	27.10	24.80
8/13/01	3.07	28.00	26.10	3.77	25.90	26.50
8/20/01	5.50	26.00	20.30	5.25		20.60
8/27/01	7.29	26.10	24.90	7.24		24.80
10/1/01						
9/10/01	5.39	27.20	24.10	5.31	27.30	23.90
9/17/01	4.19	27.50	20.50	3.87	27.70	20.70
9/24/01	5.38	25.60	22.60	5.79	26.40	22.40
10/9/01	6.37	26.60	14.50	6.49	27.20	15.50
10/15/01	6.91	27.50	17.50	6.58	27.60	17.40
10/22/01	5.74	26.80	16.10	5.96	27.00	16.40
10/29/01	7.01	28.30	12.70	6.62	28.30	12.80
Average	6.00	25.55	20.21	5.99	25.80	20.53

Appendix 6: Bayville Cesspool Study Coliform Bacteria Data

Station	Parameter	8/1/01	8/15/01	8/29/01	9/12/01	9/26/01	10/17/01	Season Geomean	Area Geomean	Area
MNC 1	Total E-coli	41	161	426	441	63	262	**165**	396	West Oak Neck Creek
MNC 2	Total E-coli	299	521	988	388	441	554	**494**		
MNC 3	Total E-coli	150	1722	691	331	583	459	**501**		
MNC 12	Total E-coli	987	1334	1014	435	203	388	**598**		
MNC 4	Total E-coli	146	187	63	31	74	158	**92**	89	Center of Oak Neck Creek
MNC 5	Total E-coli	74	185	52	84	86	134	**94**		
MNC 13	Total E-coli				41	74	134	**74**		
MNC 6	Total E-coli	41	146	30	30	10	74	**40**	42	Mill Neck Creek
MNC 7	Total E-coli	119	121	41	20	97	31	**57**		
MNC 14	Total E-coli				41	10	41	**26**		
MNC 8	Total E-coli	63	31	10	10	10	31	**20**	27	Mill Neck Bay
MNC 9	Total E-coli	435	41	41	10	41	10	**38**		
MNC 10	Total E-coli	145	20	10	10	20	41	**25**		
MNC 15	Total E-coli				30	20	63	**34**		
MNC 11	Total E-coli	73	63	10	10	41	74	**33**	28	Mouth of Mill Neck Creek
MNC 16	Total E-coli				20	20	20	**20**		