NYSDEC

FINAL

Pathogen Total Maximum Daily Loads For Shellfish Waters in Oyster Bay Harbor and Mill Neck Creek

Nassau County, New York

September 2003
Developed in conformance with
Section 303(d) of the Clean Water Act

New York State Department of Environmental Conservation

George E. Pataki, Governor

Erin M. Crotty, Commissioner

TABLE OF CONTENTS

Section Page

EXECUTIVE SUMMARY ES-1

1 INTRODUCTION 1-1
1.1 BACKGROUND 1-1
1.2 STUDY AREA DESCRIPTION 1-2

2 PROBLEM DEFINITION 2-1

3 APPLICABLE WATER QUALITY STANDARDS 3-1

3.1 NATIONAL SHELLFISH SANITATION PROGRAM WATER QUALITY STANDARDS 3-1

3.2 NYSDEC WATER QUALITY REGULATIONS 3-2

3.3 STANDARDS USED FOR SHELLFISH TMDL 3-3

4 WATERSHED CHARACTERIZATION 4-1
4.1 TOPOGRAPHY 4-2
4.2 CLIMATE 4-2
4.3 LAND USE 4-2
4.5 STREAM FLOW DATA 4-4
4.6 WATER QUALITY DATA 4-5

5 SOURCE ASSESSMENT 5-1
5.1 SHORELINE SURVEY 5-1
5.2 SUMMARY OF POLLUTION SOURCES IN THE STUDY AREA 5-4
5.2.1 Domestic Waste Disposal Using Cesspools 5-4
5.2.2 Sewage Treatment Plants 5-4
5.2.3 Storm Water 5-5
5.2.4 Freshwater Inputs 5-6
5.2.5 Boats/marinas/Mooring Areas 5-6
5.2.6 Wildlife and Waterfowl 5-7
5.2.7 Agriculture/Domestic Animals 5-7
5.2.8 Industrial 5-8
5.2.9 Summary 5-8

TABLE OF CONTENTS - CONTINUED

Section Page

6 MODELING APPROACH 6-1
6.1 MILL NECK CREEK AND TIDAL TRIBUTARIES 6-2
6.1.1 Hydrologic Simulation 6-2
6.1.2 Water Quality Simulation 6-5
6.2 OYSTER BAY HARBOR 6-6
6.2.1 Modeling of Primary Sources 6-7
6.2.2 Modeling of Secondary Sources 6-8
6.2.3 Load Characterization 6-8

7 LOAD ALLOCATIONS 7-1
7.1 BACKGROUND 7-1
7.2 SEASONAL VARIATIONS AND CRITICAL CONDITIONS 7-1
7.3 MARGIN OF SAFETY 7-2
7.3.1 Mill Neck Creek and Its Tributaries 7-2
7.3.2 Oyster Bay Harbor 7-3
7.4 ALLOCATION SCENARIO 7-4
7.4.1 Mill Neck Creek and Tributaries 7-4
7.4.2 Oyster Bay Harbor 7-5

8 REASONABLE ASSURANCE 8-1
8.1 Monitoring for MNC, OBH1, OBH2, OBH3, and OBH4 8-2
8.2 No-Discharge Zone for MNC, OBH1, OBH2, OBH3, and OBH4.....8-2
8.3 Implementation of Phase II Stormwater Regulations.....8-3
8.3.1 General Requirements for MNC, OBH1, OBH2, OBH3, and OBH4.....8-3
8.3.2 Additional Requirements Based on this TMDL for OBH2.....8-5
8.3.3 Additional Requirements Based on this TMDL for OBH2.....8-6

9 PUBLIC PARTICIPATION 9-1

10 APPENDIX A - FIGURES.....10-1

11 REFERENCES 11-1

LIST OF FIGURES CONTAINED IN APPENDIX A

Figure Page

ES-1. Study Zones in the Oyster Bay Harbor and Mill Neck Creek 10-1
1-1. Areas of Shellfish Closures within the Study Area 10-2
1-2. Geographical Location of Oyster Bay Harbor and Mill Neck Creek 10-3
1-3. Aerial Photograph of the Study Area 10-4
3-1 Oyster Bay - Water Classifications 10-5
4-1. Distribution of Land Uses within the Study Area 10-6
4-2. Flow and Water Quality Monitoring Stations 10-7
4-3. Historic Flow Record at the MNC USGS Station 10-8
4-4(a). Summary of SRS and Beach Sampling Data (1997-2002) 10-9
4-4(b). Summary of SRS and Beach Sampling Data (1997-2002).....10-10
4-5(a). Summary of Seasonal SRS and Beach Sampling Data (1997-2002) 10-11
4-5(b). Summary of Seasonal SRS and Beach Sampling Data (1997-2002) 10-12
5-1. Storm Water Outfalls in the Study Area 10-13
6-1. SWMM Model Setup and Water Quality Monitoring Stations within MNC 10-14
6-2(a). Comparison of Modeled and Monitored Flows in MNC 10-15
6-2(b). Comparison of Modeled and Monitored Flows in MNC 10-16
6-3. Comparison of Exceedance Curves for Modeled and Monitored Flows in MNC 10-17
6-4(a). Comparison of Modeled and Monitored Water Quality Data in MNC 10-18
6-4(b). Comparison of Modeled and Monitored Water Quality Data in MNC 10-19
6-4(c). Comparison of Modeled and Monitored Water Quality Data in MNC 10-20
6-4(d). Comparison of Modeled and Monitored Water Quality Data in MNC 10-21
6-4(e). Comparison of Modeled and Monitored Water Quality Data in MNC 10-22
6-4(f). Comparison of Modeled and Monitored Water Quality Data in MNC 10-23
6-4(g). Comparison of Modeled and Monitored Water Quality Data in MNC 10-24
6-5. Relative Distributions of Pollutant Sources within Four Study Zones 10-25
7-1. Rollback Analysis for Zone OBH2 using Bayside Beach Data 10-26
7-2. Rollback Analysis for Zone OBH3 using Beekman Beach Data 10-27

LIST OF TABLES

Table		Page
ES-1.	TMDLs and Target Percent Reductions	ES-7
1-1.	Water Bodies in the 303(d) List Within the Study Area	1-2
4-1.	Data Description and Sources	4-1
4-2.	Statistics of Precipitation Data in Mineola, New York	4-3
4-3.	Distribution of Land Uses within the Study Area	4-4
4-4.	Summary of Statistics for APC Sampling Data	4-6
5-1.	List of Permitted Point Source Discharges in the Study Area	5-5
6-1.	Summary of Calibrated Hydrologic Model Parameters	6-4
6-2.	Reported Ranges of Bacteria Die-Off Coefficients from Scientific Literature	6-5
6-3.	Calibrated Coliform Buildup Rates	6-6
6-4.	Distribution of Land Uses Within the Zones	6-8
6-5.	Summary of Secondary Sources	6-8
6-6.	Summary of Annual Precipitation Values	6-9
6-7.	Summary of Pollutant Source Coefficients used in the Four Zones	6-9

LIST OF ABBREVIATIONS

APC	Adverse Pollution Conditions
BASINS	Better Assessment Science Integrating Point and Nonpoint Sources
BMPs	Best Management Practices
CREP	Conservation Reserve Enhancement Program
CWA	Clean Water Act
DEM	Digital Elevation Model
DOQQ	Digital Ortho Quarter Quads
GIRAS	Geographic Information Retrieval and Analysis System
GIS	Geographic Information System
LA	Load Allocations
MGD	Million Gallons Per Day
MNC	Mill Neck Creek
MOS	Margin of Safety
MPN	Most Probable Number
MSDs	Marine Sanitation Devices
NCDOH	Nassau County Department of Health
NHD	National Hydrography Dataset
NOAA	National Oceanics and Atmospheric Administration
NSSP	National Shellfish Sanitation Program
NYCRR	Official Compilation of Code, Rules and Regulations of the State of New York
NYS	New York State
NYSDEC/DEC	New York State Department of Environmental Conservation
OBH/ Harbor	Oyster Bay Harbor
SPDES	State Pollution Discharge Elimination System
SRS	Systematic Random Sampling
STP	Sewage Treatment Plant
SWMM	Storm Water Management Model
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USEPA	United States Environmental Protection Agency
WIN	Water Index Number
WLA	Wasteload Allocations
WQS	Water Quality Standard(s)
WTM	Watershed Treatment Model

EXECUTIVE SUMMARY

The New York State Department of Environmental Conservation (NYSDEC), with the cooperation and technical assistance of the United States Environmental Protection Agency (USEPA), along with their contractors Battelle and HydroQual, has completed the total maximum daily loads (TMDL) for pathogens in the shellfish waters for Oyster Bay Harbor and Mill Neck Creek. Oyster Bay Harbor, Mill Neck Creek and its tidal tributaries are among the 69 water bodies in the New York State's 2002 303(d) list as impaired for shellfish harvesting. In accordance with USEPA's Water Quality Planning and Management Regulations (40 CFR, Part 30), TMDLs need to be developed to achieve the applicable water quality standards. Oyster Bay Harbor needed to be broken down into four distinct areas where individual TMDLs have been developed. TMDLs for these five water bodies are developed in this report. Once implemented, these TMDLs are expected to achieve the targeted reductions in pathogens loads from point and non-point sources with the ultimate goal of achieving the water quality standards for shellfish harvesting.

Oyster Bay Harbor (referred to as Harbor in this report) is located on the north shore of Long Island and flows into the northern section of Cold Spring Harbor to form a tributary of Long Island Sound. The total area of this Harbor, including Mill Neck Creek (referred to as MNC), is approximately 2877 acres. Mill Neck Creek is approximately 297 acres in size. Land use within the drainage area to this Harbor and MNC is primarily urban with medium density residential development in the Hamlet of Oyster Bay and the Village of Bayville, and low density residential development in the remainder of the drainage area. Urban storm water is therefore the major source of pathogens (approx. 88% of total) to the Harbor. The waters support a large recreational environment for boating which represents the second largest source of pathogens (approx. 11% of total) to these water bodies. Open areas constitute the next dominant land use, with wildlife and waterfowl that also contribute pathogens (less than 1% of total) from this land use. The residential areas served by cesspools, along with some other non-point sources, are also a source of pathogens (less than 1% of total). The three permitted sewage treatment plants, although discharging continuously to these water bodies, are among the less dominant sources of pathogens (less than 1% of total).

Based on New York State's (NYS) current designation of certified areas within Oyster Bay Harbor and MNC and its tributaries, the following zones are defined and assessed individually in this study. These zones are shown in Figure ES-1 and are considered under this

document as five separate TMDLs.

Zone MNC: Listed as one of the impaired water bodies in NYS's 303(d) list, the MNC watershed includes the area conditionally certified by DEC just upstream (westerly) of the Bayville Bridge. The primary sources of pathogens in this area are. stormwater, boats/marinas, waterfowl/horses, Continental Villas STP, and other non-point sources such as low-density residential developments served by cesspools.

Zone OBH1: The seasonally uncertified (in the period from May 1 to October 31, annually) area within the Harbor downstream of the Bayville Bridge. The primary sources of pathogens in this area are flows from MNC, stormwater from a portion of the Village of Bayville, waterfowl/horses, and other non-point sources.

Zone OBH2: The seasonally certified area in the north eastern portion of the West Harbor (east of the Bayside Beach). The primary sources of pathogens in this area are stormwater, waterfowl/horses, and other non-point sources from a portion of the Village of Centre Island.

Zone OBH3: The uncertified area of the Harbor adjacent to Beekman Beach. The primary sources of pathogens in this area are stormwater, waterfowl/horses, boats/marinas, and other non-point sources.

Zone OBH4: The seasonally certified area in the Cove Neck portion of the Harbor. The primary sources of pathogens in this area are stormwater, waterfowl/horses, boats/marinas, and other non-point sources. These sources are dominated by pollution from Tiffany Creek fresh water inflows and urban storm water runoff from portions of the Hamlet of Oyster Bay and the Village of Cove Neck.

There are three more zones in the Harbor that are subjected to administrative closures as described below:

Zone OBH5: The uncertified area adjacent to the Oyster Bay STP outfall. The administrative closure area, was defined based on a dye study conducted by DEC in September,

1976.

Zone OBH6: The uncertified area surrounding the outfall point of the Seawanhaka-Corinthian Yacht Club's sewage treatment facility.

Zone OBH7: The mooring area south of OBH2 in the West Harbor.

The zones MNC and OBH1 through OBH4 are assessed individually for impairment. The zones OBH5 through OBH7 will continue to be governed by administrative closures after the implementation of TMDLs proposed in this study and therefore do not have detailed assessments.

New York State has used total coliform as indicator organisms for assessing pathogen contamination of shellfish harvesting areas. Consistent with the National Shellfish Sanitation Program's (NSSP) guidelines, NYS regulations specify the following two criteria for certified shellfish harvesting areas: (a) a geometric mean of less than 70 MPN/100mL, and (b) an estimated 90th percentile value of less than 330 MPN/100mL. Both values are calculated using bacteriological data derived from a minimum of the 30 most recent water samples. These two criteria are also used in this study for determining target load reductions for the point and non-point sources of pathogens.

Water quality data were available at 39 stations in which the DEC conducted monitoring on a systematic random sampling (SRS) basis. In addition, DEC data were available at seven stations within Mill Neck Creek monitored on a conditional basis (sampling for conditional programs was conducted from November through April, primarily during periods of dry weather or following light to moderate rainfall events ranging up to about 0.75 inches in a 24 hour period). The data were also available at four beaches within the study area conducted by the Nassau County Department of Health (NCDOH). These ambient water quality data compiled by DEC and NCDOH were assessed both on an annual and on a seasonal basis (May 1 through October 31). The seasonal analysis was performed in addressing issues in the seasonally certified areas in zones OBH1, OBH2 and OBH4. The seasonal data showed higher total coliform levels at all the DEC and NCDOH stations. Therefore, the seasonal data was used for assessing the extent of impairment and for developing target pathogens load reductions.

Based upon review of the water quality data (1997-2002), it is concluded that all the DEC

stations meet the two water quality criteria. Among the 39 stations, three stations exhibited high total coliform concentrations and the 90th percentile values were close to the criterion value of 330 MPN/100mL. The first of the three stations (Station TC-10) is located near the Bayville Bridge downstream (easterly) of MNC. The second (Station TC-22) is located near the Oyster Bay STP effluent outfall within the administrative closure zone defined by DEC, and the third station (Station TC-C4) is located in the Cove Neck area just downstream (northerly) of the Tiffany Creek.

The NCDOH beach data showed high levels of total coliform at Beekman and Roosevelt beaches and exceeded both the geometric mean and 90th percentile criteria. The Bayside and West Harbor beach data exhibited 90th percentile values lower than, yet close to, the 90th percentile criterion of 330 MPN/100mL, but the geometric mean criterion was met. Consequently, TMDL allocations for waste load allocations (WLAs) and load allocations (LAs) are developed for zones MNC and OBH1 through OBH4 based on the extent of impairment observed in the DEC and NCDOH data. It must however be noted that the sampling regimen of NCDOH (e.g., SRS and the Nassau County analytical laboratory) is not designated by DEC for use is assessing waters for the shellfish programs. The beach data is typically collected from public areas where there is a potential influence from sediment resuspension near the shoreline. DEC data is always collected at the surface and away from the shoreline. Being the most comprehensive among the compiled databases in this study, NCDOH data are used for TMDL development, where available, which results in a very conservative estimate for current loadings.

The modeling approaches used for linking the pathogen loads to receiving water responses for zones MNC and OBH1 through OBH4 are described here.

MNC: Flows in this creek upstream of the Beaver Lake are monitored by USGS (USGS Station #01303000). A Storm Water Management Model (SWMM) developed by EPA was used to characterize the MNC watershed and to assess the hydrologic/hydraulic model parameters. Extensive water quality data at the Bayville Bridge (SRS station TC-10 east of the Bridge) was used to calibrate pathogens loadings from individual land uses. Potential pathogens loadings from non-point sources such as boats/marinas, waterfowl/horses and wildlife in the MNC watershed were included in this calibration process, along with waterfowl and storm water loadings from Bayville and Mill Neck that contribute to total coliform concentrations measured at TC-10. In addition, the limited water quality data monitored by DEC in the conditionally certified area were used for model calibration in the upstream (westerly) reaches of the MNC

watershed. Based on a continuous model run for the 1997-2002 period, the linkage between loadings and receiving water total coliform concentrations were established. Since the available in-stream data in MNC is limited for developing a statistical distribution, TC-10 was chosen as the surrogate station to develop target reductions in pathogens loads using a statistical roll-back method.

OBH1: The flows and pathogen loads from MNC are used as a non-point source contributions in this zone. Additional loads included the urban storm water from portions of the Villages of Bayville and Mill Neck and waterfowl in and around West Harbor Beach. A Watershed Treatment Model (WTM) was used to characterize the relative distribution of point and non-point source loadings to this zone. The water quality data at TC-10 east of the Bayville Bridge was then used to determine the target reductions in pathogen loads.

OBH2: A WTM model was used to characterize the relative distribution of point and non-point source loadings. The point source included storm water drainage from portions of the Villages of Bayville and Centre Island, and the non-point sources included waterfowl in and around Bayside Beach. The water quality data at Bayside Beach was used to determine target load reductions for these sources.

OBH3: A WTM model was used to characterize the relative distribution of point and non-point source loadings to this zone. The point sources included urban runoff from the Town of Oyster Bay and a portion of Mill Neck. The non-point sources included waterfowl, marina and other non-point sources. The water quality data at Beekman Beach was used to determine target load reductions for these sources.

OBH4: A WTM model was used to characterize the relative distribution of point and non-point source loadings. Urban runoff from portions of the Town of Oyster Bay and the Village of Cove Neck constituted the point source loading. Boats/marinas, waterfowl/horses and other non point sources represented the non-point source loading. The SRS water quality data at the most upstream station in the Cove Neck area (TC_C4), meets the water quality standards yet exhibits high coliform bacteria levels. This water quality data was used to determine target load reductions in this zone.

The TMDL has been developed with a goal of meeting a 90th percentile concentration of 330 MPN/100mL total coliform. This is a National Shellfish Sanitation Program standard

which, if attained, will also meet the New York State Water Quality Regulations.

A margin of safety (MOS) was incorporated in the TMDL as both implicit through conservative assumptions, and explicit through allocation of a percentage of the loading capacity in the TMDL (a minimum of 10%). For zones which exhibited total coliform concentrations above the TMDL target the MOS is 10% of the TMDL allocation as an explicit MOS. For zones which exhibit total coliform concentrations below the TMDL target, waste load and load allocations were set at current loadings and the additional loading capacity above current loadings was allocated to the MOS. In the SWMM model used for Zone MNC, the conservative assumptions included a moderate decay rate of 2.5 per day, a linear buildup of coliform loads in the watershed and no constraint on the maximum coliform loads. Similarly, the conservative assumptions in the WTM model used for zones OBH1 through OBH4 included no bacteria decay during the transport process and the use of beach data for load allocation process. In both of these models, the seasonal data (May 1-October 31, annually) that exhibited higher total coliform values than the annual data were used for calibration and for development of load allocations.

A TMDL for each of the above five zones was then calculated using the sum of waste load allocations and load allocations. The urban storm water drainage areas were accounted for in the waste load allocation process. Table ES-1 summarizes the load reductions for individual sources for each of the above five zones.

Based on the target load reductions, a reasonable assurance plan that draws from the NYSDECs current in-place monitoring program to ensure achievement of the water quality standards as indicated in this report. In addition, the reasonable assurance plan provides the proposed management plan for achieving the TMDL allocations.

Table ES-1. TMDLS and Target Percent Reductions

Zone	Waterbody	Subwatershed	Current Point Source Load	Current Non Pt. Source Load	Current Total Loads*	TMDL	MOS	TMDL WLA	TMDL LA	TOTAL MOS+ WLA+ LA	PERCENT REDUCTION
MNC	Mill Neck Creek	Storm Water	95699					95699	0		
		Continental Villas STP	849					116	0		
		Boats/marinas		10886				0	10886		
		Waterfowl/Horses		2232				0	2232		
		Other Non-Point Sources		850				0	850		
		TOTAL	96548	13968	110516	164522	54739	95815	13968	164522	0
OBH1	Oyster Bay Harbor	Zone MNC		21744				0	21744		
		Storm Water	14950					14950	0		
		Waterfowl/Horses		18				0	18		
		Other Non-Point Sources		72				0	72		
		TOTAL	14950	21834	36784	55176	18392	14950	21834	55176	0
OBH2	Oyster Bay Harbor	Storm Water	9363					7454	0		
		Waterfowl/Horses		635				0	635		
		Other Non-Point Sources		52				0	52		
		TOTAL	9363	687	10050	9045	905	7454	687	9046	10
OBH3	Oyster Bay Harbor	Storm Water	376685					37093	0		
		Waterfowl/Horses		353				0	353		
		Boats/marinas		54432				0	2722		
		Other Non-Point Sources		1604				0	1604		
		TOTAL	376685	56389	433074	46413	4641	37093	4679	46413	89
OBH4	Oyster Bay Harbor	Storm Water	147296					147296	0		
		Waterfowl/Horses		1000				0	1000		
		Boats/Marinas		18144				0	18144		
		Other Non-Point Sources		734				0	734		
		TOTAL	147296	19878	167174	287372	120198	147296	19878	287372	0

Notes:
1. Units are in billion colonies/year (BCY)
2. Mill Neck Creek (MNC) and OBH1 has an MOS of 33% and OBH4 has an additional MOS of 42% This is due to a lack of current data in this stretch and provides an ultimate level of safety while the TMDL is implemented and results measured.
3. OBH2 will meet a TMDL of 9045 by providing a 10% MOS and a 20% reduction in the Storm Water
4. OBH3 will meet a TMDL of 46,413 by providing a 10% MOS, an 90% reduction in the Storm Water and a 95% reduction the loading from boats/marinas.

SECTION 1

INTRODUCTION

1.1 BACKGROUND

Section 303(d) of the Clean Water Act (CWA) as amended by the Water Quality Act of 1987, Public Law 100-4, and the USEPAs Water Quality Planning and Management Regulations (40 CFR), Part 130) require each State to identify those waters within its boundaries not meeting water quality standards for any given pollutant applicable to the water's designated uses. TMDLs are required to be developed for all pollutants violating or causing violation of applicable water quality standards for each impaired water body. A TMDL determines the maximum amount of a pollutant that a water body is capable of assimilating while continuing to meet the existing water quality standards. Such loads are established for all the point and non-point sources of pollution that cause the impairment at levels necessary to meet the applicable standards with consideration given to seasonal variations and margin of safety. TMDLs provide the framework that allows States to establish and implement pollution control and management plans with the ultimate goal indicated in Section 101(a)(2) of the CWA "water quality which provides for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water, wherever attainable" (USEPA, 1991).

NYSDEC listed the Oyster Bay Harbor and Mill Neck Creek and tidal tributaries on the State's 303(d) - 2002 as the candidates for the TMDL development. These listings are described in Table 1-1, and the areas of shellfish closures along with their designations within these two water bodies are shown in Figure 1-1. As seen in this figure, the shellfish closure areas are divided into eight zones which are further described in Section 2. TMDLs are developed for those zones that are either uncertified or conditionally/seasonally certified for shellfish harvesting.

Conditional shellfish harvesting programs allow the harvest of shellfish from areas that marginally fail to meet certified area criteria. Conditional programs are operated by DEC during the late autumn and winter months, generally from mid-December through mid-April. DEC performs annual water quality evaluations in uncertified areas specified by the Towns. The purpose of the evaluation is to identify a threshold amount of rainfall the area can tolerate and meet certified area

Table 1-1. Water Bodies in the 303(d) List Within the Study Area

ID	WIN	Name	Description	Class	Details
1702-0016	(MW4.4a) LIS-OBH	Oyster Bay Harbor	Entire bay	SA	This segment includes tidal waters west of a line from Plum Point to Cove Point and east of Bayville Bridge, which excludes Mill Neck Creek listed separately.
1702-0151	(MW4.4a) LIS-OBH-MNC	Mill Neck Creek and tidal tributaries	Entire tidal reach and tributaries	SA	This segment includes tidal waters west of the Bayville Bridge, including Oak Neck Creek.

criteria. During the operation of a conditional program, rainfall is measured daily in the vicinity of the conditional harvest area. Shellfish harvesters are allowed to work in the area on a day-to-day basis during dry weather and moderate rainfall conditions, when the daily rainfall reading is less than the threshold amount of rainfall. When the daily threshold amount is exceeded, the area is closed for a period of seven days and re-opened (certified) on the eighth day if the daily rainfalls during the closed period do not exceed the threshold amount. The fact that the conditional program threshold rainfall for Mill Neck Creek has typically been around 0.25" demonstrates how sensitive water quality in these areas are to the effects of bacteria laden storm water runoff.

The zones that are subjected to administrative closures will continue to be closed as discussed in Section 2.

1.2 STUDY AREA DESCRIPTION

Oyster Bay Harbor (also referred to as the Harbor in this report) is located on the north shore of Long Island and flows into the northern section of Cold Spring Harbor to form a tributary of Long Island Sound. Both Oyster Bay Harbor and its major tributary, Mill Neck Creek (MNC), are located within the Town of Oyster Bay in Nassau County. The Town has management authority over the shellfish resources within Oyster Bay Harbor and Mill Neck Creek. Shown in Figure 1-2 is the geographical location of this Harbor. Figure 1-3 shows the aerial photograph of the study area obtained from the DEC's databases (DEC GIS Clearing house - DOQQ).

The Village of Bayville is located on the northern side of Mill Neck Creek and the northern shore of the Harbor. The Village of Centre Island is located on a peninsula in the middle of the Harbor. A number of small creeks discharge into the Harbor, including Tiffany Creek that discharges into the Oyster Bay Cove located in the southeast corner of the Harbor.

The total area of the Harbor, including MNC, is approximately 2877 acres. Mill Neck Creek is approximately 297 acres in size, including the mud flat areas of Oak Neck Creek and northerly of Beaver Lake. The Harbor and MNC have approximately 17 miles of shoreline, virtually all of which is developed with residences. Much of the residential area is large estate type property. There is a small commercial and business district along the southern shoreline of the Harbor at the Hamlet of Oyster Bay. The tidal cycle is semi-diurnal with a mean tidal range of about 7.4 feet and a spring tide of up to 8.5 feet.

The watershed is home to approximately 20,000 people based on the 1999 census data of Nassau County. The predominant land use is low (with an estimated percent imperviousness of 10%) to medium-density (about 30% imperviousness) residential housing. The watershed consists of approximately 30% impervious surfaces in the Hamlet of Oyster Bay and the Village of Bayville, and about 10% impervious surfaces in the Mill Neck Creek subwatershed and Centre Island. The Hamlet of Oyster Bay, beaches in Bayville and nearby Sagamore Hill, in Cove Neck, all attract visitors and some tourists. As a result, this watershed experiences a slightly higher summer time population compared to the rest of the year. Apart from the resident and visitor/tourist population, there are other known sources of pollution such as waterfowl, wildlife, horses and other pets associated with individual homes and occupied boats in marinas and mooring areas. More details on these sources including the number of animals and waterfowl along with the number of boats docked at specific marinas and moored in the various mooring areas around the Harbor can be found in Sections 5 and 6 of this report.

SECTION 2

PROBLEM DEFINITION

Shellfish harvesting is the designated use for Oyster Bay Harbor and Mill Neck Creek and its tributaries. Molluscan shellfish, such as oysters and clams, are filter feeders. They filter the water around them to feed on microscopic organisms suspended in the water column. If the waters are polluted, viruses or bacteria that are harmful to humans can be potentially retained in the shellfish. Because oysters and clams are often eaten raw or partially cooked, they have the potential to cause serious illness or death in shellfish consumers if they are harvested from waters that are polluted.

New York State has listed Oyster Bay Harbor, Mill Neck Creek and tidal tributaries in the 303(d)list (DEC, 2002) among the water bodies closed for shellfish harvesting due to pathogen impairment. Based on the review of uncertified and conditionally certified areas in the study area, the water body is divided into eight zones for assessing impairment using modeling tools and subsequently developing load reduction targets to meet WQ Standards. These eight-study zones are shown in Figure ES-1 are described below.

The DEC shellfish sanitation program conducted a shoreline survey in 1988 to identify the actual and potential sources of pollution to the Harbor (DEC, 1988). Approximately 850 acres of the Harbor area out of the total of 2877 acres are currently classified as uncertified for the harvest of shellfish. There are three seasonally uncertified areas in the Harbor totaling approximately 88 acres. One area is located immediately east of the Bayville Bridge at the mouth of Mill Neck Creek (Zone OBH1), comprising about 22 acres. Another area (Zone OBH2) is located at the northwestern side of the Centre Island peninsula, comprising about 18 acres. The third seasonally uncertified area (Zone OBH4), about 48 acres is in the northern portion of Oyster Bay Cove. All three seasonally uncertified areas are closed to shellfishing from May 1 through October 31, annually. The largest section of uncertified lands (486 acres) is located along the southern shore of the Harbor, adjacent to the Hamlet of Oyster Bay. This area is divided into two zones, one that extends through the administrative closure boundary defined by DEC for the Oyster Bay STP outfall (Zone OBH5) and the other one (Zone OBH3) to the west near Beekman Beach. Mill Neck Creek (Zone MNC) has both uncertified and conditionally certified areas which are approximately 297 acres in size. The southern portion of Oyster Bay Cove, about 38 acres, is closed throughout the year. There is a small (six acres) uncertified area (Zone OBH6) around the sewage discharge from the Seawanhaka-Corinthian Yacht Club, immediately west of Plum Point on Centre Island. Finally, the mooring area (OBH7) south of OBH2 in the West

Harbor is subjected to administrative closure.

The Town of Oyster Bay regularly requests DEC to evaluate water quality in MNC in order to determine its suitability for a conditional harvesting program during the late fall and winter months. In 1987, the Town and DEC performed a water quality study of Oyster Bay Cove (DEC, 1988) to determine whether that area was suitable for a classification upgrading. The Cove study did not support designating the area as a certified growing area. During several years in the 1990s, conditional program evaluations of MNC showed that the area did not meet the criteria for conditional harvest areas, although, the Creek just exceeds the criterion 90th percentile value of 330 MPN/100 ml.

In addition, the DEC conducted a dye study in September 1976 at the sewage treatment plant (STP) effluent outfall of the Hamlet of Oyster Bay, and has defined a zone of administrative closure (uncertified for shellfish harvesting any time) around the outfall.

DEC maintains administrative closures around sewage treatment plant (STP) outfalls. Although water quality within the administrative closure might meet the bacteriological criteria for certified shellfishing areas, the closures are necessary in the event of failure or malfunction, such as loss of disinfection, by the sewage treatment plant. These closures serve as buffer zones between the actual pollution point source (the STP outfall) and the nearest certified shellfishing areas. The closures are of sufficient size that untreated or inadequately treated sewage would be contained within them during the time it takes for the STP operator to notify DEC officials about a malfunction and to give DEC sufficient time to notify shellfish harvesters in the adjacent certified areas to stop harvesting before those certified areas are adversely affected by the untreated or inadequately treated sewage. In Oyster Bay Harbor DEC has administrative closures around the Hamlet of Oyster Bay and Seawanhaka-Corinthian Yacht Club sewage treatment plant outfalls, OBH5 and OBH6, respectively.

Similarly, DEC also maintains administrative closures within and around marinas and boat mooring areas due to the presence of marine sanitation devices (MSD) on board the boats. Administrative closures around marinas and boat mooring areas provide a buffer zone between the potential pathogens sources, the MSDs on the boats, and the nearest certified shellfish harvesting areas. The guidelines of the National Shellfish Sanitation Program (NSSP), in which New York State participates, requires closures within all marinas with more than 10 boats and also areas adjacent to the marinas that may be affected by sewage discharged from the MSDs onboard those boats. The size of the closures around marinas or mooring areas in which people live onboard their boats for extended periods is based on a number of variables, including: the number of boats with marine sanitation devices onboard, the number of people occupying the boats, the availability of shore-based toilets, the

tidal range and current in the area, etc. Temporary administrative closures are enacted in West Harbor during the July 4th and Labor Day weekends due to the presence of large numbers of boats (150 or more) each occupied by a few to several people during those holiday periods. The presence of so many potential pollution sources (MSDs) in close proximity to certified shellfishing areas in West Harbor, OBH7, requires temporary administrative closures.

The TMDLs developed in this study will address impairment at the remaining uncertified and seasonally uncertified areas (Zones MNC and OBH1 through OBH4) and develop load allocations for point and non-point sources to achieve the water quality goals for shellfish harvesting in the two water bodies.

Natural background was not separated from the total non-point load because of a lack of detailed site-specific information. Without detailed site-specific information on coliform contributions from wildlife and other sources, it is difficult to meaningfully separate natural background from the total nonpoint source load.

SECTION 3

APPLICABLE WATER QUALITY STANDARDS

3.1 National Shellfish Sanitation Program Water Quality Standards

NYS participates in the National Shellfish Sanitation Program (NSSP) which recommends strict bacteriological water quality standards for shellfishing areas to be designated as approved, or certified, for the harvest of shellfish for human consumption [Note: New York State's water quality standards for certified shellfish lands are specified in 6NYCRR, Part 47, "Certification of Shellfish Lands."] The standards are developed for specific indicator organisms which are assumed to indicate the presence of human pathogenic organisms associated with fecal material from warm blooded animals. [Note: Total and fecal coliform bacteria are not suitable indicators of the presence of some naturally occurring marine bacteria, such as certain Vibrio species, that can cause illness in consumers.] Total coliform are used as indicator organisms by NYS for classifying shellfish harvest areas. The applicable water classifications for Oyster Bay area are indicated in Figure 3-1.

Prior to January 1997, NYS used adverse pollution condition (APC) sampling for monitoring the sanitary condition of Oyster Bay Harbor and its tributaries to determine whether they meet NYS and NSSP standards for certified areas. An APC is considered to exist when rainfall is greater than 0.25 inches but less than 3.0 inches in one or more of the days during the 96 hours (4 days) prior to sampling. APC sampling is conducted only during outgoing tides.

NSSP requirements (NSSP, 1986) specify that a minimum of 5 APC samples per year be collected at all sampling locations necessary to characterize water quality in a water body used for shellfish harvesting. The NSSP also specified that a minimum of 15 APC samples collected over a 3-year period are needed for a valid data analysis. The standard for water bodies designated as certified for shellfish harvesting (Class SA) has two components. The median total coliform value at each station in a certified area may not exceed a Most Probable Number (MPN) value of 70 per 100mL; and, ordinarily not more than 10% of the values at a sampling station may exceed 330/100mL. APC data collected between 1987 and 1996 at all the water bodies, and being collected now at selected water bodies, are reviewed and analyzed based on these two criteria.

NSSP requirements (NSSP, 1999) specify that a minimum of 6 systematic random sampling (SRS) samples per year be collected at all sampling locations needed to characterize water quality in a water body used for shellfish harvesting. Sample collection is scheduled sufficiently far in advance to

support random collection with respect to environmental conditions. DEC schedules sampling during outgoing tide. A minimum of 30 samples collected over a 5-year period are required for a valid analysis of the SRS data. NYS typically uses a minimum of 30 most recent observations to calculate the geometric mean ($X_{geomean}$) and 90th percentile values (X_{90}) at any monitoring location. These values are compared with the NYS standards, consistent with NSSP guidelines (NSSP, 1999), of a geometric mean of 70 MPN/100mL and a 90th percentile criterion not to exceed a value of 330 MPN/100mL. $X_{geomean}$ and X_{90} are calculated as below:

$$X_{geomean} = Anti\log[(\sum_{i=1}^{n} \log(X_i)) / n]$$

where X_1, ... X_n are the total coliform concentrations from the SRS sampling. The estimated 90th percentile is computed as:

$$X_{90} = \text{Anti}\log[(S_{\log})*1.28 + XAVG_{\log}]$$

where $S_{\log}$ is the standard deviation of the logarithms of the MPN values and $XAVG_{\log}$ is the mean of the logarithms of the MPN values comprising the data set (also known as the log mean or the arithmetic average of the logarithms - the geometric mean is the antilog of $XAVG_{\log}$). $S_{\log}$ is calculated as follows:

$$S_{\log} = \sqrt{\sum_{i=1}^{n} (\log(X_i) - XAVG_{\log})^2 / (n-1)}$$

Although the NYS water quality standard for Class SA water bodies is expressed as a median value of 70 MPN/100mL, the same numerical value is used as geometric mean criterion for the SRS data. According to NSSP guidelines (NSSP, 1997), these two are equivalent in terms of public protection.

3.2: NYSDEC Water Quality Regulations

NYSDEC maintains water quality regulations for surface water and groundwater as Title 6, Chapter X Parts 700-706, last amended August 4, 1999. Contained within these regulations are standards for coliform. The standard for total coliform in SA waters is the median most probable number (MPN) value in any series of representative samples shall not be in excess of 70.

3.3 Standard used for shellfish TMDLs

The NSSP program standards are used by the state's shellfish program to determine whether or not shellfish waters are open for harvesting. Since the use impaired for these waters is shellfishing, it is logical that the standards used to determine the usability of the waters be used in the TMDL. As noted in Section 3-1, The New York State shellfish standard of "a median value of 70MPN/100ML" are equivalent to NSSP standards of a geometric mean criterion for SRS data. Therefore, the NSSP standards are used as the endpoint in achieving acceptable water quality in the waters considered under these TMDLs.

SECTION 4

WATERSHED CHARACTERIZATION

A wide range of data and information were used to characterize the watershed. The categories of data used include physiographic data that describe the physical conditions of the watershed, environmental monitoring data that identify potential pollution sources and their contributions, and ambient water quality monitoring data. Table 4-1 summarizes the various data types and data sources used in this characterization. Some of these data types are described in the subsequent sections.

Table 4-1. Data Description and Sources

Data Category	Description	Data Source(s)
Watershed Physiographic Data	Land Use	USEPA's BASINS
	Aerial Photographs	NYSDEC
	Stream Reach Coverage	National Hydrography Dataset (NHD) by USEPA and US Geological Survey
	Weather Information	National Climatic Data Center
	Digital Elevation Data	USEPA's BASINS
	Stream Flows	USGS
	Bathymetry	NOAA
	Storm Water Drainage Outfalls	Nassau County
Environmental Monitoring Data	SPDES Data	NYSDEC
	303(d) Listed Waters	NYSDEC
	Ambient Water Quality Monitoring Data	NYSDEC
	Beach Monitoring Data	Nassau County

4.1 TOPOGRAPHY

The topography of the area surrounding Oyster Bay Harbor is typical of the north shore of Long Island. The area is characterized by gentle to steeply sloping hill with some sandy rocky bluffs of 20'-80' elevation adjacent to narrow beach areas. The glacially deposited soil is generally a gravel/sand mix with occasional clay layers and the drainage is good. The Hamlet of Oyster Bay is situated at the foot of a long, moderately sloping valley which directs storm water runoff towards the Harbor.

The digital elevation data for the entire watershed was obtained from the BASINS tool in order to delineate the drainage areas discharging to the Harbor and MNC and its tributaries.

4.2 CLIMATE

The official climatic data from National Climatic Data Center recorded since January 1971 were available at Mineola, New York (Station Number: 305377). Table 4-2 summarizes the annual and monthly precipitation statistics for the available period of record. Precipitation is generally evenly distributed throughout the year, with an annual rainfall of about 44 inches per year. Precipitation data for the calendar year 2002 were not available at this station.

Winters are usually mild, with an average temperature in the mid 30°F. Snowfall averages about 30 inches per year, and usually melts quickly. Spring and fall are very mild climates, with very pleasant weather. Summers can be hot and humid, with day time temperatures averaging about 80°F. Winter ambient water temperature in the Harbor is in the low to mid 30s^{o}F. Summer ambient water temperature is in the low to mid 70s^{o}F, but may approach 80°F during a particularly warm summer.

4.3 LAND USE

Land use is a major factor in determining the extent of pathogen impairment in a water body. For example, wildlife is more common in open space and parkland than highway corridors and high density residential development. Similarly, the pet populations are more highly associated with residential use than commercial or industrial areas.

Land use information was obtained from BASINS (EPA, 2002) databases. The source for this land use data is 1:250,000 scale quadrangles of GIRAS spatial data published by USGS in 1998, which has been converted to ARC/INFO by the USEPA. Other potential sources such as Nassau County were explored and no recent databases were available. The categories available

Table 4-2. Statistics of Precipitation Data in Mineola, New York

Year	Monthly Total Rainfall (inches)												Annual Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(inches)
1971	2.64	5.10	3.19	3.12	2.63	0.79	4.89	3.43	5.24	3.45	4.56	1.76	40.80
1972	1.96	5.18	4.66	3.80	6.10	6.20	2.20	1.00	2.50	6.80	10.00	6.40	56.80
1973	4.00	3.60	4.60	8.20	3.60		4.70	0.70	3.30	2.00	1.80	9.40	45.90
1974	3.50	1.90	5.80	3.30	3.10	2.60	1.00	4.20	6.70	2.40	1.80	5.40	41.70
1975	6.10	3.50	3.60	3.30	4.30	9.40	9.00	4.90	9.10	3.30	4.20	4.50	65.20
1976	6.10	3.10	2.40	1.90	3.70	0.80			1.80	4.50	0.40	1.90	26.60
1977	1.90	2.10	5.20	3.30	2.50	4.10	2.20	4.40	6.00	7.00	8.10	5.30	52.10
1978	9.20	1.50	2.90	2.00	4.80	1.40	3.00	3.80	2.80	2.80	2.00	5.90	42.10
1979	10.60	4.10	4.60	4.60	5.20	3.20	0.70	6.30	4.50	2.60	2.60	2.60	51.60
1980		1.30		7.40	2.40	3.50	2.10	1.80	1.40		4.30	0.60	24.80
1981	0.40		1.00	3.80	2.10	4.10	3.30	0.80	3.60	1.10	2.10	2.10	24.40
1982			0.90	0.60			2.30	3.30	1.50	1.40	3.30	1.90	15.20
1983	4.50	1.50	0.50				0.70		3.70		6.00	7.00	23.90
1984	0.30	4.50		3.80	9.40	1.70	6.10	0.20	1.80	2.10	3.00	2.70	35.60
1985	0.90	2.10	0.10	0.30	1.10	3.70	3.70		4.30	0.90	6.70	0.70	24.50
1986	0.80	0.70	1.80	3.90	1.50						7.60	6.10	22.40
1987	3.60		3.50	5.10	0.90	1.80	1.90	1.20	0.40	1.00			19.40
1988				0.60		0.50	7.20	2.00	3.40	3.70	8.70	1.30	27.40
1989	1.40	3.00	5.50	3.80	12.70	6.80	5.80	5.30	4.10	6.60			55.00
1990			3.00	5.30	8.30	1.20	4.90	7.40	3.00	7.80	1.80	5.30	48.00
1991	4.00	2.00	3.80	3.70	3.60	3.00	3.50	7.70	3.70	1.60	2.00	3.90	42.50
1992	1.60	1.90	3.50	1.40	3.10	3.50	4.00	7.30	2.30	1.80	7.00	5.50	42.90
1993	2.80	2.50	5.70	3.50	0.30	2.10	2.40	3.70	6.30	4.30	1.70	4.30	39.60
1994	5.00	3.20	5.80	3.10	4.00	0.50	3.10	3.80	5.40	1.60	3.00	3.60	42.10
1995	3.20	3.10	2.10	1.90	3.20	2.20	4.20	0.20	4.80	5.40		2.00	32.30
1996	2.50	2.70	3.60	5.50	2.90	3.60	8.60	2.20	5.10	6.90	2.70	4.30	50.60
1997	3.20	2.90	5.30	4.50	3.30	2.30	6.00	5.60	2.30	2.30	5.10	4.40	47.20
1998	6.20	4.40	5.80	3.60		5.30	1.90	1.20	3.90	2.50	1.40	1.00	37.20
1999	9.40	2.40	4.20	1.50	3.90	0.90	0.90		8.00	3.40	2.90	2.80	40.30
2000	2.60	1.90	4.90	5.70	4.40	4.00	5.40	2.70	5.20		5.50	3.20	45.50
2001	3.50	2.22	8.23	1.11		4.85	2.50	2.55	3.29	0.73	0.72	2.43	32.13
31-Year Total	101.9	72.4	106.2	103.6	103.0	84.0	108.2	87.7	119.4	90.0	111.0	108.3	1195.7
31-Year Average	3.78	2.81	3.63	3.54	3.96	3.05	3.77	3.41	4.00	3.43	4.08	3.78	38.79

Note: The greyed cells in the table indicate missing data in the corresponding months.

within BASINS were further grouped to reflect potential sources of total coliform. Table 4-3 summarizes the areas for each land use and their relative distribution within the drainage areas to Oyster Bay Harbor and Mill Neck Creek. Figure 4-1 shows the land use distribution within the study area. The aerial photograph shown in Figure 1-3 was used to supplement characterization of the land uses.

Table 4-3. Distribution of Land Uses within the Study Area

	Oyster Bay Harbor		Mill Neck Creek	
Land Use	**Area (acres)**	**Relative Distribution (%)**	**Area (acres)**	**Relative Distribution (%)**
Residential	4536.38	56.39	3185.51	65.30
Commercial	267.94	3.33	209.09	4.29
Industrial	48.39	0.60	0.00	0.00
Mixed Urban or Build-up Land	148.76	1.85	151.93	3.11
Forest Land	2086.31	25.94	981.91	20.13
Agricultural Land	720.27	8.95	248.06	5.08
Water and Wetland	84.23	1.05	101.86	2.09
Barren Land	151.97	1.89	0.00	0.00
Total	8044.25	100.00	4878.36	100.00

It must be noted that the agricultural land in this study area as classified in BASINS databases is not a typical farm with issues related to non-point sources. This land, in fact, includes orchards, vineyards, nurseries and other urban fruit/flower growing areas.

4.4 STREAM FLOW DATA

A USGS stream flow gaging station is located on MNC just upstream of the Beaver Lake as shown in Figure 4-2. Long-term hourly flow data were available from 1991 through March 2000. The portion of the Mill Neck Creek watershed up to this station is 11.5 square miles, and the average base flow is about 8 cubic feet per second (cfs). Figure 4-3 shows the historic flow data observed at this station.

Tiffany Creek, Whites Creek, Mill Pond and Spring Lake Pond chain discharges are the largest surface freshwater flows into the Harbor. There are numerous freshwater springs which discharge through pipes at or below mean high water along the southern and western shoreline areas of Oyster

Bay Harbor. There is no historical streamflow data available at any of these freshwater creeks or springs.

4.5 WATER QUALITY DATA

The water quality data relevant for development of TMDLs in the study area were compiled from DEC and the Nassau County Department of Health (NCDOH).

The DEC shellfish sanitation program has typically collected 8 to 16 samples per year since 1987 at 40 ambient water quality monitoring stations. DEC examines water samples for total coliform bacteria. Prior to 1997, samples were collected during adverse pollution conditions. Since January 1997, the samples are collected on a systematic random sampling basis at 39 stations located throughout the Harbor shown in Figure 4-2. Some conditional sampling stations were located within Mill Neck Creek, which were not monitored at the same frequency as those in the Harbor since the Creek was classified as uncertified or conditionally certified for shellfish harvesting.

The NCDOH has conducted long-term monitoring of four beaches within the study area: (1) Beekman; (2) Bayside; (3) West Harbor; and (4) Roosevelt. Both total coliform and fecal coliform data were available from January 1997 and the sample size ranged from 15 to 30 samples per year.

The DEC total coliform data is generally constrained by a minimum detection limit of 3 MPN/100mL and a maximum limit of 2,400 MPN/100mL. Indeterminate sample results below the sensitivity of the MPN procedure used by DEC are reported as <3 MPN/100ml. Sample results above the sensitivity of the MPN procedure are reported as $2400 MPN/100ml. For purposes of data analyses, DEC converts <3 MPN/100ml values to 2.9 MPN/100ml and $2400 MPN/100ml values to 2501 MPN/100ml. The beach data from NCDOH does not have such limits. Statistical analysis was conducted on APC, SRS and beach data available at all the monitoring stations. Table 4-4 summarizes the median values and the percent number of APC samples (for the 1987-1996 period) exceeding the 330 MPN/100mL criterion. Comparison of these values to a median water quality criterion of 70 MPN/100mL and 10% threshold for the 330 MPN criterion indicates the extent of impairment based on APC data at any water quality monitoring station. One or both of the water quality criteria (geometric mean and 90th percentile) are exceeded at 13 stations (highlighted in Table 4-4) with high levels of exceedance at stations, including six stations within the Mill Neck Creek and Cove Neck.

Table 4-4. Summary of Statistics for APC Sampling Data

Station Number	Median (# / 100 ml)	% > 330 MPN / 100 ml	Station Number	Median (# / 100 ml)	% > 330 MPN / 100 ml
TC1	23	7.5	TC24	23	4.0
TC2	23	6.0	TC25	23	8.1
TC3	15	3.2	TC26	20	9.1
TC4	23	5.1	TC27	23	6.0
TC5	15	9.0	TC28	23	6.1
TC6	23	6.9	TC29	15	6.1
TC7	23	5.0	TC30	9	2.0
TC8	23	8.9	TC31	12	1.1
TC9	23	10.8	TC32	9	4.2
TC10	43	16.6	TC33	9	5.1
TC11	23	10.2	TC22A	43	12.0
TC12	9	8.0	TC_C1	23	9.3
TC13	9	5.2	TC_C2	23	7.0
TC13A	15	10.4	TC_C3	23	10.0
TC14	9	4.0	TC_C4	43	17.5
TC15	9	3.1	TC_C5	1101	76.8
TC16	23	5.0	TC_A1	23	5.8
TC17	23	10.6	TC_A	23	5.8
TC18	9	5.0	TC_B	23	6.9
TC19	14	3.1	TC_C	23	5.9
TC20	15	5.0	TC_D	43	10.7
TC21	15	0.0	TC_E	43	14.1
TC22	43	5.3	TC_F	75	19.4
TC23	23	13.3			

All stations are located within uncertified areas, with the exception of station TC-11. The DEC has in fact designated these uncertified areas based on their prior APC sampling results. It clearly shows that those stations do not meet certified area total coliform criteria under APC which is a strong indication that they are impaired by post-rainfall runoff.

Figures 4-4(a) and 4-4(b) show the results for SRS and beach data from 1997 through 2002. The statistics shown in box-whisker plots include the geometric mean, maximum, minimum and the values corresponding to 90% and 10% exceedance probabilities. Also shown are the two water quality criteria (70 and 330 MPN/100mL) with the 90th percentile value calculated based on NSSP guidance (NSSP,

1997). In the SRS data, these two criteria are met at all the DEC stations including the ones within the Oyster Bay Cove area.

As indicated in Section 3, the geometric mean and median values are equivalent in terms of public protection. All the SRS sampling stations exhibited geometric mean values higher than the median values, therefore, the geometric mean values will ensure better water quality protection. However, based on the historical data analysis conducted by DEC and the water quality data analysis conducted in this study, the 90th percentile criterion is more difficult to meet than the geometric mean criterion. Therefore, the 90th percentile criterion will primarily govern the TMDL development and allocation process.

The beach data shows exceedance of these two criteria at two of the four beaches, with the worst level of exceedance at Beekman Beach, and the next worst being the Roosevelt Beach.

Although the analysis of recent water quality data (1997-2002) collected by DEC and NCDOH indicate that the two criteria are met at all stations except for Beekman and Roosevelt beaches, the DEC cautioned that there were inadequate water quality sampling data in the Mill Neck Creek and Oak Neck Creek watersheds. Seasonal excursions in coliform data have occurred in the past, which is the reason why the Mill Neck Creek and the Harbor were included in the 303(d) list. Therefore, the data for the period May 1 to October 31 were analyzed to assess the extent of impairment in this season in which a portion of the study area is uncertified for shellfish harvesting. It must however be noted that the majority of the study area is certified year-round. About 850 acres are uncertified, of which about 88 acres are uncertified from May 1 through October 31, annually. These summaries are provided in Figures 4-5(a) and 4-5(b).

Again, the seasonal data shows similar trends yet higher coliform concentrations at all the DEC stations and beach stations compared to the annual coliform data. Three of the 39 DEC stations exhibit 90th percentile values close to the criteria of 330 MPN/100mL. These stations include the one east of the Bayville Bridge (TC-10), another one near the Oyster Bay STPs outfall within the administrative closure zone (TC-22) and the third one at the upstream end (westerly of Tiffany Creek) of the Cove Neck area (TC-C4). The seasonal data, being more conservative, are used in assessing the extent of total coliform impairment and in developing target load reductions in this study.

SECTION 5

SOURCE ASSESSMENT

This section identifies the potential sources of total coliform in the study area discharging either to MNC or directly to the Harbor. These sources were primarily identified from the shoreline survey (DEC, 1988) that could help in characterizing the relationship between point and non-point source discharges and in-stream responses at the monitoring stations located throughout the study area.

5.1 SHORELINE SURVEY

Oyster Bay Harbor is divided into four areas for ease of description: Mill Neck Creek (MNC); the West Harbor area; the South Harbor area; and the Cove Neck area. The MNC section is partially uncertified with an area just upstream from Bayville Bridge conditionally certified . The West Harbor section is certified for shellfish harvest and supports the majority of the hand digging operations in the Harbor. There are three seasonally certified areas in the northwest (Zone OBH1) and northeast (Zone OBH2) portions of West Harbor, and portions of Oyster Bay Cove (Zone OBH4). The mouth of Mill Neck Creek is located at the northwest corner of West Harbor.

The immediate northern shoreline of the West Harbor area is not highly developed with only three buildings. The first facility east of the Bridge is the Village of Bayville beach and boat ramp. The beach has a pavilion which houses public toilets that discharge to a sub-surface sanitary disposal system (cesspools). Storm water runoff from the parking area may enter the Harbor from the boat ramp. The Mill River Rod & Gun Club is located on the property immediately east of the Bayville beach. The Club uses cesspools for waste disposal. There is a stretch of undeveloped wetlands (approximately 0.6 miles) between the Rod & Gun Club and the Town of Oyster Bay Beach, the beach pavilion has toilet facilities which discharge to cesspools. The toilet facilities at the two municipal beaches are open from late May through early September.

Several street/storm drains discharge through the seawall along West Harbor Road into the upper wetlands area along the northern shore of the West Harbor area. Land use along West Shore Road (Mill Neck) is residential with large lots. Dry weather flow can be seen from these drains generated from intrusion of ground water into the storm water collection systems in this area that has fresh water springs. West Harbor Road intersects with Centre Island Road, both run along the northern shore of this area.

The eastern shore of West Harbor is entirely within the Village of Centre Island. There are approximately 40 residences along the shore. Several pipes drain a small duck pond, driveways and roof runoff directly into a canal that drains to the Harbor. This canal receives drainage from a small pond on the property of one residence north of the canal and overland storm water runoff from that property and one on the south side of the canal. This dead-end canal is not very large and essentially serves to provide boat docking space for one or both of the residences adjacent to it. Much further south on the Centre Island shoreline, there is a small cluster of eight homes along Bay Avenue that use cesspools for waste disposal with a potential for leaching and for mixing with storm water that reaches into the Harbor.

The South Harbor shoreline area is the most densely developed section in all of Oyster Bay Harbor with an estimated percent imperviousness of 30%. The Hamlet of Oyster Bay occupies most of the southern shore and there are several commercial establishments within the Hamlet. The entire southern shoreline between the Cleft Road/West Shore Drive intersection east to Week's Point is within an uncertified harvest area. The Hamlet of Oyster Bay is served by a municipal sewage treatment plant (STP) and all properties along the southern shore are served by the STP. The northern shoreline of the South Harbor area is the southern shoreline of the Centre Island peninsula.

Beekman beach has no pavilion or toilet facilities. Immediately east of the beach area is a small freshwater creek which drains the Oyster Bay Mill Pond, located at West Shore Drive and Lake Avenue. This pond attracts waterfowl and receives storm water from a fairly large drainage area consisting of the entire Lake Avenue and River Hollow Road. The Town of Oyster Bay boat ramps and Roosevelt Memorial Park and Beach complex is located adjacent to the small undeveloped beach area; the Beach and Park occupy approximately 2000 feet of shoreline. Two large storm/street drains are located at the ramps and discharge directly into the Harbor; the drains serve the parking area of the Park as well as some of the nearby streets within the Hamlet of Oyster Bay with mixed land use (mostly residential and some commercial/municipal use). The Park and Beach have toilet facilities which are served by the Oyster Bay STP.

The Oyster Bay Yacht Club is situated immediately east of the Town marina and the Oyster Bay STP is located at Bayview Avenue, just east of this Club. The shoreline area in front of the STP is undeveloped beach and wetlands. The STP outfall is located approximately 1200 feet east of the facility, and this facility is affected by rainfall runoff infiltration. This infiltration results from the fairly old collection system with potential cracking that allows ground water intrusion and infiltration

from manhole covers. Wet weather flows at the STP are typically higher than the dry weather flows, but the facility does not exceed its design capacity of 1.8 million gallons per day (MGD).

A small creek (Whites Creek) enters the Harbor just east of the Commander Oil facility and flows out of a drain culvert (about 36 inches diameter) at the foot of South Street. There is a storm water drain approximately 20 feet west of the creek culvert, it directs runoff from nearby streets in the Hamlet of Oyster Bay with mixed land use (mostly residential with some commercial/municipal use). The creek crosses under Elsie Avenue and continues along the west side of the street through the backyards of several homes which front on South Street; the creek emerges from a small culvert (approximately 18 inches).

The area east of Whites Creek is all residential, the area is served by the STP district. The foot of Florence Avenue is bulkheaded and two storm drain culverts are located under the bulkheads. The drainage area to these storm drains consists of mixed residential and commercial land uses, and the drains are located closer to the business district of the Hamlet of Oyster Bay. A large rectangular culvert allows storm water into the Harbor at the foot of Ship's Point Lane. A duck pond on the estate property, approximately 250 feet east of Harbor Road, drains into the Harbor. The shoreline area east of the duck pond as far as Week's Point is variously natural beach and bulkheading, the large estate properties in this section all have long fixed piers used for docking large recreational vessels. Several freshwater springs emerge along the beaches that flow directly into the Harbor. There is a large culvert located between the 2nd and 3rd fixed piers east of Steamboat Landing Road, samples taken at the discharge (during dry weather) indicate high total and fecal coliform levels.

The northern shoreline of the South Harbor area, between Brickyard Point and Moses Point (both on Centre Island) is all residentially developed. Some of the shore is bulkheaded and most of the residences are situated well back from the shoreline; cesspools are the standard waste disposal method for all properties.

The Cove Neck section of the Oyster Bay Harbor shoreline is virtually all large estate type residential development. The properties all utilize cesspools, except the seven homes on the west shore of Cove Neck that are hooked up to the Oyster Bay STP. The western shoreline of the Cove Neck section of the Harbor is located along the eastern shoreline of the Centre Island peninsula, between Moses Point and Plum Point. With the exception of the yacht club, all the properties are residential and utilize cesspools for waste disposal. The Seawanahaka-Corinthian Yacht Club is located approximately 1500 feet west of Plum Point, and the club utilizes a small treatment plant that uses a leaching field filtration chlorinated effluent method for waste disposal. The plant, with a design flow of 6,000 gallons

per day, discharges chlorinated effluent from a leaching field directly into the Harbor approximately 150 feet southerly of its shipyard facility. There is a six acre uncertified buffer area around this low volume discharge.

5.2 SUMMARY OF POLLUTION SOURCES IN THE STUDY AREA

5.2.1 Domestic Waste Disposal Using Cesspools

Residential: **39 Units.** At or near the shoreline which could be potential pollution sources if the cesspools or septic waste disposal systems overflowed and/or were leaching through the soil into the adjacent marine waters.

Other: **4 Units.** 1 Unit - the Centre Island police booth located near the shoreline. 2 Units - Municipal beach pavilions with toilet facilities discharging to cesspools; both are located along the northern shoreline of the West Harbor section. 1 Unit - private Rod and Gun Club.

5.2.2 Sewage Treatment Plants

There are three point source discharges regulated by DEC through State Pollution Discharge Elimination System (SPDES) shown in Table 5-1. There are no combined sewers in this study area. While most of the Hamlet of Oyster Bay is served by separate sanitary and storm sewers, the remainder of the study area including the Villages of Bayville and Centre Island are served by individual cesspools and septic systems.

Table 5-1. List of Permitted Point Source Discharges in the Study Area

Facility Description	SPDES ID	Latitude	Longitude	Design Flow (MGD)	Peak Flow (MGD)
Oyster Bay Sewer District STP	NY0021822	40°52'34.8"	-73°31'42.7"	1.8	1.24
Seawanhaka-Corinthian Yacht Club	NY0088510	40°54'11.7"	-73°30'41.5"	0.006	0.0058
Continental Villas STP (The Birches)	NY0189995	40°54'19.4"	-73°35'8.5"	0.012	0.0159

The Oyster Bay Sewer District and Seawanhaka-Corinthian Yacht Club Plants discharge to areas which have administrative closures and do not effect the areas being analyzed under this TMDL.

The Continental Villas STP consists only of a concrete chamber that collects septic tank overflows from 27 residences where it is chlorinated before discharge to Mill Neck Creek. The chamber with chlorination is an interim measure until the treatment plant is built. There is a Consent Order between Nassau County and the NYSDEC that has been in effect for the few years to require the construction of a secondary sewage treatment plant to handle septic tank overflows from the Continental Villas STP. This plant has not been constructed to date. There is currently legal action which was initiated by NYSDEC against Nassau County since the County has violated the terms of the Consent Order. The NYSDEC and County are currently awaiting a decision on this by an Administrative Law Judge.

5.2.3 Storm Water

Drain pipes or culverts were located and verified as storm water discharges from streets and parking areas directly discharging to the Oyster Bay Harbor. Direct overland runoff occurs from many sites, street ends, boat ramps, etc. The major storm drain sites, along the southern shoreline, discharge into uncertified waters. In addition to the outfalls that discharge directly into the Harbor, there are numerous outfalls that first discharge to the fresh water creeks or ponds and then eventually drain to the Harbor. The storm water outfall locations are shown in Figure 5-1.

There are a number of infiltration/ recharge basins located throughout the study area that are designed to replenish ground water. Therefore, the entire storm water runoff generated from land

surfaces does not reach the Harbor. At this time, the proportion of the drainage area served by infiltration basins is not known. To simplify the analysis, it is assumed that the first half mile from the shore and also from the fresh water creeks directly drain to the Harbor, and that the rest of the storm water reaches the infiltration basins. Based on the drainage area configuration in the Villages of Mill Neck, Cove Neck, Bayville and Centre Island and the Town of Oyster Bay, this assumption of half mile leads to designating all the drainage area as a storm water source. This storm water will be accounted for in the TMDL process as a point source based on the guidance from U.S. EPA (EPA, 2002).

The Village of Bayville has completed storm water mitigation projects over the past few years that direct the first flush of contaminated storm water into leaching pits which direct the stormwater into the ground instead of to Mill Neck Creek. This minimizes the contribution of pathogens to Mill Neck Creek.

5.2.4 Freshwater Inputs

Tiffany Creek, Whites Creek, Mill Pond and Spring Lake Pond are the largest discharges to surface freshwater flows. There are numerous freshwater springs which discharge through pipes at or below mean high water along the southern and western shoreline areas of Oyster Bay Harbor. Among these, the flow from Mill Pond into the southwest corner of the Harbor near Beekman Beach is the largest. Other creeks contribute less significant flows into the Harbor.

5.2.5 Boats/Marinas/Mooring Areas

Oyster Bay Harbor and Cove - includeconsists of 160 boats as marina dockage and about 975 boats in the mooring area. There are two marinas - Town of Oyster Bay Marina at Roosevelt Park and Oyster Bay Marine Center located in the south shore within the Hamlet of Oyster Bay. Two of the SRS water quality sampling stations (TC-17 and TC-22) are located near these marinas. The Town marina accommodates about 110 vessels ranging in size up to 45' yachts; larger vessels are often used for overnight living during the season (April 1 through October 31). A pumpout facility for MSDs is available. The Town of Oyster Bay provides moorings for approximately 550 boats in the southern portion of the Harbor. The private Oyster Bay Marine Center has 35 slips for vessels up to 45' and transient docking for up to 15 vessels, overnight living on vessels is common. This club provides water taxi service to the nearby mooring areas, it also has a pumpout facility.

The Seawanhaka-Corinthian Yacht Club is a private facility located on Centre Island. It has very limited dock space or transients, there is a mooring area for about 100 vessels with no pumpout facility.

The Village of Centre Island provides moorings for about 75 boats along the southern shore of the Centre Island peninsula. The Village of Cove Neck allows moorings for about 75 boats in the northern portion of Oyster Bay Cove. The Village of Bayville provides moorings for about 75 boats westerly of the Bayville Bridge.

Mill Neck Creek includes 132 boats as marina dockage and 20 boats in the mooring area. The Village of Bayville provides docking for 86 boats at the Creek Beach Marina at the western end of Mill Neck Creek. Two conditional water quality monitoring stations, A and F, are located near these marinas. There is no pumpout station for MSDs but shore side toilet facilities are available. Boaters are not permitted to live-aboard their boats at this marina. The Bridge Marina is a privately operated facility located just westerly of the northern end of the Bayville Bridge. It provides dock space for 46 boats and maintains 20 moorings in Mill Neck Creek. This marina has no pumpout station for MSDs but shore side toilet facilities are available for patrons. Boaters are not permitted to live-aboard their boats at this marina.

It must be noted that there is transient boating (people who take day trips from Connecticut, Westchester County, New York City and other ports around Long Island) which is difficult to quantify due to lack of data. This source is accounted as part of the regular boating traffic in the Mill Neck Creek and Oyster Bay Harbor area discussed above.

5.2.6 Wildlife and Waterfowl

Large waterfowl populations are present seasonally during the migration seasons. Smaller numbers of waterfowl are present throughout the year. Several sources including DEC and local Audubon society were contacted to get an estimate of the number of birds. Since this data was not readily available, reasonable assumptions were made for each of the study zones within MNC and the Harbor for modeling purposes.

5.2.7 Agriculture/Domestic Animals

About two dozen horses are estimated to be present in the study area. Similarly, several hundred dogs and other pets are also estimated to be present (personal communication: DEC, 2003). This assumption is supported by the 2000 U.S. Census which determined that about 46% of households have dogs.

5.2.8 Industrial

Commander Oil Co. foot of South Street, Hamlet of Oyster Bay. The facility has numerous large oil storage tanks and an off-loading dock.

5.2.9 Summary

The Harbor is primarily affected by storm water runoff, the STP discharge and The USEPA/USCG standards for marine sanitation devices for flow through systems are less stringent than the shellfish growing area criteria. The NYSDEC also consider the potential for illegal discharges from holding tanks, and therefore, the closures in the west harbor area on holiday weekends (septic wastes from recreational vessels). The STP collection system is subject to infiltration by storm water following heavy rains. There is a potential for septic system failure at the residential properties along the shoreline. The freshwater inputs are relatively low flow creeks and groundwater springs. The area topography causes storm water to be funneled toward the Harbor along streets and parking areas. In addition, the Harbor receives pollution from secondary sources such as waterfowl, wildlife and domestic animals such as horses and dogs associated with individual residences.

Similarly, the MNC watershed is dominated by storm water runoff and potentially failing septic systems particularly those in the Oak Neck Creek subwatershed in which the cesspools are known to interact with high ground water table. Finally, the waterfowl and wildlife are also a source of pollution in this watershed.

SECTION 6

MODELING APPROACH

The most critical component of TMDL development is the establishment of the relationship between source loadings and the impacts on the receiving water body. This relationship will assist in the screening and selection of appropriate watershed management options that will eventually achieve the desired water quality goals.

Some of the core principles in selecting modeling approaches for the Harbor and MNC and its tributaries include: (1) The TMDL must be based on scientific analysis and reasonable and acceptable assumptions - all major assumptions have been made based on available data and experience gained from similar watersheds.; (2) The TMDL must use the best available data - all available data in the watershed draining to these two water bodies were reviewed and were used in the assessment wherever possible or appropriate; and (3) Methods should be clear and as simple as possible to facilitate explanation to stakeholders - all methods and major assumptions used here are described in detail and presented in a format accessible to a wide range of audiences including the public and interested stakeholders.

To achieve this objective, two unique modeling approaches have been utilized for characterizing the Oyster Bay, Mill Neck Creek (MNC) and tributaries for the following reasons.

- The entire MNC watershed has been characterized and assessed. Mill Neck Creek zone has been treated as an independent zone since it has no affect upon the other shellfish closed area and vice versa. The area of MNC near the Bayville bridge is currently conditionally certified for shellfish harvesting and the area upstream from utility Pole 51 is currently uncertified. Based on the review of uncertified and conditionally certified areas, the Harbor has been divided into four local zones (OBH1 through OBH4) in order to simplify the TMDL analysis. These areas are also currently conditionally certified for shellfish harvesting. As a result of this division, the Oyster Bay Harbor TMDL will be addressed through four (4) separate TMDLs for these areas.

- Continuous flow data is available at the USGS station on MNC and water quality data (few on the upstream reaches and adequate data at the confluence of MNC with the Harbor) are available to facilitate detailed hydrologic and water quality calibration. On the other hand, there are no flow data available for storm water or fresh water creeks and springs that drain to the Harbor yet abundant data are available at the ambient water quality stations and at beaches within or adjacent to the four zones OBH1 through

OBH4.

These approaches along with model development, assumptions and model results are presented in the following sections.

6.1 MILL NECK CREEK AND TIDAL TRIBUTARIES

A Storm Water Management Model (SWMM) has been used to characterize MNC and its tributaries. This model simulates the quantity and quality of runoff produced by storms in urban watersheds (USEPA, 1997). SWMM allows for the representation of mixed land use watersheds using continuous simulation based on observed meteorologic conditions. At the subwatershed level, this model characterizes the simple decay of pathogens and evaluates in-stream concentrations. The model represents MNC as a series of hydrologically connected subwatersheds as shown in Figure 6-1.

The model setup consists of Beaver Brook that drains into the Beaver Lake. The USGS gaging station is located on this brook just upstream of the Beaver Lake. Oak Neck Creek watershed is represented as a tributary to MNC. The Beaver Lake and the downstream of MNC were characterized as broad open channels, and the segmentation of these channels was performed to enable water quality data assessment at the DEC's conditional water quality stations (A through F and A1) located within the conditionally certified harvesting area shown in Figure 6-1.

In January 1997, the DEC began monitoring Oyster Bay Harbor using SRS sampling methodology as per NSSP guidelines. However, there is no SRS station located within MNC. Therefore, the SWMM model was set up to calibrate based on the data at conditional sampling stations within MNC and at TC-10 east of the Bayville Bridge. Discharges from portions of Mill Neck and Bayville that influence water quality at TC-10 were also included. The time period used will be from 1997 forward to reflect the most recent data.

6.1.1 Hydrologic Simulation

The SWMM model was setup using data on watershed characteristics that influence runoff volume (e.g., land use distribution, percent imperviousness, surface roughness, evaporation, infiltration and depression storage). A representative base flow was estimated from the January 1997-March 2000 flow record available at the USGS station, and was used as constant baseflow in the continuous simulation period of 1997-2002. Since the precipitation data for the year 2002 were not available at Mineola, the John F. Kennedy Airport in Queens, New York was used as the surrogate precipitation station and the measurements at this airport were used in the SWMM model.

The percent imperviousness values were chosen based on several case studies with similar land use classification, and aerial photographs of the study area were used to ensure that the selected parameters were typical of the local physiographic conditions. Table 6-1 summaries the calibrated hydrologic model parameters for each of the subbasins included in the SWMM model. Figure 6-2 shows the comparison of modeled and monitored time-series data at hourly intervals, and Figure 6-3 compares the flow exceedance curves for the period January 1997 to March 2000 in which the monitoring data were available.

Table 6-1. Summary of Calibrated Hydrologic Model Parameters

Subbasin	Area (acre)	Percent Imperviousness (%)	Infiltration (inch/hr)		Depression Storage (inch)		Surface Roughness		Evaporation (inch/day)
			Maximum	Minimum	Impervious Area	Pervious Area	Impervious Area	Pervious Area	
1	307.06	7	3	2	0.161	0.411	0.03	0.3	0.1
24	197.75	10	3	2	0.161	0.411	0.03	0.3	0.1
25	245.71	25	3	2	0.161	0.411	0.03	0.3	0.1
26	158.26	25	3	2	0.161	0.411	0.03	0.3	0.1
27	98.33	25	3	2	0.161	0.411	0.03	0.3	0.1
2	435.29	7	3	2	0.161	0.411	0.03	0.3	0.1
3	239.63	6	3	2	0.161	0.411	0.03	0.3	0.1
6	801.39	6	3	2	0.161	0.411	0.03	0.3	0.1
7	103.46	6	3	2	0.161	0.411	0.03	0.3	0.1
20	367.35	6	3	2	0.161	0.411	0.03	0.3	0.1
21	271.38	6	3	2	0.161	0.411	0.03	0.3	0.1
4	224.43	6	3	2	0.161	0.411	0.03	0.3	0.1
12	34.49	6	3	2	0.161	0.411	0.03	0.3	0.1
13	85.40	6	3	2	0.161	0.411	0.03	0.3	0.1
14	183.93	6	3	2	0.161	0.411	0.03	0.3	0.1
22	250.14	6	3	2	0.161	0.411	0.03	0.3	0.1
23	586.97	6	3	2	0.161	0.411	0.03	0.3	0.1
15	287.39	6	3	2	0.161	0.411	0.03	0.3	0.1

6.1.2 Water Quality Simulation

After calibrating the hydrologic component of SWMM, the water quality was simulated by developing total coliform accumulation rates for each of the land uses. The concentrations for some land uses were varied to reflect differing numbers of wildlife/waterfowl or to recognize whether the houses were connected to the STP/cesspools. In the model, the total coliform loading was established as the relationship between total coliform buildup (which, among other things, is a function of time between runoff-producing events) and the wash-off of the buildup. The coliform building was assumed to be linear, i.e., it accumulates at an uniform rate and continues to accumulate at that rate (with no maximum) until some fraction is washed off during a storm event of sufficient intensity and duration. The uniform buildup rates for different land uses were adjusted to obtain a best fit for monitored data at the conditional stations within MNC and at station TC-10 east of the Bayville Bridge. A conservative decay rate of 2.5 per day was used accounting implicitly for temperature, salinity and solar radiation dependent decays. Literature values report decay rates ranging from 0.73 to 22.1 per day as shown in Table 6-2.

Table 6-2. Reported Ranges of Bacteria Die-Off Coefficients from Scientific Literature

Reference	Reported Range of Die-Off Coefficients
Auer et al., 1996	0.73 - 2.4
McFeters and Stuart, 1974	0.151 - 6.93
Feacham et al., 1983	0.4 - 12.05
Valiela et al., 1991	3.7 - 22.1

The calibrated buildup rates for all the land uses are summarized in Table 6-3. Figures 6-4(a) through 6-4(g) show the comparison of monitored and modeled water quality data for the 6-year period for TC-10 and six of the seven conditional stations (A, A1, C, D, E. and F) within MNC watershed. The SWMM model does not explicitly include the drainage area to the conditional Station B on its own but includes as part of C and A. Therefore, the comparison is not made at Station B.

A background concentration of 10 MPN/100ml was used in the model with no decay throughout the Mill Neck Creek reach. This concentration is above the observed total coliform concentration, particularly during dry weather, to be less than 10 MPN/100ml at the conditional stations. During wet weather conditions however, the modeled concentrations either exactly matched the observed concentrations or showed increasing trends when the monitored data also showed high total coliform concentrations. Therefore, the accuracy of model predictions is considered to be very good.

Table 6-3. Calibrated Coliform Buildup Rates

Land Use	End-of-Pipe Total Coliform Concentration (MPN/100ml)
Unsewered Low Density Residential	20,000
Unsewered Medium Density Residential	25,000
Hobby Farms (Horses)	20,000
Waterfowl/Wildlife	20,000
Agriculture	80
Wetland	40
Forest	500

6.2 OYSTER BAY HARBOR

As discussed earlier in Section 4, there was no historical flow data available either at the storm water outfalls or at the fresh water creeks in order to quantify pathogens loadings. However, there are adequate ambient water quality data at the stations within or adjacent to the zones OBH1 through OBH4 . Keeping this data limitation in perspective, a Watershed Treatment Model (WTM) has been used. This model is simple in terms of application yet detailed enough in terms of characterization of the different types of point and non-point sources of pollution.

The WTM is a series of spreadsheets that quantify the loading of pathogens (including total coliform bacteria) based on land use, precipitation and total coliform fate and transport information where available. The model is designed as a planning level tool for watersheds that do not have sufficient data for complex modeling applications. Although the WTM has several tiers of data specificity, loading estimates can be calculated with only simple land use data. The spreadsheets calculate a pathogens load on an annual basis by using a series of coefficients for runoff volume and pathogens loading derived from scientific literature for the primary and secondary sources.

Primary sources in WTM include general land use categories that are assigned either a coefficient that are then multiplied by an annual runoff volume to calculate an annual load (e.g., urban land uses) or an annual unit load is applied as a function of land use (e.g., rural land uses). These coefficients were chosen based upon the best available research and are summarized in WTM's user manual (Caraco, 2001). Secondary sources represent a more refined set of model inputs and can include more specific information such as combined sewer overflows or the presence of livestock , pets, waterfowl and wildlife within a watershed. Similar to the primary source calculations, the secondary sources are assigned a loading coefficient based on the extent of the land use activity. Depending on

data availability, specific data for point source discharges may be placed in this section of the model as well as head counts for various livestock animals.

Watershed areas with even more specific data relative to watershed management strategies can use spreadsheets within the model designed to calculate load reductions that are 'discounted' based on the extent and success of implementation. The presence of Best Management Practices (BMPs) such as detention basins or buffer strips, or the use of public education regarding the management of animal waste can be accounted for in existing and future loading scenarios.

The goal of applying WTM is to characterize all the point and non-point sources in the existing system and to determine their relative contributions to the water body of interest. The loading values thus derived will serve as the reference point from which reductions could be made toward the TMDL target. Since flow and water quality data for creeks and storm water were not available, the point and non-point sources including storm water, waterfowl, cesspools, and marinas are assessed based on experience from similar case studies and in consultation with DEC staff.

Percent reductions required to achieve the water quality goals are derived by analyzing the water quality data using the statistical rollback method (Ott, 1995). Once the targeted reductions for point and non-point sources are derived, specific management strategies can be developed and applied for each of the four zones to comply with the corresponding TMDLs.

6.2.1 Modeling of Primary Sources

A land use analysis was performed for the entire drainage area to the Harbor and MNC and tributaries. The land use categories, as extracted from BASINS (EPA, 2002), were grouped into more general categories that are default land use categories in WTM. These categories included: (1) Forest; (2) Pasture; (3) Urban; (4) Cropland; (5) Wetland; and (6) Surface Water.

The overall land use map was intersected with the drainage areas for each of the four zones: OBH1 through OBH4, and land use distribution within these zones were determined. Wetlands and surface water areas were omitted from the analysis because the spreadsheet model does not consider these categories as total coliform sources. These land uses were assumed to be non-contributing sources of pathogens in this study. Table 6-4 shows the distribution of land uses within these zones.

Table 6-4. Distribution of Land Uses Within the Zones

Zone	Land Use in Acres					
	Residential	Commercial	Industrial	Rural	Forest	Total by Subwatershed
OBH1	189.6	0.0	0.0	19.2	0.0	208.8
OBH2	99.5	0.0	0.0	49.0	0.0	148.5
OBH3	2421.7	317.5	98.0	758.6	1046.2	4642.0
OBH4	1102.5	0.0	0.0	96.5	924.2	2123.3

6.2.2 Modeling of Secondary Sources

Except the Hamlet of Oyster Bay, the residences in the remainder of the study are served by cesspools. In addition, the wildlife and waterfowl are among the sources of pollution in the watershed. Table 6-5 summarizes the secondary sources used in each of the four zones.

Table 6-5. Summary of Secondary Sources

Zone	Number of Households	Unsewered Units (%)	Marinas		Wildlife/ Livestocks		STP	
			Berths	Season Length (days)	Water fowl	Horses	Flow (MGD)	TC (MPN/ 100ml)
OBH1	1381	100	150	120	50	-	-	-
OBH2	275	100	-	-	100	6	-	-
OBH3	1800	7	750	120	1000	-	1.01	50
OBH4	578	100	250	120	-	10	-	-

6.2.3 Load Characterization

The primary and secondary sources listed above were used in the WTM to determine their relative distribution within each of the zones. The WTM requires an annual rate of precipitation for the study area. Precipitation data at Mineola, New York was used in this analysis, supplemented by the data at John F. Kennedy Airport where the Mineola data had missing precipitation records. Table 6-6 summarizes the annual and seasonal precipitation values.

Table 6-6. Summary of Annual Precipitation Values

Year	Annual Total (inches)	Seasonal Total (inches)
1997	47.20	21.80
1998	42.79	20.39
1999	43.88	20.68
2000	45.94	22.14
2001	35.53	17.22
2002	45.95	27.11

The WTM uses default values for source loadings where the user does not have site-specific data. A summary of these sources and associated loading coefficients is provided in Table 6-7.

Table 6-7. Summary of pathogens Source Coefficients used in the Four Zones

Loading Source	Total Coliform Loading Coefficient
Low Density Residential	60 X 10^9 colonies per acre per year
Medium Density Residential	97 X 10^9 colonies per acre per year
Commercial	282 X 10^9 colonies per acre per year
Industrial	213 X 10^9 colonies per acre per year
Forest	12 X 10^9 colonies per acre per year
Rural	39 X 10^9 colonies per acre per year
Wastewater	10 X 10^6 colonies per 100 ml
Horses	2000 X 10^9 colonies per animal per year
Waterfowl	47 X 10^9 colonies per animal per year

Conservative estimates of loads were used in this assessment by not including bacterial decay rates. The pie charts showing these relative distributions for each of the four zones for the year 2002 (the most critical among the six years modeled here) are presented in Figure 6-5. These relative loadings in conjunction with the target concentrations in the receiving water body and a margin of safety are used in the development of allocations for point and non-point sources, as described in the following section.

SECTION 7

LOAD ALLOCATIONS

7.1 BACKGROUND

The objective of a TMDL plan is to allocate allowable loads among the various pathogens sources that the appropriate management actions can be taken to achieve the desired water quality results. The specific objective of the TMDLs in Oyster Bay Harbor and MNC and tributaries is to determine the required reductions in total coliform loadings from various non-point and point sources in order to meet the two water quality standards of 70 MPN/100mL as geometric mean and a 90th percentile value of less than 330 MPN/100mL. The incorporation of different sources into the TMDL is defined in the following equation (USEPA, 1999).

$$TMDL = WLA + LA + MOS$$

where:

WLA = waste load allocation (point sources)
LA = load allocation (non-point sources), and
MOS = margin of safety.

In addition, the selection of critical conditions that will stress the water body is an important element in the TMDL development process, along with consideration of seasonal variations and a margin of safety. These elements are described in the following sections.

7.2 SEASONAL VARIATIONS AND CRITICAL CONDITIONS

As discussed in Section 4, the generation and availability of total coliform bacteria in the study area, primarily from urban storm water runoff, boats/marinas, waterfowl and leaking septic systems seems to vary greatly on a seasonal basis. Analysis of water quality data at SRS stations, as discussed in Section 4, shows that the seasonal data exhibit higher coliform bacteria concentrations and statistics than the annual data. Therefore, the period from May 1 through October 31 was chosen for analysis with the expectation that the pollution management plans developed for this period will protect the water body during the winter period from November 1 through April 30. The use of continuous simulation modeling accounts for these seasonal variations by reflecting seasonal climatic and hydrologic conditions as they occur throughout the year.

In addition to being the period in which SRS sampling data are available, the 1997-2002 period contains a mix of wet years (above the long-term average) and average years. The year 2002 exhibited highest seasonal as well as annual precipitation among these six years, therefore, was chosen as the critical year for TMDL development.

7.3 MARGIN OF SAFETY

The margin of safety (MOS) is included in the TMDL development process to account for any uncertainty on loadings and the fate and transport of total coliform in the watershed. There are two basic approaches for incorporating the MOS (USEPA, 1999):

- Implicit incorporation of MOS using conservative model assumptions to develop allocations, or
- Explicit incorporation of MOS as a portion of the total TMDL and the remainder is used for the loading allocations.

The MOS was included in this study as a combination of the implicit and explicit approaches for Mill Neck Creek and its tributaries and for Oyster Bay Harbor as described in the following sections. A minimum of 10% explicit margin of safety was calculated for each TMDL. For zones which exhibited total coliform concentrations above the TMDL target the MOS is 10% of the TMDL allocation as an explicit MOS. For zones which exhibited total coliform concentrations below the TMDL target, waste load and load allocations were set a current loadings and the additional loading capacity above current loadings was allocated to the MOS.

7.3.1 Mill Neck Creek and Its Tributaries

On the implicit side, a series of conservative assumptions were made within the EPA's SWMM model which included:

- The use of a linear buildup rate for total coliform: Other buildup methods, such as exponential buildup, would yield slower buildup in the first few days after a storm. Given the frequency of a rain event every 3-4 days in the study area, a linear buildup rate will tend to estimate a higher amount of total coliform bacteria.

- No maximum was placed on the amount of total coliform bacteria buildup: In the field, total coliform bacteria will generally buildup to a maximum level at which the rate of buildup is balanced by the rate of die-off. No such maximum level was used in the model, allowing higher levels of buildup to occur between storms.

- Use of a conservative decay rate of 2.5 per day in MNC and tributaries. Accounting for temperature, salinity and sunlight dependent processes, the decay rate used here will result in very conservative load estimates.

- Use of seasonal data instead of the annual data for conservative assessment of the pollution in MNC and its tributaries, and for development of load allocations for the contributing point and non-point sources of pollution.

- Use of the year 2002 as critical condition in which the seasonal precipitation was highest among the six years considered for model calibration and confirmation.

On the explicit side, a 33% MOS (33% of TMDL) was provided to assure a buffer for the unknowns in the estimation of the TMDL.

7.3.2 Oyster Bay Harbor

On the implicit side, a series of conservative assumptions were made within WTM which included:

- Use of design (maximum) flows for Oyster Bay STP and the Seawanhaka-Corinthian Yacht Club treatment facility instead of the flows from recent discharge monitoring reports that are typically lower.

- Treatment of coliform bacteria as a conservative tracer in the model. A zero decay rate was used for coliform bacteria loads from the respective storm water, STP and other discharges that are included in zones OBH1 through OBH4. This will result in very conservative load estimates and will lead to conservative load allocations.

- Use of seasonal data instead of the annual data for conservative assessment of pollution in the Harbor, and for development of load allocations for the contributing point and non-point sources of pollution.

- Use of the year 2002 as critical condition in which the seasonal precipitation was highest among the six years considered for model calibration and confirmation.

On the explicit side, an MOS of 33% (33% of TMDL) was provided for OBH1, an MOS of 42% (42% of TMDL) was provided for OBH4, and an MOS of 10% for OBH2 and OBH 3 to assure a buffer for the unknowns in the estimation of the TMDLs.

7.4 ALLOCATION SCENARIO

As described in Section 3, the geometric mean (70 MPN/100mL) and the 90th percentile (330 MPN/100mL) criteria must be met in order to designate the water body for shellfish harvest. New York State standards set no averaging period (but specifies a minimum number of samples to be used for calculation of geometric mean and 90th percentile values) on which to calculate these values from the historic water quality data for comparison with the standards. The SRS data and the data compiled by DEC in the past has shown that the geometric mean criterion is usually met and the 90th percentile criterion is often the difficult target to meet.

A statistical rollback method (Ott, 1995) describes a way to use the statistical characteristics of a set of water quality parameter results to estimate the distribution of future results after abatement processes are applied to sources. The method relies on basic dispersion and dilution assumptions and their effect on the mean and standard deviation of bacteria sample results at a monitoring site downstream from a source. The rollback method then provides a statistical estimate of the new population after a chosen reduction factor is applied to the existing pathogens source. In this load allocation process, compliance with the most restrictive of the dual total coliform criteria will determine the bacteria reduction needed.

The target reductions developed for Mill Neck Creek and its tributaries and the Oyster Bay Harbor are discussed here.

7.4.1 Mill Neck Creek and Tributaries

Since the data within MNC are monitored only during conditionally certified periods and are very few in number, the statistical distribution cannot be assumed to be log-normal to be able to perform the rollback analysis. The station TC-10 located just east of the Bayville Bridge, however, has sufficient number of samples taken throughout the year. So, the data from this station is used in the assessment of impairment. This station exhibits a 90th percentile value of 220 MPN/100mL (see Figure 4-4 (a) and (b) far lower than the criterion value of 330 MPN/100mL. Table ES-1 itemizes the specific point and non-point sources of pollution, both of which do not require any reductions. However, the DEC is concerned about the conditionally certified area west of the Bayville Bridge in which there are very few historical water quality data.

Therefore, the TMDL for MNC is:

TMDL = WLA + LA + MOS
164,522 = 96,815 + 13,968 + 54,739
(Units are in Billion of Colonies per year)

The total current loading of 110,516 for MNC is below the TMDL. Therefore, the current WLA and LA are used in the TMDL equation, with an added MOS of 54,739 which is 33% of the TMDL. This is above the minimum 10% margin of safety. The portions of this water body which are conditionally certified and uncertified are based on past APC sampling data. There is no current SRS data in MNC to adequately determine the ability to open these waters. Based on this the NYSDEC in taking a conservative approach and will limit future loadings to those currently in place, along with additional measures which will be discussed in Section 8.

7.4.2 Oyster Bay Harbor

Each of the four zones within the Harbor are assessed for impairment and allocations are developed individually in this section.

OBH1

Station TC-10 is most appropriate for assessing the extent of impairment in this zone. Based on the SRS data, the 90th percentile value at this station is 220 MPN/100mL which is considerably lower than the target value of 330 MPN/100mL. As indicated in Table ES-1, the point and non-point sources of pollution that contribute to this zone do not require any reductions.

The data compiled by NCDOH at West Harbor beach (about ½ mile east of the Bayville Bridge) complies with the 330 MPN/100mL criterion, however, the 90th percentile value for the seasonal data is 300 MPN/100mL. This value is quite close to the criterion value. Considering the local influence of the wetland in the Village of Bayville on the beach data and the vicinity of this beach with respect to zone OBH1, BMPs that would achieve reductions or maintain the current loading into this zone from the storm water drainage areas in Bayville and Mill Neck, along with the maintenance of the wetland, are proposed in order to protect this zone for shellfish harvesting.

Therefore, the TMDL for OBH1 is:

TMDL = WLA + LA + MOS
55,176 = 14,950 + 21,834 + 18,392

(Units are in Billion of Colonies per year)

The total current loading of 36,784 for OBH1is below the TMDL. Therefore, the current WLA and LA are used in the TMDL equation, with an added MOS of 18,392 which is 33% of the TMDL. This is above the minimum 10% margin of safety. This water body is seasonally certified (closed May 1 to October 31) which is based on past APC sampling data. Based on this, the NYSDEC in taking a conservative approach and will limit future loadings to those currently in place, along with additional measures which will be discussed in Section 8.

OBH2

TC-13A is the most appropriate station to determine the extent of impairment in this zone. The water quality data complies with both geometric mean and 90th percentile criteria values. The Bayside beach data was analyzed using the rollback method as shown in Figure ES-1.

Therefore, the TMDL for OBH2 is:

TMDL = WLA + LA + MOS
9,045 = 7,454 + 687 + 905
(Units are in Billion of Colonies per year)

The total current loading of 10,050 for OBH2 is above the TMDL. Therefore, the current WLA and LA need to be reduced to the amounts listed in the above equation to meet the TMDL, with an added MOS of 905 which is 10% of the TMDL. Based on this, the NYSDEC in taking a conservative approach and will require these reductions as delineated in Section 8.

OBH3

Being the largest of the four zones within the Harbor, there are several ambient water quality monitoring stations located in the southern side of the Harbor that can be used to assess the extent of impairment. Among these stations, TC-22 located near the Oyster Bay STP outfall shows the highest levels of coliform bacteria and exhibits a 90th percentile value of 300 MPN/100mL close to the criterion value of 330. However, the outfall and the vicinity area are subjected to administrative closure by DEC.

The water quality data collected by NCDOH at Beekman Beach within the zone OBH3 show

that the two water quality criteria are not met. This data was analyzed using the rollback method, as shown in Figure 7-2, a total reduction of 90% is recommended with the waste load allocations (point source) and load allocations (non point source) shown in Table ES-1.

Therefore, the TMDL for OBH3 is:

TMDL = WLA + LA + MOS
46,413 = 37,093 + 4,679 + 4641
(Units are in Billion of Colonies per year)

The total current loading of 433,074 for OBH3 is above the TMDL. Therefore, the current WLA and LA need to be reduced to the amounts listed in the above equation to meet the TMDL, with an added MOS of 4641 which is 10% of the TMDL. Based on this the NYSDEC is taking a conservative approach and will require these reductions as delineated in Section 8.

OBH4

This area has both an uncertified area and a seasonally certified area. The station TC-C4 is most appropriate for assessing the extent of impairment in this zone. Based on the SRS data, the 90th percentile value at this station is 192 MPN/100mL considerably lower than the target value of 330 MPN/100mL. As indicated in Table ES-1, the point and non-point sources contributing to this zone do not require any reductions.

Therefore, the TMDL for OBH4 is:

TMDL = WLA + LA + MOS
287,372 = 147,296 + 19,878 + 120,198
(Units are in Billion of Colonies per year)

The total current loading of 167,174 for OBH4 is below the TMDL. Therefore, the current WLA and LA are used in the TMDL equation, with an added MOS of 120,198 which is 42% of the TMDL. This is above the minimum 10% margin of safety. This water body is uncertified and seasonally certified (closed May 1 to October 31) which is based on past APC sampling data. Based on this, the NYSDEC in taking a conservative approach and will limit future loadings to those currently in place, along with additional measures which will be discussed in Section 8.

SECTION 8

REASONABLE ASSURANCE

The waters of the Oyster Bay Harbor and Mill Neck Creek are affected by several generators of pathogens.

- Storm Water (approx. 88%)
- Boats/Marinas (approx. 11%)
- Waterfowl/Horses (less than 1%)
- Other Non-Point sources (less than 1%)
- Waste Water Treatment Plants (less than 1%).

The major source currently identified is the point sources of storm water. This is the runoff from rainfall events that is collected by the stormwater collection systems and discharged via a pipe to the receiving waters. The next major source identified is the discharges of pathogens from boats and marinas which is considered a non-point source. The other identified sources make up approx. 1% of the total load and are not being specifically targeted for reductions under the individual areas, but the use of best management practices should be used to reduce discharges to the maximum extent feasible as further describe below.

The Hamlet of Oyster Bay's STP, Continental Villas STP and the Seawanhaka-Corinthian Yacht Club are covered by DEC's existing SPDES permits. These permits are reviewed and re-issued at regular intervals. These plants should be maintained and operated in conformance with their SPDES permits and minimize the amount of pathogens discharged to the maximum extent feasible.

Centre Island, Mill Neck, Cove Neck and other portions of the study area are developed with extremely large lots, and may also be home to a few dozen horses. Horse farms, and even individual owners of only a few horses, should be educated regarding best management practices for manure. Horses produce large amounts of manure that can comprise a threat to local water quality, especially when receiving waters are shallow and constricted. Good housekeeping practices for horses are similar to those applied successfully to small dairy farm operations, and involve the close control of manure, limiting the use of spreading, careful construction of composting areas, where appropriate, preventing horse traffic or grazing over small streams that are tributary to receiving waters, and similar measures.

The practices need not impose any large cost on the affected parties, and often involve more careful use of existing facilities or adjustment of common practices. In addition, levels of coliform bacteria may be reduced through waterfowl mitigation programs and through storm water management mitigation strategies. If these type of areas are located in local municipalities, they should be addressed through their implementation of the Phase II stormwater program.

The reasonable assurance regarding the five (5) TMDLs addressed in this report has been divided into separate sections for each activity anticipated.

8.1: Monitoring for MNC, OBH1, OBH2, OBH3, and OBH4:

The NYSDEC will continue it's shellfish monitoring program to ascertain the suitability for New York State waters for shellfishing. The beach data frequently monitored by Nassau County will continue to be used in conjunction with the DEC data to evaluate reductions in pathogen loads and the effectiveness of the TMDL in attaining and maintaining the water quality standards for the beneficial use of shellfish harvesting. The above data, along with any other data provided to DEC will be used in DECs assessment of the water quality in Oyster Bay Harbor and Mill Neck Creek during their development of the DEC list of impaired waters (303d report). The review of this data for the 303(d) report will be the tracking mechanism to determine if the TMDL is moving water quality in the direction necessary to open the waters to shellfishing. (NOTE: As of February 2003, DEC began examining its water samples for shellfish harvest area classification with A-1 medium which only gives fecal coliform results)

The NYSDEC will establish compliance of the TMDL(s) and applicable water quality criteria through monitoring prior to opening shellfish areas consistent with the National Shellfish Sanitation Program's (NSSP) guidelines, NYS regulations and criteria.

8.2: No-Discharge Zone for MNC, OBH1, OBH2, OBH3, and OBH4:

The pollution from marinas and boat mooring areas in Oyster Bay Harbor should be reduced using appropriate mitigation techniques such as:

- public awareness campaigns on illicit dumping of wastewater,
- enhancement of public toilet facilities near the shore so that the marina users would minimize the use of their on-boat facility, and
- expansion of current pump-out programs including the mobile and on-shore pump out facilities.

Oyster Bay is not currently designated as a no discharge zone. NYSDEC will work with the Town of Oyster Bay and other Long Island Sound partners to develop the information necessary to petition EPA to designate Oyster Bay Harbor a no-discharge zone. By doing this, the pathogens discharged at "marinas" and in the Harbor will dramatically be reduced.

New York State will nominate vessel no-discharge areas for Oyster Bay Harbor and Mill Neck Creek in accordance with the Long Island Sound 2003 Agreement.

8.3: Implementation of Phase II Stormwater Regulations

8.3.1: General Requirements for MNC, OBH1, OBH2, OBH3, and OBH4:

NYSDEC has expanded its permitting program to include a new federally mandated program to control stormwater runoff and protect waterways.

According to the federal law, commonly known as Stormwater Phase II, permits will be required for stormwater discharges from Municipal Separate Storm Sewer Systems (MS4s) in urbanized areas and for construction activities disturbing one or more acres. To implement the law, the Department has developed two general permits, one for MS4s in urbanized areas and one for construction activities. The permits are part of the State Pollutant Discharge Elimination System (SPDES). Operators of regulated MS4s and operators of construction activities must have obtained permit coverage–under either an individual SPDES permit or one of the general permits – no later than March 10, 2003 or prior to commencement of construction.

Operators of regulated small municipal separate storm sewer systems (MS4s) seeking authorization to discharge stormwater in compliance with the federal Clean Water Act are required to apply for and secure coverage under the State Pollutant Discharge Elimination System (SPDES) General Permit for Municipal Separate Storm Sewer Systems.

The MS4 municipalities are required to develop, implement and enforce a stormwater management program (SWMP). The SWMP must describe the Best Management Practices (BMPs) for each of the minimum control measures:

1. Public Education and Outreach program to inform the public about the impacts of the stormwater on the water quality of the receiving waters.
2. Public Involvement and Participation.
3. Illicit Discharge Detection and Elimination.

4. Construction site Stormwater Runoff Control Program for sites disturbing one or more acres.
5. Post-Construction Runoff Control Program for new development and redevelopment sites disturbing one or more acres.
6. Pollution Prevention and Good Housekeeping Operation and Maintenance program.

Operators must have developed the initial SWMP prior to March 10, 2003 and have provided adequate resources to fully implement the SWMP no later than five (5) years from the issuance date of the MS4 Storm water permit. An MS4 may modify its SWMP at any time. Any changes to a SWMP shall be reported to the Department in the MS4's annual report. MS4s are required to make steady progress toward full implementation.

SWMP is designed to reduce the discharge of pollutants to the maximum extent practicable (MEP) to protect water quality and to satisfy the appropriate water quality requirements of the Environmental Conservation Law and the Clean Water. MEP is a technology-based standard established by Congress in the Clean Water Act. Since no precise definition of MEP exists, it allows for maximum flexibility on the part of MS4 operators as they develop their programs. If the stormwater discharges to a 303 (d) listed segment of a water body, the stormwater program must ensure no increase in the listed pollutant of concern to the listed receiving waters. Where required to meet water quality standards NYSDEC enforces additional requirements based on WLAs determined through a TMDL. The MS4 must review the applicable TMDL to see if it includes requirements for control of stormwater discharges. If an MS4 is not meeting the TMDL stormwater allocations, it must, within six (6) months of the TMDL's approval, modify its stormwater management program to ensure that reduction of the pollutant of concern specified in the TMDL is achieved. Modifications must be considered for each of the six minimum measures. The revised management program must include an updated schedule for implementation.

The MS4s that discharge to the MNC, OBH1, OBH2, OBH3, and OBH4 are owned and operated by the municipalities located around this waterbodies. Accordingly, all municipalities identified in the TMDL have submitted an application for inclusion in New York's SPDES General Permit for Municipal Separate Storm Sewer Systems:

Municipality	SPDES #	Date NOI Submitted
City of Glen Cove	NYR20A100	2/26/03
Nassau County DPW	NYR20A022	3/04/03
Town of Oyster Bay	NYR20A371	3/05/03
Village of Bayville	NYR20A304	3/05/03
Village of Brookville	NYR20A439	3/04/03
Village of Centre Island	NYR20A415	3/03/03
Village of Cove Neck	NYR20A440	3/04/03
Village of Lattingtown	NYR20A436	3/05/03
Village of Matinecock	NYR20A437	3/04/03
Village of Mill Neck	NYR20A449	3/03/03
Village of Muttontown	NYR20A448	3/03/03
Village of Old Brookville	NYR20A447	3/03/03
Village of Oyster Bay Cove	NYR20A435	3/03/03
Village of Upper Brookville	NYR20A442	3/03/03

NOI: Notice of Intent

NYSDEC will continue to work with these municipalities to identify funding sources and to evaluate locations and designs for stormwater control BMPs throughout the watershed. Under the State's Environmental Protection Fund (EPF), $3.4 million will be provided this year (2003) through an application process to assist communities in implementing the Stormwater Phase II regulations. In addition, $380,000 from New York's federal nonpoint source grants and $800,000 in partnership funding has been committed to its implementation.

This TMDL does not invoke additional requirements set forth in the SPDES General Permit for Stormwater Discharges from Construction Activity, Permit No. GP-02-01, applicable to facilities satisfying Condition A of Part III.A.1.b.(1) for construction sites discharging to Oyster Bay and Mill Neck Creek watersheds.

8.3.2: Additional Requirements Based on this TMDL for OBH2

Under the SPDES General Permit for Stormwater Discharges from MS4s, Permit No. GP-02-02, Part III.B.2., the MS4s discharging to the OBH2 watershed must provide controls beyond the six minimum measures, such that pathogens are reduced to the extent necessary to meet the allocation set forth in this TMDL.

8.3.3: Additional Requirements Based on this TMDL for OBH3

Under the SPDES General Permit for Stormwater Discharges from MS4s, Permit No. GP-02-02, Part III.B.2., the MS4s discharging to the OBH3 watershed must provide controls beyond the six minimum measures, such that economically feasible programs are developed and implemented to reduce known pathogens sources to a level which will meet the pathogen standards necessary to open the waters to shellfishing based on the National Shellfish monitoring program.

Once sampling is obtained which meets the National Shellfish monitoring program for this area, and if the sampling indicates that the shellfish waters continue to violate shellfish standards, additional measures will be required to be implemented such that pathogens are reduced to the extent necessary to meet the allocation set forth in this TMDL. As an alternative to additional measures, if shellfishing waters continue to violate shellfish standards after economically feasible programs in place, the Towns associated with the drainage area OBH3 may perform a Use Attainability Analysis to determine if this area's designated use can be changed to eliminate shellfishing.

SECTION 9

PUBLIC PARTICIPATION

9.1. Introduction

Notice of availability of the Draft TMDL was made available to approximately 19 local government representatives and interested parties on July 30, 2003. The TMDL was public noticed in the State Environmental Notice Bulletin on July 30, 2003 as a Region 1 and statewide notice. A 30-day public review period was established for soliciting written comments from stakeholders prior to the finalization and submission of the TMDL for USEPA approval. The public comment period officially ended on September 2, 2003.

One commentor, Albert Machlin, requested an extension to September 30, 2003. The issues raised by Mr. Machlin for the extension did not raise to the level which would allow for this extension to be granted, however, the Department did incorporate Mr. Machlin's September 7, 2003 comments into the response to comments.

The TMDL was also made available through the NYSDEC Website at:

http://www.dec.state.ny.us/website/dow/tmdl.html

NYSDEC held a meeting with stakeholders on July 28, 2003 at The Waterfront Center located in Oyster Bay. Staff from NYSDEC and USEPA were present at this meeting. The NYSDEC personnel discussed the development of the TMDL, the assumptions used in its preparation, the TMDL projected by the modeling, and the reasonable assurance's section.

Comments were received from individuals representing three organizations, as identified below. These comments addressed various aspects of TMDL which were considered in finalizing the TMDL.

Name	Associated Organization
1. Albert Machlin	Environmental Technology Group, Consultant to Village of Bayville
2. Thomas D Galasso	Oyster Bay Sewer District
3. James T. Wheland and Richard W. Lenz	Town of Oyster Bay

9.1. Response to Public Comments

Comment 1: The Oyster Bay STP discharge outfall is located in the OBH5 and has an administrative closure area associated with it as defining the primary area of impact. This area is defined in the TMDL as area OBH5. However, the pathogens contributed by the STP are shown in are OBH3 on Table ES-1 in the draft TMDL. This is an incorrect depiction of the effective area of the STP discharge.

Response 1: The pathogen loadings from the Oyster Bay STP had been mistakenly included in OBH3. This has been corrected by eliminating this loading from that area.

Comment 2: The Continental Villas STP loading to MNC used in Table ES-1 is below its permitted level and therefore misrepresents that allowable loading of pathogens which the STP can legally discharge to this area. The loadings should be raised to the permitted levels.

Response 2: The NYSDEC reviewed the loads reported on the DMRs from the facility from September 1998 through June 2003. The average monthly loading from the STP is 849 billion colonies per year. This average has been incorporated as the "Current Point Source Loading" for the STP in table ES-1. Based on the modeled result of the current load, this represents only 0.77% of the current loading in the MNC, or less than 1% of the total load as cited in the original draft TMDL.

The "TMDL WLA" use of 14 billion colonies per year was based on a flow of 0.01 mgd and a loading of 100 MPN per 100 ml. The loading has been revised

in table ES-1 to 116 bcy which is based on a permitted flow of 0.012 mgd and a loading of 700 MPN per ml.

Comment 3: Table 5-1 on page 5-4: The facility description for the first point source listed in the table should be changed from "Town of Oyster Bay Sewage Treatment Plant" to "Oyster Bay District Sewage Treatment Plant"

Response 3: The change has been made.

Comment 4: The TMDL lacks the use of site-specific data for pollutant loads. The TMDL report states on page 6-1, "The most critical component of the Total Maximum Daily Load development is the establishment of the relationship between source loadings and the impacts on the receiving water body." The proposed TMDL, however, relies on textbook values for loadings and a 1988 Shoreline Survey by the NYSDEC. NYSDEC should consider more recent site-specific data including that contained in the Town's 2002 and 1997 Harbor Management Plans. Further data is available in the Water Quality Monitoring Reports by Friends of the Bay and the Town of Oyster Bay Mill Pond Outflow Study, August 2001.

Response 4: The TDML was developed based on data the NYSDEC had available to it at the time of the initiation of the TMDL development. NYSDEC used actual data from the Department's shell fish program. Other data sources are delineated in table 4-1. The 1997 Harbor Management Plan published by the New York Department of State (1997 Draft Oyster Bay-Cold Spring Harbor Resource Management Plan) does not seem to have any quantitative data regarding total coliform. The other two reports reference above could not be located by NYSDEC staff. Any data in these reports would need to meet all qualitative assurance and control measures required by the NYSDEC, along with being conducted at a laboratory approved by NYSDEC.

Any additional data available regarding these waters should be forwarded to the NYSDEC Division of Water Regional office in Stony Brook. This data will be used as these waters are accessed through the NYSDEC Priority Water Bodies list. This list is used to identify which water bodies in the State have problems.

This process will be used to evaluate the effectiveness of the solutions being implemented in this TMDL .

Although the NYSDEC shoreline survey report is from 1988, field work in 2002 by NYSDEC shellfish sanitation program staff to update the pollution inventory in that report showed no new significant pollution sources affecting the area. The major contamination source continues to be the storm water runoff from Mill Pond, Whites Creek, and Mill Neck Creek as demonstrated by NYSDEC's data which shows increased total and fecal coliform levels following rainfall events, especially heavy rainfall.

Comment 5: The TMDL uses extremely conservative ambient water quality data, particularly the application of NCDOH beach data to an open water segment. Data collected by the NYSDEC, which showed that ambient water quality standards are achieved in the open areas of Oyster Bay Harbor, from 1997 to 2002, are not incorporated in model calculations. Instead, beach data from NCDOH at Beekman Beach was used. This is in spite of the caveat on page ES-4 of the report "that the sampling regimen of Nassau County Department of Health (for beaches) is not designated by Department of Environmental Conservation for use for potential influence from sediment resuspension near the shoreline. NYSDEC (shellfish) data is always collected at the surface and away from the shoreline."

Response 5: NYSDEC is aware that the beach data collected by the NCDOH is conservative when used for evaluating waters with regard to meeting the shellfish standards. However, the beach data was the only usable data available in area OBH3. Due to the conservative nature of this data, the reasonable assurance section for OBH3 has been revised to provide a phased approach in implementation of the remedies concerning storm water. This phased approach includes the need for additional data to further evaluate the effectiveness of the implemented solutions.

Comment 6: The TMDL conclusion indicates the MNC is below its TMDL allocation. Of the approximate 297 acres of this segment, more than half of the area is designated as uncertified, with the remaining portion designated as conditionally certified. Since the TMDL is being developed to meet water quality standards for shellfish harvesting, it would seem inconceivable that according to your calculations, the

waters of this area can receive additional loadings when TC-10, which is not located within the MNC segment, actual data should be compiled from within the area, as well as in the conditionally certified area during times when the area is certified and uncertified.

Response 6: The only data available in this area for NYSDEC to assess the waters of MNC against the shellfish standard was sampling location TC-10. NYSDEC also had a few other sampling points within MNC which were used in calibration of the model, however, these sampling points could not be used in assessment against the standard. NYSDEC agrees with the commentor's assessment that there is a need for additional data in this area. The reasonable assurance section for Mill Neck Creek has been revised to better reflect the requirements of the Phase II storm water regulations. In addition, as additional data is obtained, resources permitting, the implementation of the MS4 permits in this area and the no discharge zone will be assessed to determine if shellfish standards are met.

The NYSDEC will establish compliance of the TMDL(s) and applicable water quality criteria through monitoring prior to opening shellfish areas consistent with the National Shellfish Sanitation Program's (NSSP) guidelines. As per the TDML, MNC and OBH1 have a MOS of 33% and OBH4 has an MOS of 42%. This is due to a lack of current data in this stretch and provides an untimate level of safety while the TMDLs and MS4 permits are implemented and results/reductions are measured.

Comment 7: The report does not provide a cost estimate for the mandated controls; in Section 8.1.3.2, which calls for additional measures beyond the six minimum controls for MS4s. The proposed TMDL requires a 90% reduction in loads to OBH3. This order of magnitude reduction may or may not be economically or technically achievable. The report should include likely alternative solutions and costs associated with a 90% load reduction. In addition to these concerns, it is questionable if a pathogen TMDL is, if fact, technically appropriate. As stated on Page 4-7, all recent open water quality data for the shellfish program 1997-2002, indicate standards are met except for the areas of Beekman Beach, where coliform loadings from the Mill Pond Outflow have been identified as the primary source of pollutants, and Roosevelt Beach, which is influenced by the

Oyster Bay STP.

Response 7: The development of cost estimates is not a requirement for the development of a TMDL. The purpose of the TMDL is to develop the load reduction targets such that ambient waters are brought back into compliance with the applicable water quality standards. The data referenced by the commentor has been collected under the current program and meets the NYSDEC requirements in order to compare it to the shellfish programs standards. However, the sampling stations are not located within OBH3. OBH3 was closed based on earlier data which used a different water quality standard. The reasonable assurance section for OBH3 has been revised to provide a phased approach in implementation of the remedies concerning storm water. This phased approach includes the need for additional data to further evaluate the effectiveness of the implemented solutions.

Comment 8: Before the TMDL is finalized, it is recommended that additional data be collected for both ambient water quality and loadings. Water quality samples should be collected in water body segment OBH3 for at least one season and within multiple points of segment MNC for at least one year. Stormwater samples should be collected at representative outfalls, and water samples should be collected at STP outfalls, to provide accurate site-specific loadings data.

Response 8: The TMDL is developed based on a point in time. Data continues to be collected and conditions are constantly changing. In order to assess a water body and make recommendations to solutions, it is necessary to pick a point in time, and perform this assessment, which results in a TDML. Additional data should continue to be collected to better assess the water body, along with potential modification of this TMDL. Therefore, this TMDL will be finalized and assessment will continue over time to determine if implementation of programs to eliminate or reduce pathogens is effective are returning the waters to shellfish harvesting status. The TMDL can be revised, as necessary, as better data becomes available.

Comment 9: The TMDL does not include information pertaining to the Village of Bayville's efforts which has resulted in the completion of storm water alleviation projects that direct the first flush of contaminated storm water into leaching manholes

instead of the MNC. The purpose of these projects was to lower the pathogen contribution to MNC. Based on this, the contribution from storm water to MNC should be lower.

Response 9: Section 5.2.3 has been modified to include information pertaining to the above efforts made by the Village of Bayville. The contribution from Storm Water in the MNC segment is based on modeling assumptions used to meet specific pathogens levels based on data at sampling point TC-10. The Village of Bayville's early efforts to control the flow of pathogens through stormwater to the MNC will assist in the lowering of the stormwater pathogens levels which will result in improving the water quality. The TMDL has used some assumptions in its projection of stormwater pathogen levels. Section 5.2.3 indicates that "To simplify the analysis, it is assumed that the first half mile from shore and also from the fresh water creeks directly drain to the Harbor, and that the rest of the storm water reaches the infiltration basins." This assumption should take into account some of the work from the Village of Bayville. Based on the above, the estimated current storm water load to MNC should remain at 95,699 billion colonies per year.

Comment 10: There is a Consent Order between Nassau County and the NYSDEC that has been in effect for a few years to require the construction of a secondary STP to handle septic tank overflows from the Continental Villas STP. This plant has not been constructed to date. The Continental Villa STP consists only of a concrete chamber that collects septic tank overflows from 27 residences where it is chlorinated before discharge to MNC. The chamber with chlorination is an interim measure until the treatment plant is built. This action is presently under legal action with NYSDEC since Nassau County has violated the terms of the Consent Order. Solid materials have been noticed in the flows from MNC. In addition, water quality sampling that was carried out during a study in MNC indicate very high coliform counts due to effluent from the chamber. Based on the above, the contribution from Continental Villas STP to MNC should be higher.

Response 10: Please see response #2. In addition, language has been added to section 5.2.2 which better describes the current status of the Continental Villas STP.

REFERENCES

Auer, Martin. T and Stephen Niehaus. 1993. Modeling Fecal Coliform Bacteria-I.Field and Laboratory Determination of Loss Kinetics. Water Resources, 27(4), pp 693-701.

Caraco, D., 2001. The Watershed Treatment Model. Version 3.0. Center for Watershed Protection, Ellicott City, Maryland.

Feacham, R.G., Bradley, D.H., Garelick, H., and Mara, D.D. 1983. Sanitation and Disease Health Aspects of Excreta and Wastewater Management. New York. John Wiley and Sons.

McFeters, G.A., and Bissonnette, G.H. 1974. Comparative Survival of Indicator Bacteria and Enteric Pathogens in Well Water. Applied Microbiology 27: 823-829.

National Shellfish Sanitation Program, 1986. Manual of Operations, Part 1, U.S. Department of Health and Human Services, Public Health Service, Food and Drug Administration, 1986 revision.

National Shellfish Sanitation Program, 1997. Guide for the Control of Molluscan Shellfish, U.S. Department of Health and Human Services, Public Health Service, Food and Drug Administration, 1997 revision.

National Shellfish Sanitation Program, 1999. Guide for the Control of Molluscan Shellfish, U.S. Department of Health and Human Services, Public Health Service, Food and Drug Administration, 1999 revision.

New York State Department of Environmental Conservation, 1988. Shoreline Survey: Pollution Source Identification - Oyster Bay Harbor (Shellfish Growing Area 47). Bureau of Shellfisheries, Stony Brook, NY.

New York State Department of Environmental Conservation, 2002. New York State 2002 303(d) List. NYSDEC, Division of Water, Albany, NY.

Ott, W. 1995. Environmental Statistics and Data Analysis, Lewis Publishers, New York, NY.

USEPA, 1991. Guidance for Water Quality-based Decisions: The TMDL Process. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA, 1997. Compendium of Tools for Watershed Assessment and TMDL Development, EPA 841-B-97-006. U.S. Environmental Protection Agency, Washington, DC.

USEPA, 1999. Guidance for Water Quality-Based Decisions: The TMDL Process. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA, 2001. Protocol for Developing Pathogen TMDLs. EPA841-R-00-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA, 2002. Better Assessment Science Integrating Point and Non-point Sources (BASINS), U.S. Environmental Protection Agency, Office of Science and Technology, Washington, DC.

Valiela, Ivan; Alber; Merrel; and Lamontagne. 1991. Fecal Coliform Loadings and Stocks in Buttermilk Bay, Massachusetts, USA, and Management Implications. Environmental Management. 15(5). Pp 659-704.