



CWMP Update

Volume I of II

woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS

#225139.00
Town of Nantucket
October 2014

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EXECUTIVE SUMMARY

Executive Summary

Nantucket began its Comprehensive Wastewater Management Planning (CWMP) in 2000 with the first of three phases well underway when the Massachusetts Department of Environmental Protection (MassDEP) and the University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST) announced the commencement of the Massachusetts Estuary Project (MEP). The MEP was a study of 89 embayment areas in southeastern Massachusetts, the Cape and Islands. Nantucket was the subject of four such embayment area studies; 1) Nantucket Harbor (including Polpis Harbor); 2) Madaket Harbor and Long Pond; 3) Sesachacha Pond; and 4) Hummock Pond. The MEP was centered on evaluating the nutrient enrichment of these coastal waters, specifically targeting nitrogen loading from various sources including the part on-site wastewater systems had in the degradation. The 89 embayments were divided up into various phases with the first beginning in 2002. Nantucket and Polpis Harbors were included in the first round of studies starting in July 2002. The results of these studies were not expected to be finalized for at least two years. In reality, it took more than two years to complete. When the news of the impending MEP studies was announced, Nantucket reached out to MassDEP for advice as to how to proceed with the on-going CWMP due to the potential impact the MEP would have on the results carried in the CWMP. Because the MEP studies were expected to take years to complete, Nantucket was advised to continue with the CWMP and efforts could be coordinated during the MEP study period. Nantucket completed the three phases of the CWMP with the Final CWMP and Final Environmental Impact Report in 2004 and the MEP studies were still pending in all embayment areas of the Island. In hindsight, the decision between Nantucket and MassDEP to continue moving forward with the CWMP was a good one. When Nantucket was filing the final phase of the CWMP through the Massachusetts Environmental Policy Act Office (MEPA) in 2004, it was mandated that once the MEP studies were completed that Nantucket would have to complete an update to its Final CWMP incorporating the MEP data into the overall wastewater planning. Refer to Section 1 for an update of the 2004 planning.

The 2004 CWMP completed a wastewater evaluation that determined areas of the Island that were not long-term sustainable with on-site wastewater systems. This was based on a host of criteria that included review of Board of Health records for Title 5 failures, major repairs, multiple system pumping, soils and groundwater conditions and potential impacts of on-site systems to environmental resources. Based on a rating criteria matrix, geographical areas were delineated and rated as either requiring an off-site wastewater solution or able to sustain long-term with an on-site system. At this time, there was no knowledge of the issues that would be encountered due to nitrogen enrichment to the water resources. So the 2004 CWMP recommendations were made based on the criteria that existed at that time. With the introduction of the MEP, nitrogen would now add to a host of diverse criteria to determine Needs Areas.

According to the MEP, Project partners were tasked with determining the geographic area contributing nutrients to a specific estuary; establish what the nutrient sources are, what the amount of each nutrient load is, and the maximum nutrient load the estuaries could tolerate without dramatically changing their character and usages. In the Nantucket case studies, returning the estuaries to the water quality condition that support sensitive shellfish habitats and lush eelgrass beds, revealed it would be necessary to remove a significant percentage of the nutrient loadings coming from the estuary's watershed. The MEP studies provided water quality, nutrient loading, and hydrodynamic information for six geographic areas on Island that would need to be added to the previous data collected and an updated CWMP be completed. This 2014 CWMP Update comes twelve years after the inception of the MEP and over 14 years after Nantucket began the CWMP quest. This Report contains an exhaustive study of not only the MEP results on Island, but also all that has transpired since 2004 when the Town filed its final phase of the initial CWMP. This document satisfies the MEP update mandate, as well as updates the existing and future conditions Town Wide in this Integrated Planning document for the next 20-years.

The various sections of this Report describe in detail the changes that have been made over the last decade and what, if any, influence to the wastewater planning on Island was or would be realized. These include:

- Completed MEP Reports
- Total Maximum Daily Loads (TMDLs) Issued
- Revised, Updated and New Board of Health Regulations
- Watershed Updates
- Updates to the Surfside WWTF Since 2004
- Sewer Act of 2008
- Updated Zoning
- Septage Management Plan
- Public Water Update
- Stormwater Planning and Implementation
- Fertilizer Management
- Tight Tank Policy
- Landfill Mining
- Ocean Outfall
- Climate Change
- Water Quality Programs
- Energy

The Report sections that follow identify the Town's efforts in each of these areas over the last ten years since the completion of the 2004 CWMP/EIR and how each has had an impact to the initial wastewater planning creating an Integrated Wastewater Management Plan that will serve the Town for the next 20 years. Section 2 summarizes the data updates completed as part of this Report.

Major highlights of this CWMP Update effort include the Capacity Analysis of the Surfside Wastewater Treatment Facility (WWTF). The results of this study opened the door to be able to eliminate the need to plan and design a third WWTF in the Madaket Area at the western end of the Island on the former FAA land. The Town contracted the Preliminary Design of this WWTF in 2009 with the initial intent of designing and constructing a new WWTF to service the Needs Areas on this end of the Island. The original scope of work was to complete the due diligence needed to design this WWTF. This included the intensive surveys for the Natural Heritage and Endangered Species Program (NHESP) and the Massachusetts Historical Commission (MHC). The results of the NHESP survey identified significant challenges with the site due to the presence of both plant and animal species. With concerns for both the environmental constraints revealed, financial hurdles in acquiring and permitting, as well as local concerns for utilizing this site for wastewater, the Town amended the Madaket Preliminary Design scope. The amendment directed new tasks to concentrate on the potential to utilize the Surfside WWTF for the Needs Areas initially recommended for the Madaket WWTF.

Concurrent with the Surfside WWTF Capacity Analysis, the 2004 Needs areas were in the process of being updated with both the MEP results where appropriate and with the afore mentioned data sets to confirm the 2004 CWMP results and identify any new areas of wastewater concern. This task entailed an exhaustive exercise of reviewing Board of Health files and new and/or revised Local Regulations in order to supplement the new data with that evaluated in the original CWMP. Existing data was applied to the Needs Areas, which updated the on-site information to 2012. Because of this exercise, a new Local Regulation was created and adopted by the Town-the Administrative Consent Order (ACO). The ACO provides property owners with failing on-site systems the ability to defer major repairs as long as their property is located within an approved Needs Area and sewer is proposed in the near future. At the time of this development, Madaket Needs Area was approved to utilize the ACO, which saves the

owner from having the expense of designing and installing a major repair/replacement system and then having to pay for sewer. The Board of Health will work with the property owner to find a temporary solution until such time as sewer is available. This is but one solution that is a win/win for the Town and its residents. Sections 2 and 3 summarize the processes taken, including the alternatives evaluation.

Other coordination with data updates was carried on with multiple entities including Town staff and various local groups. The result is this collaboration is a comprehensive update of areas needing an off-site wastewater solution. This included adding three new Needs Areas in addition to confirming six from the 2004 CWMP. The complete data update is included in Section 2.

The revised 2014 Needs Areas look like this:

- Somerset
- Madaket
- Warrens Landing
- Town Sewer District Unsewered Parcels
- Monomoy
- Shimmoo
- Hummock Pond North (New)
- Hummock Pond South (New)
- Miacomet (New)

The total estimated cost of servicing the Needs Areas as noted above is \$198.8M. This is included in the 2014 Capital Improvements Plan detailed in Section 5 of this Report. The Needs Areas details are included in Section 2. A CY2015 State Revolving Fund Project Evaluation Form (PEF) was filed in August 2014 to fund the first priority Needs Areas of Somerset, Madaket/Warrens Landing.

The revised Needs Areas projected a new wastewater flow of 4.0 MGD, which was utilized as the target for the Surfside WWTF. Surfside WWTF was upgraded in 2009 to 3.5MGD to service the needs identified in the 2004 CWMP. The task then at hand was to determine if the Surfside WWTF could support the additional 0.50MGD. The outcome of the Capacity Analysis was positive that the facility itself could handle the additional flows, which eliminated the need for a Madaket facility. The Capacity Analysis did uncover a number of upgrades necessary for reliability in every day operations, upgrades to support additional flow that was not included in the 2004 CWMP and upgrades to support energy efficiencies for savings in both the short and long term. During the Capacity Analysis, there were some issues identified as a result of budget cuts that were taken during the last upgrade-major item was the screening that protects the membranes. While the facility is relatively new, operations since the upgrade has proven to show that some of the items initially cut need to be added for reliability and preservation of a major part of the wastewater operations-the membranes. The total cost for the recommended upgrades is \$8.827M. A CY2015 State Revolving Fund Project Evaluation Form (PEF) was filed in August 2014 to fund these recommendations. Sections 3 and 4 contain all supporting information on the Surfside Capacity Analysis.

Once the WWTF was determined able to support the total revised flow, the limiting factor was the Surfside Groundwater Discharge Permit, which was set at 3.5 Max Day. Multiple meetings ensued with MassDEP to open discussions on the potential to modify the permit to meet the revised flow of 4.0 MGD. The discussions centered on the ability of the 15 existing sand beds to be loaded at a higher rate than is currently done, which would support the additional flow at full buildout. A full hydrogeological evaluation, with updated modeling of the new load rates applied to the existing beds was completed. The results showed that the current bed system could accept the higher loads up to 4.0 MGD. A Groundwater Discharge Permit Modification was filed and together with the Hydrogeological Evaluation filed has been approved by MassDEP. The new permit is pending. There is no additional cost to upgrade the permit limits as the existing physical infrastructure supports the new permit.

The impetus for embarking on the CWMP Update was to incorporate the MEP results into the wastewater analyses and planning. This entailed evaluating a scope of potential solutions in the embayment areas in order to develop a sound plan to meet the Total Maximum Daily Loads (TMDLs) or water quality thresholds established in the MEPs. This included developing and having various model run scenarios completed by SMAST utilizing nitrogen loading results from the respective MEP Reports and compiling datasets in order to develop plans to meet the water quality thresholds set throughout the Island. Each embayment area MEP was different and based on the specific nitrogen loads relative to the area. This Report developed plans to meet all water quality thresholds set in the MEP and subsequent TMDLs in an Adaptive Management Plan for each specific area; 1) Nantucket Harbor (including Polpis Harbor); 2) Madaket Harbor and Long Pond; 3) Sesachacha Pond; and 4) Hummock Pond. An Adaptive Management Plan was created for each area and includes both structured and non-structured solutions to meet the established TMDLs and/or water quality thresholds set in the specific water resource.

The Adaptive Management Plan is intended to be an iterative process whereby incorporating recommended solutions meets one or more resource management objectives and accrues data needed to determine the need for additional future management. For example, Nantucket Harbor will realize water quality improvements as a result of the restructuring of the jetties that are poised for completion in 2015. Will this improvement be enough to raise the water quality in both Nantucket and Polpis Harbors where the two TMDLs are set? On the other hand, will additional improvements be needed such as sewerage Monomoy, Shimmo in order to meet the mandated thresholds here? This is the “adapting” in the Adaptive Management Plan that will serve as a tool to change existing conditions. This recommendation is documented in Section 4.

The above are the major highlights of the CWMP Update. There is a significant amount of other supporting data that has been updated and is included throughout this Report. The CWMP Update summarizes all the efforts the Town has undertaken since the completion of the 2004 CWMP in order to assess the need for additional work.

The result of this CWMP Update is a new Recommended 20-Year Plan for wastewater management. This includes additional planning, operation and maintenance recommendations, as well as structures solutions for both Surfside WWTF upgrades and sewerage. A Capital Improvements Plan (CIP) and 20-year schedule was developed incorporating all of the recommendations included in this Update. This CIP meets and or exceeds the requirements of the TMDLs and or water quality thresholds established in the MEPs. All recommendations are identified in chronological order of need and associated costs in Section 4. With the Adaptive Management Plan, the ultimate result may in fact be a plan that costs far less than originally anticipated based on progress of actions and future need.

Research into available funding and financing mechanisms to support the CIP contained herein are included in Section 5. The State Revolving Fund (SRF) Program is the most probable way to finance the capital costs of the Final Recommended Plan. Four CY2015 Project evaluation Forms (PEFs) were filed in August 2014 to fund portions of the CIP. These include; 1) Surfside WWTF Upgrades; 2) Somerset, Madaket/Warrens Landing Sewer Extensions; 3) Stormwater Master Plan; and 4) Infiltration and Inflow Assessment. The Town will now have to work to produce a Capital Cost Recovery Program that will be accepted by the public.

There was significant public outreach that took place that started in 2011 with the Board of Selectmen sponsored Wastewater Action Plan. This was the precursor to the CWMP Update Public Outreach planning that has been continuous since 2012. Refer to Section 6 for a summary of this outreach.

This CWMP Update meets the regulatory requirements set in the 2009 MEPA Certificate and delivers a Final Recommended Plan for wastewater management for the next two decades. Nantucket is well ahead of the region with its proactive approach to wastewater management. The overall water quality in Nantucket Town Basin in the Harbor is a credit to the Town showing the proactive nature of the people and mainly due to the fore fathers of wastewater who over a hundred years ago implemented the Town wastewater system. Without knowing or having

the knowledge of what would come in the twenty first century with nitrogen load issues, this system has proven to be the lead in maintaining water quality in this area. The Adaptive Management Plan recommended herein will follow in these steps to assure that all areas on Island preserve and protect the water resources from further degradation and return them to water quality standards set by each individual resource. The preservation and protection of Nantucket's most valuable resource, water quality, is a priority to the economic, political and overall sustainability of this Island. The 2014 Recommended Plan is the wastewater plan that will carry this forward.

1. CWMP UPDATE

1.1 SUMMARY OF 2004 CWMP/EIR

The Town of Nantucket completed its Comprehensive Wastewater Management Plan and Environmental Impact report (CWMP/EIR) in March 2004. The Phase III CWMP, CWMP/FEIR was submitted through the Massachusetts Environmental Policy Act Office (MEPA), and approved with a MEPA Certificate determining that the Phase III CWMP/EIR filing “adequately and properly complies with the Massachusetts Environmental Policy Act (G.L., c.30, ss.61-62H) and with its implementing regulations (301 CMR 11.00). Refer to Appendix A for all MEPA Certificates issued on the 2004 CWMP/EIR.

The CWMP/EIR addressed the Town’s long-term and short-term wastewater management needs. The report evaluated Island-wide methods of managing wastewater treatment and disposal. The Report also identified and evaluated environmentally long-term sustainable wastewater management, both in treatment and disposal in order to meet local, state and federal water quality standards, as well as standards related to public health, again at state Title 5 and Nantucket’s local standards, identified as Local Regulations, through the Board of Health. The Report included a summary of existing conditions on Island, future conditions, identification and screening of alternative wastewater methods, development and implementation of a public participation program and conclusions, including identifying those areas on Island recommended for an off-site wastewater solution.

The CWMP was initiated through the filing of an Environmental Notification Form (ENF) in November 2001, which determined that the CWMP, EOE No. 12617, would be filed as a Special Review Procedure with the filing of three documents:

- Phase I, Needs Analysis (including Screening of Alternatives)
- Phase II Draft CWMP/Draft EIR
- Phase III Final CWMP/Final EIR

1.1.1 Phase I CWMP/EIR

The Phase I Needs Analysis and Screening of Alternatives was filed through MEPA in August 2012. This Report contained the results of a Town-wide Needs Analysis to determine whether or not conventional Title 5 on-site wastewater disposal systems were long-term sustainable throughout the project life of 20 years and beyond. The Town was delineated into 18 areas of study in order to compile specific data about the geographic area within the ranking matrix. The rating criteria matrix was developed utilizing criteria to determine the sustainability of on-site disposal systems using both on-site details (physical characteristics such as size of lot, soil and groundwater conditions), as well as community information on file with the Assessor, Water Department and Board of Health (Number of bedrooms, baths, potential for buildout, areas within watershed protection areas, number and type of Title 5 on-site system failures and/or major repairs, etc.). The data that resulted from the exercise was compiled into each of the 18 Study Areas and were then compared using a two-stage ranking system:

1. First stage rated the 18 Study Areas based on the data in the Criteria Matrix
2. The second stage reviewed the results of Stage 1 and further evaluated the areas based on severity of soils and groundwater conditions as they relate to the sustainability of on-site wastewater disposal systems, as well as age of on-site system (related to life of a Title 5 system).

The 2004 CWMP final recommendation included five Study Areas as Needs Areas- areas needing an off-site wastewater solution. These Needs Areas are:

Madaket

Warrens Landing

Somerset

Monomoy

Shimmo

The sewer recommendation also included the complete build-out within the Town Sewer District. The remainders of the study Areas were recommended to maintain existing on-site wastewater disposal systems managed under a Septage Management Plan (SMP). The Town developed and adopted a SMP on November 9, 2005. Provisions within this Plan will afford the Town to continue to monitor and manage areas where no municipal sewer is proposed. Refer to Chapter 2, Section 2.9 of this Report for a summary for the SMP activities to date.

Refer to Appendix A for a copy of the 2004 CWMP Phase I Rating Criteria Matrix

The Phase I Report also reviewed and evaluated preliminary alternatives for wastewater including the following:

- Continued use of Title 5 on-site wastewater disposal systems
- Massachusetts approved on-site Innovative/Alternative Systems
- Various types of wastewater collection, treatment and disposal systems
 - Local
 - Communal / Small Package Plants
 - Decentralized
- Groundwater discharge options and sites

Figure 1-1 from the Phase I CWMP details the final areas of wastewater disposal need as well as a summary of each Study Area and its recommendation for wastewater solution.

The Phase I Report can be accessed through the Town's website at www.nantucket-ma.gov or at the Department of Public Works Office.

Challenge:

Evaluate alternatives for a 20-year solution to wastewater collection, treatment and disposal needs of the Town.

Solution:

An Island-wide study to maintain and/or improve environmental conditions while determining costs, benefits for long-term sustainability, protection of the sole source aquifer and public health, and preservation of Nantucket Harbor, Madaket Harbor, Polpis Harbor and Sesachacha Pond

Area of Wastewater Disposal Need Based on Wellhead Overlay Protection Zone

Town WPZ

- Challenge**
- Wellhead Protection Zone
 - Private Water Supply & Wastewater Disposal
- Solution**
- Septage Management Plan

Area of Wastewater Disposal Need Based on Harbor Watershed Line

Pocomo

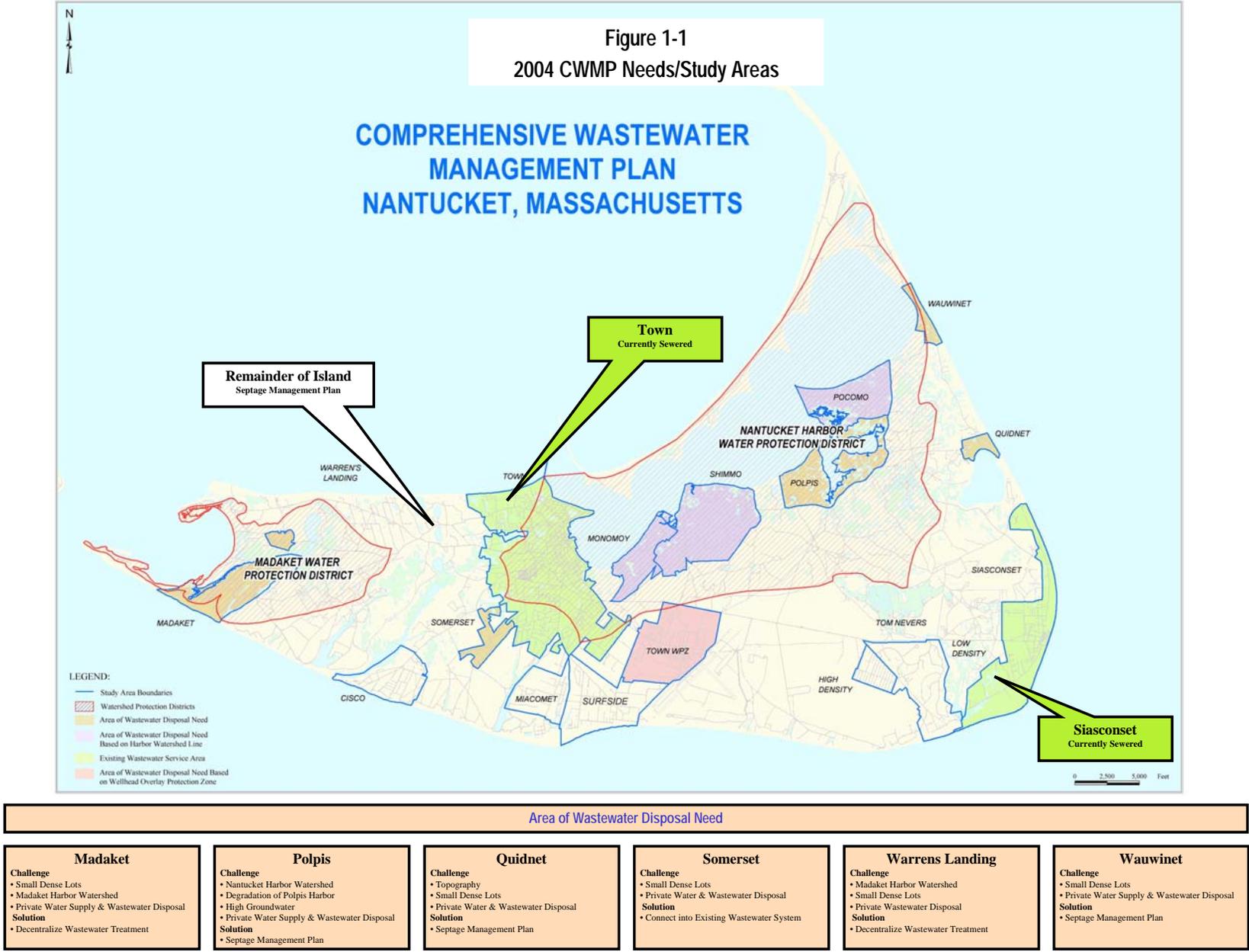
- Challenge**
- Nantucket Harbor Watershed
 - High Groundwater
 - Private Water Supply & Wastewater Disposal
- Solution**
- Septage Management Plan

Monomoy

- Challenge**
- Nantucket Harbor Watershed
 - Private Water Supply & Wastewater Disposal
- Solution**
- Connect into Existing Wastewater System

Shimmo

- Challenge**
- Nantucket Harbor Watershed
 - Private Water Supply & Wastewater Disposal
- Solution**
- Connect into Existing Wastewater System



Area of Wastewater Disposal Need

- Madaket**
- Challenge**
- Small Dense Lots
 - Madaket Harbor Watershed
- Solution**
- Private Water Supply & Wastewater Disposal
 - Decentralize Wastewater Treatment

- Polpis**
- Challenge**
- Nantucket Harbor Watershed
 - Degradation of Polpis Harbor
 - High Groundwater
 - Private Water Supply & Wastewater Disposal
- Solution**
- Septage Management Plan

- Quidnet**
- Challenge**
- Topography
 - Small Dense Lots
- Solution**
- Private Water & Wastewater Disposal
 - Septage Management Plan

- Somers**
- Challenge**
- Small Dense Lots
 - Private Water & Wastewater Disposal
- Solution**
- Connect into Existing Wastewater System

- Warrens Landing**
- Challenge**
- Madaket Harbor Watershed
 - Small Dense Lots
- Solution**
- Private Wastewater Disposal
 - Decentralize Wastewater Treatment

- Wauwinet**
- Challenge**
- Small Dense Lots
 - Private Water Supply & Wastewater Disposal
- Solution**
- Septage Management Plan

1.1.2 Phase II CWMP/Draft EIR

The Phase II CWMP/EIR, EOE No. 12617, was filed and approved through MEPA in September 2003. This Report contained responses to the comments received on the Phase I CWMP, as well as an evaluation and screening of all potential treatment alternatives and groundwater discharge sites that could address the needs identified in the Phase I CWMP. A number of Massachusetts approved alternative treatment technologies were evaluated and detailed, including an option of continuing to utilize on-site Title 5 systems.

The Phase II Report also reviewed opportunities to reduce wastewater flows, potential wastewater reuse alternatives and disposal options for residuals. This information is contained in full within Chapter 3 of the Phase II Report. A full screening of sites on Island was evaluated for the potential discharge of highly treated wastewater; similar to how the Town currently operates the Surfside Wastewater Treatment Facility and Siasconset Wastewater Treatment Facility discharge beds. Figure 2-12 from the Phase II CWMP Report detailing the sites follows here as Figure 1-2.

The Draft Recommended Plan contained in Chapter 5 of the Phase II CWMP proposed to sewer the following Needs Areas:

- Madaket and Warren’s Landing Needs Areas
 - Design and install a satellite WWTF on the former FAA Site on Red Barn Road
 - Low-Pressure sewer
- Somerset Needs Area
 - Connect into Surfside WWTF
- Shimmo
 - Preliminary to connect into Surfside WWTF. Finalize after review of Massachusetts Estuaries Report results
- Monomoy
 - Preliminary to connect into Surfside WWTF. Finalize after review of Massachusetts Estuaries Report results
- Town
 - Continue to build out the Town Sewer District (TSD) into the Surfside WWTF

The following Study/Needs Areas were recommended for maintaining current on-site systems under a Septage Management Plan:

Cisco	Miacomet
Surfside	Tom Nevers Low Density Areas
Tom Nevers-High	Wauwinet
Pocomo	Polpis
Quidnet	Town WPZ*

*With the caveat that should any impacts to Town well area arise, this area will be connected to sewer at Surfside WWTF

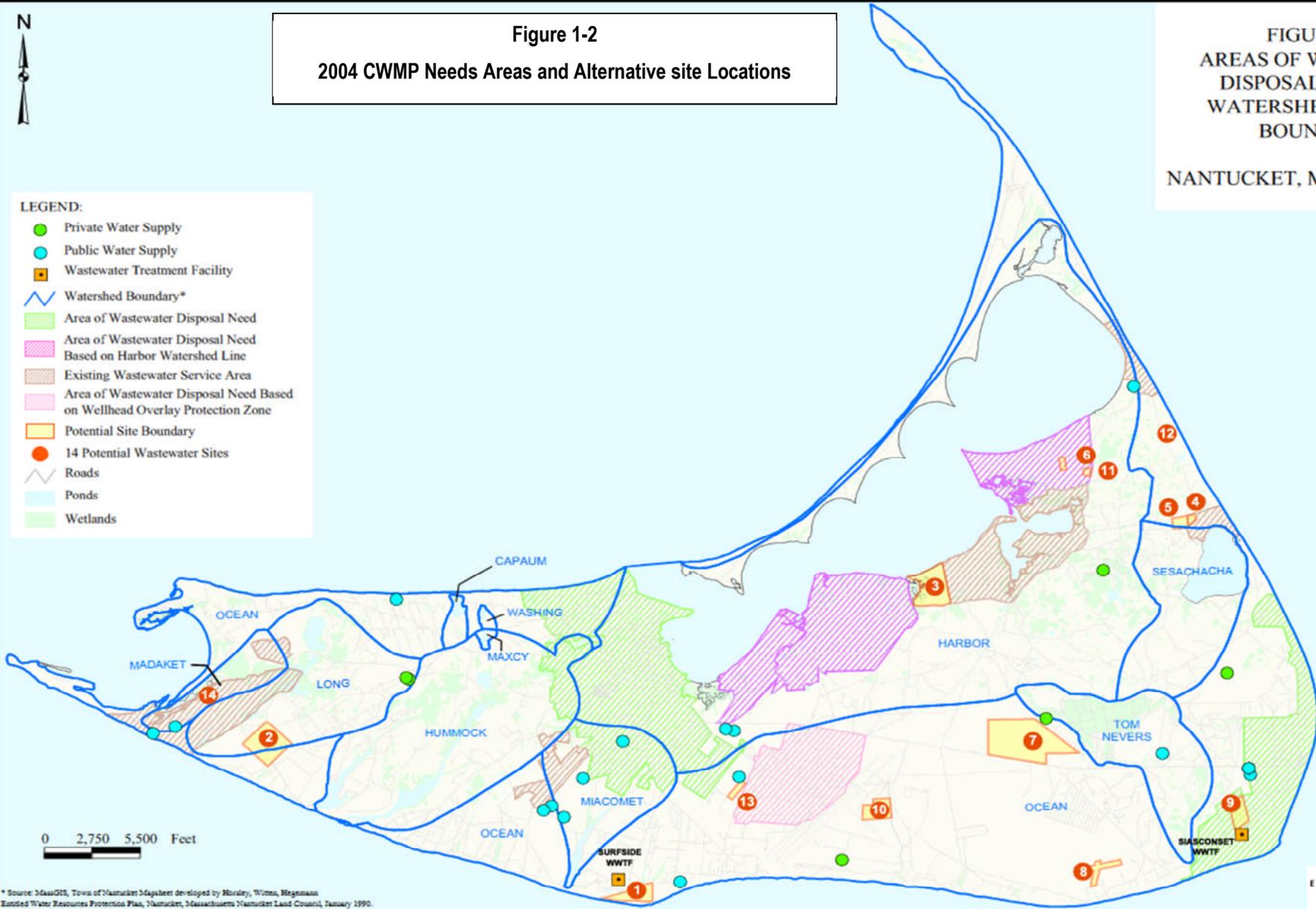
Figure 1-2

2004 CWMP Needs Areas and Alternative site Locations

FIGURE 2-12
AREAS OF WASTEWATER
DISPOSAL NEED AND
WATERSHED SUBBASIN
BOUNDARIES

NANTUCKET, MASSACHUSETTS

- LEGEND:
- Private Water Supply
 - Public Water Supply
 - Wastewater Treatment Facility
 - Watershed Boundary*
 - ▨ Area of Wastewater Disposal Need
 - ▨ Area of Wastewater Disposal Need Based on Harbor Watershed Line
 - ▨ Existing Wastewater Service Area
 - ▨ Area of Wastewater Disposal Need Based on Wellhead Overlay Protection Zone
 - ▭ Potential Site Boundary
 - 14 Potential Wastewater Sites
 - Roads
 - Ponds
 - Wetlands



* Source: MASSGIS, Town of Nantucket Mapsheet developed by Hirsley, Wiman, Hegmann
 Estimated Water Resources Protection Plan, Nantucket, Massachusetts Nantucket Land Council, January 1990.

The Phase II CWMP Report also detailed necessary upgrades to the Surfside WWTF to accommodate the flows and loads associated with the existing Town Sewer District (and build-out) , as well as the Needs Areas identified in the Report.

A comprehensive public outreach program was on going throughout the project duration in order to educate the public as to the CWMP process and solicit comment from the interested parties.

The Phase II Report can be accessed through the Town's website at www.nantucket-ma.gov or at the Department of Public Works Office.

1.1.3 Phase III CWMP/Final EIR

The Phase III CWMP/EIR, EOEA No. 12617, was filed and approved through MEPA in May 2004. This was the Final CWMP and Final Environmental Impact Report (CWMP/FEIR). This Report contained responses to the comments received on the Phase II CWMP, as well as final evaluation of the Draft Recommended Plan included in the Phase II Document. The Final Recommended Plan to sewer specific Needs Areas as noted above, were evaluated environmentally, as well as financially, detailing individual household costs should the Plan be implemented. A complete review of the existing staffing levels at the Department of Public Works was reviewed with recommendations for preparing for an expanded wastewater collection and treatment system. There were specific recommendations in order to operate and maintain the entire wastewater collection, treatment and disposal system in order to meet the proposed new demands.

A review of the then current sewer user charge system, sewer system expansion control and potential flow reduction options were evaluated and summarized.

The 2004 CWMP/FEIR is the basis for this CWMP update. The Town moved forward with many of the 2004 CWMP recommendations with the largest project completed the upgrade to the Surfside WWTF. The CWMP/FEIR was completed without having the benefit of having the MEP results and thus was mandated by MassDEP to update once the MEP Reports and any subsequent Total Maximum daily Loads (TMDLs) issued. It is under this direction that this Report is underway with the result being this Report.

A Capital Improvements Program (CIP) was completed as part of the Phase III CWMP that detailed the report recommendations in a chronological calendar and associated costs per recommendation. This CWMP Update has updated the 2004 CIP, which is included in Section 4 - Final Recommended Plan of the Phase III CWMP/FEIR Report. Figure 1-1, shown previously, details the Final Recommended Plan from this Phase III Report.

The Phase III Report can be accessed through the Town's website at www.nantucket-ma.gov or at the Department of Public Works Office.

1.1.4 Summary of Massachusetts Estuaries Program

The Massachusetts Estuaries Program (MEP) is a collaboration between the Massachusetts Department of Environmental Protection (MassDEP) and the University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST). The MEP was initiated to evaluate nitrogen sensitivity in coastal embayments in southeastern Massachusetts, Buzzards Bay, Cape Cod and the Islands of Nantucket and Martha's Vineyard. The MEP is being completed through comprehensive water quality sampling/testing and quantitative Total Maximum daily Load (TMDL) modeling. The data from the analysis is utilized to prepare technical reports that detail the analysis process and present final results of areas where nitrogen loading is an issue, what is causing it and providing communities with "locally controllable" solutions for reducing the nitrogen loading that will provide solutions to meet the TMDLs established in the area.

The MEP was initiated in July 2002 with a list of 89 embayment areas; Nantucket was included in the list with five embayments; Nantucket Harbor (included Polpis Harbor), Sesachacha Pond, Madaket Harbor, Long Pond and Hummock Pond. The first round of studies started in 2002 encompassed 20 embayments, with Nantucket having two areas of study in the first round:

Nantucket Harbor (#13)

Sesachacha Pond (#18)

Both of these MEP Projects were started during the 2004 CWMP, but had just started gathering data and were not near completion in 2004 when the CWMP was ready for finalization. Discussions with MassDEP resulted in a determination that it was best to continue moving the CWMP forward and the Town would be required to incorporate the final results of the MEP into a CWMP Update at some point in the future. This would include providing a recommended solution to meet the TMDLs issued. This CWMP Update Report is the result of this mandated review.

Round 2 of the MEP was started in July of 2003 with 14 additional embayment areas and included two more areas in Nantucket:

Madaket Harbor (#12)

Long Pond (#13)

The last watershed to be studied on Island was Hummock Pond, which was eliminated from the original list of 89 due to the lack of available state funds to subsidize. Nantucket, being a proactive community when it comes to water resource issues, particularly water quality, was quick to respond that the Town itself would partner directly with SMAST in order to get the Hummock Pond MEP started. In October 2012, the Town entered into a contract with SMAST to initiate the start of the MEP for Hummock Pond. The timing was crucial as the CWMP Update was in process and the Town wanted to incorporate all MEP studies into the final report. Because the Town was diligent in its annual water quality testing and had over two years of previous water quality data on Hummock Pond, it was determined that the MEP could be accomplished before the final CWMP update was delivered. So, the final round of MEP for Nantucket included:

Hummock Pond

In addition, the Town is including a study of Miacomet Pond to round out the nutrient studies of larger Island watersheds. A fresh water system and not an area subject to nitrogen loading, there are concerns based on historical water quality testing results, as well as issues with flooding that have prompted the Town to pursue a separate contract to look at Miacomet's specific issues. While Miacomet is a fresh-water body and not the subject of nitrogen loading, it will be studied and evaluated in order to document the chronic issues the Pond is facing and detailed recommendations to provide solutions to eliminate or provide relief from those chronic issues will come forward in the future.

Chapter 2 provides more detailed discussion on the MEP studies and specific results for each area.

1.1.5 Overall 2004 CWMP/EIR Summary

The 2004 CWMP addressed the long-term and short-term issues relating to the Town's wastewater and disposal needs. The Report examined the full range of the Town's needs and identified environmentally sustainable wastewater collection, treatment and disposal alternatives that at that time met the Town's needs while also meeting local, state and federal water quality and public health standards. The Report summarized existing and future conditions in the Town and developed a 20-year plan to meet the local needs. At the same time, the recommended plan met the state's goal of sustainable growth, which looked at resource protection and met the local and state sustainable economic development.

The upgrades at the Surfside WWTF were initiated in 2005 and included the construction of five additional sand beds for effluent disposal, which was a direct result of recommendations in the 2004 CWMP, as well as contained in an Administrative Consent Order (ACO). Although no new Needs Areas have been designed and constructed and thus sewerage since the 2004 CWMP, other portions of the 2004 CWMP have been implemented. The Town embarked on an aggressive Infiltration and Inflow (I/I) removal program. This I/I Program is an on-going process that is driven by the need for flow reduction, which is part of the 2004 MEP Certificate recommendations. Currently, the Town is working on Phase 2B working in the downtown area to identify and correct extraneous water filtering into the municipal sewer system.

The Stormwater Drainage and Outfall Evaluation Project was completed in 2005 to document and map all drainage outfalls in Town. This Project was a mapping exercise only and did not include a coordinating, documented report. A future recommendation included in this CWMP Update is to complete a Stormwater Master Plan that will provide the Island-wide data to support the 2005 mapping exercise. The Town filed and was approved in the CY2014 Project Evaluation Form (PEF) for State Revolving Funds to complete a Stormwater Master Plan Island-wide and supplement this information to the completed mapping exercise. The Town decided to defer this project until the CWMP Update was finalized. A CY2015 Project Evaluation Form (PEF) will be re-filed in August 2014 for the Stormwater Master Plan, which can then be started late 2015 or early 2016. The project will then have information relative to stormwater and the MEP and subsequent TMDLs to evaluate as part of the overall plan.

The Final Recommended Plan contained in the 2004 CWMP contained areas where there were preliminary recommendations as to how a Needs Area would be treated, but also contained language that stated the final recommendations would be presented based on the MEP study results.

The MEP results for all embayment areas are now complete, with Hummock Pond being the most recent in late 2013. The subsequent chapters of this CWMP Update the 2004 CWMP with a new, comprehensive plan that serves to meet not only the requirements set forth in the 2004 MEPA Certificate, but all current local, state and federal standards. The final chapter in this Report details a revised Final Recommended Plan that should serve to meet the needs of the Town for a 20-year planning period. This Final Recommended Plan also includes provisions contained in an Adaptive Management Plan that specifically address the MEP studies and results in order to develop a plan to meet the Massachusetts Department of Environmental Protection issued Total Maximum Daily Loads (TMDLs) in multiple areas on Island.

2. DATA COLLECTION AND REVIEW

This section presents information and data from all pertinent documents developed and issued between 2004, the completion of EOE 12617 CWMP/FEIR, and present, that relate to wastewater and stormwater planning. These updates are necessary to address the time lapse between the 2004 CWMP/FEIR and this Report. Pertinent documents include regulations, zoning changes, by-law changes and additions, regulatory changes, ongoing water quality testing and analysis results, and MEPA's review of the 2004 CWMP/FEIR.

2.1 UPDATE TO NEEDS AREAS

As part of the August 2001 Phase I CWMP, the Town was delineated into 18 study areas based on geographic location and neighborhood land uses. A Town-wide Needs Analysis was performed to determine whether or not conventional Title 5 septic systems would be long-term sustainable in disposing of wastewater throughout the 20 year planning period. The Analysis included data from the Board of Health records, Assessor's files, Geographic Information Systems (GIS) records, and USDA soils and groundwater data. The 2004 CWMP/EIR identified five geographic areas, determined as Needs Areas, defined as not long-term sustainable with on-site wastewater disposal systems. These Needs Areas include:

Madaket	Warrens Landing	Somerset
Monomoy	Shimmo	

Also included in the above Needs Areas is the full build-out for the existing Town Sewer District where the majority of parcels are currently connected to the municipal wastewater system at Surfside WWTF.

As part of developing this CWMP Update, W&C worked with multiple entities of the Town to update the 2004 Needs Areas with supplemental data derived within the period of when the 2004 CWMP was finalized and 2012/2013 – an eight to nine year period when many changes were adopted on Island. These changes include the following:

Completed Massachusetts Estuaries Reports	Total Maximum Daily Loads (TMDL) Issued
Revised Board of Health Septic Regulations	Revised Zoning Regulations
Nantucket Sewer Act of 2008	Surfside WWTF Capacity Analysis
MEPA Greenhouse Gas Emissions Policy	Stormwater Planning
Landfill Mining	Innovative/Alternative Technologies Update
Septage Management Planning	Fertilizer Management Plan
Board of Health – Administrative Consent Order	Tight Tank Policy
Sewer Connection Policy	Infiltration / Inflow Program Update
Potable Water Update	Energy Program

Surfside WWTF Capacity Analysis	Funding / Financing Planning
---------------------------------	------------------------------

Figure 2-1 details all the components of this Integrated Planning. (Bubble Chart)

2.2 ZONING

Since 2004, the Town’s Zoning Bylaw (Chapter 139 of the Nantucket Code) has been amended, resulting in a reduction to the number of potential second dwelling units in a number of areas on Island. In December 2006, the then Sewer Advisory committee submitted the “Report of Recommendations from the Sewer Advisory Committee to the Nantucket Board of selectmen, December 13, 2006”. The Report contained three major goals that were derived from the state-approved 2004 CWMP with one goal relating to zoning. The Committee was cognizant of the fact that future availability of centralized wastewater into areas that relied on on-site wastewater treatment may have an impact on future development potential. While the availability of municipal wastewater versus on-site wastewater could impact future development potential, it is the Town zoning that should drive how an area is built out. With this fact in mind, the Committee made specific zoning recommendations to the Board of Selectmen.

The 2006 Report outlined three major goals for the Board’s consideration, with Goal No. 2 directed to zoning:

“Goal 2: Formulate recommendations on how best the Board of Selectmen may comment upon or sponsor specific zoning articles which would increase or decrease potential flow or density with the Sewer Districts or Needs Areas”.

The Board of Selectmen were receptive to this recommendation and through the efforts of the Board and the Town Planner, developed revised zoning that was widely accepted and adopted in the areas of the Sewer Districts and Tributary Areas. This proactive approach in 2006 has led to vast improvements in this CWMP Update with reduced flows and loads overall.

We worked with the Nantucket Planning and Land Use Services (PLUS), including the GIS Department, in attaining the new, revised zoning data. The new zoning data was overlaid onto parcel data for each of the Study and Needs Areas in order to establish a basis for developing current and future wastewater flows and loads. The results were compared to results from the 2004 CWMP in applicable areas and the result was in fact a reduction in flow estimates.

In addition, the revised zoning was evaluated in order to estimate the number of future second dwellings that needed to be accounted for in the overall flows and loads estimates. Because the Town had solid zoning data, the second dwelling estimate was more finitely defined in this CWMP Update versus the 2004 CWMP. In the 2004 CWMP, second dwellings were estimated using a flat calculation-it was estimated that 2/3rds of all properties would have second dwellings. In this CWMP Update, the zoning was overlain onto GIS and utilizing set formulas for each parcel, first to determine if the existing parcel met current zoning, and then reviewing the data to see if zoning and land area met requirements for second dwelling. Once this data was confirmed, a formula was applied based on discussions with the Nantucket PLUS. According to PLUS, historically, 12 percent of properties have constructed second dwellings. We applied a little more conservatism with this and applied a 25 percent formula-that based on future build-out conditions where a parcel met zoning and land area requirements, 25 percent of these properties would construct second dwellings. Appendix B includes a copy of the Zoning Bylaw and a list of the removals and additions to the number of potential dwelling units by area (updated through the changes approved at 2012 Annual Town Meeting and through the Fiscal year 2011 Land Bank acquisitions).

2.3 BOARD OF HEALTH FILE REVIEW

Woodard & Curran (W&C) conducted a review of Board of Health records and files to supplement the 2004 CWMP/FEIR with data for on-site wastewater disposal systems operations and management between 2004 and

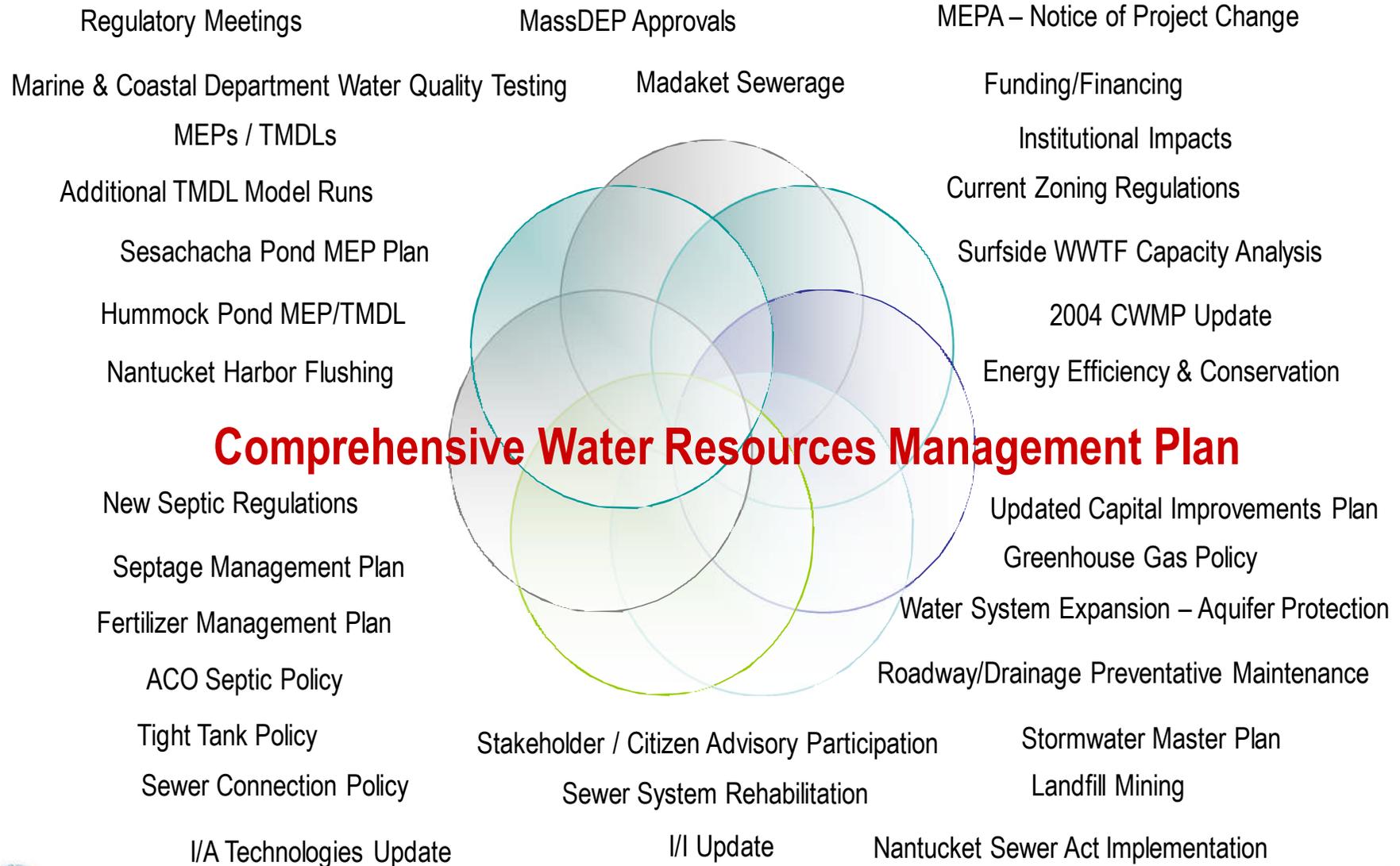
2012 to continue to support the Needs Areas from the 2004 Report, as well as to evaluate areas outside of the 2004 study that appear to be experiencing on-site issues and potentially needing alternative wastewater disposal solutions. Since 2007, the Town has undertaken an inspection program for all parcels with on-site wastewater disposal systems in the defined Watershed Protection Districts based on Local Regulations under the jurisdiction of the Board of Health. W&C staff reviewed these records, as well as other Board of Health files, for information on the timing of inspections, results of inspections, system pumping data, and other pertinent data contained on file. The Board of Health file review focused on a review of the 2004 Needs and Study Areas, as well as two new Study Areas; Hummock Pond North and Hummock Pond South (in 2004 referred to as the Cisco Study Area). The need for review and evaluation of the Hummock Pond Study Areas came about due to the history of annual water quality testing results that were showing this area to be nutrient degraded. The Town adopted the Hummock Pond Watershed Area, under Local Regulation 55.00, with a mandate for Title 5 inspections to determine the extent that on-site wastewater disposal systems are contributing to the nutrient enrichment of the water resources in this area. In addition, a number of residents in these geographic areas have been very vocal about the need for review of the on-site systems operations and a potential need for an alternative wastewater option.

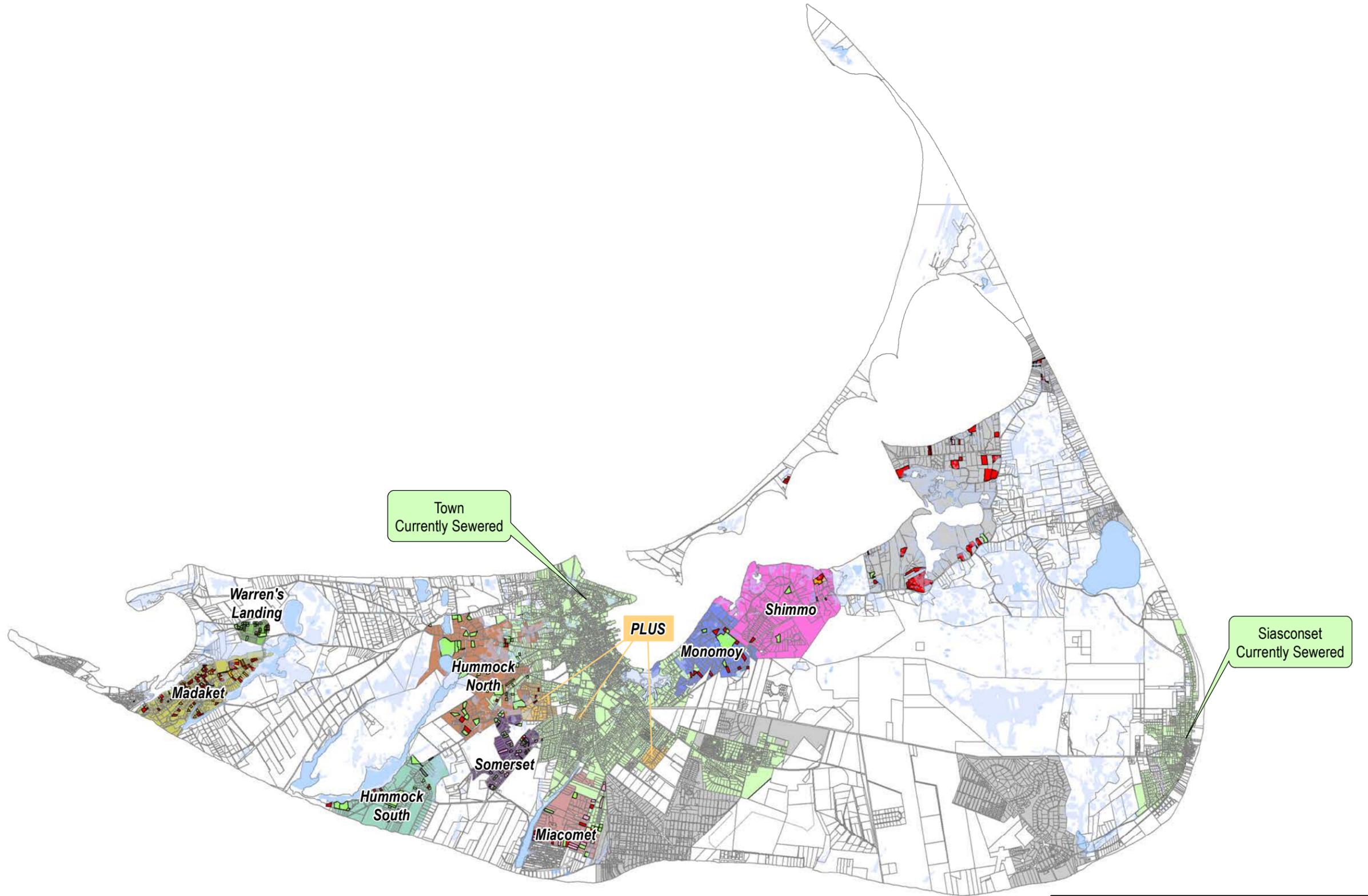
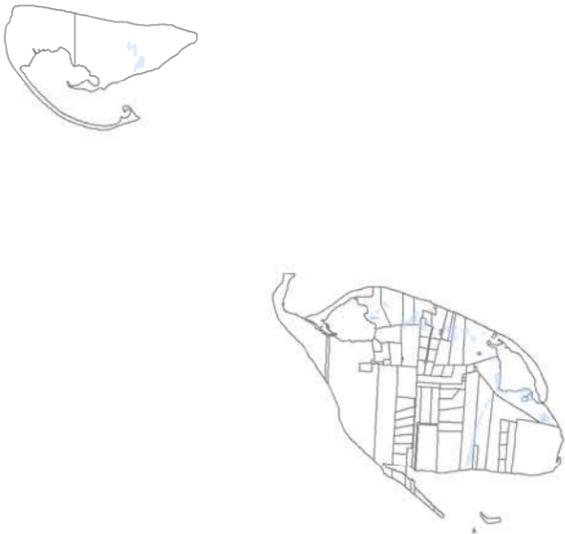
The file review looked at the entire Island, specifically areas where Title 5 Inspections have yielded failures in order to see if any specific area stood out as having dense issues. There were no such areas that stood out, so a general review Island-wide was completed. This exercise, while able to pinpoint areas of interest, is only as good as the data on file. There is a certain amount of “gray area” with this review as not all issues with on-site systems are reported and/or documented. There are additional means of support for this evaluation including a thorough review of the Town’s Annual Water Quality Testing results, finalized MEP Reports, soils and groundwater data through MassGIS and the United States Soils Conservation Service, and the results of the cumulative criteria analysis is included in the matrix. Additionally, we spent a considerable amount of time reaching out to others on Island that have a keen perspective into this issue and took much of what we gathered into consideration in the overall analysis.

Table 2-1 and Figure 2-2 present a summary of the results of the file review. Appendix B includes a list of the files reviewed by parcel map-block-lot, including dates of inspection where known, results of inspection and other comments and notes.

Figure 2-1
Integrated Plan Components

Components Of Integrated Plan





Legend

- Pond
- Wetland
- Board of Health Septic Records Result**
- Condition Pass/Fail
- Certificate of Compliance
- Fail
- I/A System
- New system
- Pass

COMPREHENSIVE WASTEWATER
 MANAGEMENT PLAN UPDATE
 TOWN OF NANTUCKET, MA
**UPDATE TO BOARD OF
 HEALTH DATA**
FIGURE 2-2



SCALE: 1" = 1.25 MILES	DOC: BOHUpdate.MXD
DATE: FEB. 2014	JOB NO.: 225139
DRAWN BY: JSM/RTB	SOURCE: MassGIS & Town

Table 2-1: Board of Health File Review Results

Area	Total Number of Records Reviewed	Pass	Fail	Conditional Pass/Fail	I/A System	New System	Certificate of Compliance	No Issue	No Record
Hummock Pond North Study Area	243	31	5				1	89	117
Hummock Pond South Study Area	94	15	5		3			55	16
Miacomet Need Area	78	14	4			3	12	3	42
Pocomo Need Area	15		13				2		
Somerset Need Area	122	15	2				20	14	71
Shimmo Need Area	8	3	3	2					
Warrens Landing Need Area	49	37	5	2				5	
Madaket Need Area	90		65	25					
Monomoy Need Area	15	4	11						
Polpis Need Area	16	2	14						
Wauwinet Need Area	4		4						

2.4 MASSACHUSETTS ESTUARIES PROGRAM (MEP)

As was mentioned in the previous chapter, the MEP was initiated in July 2002 with an original list of 89 embayment areas (eventually 19 embayments would be dropped from the study due to budget constraints). Nantucket was included in the list with five embayments; Nantucket Harbor (included Polpis Harbor), Sesachacha Pond, Madaket Harbor, Long Pond and Hummock Pond (which was one of the 19 dropped from review). The MEP started after the Town embarked on the CWMP Special Review Procedure, with the CWMP in full swing far ahead of any MEP results. As it stands, the CWMP was completed and approved in 2004, with the first of the MEP Reports, Nantucket Harbor (including Polpis Harbor), completed in November 2006. The 2004 CWMP Final Recommended Plan was completed utilizing a myriad of criteria, both physical and environmental, but was limited as to applying any of the nitrogen criteria driving the MEP. Several meetings with regulatory officials were held in 2002 during the 2004 CWMP process to determine if and how Nantucket was to proceed with the CWMP. The big question was, should Nantucket stop the CWMP process and wait until the MEP was completed. Based on the fact that the MEP was very early in process and would take an estimated two-year period to complete, it was decided that the CWMP should continue and the Town would prepare an update to include the final MEP results when finished. In hindsight, this was a very smart decision for a number of reasons. One, the Town was under an ACO for its Surfside WWTF, which was addressed and completed on time (2005) and second, the CWMP was completed over two years ahead of the first MEP in Nantucket Harbor, with Sesachacha Pond finalized November 2006 and Madaket Harbor and Long Pond not completed until November 2010. Hummock Pond, which was due to be studied on the last round of MEP, was dropped from the list due to state budget constraints. Nantucket, being a proactive community, was in discussions on updating the 2004 CWMP because not only were MEPs completed, but subsequent Total Maximum Daily Loads (TMDLs) had been issued to the Town mandating solutions to meet new water quality standards. During scope discussions, it was decided that if the Town was going to update the 2004 CWMP, it wanted to be comprehensive and include addressing ALL embayment areas and not have to repeat the process if sometime in the future, Hummock Pond was added back to the study. The Town progressed with plans to fund the study independent of the state MassDEP portion so the CWMP Update would be comprehensive in its approach to its 20-year planning. With funding in hand, a contract was signed between the Town and the University of Massachusetts Dartmouth, School of

Marine Science and Technology (SMAST) and the Hummock Pond Study was initiated in summer 2012. Copies of all MEP Reports Summaries and TMDLS are included in Appendix C. Full Reports can be accessed on the Town's website at <http://www.nantucket-ma.gov/132/Water-Quality-Initiative>.

The Town now has four completed MEP reports encompassing six geographical embayments:

Nantucket Harbor	Polpis Harbor
Madaket Harbor	Long Pond
Sesachacha Pond	Hummock Pond

These Studies are part of the overall coastal embayments throughout Massachusetts and are nutrient driven-namely studying the impacts of embayment areas due to nitrogen loading from various sources. The nutrient enrichment is basically due to land use changes-increasing building, population densities and human interactions with the land. Rising nutrient levels are causing a decline in the ecological health of the estuarine systems leading to loss of eelgrass beds, fisheries habitat and impacting the benthic communities. As nutrient levels continue to increase, the overall water resources in the area start to show the degradation aesthetically with visual impacts including dense algae blooms, which will begin to inhibit recreational resources in the watersheds.

Nutrient degradation is generally contributed through multiple channels including:

- Atmospheric deposition – what is deposited through the atmosphere, i.e. pollution from power plants
- Wastewater – from on-site wastewater disposal systems leaching into groundwater
- Fertilizer – from over fertilizing of lawns, golf courses, cranberry bogs, etc.
- Stormwater – surface water runoff from roadways, roofs, impervious areas
- Water Body Surface Areas – direct precipitation to surface water resources

The major focus of the MEP Projects was to develop site-specific nitrogen load thresholds-how much degradation can the watershed take and continue to maintain water quality standards (Total Maximum Daily Load-TMDL). Then utilizing the site specific data, develop a plan to mitigate the nutrient loading in excess of the TMDL. The following sections detail each individual MEP Report with identification of the MEP study locale, detail the sub-watersheds, identify the site-specific nitrogen load contributors and finally develop a plan of action that is implementable by the Town and meets the water quality standards in the watersheds. The MEP Reports evaluated the surface and groundwater flows in each watershed and sub-watershed as they are the pathways for transfer of these land-sourced nutrients to the coastal waters. The MEP “Linked Watershed-Embayment Model” provides a quantitative approach for determining an embayment's; 1) nitrogen sensitivity; 2) nitrogen threshold loading levels (TMDL); and 3) response to changes in loading rate.

The main focus of the MEPs is the protection, preservation and restoration of coastal embayments from nitrogen loading and its overall impact to the environment.

The completed MEP Reports can be found on the Town's website at http://www.nantucket-ma.gov/Pages/NantucketMA_NatRes/waterquality.

2.4.1 Nantucket Harbor and Polpis Harbor MEP

The Final Report titled, “Linked Watershed Embayment Model to Determine Critical Nitrogen Loading Threshold for the Nantucket Harbor, Town of Nantucket, MA” was issued in November 2006. This estuary includes Nantucket Harbor and Polpis Harbor. The system’s geographic location is on the Island’s northern shore bounded by water from Nantucket Sound. See Figure 2-3 from the MEP (Figure I-1 in MEP) that shows the locale of the study.

The Nantucket and Polpis Harbors MEP Report summarizes the study results’ as stating that Nantucket Harbor appears to have reached its nitrogen loading threshold, the level of nitrogen input that a system can tolerate without showing a decline in habitat quality. As the Harbor has not yet reached build-out conditions (all developable parcels developed and thus increased nitrogen loading), the Town needs to plan for nitrogen management now and in the future. The Nantucket Harbor system is described as a complex estuary made up of a large lagoonal estuary (Nantucket Harbor), with basins running parallel to the watershed that was formed behind a barrier beach (Coatue). The system also includes Polpis Harbor, which is separated into an east and west system that receives surface water inflow from various smaller creeks and brooks as well as wetlands.

Nantucket Harbor was divided into five sub-systems that are all different as far as the roles they play in the overall Harbor, their flushing abilities, and where their nutrient loading impacts come from. The major sub-embayment in the Nantucket Harbor system is Polpis Harbor, which is directly connected to the larger Harbor system. The physical layout of Polpis Harbor is a much more closed embayment that does not receive the flushing from Nantucket Sound that the Town Basin receives, which makes this sub-embayment more sensitive to the human impact of nutrient loading, specifically Nitrogen. The other three subsystems are Town Basin, Quaise and Head of Harbor. These are delineated in Figure 2-4 (Figure III-1 from the MEP Report).

The MEP Report completed for Nantucket Harbor identifies the Nitrogen loadings to the Harbor as wastewater, fertilizers, impervious surfaces, water body surface area and atmospheric deposition - see Figure 2-5 (Figure IV-4 from MEP). The MEP also details those contributors that can be controlled under local regulatory control as on-site wastewater disposal systems, fertilizers and impervious surfaces. Atmospheric deposition - nutrients received through the atmosphere cannot be controlled, nor can the water body surface areas themselves. In evaluating solutions to reduce the Nitrogen loading to the receiving waters, we are looking towards the locally controllable means. Refer to the Figure 2-5 for a description of the Nitrogen loadings from the MEP Report:

2.4.2 Model Run Scenarios

As part of the original MEP Report, model run scenarios were completed to determine potential Nitrogen reduction approaches in order to meet the TMDL(s) established as a result of the MEP. It is noted that there are two Sentinel Stations where reductions must be met due to Polpis Harbor being so closed off from the Nantucket Harbor system. For the 2006 Nantucket Harbor MEP, two scenarios were completed to showcase different approaches to meeting the Nitrogen reduction to maintain water quality thresholds established in the MEP. The first scenario looked at removing 100 percent of the present (no build-out) septic load from the Town Watershed, as well as removal of 80 percent of the septic, fertilizer and impervious surfaces from the remaining Basins. The second scenario looked at removing 100 percent of the septic from all Basins. While a significant reduction was observed, these two scenarios are not realistic due to the extent of sewerage that would be needed and the lack of availability of sewer capacity to service the entire watershed. The TMDL solution needs to look at realistic and implementable solutions-those measures that the Town can afford- technically, politically and economically in order to bring about a sound solution.

Figure 2-3
Nantucket Harbor Estuary

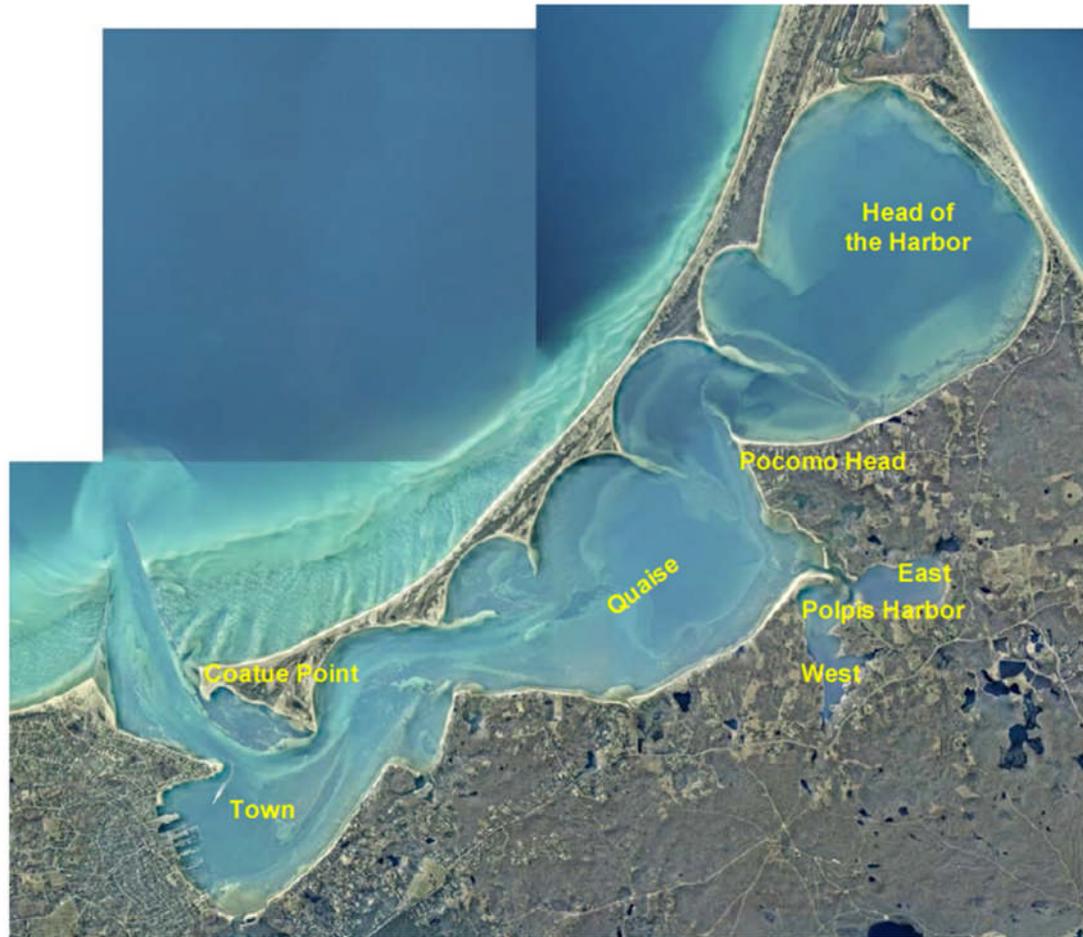


Figure I-1. Major component basins of the Nantucket Harbor Estuary assessed by the Massachusetts Estuaries Project relative to nutrient related habitat health and nitrogen management planning. The Harbor exchanges tidal waters with Nantucket Sound through a single jettied inlet. Freshwaters enter from the watershed primarily through direct groundwater discharge and a series of small, short streams draining wetlands and 1 small surface water discharge (Mill Brook to Polpis Harbor).

FIGURE 2-4
Nantucket Harbor Sub-Watersheds

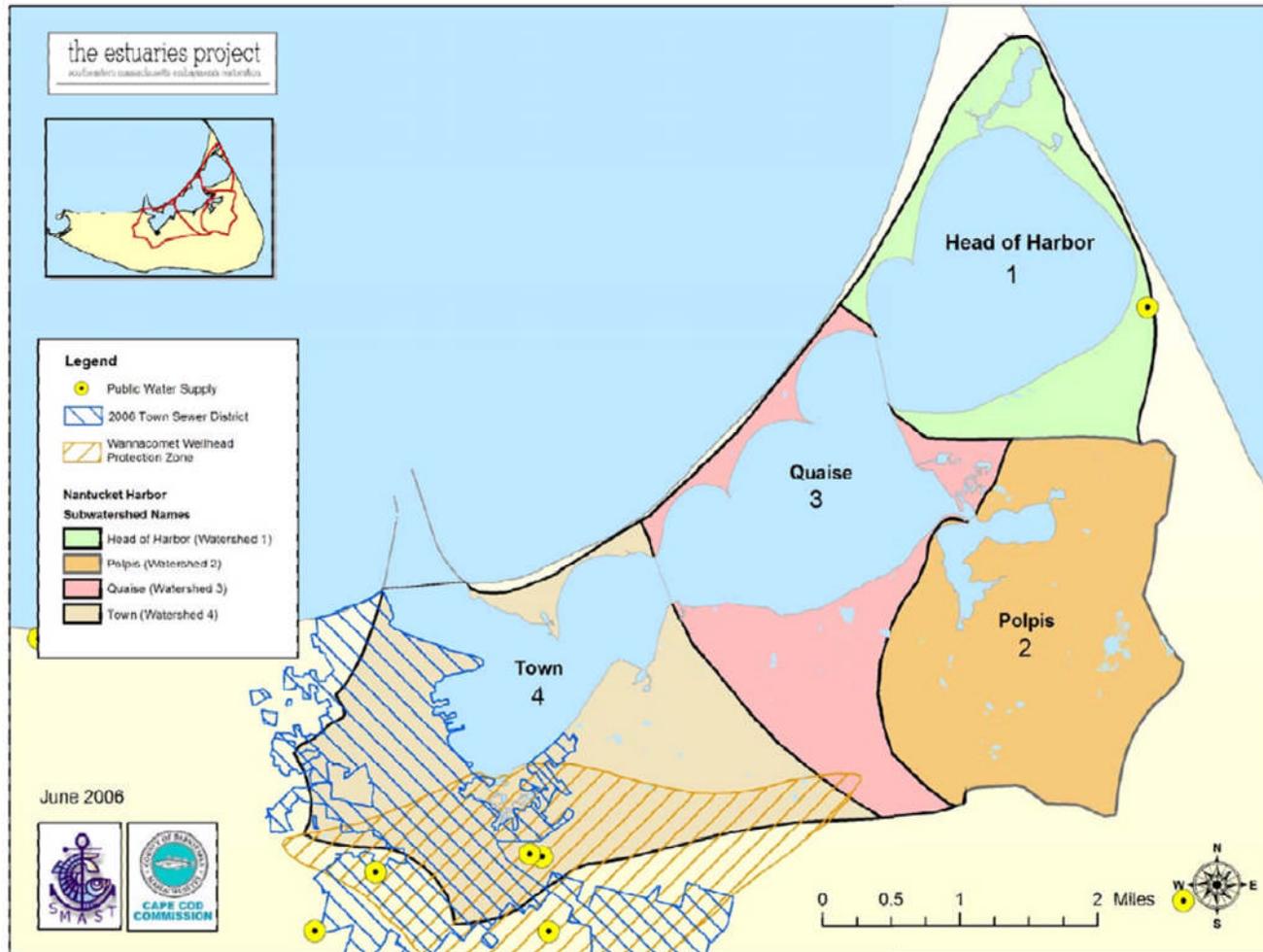
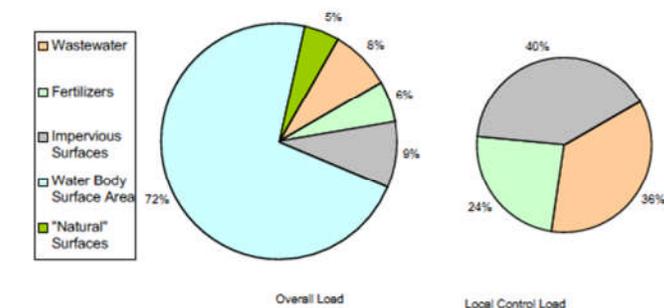
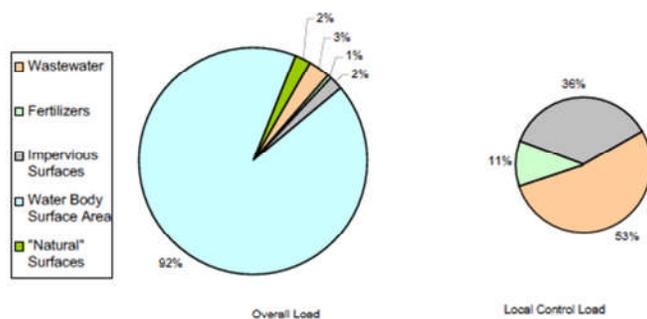


Figure III-1. Watershed and sub-watershed delineations for the Nantucket Harbor estuary system. Sub-watersheds to embayments were selected based upon the functional estuarine sub-units in the water quality model (see section VI).

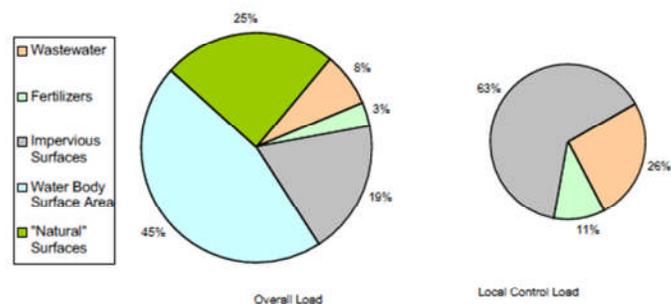
**Figure 2-5
Nantucket Harbor Land Use Specific Nitrogen Load**



a. Nantucket Harbor System Overall



b. Head of the Harbor Subwatershed



c. Polpis Subwatershed

Figure IV-4 (a-c). Land use-specific unattenuated nitrogen load (by percent) to the (a) overall Nantucket Harbor System watershed, (b) Head of the Harbor subwatershed, and (c) Polpis subwatershed. "Overall Load" is the total nitrogen input within the watershed, while the "Local Control Load" represents only those nitrogen sources that could potentially be under local regulatory control.

The Town worked with SMAST to run more appropriate (realistically attainable) scenarios to evaluate options for meeting the required Nitrogen reductions. In January 2012, the Town received the results of four model scenarios that were more likely to meet and achieve the Nitrogen reduction, as well as be implementable locally.

The four model run scenarios, developed under existing conditions, are as follows:

Scenario 1 – Sewering the Monomoy Needs Area (as shown delineated in the 2004 CWMP and included in the 2012 TM). This includes ONLY the currently developed lots and no future build-out.

Scenario 2 – Sewering the Monomoy and Shimmo Needs Areas (as shown delineated in the 2004 CWMP and included in the 2012 TM). This includes ONLY the currently developed lots and no future build-out.

Scenario 3 – Elevating the Jetties – exclusive of any land-based solutions

Scenario 4 – Sewering Monomoy/Shimmo AND raising the jetties in the Harbor - combination of sewerage the two Needs Areas as delineated in the 2004 CWMP in conjunction with raising the jetties. This includes ONLY the currently developed lots and no future build-out.

All scenarios above result in lower Nitrogen levels in the Harbor; with the Nantucket Harbor station meeting the requirements of one of the two TMDLs established by MassDEP (threshold Nitrogen levels at both sentinel stations located in Nantucket Head of Harbor and East Polpis Harbor. See Figure 2-6 for map of Sentinel Stations).

These model runs show that sewerage alone (as in the scenarios above) in the Nantucket Harbor area will not meet TMDLs established at either the Nantucket Harbor or East Polpis sentinel stations. These scenarios were evaluated under existing conditions and did not take future build out into consideration. The TMDLs require Nitrogen reductions, as in the following Table, in order to meet the maximum Nitrogen load allowed in order to maintain required water quality as per threshold established:

Table 2-2: Embayment Area, Present Watershed Nitrogen Loading Rate, Target Threshold Nitrogen Loading Rate, and Difference Necessary to Achieve the Target Threshold Load

Embayments	Present Watershed Load ¹ (kg/day)	Target Threshold Watershed Load ² (kg/day)	Difference
Head of Harbor	1.86	0.79	1.07
Quaise Basin	2.12	1.14	0.98
Town Basin	12.22	10.71	1.51
Polpis Harbor	3.52	2.18	1.34
TOTAL	19.72 kg/day	14.89 kg/day	4.9 kg/day

¹ Composed of combined fertilizer, runoff, on-site wastewater disposal system loads and atmospheric deposition to natural surfaces.

² Target threshold watershed load is the load from the watershed needed to meet the target threshold Nitrogen concentrations. See Figure below for graphic of this text. Refer to Figure on Page 3 for Sentinel Station locations.

Table 2-2 clearly shows that a reduction of 4.9 kg/day of Nitrogen in Nantucket Harbor at the two sentinel stations (Head of Harbor and East Polpis) is needed to meet the target threshold - the maximum Nitrogen loading allowed in order to maintain required water quality. Based on this 4.9 kg/day, the Town evaluated projects that can reduce the Nitrogen loading in the overall Harbor that will reach this goal.

Figure 2-6 (Figure VI-1 from MEP Report) shows the sentinel station locations (both SMAST and Town) where water quality data was collected and evaluated to attain the results previously stated. The TMDL is measured at Sentinel Stations 2A for Nantucket Harbor and 4 in Polpis Harbor.

The two scenarios detailed below showing promise in their ability to reduce the Nitrogen loading in the overall Harbor System are Scenarios 3 and 4. One is only the tidal flushing - which is not a land-based solution, but could provide a cleansing action by flushing fresh tidal water further into the Harbor thus removing nutrients as the tide flows back out to sea. The other deals with removing wastewater from the Harbor (a controllable source of Nitrogen) and adds a tidal flushing solution with the wastewater removal. These scenarios are:

Scenario 3 – Raising the jetties without any land-based solution (no sewerage in Monomoy or Shimmo) attains the threshold Nitrogen level of the May 12, 2009 established TMDL at the sentinel station at the Head of the Harbor (Sentinel Station 2A) and comes very close to attaining the Nitrogen threshold level at East Polpis (Sentinel Station 4).

Scenario 4 – Sewering existing properties in Monomoy and Shimmo AND raising the jetties meets the TMDL established in Nantucket Head of Harbor (Sentinel Station 2A), but does not meet the TMDL established in East Polpis. This solution comes very close to meeting both TMDLs, but falls just shy in meeting the TMDL established in East Polpis (Sentinel Station 4). Again, this is but one solution evaluated in this scenario and needs to be further explored.

The additional work completed by SMAST in Scenario 1, adding full build - out of all developable lots in the Monomoy Needs Area and sewerage currently existing AND build-out parcels, results in the same as sewerage existing dwellings in Monomoy and Shimmo (Scenario 2). So, it could be assumed that, if the Town continues sewerage Monomoy AND sewers future developable parcels in this Needs Area, while also raising the jetties, both Nitrogen threshold levels (Nantucket Harbor and East Polpis Harbor) are closer to being met.

In summary, these are four “scenarios” and their respective results in attempting to reduce the Nitrogen loading to Nantucket Harbor by 4.9kg/day.

In February 2014, four additional scenarios were modeled with each of these under build-out conditions. These include:

1. Update historically sewerage parcels and update all changes with Town Sewer District (new, existing parcels)
2. Update historically sewerage parcels and update all changes with Town Sewer District (new, build-out parcels)
3. Dredge entrance to Polpis Harbor and raise the jetties to ACOE specifications
4. Dredge entrance to Polpis Harbor, elevate jetties to ACOE specifications and sewer Monomoy

The results of these additional scenarios came close to, but did not meet the established TMDL thresholds in either Nantucket or Polpis Harbor. These results show Nantucket that while meeting existing conditions as is now seen with developed parcels may meet the water quality standards, the Town needs to have a plan in place to adapt to build-out conditions. While 100 percent build-out may never occur, the Town has the responsibility to monitor the water quality conditions in the identified embayment/harbor/pond areas through the Annual Water Quality Program and adapt as needed as is discussed throughout the Adaptive Management Planning process.

The result is a need for Nitrogen management in the overall system in order to restore the resources and limit future nitrogen loading in the watershed.

In May 2014, an additional three scenarios were modeled utilizing existing conditions. These include:

1. Elevate jetties to ACOE specifications, sewer Town Sewer District with updated parcel data, sewer Monomoy
2. Elevate jetties to ACOE specifications, sewer Town Sewer District with updated parcel data, sewer Monomoy, include fertilizer reductions as per Town's BMP
3. Elevate jetties to ACOE specifications, sewer Town Sewer District with updated parcel data, sewer Monomoy with new delineations as defined in CWMP Update, include fertilizer reductions as per Town's BMP

Scenarios 9 through 11 each are sufficient to meet the TMDLs established in both Nantucket and Polpis Harbors. There was no significant difference between the three scenarios, but the addition of fertilizer reduction based on the Town's BMP reduced the overall numbers by a small margin based on the computer model. It is recommended that the Town monitor these results during and after implementation in the Adaptive Management Plan in order to add/revise or delete solutions. For example, particular attention needs to be paid to any dredging at the entrance to Polpis Harbor as this model determined that this would add Nitrogen (N) rather than reduce it due to the physics of tidal flushing. Dredging will allow a larger volume of water into the Harbor, which maintains a much longer residence time as there is no mechanism to then flush water out. This results in an increase in N concentrations since the water has a longer period of time to be exposed to the addition of nitrogen inputs from the watershed and sediments.

It is recommended that the Town apply scenarios 9 through 11, with a mixed approach for the Harbor. Start with the most impactful approach first-with this being the reconstruction of the east and west jetties to the Army Corps of Engineers (ACOE) specifications. This project is in final design phase and due for implementation in early 2015 based on the most current project update (July 2014). Careful monitoring of results will be needed to measure the actual improvements realized from implementation of the jetties reconstruction and to manage the implementation of other solutions for the Adaptive management Plan. Once the Town understands the improvements realized, it can adapt and add additional implementation of solutions on an as needed basis. This approach under the Adaptive Management Plan affords the Town the ability to refine what tasks it takes on in the MEP areas as it better understands the real, versus computer modeled, results from implementation of solutions as shown in current data. As the town moves further into the Adaptive Management process, it will better understand the details of each of the varied MEP areas on Island and what solutions appear to be making the most progress in real world results. Additional items to follow are the cranberry bogs in the Watershed and Pest House Pond. The bogs utilize N to fertilize and Pest house Pond has a direct discharge to Nantucket Harbor. We recommend some water sampling in Mill Brook to determine if any impact to Polpis Harbor is seen from the bogs. Pest House Pond has an open pipe that discharges directly to the harbor. This needs follow up. All of the Technical Memorandums detailing the model run scenarios are included in Appendix C.

2.4.3 CWMP Update Adaptive Management Plan to Meet Nantucket Harbor/Polpis Harbor TMDL

The Town will continue with its mandate to sewer all areas located within the Town Sewer District where infrastructure exists under Local Regulation 69.00. The reconstruction of the east and west jetties in Nantucket Harbor are currently under design with the ACOE and as of last update in July 2014, due to be bid in late fall 2014 with construction starting early 2015. The Town has begun enforcement of its Fertilizer Regulations, which will be an on-going effort Island-wide, with particular attention paid to the Harbor Watershed areas. As the above approaches are implemented, data will support the need for additional work, which includes extending the municipal sewer to the Monomoy Needs Area. Future considerations include extending sewer to Shimmo Needs Area, implementing a Local Regulation for Innovative/Alternative (I/A) systems within the Study Areas delineated within MEP Areas and potential future stormwater BMPs based on the Town completing a Stormwater Master Plan. The Town will continue to monitor water quality in Nantucket and Polpis Harbor through its Annual Water Quality Testing Program. The historical MEP Sentinel Stations will be sampled on a regular basis in order to monitor results as the Town moves forward with its plan to meet the TMDLs established in this location.

Figure 2-6
Location of Sentinel Stations in Nantucket Harbor MEP

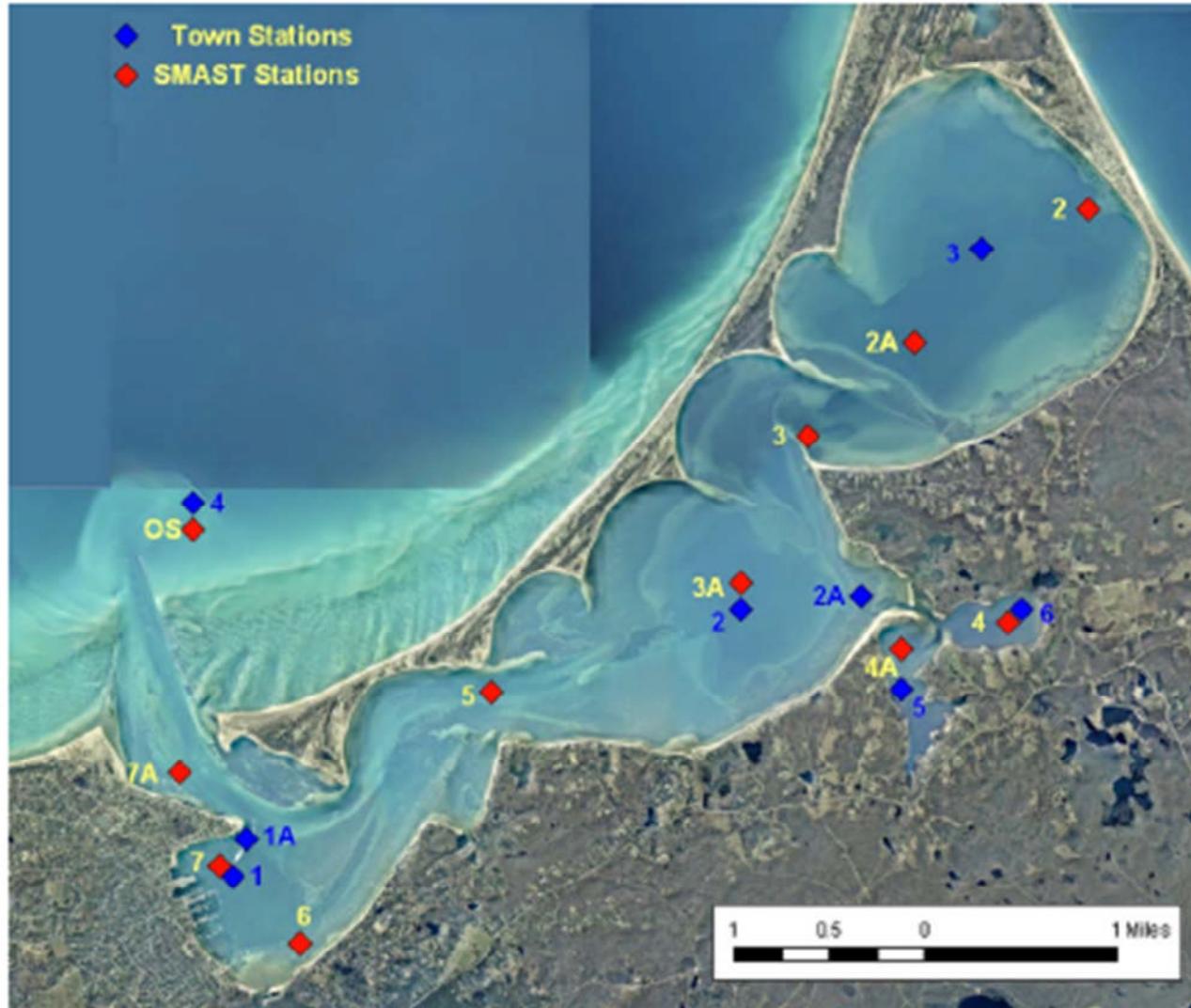


Figure VI-1. Estuarine water quality monitoring station locations in the Nantucket Harbor estuary system. Station labels correspond to those provided in Table VI-1.

2.4.3.1 Sesachacha Pond MEP

The Final Report titled, “Linked Watershed Embayment Model to Determine Critical Nitrogen Loading Threshold for Sesachacha Pond, Town of Nantucket, MA” was issued in November 2006. This estuary includes Nantucket Harbor and Polpis Harbor. The system’s geographic location is on the Island’s eastern shore bounded directly abutting the Atlantic Ocean to its east. See Figure 2-7 from the MEP (Figure I-1 in MEP) that shows the locale of the study.

The MEP states, “The Sesachacha Pond Embayment is a simple estuary located within the Town of Nantucket on the Island of Nantucket, Massachusetts. Sesachacha Pond is stabilized as an estuarine system by periodic management breaching of the barrier beach, which separates the salt pond from the marine waters of the Atlantic Ocean. The Pond is breached 2-3 times per year to lower its nitrogen levels and raise its salinity through the exchange of brackish pond waters with the high quality offshore waters. Pond openings are also to allow the entry of marine larvae and potentially herring. Studies of Sesachacha Pond in the late 1980’s indicated that periodic tidal exchange was required to help stabilize the ecology. Data indicated that not breaching the Pond regularly for management would result in long term cycling of pond waters between saline and near freshwater (water with less than 3 parts per thousand of salt is considered freshwater) due to the freshening by groundwater inflow and periodic storm inflows of salt water (Howes and Goehringer 1989). This salinity cycling would result in highly unstable conditions and impairment of habitat quality. The natural breaching of the barrier beach was subsequently observed during Hurricane Bob in 1991. Sesachacha Pond has been breached for management purposes for more than a century, with greater and lesser success. However, it is clear that the health of this estuary’s habitats is dependent on the amount and timing of periodic tidal exchanges.”

Sesachacha Pond is approximately 6.0 miles northeast of the Nantucket Town center and its watershed abuts the watershed to Nantucket Harbor. Sesachacha Pond is situated on the eastern coast of Nantucket Island between Squam Head and Sankaty Head. The watershed to Sesachacha Pond is fully within the Town of Nantucket. All watershed freshwater and nutrients enter Sesachacha Pond via groundwater seepage, as there are no significant surface inflows to this system. As a result, there is little opportunity for nitrogen removal during transport from watershed source to estuarine waters. The Pond is comprised of a single basin and a narrow barrier beach. Sesachacha Pond meets Massachusetts Statute as a Great Pond. Refer to Figure 2-8 (Figure III-1 from MEP) for a map of the watershed.

The MEP Report determined the nitrogen loading contributors are groundwater, which transports wastewater from septic systems, fertilizer, impervious surfaces, direct atmospheric deposition to water surfaces, and recharge within natural areas. Based on the land use, the major nitrogen contributors that are locally controllable are impervious surfaces (stormwater), wastewater and fertilizer as detailed in Figure 2-9 (Figure IV-4 from the MEP). However for this water body the nitrogen load from wastewater and fertilizer are deemed relatively low due to the low-density development in this Watershed. Figure 2-10 (Figure VI-1 from the MEP) details the sampling locations in the Pond.

2.4.4 Model Run Scenario

The modeling completed in the MEP determined that the best management practice for meeting the threshold water quality for the Pond is through breaches to the ocean to afford tidal flushing that maintains water quality as well as appropriate salinity levels. One of the major goals of the Sesachacha Pond MEP evaluation was to determine the best protocol for Pond openings so that they would support the highest quality habitat within the embayment. The Town has included Sesachacha in its bi-annual breaching program, along with Hummock Pond on the southern shore, which has led to maintenance of the water quality thresholds established in the MEP. The Town completed its third year (2013 Annual Water Quality Testing) with preliminary data showing the openings continue to reach the water quality thresholds with the ultimate goal of submitting the last three years water quality reports to the state to remove the Pond from the state’s list of impaired waters. Sesachacha Pond is one of the state’s first success stories within the overall MEP Project.

CWMP UPDATE FINAL ADAPTIVE MANAGEMENT PLAN TO MEET SESACHACHA POND THRESHOLD ESTABLISHED IN MEP (NO Formal TMDL, BUT THRESHOLD LEVELS ESTABLISHED AND DOCUMENTED)

The Town will continue to breach Sesachacha Pond twice annually in April and October. Sesachacha Pond Sentinel Station will be included in the Town's Annual Water Quality Testing program to continue to monitor results. The Town's 2013 Annual Water Quality Monitoring Program will support previous results in order to petition the state to remove Sesachacha Pond from the State's List of Impaired Waters.. At the time of this Report, the Sesachacha Pond Report had not been received from SMAST.

Figure 2-7
Map of Sesechacha Pond MEP



Figure I-2. Study region for the Massachusetts Estuaries Project analysis of the Sesachacha Pond System. Tidal waters enter the Pond from the Atlantic Ocean during periodic openings of the barrier beach. Freshwaters enter from the watershed primarily through direct groundwater discharge and direct precipitation.

Figure 2-8
Sesachacha Pond MEP Watershed

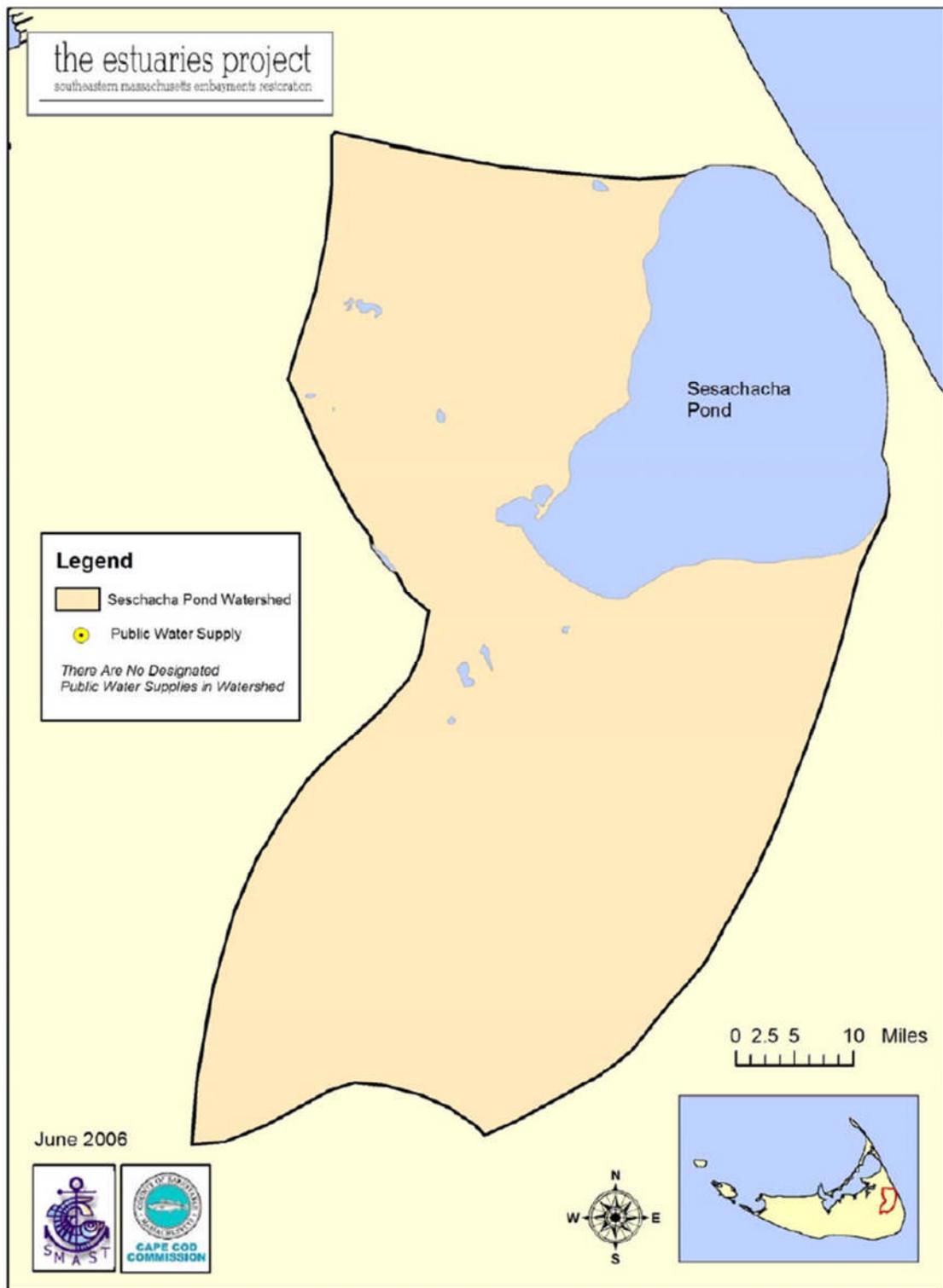


Figure III-1. Watershed delineations for the Sesachacha estuary system..

Figure 2-9
Sesechacha Pond Nitrogen Load

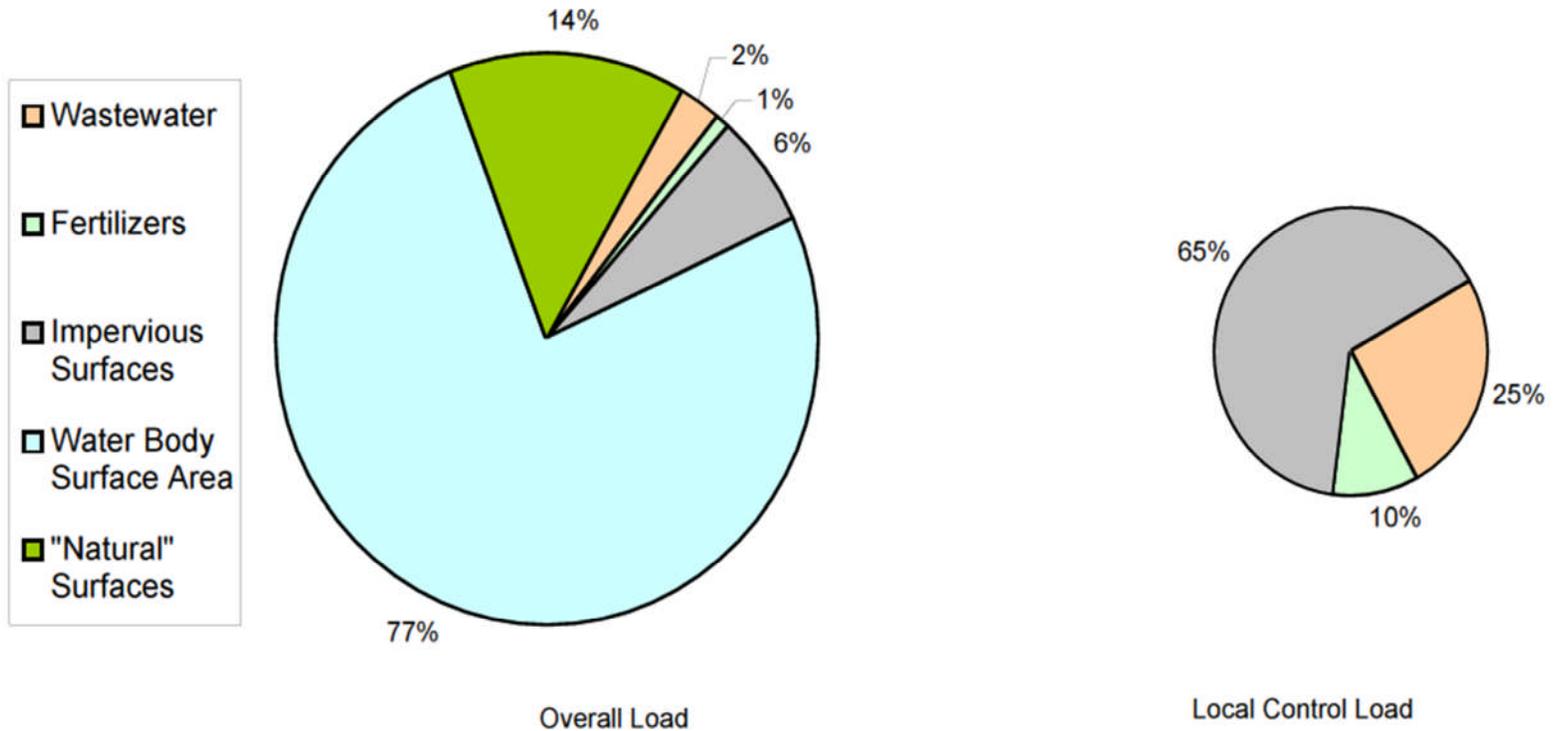


Figure IV-4. Land use-specific unattenuated nitrogen load (by percent) to the Sesachacha Pond System watershed. "Overall Load" is the total nitrogen input within the watershed, while the "Local Control Load" represents only those nitrogen sources that could potentially be under local regulatory control.

Figure 2-10
Location of Sentinel Stations in
Nantucket Harbor MEP

MASSACHUSETTS ESTUARIES PROJECT

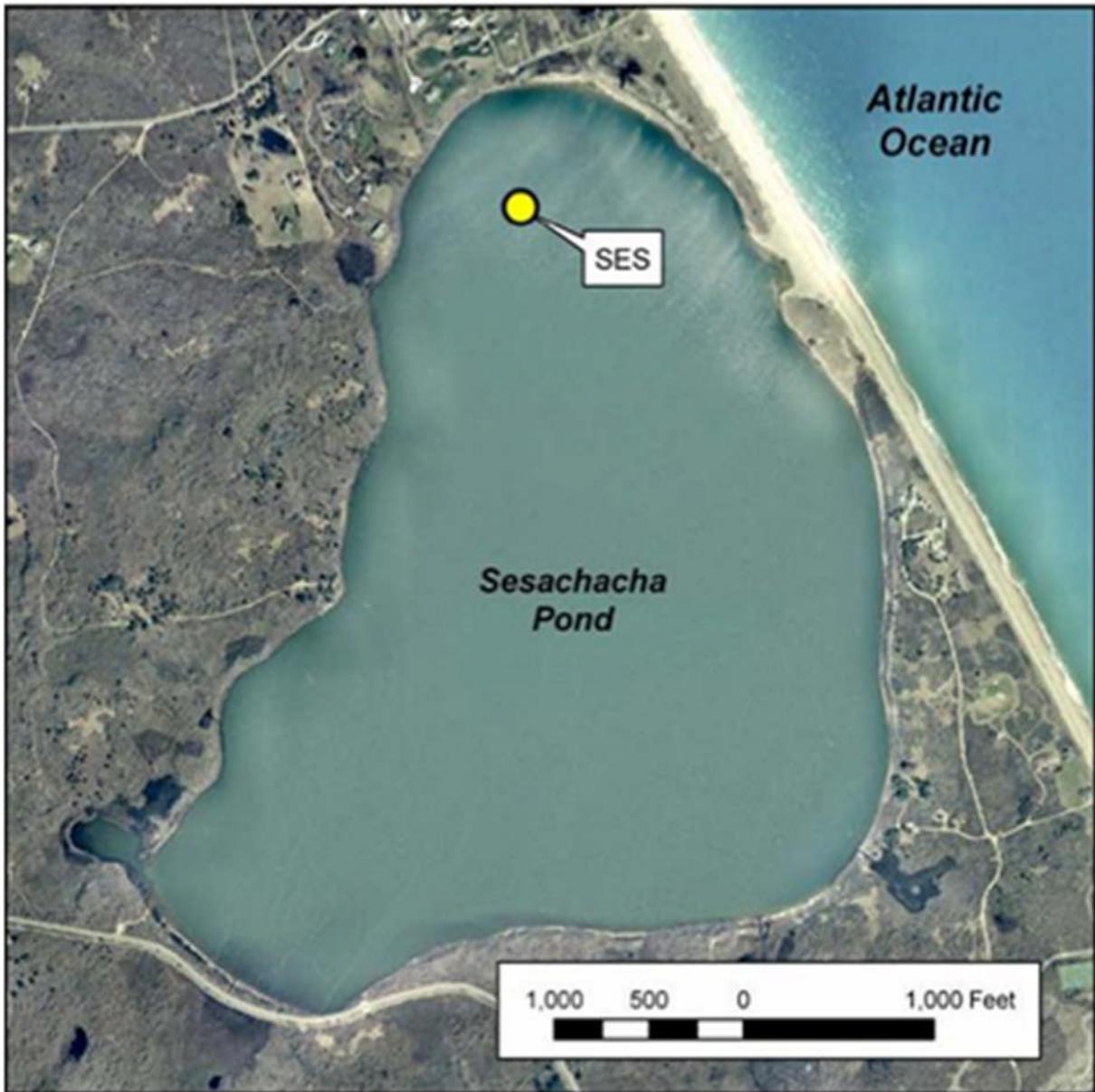


Figure VI-1. 2005 aerial photo showing monitoring station location in Sesachacha Pond that was used in the water quality analysis.

2.4.4.1 Madaket Harbor and Long Pond MEP

The Report titled, “Linked Watershed Embayment Model to Determine Critical Nitrogen Loading Threshold for the Madaket Harbor and Long Pond Estuarine System, Town of Nantucket, MA” was issued in June 2010. This estuary includes Madaket Harbor, Hither Creek and Long Pond. The system’s geographic location is on the far western edge of the Island with Madaket Harbor generally open to Nantucket Sound and the Atlantic Ocean restricted in some areas by a complex group of land shoals. Hither Creek is connected in land to Madaket Harbor on the east and Long Pond through Madaket Ditch to the west. See Figure 2-11 (Figure I-2 from the MEP) that shows the locale of the study.

The Madaket Harbor and Long Pond MEP Report summarizes the study results’ as stating that Madaket Harbor area itself appears to be below the nitrogen threshold and therefore supporting healthy aquatic habitat. This is an area wide open to Nantucket Sound and the Atlantic Ocean, which affords a large tidal flushing of the area thus maintaining healthy water quality in the water. In contrast to Madaket Harbor, Long Pond and Hither Creek are well beyond their respective abilities to assimilate additional nutrient loading without impacting ecological health. Nitrogen levels are elevated in these areas with eelgrass beds totally lost from Hither Creek. The result is a need for nitrogen management in the overall system in order to restore the resources and limit future nitrogen loading in the watershed. See Figure 2-12 (Figure III-1 from MEP) that breaks the system down into the sub-watersheds.

On Figure 2-13 (Figure IV-6 from MEP), the MEP report details the land-use specific nitrogen load to the overall Madaket Harbor System Watershed, with wastewater being the major locally-controllable source. The major Nitrogen loads are attributed to the landfill and on-site wastewater systems. The MEP evaluated a model scenario of removing all wastewater from the Hither Creek watershed, which met the threshold established. The landfill is included as an overall contributor at 10 percent and as a locally controllable contributor at 21 percent. The MEP report suggests that the current mining of the landfill results in a reduction of nitrogen loading in this area. The landfill is a “piece” of the locally controllable portion of nitrogen loading and is a part of the overall solution to meeting the draft TMDL that MassDEP issued in August 2011. Figure 2-14 (Figure VI-1 from MEP) details the sampling locations in this Estuary System.

With the current mining operation of the landfill, material in the existing unlined cell is removed, sorted, portions passed through a digester and/or recycled. Some materials that cannot be recycled are then shipped off Island and what cannot be recycled or reused are then placed in lined cells, which are then capped preventing contamination to the groundwater. This process reduces the potential for nitrogen loading to the groundwater that ultimately flows into the watershed via Long Pond, Madaket Ditch, Hither Creek and ultimately Madaket Harbor. As this process continues, nitrogen loading is further reduced to the overall watershed. The Town’s 2012 Annual Water Quality testing shows preliminary results that this mining is reducing the Nitrogen load to Long Pond and together with the removal of on-site wastewater is the solution to meet the TMDL in this embayment area. See Section 2.8 for more detailed information on the landfill mining.

CWMP UPDATE FINAL ADAPTIVE MANAGEMENT PLAN TO MEET MADAKET HARBOR / LONG POND THRESHOLD ESTABLISHED IN MEP (Draft TMDL issued)

The Town will continue to mine the landfill and monitor water quality testing done in this location for further reductions of N. Madaket and Warren’s Landing Needs Areas are proposed for municipal sewerage at the Surfside WWTF thus removing 100 percent of the land use wastewater contributing to the degradation, which based on the MEP , will serve to meet the Draft TMDL issued for this area.

The Draft TMDL issued by the Massachusetts Department of Environmental Protection is detailed in the following Section 2.5 along with the final nutrient management plan for this geographical area. A copy of the TMDL can be accessed in Appendix C.



Figure I-2. Major component basins of the Madaket Harbor Estuary system as assessed by the Massachusetts Estuaries Project. Freshwaters enter from the watershed primarily through direct groundwater discharge to Long Pond and Hither Creek as well as to the Harbor proper. Surfacewater from Long Pond also flow to Madaket Harbor via Madaket Ditch and Hither Creek.

FIGURE 2-12

Map of Madaket Harbor and Long Pond MEP Sub-Watersheds

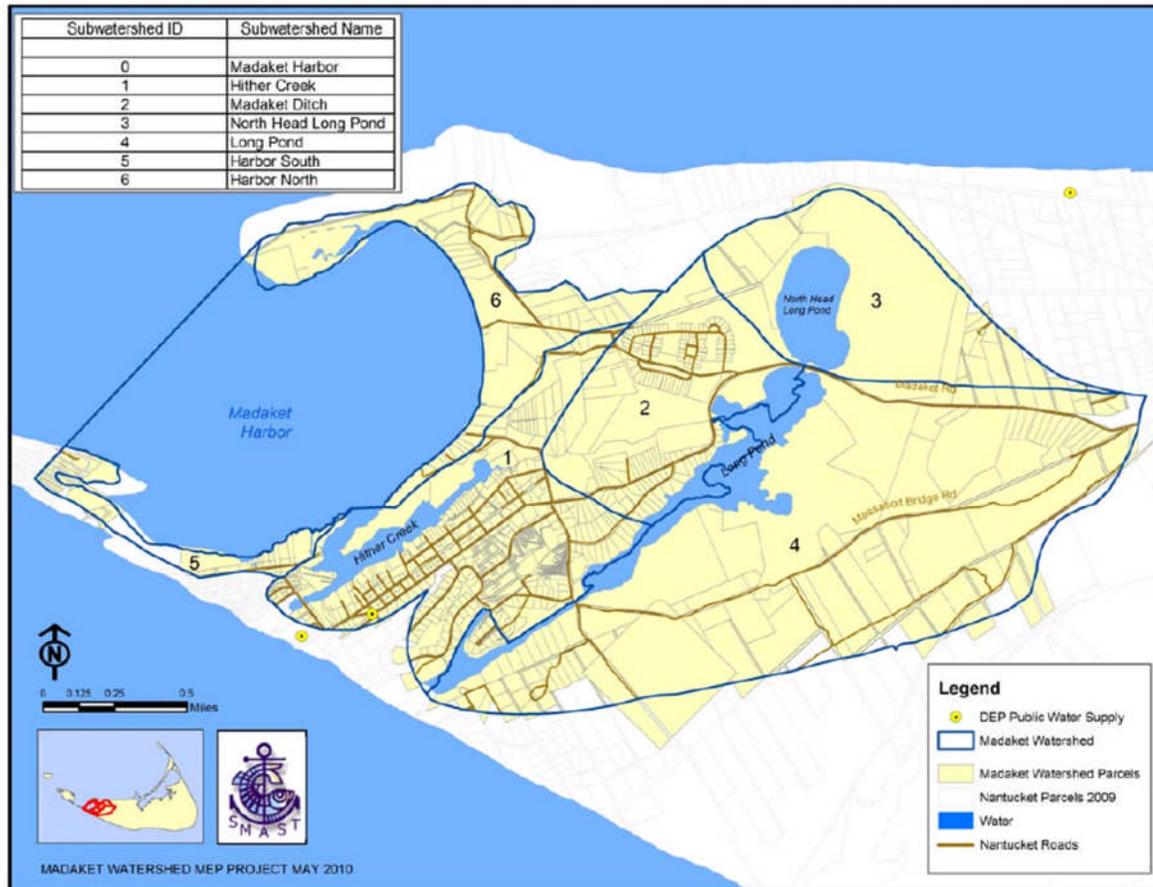


Figure III-1. Watershed and sub-watershed delineations for the Madaket Harbor estuary system. Sub-watersheds were delineated based on functional estuarine sub-units in the water quality model (see section VI), flow gaging locations, wetland delineations, and best professional judgment. Outer watershed boundary is based on HWH (1990) and Town of Nantucket Watershed Protection District.

FIGURE 2-13
Madaket Harbor and Long Pond MEP Nitrogen Load

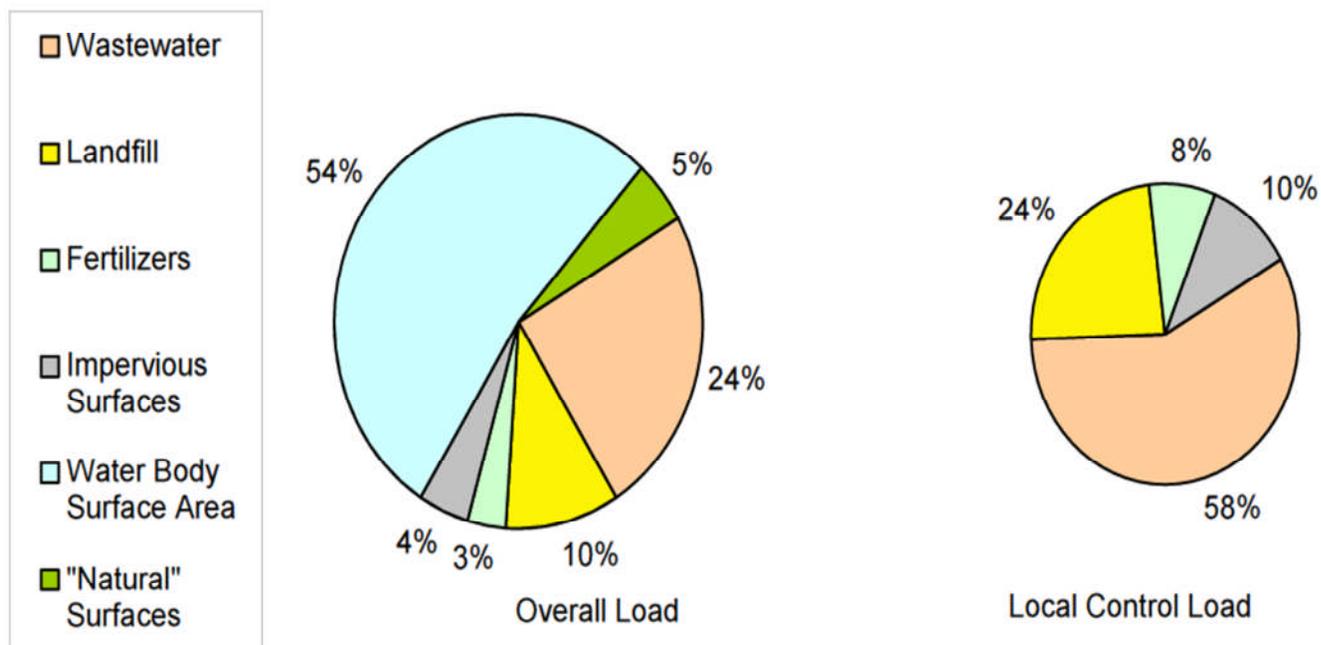


Figure IV-6. Land use-specific unattenuated nitrogen load (by percent) to the overall Madaket Harbor System watershed. "Overall Load" is the total nitrogen input within the watershed including atmospheric deposition to the estuary and nitrogen from natural surfaces (forests, grassland, etc), while the "Local Control Load" represents those nitrogen sources that could potentially be under local regulatory control.

Figure 2-14
Location of Sentinel Stations in Madaket Harbor



Figure VI-1. Estuarine water quality monitoring station locations in the Madaket Harbor System. Station labels correspond to those provided in Table VI-1.

2.4.4.2 Hummock Pond MEP

The Draft Report titled, “Linked Watershed Embayment Model to Determine Critical Nitrogen Loading Threshold for the Hummock Pond Estuarine System, Town of Nantucket, MA” was issued in January 2014. This study includes the main body of Hummock Pond, as well as the Head of Hummock Pond. The system’s geographic location is on the southern shore abutting Nantucket Sound and the Atlantic Ocean. As the MEP Report states, the Hummock Pond Embayment system is a simple coastal pond estuary with a single temporary inlet, a main estuarine basin in the lower part of the system and a narrow upper section that connects to a small basin that is known as Head of Hummock. See Figure 2-15 from the MEP (Figure I-2 in MEP) that shows the locale of the study.

The Hummock Pond MEP Report summarizes the study results’ as stating that Hummock Pond is presently supporting a gradient in impairment from significantly impaired in the upper basin to moderately impaired in the lowest portion adjacent to the barrier beach. The area that is showing severe impairment is the basin of Head of Hummock. Head of Hummock contains less salinity than the main portions of the Pond due to its location in the upper most region and functions more as a kettle pond as it does not receive any mixing from tidal currents. The Head of Hummock is not supporting any significant habitat. The Report delineated the current Watershed, which was revised a bit since the 1990 Horsley Whitten Study delineated the Town’s watersheds due to the fact that Clark’s Cove is no longer attached to the Hummock Pond watershed. Refer to Figure 2-16 (Figure III-1 from MEP). The MEP utilized the Town of Nantucket’s Island-wide water Quality Monitoring Program sampling stations to conduct this study so new results of testing correspond to historic records. See Figure 2-17 (Figure II-1b from MEP) for a location of the stations. The ensuing result is a need for nitrogen management in the overall system in order to restore the resources and limit future nitrogen loading in the watershed. Based on the nature of the Pond with almost a separate upper Head of Hummock and the main basin, the nitrogen management recommended is individual in nature to support each section.

The MEP report identifies the land-use specific nitrogen load to the overall Hummock Pond Watershed, with wastewater being the major locally controllable source at 81 percent contribution. See Figure 2-18 (Figure IV-3 from MEP). The major locally controllable nitrogen load is attributed to the on-site wastewater systems. There are a number of smaller contributors such as impervious surfaces at 7 percent, farm animals at 6 percent and fertilizer at 4 percent. While these rates are small, they are “pieces” of the puzzle that the Town can address in the proposed Adaptive Management Plan to help with the overall solution. For example, although fertilizer is contributing only 4 percent, the Town has a fertilizer regulation in place and when it is fully implemented, will help towards reducing any current and surely future potential for degradation to continue from this source. The same holds true for stormwater. This CWMP Update recommends that the Town complete a Stormwater Master Plan to address runoff issues, as well as a host of other issues in the overall wastewater system.

The MEP evaluated a model scenario of removing all wastewater from the watershed, which did not meet the threshold established based on results from Station 3 testing. The following are the MEP report recommendations for the entire Hummock Pond watershed:

2.4.4.2.1 Head of Hummock

With Head of Hummock evaluated as a separate unit, the Adaptive Management Plan is to isolate this portion of the Pond from the main Pond thus allowing it to return to a freshwater kettle pond. Historically, this was a separate freshwater body that was artificially connected to the main Pond. By cutting it off from the main Pond, there will be a reduction of nitrogen to the main Pond from this severely impaired water body by 50 percent. As groundwater will continue to flow hydrogeologically through the system, some nitrogen will continue to be fed to the main Pond, but the solution below for the main Pond will help alleviate the potential impact. Once returned to freshwater, the Head of Hummock will become phosphorous limited and more responsive to removals of said nutrient as means of controlling the observed eutrophication in that receiving water body. There are specific biogeochemical methods that have been successfully implemented in phosphorous limited impaired ponds (alum, iron, aeration, etc.) and these methods can

be used to “treat” the water within the Head of Hummock. Converting the Head of Hummock into a strictly freshwater pond enhances its function as a natural attenuator of nitrogen. With the recommendation to sewer the Watershed (see below), the nitrogen load flowing into the Head of Hummock will be eliminated through natural denitrification processes and prevented from entering the top portion of the main body of Hummock Pond. The amount of load that passes to Hummock Pond is controlled by the attenuating capacity of the modified fresh water basin. Based on TN (Total Nitrogen) attenuation observed in freshwater ponds with similar depths and retention times throughout the southeastern Massachusetts region, it is estimated that Head of Hummock would be able to attenuate 50% of the TN load entering the pond from its watershed. At present, Head of Hummock as a brackish water basin transforms significant amounts of nitrogen but ultimately passes nitrogen to the down gradient main basin. Inflowing nitrogen from the watershed will thereby be limited to those loads associated to the groundwater resources feeding into the top, middle and lower portions of the main body of the Pond.

2.4.4.2.2 Main Hummock Pond

With wastewater as the largest contributor, it makes sense that this Report recommends reducing the wastewater that drains to the Pond from the watershed. The main goal of this proposed management scenario (wastewater related nitrogen load reduction) is to prevent time averaged pond-wide TN concentrations in the pond from rising above 0.50 mg/L in the main basin of the Pond at a sentinel station (monitoring station HUM-3) during the summer months, when benthic regeneration and algae production is greatest. A way to achieve these goals is to reduce the watershed loading to the pond, together with an additional mid-summer breach (export nitrogen). Watershed loading was reduced from present conditions until the time averaged TN concentration at sentinel station HUM-3 would remain below 0.50 mg/L during a complete breaching cycle, where the pond is open to tidal flushing for at least four days and subsequently closed for 60 days. An 81 percent reduction in wastewater is needed, but this alone will not lower water column nitrogen levels to meet the threshold set. In addition to sewerage the watershed, the additional breach is also recommended. Historically, the bi-annual breaches have not been engineered to afford a tidal wash into the Pond but instead just to drain the Pond. The Report details the need to model a breach that will afford a tidal wash of at least four (4) days and then subsequently closed for at least 60 days.

This Report recommends that the Town work to forecast breach weather conditions well in advance of any openings in order to meet the above needed conditions. The Town applied this science to its regularly scheduled breach in April. Tides were forecast according to the moon schedule, winds were forecast and in addition, the actual opening cut was engineered to afford an opening that would not only drain the Pond, but also afford the open ocean water to flush up into the Pond, which flushes old water out and replaces with new, fresh ocean water. The date that matched all of the above was April 16, 2014 and the plan was put in to place. The actual breach was a success in that the opening was maintained for over seven days-longer than the recommended four from the MEP report. Water sampling was done before the opening and after to compare results, especially salinity. Initial results of this testing showed that salinity levels rose throughout the Pond and Total Nitrogen was lowered. SMAST will synthesize the water level data along with salinity and nutrient data for the April 2014 opening and the October 2014 opening and pull it all together in a separate memorandum, which will come after this Report.

A Draft TMDL has not yet been issued by the Massachusetts Department of Environmental Protection, but should be at some future point based on the results of this MEP. The Town, being proactive, is detailing solutions to meet the water quality standards set for this Watershed in this CWMP Update. Once a TMDL is issued, the Town will be well on its way to meeting the mandate.

FIGURE 2-15
HUMMOCK POND MEP



Figure I-2. Study region for the Massachusetts Estuaries Project analysis of the Hummock Pond Embayment System. Tidal waters enter the Pond through periodic breaching of the barrier beach and flow in from the Atlantic Ocean. Freshwaters enter from the watershed primarily through direct groundwater discharge.

FIGURE 2-16
HUMMOCK POND MEP WATERSHED



Figure III-1. Watershed and sub-watershed delineations for the Hummock Pond estuary system. This MEP delineation is based on an updated review of HWH (1990) and Town of Nantucket Watershed Protection District delineation, which has a watershed that includes both Hummock Pond and Clark Cove. MEP adjusted the watershed to include only Hummock pond and confirmed the delineation based on measured water level in the pond, wetland delineations and comparison to similar systems in the region.

FIGURE 2-17
 HUMMOCK POND MEP SAMPLING STATIONS

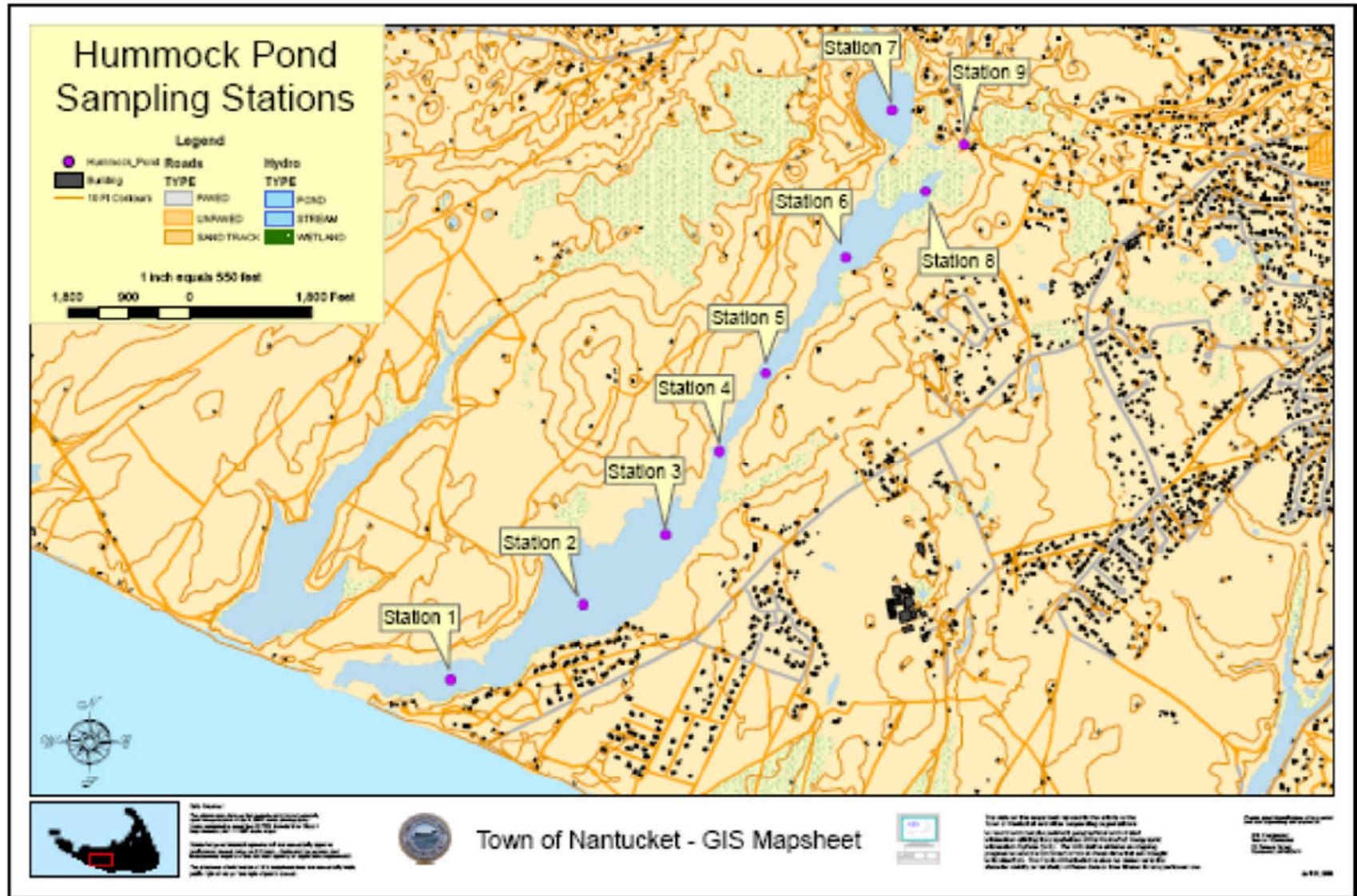


Figure II-1a. Town of Nantucket Water Quality Monitoring Program. Hummock Pond Estuarine water quality monitoring stations sampled by the Nantucket Marine Department (2002-2007).

**FIGURE 2-18
HUMMOCK POND NITROGEN CONTRIBUTIONS**

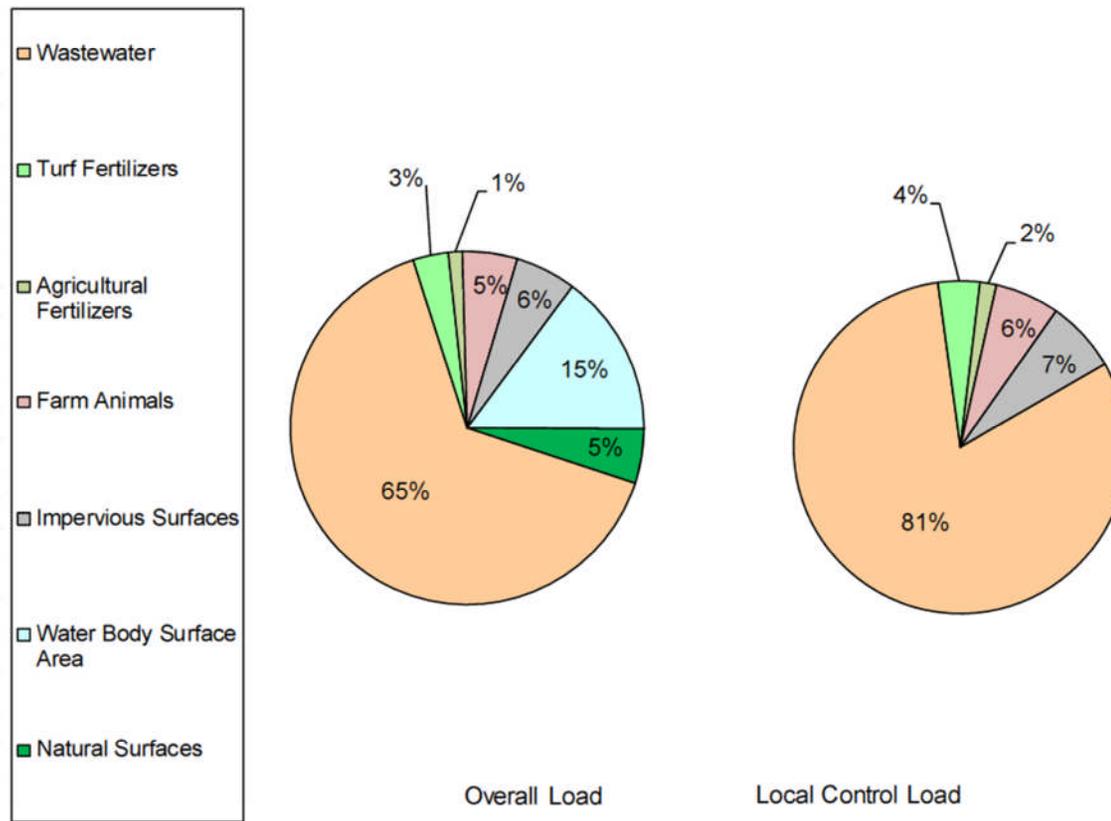


Figure IV-3. Land use-specific unattenuated nitrogen load (by percent) to the overall Hummock Pond System watershed. "Overall Load" is the total nitrogen input within the watershed, while the "Local Control Load" represents those nitrogen sources that could potentially be under local regulatory control.

CWMP UPDATE FINAL ADAPTIVE MANAGEMENT PLAN TO MEET HUMMOCK POND THRESHOLD ESTABLISHED IN MEP (No Formal, issued TMDL to date. The following recommendation is based on the results detailed in the Report, which will form the future basis for a TMDL)

The Town has identified Hummock Pond South and Hummock Pond North as Needs Areas requiring an off-site wastewater solution. The Adaptive Management Plan contained herein proposes to collect, transport and treat these Needs Areas at the existing Surfside WWTF, thus removing the 81 percent wastewater from land use in the Watershed. In addition, the Town will work towards more finite planning for semi-annual breaches of Hummock Pond by forecasting weather conditions looking towards conditions that present the appropriate weather conditions, tides and northerly winds to afford an opening that stays open to tidal flushing for a minimum of four days. Hummock Pond Sentinel Station 3 will be included in the Town's Annual Water Quality Testing program to continue to monitor results. Another piece to this Plan is the separating of the Head of Hummock from the main Pond as was detailed earlier in this Report. This Plan is currently being evaluated through the Nantucket Land Council together with the Town.

2.5 TOTAL MAXIMUM DAILY LOADS AND WATER QUALITY IMPAIRMENTS

One of the major drivers for the Town to update its 2004 CWMP is due to the Massachusetts Estuaries Program (MEP) Reports that were completed after the 2004 CWMP was filed and approved. The MEPA Certificate issued on the 2004 CWMP reiterated the fact that once the MEP studies were completed, the CWMP would need to be updated and the TMDLs issued addressed. This CWMP Update serves as the update mandated in 2004. While the 2004 CWMP detailed the on-going studies, it took another almost ten years for the MEP Reports to be completed and some TMDLs finalized, some in draft form and Hummock Pond yet to be issued. Since that time, MEP Reports for the following waterbodies were completed:

- Nantucket Harbor;
- Polpis Harbor;
- Sesachacha Pond*
- Madaket Harbor / Long Pond
- Hummock Pond.

As a result of the above, TMDLs for the following waterbodies have been issued:

- Nantucket Harbor;
- Polpis Harbor;
- Madaket Harbor / Long Pond (draft)
- Hummock Pond (pending)

*Note There was no official TMDL issued for Sesachacha Pond based on the 2006 study; it is listed on the State's List of Impaired Waters as needing a TMDL. While no formal TMDL document was issued, thresholds were established and documented in the MEP and are on record with MassDEP. As a result of the MEP, the Report recommended water quality thresholds that are being monitored through two breaches happening bi-annually in April and October. Now in the third year of Annual Water Quality Testing through SMAST, Sesachacha Pond results are meeting thresholds established in the 2006 MEP and the Pond is on its way to be eliminated from the State's List of Impaired Waters.

Since preparation of the 2004 CWMP/FEIR, there have been changes to the water quality impairments and Total Maximum Daily Loads (TMDLs) that apply to waterbodies within Nantucket. The Massachusetts Integrated List of Waters (the Final Massachusetts Year 2010 Integrated List of Waters was approved by EPA on November 16, 2011

and the Proposed Massachusetts Year 2012 Integrated List of Waters was released in January 2012) and the Surface Water Quality Standards have been updated, and three TMDLs have been released as drafts or final TMDLs.

The objective of the Federal Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. As a step to reach this goal, under Section 305(b) of the CWA, MassDEP is tasked with monitoring and assessing the quality of waters of Massachusetts, evaluating if water bodies can support designated uses. Designated uses include aquatic life support, fish and shellfish consumption, drinking water supply, and primary (e.g., swimming) and secondary (e.g., boating) contact-recreation as identified in the State Surface Water Quality Standards (314 CMR 4.00). Under Section 303(d) of the CWA, the State is required to identify those waterbodies that are Impaired (not expected to meet surface water quality standards and designated uses after the implementation of technology-based controls) and develop a plan and schedule to bring the impaired waters back into compliance with the water quality standards through a TMDL. The Integrated List of Waters identifies specific segments of each water body based on the following categories:

- Category 1 Waters – “Waters attaining all designated uses”
- Category 2 Waters – “Attaining some uses; other uses not assessed”
- Category 3 Waters – “No uses assessed”
- Category 4a Waters – “TMDL is completed”
- Category 4b Waters – “Impairment controlled by alternative pollution control requirements”
- Category 4c Waters – “Impairment not caused by a pollutant”
- Category 5 Waters – “Waters requiring a TMDL”

Water bodies identified as Category 5 waters on the Integrated List are equivalent to the “303(d) list” of water quality impaired waters under the Clean Water Act.

Once a body of water is identified as a Category 5 water body on the Integrated List of Waters, MassDEP is required by the CWA to develop a “pollution budget” designed to restore the health of the impaired body of water. The process of developing this budget, generally referred to as a Total Maximum Daily Load (TMDL), includes identifying the source(s) of the pollutant from direct discharges (point sources) and indirect discharges (non-point sources), determining the maximum amount of the pollutant that can be discharged to a specific water body to meet water quality standards, and assigning pollutant load allocations to the sources.

As a result of the MEP Reports, three formal TMDLs have been issued to Nantucket waters, with Sesachacha Pond listed as needing a TMDL and a fifth potential expected as a result of the completion of the Hummock Pond MEP.

2.5.1 Final Nantucket Harbor Embayment System TMDL for Total Nitrogen

The Nantucket Harbor Embayment System TMDL for Total Nitrogen (Report # MA97-TMDL-2, Control #249.0) was issued on January 28, 2009 and approved by EPA on May 12, 2009. The TMDL was issued due to excessive Nitrogen loading from a variety of sources that led to degradation to the environmental quality in the overall Nantucket Harbor system that includes Polpis Harbor. In order to restore the system, and preserve and protect it in the future, the concentrations of Nitrogen must be reduced to levels that are below the thresholds detailed in the MEP Report. The MEP Report determined that N concentrations of 0.35 mg/L in Head of the Harbor (Sentinel Station 2A) and an N concentration of 0.36 mg/L in Polpis Harbor (Sentinel Station 4) will meet the target thresholds. See Figure 2-6 in previous section for Sentinel Station location.

The major goal of the TMDL is for the Town to implement a plan that reduces N loading from the sources identified in the MEP as the contributing factors. In Nantucket Harbor's case, there are a multitude of locally controllable contributors including wastewater, fertilizer and stormwater and the percentages of these differ in Nantucket Harbor and Polpis Harbor. A major consideration in putting together a plan to meet the established thresholds is to include future build out scenarios. If the Town only planned for existing conditions to meet existing established thresholds, additional loading from future build out can exacerbate the environment and eliminate any good the original plan intended. On a proactive level, build out is included in this CWMP Update to provide for future conditions.

Table 2-3 details the present N load and target threshold, with the final column showing the percentage of reduction needed to achieve the threshold.

Table 2-3: Nantucket Harbor Estuary N Reductions Necessary to Meet TMDL (Table 4 from MEP)

TABLE 4: Present Watershed Nitrogen Loading Rate, Target Threshold Nitrogen Loading Rate, and the Percent Reduction of the Existing Load Necessary to Achieve the Target Threshold Load

Embayments	Present Watershed Load ¹ (kg/day)	Target Threshold Watershed Load ² (kg/day)	Percent Watershed Load Reductions Needed to Achieve Threshold Loads
Head of Harbor	1.86	0.79	58 %
Quaise Basin	2.12	1.14	46 %
Town Basin	12.22	10.71	12 %
Polpis Harbor	3.52	2.18	38 %

¹ Composed of combined fertilizer, runoff, septic system loadings, and atmospheric deposition to freshwater lakes and natural surfaces

² Target threshold watershed load is the load from the watershed needed to meet the target threshold N concentrations identified in Table 2 above

The critical element in achieving the above reductions is developing and implementing a plan that meets the targets set at the two sentinel Stations in the Harbor – 2A (Nantucket Harbor) and 4 (Polpis Harbor). The results of the model scenarios completed for this embayment area detail the following plan to meet the above:

- Elevate jetties to ACOE specifications, sewer Town Sewer District with updated parcel data, sewer Monomoy
- Elevate jetties to ACOE specifications, sewer Town Sewer District with updated parcel data, sewer Monomoy, include fertilizer reductions as per Town's BMP
- Elevate jetties to ACOE specifications, sewer Town Sewer District with updated parcel data, sewer Monomoy with new delineations as defined in CWMP Update, include fertilizer reductions as per Town's BMP

The above scenarios each are sufficient to meet the TMDLs established in both Nantucket and Polpis Harbors. There was no significant difference between the three scenarios, but the addition of fertilizer reduction based on the Town's

BMP reduced the overall numbers by a small margin based on the computer model. It is recommended that the Town monitor these results during and after implementation in the Adaptive Management Plan in order to add/revise or delete solutions. It is recommended that the Town apply these scenarios, with a mixed approach, implementing the most impactful approach first-with this being the reconstruction of the east and west jetties to the ACOE specifications. This project is in final design phase and due for completion in early 2015. With the Adaptive Management Planning approach and in order to provide sufficient reductions in TN concentrations, careful monitoring of results will be needed to measure the actual improvements realized from implementation of the jetties reconstruction. Once the Town understands the improvements realized, it can adapt and add or reduce additional implementation of solutions on an as needed basis. This approach, under the Adaptive Management Plan, affords the Town the ability to refine what tasks it takes on in the MEP areas as it better understands the real, versus computer modeled, results from implementation of solutions as shown in current data. As the Town moves further into the Adaptive Management process, it will better understand the details of each of the varied MEP areas on Island and what solutions appear to be making the most progress in real world results.

In addition, it is recommended, the Town fully implements the approved Septage Management Plan to include a septic tank pump out program. It is also suggested, that the town closely monitor build-out in the Needs Areas with the potential to implement a new Local Regulation requiring all new properties developed within the delineated Needs Areas be built utilizing an Innovative/Alternative system that reduces TN load to the groundwater. These I/A systems attain a 50 percent TN reduction over conventional Title 5 systems and in areas where no sewer infrastructure is planned will serve to supplement all efforts at reducing TN loading. This is critical when looking at build-out conditions based on current land uses. If the Town sets an Adaptive Management Plan in place under existing conditions, which attains the thresholds set by the MEP, it must also take future loading from build out into consideration.

All final plans put in place will be monitored closely in the Town's Annual Water Quality Program, which is currently an on-going event. The schedule and locations of the current tracking are coordinated directly to the MEP reports and subsequent TMDLS in order to show progress at sentinel Stations and throughout the watershed. It is recommended that this process continue to monitor TMDL compliance.

2.5.2 Draft Madaket and Long Pond Estuarine System TMDL for Total Nitrogen

The Draft Madaket and Long Pond Estuarine System TMDLs for Total Nitrogen (Report # 97-TMDL-5 Control # 283.0), was released in August 2011. This TMDL applies to impaired waterbodies on the Category 5 list, including Hither Creek, Long Pond, and Madaket Harbor.

The TMDL was issued due to excessive Nitrogen loading from a variety of sources that led to degradation to the environmental quality in the overall Madaket Harbor system that includes Hither Creek and Long Pond. In order to restore the system and preserve and protect it in the future, the concentrations of Nitrogen must be reduced to levels that are below the thresholds detailed in the MEP Report. The MEP Report determined that N concentrations of 0.45 mg/L in Hither Creek (Sentinel Station M11) will meet the target thresholds range from 1.67 kg/day in the Hither Creek subwatershed to 27.218 kg/day in the Madaket Harbor watershed. Refer to Figure 2-14- in the previous section for location of Sentinel Stations.

The major goal of the TMDL is for the Town to implement a plan that reduces N loading from the sources identified in the MEP as the contributing factors. In Madaket Harbor's case, the major source of degradation is wastewater.

2.5.2.1 Model Run Scenario

The TMDL model run scenario recommends removing 100 percent of the septic load for the watershed while continuing to mine and reduce the nutrient loading impacts from the landfill. A major consideration in putting together a plan to meet the established thresholds is to include future build out scenarios. If the Town only planned for existing conditions to meet existing established thresholds, additional loading from future build out can exacerbate the

environment and eliminate any good the original plan intended. On a proactive level, build out is included in this CWMP update to provide for future conditions.

Table 2-4 (Table 6 from the TMDL) details the present N load and target threshold, with the final column showing the percentage of reduction needed to achieve the threshold.

Table 2-4: Madaket Harbor Estuary N Reductions Necessary to Meet TMDL (Table 6 from MEP)

Table 6: Present Watershed Nitrogen Loading Rates, Calculated Loading Rates that are Necessary to Achieve Target Threshold Nitrogen Concentrations, and the Percent Reductions of the Existing Loads Necessary to Achieve the Target Threshold Loadings

Sub-embayment System	Present Total Watershed Load ¹ (kg/day)	Target Threshold Watershed Load ² (kg/day)	Percent Watershed Load Reductions Needed to Achieve Target
Madaket Harbor	0.663	0.663	0%
Hither Creek	4.041	1.134	71.9%
Madaket Ditch	2.433	2.433	0%
North Head Long Pond	0.238	0.238	0%
Long Pond	3.230	1.101	65.9%
Total for Madaket Harbor/ Long Pond Estuarine System	10.605	5.570	47.5%

¹ Composed of septic, fertilizer, landfill and runoff loadings.

² Target threshold watershed load is the N load from the watershed (including natural background) needed to meet the target threshold N concentrations identified in Table 4, above.

Taken from Tables ES-2 and VIII-3 in the MEP Technical Report

The critical element in achieving the above reductions is developing and implementing a plan that meets the targets set at the Sentinel Station, M11 for the overall Madaket Harbor System. The results of the model scenario completed for this embayment area are to sewer 100 percent of the Watershed, which is included in the Final Recommended Plan for both the 2004 and this CWMP Update based on additional criteria. Both Madaket and Warren's Landing Needs Areas (two geographical areas in the overall watershed) are identified as Needs Areas-areas needing off-site wastewater solutions. Initially both of these Needs Areas were determined to need an off-site wastewater solution based on criteria developed in the 2004 CWMP, which did not include nutrient loading, as this was not an issue when the original CWMP was begun. We now take the original criteria and add the nutrient factor to it and it strengthens the need for off-site wastewater. The Final recommended Plan is to sewer this area with low-pressure infrastructure and send the wastewater to the Town's main treatment facility, Surfside WWTF for treatment and disposal. The Town's existing Groundwater Discharge Permit at Surfside has been approved by MassDEP to be modified from 3.5 MGD (existing) to 4.0 MGD to accept this geographical area rather than the Town designing and constructing a third WWTF in Madaket.

In addition, it is recommended that the Town closely monitor its water quality testing in Long Pond adjacent to the landfill, to determine the overall impact mining the landfill has on the water resources with respect to Nitrogen reduction. To date, testing between 2010 and 2012 is showing results of N reduction of over 40 percent in this area.

2.5.3 Sesachacha Pond

Sesachacha Pond (Segment ID MA97-02 was not issued a formal TMDL document as a result of the 2006 MEP Report, but did establish and document water quality threshold statistics. The MEP Report determined the Nitrogen loading, as determined through groundwater, as wastewater (e.g., septic systems), fertilizer, impervious surfaces, direct atmospheric deposition to water surfaces, and recharge within natural areas. Basically, Nitrogen load from wastewater and fertilizer are deemed relatively low due to the low-density development in this Watershed. Based on the land use, the major Nitrogen contributors that are locally controllable are impervious surfaces (stormwater), wastewater, and fertilizer. Because of the lack of housing/development densities in the watershed, these contributors are low.

The modeling completed in the MEP determined that the best management practice for meeting the threshold water quality for the Pond was through breaches to the ocean to afford tidal flushing that maintains water quality as well as appropriate salinity levels. One of the major goals of the Sesachacha Pond MEP evaluation was to determine the best protocol for Pond openings so that they would support the highest quality habitat within the embayment. The Town has included Sesachacha in its bi-annual breaching program, along with Hummock Pond on the southern shore, which has led to maintenance of the water quality thresholds established in the MEP.

The Final Recommended Adaptive Management Plan to meet the thresholds in this area is to continue with the bi-annual breaching of the Pond in April and October. The Town is in its third year (2013 Annual Water Quality Testing) with preliminary data showing the openings continue to reach the water quality thresholds with the ultimate goal of submitting the last three years water quality reports to the state to remove the Pond from the state's list of impaired waters. Sesachacha Pond is one of the state's first success stories within the overall MEP Project.

2.5.4 Hummock Pond

The Hummock Pond MEP was completed in January 2014. At the time of this Report writing, no official TMDL has been issued. The Report contains the water quality thresholds necessary to meet water quality standards for the Pond and this data is the data utilized in the future to issue a TMDL.

The Model Run Scenarios completed for the Hummock Pond MEP met the water quality threshold set at Station 3 in the main Pond. The models completed include removing the land use wastewater from the Watershed, which in itself did not meet the threshold. In addition to sewerage, the model run for breaching the Pond semi-annually and possibly a third breach during the time when the population is at its highest, thus the highest N loading time. The sewerage and breaching together meets the threshold. The Final Recommended Adaptive Management Plan for this area is to forecast and plan breaching to meet tides, winds, weather, and specifications for depth and width in order to get a sustained breach for at least four days that will afford a sufficient tidal flush versus draining the Pond. In addition, the removal of the Head of Hummock from the main Pond is recommended to reduce N loading. Consequently, Hummock Pond North and Hummock Pond South have been added to the CWMP Update Needs Areas and recommended for sewerage.

2.6 STORMWATER UPDATE

According to the Town's GIS mapping, the stormwater collection system consists of approximately 20 miles of storm drain pipes, and over 3,000 structures including catch basins, drainage manholes, infiltrators, grit chambers, and outfalls. The majority of the drainage system serves the downtown area and discharges directly into Nantucket Harbor. Some of the outfalls discharge to wetland areas. In some cases, the outfalls that drain to the Harbor are inadequately sized and impacted by backwater from the ocean tides, which results in upstream system surcharging, sediment deposition, and surface flooding.

The Town’s stormwater systems were detailed in the July 2006 Sewer System Evaluation Study. This Report recommended a series of improvements that would eliminate surge charging, street flooding, and undersized piping and deteriorated structural integrity of the pipes. The plan was delineated into three phases, with Phase I and Phase II completed as of the writing of this Report. These areas include Children’s Beach, Orange Street, and Consue Springs. The 2004 CWMP carried approximately \$24,000,000 worth of stormwater improvements in the three phases consisting of both outfall and infrastructure improvements, with approximately \$9,000,000 completed to date. Previous reports detail a balance of approximately \$15,000,000 with an inflation factor of 3 percent per year resulting in a 2014 cost of \$20,000,000 in improvements. Because a significant amount of time has passed since these recommendations, as well as the completion of the Town’s MEP studies, it is the recommendation of this Update that the Town complete a Stormwater Master Plan. This study will identify and review not only previous recommendations for implementation, but also all current work necessary to meet established TMDLs on Island. This CWMP Update will carry the \$350,000 cost for the Stormwater Master Plan in the CIP, but will not carry any previously recommended amounts until thoroughly reviewed and confirmed.

As part of this CWMP Update, with a goal to address requirements of the Final TMDLs for Total Nitrogen in the Nantucket Harbor Embayment System, Woodard & Curran evaluated opportunities to reduce nitrogen loads from stormwater runoff on impervious cover throughout the Nantucket Harbor and Polpis Harbor Watersheds. As part of this process, W&C reviewed the TMDLs and modeling conducted by the Massachusetts Estuaries Project, the loading values used to calculate the TMDLs, the Town’s drainage system mapping, and the January 2005 Drainage Outfall Evaluation prepared by Earth Tech, Inc. and conducted a site walk throughout the four sub-watersheds in June 2013.

In January 2005, the Town received a Drainage Outfall Evaluation report prepared by Earth Tech, Inc. The report presented a hydrologic analysis of each outfall’s watershed, capacity evaluation, and conceptual designs to rehabilitate or replace stormwater outfalls that are either deteriorated or undersized, with consideration for applicable BMPs to be considered for water quality improvements to the Harbor. This Report recommended improvements to improve water quality in the harbor by decreasing sediment loading, reduce flooding due to undersized pipes, and address deficiencies within the drainage system.

2.6.1 Evaluation

Woodard & Curran identified and evaluated structural and non-structural stormwater control practices that have the potential to reduce nitrogen pollution in the Nantucket Harbor Embayment. Structural Stormwater control practices are systems designed and engineered for the physical removal of total nitrogen from impervious area runoff, such as bioretention areas/rain gardens, wet ponds, swales, detention basins, filtration units, etc. Non-structural management systems are operations and conservation practices such as street sweeping, catch basin cleaning, leaf litter cleanup, rooftop disconnection programs, etc. In addition, Woodard & Curran assessed management of impervious cover both on private and public parcels (including street right of ways) and structural stormwater treatment retrofits for the “downtown” area that build upon Earth Tech’s recommendations from their January 2005 Drainage Outfall Evaluation Report. Watershed boundaries, miles of paved Town/state-owned streets, rooftops, impervious area, and number of catch basins, were quantified using the Town’s GIS system.

2.6.1.1 Street Sweeping

The following Table 2-5 shows paved roads that are Town or State-owned within the sub-watershed, potential nitrogen load reductions in kg/day, the load reduction needed per the TMDL and the percentage of load reduction accomplished as a function of the activity.

Table 2-5: Potential Street Sweeping Load Reduction

Watershed	Paved Town/State-Owned Road Area	Load Reduction - Street Sweeping ¹	Total Load Reduction Target (kg/day) from	% of Target Load
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	(sq. ft.)	(kg/day)	all sources per TMDL	Reduction
Town Harbor	3,624,382	0.113	1.51	7.48%
Quaise	152,856	0.005	0.98	0.51%
Polpis	501,480	0.015	1.34	1.12%
Head of Harbor	284,171	0.009	1.07	0.84%
Total	4,562,889	0.142	4.9	2.90%

¹ Monthly sweeping via high efficiency regenerative air-vacuum (8%), factor per EPA Region 1 Stormwater General Permits.

2.6.1.2 Catch Basin Cleaning

Because there are very few-paved town/state owned streets outside of the Town Harbor watershed with non-infiltrating catch basins and connected drainage systems, only the Town Harbor watershed was evaluated for catch basin cleaning pollutant reductions. For these estimates, we assumed that all impervious surfaces within the Town Harbor watershed drain to the catch basins and therefore the total load of nitrogen from these surfaces were evaluated for pollutant load reductions associated with catch basin cleaning. Rooftop and surface impervious areas have a different pollutant load export coefficient in the TMDL, and therefore they have been segregated to estimate catch basin cleaning load reductions.

The following Table 2-6 summarizes impervious surfaces within the Town sub-watershed, potential nitrogen load reductions in kg/day, the load reduction needed per the TMDL and the percentage of load reduction accomplished as a function of the activity.

Table 2-6: Potential Catch Basin Cleaning Load Reduction

Watershed	Rooftop Impervious Area (sq. ft.)	Surface Impervious Area (sq. ft.)	Load Reduction – Catch Basin Cleaning ¹ (kg/day)	Total Load Reduction Target (kg/day) from all sources per TMDL	% of Target Load Reduction
Town Harbor (Downtown Area)	5,585,374	13,164,981	0.124	1.51	8.20%

¹ Semi-annual catch basin cleaning via clam shell truck (2%), factor per EPA Region 1 Stormwater General Permits.

2.6.1.3 Structural Controls

In addition to sweeping and catch basin cleaning, selected catchments were evaluated for nutrient load reductions based on stormwater control practices in place where possible and based on W&C site visits. Reductions for control practices are based on assumptions about impervious area managed (e.g. rooftop or surface impervious area) and the type of stormwater control system (in-place or projected). The following Table 2-7 details drainage areas identified in Earth Tech’s January 2005 Drainage Outfall Evaluation report that were further evaluated by Woodard & Curran for potential load reduction through a structural control:

- Children’s Beach (034)
- The Creek (061)
- Consue Spring (127)

- Cambridge Street (074)
- Commercial Wharf (116)
- Marine Fisheries (148)
- Washington Street Extension, Middle and North (159, 187, 197).

Table 2-7: Stormwater Control Structure Load Reduction

Sub-catchment	Rooftop Impervious Area (sq. ft.)	Surface Impervious Area (sq. ft.)	Load Reduction (kg/day) – Stormwater Control System ¹	Total Load Reduction Target (kg/day) from all sources per TMDL	% of Target Load Reduction
Children's Beach (034)	306,532	369,147	0.036	1.51	2.42%
The Creek (061)	49,372	289,071	0.022	1.51	1.45%
Consue Spring (127)	609,595	853,621	0.081	1.51	5.36%
Cambridge Street (074)	218,121	234,084	0.024	1.51	1.59%
Commercial Wharf (116)	74,904	131,051	0.012	1.51	0.78%
Marine Fisheries (148)	29,849	109,445	0.009	1.51	0.58%
Washington Street Extension, Middle and North (159, 187, 197).	84,866	209,427	0.018	1.51	1.16%

¹ Several structural control structures have been proposed in these drainage areas. We assumed control based on below-grade treatment train and used a conservative value of nitrogen removal (18%) at end of pipe treatment structures.

2.6.1.4 Opinions of Probable Cost

Based on this evaluation, W&C developed the following Table 2-8 to provide an overview of most feasible nitrogen management solutions and the cost per pound of Total Nitrogen reduced through several management activities. Costs are preliminary and should not be used for budgeting.

Table 2-8: Most Feasible N Reduction Stormwater Activities and Cost Estimates

Management Activity	Annual Nitrogen Load Reduced (lb)	Opinion of Cost Per Year	Low/High Opinion of Cost Per Year	Cost per lb removed

Street Sweeping¹	114	\$60,000	\$50,000/\$70,000	\$438-\$614
Catch Basin Cleaning¹	99	\$80,000	\$70,000/\$90,000	\$707-\$909
Structural Stormwater Controls²	162	\$66,000	\$66,000/\$264,000	\$407-\$1,629

¹ Cost estimate spreadsheets developed by W&C based on regional operations data. Data input includes assumed hourly labor rate, numbers of catch-basins cleaned and miles of roadway swept, disposal costs and normalized hourly rate for equipment use, maintenance and depreciation.

² Utilized Construction Cost Estimates published by Earth Tech in Outfall Evaluation, 2005. Assumed \$250,000 for Consue Springs drainage area, which was not included in original 2005 study. As projects identified in 2005 study included drainage enhancement as well as water quality efforts, W&C assumed that 25% of overall project cost were related to stormwater water quality improvement for the base opinion of cost. This percentage was based on average % of construction cost of 17% for stormwater control structure of all projects. High opinion of cost assumed drainage components of project must be completed to provide water quality benefit. All capital costs converted to annual costs with annual debt repayment for 2% interest over 20-year loan. This does not include maintenance, which is assumed in catch basin cleaning program cost.

2.6.2 Recommendations

Implementation of structural and heightened non-structural controls is not recommended at this time. These activities will require substantial capital costs, including purchase of multiple high efficiency regenerative air-vacuum sweeping trucks, construction of structural controls to treat nitrogen at outfalls that drain portions of the downtown area, as well as continued annual expenditures on ongoing implementation of sweeping and catch basin cleaning, and maintenance of the structural controls. Preliminary estimates show both capital and ongoing operational costs associated with these practices are very high per kg of nitrogen removed, as compared to management of fertilizer, septic systems, and sewerage. Based on discussions with Town Staff about implementation of these potential non-structural and structural control practices to reduce nitrogen loading to the harbors from impervious cover, Woodard & Curran has recommended the Town implement the following activities to reduce nitrogen loading from impervious cover runoff:

- Continue its current street sweeping and catch basin cleaning operations in the downtown area;
- Develop local bylaw and regulations to manage stormwater runoff during construction and post-construction for new development and redevelopment;
- Implement “adaptive management” for street sweeping, catch basin cleaning, and structural BMPs as needed based on water quality results in Nantucket and Polpis Harbors; and
- Develop a comprehensive island-wide Stormwater Management Master Plan. This Plan should build off of related work completed to date including: the drainage system map and the evaluation of drainage outfalls in the downtown area to develop a Plan that integrates existing and future stormwater capital planning, drainage operations and maintenance efforts, regulatory requirements, public outreach and involvement, previously completed watershed and water quality work, and known local problems such as areas prone to flooding. This Master Plan will help the Town to holistically understand its stormwater assets, water quality and quantity issues, budgetary costs and drivers for these costs, and develop a sustainable plan for long-term management of stormwater throughout Town. Ultimately, a Master Plan can set the framework for a stormwater financing mechanism. This Plan is necessary to protect public and environmental health, address water quality issues, and protect public and private drinking water supplies. Although the Town is not regulated under EPA’s Phase II Small Municipal Separate Storm Sewer System (MS4) stormwater

program, the Town does have a need to manage its stormwater runoff to prohibit discharges from causing or contributing to exceedances of water quality standards. In addition, the Town has aging stormwater and sewer infrastructure, therefore has a high potential for illicit connections or illicit discharges to the drainage system from improper connections or failing sewer pipes. The Plan will also preserve recreational areas used for swimming and boating, commercial fisheries, and protect endangered species habitat.

2.7 FERTILIZER UPDATE

At the Town's 2010 Annual Town Meeting, a Home Rule Petition, Article 68, to regulate fertilizer application was brought forward for vote. The voters put the Article on hold and formed the Article 68 Work Group to review and make constructive changes to a Home Rule Petition, Article 68 with the intent of reworking the Article for vote in the future. The 2010 Home Rule Petition sought to regulate the application of fertilizer, which was not supported by local landscapers and the golf clubs on Island. The new group was tasked with making constructive changes to the 2010 document and perfecting the original language so that the town could bring it forward with support to approve and pass it. The Article 68 Work Group worked over the following two years (2010 -2012) and came up with the Best Management Practices for Landscape Fertilizer Use on Nantucket Island. The Work group reached out to various technical experts from the scientific community, as well as a host of local professionals, who all contributed to the final BMP. The purpose of the BMP is to provide a science-backed guideline for fertilizer use that reduces excess nutrient loading into nitrogen and phosphorus sensitive water resources where contamination is degrading not only the environment, but, aquatic life and human health and welfare as well. A copy of the BMP can be found on the Town's website under Natural resources Department at:

http://www.nantucket-ma.gov/Pages/NantucketMA_NatRes/BMP%20final%202012-03-05.pdf.

After extensive research and a wide public outreach/education program, the BMP was finally approved and adopted by the Board of Health in 2012 and went into effect in January 2013. The main components of the BMP include prohibiting fertilizer application during specific calendar times and during heavy rains. The Regulation also limits the use of nitrogen enriching fertilizer based on land area and no more than one application every two weeks. The Regulations contains an education component, as well as a licensing provision for professional landscapers who must pass a test before receiving a license to apply.

The Regulations are a critical component to limiting the nitrogen loading that has been well documented through the Massachusetts Estuaries Program (MEP) in multiple areas on Island as degrading the coastal embayments and estuaries. Nantucket Harbor and Polpis Harbor are two of the main areas on Island that have been documented by the MEP as suffering from degradation due to nitrogen loading from fertilizer. Based on the MEP reports, the Massachusetts Department of Environment Protection (MassDEP) has issued Total Maximum Daily Loads (TMDLs) that mandate a reduction of the nutrient loading in order to maintain healthy water quality in the receiving waters. The BMP developed by Nantucket will work in tandem with other water quality initiatives to reach and maintain healthy water quality Island-wide.

At the time of this Report writing, Local Regulation 75.00 work to implement is still a work in progress. The Natural Resources Department is overseeing the Fertilizer Program and has worked with the University of Massachusetts Amherst Extension Office in developing and instructing the educational course that is required in order to obtain the mandated license. As of this Report writing, the course has been offered on four separate occasions with significant attendance at each. Nearly 300 licenses required for commercial fertilizer use have been issued. Based on the demand, the course will continue to be offered throughout May and periodically throughout the summer. The Town is looking into offering the classes in Spanish so that they can reach out to as many landscapers as possible. Additional goals are to offer classes in gardening, flower beds, trees and shrubs. The Town has begun the enforcement of the Regulations and is finding this leads to compliance in the majority of the cases. The Town is also working to educate its own staff with the entire body of the Natural Resources Department having completed the course, as well as employees from the DPW and Public school system.

Fertilizer reduction scenarios are detailed in the second round of model runs completed for Nantucket and Polpis Harbors in order to identify TMDL solutions in these impacted areas on Island. While fertilizer scenarios were not completed in all areas of the Island subject to MEP, the very fact that the Town is implementing these Regulations should serve as a piece of the proposed Adaptive Management Plans developed for each embayment area that is the subject of a MEP Report. All N reductions that are as a result of fertilizer reductions will be shown on the subsequent water sampling completed in the Town’s Annual water quality Program. There is data to support the reduction of loadings included in work done in the Chesapeake Bay area. Research in this watershed, documented in the approved final report titled “Recommendations of the Expert Panel to Define Removal Rates for Urban Nutrient Management”, shows urban nutrient management practices such as: fertilizer regulatory controls, training, and education can reduce from 6 percent up to 20 percent of nitrogen loads to a water-body. Furthermore, 20 percent reduction is seen in high risk parcels (such as those adjacent to waterbodies, over-irrigated lawns, those with high water tables, those abutting closed drainage systems, etc.- much like the ones in the Nantucket Harbor and Polpis Harbor watersheds).

For the purposes of evaluating possible load reductions from fertilized areas, Woodard & Curran has estimated the potential reduction in application rates, given the Town’s current efforts to manage private fertilizer use through the Board of Health Regulation 75.00 and the Town’s Best Management Practices for Landscape Fertilizer (“BMP Manual”). Among other requirements, the Regulation requires the Town’s Board of Health to maintain an education program based on the BMP Manual. This manual provides science-based fertilizer application guidelines for residents and commercial applicators, which will result in a reduction of fertilization application over current practices.

Given the passage of local regulations, the creation of the BMP Manual and active education and enforcement efforts, nitrogen reduction through fertilizer management will be realized in the Nantucket Harbor and Polpis Harbor Watersheds. At this time, W&C has taken a conservative approach to modeling load reductions for fertilizer inputs.

To estimate the potential load reduction from fertilizer application, we looked to typical fertilizer products currently available for retail purchase and the TN application rate if following manufacturer’s guidelines. The typical products contain guidelines that will result in an average application of 0.9 lbs per 1000 sq. ft for a single bag.

W&C has assumed that through municipal outreach and enforcement at least 75 % of the residential and commercial properties in the Nantucket Harbor and Polpis Harbor watersheds will reduce fertilizer application by just over 15%, therefore reducing the overall nitrogen input from fertilizer by 12.5% of the quantity estimated in the TMDL model. This is consistent with the work completed in the Chesapeake Bay Watershed. Therefore, we estimate that the overall fertilization application rate will be approximately 0.945 lbs per 1,000 square feet.

Table 2-9: MEP Fertilizer Target Load Reductions

Watershed	Original Load (kg/day)	Load Reduction - Fertilizer Management¹ (kg/day)	Total Load Reduction Target (kg/day) from TMDL	% of Target Load Reduction
Town Harbor	4.10	0.512	1.51	33.9%
Quaise	0.16	0.020	0.98	2.1%
Polpis	0.18	0.023	1.34	1.7%
Head of Harbor	0.15	0.019	1.07	1.8%
Total	4.59	0.574	4.9	11.7%

¹: Assumed 75 percent of parcels reduce application by 12.5 percent annually

It is the recommendation of this CWMP Update that the Fertilizer regulation be fully implemented Island-wide to further reduce nutrient loadings to the water resources. In Nantucket and Polpis Harbor alone, fertilizer reduction will supplement expensive structured solutions to reduce nutrient degradation in these waters such as sewerage, raising the east and west jetties in Nantucket Harbor, dredging Polpis Harbor for a wider flushing on tides and stormwater solutions. The Model Run Scenarios completed in 2014 support fertilizer reduction in reducing N loads. Fertilizer reduction is a far less costly solution than others and has significant value in contributing to the overall health of our water resources. Local Regulation 75.00 can be accessed on the Town's website through the Board of Health at http://www.nantucket-ma.gov/Pages/NantucketMA_Health/forms/75.pdf.

2.8 LANDFILL MINING

Nantucket has operated a landfill adjacent to upper Long Pond for a number of decades. In 2004 when the CWMP/EIR was completed, the Massachusetts Estuaries Program (MEP) had not started the study of nitrogen loading thresholds in this area, so the landfill was not included as part of criteria evaluated in the determination of "Need" for wastewater. The landfill is north of the Madaket Needs Area, east of the Warren's Landing Need Area and is adjacent to the east of upper Long Pond, which is part of the overall Madaket Harbor Watershed. As a result of the 2010 MEP Report, the landfill became a contributing nitrogen loading factor to the thresholds developed in the study and as such is taking on a more prominent part of this CWMP Update Report in order to evaluate its importance in developing a solution to the MassDEP issued Draft Total Maximum Daily Load (TMDL) for Madaket Harbor and Long Pond.

When the CWMP/EIR was completed in March of 2004, the Town was accepting compost residual and construction and demolition (C&D) materials into the landfill. This process continued until MassDEP amended the Waste Ban in 2005 and then in 2006 instituted a full ban on C&D materials in landfills. In the time before the waste ban, Nantucket was becoming aware that it was running out of space for solid waste at the landfill and that to have to ship all solid waste off Island in the near future would be cost-prohibitive. In the late 1990s, the Town hired Waste Options, Inc. to integrate a solid waste disposal program. Tasks included landfill clean-up, recycling and composting. Fast forward sixteen/seventeen years later and Nantucket's state of the art landfill facility has far exceeded original goals. Today they recycle over 80 percent of materials that would have gone into the landfill. The composting system results in landfilling no more than 20 percent of incoming materials and the Town integrated a landfill mining and closure program. A report on the status of the landfill capacity written in July 2012 estimated that of cell 2B, which is the current active cell, had in the range of 10,000 to 20,000 cubic yards of airspace remaining to accept residual materials. This space is estimated to last until FY2015. Construction of the next cell, Cell 2C, can be deferred until approximately FY2014 or FY2015.

In 2010, the Massachusetts Estuaries Program (MEP) released the Report entitled, "Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Madaket Harbor and Long Pond, Nantucket, Massachusetts". The Report evaluated the complex coastal embayments in the Madaket Harbor watershed and completed an analysis to determine the necessary nitrogen-management decisions that Nantucket needs to make in order to preserve and protect the embayments areas and water resources that are becoming severely degraded due to over enrichment of nitrogen. The Report detailed nitrogen loading thresholds for the Town to utilize as management tools. The Report is a science-based approach utilizing water quality data, habitat assessment, oxygen measurements and benthic community structures to assess the overall health of the watershed. Based on the results, land use specific unattenuated nitrogen loads to the overall watershed system were detailed, including overall contributors, as well as locally controllable contributors. The landfill is included as an overall contributor at 10 percent and as a locally controllable contributor at 21 percent. See Figure IV-6 from the MEP Report. As a result of the MEP, MassDEP issued a Draft Total Maximum Daily Load (TMDL), which is a regulatory driver that mandates Nantucket find a solution, or solutions to meet target thresholds for nitrogen loading in the overall Madaket Harbor Watershed. This CWMP Update is scoped with delivering a plan to do exactly this.

The MEP report suggests that the current mining of the landfill results in a reduction of nitrogen loading in this area. The landfill is a “piece” of the locally controllable portion of nitrogen loading and is a part of the overall solution to meeting the draft TMDL that MassDEP issued in August 2011.

With the current mining operation of the landfill, material in the existing unlined cell is removed, sorted, portions passed through a digester and/or recycled. Some materials that cannot be recycled are then shipped off Island and what cannot be recycled or reused are then placed in lined cells, which are then capped preventing contamination to the groundwater. This process reduces the potential for nitrogen loading to the groundwater that ultimately flows into the watershed via Long Pond, Madaket Ditch, Hither Creek and ultimately Madaket Harbor. As this process continues, nitrogen loading is further reduced to the overall watershed.

Nantucket undertakes Town-wide water quality monitoring on a yearly basis and includes Madaket Harbor and Long Pond sampling. As of this report writing, the Town received the 2012 results in a Report entitled, “Town’s Water Quality Monitoring Assessment of the Nantucket Island-Wide Estuaries and Salt Ponds”. The data collected for Long Pond shows a reduction in Total Nitrogen, approximately 40 percent less, from 2010 data results. While this is a positive step in nitrogen loading reductions to this watershed, it will need to be monitored very closely in order to determine if it represents a real reduction as a result of the landfill mining and closure or merely a natural inter-annual variation. The 2013 summer water quality monitoring continues to show the N reduction trend continuing as shown in the 2012 results. This will continue to be monitored in the future.

Overall, the landfill reduction, clean-up process is a positive course of action on multiple levels. It is providing a vital clean-up and storage effort to the limited amount of space available on Island through clean-up and recycling. The 2013 summer sampling results also continue to show the trending of N reduction, which is another of the overall benefits of the landfill program and will contribute to meeting the Draft TMDL set in this embayment area.

Refer to Appendix C for copies of landfill materials used to summarize this section.

2.9 POTABLE WATER SYSTEM EXPANSION UPDATE

Since the 2004 CWMP, the Town Water Department has installed water mains into various areas of Town that previously were limited to on-site wells. During the Needs Analysis conducted in 2001, Madaket Needs Area was completely dependent on on-site wells for its potable water. In 2010, public water was extended along Madaket Road to service a small portion of the upper Madaket Needs Area and all of Warren’s Landing. While the entire Needs Area is not serviced with public water, it was brought from Warren’s Landing to Massasoit Village and then in 2011 to F Street, Tennessee Avenue to North Cambridge street ending on Little Neck Way. This mainly accounts for the northern portion of the Madaket Needs Area leaving the middle and southern portions to continue to rely on private wells. The Town also brought a 2,000,000-gallon water storage tank located in North Pasture into service in 2010.

Additionally, Wannacomet Water is in the process of extending water mains on Hummock Pond Road to service the Cisco and Hummock Pond area of the Island.

Refer to Figure 2-19 for a map of the existing potable water system (not including Cisco and Hummock Pond as this work is in progress as of this Report writing).

Potable water comes from three groundwater wells located throughout the mid-Island located in Nantucket’s Sole source Aquifer. The Milestone Well #2 and State Forest Well #3 are protected by Zone Is with a radius of 400 feet surrounding the well. The Milestone Well #1 has a Zone I protection that extends 250 feet from the perimeter of the well. The drinking water comes from two different levels of the aquifer. The water system distributes water through a network of water mains that range in size from two inches up to sixteen inches in diameter.

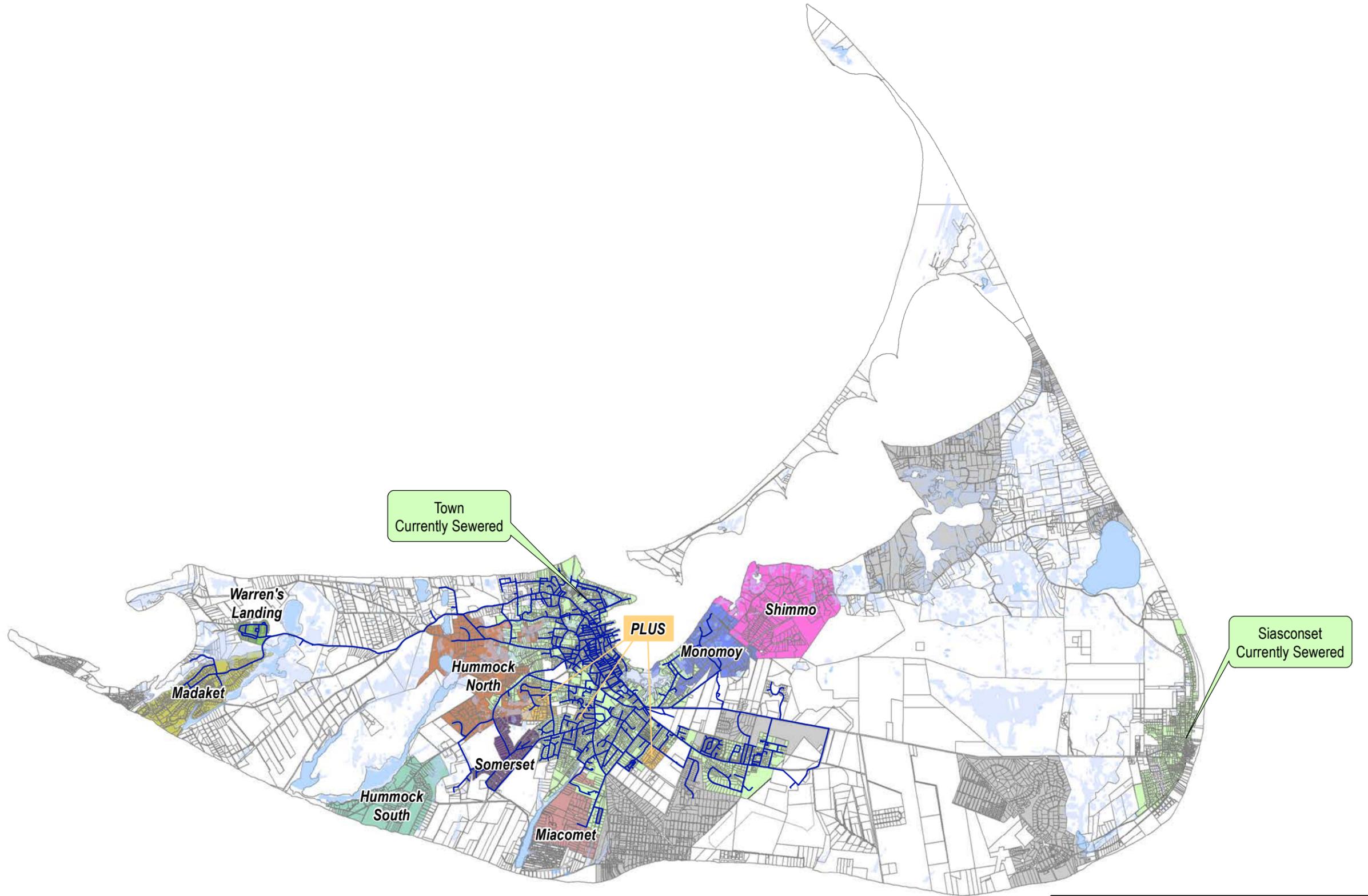
According to the Water Department, in 2012 the Town produced and delivered 612,314,000 gallons of drinking water from all of its wells. Highest demand was on July 6, 2012, which is expected given the population surges during this

summer period. Nantucket relies entirely on rainfall to recharge its Sole Source Aquifer, with 2012 receiving 32 inches in rainfall, with average rainfall recharge around 43 inches per year.

Wannacomet Mission Statement

“ The Wannacomet Water Company shall strive to provide high quality drinking water that exceeds all established Federal and Commonwealth drinking water standards, provide the highest level of customer and water related services achievable, educate and inform the public of the need to protect Nantucket’s water resources, and to accomplish this mission using prudent utility practices and responsible fiscal management.”

Refer to Appendix D for copies of Wannacomet Water Company materials and information.



Town
Currently Sewered

PLUS

Siasconset
Currently Sewered

Legend

- Water Mains
- Pond
- Wetland

COMPREHENSIVE WASTEWATER
MANAGEMENT PLAN UPDATE
TOWN OF NANTUCKET, MA

WATER SYSTEM

FIGURE 2-19



SCALE: 1" = 1.25 MILES	DOC: WATER.MXD
DATE: FEB. 2014	JOB NO.: 225139
DRAWN BY: JSM/RTB	SOURCE: MassGIS & Town

2.10 NANTUCKET SEWER ACT OF 2008

On December 18, 2008, the Governor of Massachusetts under the Acts of 2008, Chapter 396, signed an act authorizing the establishment of the Nantucket Sewer Commission and Sewer Districts (“Nantucket Sewer Act”) into law. The Act was effective on July 1, 2008. Final approval was on December 17, 2008. This Act authorized the Town, through the Sewer Commission (Board of Selectmen) to design, construct, maintain and operate a sewer system within designated sewer districts. The Act contains twelve sections as follows:

Section 1	Lay out, plan, construct sewers
Section 2	Maintain sewer connections
Section 3	Selectmen to act as Sewer Commissioners Completed by 2/3 vote
Section 4	Make policies, finances and goals Subject to Charter of the Town of Nantucket
Section 5	Eminent Domain provisions
Section 6	Establish Enterprise Fund
Section 7	Revenues of Sewer Funds
Section 8	Prescribe annual charges, connection fees, assessments, privilege fees et al
Section 9	Adopt Rules and Regulations
Section 10	Defined Sewer Districts
Section 11	Municipal Buildings
Section 12	Act takes place July 1, 2008

Final approval of the provisions of this Act by the Town was on December 17, 2008.

Once the CWMP Update is finalized and approved, a review of the Act needs to take place and any appropriate amendments to such Act made based on changes between the 2004 CWMP and 2013 CWMP Update. See Appendix E for a copy of the Act.

2.11 SEWER CONNECTION POLICY

The Town enacted Local Regulation 69.00, “Connections to New and Existing Publicly Owned Sanitary Sewer Lines” on May 7, 2003 under the jurisdiction of the Board of Health (BOH). The intent of the Regulation is as stated, “to

further protect all existing and potential ground water, surface waters, harbors and estuaries on Nantucket Island from contamination from septic system failure". In addition to the above intent, this Regulation should serve to protect the Island's water resources from nutrient degradation from on-site wastewater systems by mandating that in areas where sewer infrastructure is operational existing properties officially abandon their on-site systems and hook into the municipal sewer. This is extremely important in areas where nitrogen degradation is documented by the Massachusetts Estuaries Program (MEP), specifically Nantucket Harbor area where municipal sewer is available at the time of this report writing.

This Regulation mandates that properties abutting a sanitary sewer line installed or approved by the Town of Nantucket Department of Public Works connect the structures located on the property within two years notice of availability. If the property is located within an environmentally sensitive area as defined by the Nantucket BOH and is located in an area where municipal sewer lines are available, the property must be connected within six months of notice of availability, weather permitting, but cannot exceed one year in any case.

Local Regulation 69.00 takes into account those properties that have a newer on-site system and affords the property owners a deferral period to abandon their system. If a system was installed less than five years before sewer lines were activated, a variance to connect to the sewer may be granted by the Board of Health. This affords the property owner time to utilize the on-site system and defrays connection costs that would be incurred connecting to the municipal sewer. This section of the Regulation is not a given, but a "consideration" by the BOH taking into account site specifics. For example, if the property owner replaced their system within five years of municipal sewer becoming operational, but is in a nitrogen or environmentally sensitive area where it was deemed detrimental to continue with the on-site system, then the BOH reserves the right to mandate a connection.

Regulation 69.00 also provides a Right of entry onto private property with reasonable notice in order to ensure compliance of the Regulation. It also stipulates the penalties for not conforming to it.

At the time of this report writing, a review of municipal sewer connections in the Nantucket Harbor Watershed Area that are included within the Town Sewer District was completed in order to determine properties currently being billed for sewer usage and those existing and developable parcels that are not receiving bills. The results show that there are existing properties that are showing as not connected at this point in time. These were reviewed by the DPW for any errors in billing and it has been determined that this overall number is divided into two categories:

1. Parcels connected to sewer, but not receiving bills
2. Parcels still on on-site wastewater disposal systems

The DPW has worked with the Wannacomet Water Company (WWC) rechecking billing records as the WWC processes the water and sewer bills for the Town. The Sewer Planning Work Group (SPWG) took on the charge of addressing the properties that currently receive sewer service, but are not billed. As of June 2013, the SPWG sent a letter of recommendation to the Board of Selectmen, the Town's Sewer Commissioners, regarding these properties. The recommendation includes billing these properties for the last three years of sewer service (as directed by Town Counsel) and affording a payback period of three years. Discussions are on-going as to the charging of privilege fees to these properties as has been the protocol with other properties connecting into the system. There is also on-going discussion on the best manner to notify each of these property owners of the final decisions made by the Sewer Commissioners that impact future actions.

There are also many properties within the Town Sewer District that have not connected into the sewer system even though the Town has mandated that they do so. A recommendation of this CWMP Update is to notify all existing parcels not connected into the system of the sewer availability and afford them a minimum time limit to connect to the sewer lines based on Regulation 69.03, item B-based on location within an environmentally sensitive area. The Town Sewer District is located within an environmentally sensitive embayment as detailed in the Massachusetts Estuaries Report (MEP). The Town is also under the mandate of a TMDL in Nantucket Harbor to reduce nutrient loading. The

MEP details this nutrient loading as being contributed by on-site septic systems. It is important to remove these on-site systems to reduce the nitrogen loads that are contributing to the degradation to the Harbor embayments. For those undeveloped, but developable parcels, a recommendation to apply to hook into the sewer as soon as the property is developed will be sent. No undeveloped property developed within the existing Town Sewer District will be approved with an on-site wastewater disposal system-it must connect to the Town's sewer system. It is recommended that this Regulation be evaluated and enforced through the appropriate jurisdiction (s). Refer to Appendix E for copies of Board of Health Local Regulations.

2.12 SEPTAGE MANAGEMENT PLAN

A Septage Management Plan (SMP) was developed as part of the 2004 CWMP and formally adopted by the Town. The goal of the SMP was to provide the tools, options and resources necessary for the Town to manage on-site wastewater disposal systems, both in areas identified and approved as Needs Areas while they wait for sewer infrastructure to become implemented and active in their area. The SMP is particularly directed towards those areas on Island where on-site wastewater disposal is the long-term solution where a well-managed plan will act as "sewer avoidance" in the long-term. The SMP long-term goals were developed for multiple reasons;

- To protect and maintain public health
- Ensure the protection of both groundwater and surface water resources
- Maintain environmental, economic and recreational water resources
- Retain local control of on-site systems without regulatory or management intervention
- Preserve and protect property values
- Maximize options for on-site management with both local and regulatory requirements
- Identify staffing and financing needs in the local jurisdiction, the Nantucket Board of Health

The SMP was officially adopted by the Board of Selectmen on November 9, 2005. The Board of Health is the official jurisdiction for implementing and maintaining the SMP. As part of this CWMP Update, we met with the DPW Director and Board of Health Agent to review the individual components of the SMP to ascertain where items have been implemented, milestones reached and areas where an action plan needs to be developed in order to implement. The SMP is divided into seven major sections as follows:

1. Regulations
2. Inspections
3. Staffing
4. Funding
5. Record Keeping
6. Education & Outreach
7. Management of Onsite Sewage Disposal Systems

Each section contains pieces that have been implemented to date, as well as items that have not yet been addressed. Those items not yet addressed are due to overall budgetary and staffing issues that are common throughout the state over the past decade because of a failing economy. Nantucket has done a good job of prioritizing sections in the SMP for implementation with available budgets. For instance, the Town has addressed the major watershed protection areas with the adoption of the new Districts including regulations, inspection schedules, and enforcement procedures. The following details each of the seven elements of the SMP with a summary of completed items and those on track for future implementation:

2.12.1 Regulations

Regulations include the adoption of new Regulations, as well as variance provisions and available repair and escrow options. This element also addresses enforcement procedures, maintaining an on-going discussion with the state regarding Title 5 changes and assisting with the areas on Island subject to study in the Massachusetts Estuaries Program (MEP). Table 2-10 detail the progress made in adopting new regulations and escrow/repair options

Table 2-10: Septic Management Plan Regulations Implemented to Date

Component	Adopted As	Date
Mandatory Sewer Connections in Sensitive Areas	Local Regulation 69.00	May 2003
Nantucket Harbor Watershed Regulation	Local Regulation 68.00	May 2005
Madaket Harbor Watershed Regulation	Local Regulation 53.00	June 2006
Nitrogen Sensitive Areas	Local Regulation 54.00	August 2009
Identify Remaining Needs Areas / Environmentally Sensitive Areas	On-Going	
Adopt and Implement Regulations for Remaining Needs Areas/Environmentally Sensitive Areas – Hummock Pond - Zones A & B	Local Regulation 55.00	September 2010 Amended February 2013
Adopt Provisions of Community Septic Management Program	Annual Town Meeting 2011	April 11, 2011
Administrative Consent Order for Septic Repair Deferral	Local Regulation 59.00	September 2012

As is shown in the above Table, Nantucket has been proactive in its approach to adopting new regulations for the preservation and protection of its water resources. Each Local Regulation contains a purpose, procedure, definitions, and enforcement provisions.

Additionally, the Town has adopted a means to fund on-site wastewater system repairs through Town Meeting approval. April 2011 Annual Town Meeting approved the Town’s participation in the Massachusetts Community Septic Management Program (SPM), for an initial borrowing of \$1,000,000 with an additional \$1,000,000 available, for the repair/upgrade of on-site wastewater systems. This Program is a collaboration of MassDEP, The Executive Office of Administration and Finance, The Office of State Treasurer and the Department of Revenue to provide funding and assistance to Nantucket homeowners to repair, upgrade, replace on-site wastewater disposal systems for long-term sustainability, especially in environmentally sensitive areas, as well as those areas determined long-term sustainable with on-site systems.

Additional, this funding can be utilized in the future with property owners’ sewer connections in identified Needs Areas. To date, the Town has lent out \$478,450 through this Program. These loans are targeted toward those areas within environmentally sensitive watersheds, including systems that are located within the Town’s Wellhead Protection Zone.

The Board of Health has developed an Administrative Consent Order process (ACO) that will alleviate property owners from having to pay for an expensive upgrade/repair of an on-site wastewater disposal system and essentially pay again when municipal sewer becomes operational in the area. If a person currently owns and/or operates an on-site wastewater disposal system on property that is located in a proposed future municipal sewer service area and identified as a Needs Area in the CWMP Update Document, (which the Board has determined requires an upgrade pursuant to 310 CMR 15.00 (Title 5) and as defined in the Board of Health Regulations under Local Regulations 51.00, 53.00, 54.00, 64.00, and 66.00), the Nantucket Board of Health has determined that the property owner may not be required to undertake construction of a major upgrade and/or major repair or new on-site wastewater disposal system at this time.

Once approved, the property owner can enter into an ACO with the Nantucket Board of Health and meet the minimum local requirements until a municipal sewer is operational in the area. The Board of Health reserves the right to require any property owner with a failed septic system, in an area where future phases are being considered and where connection to the municipal sewer system is not available because no municipal sewer exists in that area or that the existing sewer system has no available capacity in that area to accommodate a connection, to enter into an Administrative Consent Order (ACO). Once the ACO is recorded with the deed at the Nantucket County Registry of Deeds and the first payment made to the Finance Department, the property owner will be allowed to make repairs to the failed septic system that would normally not be allowed such as, but not limited to, installing a replacement leach area to Title 5 minimum standards. All repairs must be approved and permitted by the Health Department prior to installation.

This Program affords the property owner in a Needs Area where municipal sewer is targeted this option to avoid paying for an expensive repair and then having to pay a capital cost for municipal sewer-essentially having to pay twice for wastewater services. The ACO Program is currently underway in the Madaket Needs Area. As the CWMP Update confirms additional Needs Areas from the 2004 CWMP, those areas will be afforded the use of Local Regulation 59.00.

The Board of Health maintains communication with the state with regards to Title 5 elements as well as is involved regionally through the Barnstable County Department of Health on these issues. At the time of this Report writing, revisions to Title 5 are under public comment and due to be finalized sometime during summer 2013.

The Board of Health is one of multiple Nantucket Departments involved with the Massachusetts Estuaries Program (MEP), which is in its tenth year of studies on Island. To date, Nantucket Harbor, Polpis Harbor, Sesachacha Pond, Madaket Harbor and Long Pond MEP studies are completed with either final or draft Total Maximum Daily Loads (TMDLs) issued. Hummock Pond MEP has been completed through Town funding with SMAST. The MassDEP was not partnered in this effort due to lack of state funding available. MassDEP has been sent a copy of the MEP Report, but the Town has not received any formal response from the Department at the time of this Report writing. The MEP areas are discussed in detail throughout this Report.

2.12.2 Inspections

The Town revised its Title 5 inspection and certification standards in May 2005 with more detailed forms and more formalized schedules. Based on the new Regulations discussed above, inspection schedules were developed with letters sent to all impacted properties. The one-time inspections mandated through the Local Regulations are as follows:

Nantucket Harbor Watershed – completed

Madaket Harbor Watershed – completed, with repair options underway

Hummock Pond – letters sent and Board of Health deferred until MEP Study is complete.

The majority of these inspections show failures of on-site wastewater systems. The failures are defined as “technical failures” and due to high groundwater conditions. Hydraulic failures do happen, but are in the minority. These system failures require immediate attention.

2.12.3 Staffing and Funding

Staffing and funding are areas that the SMP has documented as an on-going issue, but to date has yet to be able to fully address. Staffing and associated costs for the various areas in the Board of Health need to be updated to

include the tasks currently under the BOH jurisdiction. The SMP contains recommended targets / timelines for this, but due to budgetary constraints have not been revised. Staffing issues are reviewed annually for appropriate updates on an on-going basis. The fee schedule and update recommendations in the SMP were completed in October 2005 based on the then duties performed by the BOH. As of this Report writing, additions to local regulations and subsequent duties need to be accounted for and a review of the October 2005 fee schedule updated accordingly.

While the BOH has updated user fees, inspection fees and overall accounts receivables, these have not been sufficient to support additional staffing needs. The BOH is not alone in this dilemma, as all Nantucket Town Departments are working with smaller staffs carrying current workloads.

The BOH does not have staff targeted to research grants available, but various consultants working with the Board have. At this time, there are very few, if any, available grant programs to supplement the activities in the BOH.

Staff currently processes the day to day activities of the BOH, which is far greater than SMP. The Community Septic Management Program, ACO Program, Title 5, Local Regulations and all areas relative to on-site wastewater are managed with existing staff.

2.12.4 Record Keeping

The Board of Health maintains a central filing system for inspections, compliance, scheduling and tracking in the PLUS Building. These files are shared with other Town Land Use Departments. A specific computer tracking program, ACCESS, is used as a database to track all ACO users. Additionally, staff maintains computer records of the Community Septic Management Program users. Under the SMP, it is recommended that the BOH purchase a computer program to use as an overall accounting system with periodic updates, but due to the lack of available budget, this has not been done.

The Town is working with Barnstable County on a cooperative program to maintain all Innovative and Alternative (I/A) Wastewater Systems. This is a win/win for both entities as Nantucket will maintain jurisdiction over the approval of systems, but Barnstable County Department of Health will become the operation and maintenance jurisdiction. Barnstable now manages all I/A Cape-wide with a comprehensive database that tracks all systems, their repair records, as well as their performance standards. Adding Nantucket's systems to the data set will afford a wider and more comprehensive record set for use by all. Barnstable is currently updating its database hardware and once completed, Nantucket will join forces with this cooperative program.

2.12.5 Education and Outreach

Since 1998, the BOH has done significant, on-going outreach when staff and budget are available. As part of both the 2004 CWMP and on-going CWMP Update, on-site system education and outreach has been and continues to be a major component. In addition, the BOH regularly holds public hearings that are widely publicized as part of its day to day activities.

There have been public informational meetings, public workshops, informational posters and booklets developed, printed and distributed. Many outreach tools have targeted specific areas of Town, recently with the adoption of the ACO Program in Madaket/Warrens' Landing multiple public informational meetings were held-some as part of the on-going CWMP Update. As part of the ACO plan, a new Local Regulation 59.00 was drafted and the public weighed in on the planning. The BOH held a Public Hearing to introduce the plan, the media published multiple articles on the plan, CWMP Update Quarterly Updates with the Board of Selectmen featured the topic and brochures were developed, printed and distributed educating the public on the plan. The BOH regularly participates in civic group meetings on a number of topics, many wastewater related. All BOH meetings are posted as required by law and open to the public.

The proponents of the CWMP Update will continue to work with the BOH to solicit participation from the public with matters related to on-site wastewater disposal systems, water quality and overall items related to wastewater as part of the on-going planning.

2.12.6 Management of Onsite Sewage Disposal Systems

The management of on-site wastewater disposal systems is under the jurisdiction of the BOH. The BOH has established a tracking system to record inspection results, repair, replacement, and upgrade of systems whether as a component of a Title 5 Inspection or because of change of use/modification of bedrooms. Inspection schedules as part of the Local Regulations in approved watershed/water resource areas. These have been established for:

- Nantucket Harbor Watershed area – Local Regulation 68.00
- Madaket Harbor Watershed Area – Local Regulation 53.00
- Madaket Harbor Watershed-Nitrogen Sensitive Area – Local Regulation 54.00
- Hummock Pond Watershed Area* – Local Regulation 55.00

*Local Regulation 59.00 – defers inspection until MEP report is complete and sources of nutrient degradation are identified.

While a significant amount of work has been conducted with regard to the management of on-site wastewater disposal systems, further work is needed. One area is the establishment of a maintenance pumping schedule. This is especially important in areas of seasonal use where systems are abandoned after Labor Day and not used again until after Memorial Day. With no consistent flows to keep the system in check, contents become highly concentrated and then when occupancies begin pre-summer, contents begin to discharge higher than normal concentrations and it takes time to get back the on-site system into compliance. Then Labor Day hits and this scenario begins all over again. Other areas where a pumping plan is important are those areas on Island deemed long-term sustainable with on-site wastewater disposal systems. These are areas where no municipal sewer is planned in the future, so in essence it is a “sewer avoidance” plan-it saves the municipality from having to fund costly capital projects and assess those charges back to the user. The CWMP determined that these areas have the capability of maintaining on-site wastewater disposal systems over the long-term as long as they are properly operated and maintained.

This is one area of the SMP where lack of budget has left the BOH without a means to fully implement an aggressive on-site system pumping plan. It is a valid component that is reviewed annually by the BOH and until such time as budget/staff afford, will remain with the system owners to do at their discretion.

The BOH established priorities such as establishing the Watershed Districts and mandated Title 5 Inspections, which have formed the basis of water quality in many areas on Island. Available staff and budget directed towards these tasks is vital and supports other coordinated endeavors such as with the Natural Resources Department. The BOH will continue to review opportunities to implement the full On-Site Sewage Management Plan, such as is available with Innovative / Alternative Systems at the Barnstable County Department of Health. There may be future opportunities to include a pumping incentive plan here as well.

2.12.7 Summary

Elements of the Septage Management Plan adopted in November 2005 have been prioritized and have been implemented based on sections that represent the most environmentally valuable projects. While the Town has done a good job representing these priorities, there still remain areas that need attention. Certainly staffing and budget remain as high priorities for future consideration, both to maintain those items implemented to date, as well as to bring to fruition other important areas that serve to benefit the Town. The complete SMP can be found in Appendix E as well as copies of the relative Local Regulations.

2.13 BOARD OF HEALTH ADMINISTRATIVE CONSENT ORDER

The Board of Health, with coordination from Town Administration and approved by MassDEP, developed an Administrative Consent Order process (ACO) that will alleviate property owners from having to pay for an expensive upgrade/repair of an on-site wastewater disposal system and essentially pay again when municipal sewer becomes operational in the area. This process was possible because the Town was currently engaged in this Comprehensive Wastewater Management Plan (CWMP) Update, which includes provisions for additional sewerage of portions of the Town. In addition, The CWMP Update is addressing areas of the Town where the Massachusetts Estuaries Program (MEP), under the jurisdiction of the Massachusetts Department of Environmental Protection (MassDEP), is mandated to reduce nitrogen loading in specific areas of Nantucket and to meet Total Maximum Daily Loads (TMDLs) set by the state in Nantucket Harbor, Madaket Harbor, Long Pond, Sesachacha Pond and potentially other embayment areas of Nantucket, including the Hummock Pond Area. Nantucket's Harbor Watershed Districts (Nantucket and Madaket) also detail reduction of nutrient loading from on-site wastewater disposal systems. In order to meet these mandates, as well as provide options for property owners with failed on-site wastewater disposal systems in areas proposed for municipal sewer, an Administrative Consent Order process has been established and approved by the Nantucket Board of Health. The process is detailed in Section 2.12.1 above.

At the time of this Report writing, Madaket Needs Area is the one area approved for utilizing the ACO. It is assumed that other areas on Island identified and approved as Needs Areas when the CWMP Update is completed will be added to the Program.

The Nantucket Board of Health defines two types of failed on-site wastewater disposal systems that qualify under this Regulation:

- Hydraulic Failure
- Technical Failure

Any property owner with such failed on-site wastewater disposal system, as determined above, and as approved by the Board of Health and/or Agent, shall connect to the municipal sewer system upon its availability or, in specific cases, upgrade and/or repair with certified Title 5 or approved Innovative Alternative system as per duly executed ACO.

To date, several Madaket property owners have entered into the Program while the CWMP Update is completed and an off-site wastewater solution is finalized for this Needs Areas.

Refer to Appendix E for copies of Local Regulation 59.00 and other approved ACO forms.

2.14 UPDATED NEEDS AREAS AND REVISED WASTEWATER FLOWS AND LOADS

A comprehensive review of the Needs Areas from 2004, as well as current and future conditions together with updates of all changes that have taken place since the 2004 Report, a revised map of Needs Areas and associated flows and loads took place. Refer to Figure 2-20 for the updated map.

2.14.1 Needs and Study Areas Update

The 2004 CWMP identified areas of the Town that were not deemed long-term sustainable with on-site wastewater disposal systems due to a number of criterion. One criterion that was not in existence at this time was the Massachusetts Estuaries Program (MEP) Reports, which identified areas impacted with nutrient loading, specifically nitrogen. Nitrogen loading from various sources including on-site wastewater systems, stormwater, fertilizer and various other sources were the subject of the MEP in southeastern Massachusetts, Cape, and Islands starting in 2003. When the 2004 CWMP was completed, none of the final results of the MEPs were completed so no nitrogen loading criterion was added to the screening criteria utilized to determine the need for an off-site wastewater solution. Now that the MEPs are completed we have redefined the Needs Areas and they are presented in Table 2-11.

Table 2-11: Updated Needs Areas and Area of Concern

Needs Area	MEP Area
Madaket	Madaket Harbor/Long Pond
Warren's Landing	Madaket Harbor/Long Pond
PLUS	Town District - Nantucket Harbor/Polpis Harbor
Monomoy	Nantucket Harbor/Polpis Harbor
Shimmo	Nantucket Harbor/Polpis Harbor
Hummock Pond North	Hummock Pond
Hummock Pond South	Hummock Pond
PLUS Parcels - Infill in Town Sewer District	Multiple - Nantucket Harbor/Polpis Harbor/Hummock Pond

2.14.1.1 Madaket and Warrens Landing Needs Areas

The Madaket Needs Area was evaluated in the 2004 CWMP and rated within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to Madaket Harbor, Hither Creek, Long Pond and other water resources in this geographical area since then. A major change is the completed and approved Madaket Harbor/Long Pond MEP Report and subsequent Draft TMDL noting the degradation in this area due to nitrogen loading from on-site wastewater disposal systems. The Madaket Harbor MEP adds significant weight to the existing 2004 criteria to maintain this as a "Needs Area" and needing an off-site wastewater solution. New zoning since 2004 in this area has further reduced potential for unwarranted growth due to introduction of sewer infrastructure

The Madaket Harbor-Long Pond Embayment System as depicted in the MEP Report is a complex estuary with full tidal basins (Madaket Harbor, Hither Creek) connected via Madaket Ditch to the brackish waters of Long Pond that is influenced greatly by wetlands. Madaket Harbor is approximately 746 acres, semicircular in shape, open to Nantucket Sound on its western edge, and open to the Atlantic on its southwest corner via a cut between Smith's

Point and Tuckernuck. The Harbor is a relatively shallow water body, 4-5 feet deep, with a deeper channel (6-9ft.) running east and north to the coastline of the Sound. There are a few deeper channels that pre date Hurricane Esther (1961), but much of the harbor has filled in because of the opening that was created by this storm. This condition existed until Hurricane Gloria (1985), which enabled a closure of the gap to Smith's Point. via drifting sand bars. Because the southwest edge is open, circulation is high (flushing every 3 days), and water quality is good. Epiphytic, and macro algae are limited in presence and density, and eel grass beds are healthy. Madaket Harbor and Long Pond make up a unique ecosystem encompassing approximately 9 square miles. These two systems are hydrologically connected via Hither Creek and the Madaket Ditch. Long Pond is somewhat isolated from the whole system, and has been evaluated as having separate water quality issues. It is relatively narrow and winding with depths of 4-6 feet with no deep basins.

Water quality results from 2010 to present show Hither Creek, Long Pond and North Head of Long Pond as not meeting water quality standards. Madaket Harbor, which is an open marine basin, is not degraded as the other water resources in the area are due to its high flushing component. The Clean Water Act and TMDL processes that followed the MEP Report mandate that the Town develop and implement solutions for restoration of these water resources. The MEP included the development of a target nitrogen load to determine the amount of total nitrogen mass loading reduction required for system restoration. This included reducing the nitrogen load from the landfill, which is an on-going process. In addition, a reduction of septic loading, 100 percent in the Hither Creek Watershed, resulted in a 72 percent reduction in the entire Watershed.

The overall plan to meet the water quality standards is to continue with the landfill mining where water quality testing is showing potential improvement. The 2012 Annual Water Quality results stated that Long Pond showed significantly lower total nitrogen levels, 40 percent, in 2012 versus results shown in 2010. This trend is being further evaluated in the 2013 Annual Water Quality Program to determine whether it is as a direct result of the landfill mining and can be credited as such. In addition, the service area as defined in Figure 1-1 is proposed to be sewerred, which is what the 2004 CWMP showed. The main difference in this Needs Area between 2004 and current is that the area included is defined up to and not crossing over Millie's Bridge.

The Needs Area encompasses approximately 342 acres, of which 222 are developed. There are 572 total parcels, with 381 developed. Out of the total 572 parcels, 120 are municipal and/or conservation parcels and 71 are undeveloped with only 17 of these potentially developable. With few available developable parcels, sewerreding this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 96 percent comprised of Riverhead Sandy Loam, Berryland and Medisaprists. These soils are detailed, by the United States Department of Agriculture Soils Conservation Service, as constrained since they percolate very fast and do not afford time in the soil layers to cleanse before discharging into groundwater resulting in fast travel times into the surrounding water resources. Also over 30 percent of soils in this Needs Area are associated with severe groundwater limitation. Properties of this soil association are highly permeable , depth to seasonal high groundwater and susceptibility to flooding. Riverhead Sandy Loams do not adequately filter the effluent, which leads to groundwater contamination it is a moderately rapid permeable soil and does not provide sufficient filtering of effluent, The other predominant soil associations in this Needs Area are Pawtucket Mucky Peats and Berryland, which are both plagued as very wet soils and not conducive to septic tank absorption fields.

There are approximately 110 acres out of the total 342 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. The majority of this Needs Area is serviced with private water, thus posing additional threat from inadequately operating on-site wastewater disposal systems. Over 53 percent of the area's systems' are located on lots less than or equal to ½ acres and over 55 percent were built before 1978 (Creation of Title 5).

Based on qualifying criteria from the 2004 CWMP, together with the results of nitrogen loading documented in the Madaket Harbor/Long Pond MEP, Madaket Needs Area qualifies as an area needing an off-site wastewater disposal solution in this CWMP Update.

2.14.1.2 Warrens Landing Needs Area

The Warrens Landing Needs Area was evaluated in the 2004 CWMP and rated within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to Madaket Harbor, Hither Creek, Long Pond and other water resources in this geographical area since then. A major change is the completed and approved Madaket Harbor/Long Pond MEP Report and subsequent Draft TMDL noting the degradation in this area due to nitrogen loading from on-site wastewater disposal systems. The Madaket Harbor MEP adds significant weight to the existing 2004 criteria to maintain this as a "Needs Area" and needing an off-site wastewater solution.

The Madaket Harbor-Long Pond Embayment System as depicted in the MEP Report is a complex estuary with full tidal basins (Madaket Harbor, Hither Creek) connected via Madaket Ditch to the brackish waters of Long Pond that is influenced greatly by wetlands.

Warren's Landing is part of the overall Madaket Watershed. According to the Town's 1990 Water Resources Plan Report, the groundwater in Warren's Landing flows directly towards Long Pond and Madaket Ditch, which are both impacted with nutrient degradation per the MEP Report.

The Warren's Landing Needs Area is north of the Madaket Needs Area just east of Long Pond and north of Madaket Ditch in the Madaket Harbor Watershed. Madaket Harbor is approximately 746 acres, semicircular in shape, open to Nantucket Sound on its western edge, and open to the Atlantic on its southwest corner via a cut between Smith's Point and Tuckernuck. The Harbor is relatively a shallow water body, 4-5 feet deep, with a deeper channel (6-9ft.) running east and north to the coastline of the Sound. There are a few deeper channels that pre date Hurricane Esther (1961), but much of the harbor has filled in as a result of the opening that was created by this storm. This condition existed until Hurricane Gloria (1985), which enabled a closure of the gap to Smith's Point. via drifting sand bars. Because the southwest edge is open, circulation is high (flushing every 3 days), and water quality is good. Epiphytic, and macro algae are limited in presence and density, and eel grass beds are healthy. Madaket Harbor and Long Pond make up a unique ecosystem encompassing approximately 9 square miles. These two systems are hydrologically connected via Hither Creek and the Madaket Ditch. Long Pond is somewhat isolated from the whole system, and has been evaluated as having separate water quality issues. It is relatively narrow and winding with depths of 4-6 feet with no deep basins.

Water quality results from 2010 to present show Hither Creek, Long Pond and North Head of Long Pond as not meeting water quality standards. Madaket Harbor, which is an open marine basin, is not degraded as the other water resources in the area are due to its high flushing component. The Clean Water Act and TMDL processes that followed the MEP Report mandate that the Town develop and implement solutions for restoration of these water resources. The MEP included the development of a target nitrogen load to determine the amount of total nitrogen mass loading reduction required for system restoration. This included reducing the nitrogen load from the landfill, which is an on-going process. In addition, a reduction of septic loading, 100 percent in the Hither Creek Watershed, resulted in a 72 percent reduction in the entire Watershed.

The overall plan to meet the water quality standards is to continue with the landfill mining where water quality testing is showing potential improvement. The 2012 Annual Water Quality results stated that Long Pond showed significantly lower total nitrogen levels, 40 percent, in 2012 versus results shown in 2010. This trend is being further evaluated in the 2013 Annual Water Quality Program to determine whether it is as a direct result of the landfill mining and can be credited as such. In addition, the service area as defined in Figure 1-1 is proposed to be sewerred, which is what the 2004 CWMP showed. The main difference in this Needs Area between 2004 and current is that the area included is defined up to and not crossing over Millie's Bridge.

Data from 2004 details this Needs Area encompasses approximately 49 acres, of which 26 are developed. There are 99 total parcels, with 68 developed. There are 19 undeveloped parcels of which 8 are developable. With few available developable parcels, sewerage this Needs Area does not promote any unwanted sprawl. New zoning since 2004 in this area has further reduced potential for unwarranted growth due to introduction of sewer infrastructure. The Needs Area is plagued with severe soils, approximately 100 percent Evesboro Sands that are detailed by the United States Department of Agriculture Soils Conservation Service as constrained as they percolate very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. Properties of this soil association are highly permeable, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination.

There are approximately 10 acres out of the total 49 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. Over 91 percent of the area's systems' are located on lots less than or equal to ½ acre. Less than one percent of properties were built before 1978. The small lot sizes and existing developed parcels contribute to density of systems with approximately 68 systems greater than 2 per acre.

Based on qualifying criteria from the 2004 CWMP, together with the results of nitrogen loading documented in the Madaket Harbor/Long Pond MEP, Warren's Landing Needs Area qualifies as an area needing an off-site wastewater disposal solution in this CWMP Update.

2.14.1.3 Somerset Needs Area

The Somerset Needs Area was evaluated in the 2004 CWMP and rated within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The Needs Area does not have significant water resources within its boundaries with degradation issues and there is no MEP Report supporting additional data. The area qualifies as a Need based on the 2004 CWMP data.

The Somerset Needs Area immediately abuts the Town sewer District to the southwest. The geographic area is a predominantly residential area, with small, dense lot sizes.

The Needs Area encompasses approximately 196 acres, of which 181 are developed. There are 243 total parcels, with 209 developed. There are 31 undeveloped residential parcels, with 30 potentially developable. There are 18 municipal/conservation parcels within this Needs Area. With few available developable parcels, sewerage this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 84 percent Evesboro Sands that are detailed by the United States Department of Agriculture Soils

Conservation Service as constrained as they percolate very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. The other predominant soil associations in this Needs Area are Riverhead and Berryland Variant soils with qualities posing severity for on-site wastewater systems highly permeable, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination

There are approximately 7 acres out of the total 151 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. The area is serviced by municipal water. Over 67 percent of the area's systems' are located on lots less than or equal to ½ acres and approximately 7 percent were built before 1978 (Creation of Title 5).

Based on qualifying criteria from the 2004 CWMP, Somerset Needs Area continues to qualify as an area needing an off-site wastewater disposal solution in this 2013 CWMP Update.

2.14.1.4 Monomoy Needs Area

The Monomoy Needs Area was evaluated in the 2004 CWMP and rated within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to the Nantucket and Polpis Harbors since then. Monomoy Needs Area is fully within the Nantucket Harbor Watershed and included in the Town's Annual Water Quality Testing with records of testing/sampling results from 2005 to present. This is one significant change since the 2004 CWMP, as water quality testing and results were not available at that time. Since 2004, the Nantucket Harbor MEP Report has been completed and two TMDLs have been issued by MassDEP, one in Nantucket Harbor and another in Polpis Harbor.

The Monomoy Needs Area immediately abuts Nantucket Harbor in the Town Basin. The Town Sewer District has been extended into the Needs Area as delineated in 2004, thus new boundaries for this CWMP Update were drawn. The upper portion of the 2004 area was cut off at Gardner Road and this is where the Shimmo Needs Area now begins. The Monomoy and Shimmo Needs Areas differ slightly from the 2004 Report's maps. The new delineations were based on recommendations from Town officials, marine and costal resources, Natural Resources and Board of Health that have historically worked on the Project. The new delineations more accurately capture Monomoy with smaller, denser lots than Shimmo, which has larger lot sizes. These two Needs Areas have been the subjects of model run scenarios completed for the Town by SMAST in order to arrive at solutions to meet the TMDLs in the overall watershed. Refer to the previous section for additional information on the model runs scenarios completed as part of the MEP.

The Needs Area encompasses approximately 391 acres, of which 303 are developed. There are 272 total parcels, with 219 developed. There are 35 undeveloped parcels of which 25 are residentially developable in the future. There are also 13 municipal/conservation parcels within this Needs Area. With few available developable parcels, sewerage this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 90 percent Evesboro Sands that are detailed by the United States Department of Agriculture Soils Conservation Service as constrained as they percolate very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. Properties of this soil association are highly permeable, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination. The other predominant soil association in this Needs Area is Riverhead Sandy Loam, which is a moderately rapid permeable soil and does not provide sufficient filtering of effluent.

There are approximately 44 acres out of the total 391 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. The majority of this Needs Area is serviced with private water, thus posing additional threat from inadequately operating on-site wastewater disposal systems. Approximately 9 percent of the area's systems' are located on lots less than or equal to ½ acres and over 35 percent were built before 1978 (Creation of Title 5).

Based on qualifying criteria from the 2004 CWMP, together with the results of nitrogen loading documented in the Nantucket Harbor MEP, Monomoy Needs Area qualifies as an area needing an off-site wastewater disposal solution in this 2013 CWMP Update.

2.14.1.5 Shimmo Needs Area

The Shimmo Needs Area was evaluated in the 2004 CWMP and rated within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to the Nantucket and Polpis Harbors since then. Monomoy Needs Area is fully within the Nantucket Harbor Watershed and included in the Town's Annual Water Quality Testing with records of testing/sampling results from 2005 to present. This is one significant change since the 2004 CWMP, as water quality testing and results were not available

at that time. Since 2004, the Nantucket Harbor MEP Report has been completed and two TMDLs have been issued by MassDEP, one in Nantucket Harbor and another in Polpis Harbor.

The Shimmo Needs Area immediately abuts Nantucket Harbor north of Monomoy and south of Polpis Harbor. The lower portion of the 2004 area was amended to start at Gardner Road and this is where the Shimmo Needs Area now begins. The Monomoy and Shimmo Needs Areas differ slightly from the 2004 Report's maps. The new delineations were based on recommendations from Town officials, marine and coastal resources, Natural Resources and Board of Health that have historically worked on the Project. The new delineations more accurately capture Monomoy with smaller, denser lots than Shimmo, which has larger lot sizes. These two Needs Areas have been the subjects of model run scenarios completed for the Town by SMAST in order to arrive at solutions to meet the TMDLs in the overall watershed. Refer to the previous section for additional information on the model runs scenarios completed as part of the MEP.

The Needs Area encompasses approximately 702 acres, of which 327 are developed. There are 203 total parcels, with 106 developed. There are 27 undeveloped parcels of which 14 are potentially developable. There are over 70 municipal/conservation parcels within this Needs Area. With few available developable parcels, sewerage this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 84 percent Evesboro Sands/Plymouth-Evesboro series that are detailed by the United States Department of Agriculture Soils Conservation Service as constrained as they percolate very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. Properties of this soil association are highly permeable, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination. The other predominant soil association in this Needs Area is Pawtucket Muck and Berryland, which are very wet, mucky soils and not conducive to soil absorption fields.

There are approximately 175 acres out of the total 702 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. The majority of this Needs Area is serviced with private water, thus posing additional threat from inadequately operating on-site wastewater disposal systems. Approximately 3 percent of the area's systems' are located on lots less than or equal to ½ acres and 17 percent were built before 1978 (Creation of Title 5).

Based on qualifying criteria from the 2004 CWMP, together with the results of nitrogen loading documented in the Nantucket Harbor MEP, Shimmo Needs Area qualifies as an area needing an off-site wastewater disposal solution in this CWMP Update.

2.14.1.6 Hummock Pond North Study Area

The Hummock Pond North Needs Area was not evaluated separately in the 2004 CWMP - this is a new addition to the CWMP Update based on the Hummock Pond MEP, which was started in spring of 2013 with and completed in early 2014 with results now in draft form. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to the Pond since then, specifically Head of Hummock. Hummock Pond was part of the original 89 embayments planned for study in the MEP, but was eliminated during the program due to budgetary constraints. With years of results in the Town's Annual Water Quality Testing Program showing severe degradation, the Town pursued the MEP with supplemental funds raised locally in order to get the study completed. The Town received the Draft Report in January 2014, showing results of 81 percent degradation due to wastewater.

Since 2004, the Town has extended the Town Sewer District into portions of this Needs Area, which touches the northern limits of the Hummock Pond Watershed as delineated and approved by the Town. Refer to Figure 2-X for a map of this Needs Area.

The Hummock Pond North Needs Area immediately abuts the Head of Hummock Pond, which is severely degraded as detailed in the Hummock Pond MEP. Head of Hummock is detailed as supporting severely degraded habitat and the focus of groundwater discharge to this portion of the Watershed and well beyond the threshold N level as established for this Watershed.

The Needs Area encompasses approximately 962 acres, of which 426 are developed. There are 374 total parcels, with 205 developed. There are 81 undeveloped parcels with 66 having potential for future development. There are over 44 municipal/conservation parcels located within this needs Area. With few available developable parcels, sewerage this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 76 percent Evesboro Sands that are detailed by the United States Department of Agriculture Soils Conservation Service as constrained as they percolate very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. Properties of this soil association are highly permeable, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination. The other predominant soil association in this Needs Area is Berryland and Medisapristis, which are moderately rapid permeable, poorly drained soils and does not provide sufficient filtering of effluent and have high water tables.

There are approximately 103 acres out of the total 962 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. Over 39 percent of the area's systems' are located on lots less than or equal to ½ acres and over 25 percent were built before 1978 (Creation of Title 5).

Based on current qualifying criteria, Hummock Pond North Needs Area qualifies as an area needing an off-site wastewater disposal solution in this CWMP Update.

2.14.1.7 Hummock Pond South Needs Area

The Hummock Pond South Needs Area was evaluated in the 2004 CWMP (was the Cisco Needs Area in 2004) and did not rate within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to Hummock Pond since then. The Hummock Pond South Needs Area immediately abuts the Hummock Pond's eastern shoreline, which shows a gradient of degradation based on the Pond areas. The upper level of the Pond abutting the Head of Hummock is severely degraded, the middle portion is moderately degraded, while the lower levels of the Pond that immediately abut the shoreline show degrading conditions, but not as significant as other portions of the Pond.

The Needs Area encompasses approximately 721 acres, of which 328 are developed. There are 358 total parcels, with 282 developed. There are 41 undeveloped parcels with 21 having the potential for future development. There are over 14 parcels either municipal, conservation or agricultural. With few available developable parcels, sewerage this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 80 percent Evesboro Sands that are detailed by the United States Department of Agriculture Soils Conservation Service as constrained as they percolate very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. Properties of this soil association are highly permeable, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination. The other predominant soil associations in this Needs Area are Riverhead-Nantucket Complex, which is a moderately extremely slow permeable soil and Berryland, which does not provide sufficient filtering of effluent.

There are approximately 56 acres out of the total 721 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. The majority of this Needs Area is serviced with private water, thus posing additional threat from inadequately operating on-site wastewater disposal systems.

Over 24 percent of the area's systems' are located on lots less than or equal to ½ acres and over 32 percent were built before 1978 (Creation of Title 5).

Based on current qualifying criteria, Hummock Pond South Needs Area qualifies as an area needing an off-site wastewater disposal solution in this 2013 CWMP Update.

2.14.1.8 Miacomet Needs Area

The Miacomet Needs Area was evaluated in the 2004 CWMP and did not rate within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to the Pond since then. While Miacomet Pond is not part of the Massachusetts Estuaries Program (MEP) Studies as it is a freshwater body, the Pond does have a delineated watershed from the 1990 Water Resources Protection Plan detailing the contributing areas to the watershed. Miacomet is included in the Town's Annual Water Quality Testing with records of testing/sampling results from 2005 to present. This is one significant change since the 2004 CWMP, as water quality testing and results were not available at that time. In addition, the Pond has been subject to severe flooding issues during storm events and the area generally is plagued with severe soil and groundwater conditions. As of this Report writing, the Town is undertaking a major plan to evaluate Miacomet Pond and the flooding and degradation issues that it is experiencing.

Also since 2004, the Town has extended the Town Sewer District into portions of the 2004 Miacomet Pond Study Area, with this 2013 Area delineation being the remaining areas from 2004 that have not been sewered. This updated delineation includes the major land area immediately abutting the Pond.

The Miacomet Needs Area immediately abuts Miacomet Pond to the west. According to the Town's Annual Water Quality Testing records from 2005 to present, Miacomet Pond is a closed coastal salt pond that is seldom (once in the past ten years) opened to the ocean to flush out nutrients and organic matter on the ebb tide and receive saline waters on the flood tide. The present non-tidal state and watershed nutrient inputs has resulted in a decline in nutrient related water quality throughout the pond, with poor water quality conditions the present norm. All of the water quality results show a consistency with a nutrient impaired basin. However, if the freshening of this basin continues, it may come into a new equilibrium as a purely freshwater system and will need to be reassessed as such. However, it will be difficult for Miacomet Pond to maintain itself as a purely freshwater system as storm overwash and rising sea level will tend to periodically cause seawater intrusion into its lower basin.

In reviewing the water quality results from 2010 to present, the nutrient impairment from nitrogen and phosphorus appear to be severe in the upper portions of the Pond (Station 3), middle portions of the Pond (Station 1) and fair in the lower reaches (Station 2) abutting the ocean. As is discussed above, this is not a water resource that can be opened to the open ocean for flushing due to its freshwater state, so solutions need to be arrived at looking at land uses in the watershed-mainly wastewater, fertilizer and stormwater.

The Needs Area encompasses approximately 295 acres, of which 181 are developed. There are 124 total parcels, with 102 developed. With few available developable parcels, sewerage this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 84 percent Evesboro Sands that are detailed by the United States Department of Agriculture Soils Conservation Service as constrained as they percolate very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. Properties of this soil association are highly permeable, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination. The other predominant soil association in this Needs Area is Riverhead Sandy Loam, which is a moderately rapid permeable soil and does not provide sufficient filtering of effluent.

There are approximately 40 acres out of the total 295 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. The majority of this Needs Area is serviced with private water, thus posing additional threat from inadequately operating on-site wastewater disposal systems. Over 25 percent of the area's systems' are located on lots less than or equal to ½ acres and over 28 percent were built before 1978 (Creation of Title 5).

Based on qualifying criteria from the 2004 CWMP, Miacomet Needs Area qualifies as an area needing an off-site wastewater disposal solution in this CWMP Update.

2.14.1.9 PLUS Needs Area

These parcels are various areas either within or directly abutting the Town Sewer District that for one reason or another were left out of the Sewer District in error. Most are sandwiched within the existing sewer or are either at the beginning or end of sewer streets. A complete review with the Town's Planning Director and Director of Public Works identified and approved these parcels to be included in the sewer plan moving forward. Most either immediately abut infrastructure or are in close proximity of collection system components.

2.14.2 Sewering Priorities

Based on the existing supporting data, this CWMP Update recommends the following sewer priorities:

Needs Area	Priority Reasoning
Somerset	This Needs Area needs to be completed first due to the proposed route of bringing the highest Needs Areas priorities-Madaket and Warrens Landing- to Surfside WWTF. Hummock Pond North and South Needs Areas are also proposed to flow through Somerset to the Surfside WWTF.
Madaket and Warren's Landing Needs Areas	Established TMDL, Large number of documented Title 5 Technical failures (inability to meet groundwater separation) contributing to nitrogen load through groundwater resources and MEP Model detailing removal of on-site wastewater meeting TMDL. Current ACO Program area with Board of Health.
Monomoy	Established TMDL and MEP Model detailing removal of on-site wastewater meeting TMDL.
Shimmo	Established TMDL and MEP Model detailing removal of on-site wastewater meeting TMDL. Priority based on Adaptive Management Plan and need for N reductions in Harbor.
Hummock Pond North	Pending TMDL and MEP Model detailing removal of on-site wastewater meeting TMDL. May make sense to sewer earlier in process as Madaket and Warrens Landing will traverse through the area towards Somerset

	on way to Surfside WWTF.
Hummock Pond South	Pending TMDL and MEP Model detailing removal of on-site wastewater meeting TMDL. This Needs Area to be prioritized based on Adaptive Management Planning with breach and removal of Head of Hummock from main body of Pond.
Miacomet	Annual Water Quality Testing results depicting degradation due to nutrient load from on-site systems.
<i>Town Sewer District Infill and PLUS Parcels</i>	<i>These areas can be serviced at any time as infrastructure exists within close proximity. It is recommended that these parcels be mandated to connect under Local Regulation 69.00 in order to reduce nitrogen loading in Nantucket Harbor Watershed.</i>

The 2004 Study Areas that have been re-evaluated based on the results of the MEP Reports include:

2004 Study Area	MEP Area
Polpis	Nantucket Harbor/Polpis Harbor
Pocomo	Nantucket Harbor/Polpis Harbor
Wauwinet	Nantucket Harbor/Polpis Harbor
Quidnet	Sesachacha Pond

These 2004 Study Areas (Polpis, Pocomo, Wauwinet and Quidnet) were re-evaluated in this CWMP Update and while not considered as areas needing an off-site wastewater solution in 2004 or 2013, they abut Nantucket Harbor in various locations and contribute in various manners to the nitrogen loading documented in the MEP Report. Based on additional studies completed by SMAST on scenarios in the Harbors to reduce nitrogen loading to meet established TMDLS, sewerage these areas did not serve to contribute to the reduction effort. It has been determined that a more cost effective approach to the Nitrogen reduction be had through other contributors-fertilizer, stormwater and future build out. These efforts will supplement the structured solutions being planned such as sewerage, raising the jetties to afford a deeper tidal exchange and dredging. This CWMP Update is making recommendations to limit additional, future nitrogen loading with current and build-out conditions within the Adaptive Management Plan contained herein.

These Study Areas are recommended for oversight under the Town's Septage Management Plan. As part of the overall Adaptive Management Plan include herein, this Report is also recommends consideration for future management utilizing Innovative / Alternative systems due to each area's geographic locations within Nitrogen-sensitive embayments as detailed in the MEP Reports. I/A systems will afford a higher nutrient reduction, up to 50 percent of TN, than a conventional Title 5 system is able to do. Each Study Area is delineated in this CWMP Update on Figure 2-21, which follows this section.

The Town is working with Barnstable County on a cooperative program to maintain all Innovative and Alternative (I/A) Wastewater Systems. This is a win/win for both entities as Nantucket will maintain jurisdiction over the approval of systems, but Barnstable County Department of Health will become the operation and maintenance jurisdiction. Barnstable now manages all I/A systems Cape-wide with a comprehensive database that tracks all systems, their repair records, as well as their performance standards in nutrient reduction capabilities. Adding Nantucket's I/A systems to the data set will afford a wider and more comprehensive record set for use by all. Barnstable is currently updating its database hardware and once completed, Nantucket will join forces with this cooperative program.

The Town, under the auspices of the local Septage Management Plan, as well as Barnstable County, will be able to monitor all on-site wastewater disposal systems, both conventional and I/A in order to evaluate future needs based on water quality results. This will aid the Town in determining the overall need to develop a new Local Regulation prescribing the use of Innovative / Alternative systems in Nitrogen-sensitive areas as so defined in the CWMP Update.

2.14.2.1 Polpis

The Polpis Study Area was evaluated in the 2004 CWMP and recommended to maintain on-site wastewater disposal under the Town's Septage Management Plan unless the MEP report being completed at the time of the 2004 Report recommended otherwise (The 2004 CMP was completed before the MEP Study was finished). This CWMP Update maintains this determination with a few exceptions based on the results of the Nantucket and Polpis Harbors MEP. Because Polpis Harbor is included as part of the overall Nantucket Harbor MEP with two TMDLs established in the Harbor areas (Nantucket Harbor and Polpis Harbor) and with a threshold water quality to meet, it is suggested that future build out in this geographic area, defined as the Polpis Study Area in the CWMP Update, as well as future repairs and/or upgrades to current Title 5 systems be endorsed with an I/A system in order to reduce Nitrogen loading to the Watershed. The Polpis Study Area is a high priority in terms of requiring attention due its location in proximity to and potential impact to not only Polpis Harbor, but also Nantucket Harbor from the existing conventional on-site wastewater disposal systems.

2.14.2.2 Pocomo

The Pocomo Study Area was evaluated in the 2004 CWMP and recommended to maintain on-site wastewater disposal under the Town's Septage Management Plan unless the MEP report being completed at the time of the 2004 Report recommended otherwise (The 2004 CMP was completed before the MEP Study was finished). This CWMP Update maintains this determination with a few exceptions based on the results of the Nantucket and Polpis Harbors MEP. Due to two TMDLs established in this geographic area as a result of the completed Nantucket and Polpis Harbor MEP and the location of this Study Area in the upper reaches of the Harbor, it is necessary to look towards future build out conditions with respect to nutrient loading. There are two TMDLs established in this area, one in Nantucket Harbor and the second in Polpis Harbor. In order to meet and maintain the established threshold water quality, it is suggested that future build out in this geographic area, defined and delineated as the Polpis Study Area in the CWMP Update, as well as future repairs and/or upgrades to current Title 5 systems be endorsed based on Adaptive Management Planning results utilizing I/A systems in order to reduce Nitrogen loading to the Watershed. The Pocomo Study Area is a high priority in terms of requiring attention due its location in proximity to and potential impact to not only Polpis Harbor, but also Nantucket Harbor from the existing conventional on-site wastewater disposal systems.

2.14.2.3 Wauwinet

The Wauwinet Study Area was evaluated in the 2004 CWMP and recommended to maintain on-site wastewater disposal under the Town's Septage Management Plan unless the MEP report being completed at the time of the 2004 Report recommended otherwise (The 2004 CMP was completed before the MEP Study was finished). This CWMP Update maintains this determination with a few exceptions based on the results of the Nantucket and Polpis

Harbors MEP. Due to two TMDLs established in this geographic area as a result of the completed Nantucket and Polpis Harbor MEP and the location of this Study area in the upper reaches of the Harbor, it is necessary to look towards future build out conditions with respect to limiting additional nutrient loading. There are two TMDLs established in this area, one in Nantucket Harbor and the second in Polpis Harbor. In order to meet and maintain the established threshold water quality, it is suggested that future build out in this geographic area, defined and delineated as the Polpis Study Area in the CWMP Update, as well as future repairs and/or upgrades to current Title 5 systems, be endorsed based on Adaptive Management Planning results utilizing I/A systems in order to reduce Nitrogen loading to the Watershed. The Wauwinet Study Area is a high priority in terms of requiring attention due its location in proximity to and potential impact to not only Polpis Harbor, but also Nantucket Harbor from the existing conventional on-site wastewater disposal systems.

2.14.2.4 Quidnet

The Quidnet Study Area was evaluated in the 2004 CWMP and recommended to maintain on-site wastewater disposal under the Town's Septage Management Plan unless the MEP report being completed at the time of the 2004 Report recommended otherwise (The 2004 CMP was completed before the MEP Study was finished). This CWMP Update maintains this determination with a few exceptions based on the results of the Sesachacha Pond MEP. Due to the threshold TMDLs established in this geographic area as a result of the completed MEP and the location of this Study Area in the overall Pond watershed, it is necessary to look towards future build out conditions with respect to limiting additional nutrient loading. It is recommended that the Town monitor the future results of the bi-annual breaches of the Pond, which are currently meeting the established threshold in the Pond. If at some point in the future it is, determined additional build-out is occurring in the Watershed, water quality monitoring should determine the need for additional nutrient reduction utilizing I/A systems. With this in mind and in order to meet and maintain the threshold water quality, it is suggested that future build out in this geographic area defined and delineated as the Quidnet Study Area in the CWMP Update, as well as future repairs and/or upgrades to current Title 5 systems be endorsed with an I/A system in order to reduce Nitrogen loading to the Watershed should the need arise.

Figure 2-20 details the Final recommended Plan for both Needs and Study Areas. Table 2-12 details the updated Matrix for areas not noted as Needs Areas in the 2004 CWMP/EIR, but now meeting criteria as a Needs Area.

**COMPREHENSIVE WATER RESOURCE MANAGEMENT PLAN UPDATE
TOWN OF NANTUCKET, MASSACHUSETTS**

RATING CRITERIA

Table 2-12

CRITERIA NAME	DESCRIPTION	Hummock Pond North		Hummock Pond South		Miacomet	
		1 Number	Points	2 Number	Points	3 Number	Points
CRITERIA POINTS	Total Number of Lots	374		358		124	
Actual Failure	Total Number of Developed Lots	205		282		102	
Imminent Failure	Total Number of Unsewered Developed Lots	205		282		102	
High Likelihood of Imminent Failure	Number of Resales since 3/31/95	146		218		81	
Health / Water Quality Issue	Number of Acres per Study Area	962		721		295	
	Number of Net Acres for Developed Lots	426		328		181	
	No. of Acres of Severe Groundwater Limitation	103		56		40	
	Number of Acres of Severe Soil Limitation	575		324		326	
Actual Failure	2004 to July 2012	5	20	5	20	4	16
			0		0		0
		5	20	5	20	4	16
	Adjusted Total based on Developed/Unsewered Developed Ratio		20		20		16
Imminent Failure	System within Zone I Aquifer Recharge Area	0	0	0	0	0	0
	System within 50 feet of Private Drinking Water Well	120	360	197	591	85	255
	System within 100 feet of Public Drinking Water Supply	0	0	0	0	0	0
	Developed Lots with Less than 10,000 sq. ft. of area per Bedroom ¹	0	0	0	0	0	0
		120	360	197	591	85	255
High Likelihood of Imminent Failure	Lots with Severe Groundwater Limitation	22	44	22	44	14	28
	Systems Built before 1978 (Title 5)	51	102	91	182	51	102
	Lot Size less than or equal to 1/2 acre	79	158	69	138	45	90
	Lots with Severe Soil Limitation	123	246	127	254	113	226
	Pumpouts Greater than 2 times per year	0	0	0	0	0	0
		275	550	309	618	223	446
Health / Water Quality Issue	Density of Systems Greater Than 2 per Acre ¹	0	0	0	0	0	0
	System within 100 feet of Surface Water Body, Wetlands or Streams	38	38	18	18	6	6
	System located within 100 Year Flood Plain	1	1	16	16	0	0
	System within Zone II Aquifer Recharge Area	4	4	0	0	0	0
	Needs Area Within MEP	1		1		0	
	TMDL Pending	1	1	1	1	0	0
	Systems within Approved Harbor Watershed Delineation	205		31	31	0	0
		250	250	67	67	6	6
	Total Criteria Points for Study Area		1,180		1,296		723
	Rating Criteria Points Per Developed Lot		5.76		4.60		7.09
	RECOMMENDED AS A NEED AREA		YES		YES		YES
	(Conventional Title 5 System Not Feasible for Majority of Study Area)						

¹ Incomplete data in Town data to calculate

2.14.3 Wastewater Flow and Loads Update

In order to update the assessment of the Town’s wastewater disposal needs and recommend appropriate wastewater disposal solutions for each Need Area and Study Area, W&C estimated the wastewater flows and waste loads that would be generated in the Areas. A key component of these updates was reflecting the revised zoning and extent of the Town Sewer Districts.

A defined methodology was utilized to calculate these estimates as described below.

W&C revised the flows and loads for the Need and Study Areas by updating counts of developed and undeveloped residential and commercial parcels in each Area, and verifying land use, zoning, and sewer status for each parcel using the Town’s Assessor’s Database, State Land Use Codes, and the Town’s Sewer Districts, sewer users, and zoning mapping in GIS.

After these updates were made, we assigned the following rules to parcels:

- All developed single-family residential parcels were assumed to have at least one wastewater connection.
- All developable or potentially developable residential parcels that met zoning were assumed to have at least one wastewater connection.
- We assumed any parcel that meets zoning could have a second dwelling. For example, single-family residential parcels that met zoning were assumed to have two wastewater connections. However, based on discussions with the Town Planner and the fact that approximately only 12% of residences on the island currently have second dwellings, overall to be conservative we assumed only 25% of the second dwellings could be built.
- All developed commercial parcels were assigned a flow based on acreage.
- Developable and potentially developable commercial parcels that met zoning were also assigned a wastewater flow based on acreage.
- Based on discussions with Nantucket Assessor, we assumed all multi-family parcels in the Areas are equal to two residential wastewater connections.

Average Daily Flow estimates for both summer and winter were developed using the above described parcel count methods and applying the unit flows consistent with the previous CWMP work. In the Phase I CWMP, wastewater flows from 1999 at the Surfside Wastewater Treatment Facility were analyzed in conjunction with the number of residential and commercial units connected to the system to estimate unit wastewater flows. Population data were used to determine the average number of people per residential household. Table 2-13 presents the results of this analysis from the Phase I CWMP. These values were used in wastewater flow calculations for this CWMP update.

Table 2-13: Phase I CWMP Wastewater Winter and Summer Wastewater Unit Flows

Season	Average Number of People per Household	Gallons per Capita Per Day	Residential Wastewater Flow (GPD)	Commercial Wastewater Flow (GPD)
Summer (June – September)	4.5	71.1	320	345
Winter (December – March)	2.5	74	185	260

Note that wastewater is typically composed of residential, commercial and industrial sources. As was the case in both the Phase I CWMP and the 2004 CWMP/EIR, industrial sources continue to be absent in Nantucket and therefore to

be representative of current conditions and consistent with these reports, only residential and commercial flows are developed for this update.

Infiltration and inflow (I/I) was estimated assuming 250 gallons per day-inch-mile (gpdim) for new pipe in accordance with MassDEP I/I standards. Infiltration/inflow was not estimated for any low pressure sewer. The length of gravity sewer in Somerset presented in the 2004 CWMP was included in these calculations. The 2004 CWMP identified Madaket and Warrens Landing as being seweraged with 100% low pressure. For the remaining Areas, to determine the total length of sewer, the approximate length of streets within each area was extracted from GIS mapping.

To be consistent with the Phase I CWMP, wastewater loads were calculated by applying industry standard factors from the New England Interstate Water Pollution Control Commission Guides for the Design of Wastewater Treatment Works (TR-16) and from Table 3-15 of Wastewater Engineer Treatment and Reuse, 4th Edition, by Metcalf & Eddy, to the estimated average daily wastewater flows. Table 2-14 presents a summary of the wastewater load factors.

Table 2-14: Wastewater Load Factors

Parameter	Residential (lbs/capita/day)	Commercial/Industrial (mg/L)
BOD	0.22	250
TSS	0.25	300
Total Nitrogen	0.04	40

In the Phase I CWMP, “Peak Hourly Flow” and “Maximum Daily Flow” were estimated using peaking factors from TR-16. However, for this CWMP update, to better represent actual conditions experienced at the WWTF, ratios from existing treatment plant data were utilized to estimate maximum month, maximum day, and peak hourly flows, as well as the maximum month loads. Table 2-15 shows these ratios.

Table 2-15: Wastewater Flow and Load Ratios Based on Existing WWTF Data

Parameter	Ratio
Max Month Flow	1.07
Max Day Flow	1.37
Peak Hourly Flow	2.65
BOD Max Month	1.17
TSS Max Month	1.32
TN Max Month	1.15

Detailed calculations are included in Appendix F and a summary of the wastewater flow and loading estimates are presented in Table 2-16.

Table 2-16: Average Daily Flow and Peak Hour Flow

	Flow (MGD)				BOD ₅ Load (lbs/day)		TSS Load (lbs/day)		Total Nitrogen Load (lbs/day)	
	Average Daily - Summer	Maximum Monthly	Maximum Daily	Peak Hourly	Average Daily	Maximum Monthly	Average Daily	Maximum Monthly	Average Daily	Maximum Monthly
Projected by Study / Need Area										
Madaket	0.16				490		560		90	
Warren's Landing	0.03				100		110		20	
Hummock Pond South	0.07				200		230		40	
Hummock Pond North	0.09				290		330		50	
Somerset	0.10				320		360		60	
Monomoy	0.08				260		300		50	
Shimmo	0.06				190		220		30	
Town	0.59				1,800		2,050		330	
Nantucket PLUS	0.07				230		260		40	
Miacomet	0.07				210		240		40	
Subtotal Projected	1.33	1.42	1.82	3.52	4,090		4,660		750	
Projected Infiltration/Inflow (Future)	0.06	0.06	0.06	0.06						
Total Projected	1.39	1.48	1.88	3.58	4,090	4,790	4,660	6,150	750	860
Existing Conditions at Surfside WWTF	1.53	1.64	2.10	4.06	4,990	5,830	3,490	4,610	530	610
Total Projected and Existing (Future Conditions)	2.9	3.1	4.0	7.7	9,100	10,600	8,200	10,800	1,300	1,500

3. ALTERNATIVES DISCUSSION

3.1 SUMMARY AND UPDATE OF 2004 CWMP ALTERNATIVES

A variety of wastewater alternatives were investigated during the Phase III CWMP/FEIR in 2004 to determine the appropriate wastewater facilities that will meet the needs of Nantucket. The wastewater alternatives that were investigated include:

- (a) the continued use of existing on-site wastewater disposal systems;
- (b) replacement of existing wastewater disposal systems with Title 5 systems;
- (c) replacement of existing wastewater disposal systems with on-site innovative/alternative options;
- (d) replacement of existing wastewater disposal systems with cluster systems consisting of a pressure system and communal subsurface disposal; and
- (e) replacement of existing wastewater disposal systems with a conventional sewer collection system, either:
 - (1) connection into the existing collection system;
 - (2) gravity sewers and pump station,
 - (3) pressure sewers and grinder pumps, or
 - (4) a combination thereof.

Each wastewater alternative was evaluated based on environmental and technical design criteria and on site-specific data such as subsurface conditions, topography, and existing septic system performance. The 2004 CWMP evaluated the environmental, technical design and institutional cost associated with each alternative and recommends the appropriate solution to the wastewater disposal problems for the Town of Nantucket in order to reach a long-term solution to the wastewater needs of the Island. Alternatives evaluated included:

- Repair / Upgrade Existing On-Site Systems
- Upgrade to Conventional Title 5 System
- Decentralized Facilities
- Small Cluster Systems
- Innovative/Alternative systems

Optimizing the performance of the existing on-site wastewater disposal systems is not conducive in many areas on Island due to a number of reasons. The most difficult condition to overcome is subsurface conditions including shallow depth to groundwater and insufficient depth of naturally occurring pervious soil. This is evident in many areas where the groundwater poses issues with meeting current Title 5 standards with a four foot separation, but is further constrained due to the Board of Health's more stringent limits of five to six foot separations. These more stringent separations are necessary to provide additional wastewater time in fast percolating soils before reaching groundwater resources, but are responsible for a great number of "technical" failures of on-site systems. Variances to these limits will only serve to continue to degrade the environment, specifically the water resources/embayment areas, which the recommendations in this Report are attempting to preserve and protect.

Based on historical data, 2004 criteria and the updates within this Report, the following areas have been identified as needing an off-site wastewater solution; 1) Madaket; 2) Warren's Landing; 3) Hummock Pond North; 4) Hummock Pond South; 5) Somerset; 6) Miacomet; 7) Monomoy; 8) Shimmo; and 8) the remainder of parcels within the Town Sewer District currently not sewered.

The remainder of the Town can remain on on-site wastewater disposal systems with specific areas being recommended for on-site Innovative / Alternatives systems. Those areas include 1) Polpis; 2) Pocomo; and 3) Wauwinet due to their being within the Nantucket Harbor watershed, which is identified in the MEP as a Nitrogen Sensitive Area.

A cost comparison of a multitude of wastewater systems was completed by the Barnstable County Wastewater Task Force for Cape Cod that are applicable to Nantucket. A "Comparison of Costs for Wastewater Management Systems Applicable to Cape Cod, Guidance to Cape Cod Towns Undertaking Comprehensive Wastewater Management Planning" is the most up to date resource for capital costs, operation and maintenance costs, equivalent annual costs and costs per pound of nitrogen removed for individual on-lot wastewater systems, cluster systems, satellite systems and new centralized systems. We had multiple discussions with the Director of Barnstable County Health regarding the various alternatives available for wastewater use. Nantucket Board of Health is in regular communication with Barnstable with regards to on-site wastewater items.

The complete report can be accessed on the Cape Cod Water Protection Collaborative website at: <http://www.ccwpc.org/index.php/component/content/article/36-wastewater-reports/78-comparison-of-costs-for-wastewater-management-systems-applicable-to-cape-cod>.

There have been multiple discussions with the Board of Health (BOH) regarding on-site systems and their ability to meet Local Regulations as adopted by the BOH. There are multiple areas where the BOH has determined I/A systems are the recommended alternative due to their ability to meet more stringent requirements than a Title 5 system. For example, an I/A system reduces nitrogen 50 percent more than a standard Title 5 on-site system. Areas where the BOH has mandated use of these systems include areas where depth to groundwater cannot be attained, proximity to water bodies and other various reasons.

The I/A of choice for use by Nantucket BOH has been the Septitech System, which the Board of Health identifies as a system that meets its documented specifications for nutrient reduction and is a system that has a reliable operating and maintenance record. Barnstable County Health Department maintains a database of all I/A systems in use Cape-wide with records of number of systems in use, length of use and records of test results. Nantucket BOH is working with Barnstable for future coordination in Barnstable taking over management of its I/A systems. This will provide benefit to both Barnstable County and Nantucket, with the former having additional data for its database and the latter by turning all management operations of I/A systems over to Barnstable, which alleviates this task from already short staff.

This database can be accessed at <http://www.barnstablecountyhealth.org/>.

3.2 RE-EVALUATION OF WWTF OPTIONS – ELIMINATION OF PROPOSED MADAKET WWTF

One of the major, if not the most noted, recommendations in the 2004 CWMP was the proposal to design and construct a new satellite WWTF located at the former FAA site in Madaket to service the Madaket and Warren's Landing Needs Areas. This proposed recommendation to design and construct a WWTF on the former FAA site on Red Barn Road in Madaket brought a cost that exceeds \$80M in today's dollars, as well as a host of environmental issues to overcome/mitigate with regards to land uses both under the Massachusetts Historical Commission (MHC) and the Natural Heritage and Endangered Species Program (NHESP).

The Town has been working with the General Services Administration (GSA) of the Federal Government since early 2000 regarding the initial decommissioning of the FAA parcel due to new technology and current disposing of the land under the jurisdiction of the GSA. As part of the Town's due diligence, and required under the 2004 Massachusetts Environmental Policy Act (MEPA) Office Certificate No. 12617, intensive surveys for both MHC and NHESP were mandated before the Town could move forward with any planning, design or construction. Under Permit with NHESP, an Inventory was performed between May 14 and September 11, 2011 to complete a habitat assessment on the former FAA parcel. The entire 91.71 acre site was surveyed in this effort. In February 2012, the "FAA Property Habitat Assessment and Rare Plant Species Inventory" Report was finalized and filed with NHESP. Significant habitat was identified and located on the site that presents severe limitations to its use and will require at least a 2 to 1 mitigation if the Town was to move forward with the WWTF planning. Refer to Appendix G for copies of the NHESP information.

Under Permit #3253 from MHC, an Intensive Survey was commenced in summer of 2013 on the 25-acre portion of the 91.71 acre site proposed for the WWTF location. An Archaeological Resources Protection Act Permit was also filed before conducting the Intensive Survey. As part of this process, a permit was required for oversight by a botanist from the NHESP in order to preserve and protect the resources identified in the NHESP Inventory that took place prior to the MHC Survey. The results of the Intensive Survey did not disclose any significant historical and/or archaeological resources on the 25-acre portion. It is important to note that the remaining 66.71 acres were not evaluated and so no determination as to the historical/archaeological relevance can be arrived at in these areas. Refer to Appendix G for MHC data and correspondence.

Based on cost consideration, environmental concerns and overall Island sentiment to building a third WWTF on Island, and after the above due diligence was completed, the Town asked that alternatives be re-evaluated for this geographical area in the CWMP Update. Because the Madaket and Warren's Landing Needs Areas are the subject of the Madaket Harbor/Long Pond MEP with a recommendation to remove wastewater from the Watershed in order to meet the Draft TMDL, a solution for wastewater management is a necessity. The Town requested that a thorough review of the existing Surfside WWTF be completed in order to determine if this was an option for Madaket and Warrens Landing Needs Areas. A Capacity Analysis was initiated at the existing Surfside WWTF to determine first what flows are now being collected, treated and discharged at this location, as well as what future flows and loads could be handled by the WWTF under existing conditions. In addition to the facility capacity analysis, a hydrogeological evaluation was completed in order to determine the capacity for discharge at the 15 existing sand beds that service the Surfside WWTF. It was determined that the Surfside WWTF was designed to handle the additional flow, but the Groundwater Discharge Permit was the limiting factor as it was for 3.5 MGD, which is less than the WWTF design flow.

Discussion was opened with MassDEP as to how the Town could modify the current Surfside Groundwater Discharge Permit SE #1-200 to accommodate all the identified Needs Areas and it was concluded that it was possible based on the Hydrogeological Evaluation completed at the site detailing that the existing beds could handle a higher discharge flow, from 5 gallons per square foot per day to 6 gallons per square foot per day. After multiple meetings with MassDEP and a Technical Memorandum, dated December 2013 detailing the agreed upon plan to modify the existing Groundwater Discharge Permit, the Town filed both BRP WP 11 – Individual Permit Renewal/Modification With Plan Approval and BRP WP 83 – Hydrogeological Evaluation. The Town has received verbal approval to the modification. MassDEP is in the process of reissuing the Groundwater Discharge Permit, which was due to be renewed in 2015. Copies of all correspondence and filings are included in Appendix H.

3.3 SURFSIDE WASTEWATER TREATMENT FACILITY RECOMMENDED IMPROVEMENTS

This section describes the improvements Woodard & Curran is recommending for the Surfside Wastewater Treatment Facility (WWTF). We prepared estimated conceptual level project capital costs for these improvements

and the recommended schedule for these improvements is included in the capital improvement plan section of this report. We have organized the recommended improvements into the following categories:

- Improvements for future capacity needs
- Improvements for reliability
- Improvements for energy efficiency

3.4 IMPROVEMENTS FOR FUTURE CAPACITY

As part of our contract with the Town for Madaket Wastewater Planning, Woodard & Curran performed a capacity evaluation of the Surfside WWTF to determine the feasibility of accepting the projected flows and loads from the Madaket and Warren's Landing Needs Areas. The evaluation included an assessment of existing and projected wastewater flows and loads, an assessment of current WWTF performance, and a determination of required improvements. A detailed description of our capacity analysis is provided in Appendix H.

The findings of our capacity assessment were as follows:

- The future condition is a maximum daily flow of 4.0 million gallons per day (MGD) which includes build out of the existing sewer areas and sewer extension to the needs areas.
- The Surfside WWTF has sufficient capacity to receive wastewater at the future condition provided that minor changes are made to operational practices and additional aeration blower capacity is provided.
- Although the Surfside WWTF has capacity, the future maximum daily flow of 4.0 MGD exceeds the Town's MassDEP Groundwater Discharge Permit limit of 3.5 MGD for daily flow to the groundwater discharge beds. Therefore, expansion of the groundwater discharge capacity or revisions to the groundwater discharge permit are required.
- Expansion of groundwater discharge capacity or revisions to the Groundwater Discharge Permit would be required at the future condition even if Madaket and Warren's Landing wastewater was not treated at the Surfside WWTF.

The recommended improvements to the Surfside WWTF for future capacity include additional aeration blowers and modifications to the nitrate recycle system as follows:

3.4.1 Additional Aeration Blowers

The Surfside WWTF existing aeration system includes three Aerzen positive displacement blowers, each with a design capacity of 950 standard cubic feet per minute. Based on our calculations for oxygen requirements, we determined that the existing aeration tank blowers do not have enough capacity for the future condition, therefore two additional blowers are needed (one to provide the additional capacity required and one to serve as a redundant backup). With this additional blower capacity, there is sufficient capacity for the flow and loads at the future condition.

3.4.2 Modifications to the Nitrate Recycle

During our evaluation, WWTF operations staff expressed concerns with having the ability to denitrify at the future condition because of the anoxic tank volume and because nitrate recycle from the membrane tanks may have a high dissolved oxygen (DO) concentration, which could inhibit denitrification. Our calculations (as well as the original GE Zenon design calculations) and the plant data that we have been provided indicate that these two items would not be a problem. However, there are many variables that can affect the actual results. Therefore, to address this concern, we recommend gathering additional nitrate data and monitoring the results as flows and loads to the Surfside WWTF

increase in the future. We also have prepared a conceptual layout and conceptual cost estimate for improvements to the nitrate recycle system in case future problems are encountered. The improvements include modifying the existing recycle from the membrane tanks with redirection to the aeration tanks and an additional, separate, nitrate recycle from end of the aeration tanks to the anoxic tanks.

3.5 IMPROVEMENTS FOR RELIABILITY

We have identified and recommend several improvements to increase the reliability and long-term effectiveness of operation of the Surfside WWTF. Some of the improvements for reliability were identified and evaluated as part of our contract with the Town for the Alternatives Analysis, Recommendations and Conceptual Opinion of Probable Cost of Proposed Upgrades to the Surfside WWTF and some the improvements were identified through the Surfside WWTF capacity assessment.

3.5.1 Corrosion Control

The Surfside WWTF has experienced severe corrosion of the concrete and metal components at the headworks, and there was concern that corrosion may have been occurring at other locations such as the primary clarifiers. The corrosion is due to the presence of hydrogen sulfide, which is formed upstream in the collection system, particularly in the force mains.

To address this concern, Woodard & Curran engaged a specialty sub-consultant, Bowker & Associates (Bowker), to perform a sampling program, assess the corrosion, identify alternatives for addressing the situation, and provide a recommended solution with opinion of probable construction cost. The Bowker study found severe hydrogen sulfide corrosion at the headworks of the Surfside Wastewater Treatment Facility and recommended an oxygen injection system, installed at the Sea Street Pump Station, for mitigation.

Woodard & Curran reviewed the Bowker Report and agrees with these findings and recommendations. The recommended oxygen injection system has a higher capital cost than the other alternatives, however it has the lowest life-cycle cost because it does not require the purchase of chemicals which are quite costly. A detailed description of the Bowker corrosion control study is provided in the appendices of the full report that is included in Appendix H.

3.5.2 Influent Screening

An influent grinder was installed at the Surfside WWTF during the 2009 upgrade, however due to severe hydrogen sulfide corrosion; the grinder is no longer functional and was removed. To evaluate this issue, a screening analysis was conducted and documented in a memorandum entitled "Enhancements to the Surfside Wastewater Treatment Facility" by AECOM, dated January 9, 2012. The memorandum outlined the importance of MBR system pretreatment, identified pretreatment alternatives, and ultimately recommended the installation of a grinder in the headworks to breakdown influent debris. A copy of this memorandum is included in Appendix H.

The Town was interested in receiving a second opinion regarding the need for membrane pretreatment (screen versus grinder) and contracted Woodard & Curran to provide an Influent Screening Alternatives Assessment. A detailed description of our influent screening alternatives analysis is provided in the full report, which included the following tasks:

- Review existing documentation related to influent screening including design plans, operation and maintenance manuals, plant hydraulics, and the AECOM Memorandum dated January 9, 2012.

- Identify feasible screening alternatives and/or combinations of alternatives suitable for a membrane bioreactor treatment facility with primary clarifiers with the Surfside WWTF specific hydraulic and spatial requirements and operational needs.
- Provide a recommendation of the most desirable screening alternative with consideration given to process, cost, operation and maintenance concerns.
- Provide an opinion of probable cost for the recommended alternative including design, construction, engineering and contingency suitable for securing funding.

After analysis of multiple alternatives, we recommend the installation of a new headworks consisting of two 6-mm screens, two 2-mm band screens, and two wash presses for screenings handling. We also recommend that a new vortex grit removal system is incorporated into the new headworks to address issues with existing corrosion and grit equipment at the existing aerated grit chamber. We also recommend that this equipment is housed within a cedar shingled building.

3.5.3 Vector Truck Unloading

Currently, the vector truck discharges directly into the primary settling tanks (PST). This means of discharging is not ideal because the contents are not screened and bypass the grit removal processes, likely disrupting settling in the PSTs. Woodard & Curran analyzed installing a vector unloading station at the Surfside WWTF. Multiple locations and options were considered for the vector discharge station, including the recommendations described in the previous memorandum entitled “Enhancements to the Surfside Wastewater Treatment Facility” by AECOM, dated January 9, 2012.

Based on our evaluation we recommend the installation of a concrete ramp adjacent to the proposed new headworks. Catch basins would be installed at the bottom of the ramp. The vector truck would back to the edge of the concrete ramp and discharge its contents at the bottom of the ramp. The catch basins would allow for the liquid to discharge through to the headworks and simultaneously prevent debris and objects from passing through. The screened contents would then be removed with a loader truck and discharged into a dump truck, which would be hauled to a disposal site.

3.5.4 Aeration Tank Instrumentation

Surfside operations staff reported that the dissolved oxygen control instrumentation is not reliable and cannot be utilized for aeration tank blower control as was the original design intent. Replacement of these instruments with more reliable DO and oxidation reduction potential (ORP) measurement capability would enhance the ability to operate the WWTF at the future condition.

3.5.5 Primary Sludge Pump Replacement

There are three existing primary sludge pumps that were installed during the 1992 upgrades. Given the age of these pumps we anticipate that these pumps will need to be replaced within the 20-year planning period of this Report.

3.5.6 Membrane Removal Equipment

Periodic removal and inspection of the membrane cassettes is recommended by the membrane manufacturer (General Electric/Zenon). The Surfside WWTF does not currently have the equipment needed to remove the membrane cassettes. When inspections have been done in the past, the Town is forced to rent a crane, which is a costly option. We recommend installation of 6-ton rated travelling monorail crane and hoist to better facilitate regular

inspection of the membranes. This equipment would also allow operations staff to make minor repairs to the membranes as needed.

3.5.7 Membrane Inspection and Replacement

The ability to predict the expected life of membranes is very limited because membrane treatment for municipal wastewater is a relatively new application. In addition, the characteristics of the influent wastewater, the treatment process conditions, and the associated membrane fouling constituents can vary greatly among WWTFs. It is our general understanding that the expected membrane life will be less than the 20-year planning period of this Report.

Based on correspondence with General Electric (GE)/Zenon, we understand that, as part of the terms of the original membrane purchase, the Town has an agreement with GE/Zenon that membranes purchased before the 10-year anniversary (approximately December of 2018) of the membrane installation may be purchased at a discount. The discounted replacement price is established using a base price adjusted for inflation using the Consumer Price Index. According to GE/Zenon, for 2013, the discounted replacement price for all four (4) trains would be \$1,240,000 versus the market price of \$1,940,000 (costs do not include installation, freight or taxes). Given the significant cost savings associated with purchasing the membranes prior to the 10-year anniversary, we recommend that the Town budget for the capital expense of replacement of half of the membranes and that a membrane inspection is made prior to determining whether or not to make the purchase.

3.5.8 Supervisory Control and Data Acquisition (SCADA) System

Through our evaluations we have identified several improvements to the Surfside WWTF SCADA system that would enhance current operations. These recommended improvements are as follows:

- Upgrade the IFIX software: the SCADA system depends on IFIX Software for its functionality. The version of IFIX currently installed is outdated and does not work with newer versions of Microsoft Windows. If one of the existing computers were to fail and had to be replaced, it would come with a newer version of Windows that would not be compatible with the IFIX software.
- Provide remote access: installation of a hardware package that provides for secure remote access into the SCADA system will allow WWTF operations staff to monitor and control the system as if they were sitting in front of the SCADA PC at the Surfside WWTF which will save personnel time including prevention of unnecessary trips to the facilities for off-hour nuisance alarms
- Improve integration between the GE/Zenon system control panel and the SCADA master node: The functionality of the GE/Zenon control panel should be fully accessible from the existing SCADA system. This recommendation would accomplish the functionality.
- Provide automatic report software: we recommend that reporting software (XLReporter) is included for the SCADA system. This package can be configured to generate automatic reports of process variables and alarms. Manual lab data can also be entered into the program to compare to readings received from online instruments. The software can generate reports on any specified period (daily, weekly, monthly, etc.) and can be formatted to be identical to regulatory agency reports to reduce the amount of staff time required for reporting.
- Provide operator training: development of a SCADA training plan for operations staff to take better advantage of the SCADA system already in use at the wastewater sites within the Town.

3.6 IMPROVEMENTS FOR ENERGY EFFICIENCY

As part of the CWMP, Woodard & Curran performed an energy efficiency evaluation of the Surfside WWTF to further refine the recommendations of a National Grid Scoping Study Energy Evaluation. The evaluation was performed by JK Muir LLC and is described in a memo dated July 2, 2014, which is provided in the appendices of the full report. Refer to Appendix H for the full Report.

A summary of the recommended cost saving measures is as follows:

- Provide instrumentation and controls modifications to allow automatic blower on/off cycling which will minimize energy usage for the primary sludge holding tanks.
- Provide instrumentation and controls modifications to allow automatic cycle blower on/off cycling which will minimize energy usage for the secondary waste activated sludge holding tanks.
- Modify the piping for the draft pumps that convey flow from the anoxic tanks to the aeration tanks to allow a reduction in the number of pumps that need to run under reduced flow conditions.
- Install a new VFD on the odor control fan and make programming changes to allow for a range of operating conditions to optimize ventilation while minimizing energy usage.
- There is a potential opportunity to modify the control system programming set points for the membrane air scour blowers to optimize their usage and reduce the blower run time, which would reduce energy usage.

3.7 ESTIMATED CONCEPTUAL COST FOR IMPROVEMENTS

Woodard & Curran's conceptual cost estimates for the Surfside WWTF improvements are summarized in the following Table 3-1.

Table 3-1: Surfside WWTF Recommended Improvements Cost Estimates

	Construction	Design Engineering, Permitting and Construction Administration	Subtotal	Contingency (30%)	Project Total
Improvements for Future Capacity					
Blower Addition	\$388,000	\$85,400	\$473,000	\$142,000	\$615,000
Nitrified Recycle	\$371,000	\$81,600	\$453,000	\$136,000	\$589,000
Subtotal					\$1,204,000
Improvements for Reliability					
Corrosion Control	\$361,000	\$79,400	\$440,000	\$132,000	\$572,000
Influent Screening and Vector Truck Unloading	\$3,080,000	\$677,000	\$3,757,000	\$1,127,000	\$4,884,000
Aeration Tank Instrumentation	\$180,000	\$40,000	\$220,000	\$66,000	\$286,000
Primary Sludge Pump Replacement	\$176,000	\$38,700	\$215,000	\$65,000	\$280,000
Membrane Removal Equipment	\$116,000	\$27,800	\$144,000	\$43,000	\$187,000
Membrane Inspection and Replacement	\$806,000	\$50,000	\$856,000	\$257,000	\$1,113,000
SCADA Improvements	\$51,800	\$60,800	\$113,000	\$34,000	\$147,000
Subtotal					\$7,469,000
Improvements for Energy Efficiency					
Sludge Blower Cycling	\$5,000	\$5,000	\$10,000	\$3,000	\$13,000
Secondary Sludge Blower Cycling	\$-	\$5,000	\$5,000	\$2,000	\$7,000
Draft Pump Piping Modifications	\$7,500	\$1,900	\$9,000	\$3,000	\$12,000
Odor Control Fan VFD Implementation	\$25,500	\$5,000	\$31,000	\$9,000	\$40,000
MBR System Optimization	\$-	\$62,500	\$63,000	\$19,000	\$82,000
Subtotal					\$154,000
Total					\$8,827,000

The conceptual estimates are based on the following:

- Equipment and materials costs were based on a combination of manufacturer budgetary quotations and cost data we obtained from similar projects
- Prevailing wage rates for labor
- Project is tax exempt
- Engineering and permitting services are included as allocations based on a percentage of the estimated construction cost
- A contingency of 30-percent is applied to the project cost
- The conceptual cost estimates are indexed to the Engineering News Record (ENR) construction cost index of 9681 for February 2014.

3.8 RE-EVALUATION OF LOADING AT SURFSIDE DISCHARGE BEDS

3.8.1 Background

The major driver of this CWMP Update Report is the completion of Massachusetts Estuaries Program (MEP) Reports at various embayment/estuary locations on Island that are documented as degraded due to nutrient loading with the major contributor being on-site wastewater disposal systems. A thorough evaluation of the 2004 recommendation of a satellite WWTF to service the Madaket and Warren's Landing Needs Areas was completed, which included extensive environmental review. As is detailed in the previous section, the Town requested that the need for a third WWTF in Madaket be reviewed by evaluating the potential to service all of the area's needs at its existing WWTF at Surfside. The review was completed and based on the MEP results in multiple areas on Island, additional areas are now being recommended for off-site wastewater treatment in order to reduce nitrogen loading to water resources. The CWMP Update evaluated the potential to not only eliminate the design and construction of the Madaket WWTF, but, also the potential to service the Needs Areas proposed in this geographic area at the existing Surfside WWTF. Revised wastewater flows were calculated utilizing all updated land use information between 2004 and present and included all Needs Areas recommended in this CWMP Update. A Capacity Analysis determined that Surfside WWTF could handle the additional flows under its current permit with the limiting factor being the groundwater discharge beds that are permitted to handle 3.5 MGD. A total of 4.0 MGD is needed to handle the total revised flows.

An initial meeting with MassDEP at their Boston offices on June 18, 2013 opened the discussion of increasing the loading to the beds based on existing conditions and current operations. Subsequent to the June meeting, a Scope of Work was developed and sent to MassDEP on August 16, 2013 and ultimately approved by MassDEP to complete a hydrogeological evaluation to determine if loading the existing beds at a higher rate was feasible. This evaluation agreed to look at three main items:

- 1) Capacity of existing beds to handle additional discharge through hydrogeological analysis;
- 2) Analysis of existing shoreline down gradient from WWTF relating to stability of shoreline; and
- 3) Determination of additional loading to identify any potential threat of breakout conditions to the down gradient beach/shoreline area as a result of additional loading.

At the meeting on December 6, 2013, it was agreed that the model would be re-run utilizing both summer maximum and average daily build out flows, with the summer max run for the month of August (4.0 MGD for August) and the remainder of the year run at summer average daily flows at build out flows of 2.92 MGD. This schedule would also be considered conservative as the Town stated the Surfside WWTF only receives the maximum summer flows for two weeks in August.

The following summarizes the current site conditions, the data utilized in the hydrogeological evaluation, including the model and method for determining high groundwater, the actual analysis and results, the shoreline stability analysis, potential for breakout determination and conclusions. This analysis will serve as the basis for the CWMP Update recommendation for Surfside WWTF and for renewal of the Town's Groundwater Discharge Permit No. SE#1-200, which was extended by Chapter 238 of the Acts of 2012 and is now due on 6/15/2015.

MassDEP also required confirmation that the location of the beds on Nantucket's southern shoreline was not impacted with the revised FEMA maps. The new maps confirmed that the site was not subject to impacts, with recent data maps from the United States Army Corps of Engineer after Hurricane Sandy. The Emergency Management Director for Nantucket was contacted to discuss the site and any changes to the area that would be of concern. He also contacted Coastal Zone Management (CZM) to assess their conclusions of this area and it was stated that there were very few changes, if any; to this area and that the site was considered stable.

The Woodard & Curran approach to this Technical Memorandum, as described in our August 16th Scope of Work was to replicate the modeling exercise that was completed in 2002 by EarthTech and reported on in their 2005 Groundwater Discharge Permit Application to support additional loading of existing beds without environmental or public health impact.

3.8.2 Current Site Conditions

The Surfside WWTF is located on the south side of Nantucket Island directly abutting the Atlantic Ocean. There are presently 15 open sand beds currently in use for wastewater disposal after treatment at the Surfside MBR Facility. Each of the beds contains approximately one acre in bottom area. On Sept 11, 2013, W&C's geologist and Kevin Manning (treatment plant operator from Nantucket) measured the bottom dimensions of each bed not described in the As Built drawings developed by EarthTech, totaling 10 in all. The beds are of slightly different sizes, ranging from the smallest at 35,700 square feet to the largest, which is about 44,900 square feet. The median size is 42400 square feet. The bed dimensions are shown in Table 3-2 below.

Table 3-2: Surfside Wastewater Discharge Bed Areas

		North	East		Bed		
		South (ft)	West (ft)		Area (sqft)		
1	*	216	208		44928		
2	*	211	210		44310		
3	*	212	211		44732		
4	*	191	187		35717		
5	*	201	204		41004		
6	*	199	204		40596		
7	*	206	204		42024		
8	*	217	218		47306		
9	*	211	215		45365		
10	x	200	193		38600		
11	*	198	201		39798		
12	*	189	204		38556		
13	x	206	206		42436		
14	x	212	212		44944		
15	x	212	212		44944		
TOTAL					635,260		

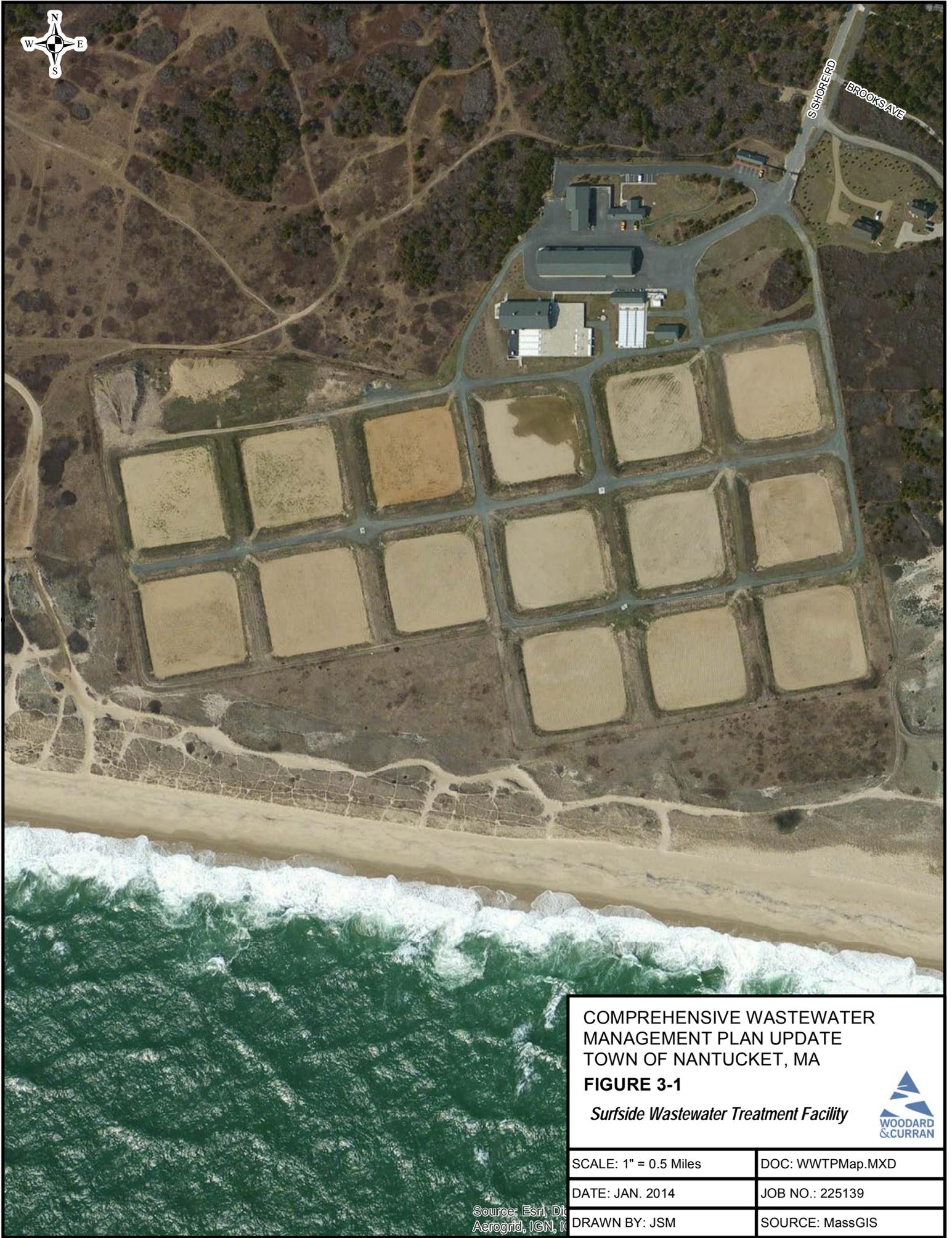
* measured by Cary Parson and Kevin Manning 9-11-13

x taken from record drawings

Using the above Table 3-2, with a 2,000,000 GPD Daily Flow and a total bed area of 635,260 that relates to a current loading factor of 3.15 GPD/sqft.

The entire Surfside WWTF site is located in an area similar to Cape Cod and is composed of glacial outwash sands and gravels. The aquifer is a simple water table aquifer with no complexities such as confining beds or semi-confined layers. The full depth of the working aquifer is not known from borings Woodard & Curran has access to; however, the EarthTech report utilized and noted in the next section suggests that the aquifer materials may extend to depths greater than 200 feet. The EarthTech report details that the fresh water aquifer may only extend to 100 or 200 feet based on the Ghyben-Herzberg principal. Ghyben-Herzberg states that for every 1 foot of fresh water that is standing above sea level, the fresh water / salt water interface should be 40 feet below sea level.

The following map downloaded from Google Earth, Figure 3-1, shows an aerial view of the entire Surfside WWTF site, including the WWTF, discharge beds and lower beach/shoreline area.



COMPREHENSIVE WASTEWATER
MANAGEMENT PLAN UPDATE
TOWN OF NANTUCKET, MA

FIGURE 3-1

Surfside Wastewater Treatment Facility



SCALE: 1" = 0.5 Miles

DOC: WWTPMap.MXD

DATE: JAN. 2014

JOB NO.: 225139

DRAWN BY: JSM

SOURCE: MassGIS

Source: Esri, Digital
Aerogrid, IGN, etc.

3.9 DATA UTILIZED IN HYDROGEOLOGICAL EVALUATION

The greatest effort in this task was to establish the appropriate water table map for a typical August from data that is available at this time. Fortunately, the earlier reports completed by EarthTech and GZA, provided the appropriate fall high water table using the Frimpter method. Data obtained from various reports in the paper trail for the Surfside location, (noted when used); have given Woodard & Curran some basic information to manipulate in trying to create a typical August water table map. The process of creating the August water table map is described in a section below.

Groundwater levels for the 2002 EarthTech report, drew on earlier work compiled in the 1980's and 1990's and used the Frimpter Method to establish the necessary water table maps. The EarthTech report and the GZA report of 1980 both referenced a Sept 1979 GWL map presented in the GZA report of 1980. Woodard & Curran accepted the Sept 20, 1979 GWL map as representative of typical conditions in the August and Sept period of high flow for the treatment plant and utilized this same data for this exercise.

Based on the description from EarthTech in their June 2005 report, Woodard & Curran built a nearly duplicate groundwater model to the model presented in the EarthTech report. Woodard & Curran located the existing 15 disposal beds as they are now found in the field. Each disposal bed was given a different color in the model to signify its disposal load. Refer to Figure 1 for the map downloaded from Google Earth as a site plan of the facility. The Woodard & Curran model has three model layers as does the EarthTech model. These layers represent the thickness of the fresh water aquifer and the aquifer thickness increases as one moves from the shore line back into the interior of the island.

The GW model chosen for this modeling exercise is the same as used by EarthTech. This is the MODFLOW model from the USGS, perhaps the most widely used model in groundwater level prediction. The Woodard & Curran model was constructed to mimic the EarthTech model as closely as possible. The model was calibrated against the only recently published groundwater table map for the area, the Sept 20, 1979 map published by GZA in their 1980 report and reused by EarthTech in the GDP application of 2005.

Exact model data files were not published by EarthTech in their 2005 report, however, from the data given, Woodard & Curran has closely reproduced the model. The calibration statistics for the Woodard & Curran model are given in the Table 3-3.

Table 3-3: Woodard & Curran Calibration Statistics

Name	Observed	Computed	Residual
N-1	2.7	2.9	-0.19149
N-8	2	2.9	-0.88175
SU-M	3.7	3.3	0.354274
N-13	3.8	3.7	0.108642
N-5	4.3	4.2	0.130373
N-3	4.1	4.1	0.044081
N-4	4.5	3.8	0.685391
N-6	4.3	4.5	-0.22127
N-9	4.6	5.2	-0.59368
Residual Mean		-0.06283	
Absolute Residual Mean			0.356774
Residual Std. Deviation		0.447967	
Sum of Squares		1.841593	
RMS Error	0.452351		
Min. Residual		-0.88175	
Max. Residual		0.685391	
Number of Observations			9
Range in Observations		2.6	
Scaled Residual Std. Deviation			0.172295
Scaled Absolute Residual Mean			0.137221
Scaled RMS Error		0.173981	
Scaled Residual Mean		-0.02416	

The calibration statistical values presented in Table 3-3 above are representative to those presented in the EarthTech Report and suggests a reasonably solid calibration for the W&C model.

3.9.1 Calculations of Typical Fall Water Table

As mentioned above, the earlier reports from GZA and EarthTech have reported that due to conditions of the beds being in continual service, the Frimpter Method is the only method for determining reasonable groundwater levels at the site. (see page 5-EarthTech GWD permit application-6-28-05). Woodard & Curran has not attempted to rerun the Frimpter method for estimating groundwater levels in the fall. We have accepted the water levels as presented via the Frimpter method in the EarthTech report for Sept 20, 1979.

Below, we present our discussion for working with the Frimpter groundwater levels.

3.9.2 Water Table

Woodard & Curran prepared a water-table contour map for Surfside using September 1979 data, the period for which a pre-existing groundwater-flow model was constructed (EarthTech, 2002). Groundwater-elevation data are from gauging events conducted by GZA personnel (GZA, 1980) prior to construction of the Surfside treatment facility. The contours presented in Figure 3-2 from the Earth Tech Report, below, indicate a southerly flow of groundwater toward the coastline. It should be noted that GZA adjusted the manually gauged water levels via the Frimpter Method to obtain an annually average data set, which was used for calibration of the flow model. The original data represented a seasonally dry period, and were increased by approximately 0.2 feet. Woodard & Curran incorporated the historic 1979 data, with the 2002 Frimpter adjustment, to generate potentiometric contours and flow directions, and to

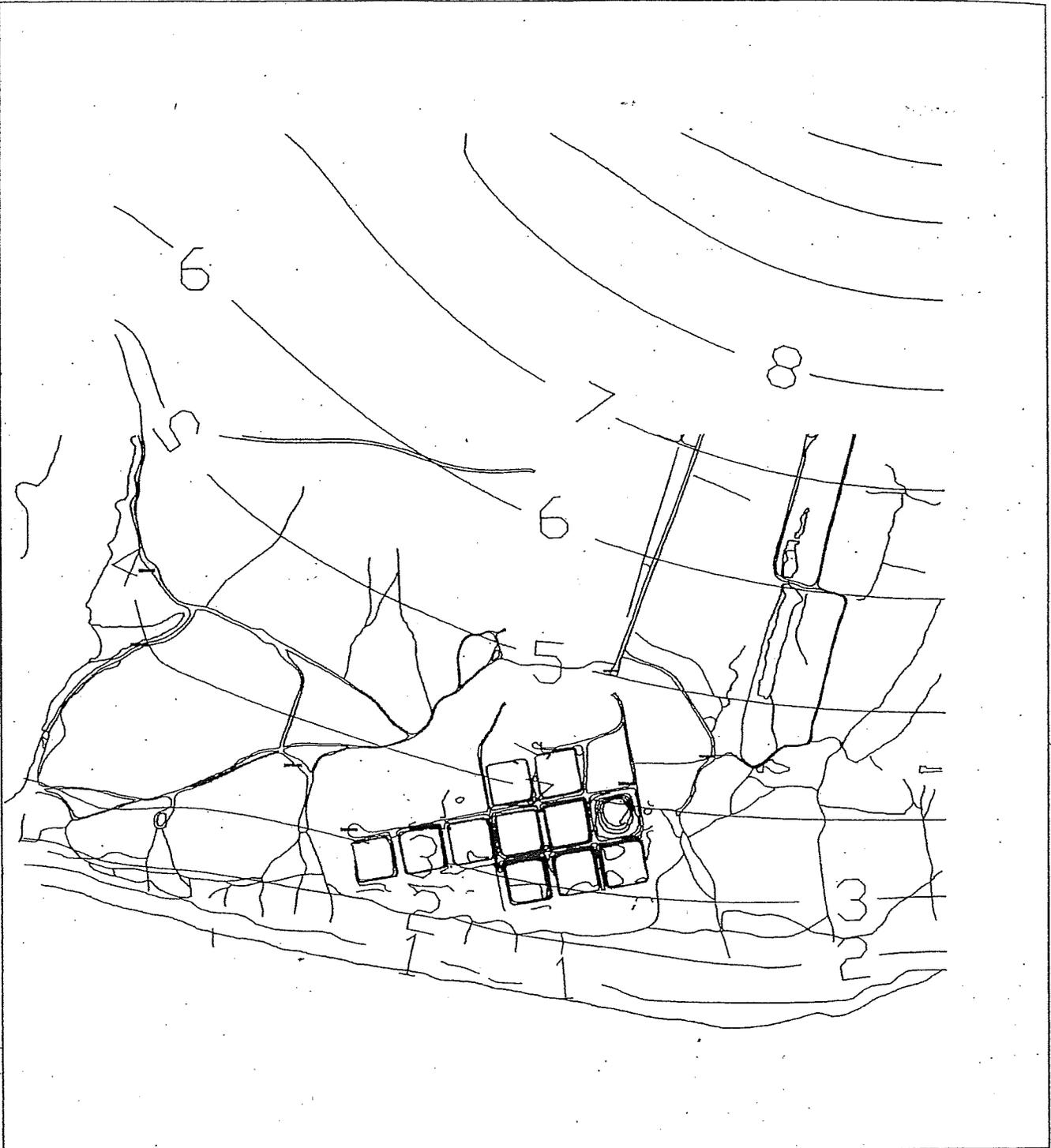
calibrate a steady state flow model. The model then is used to simulate groundwater mounding at Surfside in response to increases in discharge of treated effluent.

Current data are available at Surfside, which include five groundwater wells, which are gauged by Surfside personnel on a quarterly basis. However, the newly installed wells do not have surveyed measuring points, and topographic maps exhibit a discrepancy of elevation compared with historical well surveys. In addition, the methodology for recent gauging events includes measuring the height of water column from the bottom of the well. Over time, wells may accumulate silt from the surrounding formation, or may be clogged with foreign material deposited in the well. Thus, the height of water column may change over time irrespective of a constant depth to groundwater. Furthermore, the recent data represents a system currently subjected to discharged effluent, whereas the historical data set is more representative of a steady state, long-term, ambient environment. For these reasons, the historical data set is used for constructing a base model upon which to observe the response to discharged of treated effluent. As was discussed at the December 6th meeting, the Town will have the wells surveyed for future readings.

In an additional effort to compare the Woodard& Curran model to the EarthTech model, we duplicated the EarthTech example of loading the beds with 3.4 MGD to try for similar groundwater contours. The match of groundwater levels was very close, confirming that the Woodard & Curran model is a close replica of the models previously approved.

One can reference the following Figure 3-2 as an example of the groundwater level that was used as the calibrated groundwater map to which the proposed increased effluent flow to a maximum load of 4 MGD in the August timeframe was applied. The groundwater levels shown on Figure 3 are very similar to the levels shown on Figure 2 in the 2005 EarthTech GDA submittal.

With the Woodard & Curran Groundwater model properly calibrated, we moved on with the effort to simulate the aquifer response to applying the treated effluent as discussed at the December 6th meeting; summer flow at full build out at 4.0 MGD for the entire month of August only and the remainder of the year at the summer average daily flow at full buildout of 2.92 MGD to the beds at Surfside. The results of this transient modeling effort are shown on Figures 4 through 15, with Figure 11 - August, showing the most dramatic mound. The simulation shows 4.0 MGD for the entire month of August, which is conservative given the Town receives maximum flows for a two week period in August. These figures can be found in BRP-83 included in Appendix H.



NAME: FIGURE 3-2.dwg DATE: 09/30/03 P:\jilson

SCALE 1"=800'

LEGEND

—1— GROUNDWATER ELEVATION WITH CONTOUR (FT HALF TIDE DATUM)



FIGURE 3-2
 STEADY STATE WATER TABLE CONTOURS
 SURFSIDE WWTF SITE
 NANTUCKET, MASSACHUSETTS

The groundwater elevation under the beds in the no-load static condition, Figure 3-3, is 2.73 feet mean sea level (msl) with the month of August loading rate at 9.26 feet msl, which shows a 6.53 foot groundwater mound. Referring to the Earth Tech record drawing in Attachment A of the full report, this shows the bottom of bed #12 at elevation 13 feet. In Figure 13, the modeling shows contours on bed #12 (highest groundwater elevation is in bed #12) at approximately 9 feet at end of month. This shows an approximate vertical separation of 4 feet as the worst case scenario in all models. All other loading scenarios exceed the four foot separation with the mound considerably less than in August.

3.10 SUMMARY OF HYDROGEOLOGICAL ANALYSIS

The aquifer response to application of 3.4 MGD as modeled by EarthTech was to mound to levels of 8 feet (+) in the center of the discharge beds. When the discharge was increased to the transient model in the Woodard & Curran models, as expected the August scenario showed the most dramatic mound. All other scenarios showed considerably less mounds with vertical separations exceeding four feet in all beds.

The new models also show that all flow is directed towards the ocean. With the maximum load period of August at full build out flow of 4.0 MGD, Figure 19 details a Particle Trace that shows all flows going to the ocean. There is no impact of flow shown towards Miacomet Pond.

The revised transient models clearly show that a vertical separation of four feet is maintained at all beds during the year with the new proposed flow of 4.0MGD. Refer to Figure 3-3 for a No Load Flow; Figure 3-4 for Typical Summer Flow; and Figure 3-5 Typical Winter flow. Each of the twelve months were modeled and are included in the full report in Appendix H.

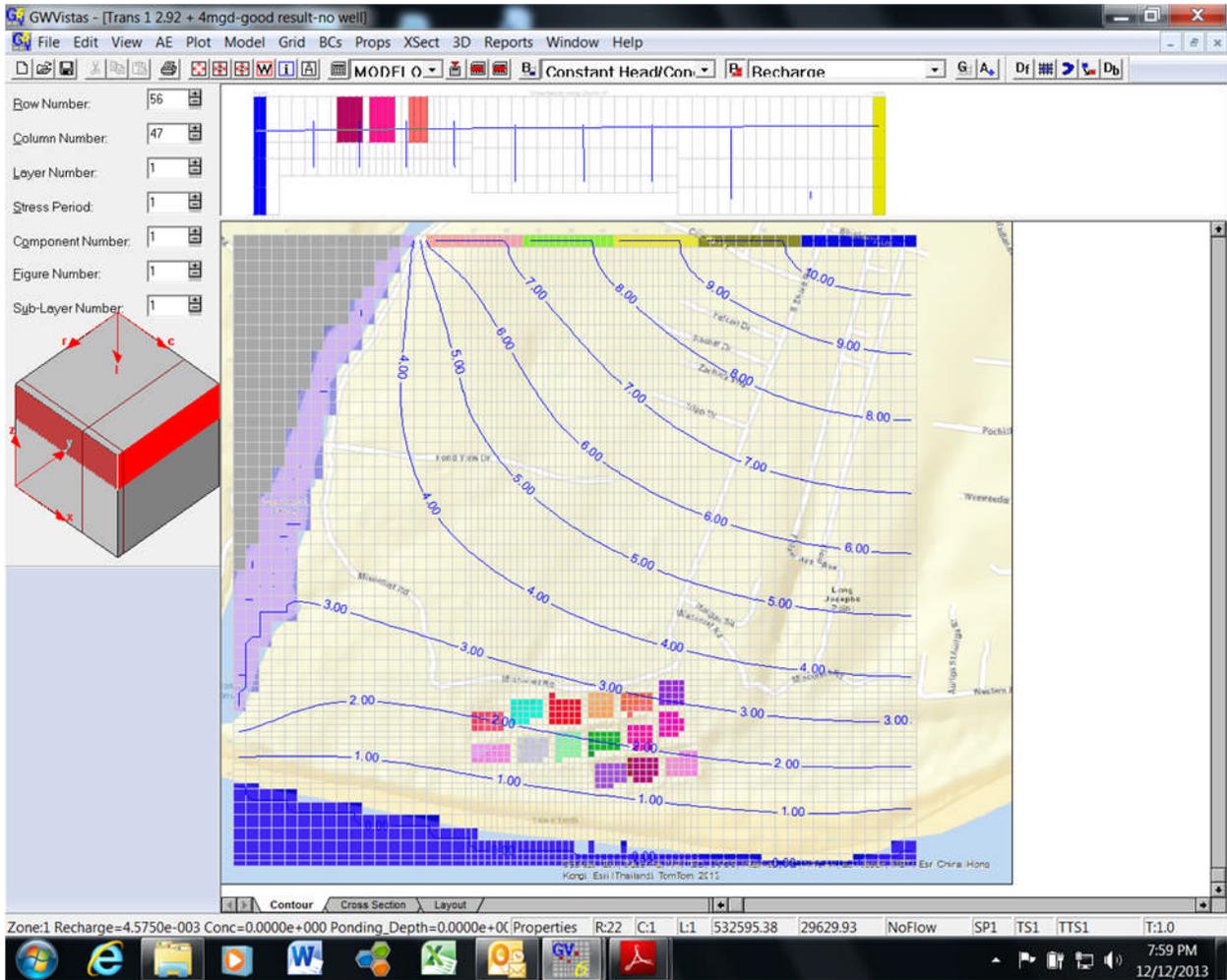


Figure 3-3
 STATIC GROUNDWATER
 CONTOURS
 (NO LOADING)

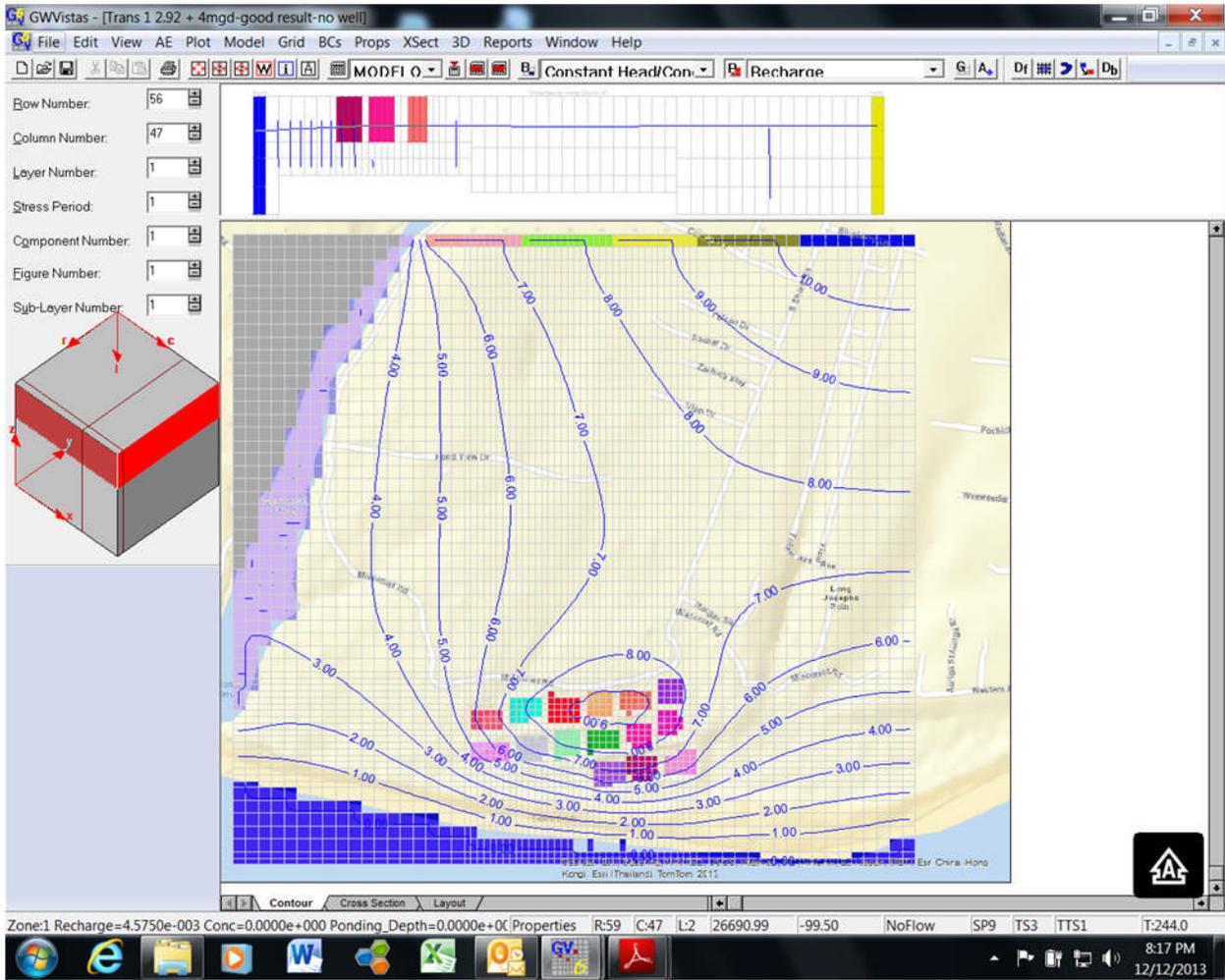


Figure 3-4

AUG AT

4.0 MGD

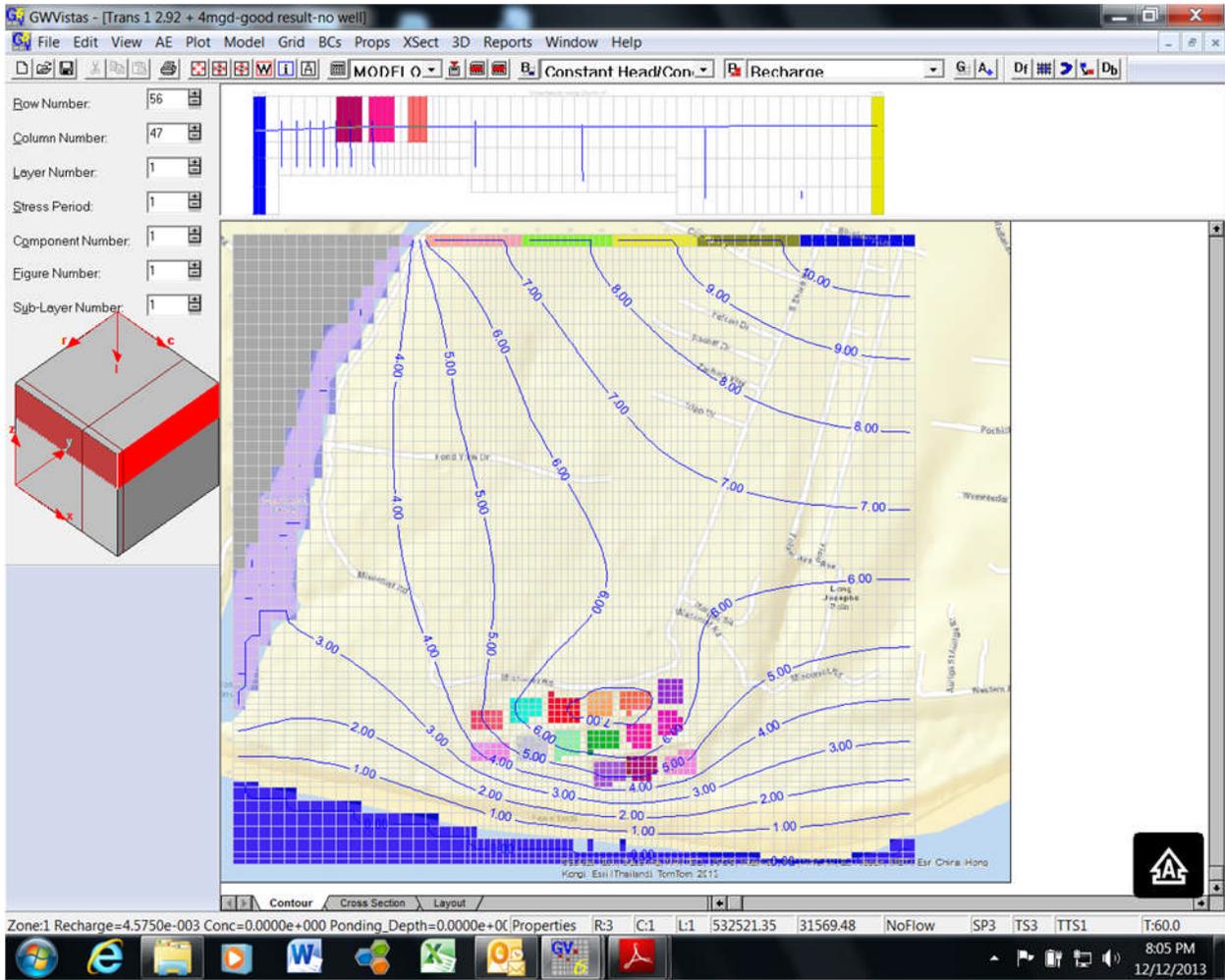


Figure 3-5

FEB AT

2.92 MGD

Based on the above-referenced permit filings, it has been determined that the Surfside WWTF discharge beds are approved to support 4.0 MGD and the existing Groundwater Discharge Permit will be modified to reflect this. At the time of this Report writing, MassDEP was in the process of revising the Groundwater Discharge Permit to reflect the revised flow of 4.0 MGD. Refer to Appendix H for copies of the filings and responses.

3.11 SHORELINE STABILITY ANALYSIS AND BREAKOUT DETERMINATION

The second task to address is the potential impact that additional flow at the Surfside Beds could have to the shoreline immediately down gradient by some 250 to 300 feet. We evaluated impacts of both shoreline stability and any potential for additional flow to breakout in the down gradient areas. To address this concern, Woodard & Curran resorted to existing published document from the Woods Hole Group, as well as recent datasets produced by the United States Army Corps of Engineers (ACOE). These documents address the stability of the shore line near the Surfside Beds with a review of several existing studies of the shoreline position in the area.

3.11.1 Shoreline

A review of the shoreline analysis by the Woods Hole Group (WHG, 2002) suggests that the shoreline near the Surfside WWTF has experienced consistent patterns of accretion or erosion from 1955 to 2002. Shoreline change during older datasets in the 1800s show greater fluctuation, which is not mimicked in recent data, either due to unique climatic factors or to greater discrepancies in data translation. Data from the WHG report indicate overall slight erosional trends in the shoreline immediately west of Surfside, stable trends south of Surfside, and accretion southeast and east of Surfside. WHG determined the average accretion or erosion rate for the period from 1955 to 2002 along transects running perpendicular to the shoreline. In general, the erosion rates southwest and west of Surfside range from zero to 0.4 ft/year, the rates immediately south of Surfside show little variance around zero, and the rate of change southeast and east of Surfside range from less than 1 ft/yr to 5 ft/yr.

An investigation by Woodard & Curran, using data from the Massachusetts Ocean Resource Information System (MORIS) database, yielded similar trends as shown on Figure 16 below. Erosion and accretion rates from 1955 to 2009 were calculated along MORIS shoreline transects in the vicinity of Surfside. In general, the western half of Surfside experienced weak erosion during the study period (less than 1 ft/yr), and the shoreline in the eastern half of Surfside experienced strong accretion (0.7 to 3.6 ft/yr).

Figure 16 represents the general shore line progression near the Surfside Beds from 1955 until 2009. In general, the shore line appears to be accreting along the area of the Beds. The shore line in place now includes the passage of Hurricane Sandy. Thus it seems that the natural shoreline processes are not eroding the area around the Surfside Beds.

A second part of the question about shoreline stability dealt with the likelihood that the additional groundwater movement of groundwater from the Surfside Beds toward the ocean will make the dune banking in the area more susceptible to erosion under natural processes. To address this question Woodard & Curran compared the groundwater gradient in the area under the proposed increased discharge of wastewater to the typical required gradient in wastewater plumbing for domestic use. Domestic plumbing codes typically require a 1 inch drop in 8 feet of piping to move solids along an open pipe. This is a gradient of 0.125 inches per foot. The groundwater gradient after the proposed additional disposal at Surfside will be 0.016667 inches /inch, about 1/10 the gradient in domestic wastewater piping. Based on this comparison, the new groundwater gradient will not be steep enough to destabilize the slope at the ocean.

Additional datasets produced by the ACOE after Hurricane Sandy also support the shoreline stability in the Surfside WWTF area. Refer to Figure 3-6.

Additionally, the revised FEMA maps were reviewed to determine any changes as a result of the mapping updates and what, if any, issues this presents at this site. As discussed in previous sections of this TM, the Town's Emergency Management Director who is in charge of the flood zones stated that there were no changes to the site and that there are no potential impacts to the Surfside Site. CZM also conferred with him and referred to the site as stable. Refer to Figure 18 for a copy of the FEMA map.

Results of the WHG, ACOE, FEMA and Woodard & Curran investigations suggest that the shoreline of Surfside is experiencing overall accretion from the mid-20th century to present. Weak erosion along the western region of the study area may continue, with an associated accretion of shoreline to the east with no impact to the WWTF.

3.12 CONCLUSIONS OF EVALUATION

The conclusions of the above tasks are as follows:

3.12.1 Additional Bed Loading

Additional loading to the existing beds at the Surfside WWTF, from 3.4 MGD to 4.0 MGD, based on summer loading at 4.0 MGD for the entire month of August only and at 2.92 MGD (summer average daily flow) for the remainder of the year is feasible under current conditions. The transient models detail the most dramatic mound during the month of August, which is expected given the maximum loading rate of 4.0 MGD for the entire month. While the modeling shows that additional loading raises the mounds in the upper beds, the overall system is able to handle the additional flow with vertical separation in the four foot range in bed #12, which previous records detail with the highest groundwater elevation. The remainder of the year under the transient models clearly shows considerably less mounding with vertical separations exceeding four feet. Additionally, the upgrades at the WWTF, most notably the upgrade to MBR technology, afford a highly treated effluent discharge that travels to the open Atlantic Ocean with no environmental impacts.

The full flow to 4.0 MGD will not be seen immediately, but, rather over a 20-year planning period. It is also in the Town's CWMP Update as an alternative, to maintain communication with MassDEP and various Cape and southeastern Massachusetts towns in the use of an ocean outfall. In a best case scenario at some point in the future, the treated effluent from Surfside could be discharged through an outfall to the Atlantic Ocean.

3.12.2 Shoreline Stability

This evaluation determined that the shoreline is stable and not subject to severe, impacts of erosion.

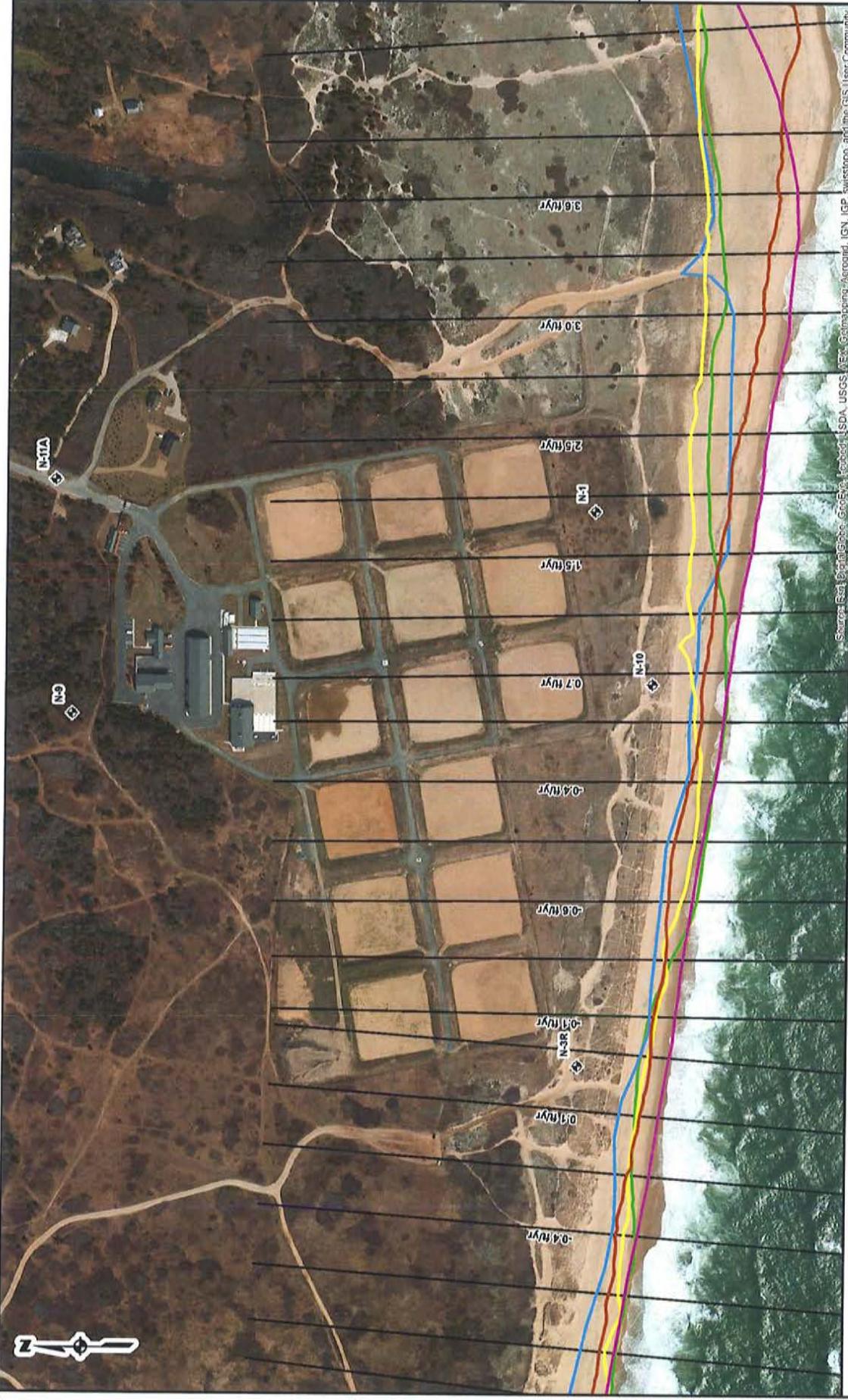
3.12.3 Breakout Potential

The evaluation determined that no breakout will occur as a result of additional loading to the existing beds.

3.12.4 Particle Trace Analysis

The model was run utilizing the August load period of 4.0 MGD in order to determine the direction of the flow. Figure 3-7 clearly details all flow towards the ocean. No flow is directed towards Miacomet Pond.

The most recent FEMA maps of the Surfside shoreline are included in Figure 3-



Legend
 MORIS SHORELINE
 1955
 1978
 1994
 2000
 2009
 MORIS SHORELINE TRANSECT AND 1955-2009 RATE OF CHANGE
 SURFSIDE MONITORING WELL
 MORIS = Massachusetts Ocean Resource Information System

Source: Esri, DigitalGlobe, GeoEye, Earthstar, USGS, AeroGRID, IGN, IGP, Swisstopo, and the GIS User Community

PN: 223970
 BY: BVA
 DATE: OCTOBER 2013

Figure 3-6

SURFSIDE TREATMENT PLANT
 NANTUCKET, MASSACHUSETTS
 HISTORICAL SHORELINE
 1955 - 2009

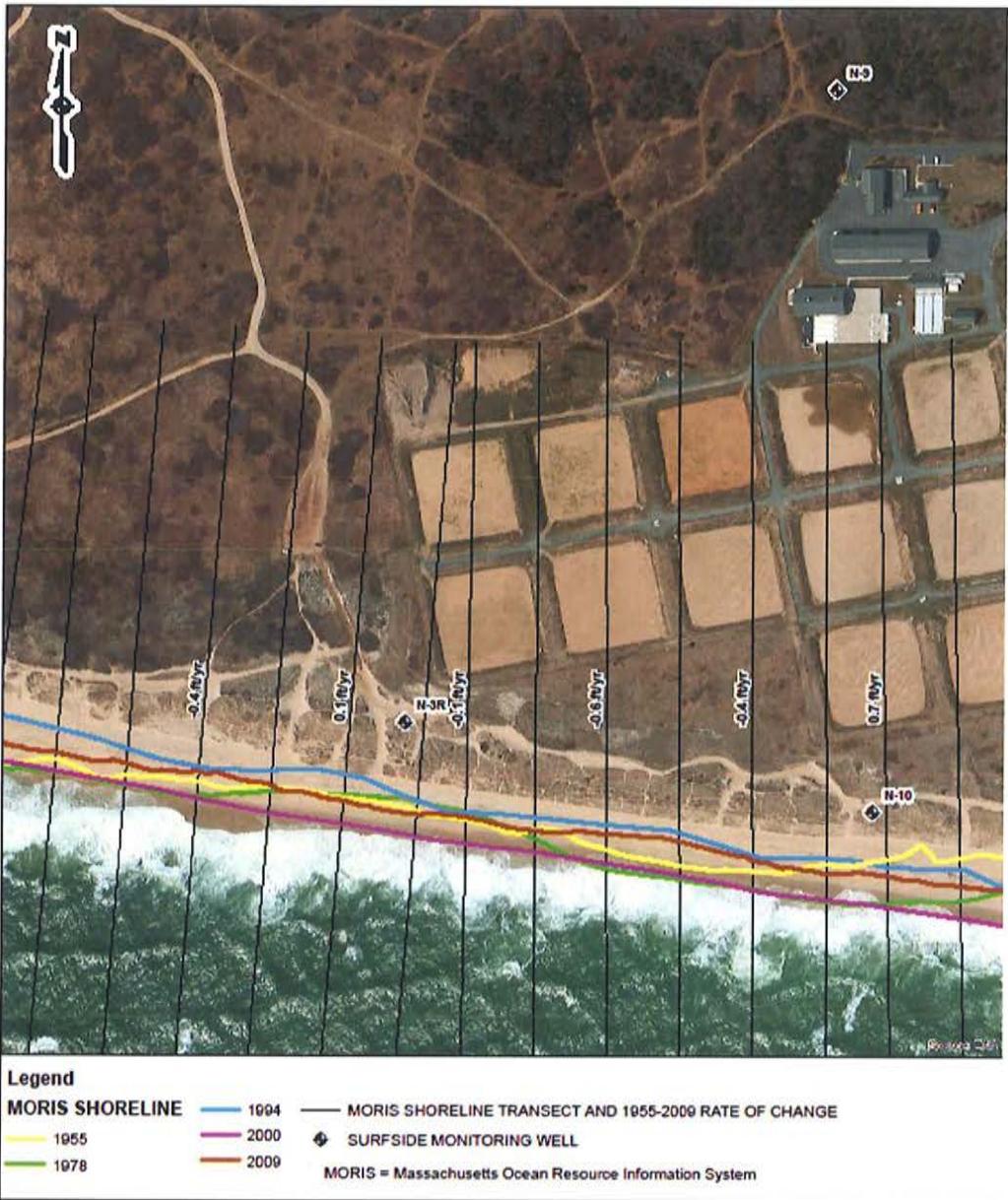


Figure 3-7



Figure 3-8

3.13 UPDATED RECOMMENDED PLAN

3.13.1 CWMP Update Final Recommended Plan

A variety of wastewater alternatives were investigated in the 2004 Phase I CWMP and both the Phase II and Phase III Reports to determine the appropriate wastewater facilities to meet the needs of Nantucket at that time. At that time the alternatives evaluation completed was compiled on the then recommended Needs Areas, environmental screening ratings, and preliminary engineering and technical criteria. This CWMP Update has relooked at the 2004 evaluations and as was detailed in previous sections, updated this information based on current conditions on Island. This update included various records reviews, as well as meetings with the local jurisdictions, including the Board of Health and all Massachusetts Estuaries Project Reports, as to how the actual physical characteristics of each geographical area supported either an on-site or off-site wastewater solution and to what environmental impacts are present. Alternatives re-evaluated included optimizing on-site wastewater disposal systems, Innovative/Alternative Systems, satellite wastewater systems and optimizing the existing wastewater facilities on Island-the Surfside WWTF. All of the above-referenced alternatives are included in Nantucket's long-term planning as detailed in Chapter 2 in "Updated Needs Areas and Revised Wastewater flows and Loads" starting on page 2-57.

The following section highlights the plan for each Needs Area recommended for municipal sewer, as well as associated environmental impacts. Figure 3-9 details the overall proposed collection system layout and downstream route to the Surfside WWTF. Additionally, those areas recommended to remain on-site with I/A systems and septage management are detailed. Figures 3-10 through 3-13 detail the environmental constraints present along the proposed infrastructure. It is noted that the entire Island is overlain by NHESP as shown on Figure 3-X. Care has been taken to identify specific resources, such as vernal pools, and identified any potential impacts. Capital costs follow the Needs Areas recommendations in this section.

3.13.2 Needs Areas in Surfside Wastewater Collection System

3.13.2.1 Madaket

The Madaket Study Area was evaluated in the 2004 Phase I Report as long-term unsustainable with the current on-site wastewater disposal systems or simply a "Needs Area" and maintains this determination in this CWMP Update. Out of the four options evaluated in the Phase III Report as a solution for this Needs Area, the most feasible is installation of Low-Pressure Sewers. Additionally, the MEP Report completed for this geographical area also determined that in order to meet the established TMDL for Madaket Harbor/Long Pond, wastewater needs to be removed from the Watershed.

The Final Recommended Plan for the Madaket Needs Area consists of the construction of approximately 40,700 linear feet of low-pressure sewer with sizes ranging from 1-1/4 to 4 inch diameter pipe. All low-pressure sewers will be located in existing, pre-disturbed roadways. The sewers will connect to the proposed new pump station to be located at the municipally-owned DPW parcel on Madaket Road, which will then pump the wastewater from both the Madaket Needs and the Warren's Landing Needs Areas via an approximately 16,800 linear foot force main that discharges to new sewer within the Hummock North and Somerset Needs Areas. Sewer within the Somerset Needs Area will connect to the existing collection system around the intersection of Bartlett Road and Mizzenmast Road, and then be pumped to the Surfside WWTF by the Pine Valley and Surfside Road Pump Stations. Figure 3-14 shows the proposed Madaket/warrens Landing Collection System. All sewers are presently proposed to be located in the pre-disturbed right of ways and/or roadways and are proposed to be constructed with no trenches utilizing directional drilling. This method of construction will avoid any open trenches, roadway disturbances on many small and one-vehicle travel lanes and eliminates any potential impact to multiple resources.

Based on Woodard & Curran's preliminary evaluation of the downstream sewer infrastructure using the Town's GIS mapping, approximately 1,500 linear feet of sewer on Mizzenmast Road and approximately, 3,500 linear feet on

Bartlett Road and Surfside Road will need to be upgraded to allow adequate capacity for wastewater flows from Madaket, Warren's Landing and Somerset. Upgrades for the Pine Valley and Surfside Road Pump Stations will also likely be necessary. The capacity analysis completed during Final Design will determine the extent of and timing of upgrades.

3.13.2.1.1 Environmental Impact

This Needs Area is overlain with NHESP, has wetlands dispersed throughout and includes coastal areas impacted by FEMA Flood Zones. There are vernal pools noted along the Madaket Road route from this Needs Area to the proposed pump station located at the DPW site, but there is no impact to these resources as the infrastructure is across the street from the resources. With the proposed layout of infrastructure and based on the above-referenced information, no environmental impact with the planning level concept is foreseen. There is no infrastructure proposed within the Flood or velocity zones. All proposed infrastructure is detailed as in existing, pre-disturbed right of ways and/or roadways. The use of directional drilling with the low-pressure sewers eliminates many potential threats to environmental resources. During the Final Design Phase of the Project, should any questions arise as to impacts to environmental resources within the Project limits, the appropriate agency will be contacted and all issues will be addressed accordingly.

3.13.2.2 Warren's Landing

The Warren's Landing Need Area was evaluated in the 2004 Phase I Report as long-term unsustainable with the current on-site wastewater disposal systems or simply a "Needs Area" and maintains this determination in this CWMP Update. Out of the four options evaluated in the 2004 Phase III Report as a solution for this Needs Area, the most feasible continues to be the use of Low-Pressure Sewers. Additionally, the MEP Report completed for this geographical area also determined that in order to meet the established TMDL for Madaket Harbor/Long Pond, wastewater needs to be removed from the Watershed.

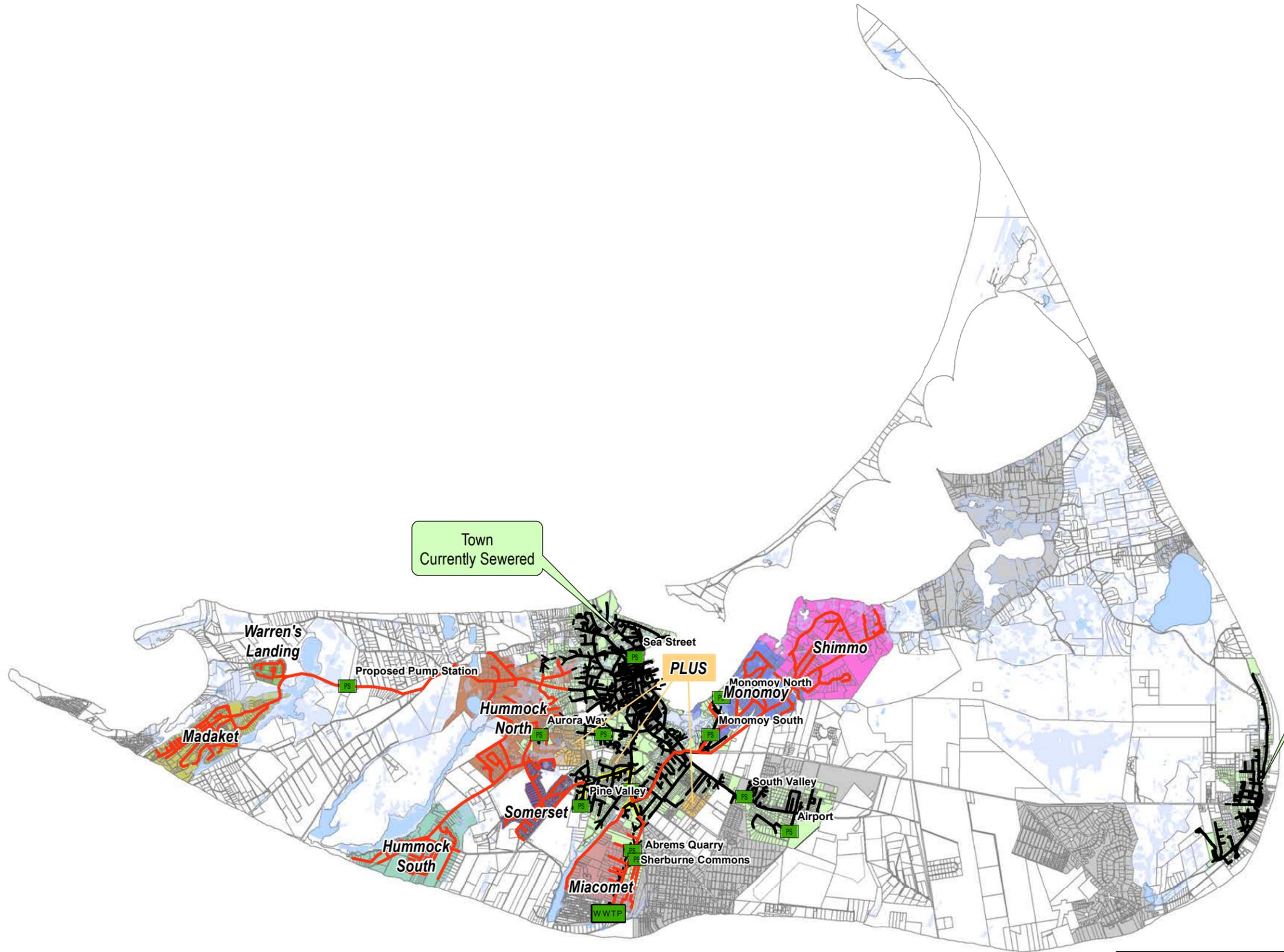
The Final Recommended Plan for the Warren's Landing Needs Area consists of installation of approximately 6,300 linear feet of low-pressure sewer with sizes ranging from 1-1/4 to 4 inch diameter pipe. All low-pressure sewers will be located in pre-disturbed, existing right of ways and roadways. The sewers will connect to the proposed pump station to be located on Town-owned land at the DPW on Madaket Road, which will then pump the wastewater from both Warren's Landing and Madaket Needs Areas via an approximately 16,800 linear foot forcemain that discharges to new sewer within the Hummock North and Somerset Needs Areas. Sewer within the Somerset Needs Area will connect to the existing collection system around the intersection of Bartlett Road and Mizenmast Road, and then be pumped to the Surfside WWTF by the Pine Valley and Surfside Road Pump Stations. Figure 3-14 includes the proposed Warren's Landing Collection System layout.

Based on Woodard & Curran's preliminary evaluation of the downstream sewer infrastructure using the Town's GIS mapping, approximately 1,500 linear feet of sewer on Mizenmast Road and approximately, 3,500 linear feet on Bartlett Road and Surfside Road will need to be upgraded to allow adequate capacity for Madaket, Warren's Landing and Somerset flows. Upgrades for the Pine Valley and Surfside Road Pump Stations will also likely be necessary. The capacity analysis completed during Final Design will determine the extent of and timing of upgrades.

3.13.2.2.1 Environmental Impact

This Needs Area is overlain with Natural Heritage and Endangered Species Program delineation. (NHESP). There are vernal pools noted along the Madaket Road route from this Needs Area to the proposed pump station located at the DPW site, but there is no impact to these resources as the infrastructure is across the street from the resources. With the proposed layout of infrastructure and based on the above-referenced information, no environmental impact with the planning level concept is foreseen. All proposed infrastructure is detailed as in existing, pre-disturbed right of ways and/or roadways. The use of directional drilling with the low-pressure sewers eliminates many potential threats

to environmental resources. During the Final Design Phase of the Project, should any questions arise as to impacts to environmental resources within the Project limits, the appropriate agency will be contacted and all issues will be addressed accordingly.



Town
Currently Sewered

Siasconset
Currently Sewered

Legend

-  WWTP
-  Pump Station
-  Proposed Sewer
-  FORCE MAIN
-  LOW PRESSURE
-  OVERFLOW PIPE
-  GRAVITY PIPE
-  Downstream Route
-  Pond
-  Wetland

COMPREHENSIVE WASTEWATER
MANAGEMENT PLAN UPDATE
TOWN OF NANTUCKET, MA

CONCEPTUAL SEWER LAYOUT

FIGURE 3-9

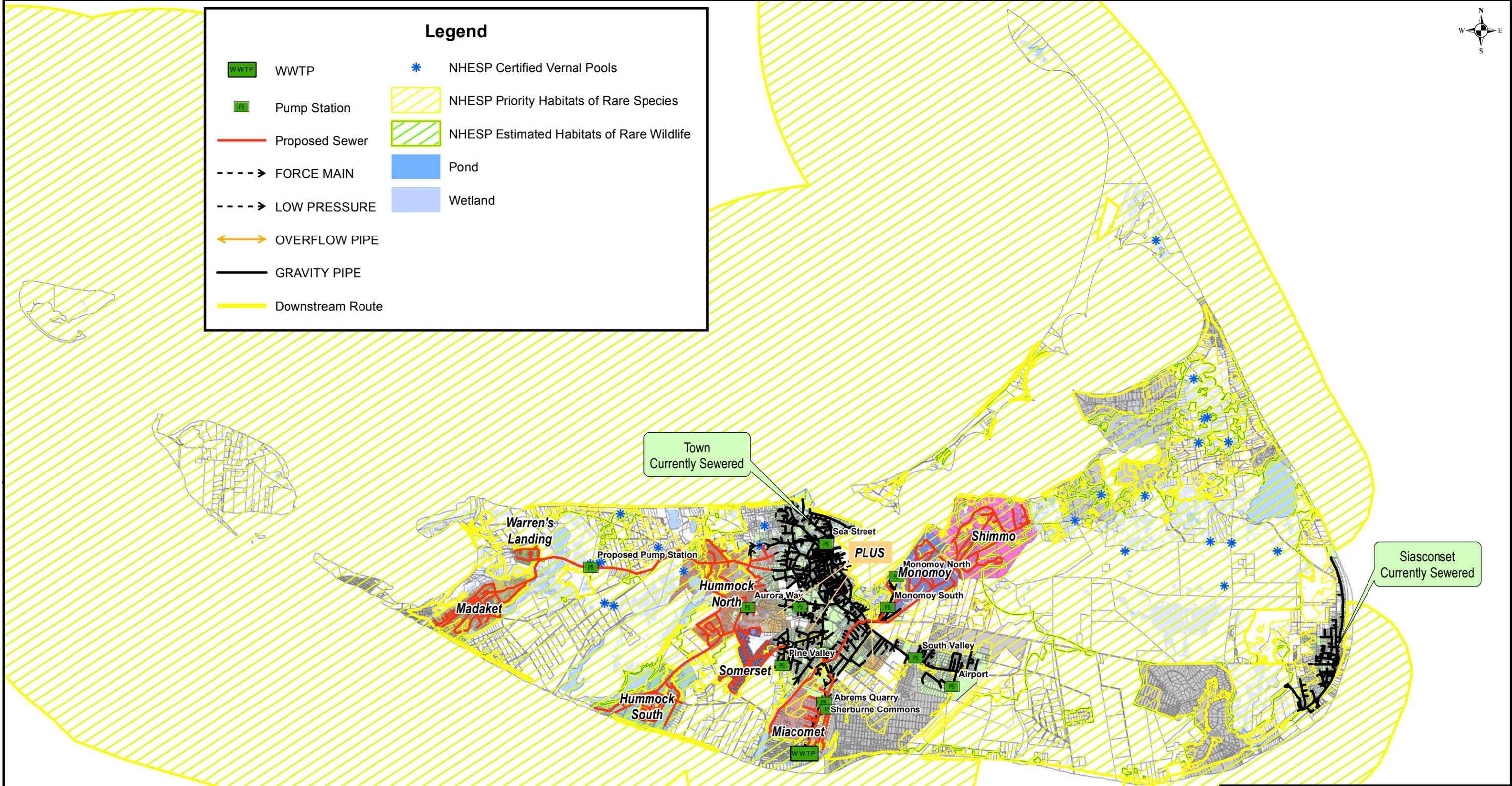


SCALE: 1" = 1.25 MILES	DOC: SEWER.MXD
DATE: FEB. 2014	JOB NO.: 225139
DRAWN BY: JSM/RTB	SOURCE: MassGIS & Town



Legend

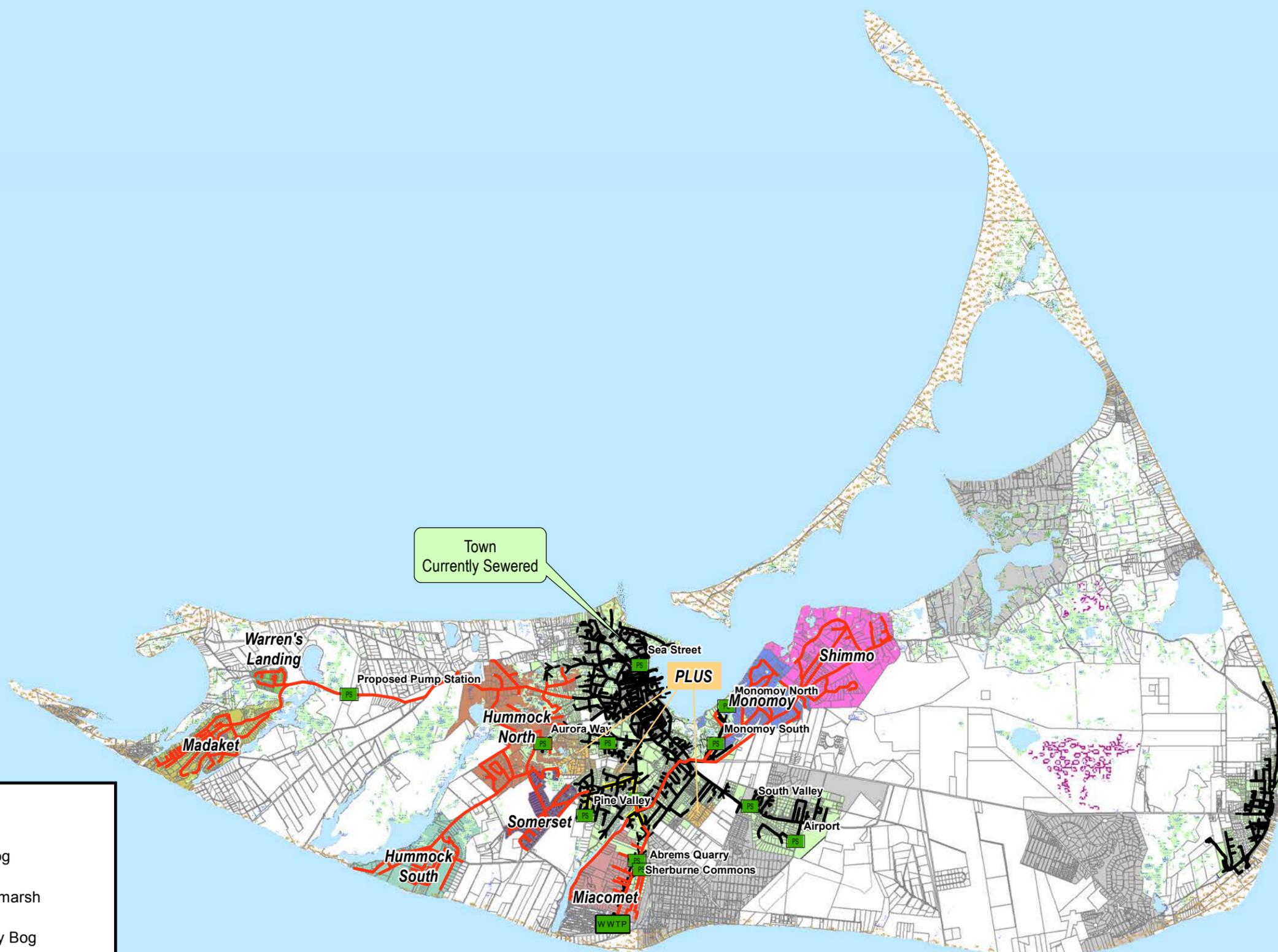
	WWTP		NHESP Certified Vernal Pools
	Pump Station		NHESP Priority Habitats of Rare Species
	Proposed Sewer		NHESP Estimated Habitats of Rare Wildlife
	FORCE MAIN		Pond
	LOW PRESSURE		Wetland
	OVERFLOW PIPE		
	GRAVITY PIPE		
	Downstream Route		



**COMPREHENSIVE WASTEWATER MANAGEMENT PLAN UPDATE
TOWN OF NANTUCKET, MA
CONCEPTUAL SEWER LAYOUT & ENVIRONMENTAL CONSTRAINTS
FIGURE 3-10**



SCALE: 1" = 1.25 MILES	DOC: NHESP.MXD
DATE: FEB. 2014	JOB NO.: 225139
DRAWN BY: JSM/RTB	SOURCE: MassGIS & Town



Town
Currently Sewered

Siasconset
Currently Sewered

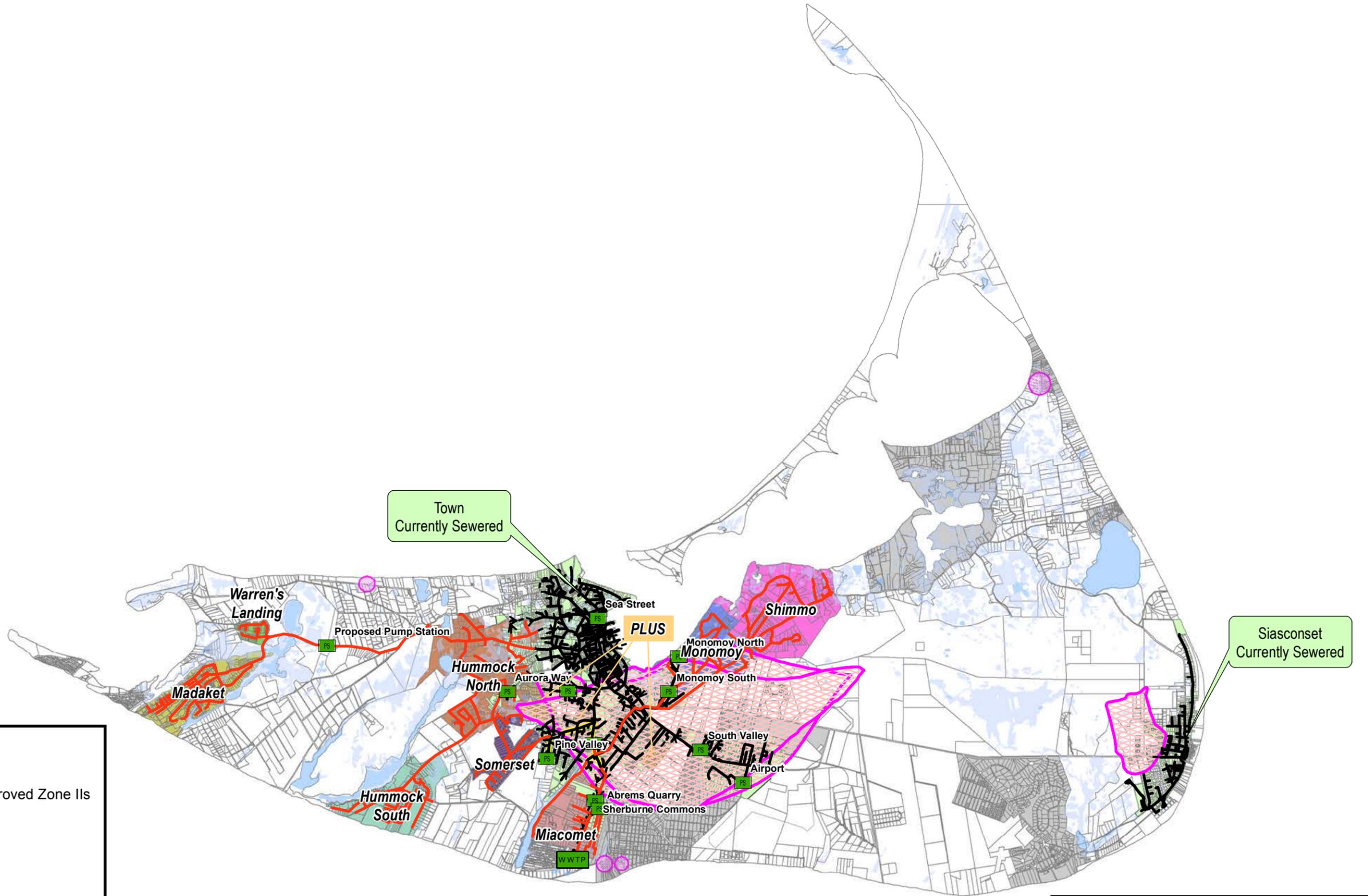
Legend

	WWTP		Marsh/Bog
	Pump Station		Wooded marsh
	Proposed Sewer		Cranberry Bog
	FORCE MAIN		Salt Marsh
	LOW PRESSURE		Open Water
	OVERFLOW PIPE		Reservoir (with PWSID)
	GRAVITY PIPE		Tidal Flats
	Downstream Route		Beach/Dune

COMPREHENSIVE WASTEWATER
MANAGEMENT PLAN UPDATE
TOWN OF NANTUCKET, MA
**CONCEPTUAL SEWER LAYOUT &
ENVIRONMENTAL CONSTRAINTS**
FIGURE 3-11



SCALE: 1" = 1.25 MILES	DOC: WETLANDS.MXD
DATE: FEB. 2014	JOB NO.: 225139
DRAWN BY: JSM/RTB	SOURCE: MassGIS & Town



Legend

-  WWTP
-  Pump Station
-  Proposed Sewer
-  FORCE MAIN
-  LOW PRESSURE
-  OVERFLOW PIPE
-  GRAVITY PIPE
-  Downstream Route
-  DEP Approved Zone IIs
-  IWPA
-  Pond
-  Wetland

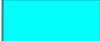
COMPREHENSIVE WASTEWATER
 MANAGEMENT PLAN UPDATE
 TOWN OF NANTUCKET, MA
**CONCEPTUAL SEWER LAYOUT &
 ENVIRONMENTAL CONSTRAINTS**
FIGURE 3-12

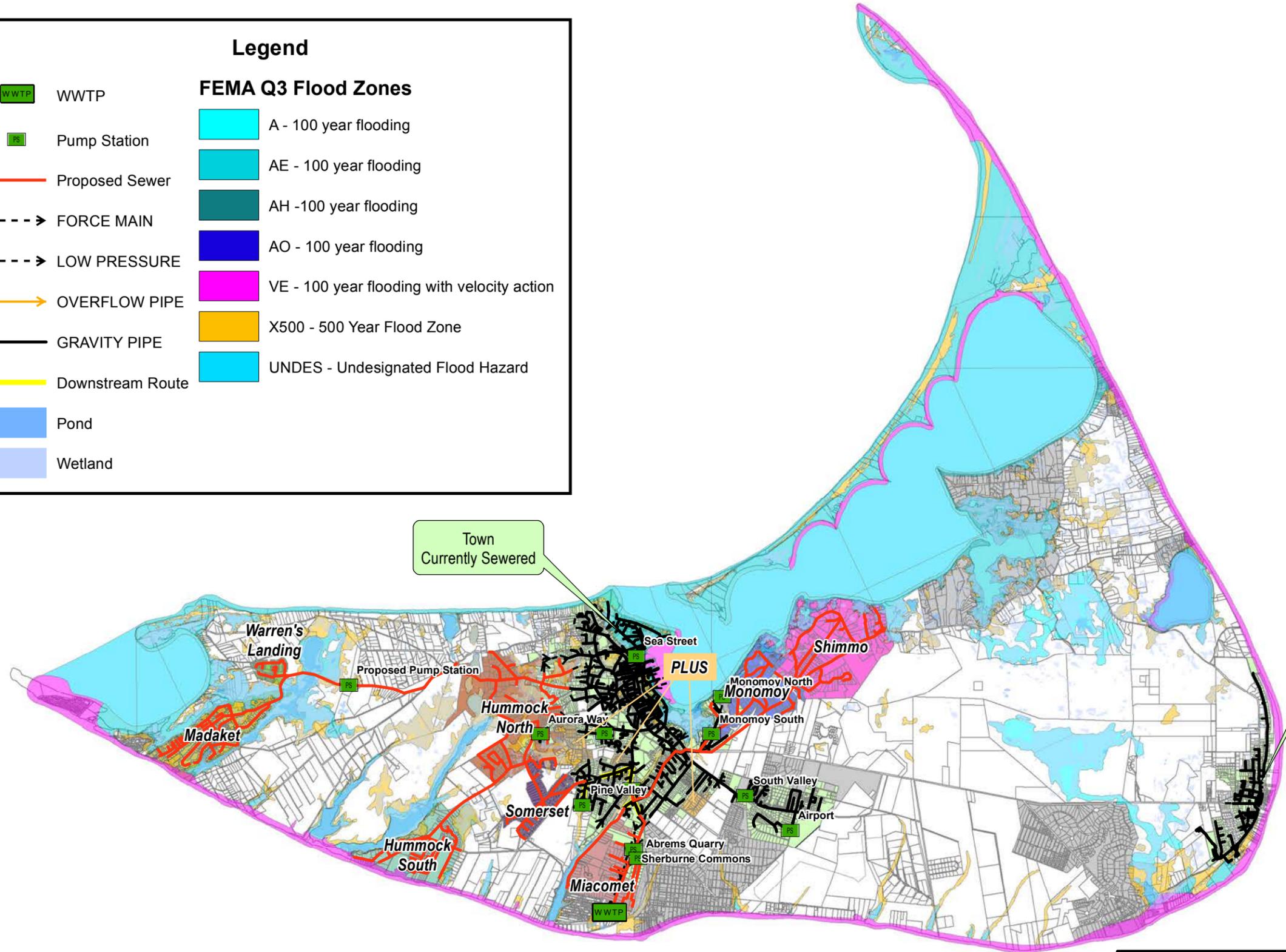


SCALE: 1" = 1.25 MILES	DOC: WELLHEAD.MXD
DATE: FEB. 2014	JOB NO.: 225139
DRAWN BY: JSM/RTB	SOURCE: MassGIS & Town



Legend

	WWTP		FEMA Q3 Flood Zones A - 100 year flooding
	Pump Station		AE - 100 year flooding
	Proposed Sewer		AH - 100 year flooding
	FORCE MAIN		AO - 100 year flooding
	LOW PRESSURE		VE - 100 year flooding with velocity action
	OVERFLOW PIPE		X500 - 500 Year Flood Zone
	GRAVITY PIPE		UNDES - Undesignated Flood Hazard
	Downstream Route		
	Pond		
	Wetland		



Siasconset
Currently Sewered

**COMPREHENSIVE WASTEWATER
MANAGEMENT PLAN UPDATE
TOWN OF NANTUCKET, MA
CONCEPTUAL SEWER LAYOUT &
ENVIRONMENTAL CONSTRAINTS
FIGURE 3-13**



SCALE: 1" = 1.25 MILES	DOC: FEMAFLD.MXD
DATE: FEB. 2014	JOB NO.: 225139
DRAWN BY: JSM/RTB	SOURCE: MassGIS & Town

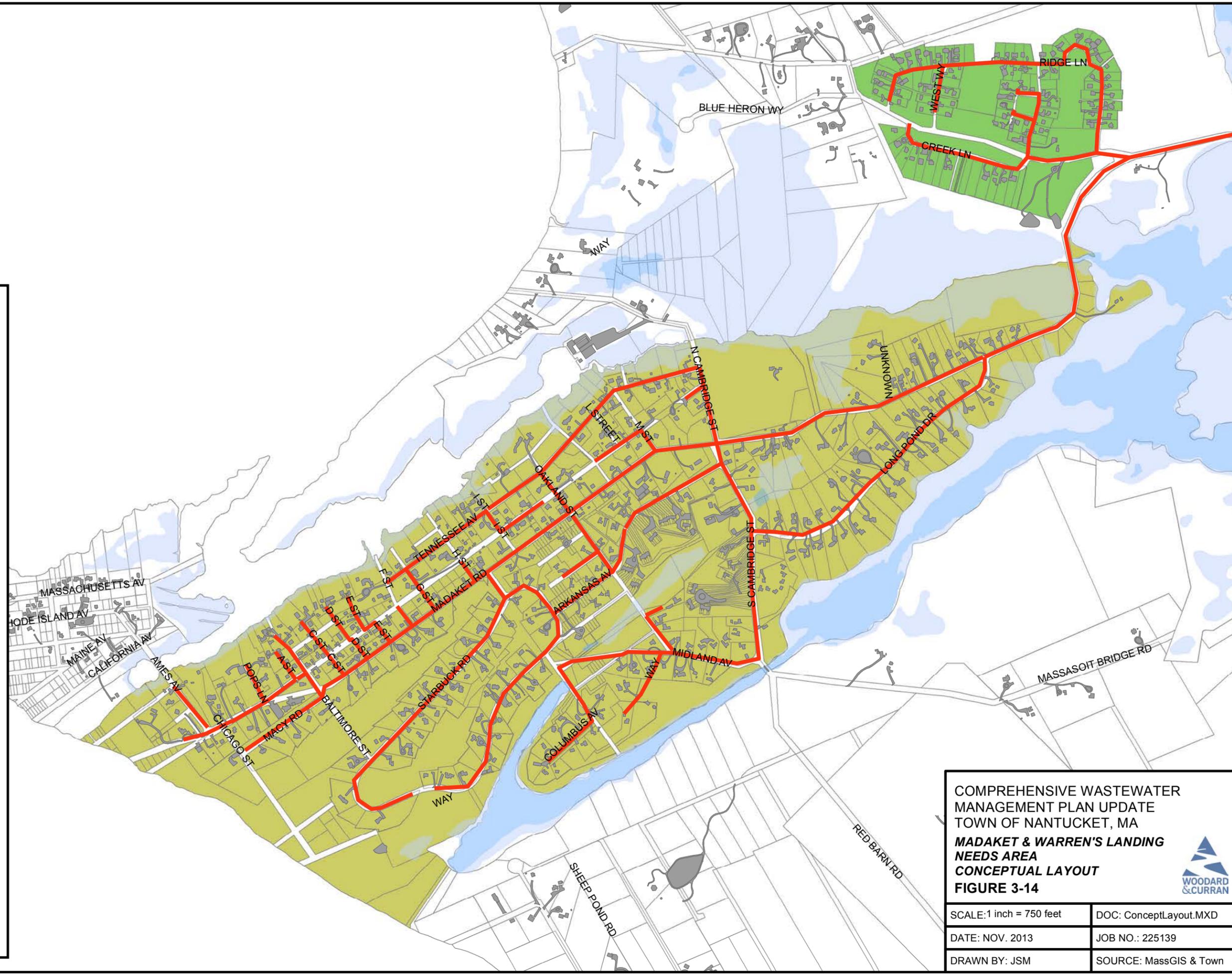


Legend

Wastewater Pipes

-  FORCE MAIN
-  LOW PRESSURE
-  OVERFLOW PIPE
-  GRAVITY MAIN, 4"
-  GRAVITY MAIN, 6"
-  GRAVITY MAIN, 8"
-  GRAVITY MAIN, 10"
-  GRAVITY MAIN, 12"
-  GRAVITY MAIN, 15"
-  GRAVITY MAIN, 18"
-  GRAVITY MAIN, 20"
-  GRAVITY MAIN, 24"
-  GRAVITY MAIN, 30"
-  GRAVITY MAIN, Unknown Diam.

-  Proposed Sewer
-  Impervious Cover
-  Pond
-  Wetland



**COMPREHENSIVE WASTEWATER
 MANAGEMENT PLAN UPDATE
 TOWN OF NANTUCKET, MA
 MADAKET & WARREN'S LANDING
 NEEDS AREA
 CONCEPTUAL LAYOUT
 FIGURE 3-14**



SCALE: 1 inch = 750 feet	DOC: ConceptLayout.MXD
DATE: NOV. 2013	JOB NO.: 225139
DRAWN BY: JSM	SOURCE: MassGIS & Town

3.13.2.3 Somerset

The Somerset Study Area was evaluated in the 2004 Phase I Report as long-term unsustainable with the current on-site wastewater disposal systems or simply a “Needs Area” and maintains this determination in this CWMP Update. Out of the four options evaluated in the 2004 Phase III Report as a solution for this Needs Area, the most feasible is a combination of Conventional Gravity Sewers and Low-Pressure Sewers.

The Recommended Plan consists of the installation of approximately 20,500 linear feet of sewer composed of both gravity pipe and low-pressure sewer. The extent of each sewer type will be determined during final design. The need for any new pump stations will also be determined during preliminary design and any pump stations identified will be submersible and installed in the existing right of way. Figure 3- 15 shows the proposed Somerset Collection System layout.

Somerset’s collection system will join the Town’s existing gravity sewer on Bartlett Road and be pumped to the Surfside Road Pump Station via Pine Valley Pump Station. The Surfside Road Pump Station will pump the wastewater flow to the Surfside Wastewater Treatment Facility for treatment and disposal. Based on Woodard & Curran’s preliminary evaluation of the downstream sewer infrastructure using the Town’s GIS mapping, approximately 1,500 linear feet of sewer on Mizzenmast Road and approximately, 3,500 linear feet on Bartlett Road and Surfside Road will need to be upgraded to allow adequate capacity for Madaket, Warren’s Landing and Somerset flows. Upgrades for the Pine Valley and Surfside Road Pump Stations will also likely be necessary. The capacity analysis completed during Final Design will determine the extent of and timing of upgrades.

3.13.2.3.1 Environmental Impact

This Needs Area is overlain by NHESP. Based on the above-referenced information, no environmental impact with the planning level concept is foreseen. All proposed infrastructure is detailed as in existing, pre-disturbed right of ways and/or roadways. In areas proposed and conducive to directional drilling, the use of directional drilling eliminates many potential threats to environmental resources. Conventional Gravity Sewers will be designed within existing right of ways and/or roadways to eliminate any threat to environmental resources. During the Final Design Phase of the Project, should any questions arise as to impacts to environmental resources within the Project limits, the appropriate agency will be contacted and all issues will be addressed accordingly.

3.13.2.4 Hummock North

The Hummock North Area was evaluated in this CWMP Update and identified as long-term unsustainable with the current on-site wastewater disposal systems or simply a “Needs Area” as further described in Section 2. Additionally, the MEP Report completed for this geographical area also determined that in order to meet the established water quality thresholds for Hummock Pond, it is recommended that wastewater be removed from the Watershed.

Out of the options evaluated in the CWMP Update as a solution for this Needs Area, the most feasible is a combination of Conventional Gravity Sewers and/or Low-Pressure Sewers.

The Recommended Plan consists of the installation of approximately 45,800 linear feet of sewer composed of both gravity pipe and/or low-pressure sewer. The extent of each sewer type will be determined during the Final Design Phase of the Project. All sewers are proposed to be located in the pre-disturbed right of ways and or roadways. The need for any new pump stations will also be determined during Final Design and any pump stations identified will be submersible and installed in existing right of ways. Figure 3-16 shows the proposed Hummock Pond North Collection System layout.

The Hummock North collection system will join the Town's existing gravity sewer system through the Somerset Needs Area. Based on Woodard & Curran's preliminary evaluation of the downstream sewer infrastructure using the Town's GIS mapping, approximately 1,500 linear feet of sewer on Mizzenmast Road and approximately, 3,500 linear feet on Bartlett Road and Surfside Road will need to be upgraded to allow adequate capacity for Hummock North and Somerset flows. Upgrades for the Pine Valley and Surfside Road Pump Stations will also likely be necessary. The capacity analysis completed during Final Design will determine the extent of and timing of upgrades.

3.13.2.4.1 Environmental Impact

This Needs Area is overlain by NHESP and includes a vernal pool location. There are wetlands dispersed throughout the geographic area. Based on the above-referenced information, no environmental impact with the planning level concept is foreseen. The Town will work with the local Conservation Commission during design and address these areas accordingly. All proposed infrastructure is detailed as in existing, pre-disturbed right of ways and/or roadways. In areas proposed and conducive to directional drilling, the use of directional drilling eliminates many potential threats to environmental resources. Conventional Gravity Sewers will be designed within existing right of ways and/or roadways to eliminate any threat to environmental resources. During the Final Design Phase of the Project, should any questions arise as to impacts to environmental resources within the Project limits, the appropriate agency will be contacted and all issues will be addressed accordingly.



Legend

Wastewater Pipes

- FORCE MAIN
- LOW PRESSURE
- OVERFLOW PIPE
- GRAVITY MAIN, 4"
- GRAVITY MAIN, 6"
- GRAVITY MAIN, 8"
- GRAVITY MAIN, 10"
- GRAVITY MAIN, 12"
- GRAVITY MAIN, 15"
- GRAVITY MAIN, 18"
- GRAVITY MAIN, 20"
- GRAVITY MAIN, 24"
- GRAVITY MAIN, 30"
- GRAVITY MAIN, Unknown Diam.

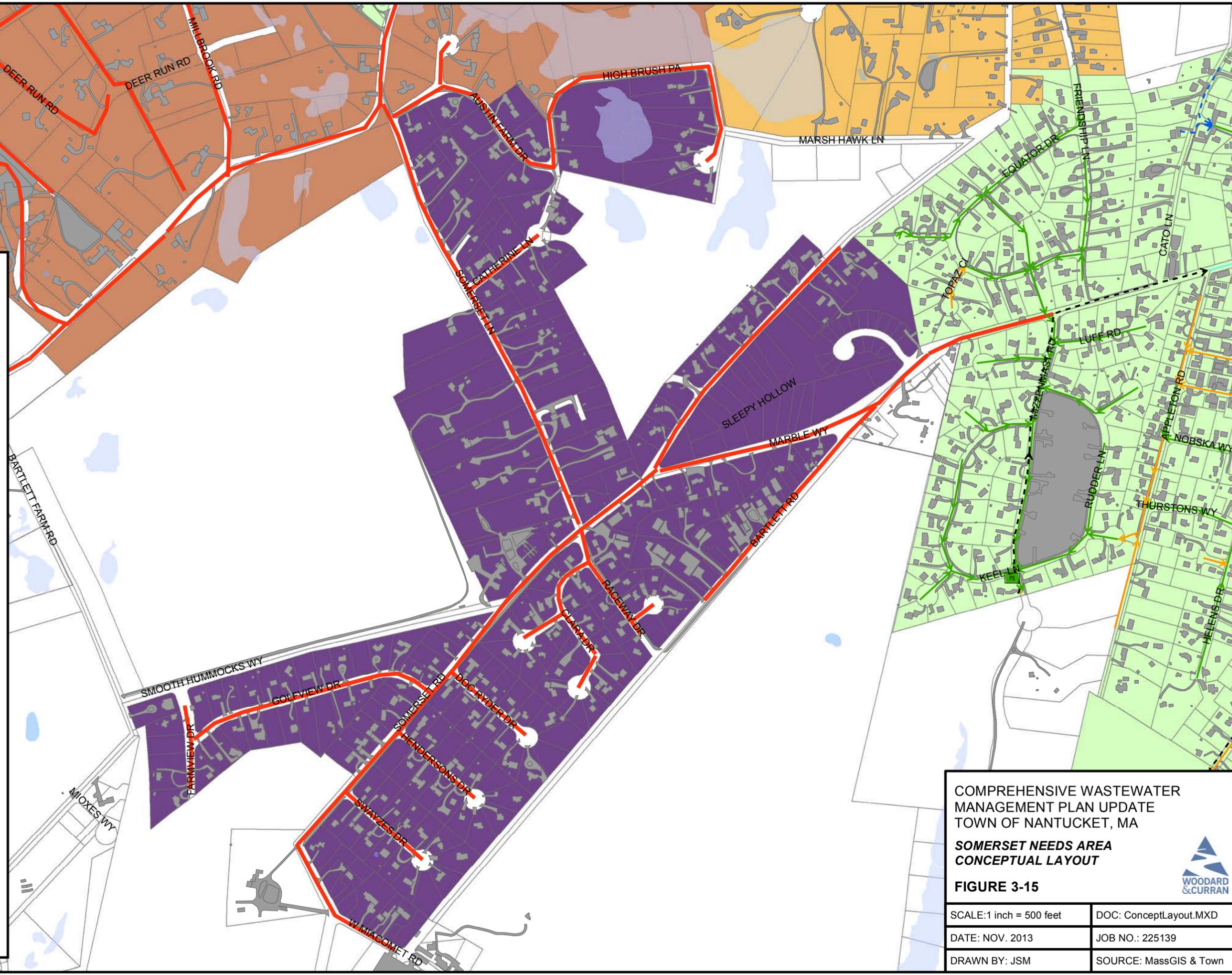
Proposed Sewer

Impervious Cover

Pond

Wetland

Town Sewer District



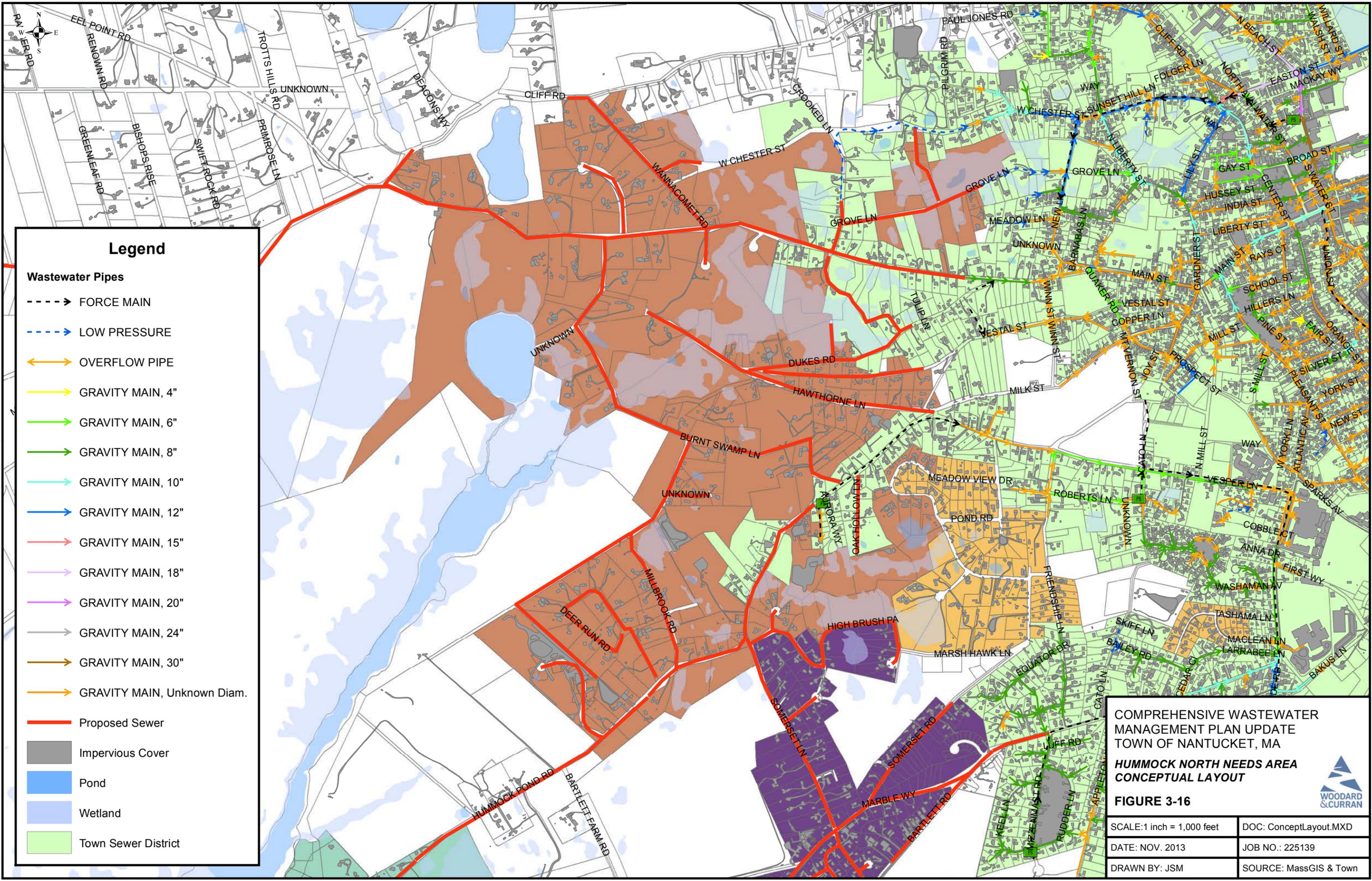
COMPREHENSIVE WASTEWATER
MANAGEMENT PLAN UPDATE
TOWN OF NANTUCKET, MA

**SOMERSET NEEDS AREA
CONCEPTUAL LAYOUT**

FIGURE 3-15

SCALE: 1 inch = 500 feet	DOC: ConceptLayout.MXD
DATE: NOV. 2013	JOB NO.: 225139
DRAWN BY: JSM	SOURCE: MassGIS & Town





**COMPREHENSIVE WASTEWATER MANAGEMENT PLAN UPDATE
TOWN OF NANTUCKET, MA
HUMMOCK NORTH NEEDS AREA
CONCEPTUAL LAYOUT**

FIGURE 3-16

SCALE: 1 inch = 1,000 feet	DOC: ConceptLayout.MXD
DATE: NOV. 2013	JOB NO.: 225139
DRAWN BY: JSM	SOURCE: MassGIS & Town

Legend

Wastewater Pipes

- > FORCE MAIN
- - - -> LOW PRESSURE
- ← OVERFLOW PIPE
- GRAVITY MAIN, 4"
- GRAVITY MAIN, 6"
- GRAVITY MAIN, 8"
- GRAVITY MAIN, 10"
- GRAVITY MAIN, 12"
- GRAVITY MAIN, 15"
- GRAVITY MAIN, 18"
- GRAVITY MAIN, 20"
- GRAVITY MAIN, 24"
- GRAVITY MAIN, 30"
- GRAVITY MAIN, Unknown Diam.
- Proposed Sewer
- Impervious Cover
- Pond
- Wetland
- Town Sewer District

3.13.2.5 Hummock South

The Hummock South Area was evaluated in this CWMP Update and identified as long-term unsustainable with the current on-site wastewater disposal systems or simply a “Needs Area” as further described in Section 2.

Out of the options evaluated in the CWMP Update as a solution for this Needs Area, the most feasible is a combination of Conventional Gravity Sewers and/or Low Pressure Sewers.

The Recommended Plan consists of the installation of approximately 32,800 linear feet of sewer composed of both gravity pipe and low-pressure sewer. The extent of each sewer type will be determined during Final Design. All sewers are proposed to be located in the pre-disturbed existing right of ways and/or roadways. The need for pump stations will also be determined during Preliminary Design and any pump stations will be submersible and installed in existing right of ways. Figure 3-17 shows the proposed Hummock Pond South Collection System layout.

The Hummock South collection system will join the Hummock North collection system and the Somerset System and then join the Town’s existing collection system on Bartlett Road and be pumped to the to the Surfside Road Pump Station via Pine Valley Pump Station,. The Surfside Road Pump Station will pump the wastewater flow to the Surfside Wastewater Treatment Facility for treatment and disposal. Based on Woodard & Curran’s preliminary evaluation of the downstream sewer infrastructure using the Town’s GIS mapping, approximately 1,500 linear feet of sewer on Mizzenmast Road and approximately, 3,500 linear feet on Bartlett Road and Surfside Road will need to be upgraded to allow adequate capacity for Hummock South, Hummock North, and Somerset flows. Upgrades for the Pine Valley and Surfside Road Pump Stations will also likely be necessary. The capacity analysis completed during Final Design will determine the extent of and timing of upgrades.

3.13.2.5.1 Environmental Impact

This Needs Area is overlain by NHESP. There are wetlands dispersed throughout the geographic area. The Town will work with the local Conservation Commission during design and address these areas accordingly. The south coastal area is included within FEMA Flood Zones, but no infrastructure is proposed within this or the velocity zone. This will be further addressed during design phase. Based on the above-referenced information, no environmental impact with the planning level concept is foreseen. All proposed infrastructure is detailed as in existing, pre-disturbed right of ways and/or roadways. In areas proposed and conducive to directional drilling, the use of directional drilling eliminates many potential threats to environmental resources. Conventional Gravity Sewers will be designed within existing right of ways and/or roadways to eliminate any threat to environmental resources. During the Final Design Phase of the Project, should any questions arise as to impacts to environmental resources within the Project limits, the appropriate agency will be contacted and all issues will be addressed accordingly.

3.13.2.6 Miacomet

The Miacomet Area was evaluated in this CWMP Update and identified as long-term unsustainable with the current on-site wastewater disposal systems or simply a “Needs Area” as further described in Section 2. While there is no formal MEP Study active for this watershed, the Town is evaluating the current watershed delineations and potential threats to the freshwater Pond’s water quality. Years of annual water quality testing results show significant degradation to the Pond, which supports removal of on-site wastewater in this geographic area. This is further detailed throughout this Report.

Out of the options evaluated in the CWMP Update as a solution for this Needs Area, the most feasible is a combination of Conventional Gravity Sewers and Low-Pressure Sewers. The Recommended Plan consists of the installation of approximately 27,100 linear feet of sewer composed of both gravity pipe and/or low-pressure sewer. The extent of each sewer type will be determined during Final Design. All sewers are proposed to be located in the pre-disturbed existing right of ways and/or roadways. The need for construction of pump stations will also be

determined during Preliminary Design, however, any pump stations will be submersible and installed in the existing right of ways. The Miacomet collection system may potentially be able to connect to the Sherburne Commons infrastructure and/or the Abrem's Quarry Pump Stations, and potentially to the Surfside Pump Station. This will be determined during Final Design. Figure 3-18 shows the proposed Miacomet Collection System layout.

Based on Woodard & Curran's preliminary evaluation of the downstream sewer infrastructure using the Town's GIS mapping, approximately 2,100 feet of sewer on Miacomet Road and Surfside Road may need to be upgraded to allow adequate capacity for Miacomet flows to connect to the Surfside Pump Station, depending on the layout of the sewer determined during final design. Upgrades for the Surfside Road Pump Station will also likely be necessary. The capacity analysis completed during Final Design will determine the extent of and timing of upgrades.

3.13.2.6.1 Environmental Impact

This Needs Area is overlain by NHESP. Based on the above-referenced information, no environmental impact with the planning level concept is foreseen. There is a significant portion of this geographic area currently serviced by municipal sewer with infrastructure that currently is active and can be utilized to connect additional areas proposed in this Needs Area. All proposed new infrastructure is detailed as in existing, pre-disturbed right of ways and/or roadways. In areas proposed and conducive to directional drilling, the use of directional drilling eliminates many potential threats to environmental resources. Conventional Gravity Sewers will be designed within existing right of ways and/or roadways to eliminate any threat to environmental resources. During the Final Design Phase of the Project, should any questions arise as to impacts to environmental resources within the Project limits, the appropriate agency will be contacted and all issues will be addressed accordingly.

3.13.2.7 Monomoy

The Monomoy Area is determined to be a Needs Area based on the Area's proximity to and potential impact relative to the Massachusetts Estuaries Program to the Nantucket Harbor Watershed and maintains this recommendation in this CWMP Update. Currently, a portion of the developed lots are within the Town Sewer District and are already connected to the Town Sewer District collection system that conveys wastewater to the Surfside Wastewater Treatment Facility. The Recommended Plan consists of connecting the remaining parcels in the delineated Needs Area via installation of approximately 30,800 linear feet of sewer. The type of sewer will be determined during Final Design, but will likely include a combination of gravity sewer and low-pressure sewer. A portion of the collection system in Monomoy will connect to the Monomoy South Pump Station and another portion of the collection system will travel down Polpis Road to Milestone Road connecting the Monomoy and Shimmo Collection Systems to the Town Collection System. Note that this option eliminates this area from having to travel to the Sea Street Pump Station.

Based on Woodard & Curran's preliminary evaluation of the downstream sewer infrastructure using the Town's GIS mapping, this whole system would connect to the Surfside Road Pump Station, which will pump the wastewater flow to the Surfside Wastewater Treatment Facility for treatment and disposal. All sewers are proposed to be located in pre-disturbed existing right of ways and/or roadways. Refer to Figure 3-19 for the proposed layout of the Monomoy Collection System.

3.13.2.7.1 Environmental Impact

This Needs Area is overlain by NHESP. There are areas that are within the Zone II of the public water supply and coastal areas abut the FEMA Flood Zone. Based on the above-referenced information, no environmental impact with the planning level concept is foreseen. All proposed new infrastructure is detailed as in existing, pre-disturbed right of ways and/or roadways. There is a significant portion of this geographic area currently included within the approved Town Sewer District serviced by municipal sewer with infrastructure that currently is active and can be utilized to connect additional areas proposed in this Needs Area. The removal of on-site wastewater systems in this geographic

area removes any potential threats to the public water supply. In areas proposed and conducive to directional drilling, the use of directional drilling eliminates many potential threats to environmental resources. Conventional Gravity Sewers will be designed within existing right of ways and/or roadways to eliminate any threat to environmental resources. During the Final Design Phase of the Project, should any questions arise as to impacts to environmental resources within the Project limits, the appropriate agency will be contacted and all issues will be addressed accordingly.

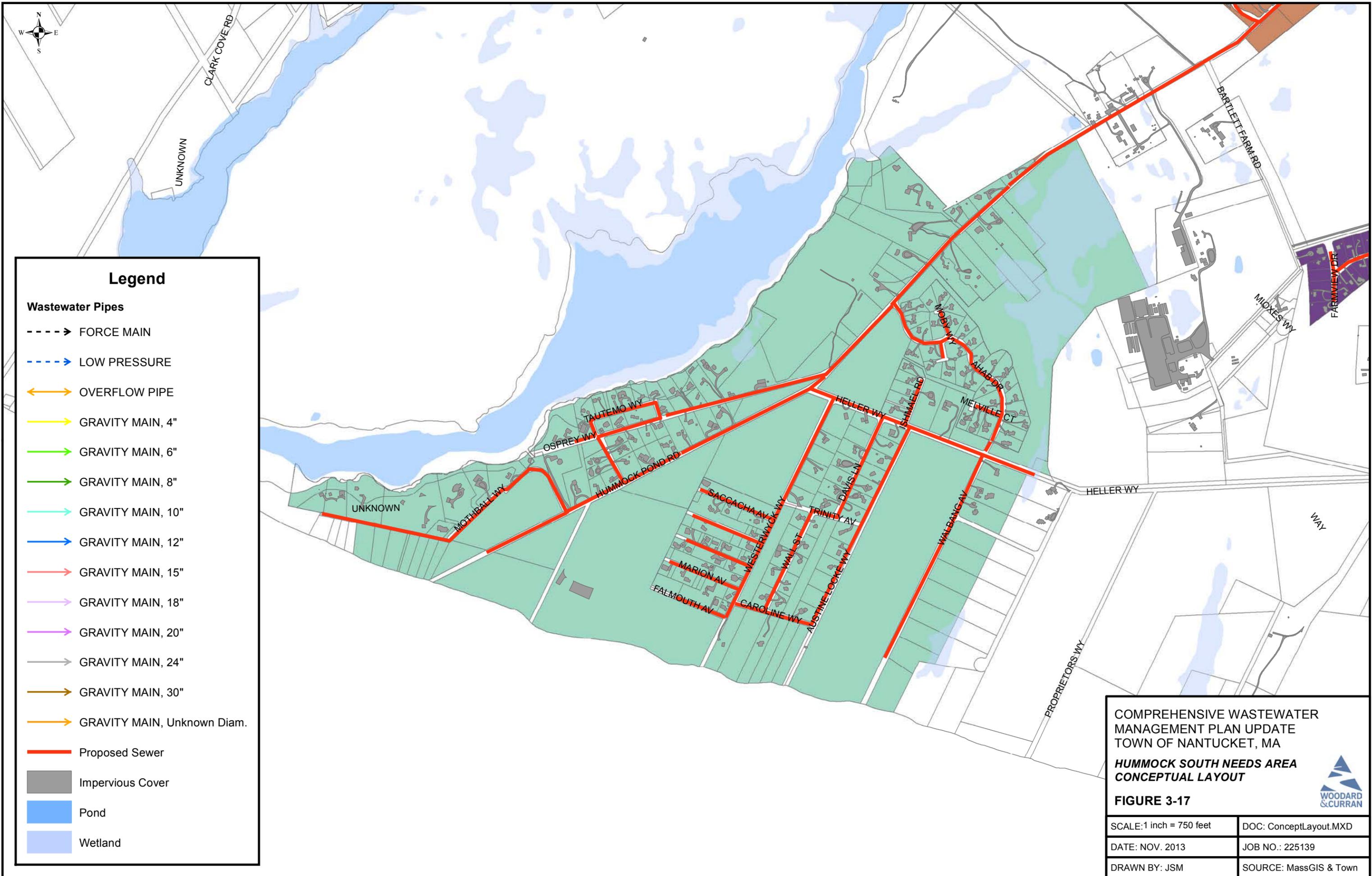
3.13.2.8 Shimmo

The Shimmo Area was evaluated in the 2004 Phase I Report and determined to be a Needs Area based on the Area's proximity to and potential impact relative to the Massachusetts Estuaries Program to the Nantucket Harbor Watershed and maintains this recommendation in this CWMP Update. Out of the options evaluated in the CWMP Update as a solution for this Needs Area, the most feasible is a combination of Conventional Gravity Sewers and Low-Pressure Sewers. The Recommended Plan consists of the installation of approximately 32,600 linear feet of low-pressure sewer with sizes ranging from 1-1/4 to 4 inch diameter pipe. All sewers are proposed to be located in pre-disturbed existing right of ways and/or the roadways. The Shimmo collection system will tie in directly to the gravity sewer in the Monomoy Needs Area via Polpis Road. Figure 3-20 provides a layout for the proposed Shimmo Collection System.

Based on Woodard & Curran's preliminary evaluation of the downstream sewer infrastructure using the Town's GIS mapping, this whole collection system would connect to the Surfside Road Pump Station, which will pump the wastewater flow to the Surfside Wastewater Treatment Facility for treatment and disposal.

3.13.2.8.1 Environmental Impact

This Needs Area is overlain by NHESP. The immediate area abutting Nantucket Harbor lies within the FEMA Flood Zone, but no infrastructure is planned within this area. Based on the above-referenced information, no environmental impact with the planning level concept is foreseen. All proposed new infrastructure is detailed as in existing, pre-disturbed right of ways and/or roadways. In areas proposed and conducive to directional drilling, the use of directional drilling eliminates many potential threats to environmental resources. Conventional Gravity Sewers will be designed within existing right of ways and/or roadways to eliminate any threat to environmental resources. During the Final Design Phase of the Project, should any questions arise as to impacts to environmental resources within the Project limits, the appropriate agency will be contacted and all issues will be addressed accordingly.



Legend

Wastewater Pipes

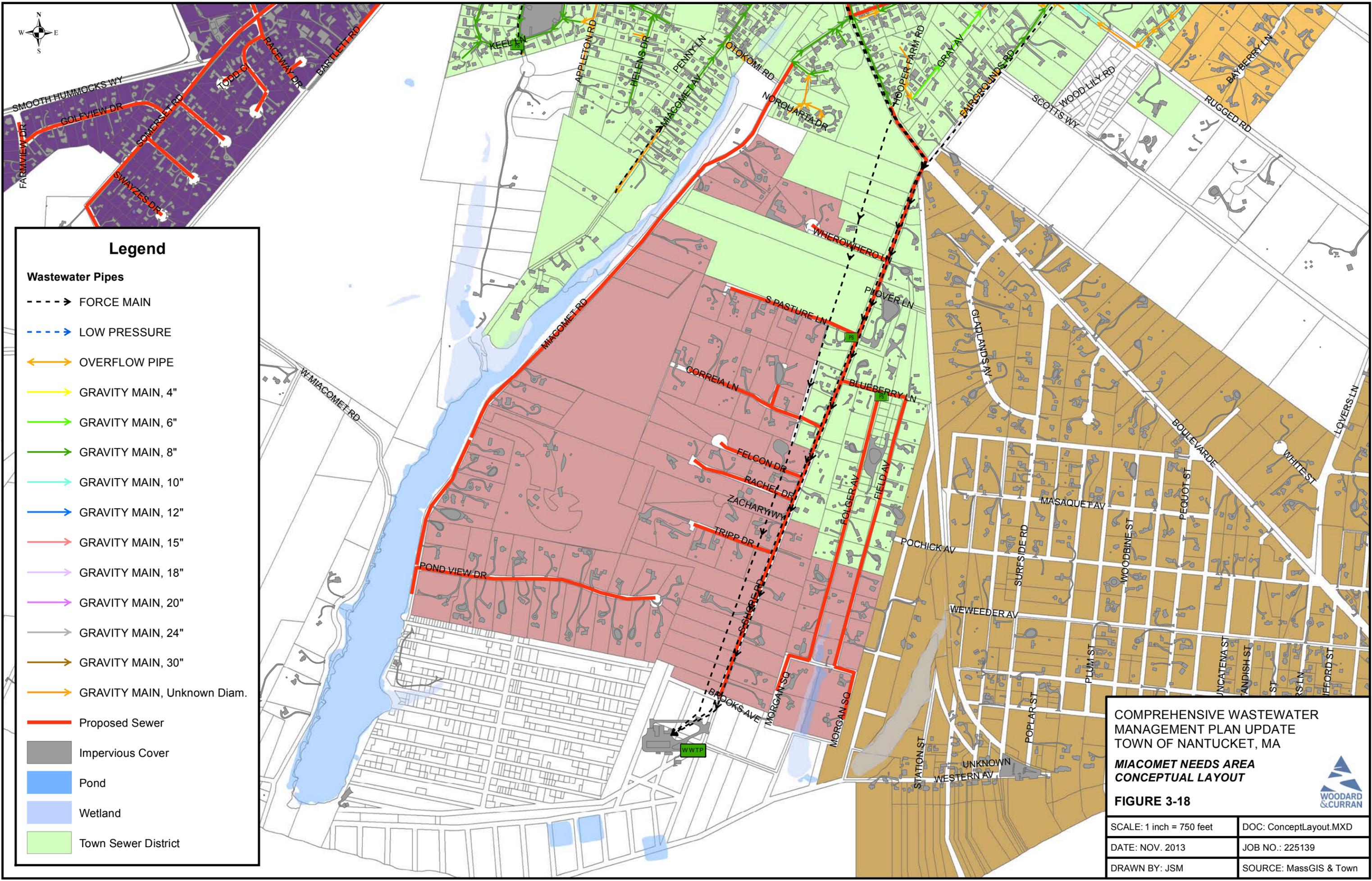
- > FORCE MAIN
- > LOW PRESSURE
- ←> OVERFLOW PIPE
- GRAVITY MAIN, 4"
- GRAVITY MAIN, 6"
- GRAVITY MAIN, 8"
- GRAVITY MAIN, 10"
- GRAVITY MAIN, 12"
- GRAVITY MAIN, 15"
- GRAVITY MAIN, 18"
- GRAVITY MAIN, 20"
- GRAVITY MAIN, 24"
- GRAVITY MAIN, 30"
- GRAVITY MAIN, Unknown Diam.
- Proposed Sewer
- Impervious Cover
- Pond
- Wetland

COMPREHENSIVE WASTEWATER
 MANAGEMENT PLAN UPDATE
 TOWN OF NANTUCKET, MA
**HUMMOCK SOUTH NEEDS AREA
 CONCEPTUAL LAYOUT**



FIGURE 3-17

SCALE: 1 inch = 750 feet	DOC: ConceptLayout.MXD
DATE: NOV. 2013	JOB NO.: 225139
DRAWN BY: JSM	SOURCE: MassGIS & Town



**COMPREHENSIVE WASTEWATER
 MANAGEMENT PLAN UPDATE
 TOWN OF NANTUCKET, MA**
**MIACOMET NEEDS AREA
 CONCEPTUAL LAYOUT**
FIGURE 3-18

SCALE: 1 inch = 750 feet	DOC: ConceptLayout.MXD
DATE: NOV. 2013	JOB NO.: 225139
DRAWN BY: JSM	SOURCE: MassGIS & Town



Legend

Wastewater Pipes

- > FORCE MAIN
- - -> LOW PRESSURE
- ← OVERFLOW PIPE
- GRAVITY MAIN, 4"
- GRAVITY MAIN, 6"
- GRAVITY MAIN, 8"
- GRAVITY MAIN, 10"
- GRAVITY MAIN, 12"
- GRAVITY MAIN, 15"
- GRAVITY MAIN, 18"
- GRAVITY MAIN, 20"
- GRAVITY MAIN, 24"
- GRAVITY MAIN, 30"
- GRAVITY MAIN, Unknown Diam.
- Proposed Sewer

- Impervious Cover
- Pond
- Wetland
- Town Sewer District

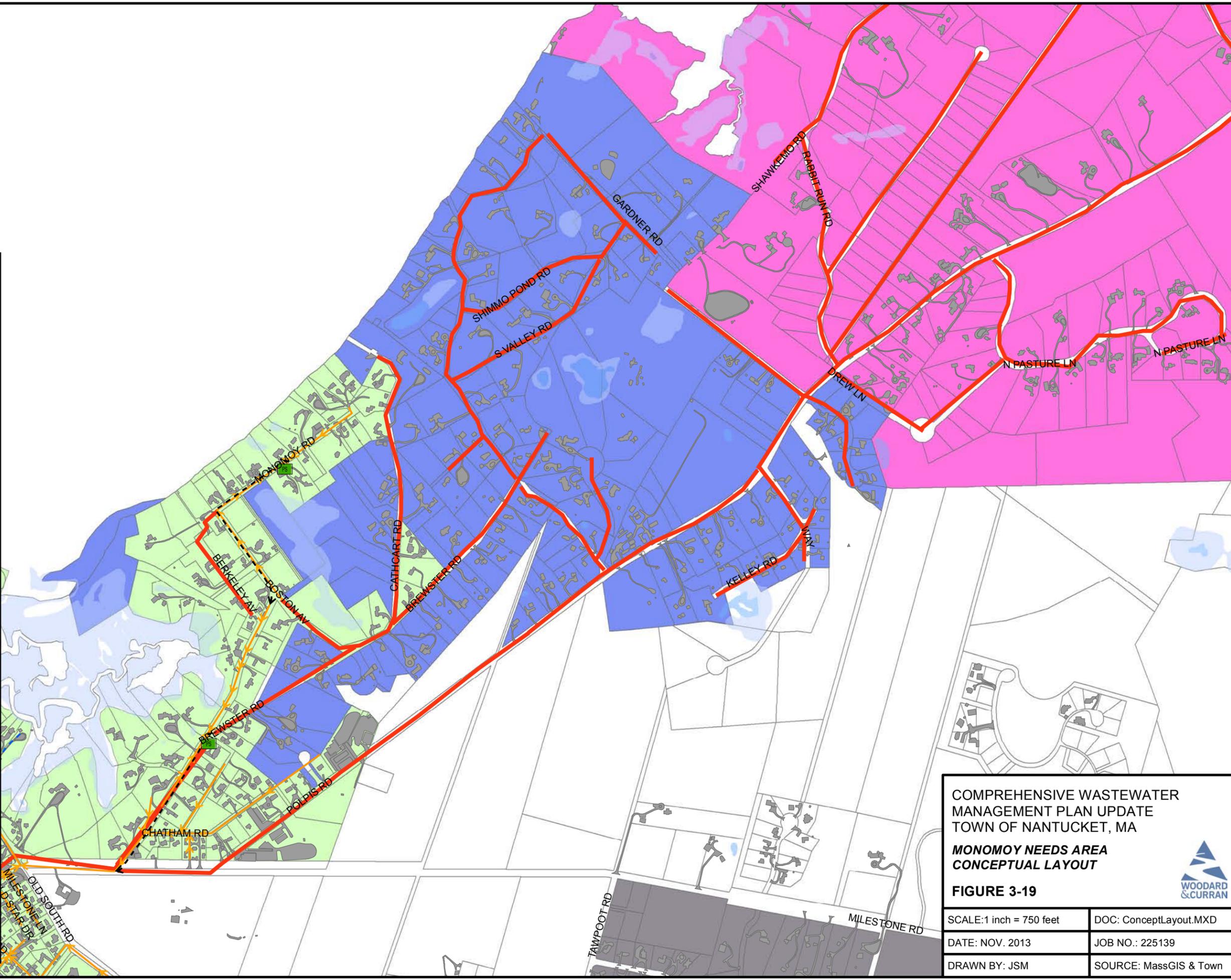


Legend

Wastewater Pipes

- > FORCE MAIN
- - -> LOW PRESSURE
- ← OVERFLOW PIPE
- GRAVITY MAIN, 4"
- GRAVITY MAIN, 6"
- GRAVITY MAIN, 8"
- GRAVITY MAIN, 10"
- GRAVITY MAIN, 12"
- GRAVITY MAIN, 15"
- GRAVITY MAIN, 18"
- GRAVITY MAIN, 20"
- GRAVITY MAIN, 24"
- GRAVITY MAIN, 30"
- GRAVITY MAIN, Unknown Diam.
- Proposed Sewer

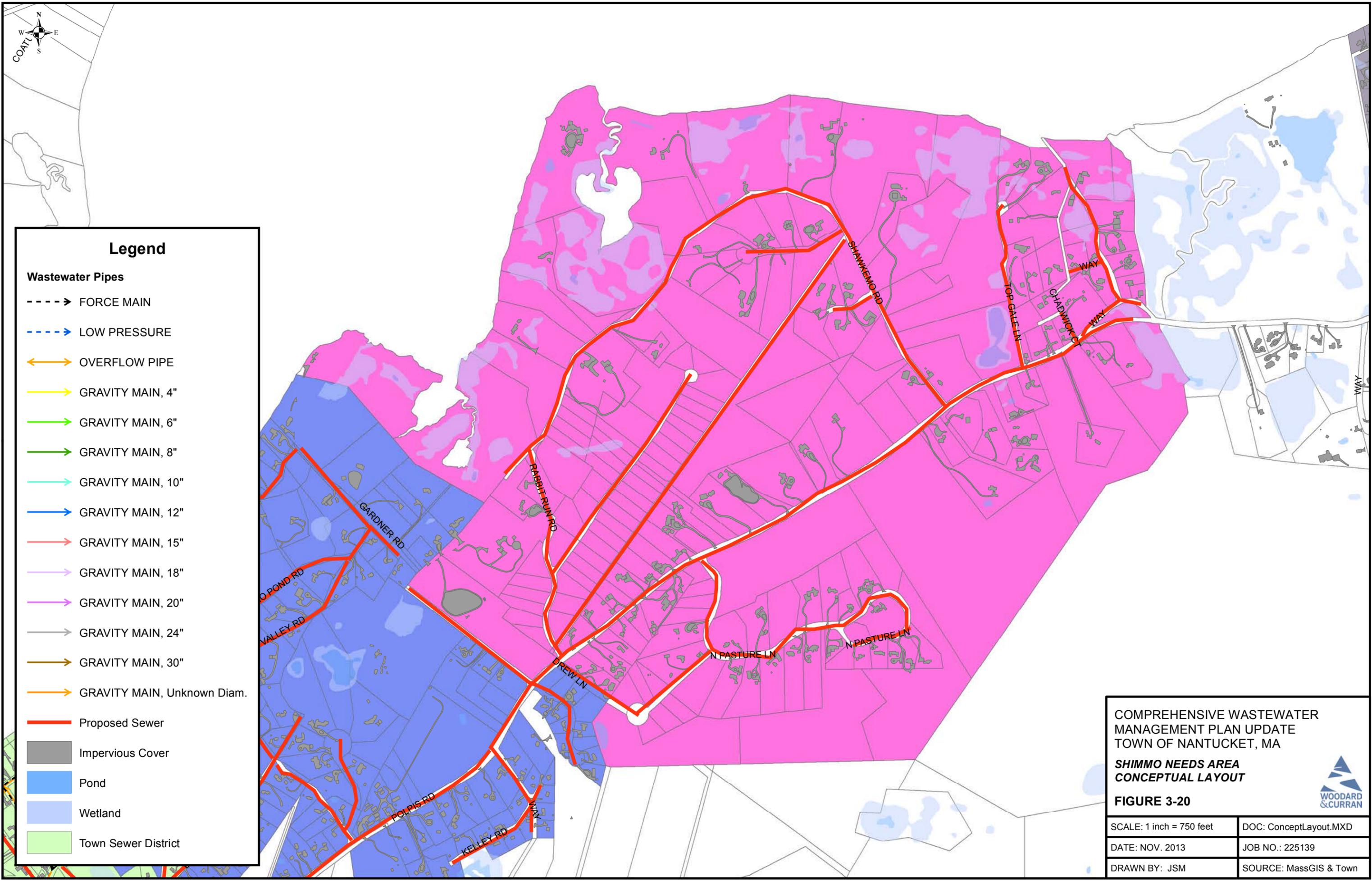
■ Impervious Cover
 ■ Pond
 ■ Wetland
 ■ Town Sewer District



**COMPREHENSIVE WASTEWATER
 MANAGEMENT PLAN UPDATE
 TOWN OF NANTUCKET, MA**
**MONOMOY NEEDS AREA
 CONCEPTUAL LAYOUT**
FIGURE 3-19

SCALE: 1 inch = 750 feet DOC: ConceptLayout.MXD
 DATE: NOV. 2013 JOB NO.: 225139
 DRAWN BY: JSM SOURCE: MassGIS & Town





Legend

Wastewater Pipes

- > FORCE MAIN
- > LOW PRESSURE
- > OVERFLOW PIPE
- > GRAVITY MAIN, 4"
- > GRAVITY MAIN, 6"
- > GRAVITY MAIN, 8"
- > GRAVITY MAIN, 10"
- > GRAVITY MAIN, 12"
- > GRAVITY MAIN, 15"
- > GRAVITY MAIN, 18"
- > GRAVITY MAIN, 20"
- > GRAVITY MAIN, 24"
- > GRAVITY MAIN, 30"
- > GRAVITY MAIN, Unknown Diam.
- Proposed Sewer
- Impervious Cover
- Pond
- Wetland
- Town Sewer District

COMPREHENSIVE WASTEWATER
 MANAGEMENT PLAN UPDATE
 TOWN OF NANTUCKET, MA
**SHIMMO NEEDS AREA
 CONCEPTUAL LAYOUT**
FIGURE 3-20

SCALE: 1 inch = 750 feet	DOC: ConceptLayout.MXD
DATE: NOV. 2013	JOB NO.: 225139
DRAWN BY: JSM	SOURCE: MassGIS & Town



3.13.2.9 Town Sewer District

The Town was evaluated and identified in the 2004 Phase I Report as long-term unsustainable with the current on-site wastewater disposal systems or simply a “Needs Area” and maintains this determination in this CWMP Update. This was due not only to its proximity in relation to the Nantucket Harbor Watershed delineation, but, also, based on qualifying criteria as detailed in the 2004 Phase I Report. The majority of the Town’s Sewer District Area properties are currently connected to the Town’s municipal sewer system that connects to the Surfside WWTF. Gravity sewers and pump stations collect and convey the wastewater to the Surfside WWTF for treatment and disposal. The Recommended Plan under is for the remaining unsewered lots to be connected to the existing collection system.

3.13.2.9.1 Environmental Impact

This Needs Area is overlain by NHESP. This area is almost entirely serviced by municipal sewer with no negative environmental impact. Based on the above-referenced information, no environmental impact with the planning level concept is foreseen. All proposed new infrastructure is detailed as in existing, pre-disturbed right of ways and/or roadways. There is a significant portion of this geographic area currently included within the approved Town Sewer District serviced by municipal sewer with infrastructure that currently is active and can be utilized to connect additional areas proposed in this Needs Area. In areas proposed and conducive to directional drilling, the use of directional drilling eliminates many potential threats to environmental resources. Conventional Gravity Sewers will be designed within existing right of ways and/or roadways to eliminate any threat to environmental resources. During the Final Design Phase of the Project, should any questions arise as to impacts to environmental resources within the Project limits, the appropriate agency will be contacted and all issues will be addressed accordingly.

3.13.2.10 Town WPZ

The Town Wellhead Protection Zone (WPZ) is a Needs Area based on its geographic location adjacent to the Town’s Potable Water Supply. The majority of the WPZ is connected via gravity sewers to the existing Surfside Collection System and is treated and disposed of at the Surfside Wastewater Treatment Facility. The remaining Town WPZ Study Area is serviced through on-site wastewater disposal systems. At this time, the Recommended Plan is for continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan. This recommendation is maintained in this CWMP Update. However, the Town should not allow any type of variances to current Title 5 rules and regulations and/or Local regulations that could present a compromise to the protection and preservation of the water supply and should establish a stringent monitoring program of all on-site wastewater disposal systems in this Study Area. If it is determined that the public water supply is being or could be subject to compromise, it is recommended that all potential impacts from unsewered lots be eliminated by connecting to the existing collection system at Surfside.

3.13.2.10.1 Environmental Impact

This Needs Area is overlain by NHESP. This geographic area supports the Town’s Wellhead Protection Zone. Based on the above-referenced information, no environmental impact with the planning level concept is foreseen. Any potential environmental impact, specifically impacts to public water supplies, must be addressed immediately. There is a significant portion of this geographic area currently included within the approved Town Sewer District serviced by municipal sewer with infrastructure that currently is active and can be utilized to connect additional areas if needed in this Needs Area. In areas proposed and conducive to directional drilling, the use of directional drilling eliminates many potential threats to environmental resources. Conventional Gravity Sewers will be designed within existing right of ways and/or roadways to eliminate any threat to environmental resources. During the Final Design Phase of the Project, should any questions arise as to impacts to environmental resources within the Project limits, the appropriate agency will be contacted and all issues will be addressed accordingly.

3.13.2.11 PLUS

These parcels are various areas either within or directly abutting the Town Sewer District that for one reason or another were left out of the Town Sewer District in error. Most are sandwiched within the existing sewer or are either at the beginning or end of currently sewered streets. Most either immediately abut infrastructure or are in close proximity of collection system components and can be connected without extraneous effort.

3.13.2.11.1 Environmental Impact

These miscellaneous parcels are overlain by NHESP. Based on the above-referenced information, no environmental impact with the planning level concept is foreseen. These individual parcels are currently within existing sewer infrastructure or in very close proximity to same and can be connected without any environmental impact. During the Final Design Phase of the Project, should any questions arise as to impacts to environmental resources within the Project limits, the appropriate agency will be contacted and all issues will be addressed accordingly.

Refer to Figure 3 -9 that details the proposed Nantucket Surfside Wastewater Collection System, as described in the above paragraphs.

3.13.3 Study Areas Recommended for Septage Management Plan Including Areas Managed with Innovative / Alternative Systems

These 2004 Study Areas were re-evaluated in this CWMP Update and while not considered as areas needing an off-site wastewater solution in 2004 or 2013, they abut Nantucket Harbor in various locations and contribute in various manners to the Nitrogen loading documented in the MEP Report. Based on additional studies completed by SMAST on scenarios in the Harbors to reduce nitrogen loading to meet established TMDLS, sewerage of these areas did not serve to contribute to the reduction effort. It has been determined that a more cost effective approach to the Nitrogen reduction be had through other contributors-fertilizer, stormwater and future build out. These efforts will supplement the structured solutions being planned such as sewerage, raising the jetties to afford a deeper tidal exchange and dredging. This CWMP Update is making recommendations to limit additional, future nitrogen loading with current and build-out conditions within the Adaptive Management Plan contained herein.

The following Study Areas are recommended for oversight under the Town's Septage Management Plan. As part of the overall Adaptive Management Plan include herein, this Report is also recommends consideration for future management utilizing Innovative / Alternative systems due to each area's geographic locations within Nitrogen-sensitive embayments as detailed in the MEP Reports. I/A systems will afford a higher nutrient reduction, up to 50 percent of TN, than a conventional Title 5 system is able to do.

3.13.3.1 Polpis

The Polpis Study Area was evaluated in the 2004 CWMP and recommended to maintain on-site wastewater disposal under the Town's Septage Management Plan unless the MEP report being completed at the time of the 2004 Report recommended otherwise (The 2004 CMP was completed before the MEP Study was finished). This CWMP Update maintains this determination with a few exceptions based on the results of the Nantucket and Polpis Harbors MEP. Because Polpis Harbor is included in the MEP and has a TMDL established in the Harbor with a threshold water quality to meet, it is recommended that future build out, as well as future repairs and/or upgrades to current Title 5 systems be mandated with an I/A system in order to reduce nitrogen loading to the Watershed. The Polpis Study Area is a high priority in terms of requiring attention due its location in proximity to and potential impact to not only Polpis Harbor, but Nantucket Harbor from the existing conventional on-site wastewater disposal systems.

The Town, under the auspices of the Septage Management Plan, will be able to monitor all on-site wastewater disposal systems, both conventional and I/A in order to evaluate future needs based on water quality results.

3.13.3.2 Pocomo

The Pocomo Study Area was evaluated in the 2004 CWMP and recommended to maintain on-site wastewater disposal under the Town's Septage Management Plan unless the MEP report being completed at the time of the 2004 Report recommended otherwise (The 2004 CMP was completed before the MEP Study was finished). This CWMP Update maintains this determination with a few exceptions based on the results of the Nantucket and Polpis Harbors MEP. Due to two TMDLs established in this geographic area as a result of the completed Nantucket and Polpis Harbor MEP and the location of this Study area in the upper reaches of the Harbor, it is necessary to look towards future build out conditions with respect to nutrient loading. There are two TMDLs established in this area, one in Nantucket Harbor and the second in Polpis Harbor. In order to meet and maintain the threshold water quality, it is recommended that future build out, as well as future repairs and/or upgrades to current Title 5 systems be mandated with an I/A system in order to reduce nitrogen loading to the Watershed. The Pocomo Study Area is a high priority in terms of requiring attention due its location in proximity to and potential impact to not only Polpis Harbor, but Nantucket Harbor from the existing conventional on-site wastewater disposal systems.

The Town, under the auspices of the Septage Management Plan, will be able to monitor all on-site wastewater disposal systems, both conventional and I/A in order to evaluate future needs based on water quality results.

3.13.3.3 Wauwinet

The Wauwinet Study Area was evaluated in the 2004 CWMP and recommended to maintain on-site wastewater disposal under the Town's Septage Management Plan unless the MEP report being completed at the time of the 2004 Report recommended otherwise (The 2004 CMP was completed before the MEP Study was finished). This CWMP Update maintains this determination with a few exceptions based on the results of the Nantucket and Polpis Harbors MEP. Due to two TMDLs established in this geographic area as a result of the completed Nantucket and Polpis Harbor MEP and the location of this Study area in the upper reaches of the Harbor, it is necessary to look towards future build out conditions with respect to limiting additional nutrient loading. There are two TMDLs established in this area, one in Nantucket Harbor and the second in Polpis Harbor. In order to meet and maintain the threshold water quality, it is recommended that future build out, as well as future repairs and/or upgrades to current Title 5 systems be mandated with an I/A system in order to reduce nitrogen loading to the Watershed. The Pocomo Study Area is a high priority in terms of requiring attention due its location in proximity to and potential impact to not only Polpis Harbor, but Nantucket Harbor from the existing conventional on-site wastewater disposal systems.

3.13.3.4 Surfside

The Surfside Study Area was evaluated in the 2004 CWMP as long-term sustainable with the current on-site wastewater disposal systems and maintains this determination in this CWMP Update. Based on an update of the 2004 criteria and regulatory drivers, this Study Area continues to be recommended for on-site wastewater management. Therefore, the Final Recommended Plan is continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.

3.13.3.5 Tom Nevers – Low Density

The Tom Nevers-Low Density Study Area was evaluated in the 2004 CWMP as long-term sustainable with the current on-site wastewater disposal systems and maintains this determination in this CWMP Update. Based on an update of the 2004 criteria and regulatory drivers, this Study Area continues to be recommended for on-site wastewater management. Therefore, the Final Recommended Plan is continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.

3.13.3.6 Tom Nevers-High Density

The Tom Nevers-High Density Study Area was evaluated in the 2004 CWMP as long-term sustainable with the current on-site wastewater disposal systems and maintains this determination in this CWMP Update. Based on an update of the 2004 criteria and regulatory drivers, this Study Area continues to be recommended for on-site wastewater management. Therefore, the Final Recommended Plan is continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.

3.13.3.7 Quidnet

The Quidnet Study Area was evaluated in the 2004 CWMP as long-term sustainable with the current on-site wastewater disposal systems and maintains this determination in this CWMP Update. Based on an update of the 2004 criteria and regulatory drivers, this Study Area continues to be recommended for on-site wastewater management. Therefore, the Final Recommended Plan is continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan. The Quidnet Area is a high priority in terms of requiring attention due its location in proximity to and potential impact to Sesachacha Pond from on-site wastewater disposal systems. Sesachacha Pond is currently listed on the State's 303(d) list and based on the last three years of water quality results that are meeting and/or exceeding thresholds levels set in the MEP, will be petitioned to have the state remove the Pond from the impaired waters list. These improved water quality tests are the results of successful semi-annual breaches that afford the Pond a solid flushing of the entire system.

Based on an update of the 2004 criteria and regulatory drivers, this Study Area continues to be recommended for on-site wastewater management. Therefore, the Final Recommended Plan is continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.

3.13.3.8 Siasconset

The Siasconset Study Area was not included in the CWMP Update Scope of Work.

3.13.3.9 Remaining Island

The Remaining Island Area, all areas not encompassed in the above-referenced Needs and Study Areas, was evaluated in the 2004 CWMP as long-term sustainable with the current on-site wastewater disposal systems and maintains this recommendation in this CWMP Update. After updating the criteria utilized in 2004, including Board of Health records, there was no additional area within this general geographic area that stood out as needing a closer evaluation of wastewater management other than those areas incorporated. Therefore, the Final Recommended Plan is continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.

Table 3-4 presents the Final Recommended Plan for the proposed Surfside Wastewater Collection System, including estimated infrastructure needs and cost estimates.

Figure 3-21 details the Capital Improvements Plan as detailed in this CWMP Update. Refer to Appendix I for back-up details.

Refer to Figure 3-22 for a map of the Final Recommended Plan.

Table 3-4: Summary of Surfside Wastewater Collection System Recommended Plan

Need Area	Proposed Recommendation	Linear Feet of Sewer	Number of New Pump Stations	Opinion of Budgetary Cost
Madaket	Low-pressure sewer and new pump station	40,700 sewer 16,800 forcemain	1	\$42,650,000 (includes forcemain)
Warren's Landing	Low-pressure sewer and pump station	6,300		\$4,536,000
Somerset	Gravity and/or low-pressure sewer	20,500		\$14,760,000
Hummock North	Gravity and/or low- pressure sewer	45,800	1 (potential)	\$34,226,000
Hummock South	Gravity and/or low -pressure sewer	32,800	1 (potential)	\$24,866,000
Miacomet	Gravity and/or low -pressure sewer	27,100	1 (potential)	\$20,762,000
Shimmo	Low pressure sewer	32,600		\$23,472,000
Monomoy	Low pressure and/or gravity sewer	30,800		\$23,426,000
PLUS	Connect into existing infrastructure in TSD where available. Work with the DPW on areas that need capital investments.	TBD		\$2,518,000
Town	Connect remaining unsewered lots to the existing collection system.	TBD		TBD
Town WPZ	Continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.	TBD		TBD
Polpis	Continued use of on-site wastewater disposal systems with future I/A mandate for build out. Oversight from the Town under a Septage Management Plan.			TBD
Pocomo	Continued use of on-site wastewater disposal systems with future I/A mandate for build out. Oversight from the Town under a Septage Management Plan.			TBD
Wauwinet	Continued use of on-site wastewater disposal systems with future I/A mandate for build out. Oversight from the Town under a Septage Management Plan.			TBD
Surfside	Continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.			TBD
Tom Nevers – Low Density	Continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.			TBD
Tom Nevers – High Density	Continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.			TBD
Quidnet	Continued use of on-site wastewater disposal systems with oversight from the			TBD

Need Area	Proposed Recommendation	Linear Feet of Sewer	Number of New Pump Stations	Opinion of Budgetary Cost
	Town under a Septage Management Plan.			
Remaining Island	Continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.			TBD
<i>Siasconset</i>	<i>Not evaluated in this CWMP Update Scope of Work</i>			

3.13.4 Ocean Outfall Alternative

This section describes the opportunities and constraints an Ocean Outfall discharge option would have for Nantucket. The Massachusetts Ocean Sanctuaries Act at Massachusetts General Laws (M.G.L.), Chapter 132A, sections 12A through 16E & 18, (and as amended by the Ocean Sanctuaries Act of 2008), and at 302 Code of Massachusetts Regulations (CMR) 5:00 (“The Act”). The Act defines the five Ocean Sanctuaries in Massachusetts waters as follows:

8. Cape Cod
9. Cape Cod Bay
10. Cape and Islands
11. North shore
12. South Essex Ocean

These areas include the majority of the state waters in the areas with an exception of an areas east of Boston Harbor. These boundaries are set by statutory regulation under M.G.L. and the CMR cited above and jurisdiction includes any activity that could endanger the ecology or appearance of the Ocean Sanctuaries. The Massachusetts Office of Coastal Zone Management is the state agency in charge of implementing and enforcing the Act. The details in the Act specifically prohibit Ocean Outfalls and more specifically the discharge of municipal waste in Cape Cod, Cape Cod Bay and the Cape and Island Sanctuaries.

The only allowable activities are described and detailed direct from the Regulations at CMR 5.08, include:

“(1) Except in the Cape Cod Ocean Sanctuary, and provided that all applicable certificates, licenses, permits and approvals required by federal, state or local law have been obtained and provided further that such activities, uses and facilities shall not be undertaken or located except in compliance with any applicable general or special statutes, rules, regulations or order lawfully promulgated, the planning, construction, reconstruction, operation or maintenance of an industrial liquid coolant discharge or intake system and any activity, use or facility associated with the generation, transmission or distribution of electrical power shall be permitted. All such activities shall be prohibited in the Cape Cod Ocean Sanctuary.

(2) With the exception of municipal wastewater treatment facilities and discharges (see 302 CMR 5.08(9)), the operation and maintenance of any municipal, commercial or industrial facility or discharge existing as of the following dates, which are the effective dates of the applicable original ocean sanctuaries acts, shall be allowed so long as such facility or discharge has been approved and licensed by the appropriate federal and state agencies:

Cape Cod Ocean Sanctuary July 15, 1970

Cape Cod Bay and Cape and

Islands Ocean Sanctuaries December 8, 1971

North Shore Ocean Sanctuary June 27, 1972

South Essex Ocean Sanctuary December 30, 1976

No municipal, commercial or industrial facility or discharge built or occurring in any ocean sanctuary after those dates shall be permitted, except as specifically allowed elsewhere in 302 CMR 5.08(1) through (9).

(3) The laying of any electric or telephone cable shall be allowed if approved by the Department of Public Utilities.

(4) Any project authorized under M.G.L. c. 91, including channel and shore protection projects

and navigation aids, shall be allowed, but only if it is not otherwise prohibited by 302 CMR 5.00, if it has received all required federal and/or state approvals and if the approving agency also finds that the project is one of public necessity and convenience.

(5) Any improvement to permitted structures or uses that is not specifically prohibited by M.G.L. c.132A §§ 14, 15, and 18 shall be allowed so long as it does not change or extend such structures or uses and it is otherwise approved by appropriate state and federal agencies. Such an improvement may change or extend such structures or uses if it is specifically permitted by 302 CMR 5.08(1) through (9) and may include maintenance and repairs to such structures or uses. Any such improvements shall be consistent with M.G.L. c. 132A, §§14, 15 and 18.

(6) The harvesting and propagation of all finfish and shellfish may be allowed if the Department and the Department of Fisheries, Wildlife and Recreational Vehicles are satisfied that such activities will be carried out in accordance with sound conservation practices.

(7) Any educational and/or scientific project of a temporary nature may be allowed notwithstanding any restriction of 302 CMR 5.08, if it is otherwise approved by all applicable state agencies.

(8) The extraction of sand and gravel from the seabed and subsoil of any ocean sanctuary shall be allowed if such sand and gravel is to be used for a shore protection or beach restoration project; but such project must be approved by the Department of Environmental Quality Engineering. In the case of a shore protection project, it must, in addition, be found to be of public necessity and convenience by the Department of Environmental Quality Engineering and any other state agency from which a permit is required.

302 CMR: DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

12/1/93 302 CMR - 37

5.08: continued

(9)(a) In the Cape Cod Ocean Sanctuary, the Cape Cod Bay Sanctuary, and the Cape and Island Ocean Sanctuary, no municipal wastewater treatment discharge into the ocean sanctuary shall be allowed.

(b) In the South Essex Ocean Sanctuary, such a discharge shall be allowed only if it is:

1. the only feasible alternative to a water pollution problem;
2. consistent with the intention and purpose of M.G.L. c. 132A, § 13 through 16 and 18; and
3. approved and licensed by the federal and state agencies that have jurisdiction over the facility or discharge at the time it is proposed to be built.

The decision as to whether a proposed discharge is the only feasible alternative shall be made by the Department in consultation with other appropriate state agencies.

(c) In the North Shore Ocean Sanctuary such a discharge shall be allowed only if:

1. all the requirements of 302 CMR 5.08(9)(b) are met;
2. construction of the facility was commenced prior to January 1, 1978 or the municipality proposing such a discharge was awarded a federal or state grant for construction of the facility prior to January 1, 1978;
3. the waste from such a discharge has been treated by the best practical means; and
4. the discharge is in accordance with plans that have been developed under the provisions of M.G.L. c. 21, § 27(10). Such plans are subject to approval of the Division of Water Pollution Control after a public hearing.”

As noted above, The Act prohibits or in some cases, severely restricts the discharge of municipal wastewater into identified Ocean Sanctuaries. The areas surrounding Nantucket are included in their entirety as located within an Ocean Sanctuary. Any attempt now or in the near future to develop this alternative would be fruitless until the Regulations are changed or amended to allow such use by Nantucket. This alternative should, however, continue to be included on the list of alternative opportunities as Ocean Outfalls are the topic of current discussions in Massachusetts, not only in southeastern Massachusetts, Cape and Island communities, but the Regulatory community as well. It is recommended that Nantucket stay involved in these discussions.

The Ocean Outfall alternative involves the siting, constructing and operating of an underground pipe that carries highly treated effluent from a Wastewater Treatment facility to the marine waters off Nantucket's shoreline, which would have the least impact on any of the Town's drinking water supplies, embayment areas, as well as environmental resources that blanket the Island. When highly treated and properly sited well outside of near shore environmentally sensitive areas, this alternative will have minimal, if any, impact to the marine environment. In comparison to how the Surfside WWTF currently discharges through 15 sand beds adjacent to the south shore of Nantucket, an Ocean Outfall in this location would avoid the environmental impacts that required mitigation with the current operations. There were multiple rare species impacted when the sand discharge beds were planned and cited requiring Nantucket to prepare several conservation management plans to mitigate the loss or disruption to a number of endangered species in the location. The groundwater discharge, under MassDEP jurisdiction, currently flows through the ground in one of fifteen open sand beds directly to the ocean on the south shore of the Island. Figure 3-23, Existing Surfside WWTF Discharge Beds, details the current operation.



Google earth



Figure 3-23

FIG X

If an Ocean Outfall were to replace the groundwater discharge at this location, the highly treated effluent would flow far below the surficial areas where the impacts exist – the rare and endangered species under Natural Heritage and Endangered Species, archaeological/historical resources under the Massachusetts Historical Commission jurisdiction, and beyond the immediate shoreline and protected coastal barrier beaches - thus less impact to the overall area. The current groundwater discharge via open sand beds travels directly to the ocean waters on the south shore with no recharge to any of the Town’s aquifers. With proper siting of an Outfall further offshore, there would be far less impact to the marine waters in this location. In addition, an Outfall in this location would provide the Town with the additional flow it needs to address the Needs Areas (areas identified as needing an off-site solution) from the CWMP. Most Needs areas are located within estuaries and or embayments areas noted in the Massachusetts Estuaries Program Reports as contributing nitrogen degradation to the water resources. As it stands now, the Town has the capacity to treat the Needs Areas wastewater at the Surfside WWTF, but is limited in its MassDEP groundwater Discharge Permit to discharge in the current location. Table 3-5 below outlines the opportunities and constraints with this alternative.

Table 3-5: Ocean Outfall Opportunities and Constraints

OPPORTUNITIES	CONSTRAINTS
Less land area needed for discharge	Currently not permitted under the Massachusetts Ocean Sanctuaries Act
Discharge is outside of environmentally sensitive areas	Costs may be high due to extensive permitting, siting and actual construction needs.
Fits current space and location existing at Surfside	

Nantucket Town Counsel was a guest speaker at the May 24, 2011; “Ocean Outfall Symposium” hosted by the Waquoit Bay Reserve, and eloquently summarized the process needed to obtain a variance under the current Regulations. This presentation is included in Appendix J for review and consideration.

Therefore, while this is considered an option for consideration, it clearly needs to stay on the table for future discussions. There are several Cape communities spearheading an effort to change the current Regulation and it is recommended that Nantucket closely follow the activities as they happen.

3.14 ENVIRONMENTAL REVIEW

3.14.1 Environmental Impacts

When determining the recommended plan for each Needs Area, it is important to take into consideration, identify, and mitigate any environmental impacts. Massachusetts’s Executive Order 385 was signed into law by then Governor William F. Weld and states in general that the citizens of Massachusetts have a constitutional "right to clean air and water and the natural, scenic, historic, and aesthetic qualities of their environment." It also states that the “conflict between environmental quality and economic activity ultimately puts at risk environmental resources as well as economic opportunity; thus threatening, for example, public water supplies, clean air, swimmable and fishable waters, flood protection, open space, agricultural lands, historic sites, and community character; but also affecting the timely provision of needed infrastructure, financial assistance and regulatory approvals for appropriately sited and designed development.” With the provisions of Executive Order 385 in effect, the conflicts of the environment should and can be avoided to a great extent through proactive and coordinated planning oriented towards both resource protection and sustainable economic activity, known as growth management, or basically sustainable development. Therefore, Executive Order 385 is the State’s direction for all planning, such as this CWMP, to account for

sustainable development in the crafting of this draft recommended plan. While this Report is not yet in any formal EIR filing, the evaluation was completed in order to distinguish any areas of environmental impact and provide mitigation measures for moving forward.

The following section presents potential environmental impacts and associated mitigation measures of the Recommended Plan, in accordance with Executive Order 385.

3.14.1.1 Direct Impacts

3.14.1.1.1 Historical, Archaeological, Cultural, Conservation and Recreation

The proposed work contained in the scope of this project is not anticipated to have any major impacts on historical, archaeological or cultural resources. Nantucket is known for its historical and archaeological resources. In the May 14, 2004 MEPA Certificate on the Final CWMP/Final EIR, MEPA suggested that as the Town progresses further with the proposed Madaket WWTF, it work with the MHC and NHESP as both agencies commented on either potential or documented resources within the project area. The Town worked directly with both MHC and NHESP with permits to conduct due diligence at the Madaket site. The Town worked with the Massachusetts Historical Commission (MHC) and PAL under a permit from MHC to complete an intensive survey, as the 2004 MEP Certificate stated, at the proposed Madaket WWTF site, former FAA property, where the 2004 CWMP recommended the design and construction of a WWTF and groundwater discharge. The Town contracted with PAL to complete both a walkover and paper file assessment of the site and subsequently an intensive survey under permit with a scope of work approved by MHC. The portion of the site that the Town was proposing to utilize, approximately 25 acres, was evaluated with results showing no impact to historical or archaeological resources. The remaining portion of the site, approximately, 67 acres, was not evaluated, as there was no proposed use.

The Town also worked under permit from NHESP to conduct an intensive botanical survey on the Madaket site as stated in the 2004 MEPA Certificate. The botanical survey identified multiple plant and animal species contained within this site and is fully documented in the 2013 Report that was subsequently filed with NHESP. The Town also worked under permit with NHESP before the historical/archaeological survey was performed as this intensive survey scope was to disturb the site with hand-digging in order to identify artifacts. The NHESP Permit mandated that a botanist be present during the intensive survey to oversee that no areas of interest to NHESP were impacted. The intensive survey was conducted during late spring 2013.

Copies of all NHESP and MHC communication and reports are included in Appendix G. The 2004 MEPA Certificate is included in Appendix A.

During the course of this CWMP Update, this site (former FAA site) has been eliminated from consideration for the wastewater utility as the Town is proposing to utilize the existing Surfside WWTF to service both Madaket and Warrens Landing Needs Areas. With the former FAA site being eliminated from use, this no longer represents a concern with MHC or the Natural Heritage and Endangered Species Program as this site was the main concern in the 2004 MEPA Certificate.

The National Register of Historic Places/Massachusetts/Nantucket County online database, the following sites are listed in Nantucket:

- The Brant Point Light Station – Town location
- The Jethro Coffin House – Town location
- Sankaty Head Light - Siasconset
- Nantucket Historic District – entire Town

The first two above-noted registered historical sites are structures located in the Town District area. The third-noted structure is located in Siasconset, which is not included in this CWMP Update. None of the first three are in any close proximity to the project locations and will not be impacted with any portions of the proposed project. The fourth, Nantucket Historic District, encompasses the entire Island. This area of historic interest is under the jurisdiction of the Nantucket Historic District Commission, which oversees all activity on Island. At this point in the planning process, there is no proposed impact as all infrastructure is either existing, as in the Surfside WWTF and collection system or new proposed piping, which is planned to be constructed within existing right of ways that are pre-disturbed roadways. The Town will work with both The MHC and the Nantucket Historic District Commission during the design phase of the project to identify and mitigate, if necessary, any potential impact

Conservation and Recreation land includes lands with Conservation Restrictions and lands owned by the Department of Conservation and Recreation, land under local Town Conservation jurisdiction, various private conservation groups, US Fish and Wildlife and others. There is over 65 percent of Town land area under conservation management of some type and these lands are within many of the project Needs Areas, but not impacted. The methodology utilized to determine future wastewater flows excludes all conservation land, open space, agricultural land, and all lands protected with land use restrictions. The State Land Use Code was used to determine future flows. There will be no impact to these lands. In addition, no infrastructure is planned to run through any of these lands.

With directional drilling of sewer infrastructure in certain areas of the Town (Madaket and Warrens Landing), and proposed construction of pipes and pump stations in existing, pre-disturbed right of ways/roadways, impacts to these resources will be avoided.

When the Town moves towards implementation of design of the Final Recommended Plan included herein, it will work with the necessary jurisdictions to ensure that all state, federal and local rules and regulations are adhered to.

3.14.1.1.2 Wetlands, Flood Plains, and Agricultural Lands

Implementation of the Recommended Plan may temporarily impact wetlands. No long term or permanent impacts to wetlands are anticipated. There is potential for construction of sewer pipe and pump stations within the 100-foot buffer zone and within wetland resource areas (including Riverfront Area, Bank, and land subject to flooding). The design process will include a survey and wetlands flagging, and the collection systems will be designed in a manner to avoid wetland resource areas and minimize proximity to wetlands where technically feasible.

Any impacts will be temporary and associated with construction of the collection system. Impacts will be mitigated by erosion and sedimentation control during construction and by any other means deemed necessary by the local Conservation Commission and MassDEP through the wetlands permitting process. The Massachusetts Stormwater Management Standards and Handbook will be followed as necessary.

While this Report is based on conceptual design, the Final Design will determine the exact location, and if necessary, design will include watertight appurtenances.

Based on the Land Use methodology, all Agricultural Preservation Restriction lands are eliminated from inclusion in the project. The methodology utilized to determine future wastewater flows excludes agricultural land based on the State Land Use Code. There will be no impact to agricultural lands.

Coordination of design and construction will be conducted with the Nantucket Conservation Commission and local/regional Board of Health, to identify any wetlands or flood plain resource issues and identify any necessary mitigation measures. In addition, the Town will work with the Conservation Commission to determine the need for Requests for Determination of Applicability (RDAs) and Notice of Intent (NOIs) as the recommended plan progresses.

With the proposed directional drilling of sewer infrastructure, and locating of new infrastructure within existing right of ways/roadways that are pre-disturbed, impacts will be avoided.

3.14.1.1.3 Zones of Contribution of Existing and Proposed Water Supply Sources

There are several sections of Needs Areas that are located within DEP Wellhead Protection Areas (approved Zones IIs).

- The Town Sewer District and the Monomoy Needs Area are partially located within Zone II wellhead protection area. The Town WPZ Area is also within the Zone II.

There are no direct impacts anticipated to the wellhead protection areas, as majority of the sewer mains will be installed within existing roadways. Sewers in the wellhead protection areas will be designed in accordance with DEP requirements for such construction and will include stringent measures to guard against exfiltration of untreated wastewater. Furthermore, steps will be taken to minimize indirect environmental impacts during preliminary design and construction. See Figure 3-X for a map of Needs Areas and Zones of Contributions.

Refer to Figure 3-12 for Needs Areas and Zones of Contributions.

Removal of on-site wastewater disposal systems from the resource areas will benefit the environment and preserve and protect the drinking water sources in these areas. As previously stated, most of the sewer mains will be constructed within existing roadways, thereby minimizing potential environmental impacts. The installation and connection of residences to a centralized wastewater collection system will divert wastewater from the public water supply, having a beneficial impact to the groundwater quality within the wellhead protection area. The Town Sewer District and Monomoy Needs Area both fall into the nitrogen-sensitive area within the Massachusetts estuaries Project (MEP) where septic systems are contributing excessive loads to the embayment areas. Removal of these on-site systems will contribute towards the nutrient reduction in the areas and serve to help meet the established Total Maximum daily Loads (TMDLs) issued.

3.14.1.1.4 Surface and Groundwater Resources

No negative impacts associated with the recommended plan are anticipated to surface and groundwater resources. The removal of on-site wastewater disposal systems from the Needs Areas will serve to reduce documented nutrient loading to the water resources and serve to help meet established TMDLs. The MEP Reports have documented the contribution of nutrients to both ground and surface water from on-site wastewater disposal systems in multiple areas on Island, as well as the years of documented water quality testing through the Marine and Natural resources Department. The project as proposed in this CWMP Update will help to restore water quality Island-wide.

There are a number of surface water bodies, harbors, embayments and estuaries located within Nantucket – many the subject of the MEP. These include Nantucket Harbor, Polpis Harbor, Madaket Harbor, Long Pond, Sesachacha Pond and Hummock Pond. Miacomet Pond, a fresh water pond, is also located in and around proposed project areas.

Any potential impacts during construction will be mitigated by erosion and sedimentation control during construction and by any other means deemed necessary by the local Conservation Commission and MassDEP through the wetlands permitting process. Any construction within 200 feet of these waterbodies will be reviewed locally as required by the Wetlands Protection Act and proper erosion and sedimentation control measures will be employed.

Portions of the proposed Project Area, as detailed above in the Zone II, are underlain by the Town's Sole Source Aquifer. Sewering these Needs Areas will help protect the water quality of the aquifer by removing failing and/or improperly operating onsite wastewater disposal systems.

Any impacts to these resources are positive with the Project as proposed and serve to meet established TMDLs.

3.14.1.1.5 Displacements of Households, Businesses, and Services

None of the recommended plan will cause displacement of households or businesses. Final design of sewer infrastructure and pump station locations will be developed to prevent displacements of households, businesses and services. There may be temporary disturbances during construction, but the Town will work to develop a plan to notify any properties well in advance of the actual construction and work together to develop a plan that has the least impact.

With directional drilling of sewer infrastructure, impacts will be avoided. All construction along major routes will have a plan developed well before actual construction, including traffic mitigation. Seasonal occupation of the Island will also be a consideration when developing construction schedules in order to mitigate traffic and interruption of businesses and services. This is a normal task on Island and will be adhered to with all aspects of the Project as proposed.

The Town has a well-developed public outreach and communication plan during times of construction that is typical of any work done on the Island. Communication will be well planned and orchestrated.

3.14.1.1.6 Noise Pollution, Air Pollution, Odor and Public Health Issues Associated with Construction and Operation

There may be temporary noise pollution and air pollution (dust) during construction involved with the Recommended Plan. Limiting the hours and the days of construction will mitigate the construction noise impacts, and employing dust control during construction will mitigate any adverse impacts to the air.

There is the potential for odor issues associated with operation of a collection system. During design, sewers and pump stations will be evaluated for inclusion of odor control. If necessary, odor control mechanisms will be installed.

No public health issues associated with the construction of the Recommended Plan are anticipated, as a wastewater collection system is constructed to solve the public health issue of contamination of groundwater by septic systems. Any impacts associated with these alternatives will be mitigated during final design.

3.14.1.1.7 Violation of Federal, State, or Local Environmental and Land Use Statutes or Regulations and Plans Imposed by Such Statutes and Regulations

Implementation of the Recommended Plan will not violate any federal, state or local environmental and land use statutes/regulations, nor will it violate any plans imposed by these statutes/regulations. All local rules and regulations will be addressed during the design phase and implemented fully during construction.

3.14.1.2 Indirect Impacts

3.14.1.2.1 Changes in Development and Land Use Patterns

The Recommended Plan contained herein has been sized for wastewater flows that were estimated from existing developed lots and those designated as buildable in the future according to the current State Land Use Code recorded at the Town Assessor Office and local zoning. In addition, early coordination with Nantucket Planning identified areas of Town where the use of second dwelling are approved. Reviewing historic records of second dwellings showed that approximately 12 percent of properties constructed second dwellings. This CWMP update took Assessor records, GIS data and applied zoning to evaluate the individual parcels within the Needs Areas to first make sure that the parcel met current zoning and then applied the zoning and land area to see if it met approval for a

second dwelling. Utilizing these results, we then applied a factor of 25 percent, basically double of historic figure of 12 percent, to arrive at a conservative estimate for future development needing sewer service.

Early and extensive communication with Nantucket's various land use departments have assisted in the proposed Project contained herein. Coordinated communication will continue during the design and construction phases of the proposed Project to ensure that any change brought as a result of the Project is welcomed and in the town's best interest.

While the introduction of sewer infrastructure in itself does not serve to promote or deny growth, the local regulatory mechanisms and Zoning Board do. After the 2004 CWMP/FEIR was approved, the Town took extraordinary measures to identify all Needs Areas where existing zoning posed issues and made changes. This revised zoning was applied to the revisions done for calculating flows and loads in this CWMP Update and presented itself as a positive move towards not only reducing the potential for sprawl and unwarranted growth, but preserving the limited wastewater capacity in the existing infrastructure allowing for highest and best use. This serves to help maintain the character of Nantucket while also serving to preserve and protect the valuable water resources that Nantucket is known for. The intent of this CWMP is to solve the problems of the existing development and existing environmental concerns, while concurrently serving to discourage unconstrained and unregulated development.

3.14.1.2.2 Pollution Stemming from Changes in Land Use

There will be no pollution stemming from changes in land use.

3.14.1.2.3 Damage to Sensitive Ecosystems

Sensitive Ecosystems include wetlands, priority habitats of rare species, estimated habitats of rare wildlife, and vernal pools. There is a potential for temporary impacts to sensitive ecosystems during construction of collection systems (sewer lines and pump stations), but these will be mitigated during design and construction. No permanent or long term impacts are anticipated. The entire Town is overlain with the NHESP as is shown in Figure 3-11.

There are a variety of sensitive ecosystems on the Island, many noted through the NHESP. This Project will work to avoid any impact to any surrounding areas to these resource areas. In evaluating potential impacts to any state-listed species in the proposed Project area, there is no evidence of impact due to the sewers' proposed locations in existing right of ways and/or roadways (all pre-disturbed areas). There is no plan of any cross-country routes.- under the Final recommended Plan contained herein. In areas where proposed infrastructure is in close proximity of protected habitats, close attention will be paid to these locations to determine if the proposed infrastructure can be moved further outside of the habitat areas or that they are placed so as to avoid or minimize potential impacts. The main concern of NHESP with the Final Recommended Plan in 2004 was the proposed Madaket WWTF site. As was discussed in a previous section, the Town worked under NHESP Permit to complete a botanical study, as well as with the MHC to conduct an Intensive Survey on this site. There were multiple species identified in the NHESP Report as rare and/or endangered-both plant and animal. The MHC Intensive Survey did not uncover any resources on the 25-acre parcel evaluated. Communication was initiated early in the CWMP Update process with both agencies in order to complete the mandated work as early in the process as could be done. With the results of both, the Town determined that the cost, both financially and to the environment, could be extensive and opted to relook at alternatives in order to eliminate utilizing this site to construct a WWTF and groundwater discharge bed. The alternatives analysis confirmed that this site could be eliminated from the proposed planning by collecting, transmitting, treating and discharging the Needs Areas from the western portion of the Island at Surfside WWTF instead. Surfside WWTF is designed to treat 5.25 MGD with a Groundwater Discharge Permit of 3.4 MGD. The Final Recommended Plan contained in this CWMP Update totals flows of 4.0 MGD so the Town is working to modify its existing Groundwater Discharge Permit. The Town filed BRP WP 83 and BRP WP 11 to do just that. MassDEP has confirmed an approval to modify the existing Groundwater Discharge Permit to meet the VWMP Update demand of 4.0 MGD. With this proposed Groundwater Discharge Permit modification, there is no damage to any sensitive

ecosystem as the existing discharge beds are proposed to be used with loading at a slightly higher rate than is now done and no new construction will be needed. . Refer to Appendix XX for correspondence.

Based on the on-going degradation and documented nutrient impairment through the MEP in multiple areas on Island due to failing and/or improperly operating onsite wastewater disposal systems, it has been determined that optimizing these onsite wastewater disposal systems are a larger and more detrimental threat to resources in this area. With the proposed sewer plan, the water resources degradation from onsite systems will be eliminated thus affording the area to rebound and the species now located within these areas to be protected from possible further degradation.

In addition, with the proposed directional drilling of sewer infrastructure, and/or infrastructure proposed in existing right of ways and/or roadways that are pre-disturbed, impacts will be avoided.

3.14.1.2.4 Socioeconomic Pressures for Expansion

Connection of the Needs Areas to the Surfside WWTF should not affect socioeconomics as it will be a flow-based system for those parcels included in the updated Needs Analysis and clearly identified in the planning process. There will be some small amount of “in-building” expected with parcels that are designated as developable in the State land Use Codes. While some “in-building” could lead to additional development in this area, it is negligible and would not increase budget needs for school systems, roadway maintenance, fire protection, and other Town services.

The proposed collection system will be constructed in phases, with full build out not expected until well after the 20-year planning period. With the methodology utilized to estimate future wastewater flows, using the current State Land Use Codes, only those properties that currently exist and those categorized as developable now will be allotted flows. If a property is coded as non-developable now with onsite wastewater system, it will remain undevelopable when municipal sewer is brought to the area. This conforms to the State’s sustainability goals.

The proposed routes of the sewer infrastructure for the Needs Areas are conceptually designed in this CWMP Update Report. Based on these elements, the following items are discussed:

3.14.1.2.4.1 Effect On Land Use

- The Project Areas will not have a permanent negative impact on any land use. There will be temporary impacts during construction that will be almost eliminated with the low pressure sewers due to directional drilling methods and routes for proposed infrastructure within existing right of ways/roadways. The proposed plan for Madaket and Warrens Landing is to directional drill all low pressure sewers with the capability to keep one roadway lane open for traffic. All proposed properties in these two Needs Areas to be sewerred are primarily residential properties, with a few small businesses, so there will be no impact to any commercial entities. IN addition, scheduling will be done so as to not interrupt the summer season where occupancy is high. This is normal and customary on Island. Other areas will be utilizing existing right of ways and roadways-pre-disturbed areas for proposed construction of pipes and collection system infrastructure. There may be temporary impact to residences, but a public outreach plan will be in place for notices to be sent to any areas during construction of any potential impacts.

3.14.1.2.4.2 Effects On Streams and/or Interbasin Transfers

- There is no proposed effect on streams and no Interbasin Transfer.

3.14.1.2.4.3 Limitations For Future Expansion

- The proposed project in the Recommended Plan will be limited to future expansion. The wastewater system is designed as “flow-based” to meet the current Needs. This will also serve to meet Executive Order 385 as “Sustainable” and limit any potential sprawl.

3.14.1.2.4.4 Reliability, Operation and Maintenance

- The proposed plan with utilizing the Surfside WWTF is already designed to be reliable with the appropriate on-going operation and maintenance standards. The WWTF was designed and constructed to meet a plan of 5.25 MGD. The proposed Recommended Plan contained herein is for 4.0 MGD, which is well under design capacity. The Town has a completed O&M Manual for the facility. Refer to Appendix H for the O&M manual.

3.14.1.2.4.5 Legal and/or Municipal Agreements And Permitting

- All legal, municipal and permitting required as part of the systems implementation will be attained according to the requirements of MassDEP. The has filed both BRP WP 11 and BRP WP 83 to revise its Groundwater Discharge Permit at the Surfside WWTF to allow for 4.0 MGD discharge. A complete Hydrogeological Evaluation was completed and filed. Preliminary meetings with MassDEP approved the Hydrogeological Evaluation and ensuing results.

The Town adopted Sewer Districts after the completion of the 2 004 CWMP to be able to properly manage its capacity at both the Surfside and Siasconset WWTFs. The Needs Areas included herein will follow the formal process now in place of adding to the existing Sewer Districts. Town Meeting action is required, as well as a host of qualifying criteria set forth by the Department of Public Works. This process has history to show that the adoption of Sewer Districts affords the Town the degree of management needed to properly address any future need for expansion and the detailing of the Needs Areas in this CWMP and associated flows meet the current conditions at the facilities.

3.15 SUMMARY OF ENVIRONMENTAL IMPACT

The proposed Project contained herein details very little, if any, environmental impact. The major change from the 2004 CWMP is the elimination of the proposed Madaket WWTF and groundwater discharge beds. The Town completed the May 14, 2004 MEPA Certificate requirements of an Intensive Survey under permit with MHC and a full botanical survey under permit from NHESP at the Madaket site. Based on the results of this due diligence, the Town opted to eliminate utilizing this site and thus has eliminated the major environmental concerns/impacts associated with the former plan. The town will continue to communicate with the MHC and NHESP, as well as all local jurisdictions as it moves forward during design and construction in order to identify and mitigate early on any potential impacts that may arise with the proposed Project.

3.16 FLOW AND WASTE REDUCATION – MUNICIPAL WATER UPDATE

Nantucket understands the significance of minimizing its wastewater flows in order to maintain permit conditions at the Surfside WWTF, as well as provide sufficient capacity for future Needs Areas. Nantucket's potable water system is managed and distributed through the Wannacomet Water Company, which is an enterprise division of the Town. Nantucket has its own source of fresh drinking water created by the glacier 12,000-10,000 years ago. Water is drawn from an aquifer that sits below the island with ground water that filters down through sand and clay. The clay prevents sea water from invading the "lens."

Potable water comes from three groundwater wells located throughout the mid-Island. The Milestone Well #2 and State Forest Well #3 are protected by Zone I delineations with a radius of 400 feet surrounding the well. The Milestone Well #1 has a Zone I protection that extends 250 feet from the perimeter of the well. The drinking water comes from two different levels of the aquifer. The water system distributes water through a network of water mains that range in size from two inches up to sixteen inches in diameter. The Town also has a 2,000,000-gallon water storage tank located in North Pasture that was brought into service in 2010. In addition, in 2010, Wannacomet brought public water to the Madaket area of Town, which was shown in the 2004 CWMP as entirely on private wells.

While the entire Needs Area is not serviced with public water, it was brought from Warren's Landing to Massasoit Village and then in 2011 to F Street, Tennessee Avenue to North Cambridge Street ending on Little Neck Way. This mainly accounts for the northern portion of the Needs Area leaving the middle and southern portions to rely on private wells.

According to the Water Department, in 2012 the Town produced and delivered 612,314,000 gallons of drinking water from all of its wells. Highest demand was on July 6, 2012, which is expected given the population surges during this summer period. Nantucket relies entirely on rainfall to recharge its Sole Source Aquifer, with 2012 receiving 32 inches in rainfall, with average rainfall recharge around 43 inches per year.

The Wannacomet Water Company also provides public educational materials on a multitude of sources including Consumer Drinking Water Quality Reports, which include: Annual Statistics as to use, Recharge Rates and new developments; Conservation Opportunities, Opportunities for Public Participation, Leak Detection, Watershed Protection/Resource Management, and various links to homeowner sites that provide information on billing, tips on finding and fixing leaks and other Town information. The site also provides a water use calculator to estimate use and plan for conserving use on a household level.

There are a host of conservation groups on the Island dedicated to the preservation and protection of the precious water resources. The Nantucket Land Council is one such example. Their website is also indicative of the type of public outreach and education afforded to the Island. See Appendix K for examples of education materials.

In 1996 the Safe Drinking Water Act (SDWA) was amended to provide communities with more information about the ways in which they can protect their drinking water sources from contamination. The amendments require states to create a Source Water Assessment Program for all their public drinking water systems. Private wells typically serving single households are not included in this requirement. According to the Environmental Protection Agency website:

"The purpose of the program is to provide local leaders, water suppliers, and citizens with the information necessary to protect public drinking water sources from contamination. Through this program, state drinking water programs are responsible for:

- *identifying the land areas which provide water to each public drinking water source in their state;*
- *completing an inventory of existing and potential sources of contamination in those areas;*
- *determining the susceptibility of each drinking water system to contamination; and*
- *releasing the results of the assessment to water users and other interested entities. "*

The Town has a completed Source Water Assessment and Protection (SWAP) Report (2004) that was compiled by the MassDEP to inventory land uses within the wellhead protection zones. This Report details plans to avoid any potential impact from land uses to the well zones. This can be found in Appendix K.

Figure 2-19 details the Town's Public Water Supply System. All water materials are included in Appendix K.

3.16.1 Summary

The Town operates and maintains a public water system that serves portions of the Island. Wannacomet Water Company also offers to provide rates and services for private fire protection Island-wide. The Town has initiated and maintains an aggressive water conservation program. The goals set by the Water Company are to promote the efficient use of water through education and maintains an updated and comprehensive website for public education. Refer to Appendix K for all water conservation information.

Wannacomet Mission Statement

“The Wannacomet Water Company shall strive to provide high quality drinking water that exceeds all established Federal and Commonwealth drinking water standards, provide the highest level of customer and water related services achievable, educate and inform the public of the need to protect Nantucket’s water resources, and to accomplish this mission using prudent utility practices and responsible fiscal management.”

3.17 I/I UPDATE

Since the 2004 CWMP, the Town has moved forward with a number of Infiltration/Inflow (I/I) projects that were included in the 2004 Capital Improvements Plan. The Town Sewer District I/I Study was completed in 2006 and identified a number of areas for rehabilitation projects to eliminate extraneous water getting into the sewer system. The Town Sewer District was divided into a number of “Mini-Systems” - each with a specific target of rehabilitation. The Town completed the Brant Point I/I Study in 2006 with a subsequent Brant Point Sewer Replacement Phase I completed in 2007.

Phase IIA (Mini-System N-1) design and construction was completed in 2009, which was in the downtown area. Phase IIB construction (Mini-System N-2) is currently on-going with rehabilitation and sewer replacement in portions of downtown. This Project includes the removal of approximately 5,000 linear feet of existing vitrified clay pipe and replacement with 8 to 10 inch PVC pipe; replacement of approximately 2,300 linear feet of sewer pipe with pipe bursting and removal of approximately 3,000 linear feet of cast iron and AC water pipe and replace with 6 to 8 inch cement lined ductile iron pipe. To date, Phase IIB has identified and corrected major I/I at Jetties beach, identified and repaired major root blockage in Lyon Street and Fair Street, and replaced multiple manholes and damaged sewer pipe throughout the Downtown area. Several sources of inflow from roof leaders and other sources have also been identified and corrected during the course of construction. Operators at the Sea Street pump station recently commented on the noticeable reduction in inflow observed at the pump station that is likely attributable to the Phase IIB improvements. This Phase is projected to be completed with final full width paving in fall 2014.

The remaining mini-systems to be completed include the areas further from the water in the Pleasant Street, Vesper Lane, Monomoy Road, Naushop Subdivision and outlying areas of the Town Sewer District. Our office is examining CCTV inspection records to identify areas in need of repair, and analyzing available inflow data to pinpoint potential sources of I/I. With this data, we are working to identify and prioritize the future Phases of construction work. Based on preliminary investigation and conversation with DPW, we anticipate that the next phase will continue to focus on sewer infrastructure repair in the N-1 Mini System. These previous phases were detailed in earlier reports from other sources and need to be updated based on current conditions. Rather than including approximately \$86,520,000 (2014 dollars recommended in 2006) for this future work without having full knowledge of current conditions, this CWMP Update is recommending the Town conduct an I/I Study and Flow Metering Update to evaluate future needs. A CY2015 project evaluation form (PEF) is being submitted to MassDEP for State Revolving Funds to cover the cost of this study. The results of the I/I and Flow Metering study will be incorporated into the CIP at a future date.

3.18 GREENHOUSE GAS

The EOEEA issued the Greenhouse Gas (GHG) Emissions Policy and Protocol in April 2007 in reference to the phrase “damage to the environment”, which also included the emission of GHG. This was further amended by the Massachusetts Environmental Policy Act Office (MEPA) in November 2008 to provide for the consideration of issuing permits, licenses and other administrative approvals that appropriate authorities also consider “reasonably foreseeable climate change impacts due to GHG emissions”. This policy now requires “that certain projects undergoing review by the MEPA Office quantify the project’s GHG emissions and identify measures to avoid, minimize, or mitigate such emissions.” The following summary details the potential for Nantucket to evaluate GHG conceptually during the CWMP planning process with recommendations to review and incorporate sustainable design standards during final design.

With respect to the GHG emission policy, it is the intent of the Town and this Project to focus attention on those areas where creative forethought, as well as potential new technology in looking at the long-term wastewater solutions, may also benefit the environment in innovative and resourceful ways.

Greenhouse Gases can be quantified by both direct and indirect sources. The two primary sources included herein to quantify GHGs are electricity (indirect) and natural gas use (direct). Electricity is used to power pumps, motors and other equipment whereas natural gas is used solely for heating systems at the WWTF and pump stations.

An energy efficiency evaluation of the Surfside WWTF was completed by National Grid as a National Grid Scoping Study Energy Evaluation. As part of the CWMP, Woodard & Curran performed an energy efficiency evaluation of the Surfside WWTF to further refine the recommendations of a National Grid Scoping Study Energy Evaluation. The evaluation was performed by JK Muir LLC and is described in a memo dated July 2, 2014, which is provided in the appendices of the full report. Refer to Appendix H for the full Report.

A summary of the recommended cost saving measures is as follows:

- Provide instrumentation and controls modifications to allow automatic blower on/off cycling which will minimize energy usage for the primary sludge holding tanks.
- Provide instrumentation and controls modifications to allow automatic cycle blower on/off cycling which will minimize energy usage for the secondary waste activated sludge holding tanks.
- Modify the piping for the draft pumps that convey flow from the anoxic tanks to the aeration tanks to allow a reduction in the number of pumps that need to run under reduced flow conditions.
- Install a new VFD on the odor control fan and make programming changes to allow for a range of operating conditions to optimize ventilation while minimizing energy usage.
- There is a potential opportunity to modify the control system programming set points for the membrane air scour blowers to optimize their usage and reduce the blower run time which would reduce energy usage.

3.18.1 Sustainable Design Standards

These sustainable design standards are set forth to provide for GHG reductions where possible by maximizing energy efficiencies in many instances. The recommended plan includes low-pressure sewer, gravity sewer with one and possibly two pump stations. There is no building, such as a WWTF that would be applicable to evaluate. The Town will also evaluate equipment standards that can be reviewed at during the design process, such as:

Equipment/Process Design – The following standards are applicable to all new equipment installations and equipment replacement and are to be evaluated/incorporated into preliminary and final design.

1. New motors greater than 1 horsepower (HP) for pumps, blowers, fans, mixers and other drives shall be premium efficiency duty.
2. New motors greater than 10 HP for pumps, blowers, fans, mixers and other drives shall consider Variable Frequency Drivers (VFDs) where variable speed operation can reduce energy consumption.
3. New equipment shall incorporate high efficiency models where cost-effective.
4. Pump sizes and combinations to maximize average efficiency shall be evaluated at preliminary/final design.
5. Incorporation of renewable energy including, but not limited to, solar PV systems and wind energy systems shall be considered for inclusion into the design.
6. Sewer force mains shall be sized, designed, and routed in preliminary design to reduce the average pumping power required to convey sewer flow.

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7. Future replacement and upgrade of existing equipment, whether under scheduled maintenance or not shall incorporate the aforementioned standards.

3.18.2 SCADA System

Supervisory Control and Data Acquisition (SCADA) is a centralized system which monitors and controls entire sites, or complexes of systems spread out over large areas. Recommendations are included in this Report for SCADA system enhancements as part of the Surfside WWTF upgrades and as a part of the implementation of the Recommended plan. The SCADA system will consider installation, which will help to reduce GHG emissions as the pump stations will be monitored on a remote basis versus having someone actually visit the station via a vehicle every time an alarm occurs. The SCADA will save the use of gasoline fuel and oil in the vehicles and the reduction of vehicular traffic will save the emissions from such on a regular basis.

4. PHASE IV REPORT – FINAL RECOMMENDED PLAN

4.1 NEEDS AND STUDY AREAS FINAL RECOMMENDED PLAN

The 2004 CWMP identified areas of the Town that were not deemed long-term sustainable with on-site wastewater disposal systems due to a number of criterion. One criterion that was not in existence at this time was the Massachusetts Estuaries Program (MEP) Reports, which identified areas impacted with nutrient loading, specifically nitrogen. Nitrogen loading from various sources including on-site wastewater systems, stormwater, fertilizer and various other sources were the subject of the MEP in southeastern Massachusetts, Cape and Islands starting in 2003. When the 2004 CWMP Update was completed, none of the final results of the MEPs were completed so no nitrogen loading criterion was added to the screening criteria utilized to determine the need for an off-site wastewater solution. The Town received its 2004 CWMP/EIR MEPA Certificate with a caveat that once the MEP studies were completed, the CWMP/EIR would need to be updated. This CWMP Update is satisfying this mandate.

The Needs Areas, in order of priority, are as shown in Table 4-1.

Table 4-1: Updated Needs Areas and Area of Concern

Needs Area	MEP Area
Somerset	Priority Route to Surfside for Madaket/Warrens Landing-MEP
Madaket	Madaket Harbor/Long Pond
Warren's Landing	Madaket Harbor/Long Pond
Monomoy	Nantucket Harbor/Polpis Harbor
Shimmo	Nantucket Harbor/Polpis Harbor
Hummock Pond North	Hummock Pond
Hummock Pond South	Hummock Pond
PLUS Parcels - Infill in Town Sewer District	Multiple - Nantucket Harbor/Polpis Harbor/Hummock Pond

4.1.1 Somerset Needs Area – Priority Number One

The Somerset Needs Area was evaluated in the 2004 CWMP and rated within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The area qualifies as a Need based on the 2004 CWMP data.

The Somerset Needs Area immediately abuts the Town sewer District to the southwest. The geographic area is a predominantly residential area, with small, dense lot sizes.

The Needs Area encompasses approximately 196 acres, of which 181 are developed. There are 243 total parcels, with 209 developed. There are 31 undeveloped residential parcels, with 30 potentially developable. There are 18 municipal/conservation parcels within this Needs Area. With few available developable parcels, sewerage this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 84 percent Evesboro Sands that are detailed by the United States Department of Agriculture Soils

Conservation Service as constrained as they perc very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. The other predominant soil associations in this Needs Area are Riverhead and Berryland Variant soils with qualities posing severity for on-site wastewater systems of permeability, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination

There are approximately 7 acres out of the total 151 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. The area is serviced by municipal water. Over 67 percent of the area's systems' are located on lots less than or equal to ½ acres and approximately 7 percent were built before 1978 (Creation of Title 5).

4.1.1.1 Final Recommended Plan

Based on qualifying criteria from the 2004 CWMP, Somerset Needs Area continues to qualify as an area needing an off-site wastewater disposal solution in this 2013 CWMP Update. This Needs Area is a priority due to its location to Surfside WWTF and the necessary infrastructure route for Madaket/Warrens Landing must traverse through this area. Somerset is Phase I of the Final Recommended Plan.

The Final Recommended Plan is to collect, transport and treat this Needs Area at the Surfside WWTF.

4.1.2 Madaket and Warrens Landing Needs Areas

The Madaket Needs Area was evaluated in the 2004 CWMP and rated within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to Madaket Harbor, Hither Creek, Long Pond and other water resources in this geographical area since then. A major change is the completed and approved Madaket Harbor/Long Pond MEP Report and subsequent Draft TMDL noting the degradation in this area due to nitrogen loading from on-site wastewater disposal systems. The Madaket Harbor MEP adds significant weight to the existing 2004 criteria to maintain this as a "Needs Area" and needing an off-site wastewater solution. New zoning since 2004 in this area has further reduced potential for unwarranted growth due to introduction of sewer infrastructure

The Madaket Harbor-Long Pond Embayment System as depicted in the MEP Report is a complex estuary with full tidal basins (Madaket Harbor, Hither Creek) connected via Madaket Ditch to the brackish waters of Long Pond that is influenced greatly by wetlands. Madaket Harbor is approximately 746 acres, semicircular in shape, open to Nantucket Sound on its western edge, and open to the Atlantic on its southwest corner via a cut between Smith's Point and Tuckernuck. The Harbor is relatively a shallow water body, 4-5 feet deep, with a deeper channel (6-9ft.) running east and north to the coastline of the Sound. There are a few deeper channels that pre date Hurricane Esther (1961), but much of the harbor has filled in as a result of the opening that was created by this storm. This condition existed until Hurricane Gloria (1985), which enabled a closure of the gap to Smith's Point. via drifting sand bars. Because the southwest edge is open, circulation is high (flushing every 3 days), and water quality is good. Epiphytic, and macro algae are limited in presence and density, and eel grass beds are healthy. Madaket Harbor and Long Pond make up a unique ecosystem encompassing approximately 9 square miles. These two systems are hydrologically connected via Hither Creek and the Madaket Ditch. Long Pond is somewhat isolated from the whole

system, and has been evaluated as having separate water quality issues. It is relatively narrow and winding with depths of 4-6 feet with no deep basins.

Water quality results from 2010 to present show Hither Creek, Long Pond and North Head of Long Pond as not meeting water quality standards. Madaket Harbor, which is an open marine basin, is not degraded as the other water resources in the area are due to its high flushing component. The Clean Water Act and TMDL processes that followed the MEP Report mandate that the Town develop and implement solutions for restoration of these water resources. The MEP included the development of a target nitrogen load to determine the amount of total nitrogen mass loading reduction required for system restoration. This included reducing the nitrogen load from the landfill, which is an on-going process. In addition, a reduction of septic loading, 100 percent in the Hither Creek Watershed, resulted in a 72 percent reduction in the entire Watershed.

The overall plan to meet the water quality standards is to continue with the landfill mining where water quality testing is showing potential improvement. The 2012 Annual Water Quality results stated that Long Pond showed significantly lower total nitrogen levels, 40 percent, in 2012 versus results shown in 2010. This trend is being further evaluated in the 2013 Annual Water Quality Program to determine whether it is as a direct result of the landfill mining and can be credited as such. In addition, the service area as defined in Figure 1-1 is proposed to be sewerred, which is what the 2004 CWMP showed. The main difference in this Needs Area between 2004 and current is that the area included is defined up to and not crossing over Millie's Bridge.

The Needs Area encompasses approximately 342 acres, of which 222 are developed. There are 572 total parcels, with 381 developed. Out of the total 572 parcels, 120 are municipal and/or conservation parcels and 71 are undeveloped with only 17 of these potentially developable. With few available developable parcels, sewerreding this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 96 percent comprised of Riverhead Sandy Loam, Berryland and Medisaprists that are detailed by the United States Department of Agriculture Soils Conservation Service as constrained as they perc very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the water resources in the area. Also over 30 percent of severe groundwater limitation plague this Needs Area Properties of this soil association are permeability, depth to seasonal high groundwater and susceptibility to flooding. Riverhead Sandy Loams do not adequately filter the effluent, which leads to groundwater contamination. The other predominant soil associations in this Needs Area is Riverhead Sandy Loam, which is a moderately rapid permeable soil and does not provide sufficient filtering of effluent, and Pawtucket Mucky Peats and Berryland, which are both plagued as very wet soils and not conducive to septic tank absorption fields.

There are approximately 110 acres out of the total 342 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. The majority of this Needs Area is serviced with private water, thus posing additional threat from inadequately operating on-site wastewater disposal systems. Over 53 percent of the area's systems' are located on lots less than or equal to ½ acres and over 55 percent were built before 1978 (Creation of Title 5).

4.1.2.1 Final Recommended Plan

Based on qualifying criteria from the 2004 CWMP, together with the results of nitrogen loading documented in the Madaket Harbor/Long Pond MEP, Madaket Needs Area qualifies as an area needing an off-site wastewater disposal solution in this CWMP Update. This Needs Area is Phase 2 of the Final recommended Plan. While the criteria within this geographic area rates it as the top priority due to environmental and public health issues, it requires Somerset to be designed and constructed first in order to carry the wastewater to Surfside.

The Final Recommended Plan is to collect, transport and treat this Needs Area at the Surfside WWTF.

4.1.3 Warrens Landing Needs Area

The Warrens Landing Needs Area was evaluated in the 2004 CWMP and rated within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to Madaket Harbor, Hither Creek, Long Pond and other water resources in this geographical area since then. A major change is the completed and approved Madaket Harbor/Long Pond MEP Report and subsequent Draft TMDL noting the degradation in this area due to nitrogen loading from on-site wastewater disposal systems. The Madaket Harbor MEP adds significant weight to the existing 2004 criteria to maintain this as a "Needs Area" and needing an off-site wastewater solution.

The Madaket Harbor-Long Pond Embayment System as depicted in the MEP Report, is a complex estuary with full tidal basins (Madaket Harbor, Hither Creek) connected via Madaket Ditch to the brackish waters of Long Pond that is influenced greatly by wetlands.

Warren's Landing is part of the overall Madaket Watershed. According to the Town's 1990 Water Resources Plan Report, the groundwater in Warren's Landing flows directly towards Long Pond and Madaket Ditch, which are both impacted with nutrient degradation per the MEP Report.

The Warren's Landing Needs Area is north of the Madaket Needs Area just east of Long Pond and north of Madaket Ditch in the Madaket Harbor Watershed. Madaket Harbor is approximately 746 acres, semicircular in shape, open to Nantucket Sound on its western edge, and open to the Atlantic on its southwest corner via a cut between Smith's Point and Tuckernuck. The Harbor is relatively a shallow water body, 4-5 feet deep, with a deeper channel (6-9ft.) running east and north to the coastline of the Sound. There are a few deeper channels that pre date Hurricane Esther (1961), but much of the harbor has filled in as a result of the opening that was created by this storm. This condition existed until Hurricane Gloria (1985), which enabled a closure of the gap to Smith's Point. via drifting sand bars. Because the southwest edge is open, circulation is high (flushing every 3 days), and water quality is good. Epiphytic, and macro algae are limited in presence and density, and eel grass beds are healthy. Madaket Harbor and Long Pond make up a unique ecosystem encompassing approximately 9 square miles. These two systems are hydrologically connected via Hither Creek and the Madaket Ditch. Long Pond is somewhat isolated from the whole system, and has been evaluated as having separate water quality issues. It is relatively narrow and winding with depths of 4-6 feet with no deep basins.

Water quality results from 2010 to present show Hither Creek, Long Pond and North Head of Long Pond as not meeting water quality standards. Madaket Harbor, which is an open marine basin, is not degraded as the other water resources in the area are due to its high flushing component. The Clean Water Act and TMDL processes that followed the MEP Report mandate that the Town develop and implement solutions for restoration of these water resources. The MEP included the development of a target nitrogen load to determine the amount of total nitrogen mass loading reduction required for system restoration. This included reducing the nitrogen load from the landfill, which is an on-going process. In addition, a reduction of septic loading, 100 percent in the Hither Creek Watershed, resulted in a 72 percent reduction in the entire Watershed.

The overall plan to meet the water quality standards is to continue with the landfill mining where water quality testing is showing potential improvement. The 2012 Annual Water Quality results stated that Long Pond showed significantly lower total nitrogen levels, 40 percent, in 2012 versus results shown in 2010. This trend is being further evaluated in the 2013 Annual Water Quality Program to determine whether it is as a direct result of the landfill mining and can be credited as such. In addition, the service area as defined in Figure 1-1 is proposed to be sewerred, which is what the 2004 CWMP showed. The main difference in this Needs Area between 2004 and current is that the area included is defined up to and not crossing over Millie's Bridge.

Data from 2004 details this Needs Area encompasses approximately 49 acres, of which 26 are developed. There are 99 total parcels, with 68 developed. There are 19 undeveloped parcels of which 8 are developable. With few available developable parcels, sewerage in this Needs Area does not promote any unwanted sprawl. New zoning since 2004 in this area has further reduced potential for unwarranted growth due to introduction of sewer infrastructure. The Needs Area is plagued with severe soils, approximately 100 percent Evesboro Sands that are detailed by the United States Department of Agriculture Soils Conservation Service as constrained as they perc very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. Properties of this soil association are permeability, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination.

There are approximately 10 acres out of the total 49 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. Over 91 percent of the area's systems are located on lots less than or equal to ½ acre. Less than one percent of properties were built before 1978. The small lot sizes and existing developed parcels contribute to density of systems with approximately 68 systems greater than 2 per acre.

4.1.3.1 Final Recommended Plan

Based on qualifying criteria from the 2004 CWMP, together with the results of nitrogen loading documented in the Madaket Harbor/Long Pond MEP, Warren's Landing Needs Area qualifies as an area needing an off-site wastewater disposal solution in this CWMP Update. This Needs Area is Phase 2, as part of the Madaket Needs Area, of the Final recommended Plan. While the criteria within this geographic area rates it as the top priority due to environmental and public health issues, it requires Somerset to be designed and constructed first in order to carry the wastewater to Surfside.

The Final Recommended Plan is to collect, transport and treat this Needs Area at the Surfside WWTF.

4.1.4 Monomoy Needs Area

The Monomoy Needs Area was evaluated in the 2004 CWMP and rated within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to the Nantucket and Polpis Harbors since then. Monomoy Needs Area is fully within the Nantucket Harbor Watershed and included in the Town's Annual Water Quality Testing with records of testing/sampling results from 2005 to present. This is one significant change since the 2004 CWMP, as water quality testing and results were not available at that time. Since 2004, the Nantucket Harbor MEP Report has been completed and two TMDLs have been issued by MassDEP, one in Nantucket Harbor and another in Polpis Harbor.

The Monomoy Needs Area immediately abuts Nantucket Harbor in the Town Basin. The Town Sewer District has been extended into the Needs Area as delineated in 2004, thus new boundaries for this CWMP Update were drawn. The upper portion of the 2004 area was cut off at Gardner Road and this is where the Shimmo Needs Area now begins. The Monomoy and Shimmo Needs Areas differ slightly from the 2004 Report's maps. The new delineations were based on recommendations from Town officials, marine and coastal resources, Natural Resources and Board of Health that have historically worked on the Project. The new delineations more accurately capture Monomoy with smaller, denser lots than Shimmo, which has larger lot sizes. These two Needs Areas have been the subjects of model run scenarios completed for the Town by SMAST in order to arrive at solutions to meet the TMDLs in the overall watershed. Refer to the previous section for additional information on the model runs scenarios completed as part of the MEP.

The Needs Area encompasses approximately 391 acres, of which 303 are developed. There are 272 total parcels, with 219 developed. There are 35 undeveloped parcels of which 25 are residentially developable in the future. There

are also 13 municipal/conservation parcels within this Needs Area. With few available developable parcels, sewerage this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 90 percent Evesboro Sands that are detailed by the United States Department of Agriculture Soils Conservation Service as constrained as they percolate very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. Properties of this soil association are permeability, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination. The other predominant soil association in this Needs Area is Riverhead Sandy Loam, which is a moderately rapid permeable soil and does not provide sufficient filtering of effluent.

There are approximately 44 acres out of the total 391 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. The majority of this Needs Area is serviced with private water, thus posing additional threat from inadequately operating on-site wastewater disposal systems. Approximately 9 percent of the area's systems are located on lots less than or equal to ½ acres and over 35 percent were built before 1978 (Creation of Title 5).

4.1.4.1 Final Recommended Plan

Based on qualifying criteria from the 2004 CWMP, together with the results of nitrogen loading documented in the Nantucket Harbor MEP, Monomoy Needs Area qualifies as an area needing an off-site wastewater disposal solution in this 2013 CWMP Update. The criteria within this geographic area rate it as the fourth priority due to environmental and public health issues documented in the 2004 CWMP, CWMP Update and MEP Report. Sewering this geographic area is vital to meeting the thresholds established and documented in the MEP and subsequent TMDL.

The Final Recommended Plan is to collect, transport and treat this Needs Area at the Surfside WWTF

4.1.5 Shimmo Needs Area

The Shimmo Needs Area was evaluated in the 2004 CWMP and rated within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to the Nantucket and Polpis Harbors since then. Monomoy Needs Area is fully within the Nantucket Harbor Watershed and included in the Town's Annual Water Quality Testing with records of testing/sampling results from 2005 to present. This is one significant change since the 2004 CWMP, as water quality testing and results were not available at that time. Since 2004, the Nantucket Harbor MEP Report has been completed and two TMDLs have been issued by MassDEP, one in Nantucket Harbor and another in Polpis Harbor.

The Shimmo Needs Area immediately abuts Nantucket Harbor north of Monomoy and south of Polpis Harbor. The lower portion of the 2004 area was amended to start at Gardner Road and this is where the Shimmo Needs Area now begins. The Monomoy and Shimmo Needs Areas differ slightly from the 2004 Report's maps. The new delineations were based on recommendations from Town officials, marine and coastal resources, Natural Resources and Board of Health that have historically worked on the Project. The new delineations more accurately capture Monomoy with smaller, denser lots than Shimmo, which has larger lot sizes. These two Needs Areas have been the subjects of model run scenarios completed for the Town by SMAST in order to arrive at solutions to meet the TMDLs in the overall watershed. Refer to the previous section for additional information on the model run scenarios completed as part of the MEP.

The Needs Area encompasses approximately 702 acres, of which 327 are developed. There are 203 total parcels, with 106 developed. There are 27 undeveloped parcels of which 14 are potentially developable. There are over 70 municipal/conservation parcels within this Needs Area. With few available developable parcels, sewerage this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 84 percent Evesboro Sands/Plymouth-Evesboro series that are detailed by the United States Department of Agriculture Soils

Conservation Service as constrained as they perc very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. Properties of this soil association are permeability, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination. The other predominant soil association in this Needs Area is Pawtucket Muck and Berryland, which are very wet, mucky soils and not conducive to soil absorption fields.

There are approximately 175 acres out of the total 702 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. The majority of this Needs Area is serviced with private water, thus posing additional threat from inadequately operating on-site wastewater disposal systems. Approximately 3 percent of the area's systems' are located on lots less than or equal to ½ acres and 17 percent were built before 1978 (Creation of Title 5).

4.1.5.1 Final Recommended Plan

Based on qualifying criteria from the 2004 CWMP, together with the results of nitrogen loading documented in the Nantucket Harbor MEP, Shimmo Needs Area qualifies as an area needing an off-site wastewater disposal solution in this CWMP Update.

The criteria within this geographic area rate it as the fifth priority due to environmental and public health issues documented in the 2004 CWMP, CWMP Update and MEP Report. Sewering this geographic area may be required in order to meet the thresholds established and documented in the MEP and subsequent TMDL. As part of the Adaptive Management Plan included herein, this geographic area will be evaluated for sewerage in conjunction with the restructuring of the jetties, fertilizer management, sewerage of both the Town Sewer District unconnected parcels and PLUS parcels. The need and timing to design and construct this Needs area will be based on results of the aforementioned efforts to meet the TMDLs established in both Nantucket and Polpis Harbors.

The Final Recommended Plan is to collect, transport and treat this Needs Area at the Surfside WWTF

4.1.6 Hummock Pond North Study Area

The Hummock Pond North Needs Area was not evaluated separately in the 2004 CWMP - this is a new addition to the CWMP Update based on the Hummock Pond MEP, which was started in spring of 2013 with and completed in early 2014 with results now in draft form. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to the Pond since then, specifically Head of Hummock. Hummock Pond was part of the original 89 embayments planned for study in the MEP, but was eliminated during the program due to budgetary constraints. With years of results in the Town's Annual Water Quality Testing Program showing severe degradation, the Town pursued the MEP with supplemental funds raised locally in order to get the study completed. The Town received the Draft Report in January 2014, showing results of 81 percent degradation due to wastewater.

Since 2004, the Town has extended the Town Sewer District into portions of this Needs Area, which touches the northern limits of the Hummock Pond Watershed as delineated and approved by the Town. Refer to Figure 4- for a map of this Needs Area.

The Hummock Pond North Needs Area immediately abuts the Head of Hummock Pond, which is severely degraded as detailed in the Hummock Pond MEP. Head of Hummock is detailed as supporting severely degraded habitat and the focus of groundwater discharge to this portion of the Watershed and well beyond the threshold N level as established for this Watershed.

The Needs Area encompasses approximately 962 acres, of which 426 are developed. There are 374 total parcels, with 205 developed. There are 81 undeveloped parcels with 66 having potential for future development. There are

over 44 municipal/conservation parcels located within this needs Area. With few available developable parcels, sewerage this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 76 percent Evesboro Sands that are detailed by the United States Department of Agriculture Soils Conservation Service as constrained as they perc very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. Properties of this soil association are permeability, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination. The other predominant soil association in this Needs Area is Berryland and Medisaprists, which are moderately rapid permeable, poorly drained soils and does not provide sufficient filtering of effluent and have high water tables.

There are approximately 103 acres out of the total 962 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. Over 39 percent of the area's systems' are located on lots less than or equal to ½ acres and over 25 percent were built before 1978 (Creation of Title 5).

4.1.6.1 Final Recommended Plan

Based on current qualifying criteria, Hummock Pond North Needs Area qualifies as an area needing an off-site wastewater disposal solution in this CWMP Update. The criteria within this geographic area rate it as the sixth priority due to environmental and public health issues documented in the 2004 CWMP, CWMP Update and MEP Report. Sewering this geographic area may be required in order to meet the thresholds established and documented in the MEP and any subsequent TMDL that MassDEP may issue as a result of threshold limits established. As part of the Adaptive Management Plan included herein, this geographic area will be evaluated for sewerage in conjunction with the bi-annual breaches to the Pond and any efforts undertaken to remove the Head of Hummock from the main Pond. The need and timing to design and construct this Needs area will be based on results of the aforementioned efforts to meet the threshold limit established in Hummock Pond.

The Final Recommended Plan is to collect, transport and treat this Needs Area at the Surfside WWTF

4.1.7 Hummock Pond South Needs Area

The Hummock Pond South Needs Area was evaluated in the 2004 CWMP (was the Cisco Needs Area in 2004) and did not rate within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to Hummock Pond since then. The Hummock Pond South Needs Area immediately abuts the Hummock Pond's eastern shoreline, which shows a gradient of degradation based on the Pond areas. The upper level of the Pond abutting the Head of Hummock is severely degraded, the middle portion is moderately degraded, while the lower levels of the Pond that immediately abut the shoreline show degrading conditions, but not as significant as other portions of the Pond.

The Needs Area encompasses approximately 721 acres, of which 328 are developed. There are 358 total parcels, with 282 developed. There are 41 undeveloped parcels with 21 having the potential for future development. There are over 14 parcels either municipal, conservation or agricultural. With few available developable parcels, sewerage this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 80 percent Evesboro Sands that are detailed by the United States Department of Agriculture Soils Conservation Service as constrained as they perc very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. Properties of this soil association are permeability, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination. The other predominant soil associations in this Needs Area are Riverhead-Nantucket Complex, which is a moderately extremely slow permeable soil and Berryland, which does not provide sufficient filtering of effluent.

There are approximately 56 acres out of the total 721 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. The majority of this Needs Area is serviced with private water, thus posing additional threat from inadequately operating on-site wastewater disposal systems. Over 24 percent of the area's systems' are located on lots less than or equal to ½ acres and over 32 percent were built before 1978 (Creation of Title 5).

4.1.7.1 Final Recommended Plan

Based on current qualifying criteria, Hummock Pond South Needs Area qualifies as an area needing an off-site wastewater disposal solution in this CWMP Update. The criteria within this geographic area rate it as the seventh priority due to environmental and public health issues documented in the 2004 CWMP, CWMP Update and MEP Report. Sewering this geographic area may be required in order to meet the thresholds established and documented in the MEP and any subsequent TMDL that MassDEP may issue as a result of threshold limits established. As part of the Adaptive Management Plan included herein, this geographic area will be evaluated for sewerage in conjunction with the bi-annual breaches to the Pond and any efforts undertaken to remove the Head of Hummock from the main Pond. The need and timing to design and construct this Needs area will be based on results of the aforementioned efforts to meet the threshold limit established in Hummock Pond.

The Final Recommended Plan is to collect, transport and treat this Needs Area at the Surfside WWTF

4.1.8 Miacomet Needs Area

The Miacomet Needs Area was evaluated in the 2004 CWMP and did not rate within the acceptable range to be determined to be an area needing an off-site wastewater solution based on the existing criteria at that time. The 2004 CWMP did not have the advantage of years' worth of water quality testing that is showing significant and rising degradation to the Pond since then. While Miacomet Pond is not part of the Massachusetts Estuaries Program (MEP) Studies as it is a freshwater body, the Pond does have a delineated watershed from the 1990 Water Resources Protection Plan detailing the contributing areas to the watershed. Miacomet is included in the Town's Annual Water Quality Testing with records of testing/sampling results from 2005 to present. This is one significant change since the 2004 CWMP, as water quality testing and results were not available at that time. In addition, the Pond has been subject to severe flooding issues during storm events and the area generally is plagued with severe soil and groundwater conditions. As of this Report writing, the Town is undertaking a major plan to evaluate Miacomet Pond and the flooding and degradation issues that it is experiencing.

Also since 2004, the Town has extended the Town Sewer District into portions of the 2004 Miacomet Pond Study Area, with this 2013 Area delineation being the remaining areas from 2004 that have not been sewerage. This updated delineation includes the major land area immediately abutting the Pond.

The Miacomet Needs Area immediately abuts Miacomet Pond to the west. According to the Town's Annual Water Quality Testing records from 2005 to present, Miacomet Pond is a closed coastal salt pond that is seldom (once in the past ten years) opened to the ocean to flush out nutrients and organic matter on the ebb tide and receive saline waters on the flood tide. The present non-tidal state and watershed nutrient inputs has resulted in a decline in nutrient related water quality throughout the pond, with poor water quality conditions the present norm. All of the water quality results show a consistency with a nutrient impaired basin. However, if the freshening of this basin continues, it may come into a new equilibrium as a purely freshwater system and will need to be reassessed as such. However, it will be difficult for Miacomet Pond to maintain itself as a purely freshwater system as storm overwash and rising sea level will tend to periodically cause seawater intrusion into its lower basin.

In reviewing the water quality results from 2010 to present, the nutrient impairment from nitrogen and phosphorus appear to be severe in the upper portions of the Pond (Station 3), middle portions of the Pond (Station 1) and fair in the lower reaches (Station 2) abutting the ocean. As is discussed above, this is not a water resource that can be

opened to the open ocean for flushing due to its freshwater state, so solutions need to be arrived at looking at land uses in the watershed-mainly wastewater, fertilizer and stormwater.

The Needs Area encompasses approximately 295 acres, of which 181 are developed. There are 124 total parcels, with 102 developed. With few available developable parcels, sewerage this Needs Area does not promote any unwanted sprawl. The Needs Area is plagued with severe soils, over 84 percent Evesboro Sands that are detailed by the United States Department of Agriculture Soils Conservation Service as constrained as they perc very fast and do not afford time in the soil layers to cleanse before discharging into groundwater and thus travel fast to the Pond. Properties of this soil association are permeability, depth to seasonal high groundwater and susceptibility to flooding. Evesboro Sands do not adequately filter the effluent, which leads to groundwater contamination. The other predominant soil association in this Needs Area is Riverhead Sandy Loam, which is a moderately rapid permeable soil and does not provide sufficient filtering of effluent.

There are approximately 40 acres out of the total 295 acres of severe groundwater limitation, which limits the proper absorption of effluent and leads to potential groundwater contamination. The majority of this Needs Area is serviced with private water, thus posing additional threat from inadequately operating on-site wastewater disposal systems. Over 25 percent of the area's systems' are located on lots less than or equal to ½ acres and over 28 percent were built before 1978 (Creation of Title 5).

4.1.8.1 Final Recommended Plan

Based on current qualifying criteria, Miacomet Needs Area qualifies as an area needing an off-site wastewater disposal solution in this CWMP Update. The criteria within this geographic area rate it as the eighth priority due to environmental and public health issues documented in the 2004 CWMP, CWMP Update and the Town's comprehensive water quality data. The timing to design and construct this Needs area will be based on results of the current and future water quality studies in conjunction with annual water quality testing in the Pond.

The Final Recommended Plan is to collect, transport and treat this Needs Area at the Surfside WWTF

4.1.9 PLUS Needs Area and Town Sewer District In-Fill

The PLUS parcels are various areas either within or directly abutting the Town Sewer District that for one reason or another were left out of the Sewer District in error. Most are sandwiched within the existing sewer or are either at the beginning or end of sewer streets. A complete review with the Town's Planning Director and Director of Public Works identified and approved these parcels to be included in the sewerage plan moving forward. Most either immediately abut infrastructure or are in close proximity of collection system components.

Town Sewer District parcels that remain unconnected to the sewer are a priority for connection in to the system as they impact the water resources as documented in the MEP. The Town is currently working to mandate, through the Board of Health Local Regulation 69.00, all parcels abutting existing sewer infrastructure connect within a specific time frame. There are additional unconnected parcels where no infrastructure exists that will be part of a future endeavor to design and connect.

The following Table 4-2 details the sewerage priorities as established in the previous sections.

4.1.9.1 Sewering Priorities

Based on the existing supporting data, this CWMP Update recommends the following sewerage priorities:

Needs Area	Priority Reasoning
Somerset	This Needs Area needs to be completed first due to the proposed route of bringing the highest Needs Areas priorities- Madaket and Warrens Landing- to Surfside WWTF. Hummock Pond North and South Needs Areas are also proposed to flow through Somerset to the Surfside WWTF.
Madaket and Warren’s Landing Needs Areas	Established TMDL, Large number of documented Title 5 Technical failures (inability to meet groundwater separation) contributing to nitrogen load through groundwater resources and MEP Model detailing removal of on-site wastewater meeting TMDL. Current ACO Program area with Board of Health.
Monomoy	Established TMDL and MEP Model detailing removal of on-site wastewater meeting TMDL.
Shimmo	Established TMDL and MEP Model detailing removal of on-site wastewater meeting TMDL. Priority based on Adaptive Management Plan and need for N reductions in Harbor.
Hummock Pond North	Pending TMDL and MEP Model detailing removal of on-site wastewater meeting TMDL. May make sense to sewer earlier in process as Madaket and Warrens Landing will traverse through the area towards Somerset on way to Surfside WWTF.
Hummock Pond South	Pending TMDL and MEP Model detailing removal of on-site wastewater meeting TMDL. This Needs Area to be prioritized based on Adaptive Management Planning with breach and removal of Head of Hummock from main body of Pond.
Miacomet	Annual Water Quality Testing results depicting degradation due to nutrient load from on-site systems.
<i>Town Sewer District Infill and PLUS Parcels</i>	<i>These areas can be serviced at any time as infrastructure exists within close proximity. It is recommended that these parcels be mandated to connect under Local Regulation 69.00 in order to reduce nitrogen loading in Nantucket Harbor Watershed.</i>

Table 4-3 details the remaining Study Areas Final recommended Plan.

Table 4-2: Study Areas Final Recommended Plan

The 2004 Study Areas that have been re-evaluated based on the results of the MEP Reports include:

2004 Study Area	MEP Area
Polpis	Nantucket Harbor/Polpis Harbor
Pocomo	Nantucket Harbor/Polpis Harbor
Wauwinet	Nantucket Harbor/Polpis Harbor
Quidnet	Sesachacha Pond

These 2004 Study Areas were re-evaluated in this CWMP Update and while not considered as areas needing an off-site wastewater solution in 2004 or 2013, they abut Nantucket Harbor in various locations and contribute in various manners to the Nitrogen loading documented in the MEP Report. Based on additional studies completed by SMAST on scenarios in the Harbors to reduce nitrogen loading to meet established TMDLS, sewerage these areas did not serve to contribute to the reduction effort. It has been determined that a more cost effective approach to the Nitrogen reduction be had through other contributors-fertilizer, stormwater and future build out. These efforts will supplement the structured solutions being planned such as sewerage, raising the jetties to afford a deeper tidal exchange and dredging. This CWMP Update is making recommendations to limit additional, future nitrogen loading with current and build-out conditions within the Adaptive Management Plan contained herein.

These Study Areas are recommended for oversight under the Town's Septage Management Plan. As part of the overall Adaptive Management Plan include herein, this Report is also recommends consideration for future management utilizing Innovative / Alternative systems due to each area's geographic locations within Nitrogen-sensitive embayments as detailed in the MEP Reports. I/A systems will afford a higher nutrient reduction, up to 50 percent of TN, than a conventional Title 5 system is able to do. Each Study Area is delineated in this CWMP Update on Figure 2-20.

4.1.9.2 Adaptive Management Plan to meet MEP and TMDLs

The Final Recommended Plan included at the beginning of this Chapter is a result of comprehensive analysis of the not only the sites themselves, but all criteria associated with the physical environment. This includes those areas that were the subject of study under the Massachusetts Estuaries Program (MEP) and have subsequently been issued Total Maximum Daily Loads (TMDLs) or have water quality thresholds established. As a result, these areas are being required to address the water quality issues identified in the MEP Reports and meet established water quality thresholds. Here we present an Adaptive Management Plan to address all MEP Areas with a plan defined as a structured, iterative process with adaptation as necessary to achieve mandated goals. The major goal is to reduce nutrient loading over time starting with projects that are easily implemented and monitor results through the Town's Annual Water Quality Program. This will enable the Town to make educated decisions on adding

In this case, the Town is structuring implementation of projects that were included in further study by SMAST with extensive modeling done to affirm results as a result of implementation in specific estuary areas. For example, the Town looked at multiple solutions to meet the TMDLs established in Nantucket Harbor and Polpis Harbor. These included fertilizer reduction as per the Town's Fertilizer By-law, coupled with reducing nutrient load from on-site wastewater systems, dredging of the entrance to Polpis Harbor and raising the east and west jetties to a height that

will afford a stronger and deeper flush of fresh ocean water into the Harbor. Adaptive Management purports to look at which of these solutions are easily implemented giving the Town the “biggest bang for its buck” and monitoring what results are achieved and then adapting measures as needed to adjust results. For example, the jetties project is underway with the Army Corps of Engineers due to safety concerns. Once the construction is completed, which is scheduled for late winter 2014/early spring 2015, water quality testing will determine the extent of flushing that will then come through the entrance to Nantucket Harbor and how far up into the Harbor the flush is realized. How does this relate to the nutrient concentrations in the Harbor at the testing stations over time? The modeling done for this geographic area told us that we need to do other tasks in coordination with the jetties in order to meet established thresholds-what would the next task be that is easily implemented given the options available? This is the first step in the Adaptive Management Plan. The next logical step is to look at the parcels that currently abut sewer infrastructure in the Town sewer District and mandate under Local Regulation 69.00 they connect into the municipal sewer system. These parcels are still relying on the on-site wastewater disposal systems, which are documented as contributing nutrients into the Harbor. Eliminating these on-site systems reduces nutrient loading into the Harbor and thus contributes towards meeting the thresholds in the TMDL.

Future decisions can be made such as to implement additional tasks that will meet the established resource management objectives and, either passively or actively, accrues information needed to improve future management options. Information learned will help the Town to add or reduce solutions as needed to meet established thresholds. Adaptive Management in the MEP areas will serve to not only help the Town change conditions within the estuaries, but will help it continue to learn about the overall system. This learning will ultimately help the Town in its long-term management of all these diverse systems on Island.

The following identifies the specific Adaptive Management Plan (ADM) approach for each embayment area included in the MEPs.

4.1.9.3 Sesachacha Pond

CWMP UPDATE FINAL ADAPTIVE MANAGEMENT PLAN TO MEET SESACHACHA POND THRESHOLD ESTABLISHED IN MEP (NO Formal TMDL, BUT THRESHOLD LEVELS ESTABLISHED AND DOCUMENTED)

The Town will continue to breach Sesachacha Pond twice annually in April and October. Sesachacha Pond Sentinel Station will be included in the Town’s Annual Water Quality Testing program to continue to monitor results. The Town’s 2013 Annual Water Quality Monitoring Program will support previous results in order to petition the state to remove Sesachacha Pond from the State’s List of Impaired Waters.. At the time of this Report, the final Sesachacha Pond Report had not been received from SMAST.

4.1.9.4 Madaket Harbor/Long Pond

CWMP UPDATE FINAL ADAPTIVE MANAGEMENT PLAN TO MEET MADAKET HARBOR / LONG POND THRESHOLD ESTABLISHED IN MEP (Draft TMDL issued)

The Town will continue to mine the landfill and monitor water quality testing done in this location for further reductions of N. Madaket and Warren’s Landing Needs Areas are proposed for municipal sewerage at the Surfside WWTF thus removing 100 percent of the land use wastewater contributing to the degradation, which based on the MEP , will serve to meet the Draft TMDL issued for this area.

4.1.9.5 Nantucket Harbor/Polpis Harbor

CWMP UPDATE FINAL ADAPTIVE MANAGEMENT PLAN TO MEET NANTUCKET HARBOR / POLPIS HARBOR TMDL

The Town will continue with its mandate to sewer all areas located within the Town Sewer District where infrastructure exists under Local Regulation 69.00. The reconstruction of the east and west jetties in Nantucket Harbor are currently under design with the ACOE and as of last update in July 2014, due to be bid in late fall 2014 with construction starting early 2015. The Town has begun enforcement of its Fertilizer Regulations, which will be an on-going effort Island-wide, with particular attention paid to the Harbor Watershed areas. As the above approaches are implemented, data will support the need for additional work, which includes extending the municipal sewer to the Monomoy Needs Area. Future considerations include extending sewer to Shimmo Needs Area, implementing a Local Regulation for I/A systems within the Study Areas delineated within MEP Areas and potential future stormwater BMPS based on the Town completing a Stormwater Master Plan.

The Town will continue to monitor water quality in Nantucket and Polpis Harbor through its Annual water Quality testing Program. The historical MEP Sentinel Stations will be sampled on a regular basis in order to monitor results as the Town moves forward with its plan to meet the TMDLs established in this location.

4.1.9.6 Hummock Pond

CWMP UPDATE FINAL ADAPTIVE MANAGEMENT PLAN TO MEET HUMMOCK POND THRESHOLD ESTABLISHED IN MEP (No Formal, issued TMDL to date. The following recommendation is based on the results detailed in the Report, which will form the future basis for a TMDL)

The Town has identified Hummock Pond South and Hummock Pond North as Needs Areas requiring an off-site wastewater solution. The Adaptive Management Plan contained herein proposes to collect, transport and treat these Needs Areas at the existing Surfside WWTF, thus removing the 81 percent wastewater from land use in the Watershed. In addition, the Town will work towards more finite planning for semi-annual breaches of Hummock Pond by forecasting weather conditions looking towards conditions that present the appropriate weather conditions, tides and northerly winds to afford an opening that stays open to tidal flushing for a minimum of four days. Hummock Pond Sentinel Station 3 will be included in the Town's Annual Water Quality Testing program to continue to monitor results. Another piece to this Plan is the separating of the Head of Hummock from the main Pond as was detailed earlier in this Report. This Plan is currently being evaluated through the Nantucket Land Council together with the Town.

4.2 SURFSIDE WASTEWATER TREATMENT FACILITY RECOMMENDED IMPROVEMENTS

The following are the improvements Woodard & Curran is recommending for the Surfside Wastewater Treatment Facility (WWTF). We prepared estimated conceptual level project capital costs for these improvements and the recommended schedule for these improvements is included in the capital improvement plan section of this report. We have organized the recommended improvements into the following categories:

- Improvements for future capacity needs
- Improvements for reliability
- Improvements for energy efficiency

4.3 IMPROVEMENTS FOR FUTURE CAPACITY

As part of our contract with the Town for Madaket Wastewater Planning, Woodard & Curran performed a capacity evaluation of the Surfside WWTF to determine the feasibility of accepting the projected flows and loads from the Madaket and Warren's Landing Needs Areas. The evaluation included an assessment of existing and projected

wastewater flows and loads, an assessment of current WWTF performance, and a determination of required improvements. A detailed description of our capacity analysis is provided in Appendix ##.

The findings of our capacity assessment were as follows:

- The future condition is a maximum daily flow of 4.0 million gallons per day (MGD) which includes build out of the existing sewer areas and sewer extension to the needs areas.
- The Surfside WWTF has sufficient capacity to receive wastewater at the future condition provided that minor changes are made to operational practices and additional aeration blower capacity is provided.
- Although the Surfside WWTF has capacity, the future maximum daily flow of 4.0 MGD exceeds the Town's MassDEP Groundwater Discharge Permit limit of 3.5 MGD for daily flow to the groundwater discharge beds. Therefore, expansion of the groundwater discharge capacity or revisions to the groundwater discharge permit are required. See section below for more detailed information relative to the beds.
- Expansion of groundwater discharge capacity or revisions to the Groundwater Discharge Permit would be required at the future condition even if Madaket and Warren's Landing wastewater was not treated at the Surfside WWTF.

The recommended improvements to the Surfside WWTF for future capacity include additional aeration blowers and modifications to the nitrate recycle system as follows:

4.3.1 Additional Aeration Blowers

The Surfside WWTF existing aeration system includes three Aerzen positive displacement blowers, each with a design capacity of 950 standard cubic feet per minute. Based on our calculations for oxygen requirements, we determined that the existing aeration tank blowers do not have enough capacity for the future condition, therefore two additional blowers are needed (one to provide the additional capacity required and one to serve as a redundant backup). With this additional blower capacity, there is sufficient capacity for the flow and loads at the future condition.

4.3.2 Modifications to the Nitrate Recycle

During our evaluation, WWTF operations staff expressed concerns with having the ability to denitrify at the future condition because of the anoxic tank volume and because nitrate recycle from the membrane tanks may have a high dissolved oxygen (DO) concentration, which could inhibit denitrification. Our calculations (as well as the original GE Zenon design calculations) and the plant data that we have been provided indicate that these two items would not be a problem. However, there are many variables that can affect the actual results. Therefore, to address this concern, we recommend gathering additional nitrate data and monitoring the results as flows and loads to the Surfside WWTF increase in the future. We also have prepared a conceptual layout and conceptual cost estimate for improvements to the nitrate recycle system in case future problems are encountered. The improvements include modifying the existing recycle from the membrane tanks with redirection to the aeration tanks and an additional, separate, nitrate recycle from end of the aeration tanks to the anoxic tanks.

4.4 IMPROVEMENTS FOR RELIABILITY

We have identified and recommend several improvements to increase the reliability and long-term effectiveness of operation of the Surfside WWTF. Some of the improvements for reliability were identified and evaluated as part of our contract with the Town for the Alternatives Analysis, Recommendations and Conceptual Opinion of Probable Cost of Proposed Upgrades to the Surfside WWTF and some the improvements were identified through the Surfside WWTF capacity assessment.

4.4.1 Corrosion Control

The Surfside WWTF has experienced severe corrosion of the concrete and metal components at the headworks, and there was concern that corrosion may have been occurring at other locations such as the primary clarifiers. The corrosion is due to the presence of hydrogen sulfide, which is formed upstream in the collection system, particularly in the force mains.

To address this concern, Woodard & Curran engaged a specialty sub-consultant, Bowker & Associates (Bowker), to perform a sampling program, assess the corrosion, identify alternatives for addressing the situation, and provide a recommended solution with opinion of probable construction cost. The Bowker study found severe hydrogen sulfide corrosion at the headworks of the Surfside Wastewater Treatment Facility and recommended an oxygen injection system, installed at the Sea Street Pump Station, for mitigation.

Woodard & Curran reviewed the Bowker Report and agrees with these findings and recommendations. The recommended oxygen injection system has a higher capital cost than the other alternatives, however it has the lowest life-cycle cost because it does not require the purchase of chemicals which are quite costly. A detailed description of the Bowker corrosion control study is provided in the appendices of the full report that is included in Appendix H.

4.4.2 Influent Screening

An influent grinder was installed at the Surfside WWTF during the 2009 upgrade, however due to severe hydrogen sulfide corrosion; the grinder is no longer functional and was removed. To evaluate this issue, a screening analysis was conducted and documented in a memorandum entitled "Enhancements to the Surfside Wastewater Treatment Facility" by AECOM, dated January 9, 2012. The memorandum outlined the importance of MBR system pretreatment, identified pretreatment alternatives, and ultimately recommended the installation of a grinder in the headworks to breakdown influent debris. A copy of this memorandum is included in Appendix H.

The Town was interested in receiving a second opinion regarding the need for membrane pretreatment (screen versus grinder) and contracted Woodard & Curran to provide an Influent Screening Alternatives Assessment. A detailed description of our influent screening alternatives analysis is provided in the full report, which included the following tasks:

- Review existing documentation related to influent screening including design plans, operation and maintenance manuals, plant hydraulics, and the AECOM Memorandum dated January 9, 2012.
- Identify feasible screening alternatives and/or combinations of alternatives suitable for a membrane bioreactor treatment facility with primary clarifiers with the Surfside WWTF specific hydraulic and spatial requirements and operational needs.
- Provide a recommendation of the most desirable screening alternative with consideration given to process, cost, operation and maintenance concerns.
- Provide an opinion of probable cost for the recommended alternative including design, construction, engineering and contingency suitable for securing funding.

After analysis of multiple alternatives, we recommend the installation of a new headworks consisting of two 6-mm screens, two 2-mm band screens, and two wash presses for screenings handling. We also recommend that a new vortex grit removal system is incorporated into the new headworks to address issues with existing corrosion and grit equipment at the existing aerated grit chamber. We also recommend that this equipment is housed within a cedar shingled building.

4.4.3 Vactor Truck Unloading

Currently, the vactor truck discharges directly into the primary settling tanks (PST). This means of discharging is not ideal because the contents are not screened and bypass the grit removal processes, likely disrupting settling in the PSTs. Woodard & Curran analyzed installing a vactor unloading station at the Surfside WWTF. Multiple locations and options were considered for the vactor discharge station, including the recommendations described in the previous memorandum entitled “Enhancements to the Surfside Wastewater Treatment Facility” by AECOM, dated January 9, 2012.

Based on our evaluation we recommend the installation of a concrete ramp adjacent to the proposed new headworks. Catch basins would be installed at the bottom of the ramp. The vactor truck would back to the edge of the concrete ramp and discharge its contents at the bottom of the ramp. The catch basins would allow for the liquid to discharge through to the headworks and simultaneously prevent debris and objects from passing through. The screened contents would then be removed with a loader truck and discharged into a dump truck, which would be hauled to a disposal site.

4.4.4 Aeration Tank Instrumentation

Surfside operations staff reported that the dissolved oxygen control instrumentation is not reliable and cannot be utilized for aeration tank blower control as was the original design intent. Replacement of these instruments with more reliable DO and oxidation reduction potential (ORP) measurement capability would enhance the ability to operate the WWTF at the future condition.

4.4.5 Primary Sludge Pump Replacement

There are three existing primary sludge pumps that were installed during the 1992 upgrades. Given the age of these pumps, we anticipate that these pumps will need to be replaced within the 20-year planning period of this Report.

4.4.6 Membrane Removal Equipment

Periodic removal and inspection of the membrane cassettes is recommended by the membrane manufacturer (General Electric/Zenon). The Surfside WWTF does not currently have the equipment needed to remove the membrane cassettes. When inspections have been done in the past, the Town is forced to rent a crane, which is a costly option. We recommend installation of 6-ton rated travelling monorail crane and hoist to better facilitate regular inspection of the membranes. This equipment would also allow operations staff to make minor repairs to the membranes as needed.

4.4.7 Membrane Inspection and Replacement

The ability to predict the expected life of membranes is very limited because membrane treatment for municipal wastewater is a relatively new application. In addition, the characteristics of the influent wastewater, the treatment process conditions, and the associated membrane fouling constituents can vary greatly among WWTFs. It is our general understanding that the expected membrane life will be less than the 20-year planning period of this Report.

Based on correspondence with General Electric (GE)/Zenon, we understand that, as part of the terms of the original membrane purchase, the Town has an agreement with GE/Zenon that membranes purchased before the 10-year anniversary (approximately December of 2018) of the membrane installation may be purchased at a discount. The discounted replacement price is established using a base price adjusted for inflation using the Consumer Price Index. According to GE/Zenon, for 2013, the discounted replacement price for all four (4) trains would be \$1,240,000 versus the market price of \$1,940,000 (costs do not include installation, freight or taxes). Given the significant cost savings associated with purchasing the membranes prior to the 10-year anniversary, we recommend that the Town budget

for the capital expense of replacement of half of the membranes and that a membrane inspection is made prior to determining whether or not to make the purchase.

4.4.8 Supervisory Control and Data Acquisition (SCADA) System

Through our evaluations we have identified several improvements to the Surfside WWTF SCADA system that would enhance current operations. These recommended improvements are as follows:

- Upgrade the IFIX software: the SCADA system depends on IFIX Software for its functionality. The version of IFIX currently installed is outdated and does not work with newer versions of Microsoft Windows. If the one of the existing computers were to fail and had to be replaced, it would come with a newer version of Windows that would not be compatible with the IFIX software.
- Provide remote access: installation of a hardware package that provides for secure remote access into the SCADA system will allow WWTF operations staff to monitor and control the system as if they were sitting in front of the SCADA PC at the Surfside WWTF which will save personnel time including prevention of unnecessary trips to the facilities for off-hour nuisance alarms
- Improve integration between the GE/Zenon system control panel and the SCADA master node: The functionality of the GE/Zenon control panel should be fully accessible from the existing SCADA system. This recommendation would accomplish the functionality.
- Provide automatic report software: we recommend that reporting software (XLReporter) is included for the SCADA system. This package can be configured to generate automatic reports of process variables and alarms. Manual lab data can also be entered into the program to compare to readings received from online instruments. The software can generate reports on any specified period (daily, weekly, monthly, etc.) and can be formatted to be identical to regulatory agency reports to reduce the amount of staff time required for reporting.
- Provide operator training: development of a SCADA training plan for operations staff to take better advantage of the SCADA system already in use at the wastewater sites within the Town.

4.5 IMPROVEMENTS FOR ENERGY EFFICIENCY

As part of the CWMP, Woodard & Curran performed an energy efficiency evaluation of the Surfside WWTF to further refine the recommendations of a National Grid Scoping Study Energy Evaluation. The evaluation was performed by JK Muir LLC and is described in a memo dated July 2, 2014, which is provided in the appendices of the full report. Refer to Appendix H for the full Report.

A summary of the recommended cost saving measures is as follows:

- Provide instrumentation and controls modifications to allow automatic blower on/off cycling which will minimize energy usage for the primary sludge holding tanks.
- Provide instrumentation and controls modifications to allow automatic cycle blower on/off cycling which will minimize energy usage for the secondary waste activated sludge holding tanks.
- Modify the piping for the draft pumps that convey flow from the anoxic tanks to the aeration tanks to allow a reduction in the number of pumps that need to run under reduced flow conditions.
- Install a new VFD on the odor control fan and make programming changes to allow for a range of operating conditions to optimize ventilation while minimizing energy usage.
- There is a potential opportunity to modify the control system programming set points for the membrane air scour blowers to optimize their usage and reduce the blower run time, which would reduce energy usage.

4.6 ESTIMATED CONCEPTUAL COST FOR IMPROVEMENTS

Woodard & Curran's conceptual cost estimates for the Surfside WWTF improvements are summarized in the following Table 4-4.

Table 4-3: Surfside WWTF Final Recommended Improvements Cost Estimates

	Construction	Design Engineering, Permitting and Construction Administration	Subtotal	Contingency (30%)	Project Total
Improvements for Future Capacity					
Blower Addition	\$388,000	\$85,400	\$473,000	\$142,000	\$615,000
Nitrified Recycle	\$371,000	\$81,600	\$453,000	\$136,000	\$589,000
Subtotal					\$1,204,000
Improvements for Reliability					
Corrosion Control	\$361,000	\$79,400	\$440,000	\$132,000	\$572,000
Influent Screening and Vector Truck Unloading	\$3,080,000	\$677,000	\$3,757,000	\$1,127,000	\$4,884,000
Aeration Tank Instrumentation	\$180,000	\$40,000	\$220,000	\$66,000	\$286,000
Primary Sludge Pump Replacement	\$176,000	\$38,700	\$215,000	\$65,000	\$280,000
Membrane Removal Equipment	\$116,000	\$27,800	\$144,000	\$43,000	\$187,000
Membrane Inspection and Replacement	\$806,000	\$50,000	\$856,000	\$257,000	\$1,113,000
SCADA Improvements	\$51,800	\$60,800	\$113,000	\$34,000	\$147,000
Subtotal					\$7,469,000
Improvements for Energy Efficiency					
Sludge Blower Cycling	\$5,000	\$5,000	\$10,000	\$3,000	\$13,000
Secondary Sludge Blower Cycling	\$-	\$5,000	\$5,000	\$2,000	\$7,000
Draft Pump Piping Modifications	\$7,500	\$1,900	\$9,000	\$3,000	\$12,000
Odor Control Fan VFD Implementation	\$25,500	\$5,000	\$31,000	\$9,000	\$40,000
MBR System Optimization	\$-	\$62,500	\$63,000	\$19,000	\$82,000
Subtotal					\$154,000
Total					\$8,827,000

The conceptual estimates are based on the following:

- Equipment and materials costs were based on a combination of manufacturer budgetary quotations and cost data we obtained from similar projects
- Prevailing wage rates for labor
- Project is tax exempt
- Engineering and permitting services are included as allocations based on a percentage of the estimated construction cost
- A contingency of 30-percent is applied to the project cost
- The conceptual cost estimates are indexed to the Engineering News Record (ENR) construction cost index of 9681 for February 2014.

4.6.1 Modified Groundwater Discharge Permit - Additional Bed Loading

The additional loading to the existing beds at the Surfside WWTF, from 3.4 MGD to 4.0 MGD, based on summer loading at 4.0 MGD for the entire month of August only and at 2.92 MGD (summer average daily flow) for the remainder of the year is feasible under current conditions and has been verbally approved by MassDEP after filing both a modification to the existing Groundwater Discharge Permit -BRP-11 and the Hydrogeological Evaluation filing -BRP-83. The transient models detail the most dramatic mound during the month of August, which is expected given the maximum loading rate of 4.0 MGD for the entire month. While the modeling shows that additional loading raises the mounds in the upper beds, the overall system is able to handle the additional flow with vertical separation in the four foot range in bed #12, which previous records detail with the highest groundwater elevation. The remainder of the year under the transient models clearly shows considerably less mounding with vertical separations exceeding four feet. Additionally, the upgrades at the WWTF, most notably the upgrade to MBR technology, afford a highly treated effluent discharge that travels to the open Atlantic Ocean with no environmental impacts.

The full flow to 4.0 MGD will not be seen immediately, but, rather over a 20-year planning period. It is also in the Town's CWMP Update as an alternative, to maintain communication with MassDEP and various Cape and southeastern Massachusetts towns in the use of an ocean outfall. In a best case scenario at some point in the future, the treated effluent from Surfside could be discharged through an outfall to the Atlantic Ocean.

The Groundwater Discharge Permit modification to 4.0 MGD affords the Town the highest and best use of the existing Surfside WWTF.

4.6.1.1 Downstream Evaluation

In order to accommodate additional wastewater flows from the needs areas, select sections of sewer and wastewater pump stations will require capacity upgrades.

The pipes that will require upgrade include the following:

- Mizenmast Road from Bartlett Road to Pine Valley Pump Station
- Bartlett Road from Appleton Road to Surfside Road
- Surfside Road from Bartlett Road to Surfside Pump Station
- Surfside Road from South Shore Road to Surfside Pump Station

Cost estimates for the upgrading the sewer pipe above were calculated similarly to the sewer for the needs areas at \$720 per linear foot.

The pump stations that will require upgrades to accommodate the additional wastewater flows from the needs areas include:

- Pine Valley Pump Station located on Mizzenmast Road
- Surfside Road Pump Station

Based on the capacity of the pump stations as evaluated during the pump station assessment task, the schedule for which the upgrades would be implemented may be determined at a future date based on when each needs area is connected and the rate at which households are connected to the new system or based on availability of project funding.

Cost estimates for upgrading the pump stations were calculated based on average pumping capacity similar to the sewer needs areas.

These cost estimates are included in the Recommended Plan CIP, Figure 4-1.

4.6.1.2 Pump Station Evaluation

The proposed pump station assessment task will observe and document the condition of 10 of Nantucket's 11 wastewater pumping stations. This task excludes the Sea Street Pump Station, which is currently being evaluated separately. This review will observe the operational and physical condition of the stations various systems including, but not limited to, the following:

- Pump age, condition, pumping capacity/efficiency
- Physical structures of the wet well, dry well or valve vault, control building and/or panel enclosures, hatches, and ladders
- Control equipment and systems - Control panels including age and physical condition of components and enclosures
- Mechanical equipment and systems - Miscellaneous mechanical systems such as unit heater, dehumidifier, sump pumps.
- Power systems and equipment - Power systems and equipment including generators, if they are on site.

These cost estimates are included in the Recommended Plan CIP, Figure 4-1.

4.6.1.3 Stormwater Recommendations

Implementation of structural and heightened non-structural controls are not recommended at this time. These activities will require substantial capital costs, including purchase of multiple high efficiency regenerative air-vacuum sweeping trucks, construction of structural controls to treat nitrogen at outfalls that drain portions of the downtown area, as well as continued annual expenditures on ongoing implementation of sweeping and catch basin cleaning, and maintenance of the structural controls. Preliminary estimates show both capital and ongoing operational costs associated with these practices are very high per kg of nitrogen removed, as compared to management of fertilizer, septic systems, and sewerage. Based on discussions with Town Staff about implementation of these potential non-structural and structural control practices to reduce nitrogen loading to the harbors from impervious cover, Woodard & Curran has recommended the Town implement the following activities to reduce nitrogen loading from impervious cover runoff:

- Continue its current street sweeping and catch basin cleaning operations in the downtown area;
- Develop local bylaw and regulations to manage stormwater runoff during construction and post-construction for new development and redevelopment;
- Implement “adaptive management” for street sweeping, catch basin cleaning, and structural BMPs as needed based on water quality results in Nantucket and Polpis Harbors; and

Develop a comprehensive island-wide Stormwater Management Master Plan. This Plan should build off of related work completed to date including the drainage system map and the evaluation of drainage outfalls in the downtown area to develop Plan that integrates existing and future stormwater capital planning, drainage operations and maintenance efforts, regulatory requirements, public outreach and involvement, previously completed watershed and water quality work, and known local problems such as areas prone to flooding. This Master Plan will help the Town to holistically understand its stormwater assets, water quality and quantity issues, budgetary costs and drivers for these costs, and develop a sustainable plan for long-term management of stormwater throughout Town. Ultimately, a Master Plan can set the framework for a stormwater financing mechanism. This Plan is necessary to protect public and environmental health, address water quality issues, and protect public and private drinking water supplies. Although the Town is not regulated under EPA’s Phase II Small Municipal Separate Storm Sewer System (MS4) stormwater program, the Town does have a need to manage its stormwater runoff to prohibit discharges from causing or contributing to exceedances of water quality standards.

In addition, the Town has aging stormwater and sewer infrastructure, therefore has a high potential for illicit connections or illicit discharges to the drainage system from improper connections or failing sewer pipes. The Plan will also preserve recreational areas used for swimming and boating, commercial fisheries, and protect endangered species habitat. The Town’s existing stormwater system was detailed in the July 2006 Sewer System Evaluation Study. This Report recommended a series of improvements that would eliminate surge charging, street flooding, and undersized piping and deteriorated structural integrity of the pipes. The plan was delineated into three phases, with Phase I completed as of the writing of this Report. The 2004 CWMP carried approximately \$24,000,000 worth of stormwater improvements in the three phases consisting of both outfall and infrastructure improvements, with approximately \$5,000,000 completed to date. This Update Report is recommending a Stormwater Master Plan be completed in order to fully assess previous recommendations, as well as assess any new tasks to be completed based on current conditions. The previous budget is not carried on the Capital Improvements Plan as the recommendation is to complete the Stormwater Master Plan in order to develop current conditions and needs. A CY2015 project evaluation form (PEF) was submitted to MassDEP for State Revolving Funds to cover the cost of this study. The results of this study will be incorporated into the CIP at a future date.

4.6.1.4 I/I Recommendations

Since the 2004 CWMP, the Town has moved forward with a number of Infiltration/Inflow (I/I) projects that were included in the 2004 Capital Improvements Plan. The Town Sewer District I/I Study was completed in 2006 and identified a number of areas for rehabilitation projects to eliminate extraneous water getting into the sewer system. The Town Sewer District was divided into a number of “Mini-Systems” - each with a specific target of rehabilitation. The Town completed the Brant Point I/I Study in 2006 with a subsequent Brant Point Sewer Replacement Phase I completed in 2007.

Phase IIA (Mini-System N-1) design and construction was completed in 2009, which was in the downtown area. Phase IIB construction (Mini-System N-2) is currently on-going with rehabilitation and sewer replacement in portions of downtown. This Project includes the removal of approximately 5,000 linear feet of existing vitrified clay pipe and replacement with 8 to 10 inch PVC pipe; replacement of approximately 2,300 linear feet of sewer pipe with pipe bursting and removal of approximately 3,000 linear feet of cast iron and AC water pipe and replace with 6 to 8 inch cement lined ductile iron pipe. To date, Phase IIB has identified and corrected major I/I at Jetties beach, identified

and repaired major root blockage in Lyon Street and Fair Street, and replaced multiple manholes and damaged sewer pipe throughout the Downtown area. Several sources of inflow from roof leaders and other sources have also been identified and corrected during the course of construction. Operators at the Sea Street pump station recently commented on the noticeable reduction in inflow observed at the pump station that is likely attributable to the Phase IIB improvements. This Phase is projected to be completed with final full width paving in fall 2014.

The remaining mini-systems to be completed include the areas further from the water in the Pleasant Street, Vesper Lane, Monomoy Road, Naushop Subdivision and outlying areas of the Town Sewer District. Our office is examining CCTV inspection records to identify areas in need of repair, and analyzing available inflow data to pinpoint potential sources of I/I. With this data, we are working to identify and prioritize the future Phases of construction work. Based on preliminary investigation and conversation with DPW, we anticipate that the next phase will continue to focus on sewer infrastructure repair in the N-1 Mini System. These previous phases were detailed in earlier reports from other sources and need to be updated based on current conditions. Rather than including approximately \$86,520,000 (2014 dollars recommended in 2006) for this future work without having full knowledge of current conditions, this CWMP Update is recommending the Town conduct an I/I Study and Flow Metering Update to evaluate future needs. A CY2015 project evaluation form (PEF) was submitted to MassDEP for State Revolving Funds to cover the cost of this study. The results of the I/I and Flow Metering study will be incorporated into the CIP at a future date.

Figure 4-1: Capital Improvement Plan - spreadsheet 11 X17

4.7 AWARENESS OF AND ADAPTATION TO CLIMATE CHANGE – PLANNING FOR THE FUTURE

The potential impacts of climate change pose significant challenges and risks to communities, particularly shoreline communities like Nantucket. Nantucket has already felt some of these impacts over the last few years with major storms, particularly 2012 Hurricane Sandy that left serious erosion issues on multiple areas of the island. One example is on the eastern shoreline where Baxter Road suffered significant impacts with buildings lost to the ocean due to the seriously eroding shoreline. It is in this area that Town officials are now having to come up with a plan to relocate municipal infrastructure in the existing roadway in order to avoid a catastrophe should future storms reach water and sewer pipes. This area has shown that climate changes pose a real threat to the water resources. Up to this point, while there has been erosion issues in various areas, the scientific community is just beginning its outreach with real facts and figures and the overall concept of global warming / climate change has not been perceived as real in the general public. The issue is now taking a front page due to the devastation experienced by the eastern shore of the United States that started with Sandy in 2012.

Nantucket is in a position to plan for the future and take climate change into account when proposing new infrastructure, as well as in its Capital Improvement and Management Planning preserving and protecting existing infrastructure. As was noted in a recent NEWEA Position Paper by the New England Water Environment Association on Climate Change and Water Resources, “The nation’s existing drinking water, stormwater, flood management, and wastewater infrastructure is already in need of significant investments to maintain current levels of service over the coming decades, and climate change only increases the need for additional resources”. Nantucket has been impacted through all these water resources due to recent storm events and can “see” the impacts of a changing climate. Nantucket also understands that mitigation to preserve and protect its resources is a sole source effort as it has no regional neighbor to depend on.

Climate change is also leading to higher tides as was evidenced in downtown Nantucket where flooding was a major issue when Sandy hit. New FEMA maps detail the further inland flood zones have changed to. Potential risks include sea level rise, more intense storms with subsequent flooding, temperature increases, ecosystem change, habitat and species impacts, and potential stormwater intrusion. The United States Army Corps of Engineers completed a LIDAR survey of Nantucket’s coastline after the 2012/2013 storm events and details areas of impact on Figure 3-6, 3-7 and 3-8. These maps show areas where storms impacted the coastline areas, which gives the Town an idea of where this CWMP Update Plan needs to integrate proactive planning with technical solutions to meet challenges presented by climate change. For example, planning infrastructure in areas of vulnerability that will withstand future potential impacts. This may mean locating pump stations well outside of coastal areas subject to high tides, flooding and erosion. Planning to prevent public health risks as a result of sewer overflows or damage to and/or actual loss of infrastructure with enhancements to protect the infrastructure should an event present itself in the future.

Based on recent evidence and studies done by the scientific communities, climate change is posing real challenges and consequences to geopolitical boundaries. Presentations by the Woods Hole Institute scientists at the 1st Annual Cape Coastal Conference, State of the Cape: Changing Waters & Shorelines in June 2013, detail impacts with changing climate, sea level and coastal hazards on the Cape and Islands.

The recommended Plan included in this Report has taken aspects of climate change into account in the conceptual planning, especially in the locating of collection system infrastructure. At this point in the planning process, it is important to take climate change into consideration, but it is more important to move forward consistently and with strategic planning in mind. When the Town moves forward with Final Design, a more comprehensive evaluation will be taken and offset mitigation measures will be applied where needed. Final Design affords the town much more detailed information, such as geotechnical data, that is not available in the planning or conceptual process.

This CWMP Update recommends that the Town prepare a long-term strategy for dealing with climate change for the preservation and protection of vital infrastructure, as well as provide a sound financial plan to maintain its sustainability.

5. FUNDING AND FINANCING

5.1 FUNDING AND FINANCING OPTIONS

5.1.1 State Revolving Fund Loan Program

A user-friendly funding option for the Recommended Plan for Nantucket is public financing through the Massachusetts State Revolving Fund (SRF) Loan Program. The SRF Program is administered through MassDEP and affords communities low interest loans currently at 2 percent over a 20-year period. Additionally, the O'Leary Legislation passed in 2008, affords projects that meet specific criteria the opportunity for 0 percent SRF loans. O'Leary Senate Bill No. 2379 was passed in August 2008, with the initial intent of supporting MEP communities. Nantucket wastewater projects included in this CWMP Update will qualify for this funding as long as they each can meet the following requirements:

1. Complete a DEP approved CWMP
2. Applies for and is approved for construction funds to implement recommendations of CWMP between CY2009 and CY2019 through SRF process
3. Total project cost does not exceed 35% of total costs of all projects on that year's IUP (applicant cap)
4. Project intended to remediate or prevent nutrient enrichment of surface water or source of water supply
5. Applicant currently not subject to a DEP Enforcement Order (due to violation of nutrient-related TMDL, etc.)
6. Project deemed consistent with regional water resources management plan
7. Applicant has adopted land use controls (subject to review of DEP) that will limit wastewater flows to amount authorized under zoning and wastewater regulations in accordance with approved CWMP

The SRF Program is financed through the Massachusetts Water Abatement Trust (Trust), which was established by Chapter 275 of the Acts of 1989 (The Hayes Act), as amended (Chapter 29C). Under Chapter 29C, financial assistance is offered to projects at one-half market rate. The General Court authorized additional funding (contract assistance) to be paid by the Trust to "buy down" the interest to 2 percent. For wastewater treatment and collection projects such as contained in this Report, design costs are ineligible for SRF financing. This cost is paid directly through Town means.

Nantucket has on many previous occasions taken advantage of the SRF Program, so is well versed on the Program requirements. The next period for submitting SRF applications is August 2014. Once the town has accepted and approved the Capital Improvements Plan (CIP) contained herein, a decision can be made as to what projects should be first for implementation and coordination completed to get an application or applications in by the August 2014 deadline. All avenues of funding under the SRF will be evaluated and pursued in order to bring the most cost-effective option to the Town.

A CY2015 PEF is being submitted in August 2014 for potential funding for Somerset, Madaket and Warren's Landing Needs Areas sewer extension.

5.1.2 Additional Funding Opportunities

All avenues of funding are being pursued at this time. The Town, with the lead of the Board of Selectmen and Town Administration are working towards defining a financing plan that meets the needs of the enclosed Capital Improvements Plan (CIP). Multiple financing scenarios are being evaluated including splitting the overall costs into thirds; 1/3 to tax base, 1/3 to Sewer Enterprise Fund and 1/3 as individual property owners. Other scenarios included

50/50 cost sharing with half on the tax base and half to the property owner, as well as 100 percent to the property owner. These scenarios are only the beginning of financing discussions, with the goal of having the Sewer Planning Work Group established by the Selectmen take this task further to refinement.

5.2 HOUSEHOLD COSTS

5.2.1 Individual Household Cost Scenarios

This section estimates individual household costs associated with the sewerage of the Needs Area. These estimates reviewed the worst-case scenario where the property owner pays 100 percent of the total capital cost as the Town, a 50/50 split between taxes and property owners and thirds where 1/3 is to the tax base, 1/3 to the Sewer Enterprise Fund and 1/3 to the property owner. The Town is in the infant stage of determining how to apportion the capital costs of the project and has not yet made a definitive decision as to how to recover capital costs. The Town is working through the Sewer Planning Work Group to develop and implement capital cost recovery options based on the results of this CWMP Update. Historically, Nantucket has funded sewer expansion through the general tax base and has reached out to look at various options, including apportioning through a combination of betterment, general tax and the Sewer Enterprise Fund. The Town is planning on furthering this discussion with the assistance of the sewer Planning Work Group. This ad hoc committee will delve further into the capital cost recovery options. At the time of this report writing, no decision had been made as to how this would transpire. For discussion purposes only, some sample individual household costs have been developed for the first phase priority-Somerset Needs Area. These calculations only include the cost of construction as shown in this Report. Future decisions on betterments, etc. could include not only construction costs, but, also, design, planning and any other costs associated with the Project as per MGL Chapters 80 and 83. Table 5-1 details sample costs using user costs of 100 percent, 50 percent (with 50 percent on tax base), and one third (one third on tax and 1/3 on sewer) scenarios using both 0 percent and 2 percent State Revolving Funds (SRF) to cover construction only costs of \$13,284,000 or \$52,300. per user.

Table 5-1: Individual Cost Scenarios for Somerset Needs Area

Somerset Needs Area	100 Percent on User	50 Percent on User	One- Third on User
0 Percent SRF	\$217.92 Month	\$108.96 Month	\$72.64 Month
2 Percent SRF	\$264.58 Month	\$132.29 Month	\$88.19 Month

A detailed breakdown of existing debt would need to be calculated by the Town in order to estimate the tax burden under the above scenarios.

There are various costs associated with the Recommended Plan to address wastewater needs that may including the following:

- Capital costs for the wastewater infrastructure, including force mains, gravity sewers, pump stations, low-pressure sewers, engineering, legal, fiscal, administrative and contingency
- Individual grinder pumps
- Operation and Maintenance costs
 - User Fees
- Connection fees

- Individual sewer connections at the private property line
- Potential plumbing and electrical upgrades
- Pumping of and abandonment of existing onsite wastewater systems

The capital and annual operation and maintenance costs in this Report represent planning level costs. The estimated capital costs for the Final Recommended Plan included herein are shown in Figure 3-21. Once the Town moves forward with implementation of the Recommended Plan contained in this Report, a Final Design Report will further refine costs.

5.2.2 Capital Costs

Capital costs include furnishing and installing sewer pipes (gravity, low-pressure and force mains), pumping stations, WWTF upgrades, engineering, legal, fiscal and contingency.

5.2.3 Individual Grinder Pumps

In those areas where low-pressure sewers are recommended each property owner will be responsible for the cost to install, operate and maintain individual grinder pumps. Located on private property, the grinder pumps convey the building's sewerage to the Town's collection system for treatment at Surfside WWTF.

5.2.4 Operation and Maintenance Costs

In addition to the capital costs for the sewer infrastructure as noted above, there will be an annual cost to the Town to both operate and maintain the collection system. This cost is born by the users of the system under a "User Fee" as described below. The Town apportions the operation and maintenance of the wastewater infrastructure, pumping stations and divides it equally among the users. A User Fee is a charge for those properties that are connected into wastewater infrastructure and this pays for the operation and maintenance of the system. This charge is typically based on water usage.

5.2.4.1 Connection Fees

This is the connection fee that the Town typically charges to connect into the wastewater system.

5.2.4.2 Individual Sewer Connections (Private Property)

This is the cost born by the property owner to connect to the Town's infrastructure. This cost will vary depending on the property specifics – how far off the road, presence of trees, soil conditions for trenches, location of indoor plumbing fixtures, etc. These costs will vary based on the site-specific situation.

5.2.4.3 Plumbing / Electrical Upgrades

These are potential costs to the property owner if upgrades on the private property need to be made either to plumbing and/or electrical systems. For example, if a property owner currently has plumbing on the back side of the building and the sewer is coming in from the front, the property owner may elect to re-route plumbing to the front to limit costs. This same holds true for electrical costs - should the property need a higher amperage electrical service, that upgrade may need to be made.

5.2.4.4 Septic System Abandonment

This is a cost that every property owner will assume once sewer service in their area is operational at the time of connection to the sewer. It involves a full pumping of the existing septic tank and either a removal of the tank or cracking and filling with sand to completely abandon the system.

Based on the information gathered to date on conceptual costs and the fact that the Town has not made any definitive decision on how it plans to appropriate costs, the estimated household costs are based on the aforementioned methods of apportioning costs. While nothing has been officially approved, these three methods give the Town a sense of affordability, both to the impacted property owner and the overall current and projected capital expenditures of the Town that would impact the general tax base. The SPWG will carry this task further as it evaluates all available capital cost recovery available both on a financial and political basis.

6. PUBLIC OUTREACH

6.1 GENERAL

As part of the scope of this CWMP Update, the Town of Nantucket has conducted an extensive public outreach program. The purpose of this public outreach/participation program is to inform the public of the scope and progress of the planning study, to describe the results of the wastewater needs analysis and siting alternatives selection process, and to encourage public input throughout the entire planning process.

The CWMP Update outreach has built upon the Public Outreach/Education Program initiated with the Wastewater Action Plan that was developed by the Board of Selectmen and Town Administration in 2011. The Board of Selectmen included the development of a “Long Term Wastewater /Water Quality Plan” in its FY12 Goals. These goals included the following:

- Develop and approve a five-year multi-phase wastewater implementation plan by 12/31/11
- Conduct multiple wastewater workshops held by BOS on specific topics throughout the summer and fall of 2011
- Seek funding at 2012 ATM for first phase of implementation plan
- Continued implementation of Stormwater Management Plan

All of these goals have been realized as follows:

- The Town implemented the Wastewater Action Plan in 2011 with the following:
 - Conducted five Workshops; May, June, July, August and September 2011
 - Set up a page on the Town’s website for all correspondence, information and information as to reference documents. The Town continues to utilize this venue for posting all wastewater related documents. The link to the site is http://www.nantucket-ma.gov/Pages/NantucketMA_BOS/Sewer%20Info
 - Developed and mass mailed a Wastewater Action Plan Newsletter to all Nantucket addresses.
- Approved funds to complete this CWMP Update at 2012 ATM
- Stormwater Management Plan on-going (Currently on the CY2014 Intended Use Plan for SRF Program funding).

A Wastewater Action Plan Schedule was developed very early in the planning that outlined the milestones for workshops and informational meetings. These included:

- Board of Selectmen Workshops
 - April 28, 2011 – Review of 2004 CWMP and Review of BOS Goals and Objectives
 - July 13, 2011 – Madaket Needs Area Planning Update
 - August 10, 2011 – Massachusetts Estuaries Program Update
- Board of Selectmen Meeting Updates
 - June 1, 2011
 - June 8, 2011

- July 6, 2011
- August 3, 2011
- September 7, 2011
- October 5, 2011
- Working Group Meetings
 - Held various times throughout the Planning process
- Stakeholder Group Meetings
 - June 13, 2011
- Neighborhood Meetings
 - July 11, 2011 – Nantucket Community Association
 - July 16, 2011 – Non-Voting Taxpayers
 - July 30, 2011 – Brant Point Association
 - August 3, 2011 – Nantucket Garden Club
 - August 6, 2011 – Tom Nevers Association
 - August 17, 2011 – Rotary Club
 - August 18, 2011 – Shimmo Association

The Wastewater Action Plan was widely attended throughout the summer and fall of 2011. All public meetings were tapes for live and cable TV. The Workshops were interactive and encouraged participation, which aided the Town in developing the scope for this CWMP Update.

6.2 PUBLIC MEETINGS, OUTREACH AND EDUCATIONAL SESSIONS

The Town has held multiple Public Informational Meetings on a variety of topics centered on the wastewater planning starting with the wastewater Action Plan detailed above and it continues as of this report writing. This CWMP Update was contracted in June 2012 and has continued to support the public outreach begun in 2011

The Board of Selectmen hosts a CWMP Update at one of its regularly scheduled meetings once a quarter. This is an opportunity for the Board to not only present the results of the work being done, but afford those in attendance the opportunity to get answers to any questions they may have related to the Project. Quarterly meetings have been held on:

- September 12, 2012
- December 17, 2012
- April 24, 2013
- August 7, 2013
- December 18, 2013
- April 23, 2014

The Board of Selectmen and Town Administration have hosted a number of meetings on the Massachusetts Estuaries Program (MEP) with active projects in a number of areas on Island. On July 13, 2011, the Madaket / Long Pond MEP was the topic of a Board of Selectmen Workshop, followed by a presentation from MassDEP on the Draft Total Maximum Daily Load (TMDL) in October 2011. On August 10, 2011, SMAST and MassDEP were guest speakers at another Board of Selectmen Workshop, explaining the MEP Program and how it has impacted Nantucket.

SMAST completed the Draft Hummock Pond MEP in January 2014 and presented the results of this study on Island on February 6, 2014. This meeting was taped for live and cable TV.

SMAST has the contract for the Town's Annual Water Quality program working in conjunction with the Natural Resources Department. After the yearly results are tabulated, a report is sent to the town detailing the Town-wide results. On April 30, 2012, the Town hosted the University of Massachusetts at Dartmouth School of Marine Science and Technology (SMAST) to present the Town's 2012 Annual Water Quality Program results. SMAST and the Natural Resources Department develop and implement the Town-wide water quality program with many of the sampling areas included as part of the MEP and directly related to the CWMP Update. In addition to SMAST, the Natural Resources Department presented its work completed for 2012 in conjunction with the water quality. This meeting was taped for live and cable TV. All presentations and data are posted on the Natural resources Department web page at http://www.nantucket-ma.gov/Pages/NantucketMA_NatRes/index.

SMAST presented the 2013 Annual Water Quality Program results at a public meeting in August 2014.

Once this CWMP Update is completed, the Town will continue to reach out with this Public Education Program in order to maintain this very public project and keep the residents and taxpayers of Nantucket fully informed. Coordination with the sewer Planning work Group with this The goal is to once again bring the project updates to a variety of neighborhood associations in 2014 that may have an impact with the Project and are only on Island during the summer season, as well as the general public. The website will continue to be maintained and public presentations at the Board of selectmen will be on-going.

Copies of all outreach and educational information are included in Appendix L.

6.3 DEPOSITORIES

As part of the Public Participation Plan, the Town maintains copies of all CWMP Update information at the DPW at 188 Madaket Road, as well as posted on the Town's website, wastewater page at http://www.nantucket-ma.gov/Pages/NantucketMA_BOS/Sewer%20Info

APPENDICES INCLUDED IN SECOND VOLUME



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