Section 8
Wastewater Needs Assessment

8.1 Introduction

In March 2008, the Harwich Wastewater Management Subcommittee developed the preliminary wastewater needs in town based on the review of available data as presented in Sections 3 through 7 of this report. These needs were then further evaluated after all of the MEP reports were completed to develop the wastewater management scenarios presented in Section 10. This section describes the various key drivers for enhanced wastewater management in Harwich and their role in the development of the wastewater management scenarios.

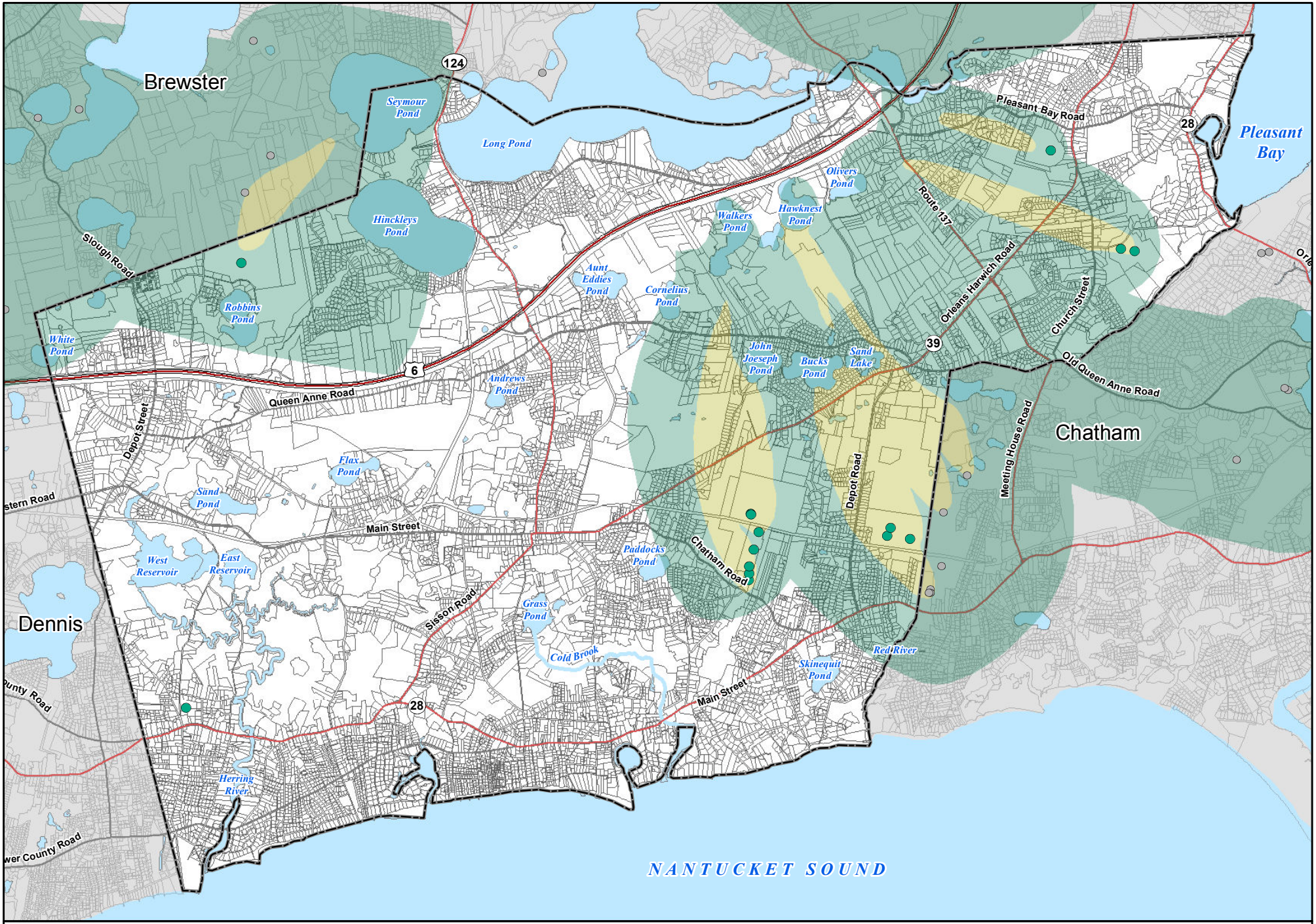
Five categories of key wastewater needs drivers were evaluated, as follows:

- Drinking Water Quality
- Freshwater Lake and Pond Quality
- Onsite (Title 5) System Performance
- Nitrogen Management
- Socio-Economic Needs

8.2 Drinking Water Supplies

Municipal drinking water supply is generally available throughout the Town using source water from 14 gravel packed groundwater supply wells. Wellfields are located in the southeast, northeast, and northwest areas of Harwich, which draw water from the Monomoy Lens Aquifer. A small percentage of properties (approximately 7%) use private onsite wells for drinking water. Therefore, all of Harwich's residents and businesses are reliant on the groundwater supply for drinking water, whether through public or private sources of supply. The Harwich public water system was recognized for excellence in 2006 for being within the top 5% of public water systems in Massachusetts. Detailed information on groundwater quality and zones of contribution of the municipal wells was described in Sections 3 and 4 of this report.

Figure 8-1 shows the municipal well zones of contribution and Zone IIs located in Harwich. Note that both are mainly concentrated in the eastern portion of town, and the majority of development anticipated in town is outside of these areas. As described in Section 4, drinking water quality data to date has shown that nitrate concentrations in the Town's drinking water wells are low. The EPA drinking water threshold for nitrates, referred to as the maximum contaminant limit, or MCL, is 10 mg/L, and the Cape Cod Commission's guidance level is 5 mg/L. The average nitrate level observed in Harwich's drinking water wells in 2011 was approximately 1.0 mg/L, falling well below both of these thresholds. Nitrate values less than 1.0 mg/L are typical of undeveloped background areas on the Cape. The highest nitrate level seen in Harwich wells in this same period was 2.4mg/L, at sampling Station No. 9 in the Pleasant Bay watershed.



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Comprehensive Wastewater
Management Plan

Figure 8-1
Drinking Water Sources

CDM Smith

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Based on this information, protection of drinking water quality is not a significant driver for sewering. Should the Town continue to exclusively use onsite systems in the long-term, nitrates in some drinking water wells could show an increase; however, evidence does not show this to be a problem which would require sewering in any particular areas during the planning period for this CWMP. As a result, drinking water quality was determined to not be a driver for sewering at this time, and therefore sewering the locations of water supply wells was not considered for the development of the wastewater management scenarios in Sections 10 and 13.

While the locations of public water supply wells in Harwich do not drive a need for sewering in any particular area of town, a reduction in onsite septic system inputs into the groundwater, especially in Zone II areas, will result in a beneficial reduction of some compounds and contaminants contained in wastewater effluent. These include nutrients such as nitrogen and phosphorus, bacterial and viral constituents, and emerging contaminants such as pharmaceuticals and personal care products. The fate of this latter category of microconstituents in the environment is less well understood, and their impacts to drinking water supplies are increasingly being studied. Thus far, research has largely shown that levels of these microconstituents in drinking water supplies are extremely low and are typically well below US EPA action levels. However, any reduction in their inputs to the contributing areas of surrounding groundwater wells has the benefit of reducing their concentrations in the public water supply.

Another manner in which public water supplies are impacted by the wastewater management strategy implemented by the town is through the location(s) of groundwater recharge of treated effluent originating from a municipally operated treatment plant. Groundwater recharge of treated effluent over 10,000 gpd requires a Groundwater Discharge Permit issued by MassDEP. Typically, MassDEP requires standards to be met for several parameters including: biochemical oxygen demand (BOD), total suspended solids (TSS), and total nitrogen (TN). Depending on the location of the recharge basins, other parameters such as total phosphorus (TP) or total organic carbon (TOC) may also be regulated. Historically, MassDEP has required a TOC concentration of below 3 mg/L in effluent recharged within a Zone II, although in some instances where travel times are longer (greater than 2 years), MassDEP has indicated that TOC removal may not be required. This will be discussed further in reference to the recommended plan for wastewater management presented in Section 13 of this report.

8.3 Freshwater Lake and Pond Quality

Section 5 summarized water quality data and the trophic status of freshwater lakes and ponds in Harwich for which data were available. As described, an overabundance of phosphorus is the main concern in freshwater systems, as phosphorus is typically the nutrient in limited supply. Therefore, an increase in phosphorus can result in significant plant and algae growth, which can cause a shift in trophic status from oligotrophic, to mesotropic, to eutrophic (over-enriched) conditions.

Four lakes and ponds in Harwich were identified in Section 5 as eutrophic or at risk of moving toward a eutrophic condition. In the watersheds of those water bodies, when the predominant controllable phosphorus source is believed to be wastewater from onsite systems, sewers should be considered to limit phosphorus input into the groundwater. Table 8-1 summarizes the ponds considered, notes those where phosphorus over-enrichment is a concern for the health of the ecosystem via its trophic status, and further notes where shoreline development (thus onsite systems) is potentially a cause for

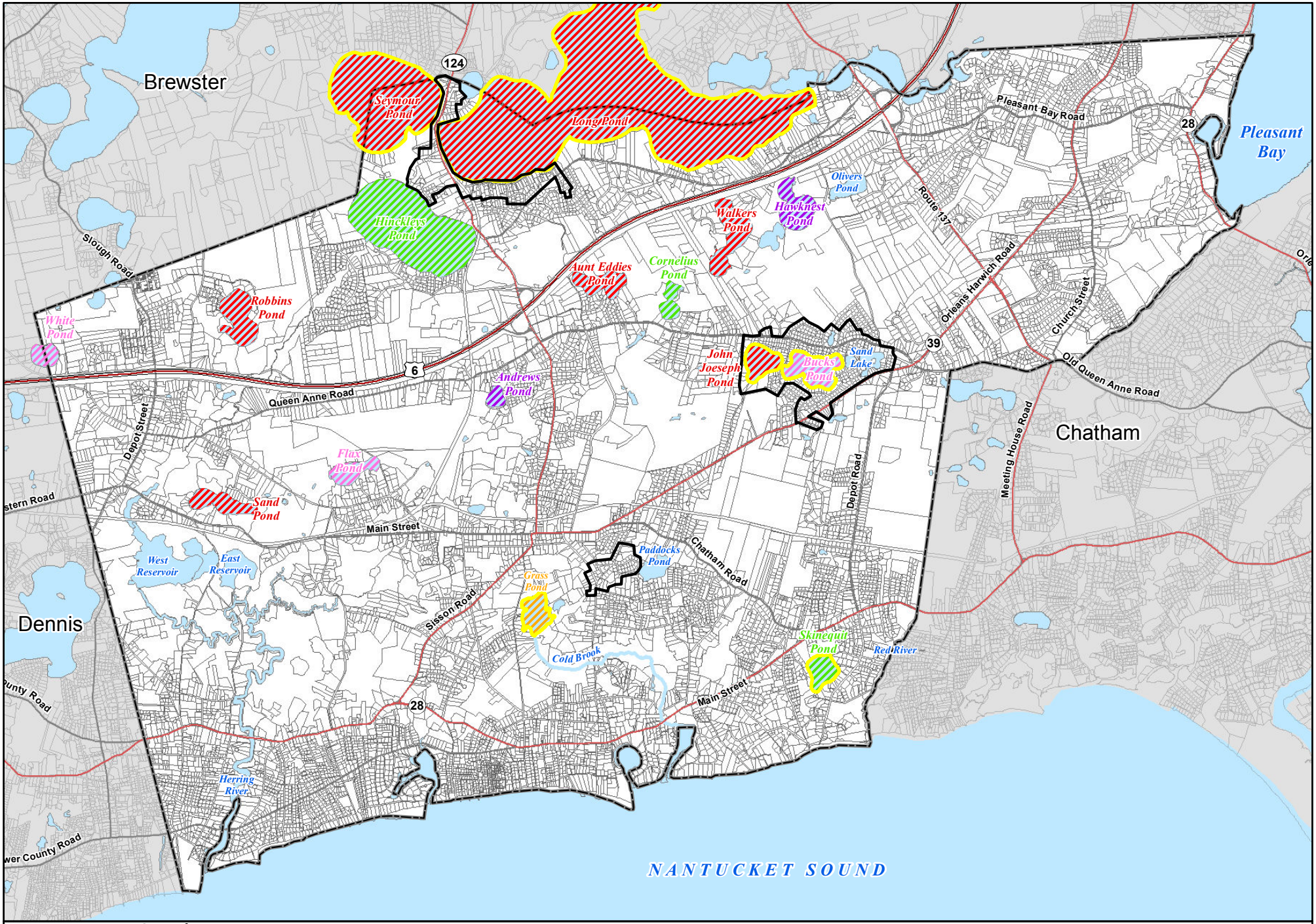
concern. Section 5 notes where further sampling is needed to confirm if sewers are necessary. In those locations, sewers may be considered in the future via an adaptive management approach during the CWMP implementation phase, as described further in Section 13. Figure 8-2 is a map summarizing the information presented in Table 8-1.

Table 8-1
Freshwater Quality and Associated Needs

Name	Pond Trophic Status	Shoreline Development
Andrews Pond	Oligotrophic	Low
Aunt Edies Pond	Mesotrophic	Low
Bucks Pond	Oligo-mesotrophic	Medium to High
Cornelius Pond	Eutrophic	Low
Flax Pond	Oligo-mesotrophic	Low
Grass Pond	Meso-eutrophic	Low
Hawksnest Pond	Oligotrophic	Low
Hinckleys Pond	Eutrophic	Medium to High
Island Pond	*	*
John Joseph Pond	Mesotrophic	Medium to High
Littlefields Pond	*	*
Long Pond	Mesotrophic	Medium to High
Oilvers Pond	*	*
Okers Pond	*	*
Paddocks Pond	*	*
Robbins Pond	Mesotrophic	Low
Sand Pond	Mesotrophic	Low
Seymour Pond	Mesotrophic	Medium to High
Skinequit Pond	Eutrophic	Medium to High
Walkers Pond	Mesotrophic	Low
West Resevior	*	*
White Pond	Oligo-mesotrophic	Low

*No Data Available

Figure 8-2 also shows three specific developed areas around Paddocks Pond, John Joseph Pond, Bucks Pond, Sand Lake, Long Pond, Seymour Pond and Hinckleys Pond that are highlighted as areas of concern for pond health and should be considered for incorporation into the final wastewater plan. Additional areas may be included at a later date, but at this time, the Town has identified these as the "Primary Areas of Concern for Pond Health."



Legend

Pond Trophic Status
- Eutrophic
- Meso-eutrophic
- Mesotrophic
- Oligo-mesotrophic
- Oligotrophic

- Water Quality Degradation Possibly Related to Development
- Primary Areas of Concern for Pond Health

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1 inch = 4,000 feet

0 1,000 2,000 4,000 Feet

Figure 8-2
Pond Water Quality

CDM Smith

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The areas are as follows:

- The area to the west of Paddocks Pond;

- Even though Paddocks Pond has very little historic water quality data at this time, the Town considers this to be a shallow eutrophic pond which some in town believe may feed the meso-eutrophic Grass Pond. For this reason, it is included as a primary area of concern. This area was not included in the recommended plan, but may be added in the future when Wychmere Harbor, Saquatucket Harbor or Harwich Center are sewered. The developed areas surrounding the Great Sand Lakes, in the vicinity of Queen Anne Road and Route 39;

  In the 2007 Stearns and Wheler Case Study Report for the Great Sand Lakes, sewering was recommended as a possible long term phosphorous management option that should be evaluated in the CWMP. Although sewering will not reverse the 50 years of phosphorus loading that was already deposited in the watershed, it will effectively reduce the future phosphorous loadings into the future.

  While The Great Sand Lakes Case Study Report did perform a limited nutrient budget for the ponds, a more comprehensive water quality study should be completed that is similar in scope to the recent Hinckleys Pond Study that further details all sources of phosphorus. The adaptive management approach will allow this to be addressed in a future phase.

- An area between Hinckleys, Seymour, and Long Ponds, in the vicinity of Pleasant Lake Avenue.

  The area around these ponds has not been recommended for sewering at this time. Long Pond was recently treated for phosphorus in-activation as the phosphorus in the sediments is the largest source. A similar recommendation has been made for Hinckleys Pond based on recent water quality study as the largest source of phosphorus is in the sediments. A water quality study needs to be conducted for Seymour Pond to determine phosphorus sources and determine appropriate actions. Thus, sewers to remove septic system phosphorus have not been recommended at this time.

8.4 Onsite (Title 5) System Performance

Soil conditions in Harwich are described in Section 3 and summarized below in relation to the operation of onsite wastewater treatment and disposal systems. Understanding subsurface conditions in the community assists in formulating long-term wastewater management options by helping to identify areas where onsite systems are not likely to provide adequate wastewater treatment. These areas include sites where groundwater is too close to the surface or where soils are not permeable enough to allow adequate leaching rates. Also, areas with very rapid infiltration rates can limit the amount of treatment occurring as Title 5 system effluent moves through the soil to the groundwater below.

Generally, the dominant soil type in Harwich consists of medium sand material with rapid permeability. With rapid infiltration rates, these soils act as less suitable filters from a wastewater treatment perspective, which is especially of interest in relation to phosphorus removal. Certain areas, mainly in West Harwich within the Herring River watershed, consist of soil layers with silty loams and

clays as reported by Harwich BOH officials and a local soils consultant. These layers restrict the downward movement of wastewater and cause a "perched" water level above the restrictive layers. Certain localized areas of Division Street, Kelley Road, and adjacent to Pleasant Lake Avenue consist of these less permeable fine silts and clays. The rest of the town typically has adequately permeable soils.

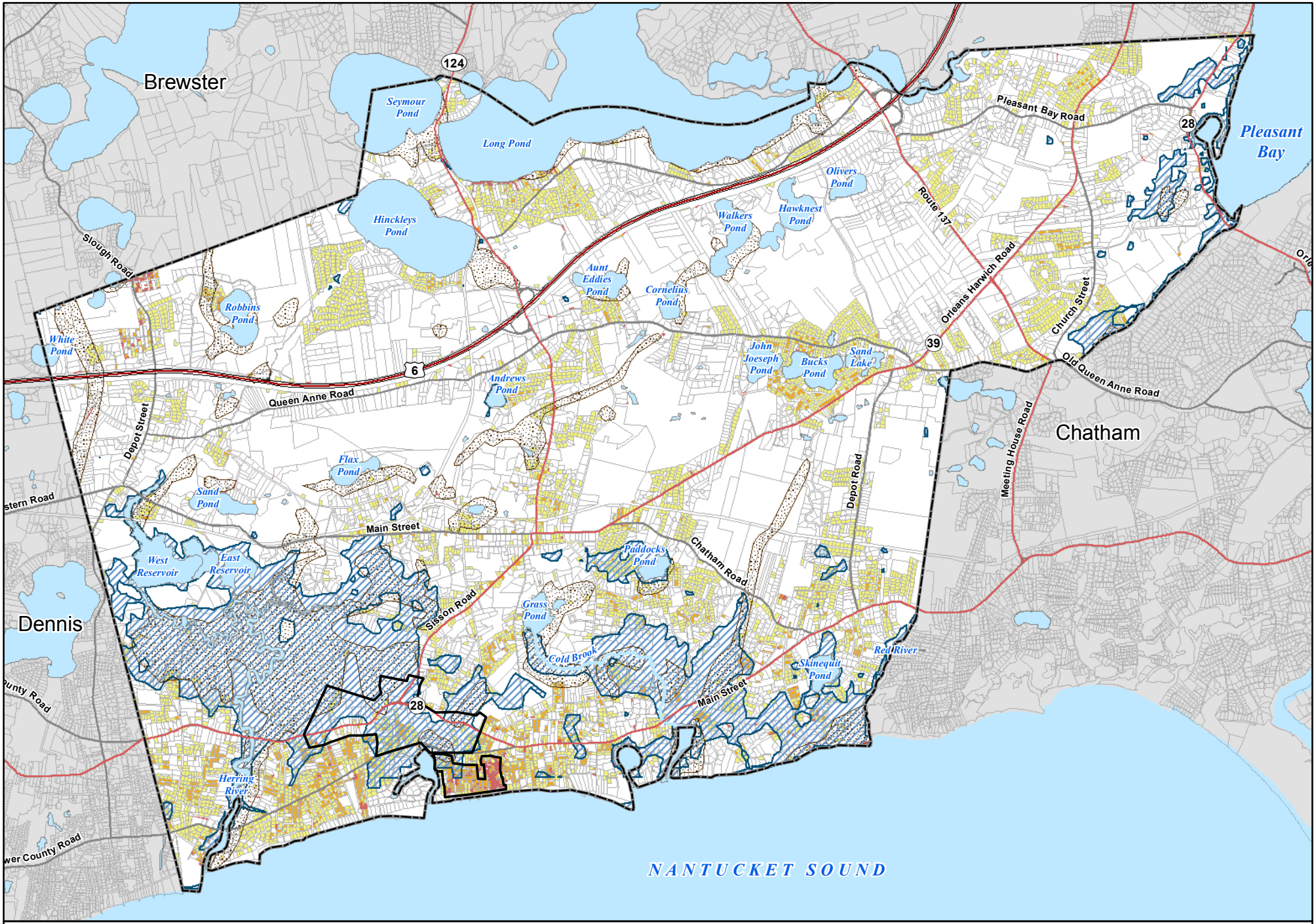
Areas along the southern coast and south of Route 28 represent challenges for long-term wastewater management. Dense development, small lot size and shallow depth-to-groundwater limit the ability to design and construct onsite system upgrades in compliance with Title 5 and local Board of Health regulations. Figure 8-3 shows the locations in town where these conditions coexist. One of these areas along the Route 28 corridor, known locally as "the Campgrounds," generally consists of small lots with a significant percentage of seasonal occupancy. Many of these properties were developed prior to local zoning codes, and prior to health standards for design and construction of onsite systems. Also, many are believed to use cesspools for wastewater treatment and disposal due to the age of construction in the area. System upgrades in this area frequently require waivers or variances from Title 5 or local regulations. In some cases, limitations are placed on future expansion or increases to the number of bedrooms through deed restrictions.

Two areas have been designated by the town as "Areas of Title 5 Concern." These areas are as follows and are called out on Figure 8-3:

- The area along Route 28 north of Allen Harbor – this area was flagged primarily due to high groundwater conditions and the presence of mounded septic systems in this area.
- The Campground area immediately east of Allen Harbor, along the southern coast of Harwich. This area was flagged primarily due to dense development, high groundwater conditions and small lot sizes.

Based on the review of onsite systems and subsurface conditions in Harwich, along with discussions with the Board of Health, the following conclusions were drawn:

1. The town generally has subsurface conditions suitable for compliant onsite systems (i.e., permeable soils and sufficient depth to groundwater).
2. The water quality of municipal drinking water wells, as noted above, is excellent, and properties adjacent to wells are protected.
3. Some areas of dense development provide challenges for Title 5 and local system regulation compliance; however the majority of these areas are outside the zones of contribution for the drinking water supply, limiting the cause for concern from a drinking water perspective. These areas have been designated "Areas of Title 5 Concern" and should be addressed in the long-term wastewater management program.
4. Nitrogen inputs from traditional Title 5 systems present the most significant challenge to Harwich water quality stemming from onsite systems, especially in areas of high permeability soils, as described further in Section 8.5 below.



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Parcel Size (sq. ft)

- 0 - 5,000
- 5,000 - 10,000
- 10,000 - 20,000
- > 20,000

- Areas of Title 5 Concern
- Low Permeability Soils
- < 5 ft Depth to Groundwater

Town of Harwich
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1 inch = 4,000 feet

0 1,000 2,000 4,000 Feet

Figure 8-3
Title 5 Summary

CDM Smith

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Based on these conclusions, the elimination of onsite systems is only deemed a high need in the Areas of Title 5 Concern and as it relates to nitrogen reduction in the context of the MEP goals for the receiving estuaries and embayments along Harwich's coastlines. In other areas, continued use of onsite systems is considered a feasible long-term wastewater management approach. Within the areas that continue to use onsite systems, regulatory waivers and/or mounded systems will still be required in certain cases where conditions do not allow for Title 5 and local compliance. However, by targeting sewering in the most densely developed and high groundwater areas within the regions where nitrogen reduction is required, the frequency of future waivers and mounded systems can be significantly reduced. These goals were incorporated into the development of the wastewater management scenarios presented in Section 13.

Monomoy Regional High School

During the development of the Draft CWMP the creation of the new Monomoy Regional High School came to fruition. The new school is to be located at the site of the existing Harwich High School. This area is in the Saquatucket Watershed. Location of the septic system for the new larger school has been coordinated so that it will be constructed in the Grass Pond subwatershed. That will maximize the amount of natural nitrogen attenuation as the groundwater flows through the down gradient freshwater ponds minimizing nitrogen impacts in Saquatucket Harbor. As flows for design of the system were not final when initially evaluating these loads, a wastewater flow of 10,000 gpd for five days per week for 10 months of the year and 5,000 gpd for five days per week for two months of the year was utilized. This resulted in an annual flow of about 6,500 gpd which was used to calculate a nitrogen load in the watershed. Natural nitrogen attenuation removes 50 percent of the load in Grass Pond and then 35 to 50 percent in Cold Brook resulting in less than a third of the nitrogen reaching Saquatucket Harbor. That load is equivalent to nine homes needing to be added to the sewer system in that area. Recent flow updates (personal communication, February, 2013) indicate the average annual flow from the school would be less than half that assumed or less than five additional homes to be sewered. Thus, the nitrogen load from this new Title 5 (proposed) septic system has been factored into the sewer system layout for the Saquatucket Watershed to meet the TMDL for the overall watershed. Due to its relatively small nitrogen load and physical location in the watershed, the school wastewater system is not part of the proposed sewer service area for the Saquatucket Watershed. If conditions change in the future, it could be connected to the adjacent sewers in the Herring River Watershed once they are constructed.

8.5 Nitrogen Management

As described in detail in Section 6, the MEP reports for five Harwich watersheds (Allen Harbor, Wychmere Harbor, Saquatucket Harbor, Pleasant Bay, and Herring River) estimate the nitrogen removal required to restore those waterbodies to support healthy aquatic ecosystems. Unlike freshwater systems, in saltwater environments, nitrogen is the nutrient of concern which can cause over-enrichment and long-term degradation of water quality. Table 8-2 provides a general overview of the water quality determination for each watershed from the MEP reports, and Table 8-3 summarizes the nitrogen loading in each watershed resulting from wastewater and the percent removal required to achieve the goals laid out in the MEP reports. Table 8-4 focuses on nitrogen loading under future buildout conditions.

Table 8-2
Water Quality Determination Based on MEP Findings

Watershed	Water Quality Determination
Allen Harbor	Moderately to Significantly Impaired System
Wychmere Harbor	Moderately to Significantly Impaired System
Saquatucket Harbor	Moderately to Significantly Impaired System
Pleasant Bay	Varies by Location from Healthy to Degraded
Herring River	Healthy Marshland Habitat, Above Route 28, Significantly impaired system below Route 28 Close to Enrichment Threshold

Table 8-3
MEP Nitrogen Reduction Goals by Watershed – Present Conditions

Watershed	Present Attenuated Septic Load (kg/day)	Threshold Septic Load (kg/day)	% Nitrogen Reduction Required
Allen Harbor	5.64	1.483	74%
Wychmere Harbor	3.208	0.00	100%
Saquatucket Harbor	13.246	5.280	60%
Pleasant Bay – Round Cove	5.18	1.87	64%
Pleasant Bay – Muddy Creek	13.32	6.89	48%
Pleasant Bay	16.69	6.51	61%
Herring River	38.592	23.751	38%

*Saquatucket Harbor and Muddy Creek Loads include Enhanced Attenuation – Additional Information is provided in Sections 10 and 13

*The three Pleasant Bay watersheds listed will collectively require a 57% nitrogen reduction. The individual reductions from each community contributing to a this watershed will need to be coordinated.

*Values in RED indicate that the value is above the standard and must be reduced.

Table 8-4
MEP Nitrogen Reduction Goals by Watershed – Buildout Conditions

Watershed	Buildout Attenuated Septic Load (kg/yr)	Threshold Septic Load (kg/yr)	% Nitrogen Reduction Required
Allen Harbor	6.71	1.483	78%
Wychmere Harbor	3.30	0.00	100%
Saquatucket Harbor	12.51	5.28	58%
Pleasant Bay – Round Cove	5.78	1.87	68%
Pleasant Bay – Muddy Creek	16.28	6.89	58%
Pleasant Bay	21.84	6.51	70%
Herring River	56.59	23.751	58%

*Saquatucket Harbor and Muddy Creek Loads include Enhanced Attenuation – Additional Information is provided in Sections 10 and 13

*The three Pleasant Bay watersheds listed will collectively require a 65% nitrogen reduction. The individual reductions from each community contributing to a this watershed will need to be coordinated.

*Values in RED indicate that the value is above the standard and must be reduced.

Figures 8-4 through 8-8 show an overlay of the watershed boundaries and aerial photographs of the town, illustrating the level of development in each MEP watershed. Figure 8-9 shows the percent nitrogen removal achievable using different types of wastewater treatment and disposal systems, and Figure 8-10 shows the resulting effluent nitrogen concentrations from each type of system.

As seen in Tables 8-3 and 8-4, the nitrogen removal requirements in all watersheds are significant enough to require a wastewater management approach beyond the sole use of Title 5 systems. Therefore, in order to meet the MEP goals, enhanced wastewater management strategies are required.

Based on the level of nitrogen removal required and the limitations of traditional onsite systems, sewering is required in some portion of the town to achieve the goals of the MEP in all five estuaries analyzed. Throughout the town, I/A systems could be used along with conventional wastewater treatment to meet the goals of the MEP. Therefore, that option was also explored as (Scenario 7A) in the wastewater management scenarios presented in Section 10. While stormwater management methods could also be used to reduce nitrogen inputs into the subject watersheds, they have less of an impact in reducing nitrogen levels and cannot meet the MEP goals by themselves. This is illustrated in the pie charts presented throughout Section 6 which show the relative contributions of controllable nitrogen sources in each MEP watershed. Stormwater controls and best management practices (BMPs) are, however, included in the overall program for nitrogen management in Harwich. Similarly, fertilizer management and education are included in the overall program for nitrogen management, although the nitrogen issues in town cannot be addressed by these programs alone.

Based on the information from the MEP reports, the reduction of nitrogen to restore estuarine water quality is a significant need and thus the main driver in the development of the wastewater management scenarios presented in Section 10.

Legend

Watershed Boundary

Town of Harwich
Comprehensive Wastewater
Management Plan

1 inch = 1,000 feet

0 500 1,000 Feet

Figure 8-4
Allen Harbor
Watershed Development

CDM Smith

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Watershed Boundary

Town of Harwich
Comprehensive Wastewater
Management Plan

1 inch = 750 feet

0 500 1,000 Feet

Figure 8-5
Wychmere Harbor
Watershed Development

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Watershed Boundary

Town of Harwich
Comprehensive Wastewater
Management Plan

1 inch = 2,225 feet

0 1,000 2,000 Feet

Figure 8-6
Saquatucket Harbor
Watershed Development

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Watershed Boundary

Harwich Town Boundary

Town of Harwich
Comprehensive Wastewater
Management Plan

1 inch = 6,500 feet

0 0.5 1 2 Miles

Figure 8-7
Pleasant Bay
Watershed Development

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Legend

- Watershed Boundary
- Harwich Town Boundary

Town of Harwich
Comprehensive Wastewater
Management Plan

1 inch = 4,500 feet

0 0.5 1 Miles

Figure 8-8
Herring River
Watershed Development

CDM Smith

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Figure 8-9
Percent Nitrogen Removal in Typical Nitrogen Treatment Systems

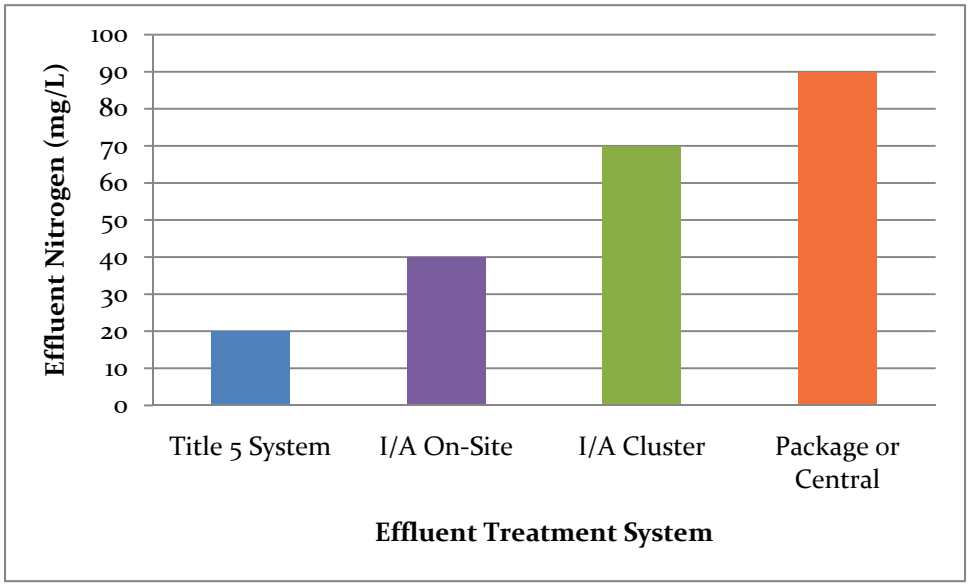
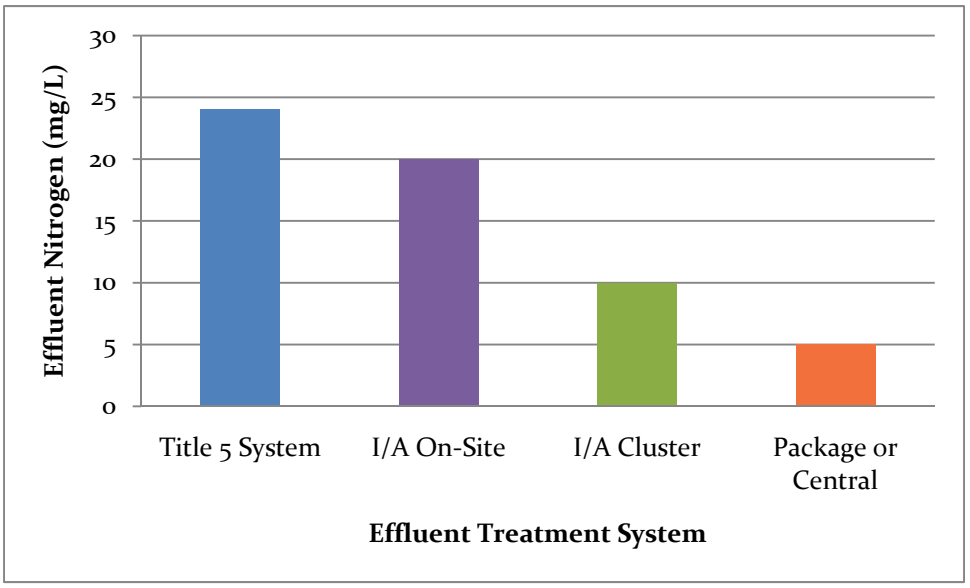


Figure 8-10
Typical Nitrogen Effluent Levels by Treatment System



8.6 Socio-Economic Needs

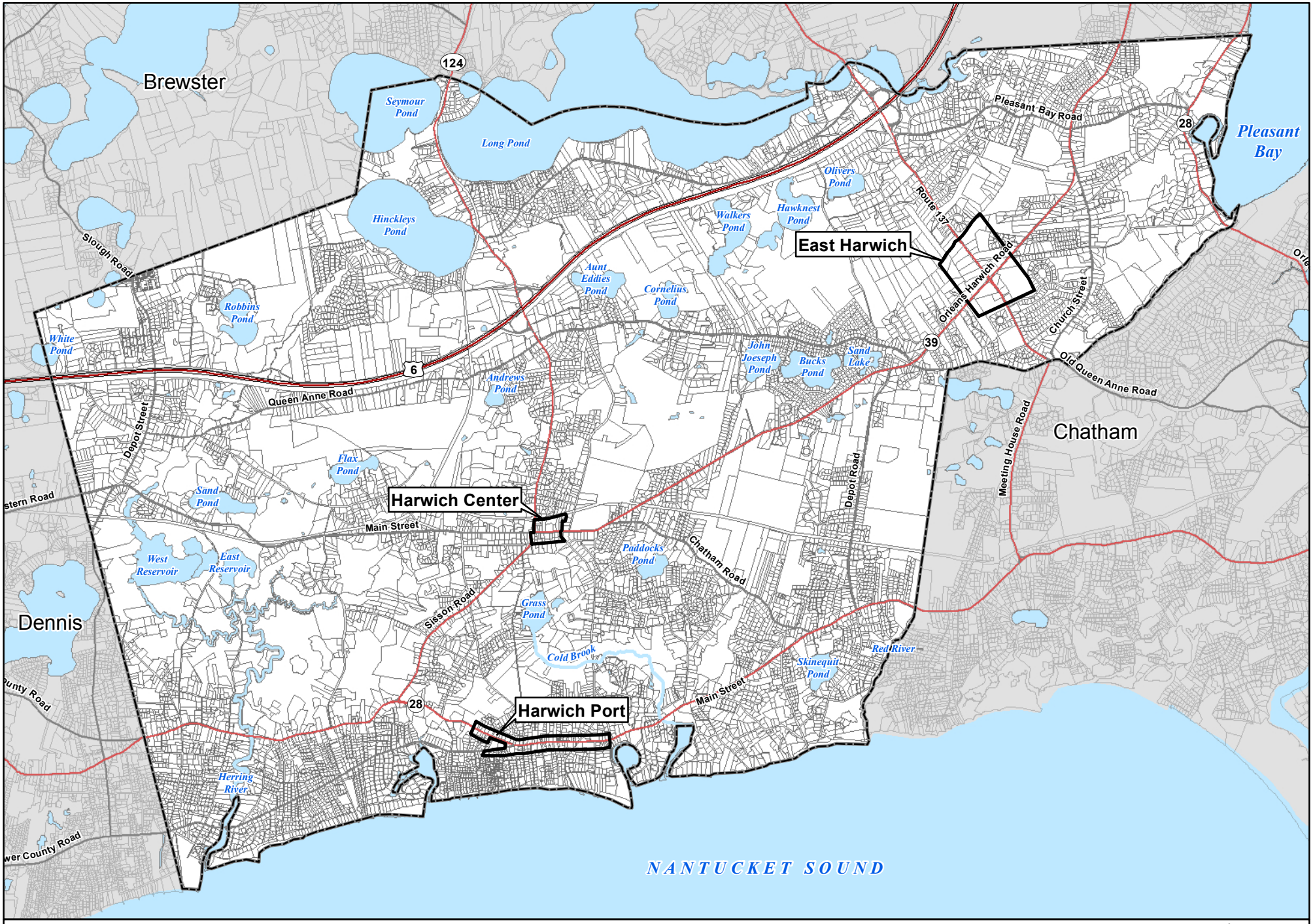
Growth and economic development are necessary components of any healthy community. Harwich's preferred approach to growth management is to promote planned growth in targeted areas which enhance pedestrian culture and offer a positive experience for both residents and visitors. Focusing growth in concentrated areas that include the appropriate supporting infrastructure (utilities, transportation, etc.) is a "smart growth" approach that allows for better protection of natural resources in town. As such, the town has designated three "villages" in town where growth and economic development are desired. These areas are the commercial districts known as the East Harwich Village Center, Harwich Port, and Harwich Center. As described in Section 2, each of these areas is undergoing independent planning for development and redevelopment appropriate to the character of the particular area.

To summarize the details provided in Section 2, East Harwich is a densely developed commercial center located within the nitrogen-sensitive Pleasant Bay watershed. The plans for this area include increasing residential density in the East Harwich Village Center with mixed commercial and residential development and increased pedestrian infrastructure including sidewalks and bike lanes. The East Harwich Village Center is presently the center of year-round commercial activity.

Harwich Port, the original economic center of the Town, is now a center for mainly summer activity. This area will undergo development which protects its beaches and harbors along Nantucket Sound while revitalizing its role as a village center. At the present time, Title 5 compliance issues have limited commercial enterprises from expanding their services. Residential septic systems, particularly in high-density development areas, have difficulty meeting current standards. Harwich Port abuts both Wychmere and Saquatucket Harbors which both need sewers. Pedestrian infrastructure, including sidewalks and bike paths, are in line to aid with parking constraints along the shore, along with remote parking and shuttle connections.

Harwich Center houses a majority of historical buildings and municipal services including the Town Hall, Brooks Free Library, Brooks Park, and the Old Colony Bike Trail, along with nearby public schools and the Community Center. As with the other areas, pedestrian infrastructure is encouraged with expanded sidewalks and bikeways, in addition to more accessible vehicular transport and parking; however, all improvements are modest in nature and meant to focus primarily on enhancing rather than reconstructing this portion of town.

All of these redevelopment efforts require a modified approach to wastewater management to provide the infrastructure necessary to support the town's goals. Figure 8-11 shows the locations of the town centers. All of these areas are proposed for inclusion in the wastewater management program developed as part of this CWMP.



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Harwich Town Centers

Town of Harwich
Comprehensive Wastewater
Management Plan

1 inch = 4,000 feet

0 1,000 2,000 4,000 Feet

Figure 8-11
Town of Harwich Village Centers

CDM Smith

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8.7 Wastewater Needs Categories

Following independent analysis, the five factors above were considered collectively to identify areas requiring a modified approach to wastewater management. Areas of town were split into two categories:

- Category 1: Areas requiring offsite wastewater management solutions; and
- Category 2: Areas that can remain with onsite systems using non-structural nutrient management solutions (such as improved stormwater controls and fertilizer management).

Using the five factors above, the following conclusions were drawn:

1. ***Drinking Water Supplies:*** Drinking water supplies are not a driver for requiring any offsite wastewater management solutions, therefore all well zones of contribution and Zone IIs are placed into Category 2, unless moved into Category 1 based on other factors.

2. ***Freshwater Lakes and Ponds:*** The upgradient lands with significant development of the following lakes and ponds were identified as potentially having over-enrichment issues due to phosphorus inputs from septic systems:

    a. Great Sand Lakes including:

        i. John Joseph Pond

        ii. Bucks Pond

        iii. Sand Lake

    b. Paddocks Pond

    The upgradient areas are placed into Category 1. All other upgradient lands near freshwater ponds are placed into Category 2 unless further research indicates a need for sewering in the future.

3. ***Onsite (Title 5) System Performance:*** The locations identified as "Areas of Title 5 Concern" were identified as requiring offsite solutions, and are thus included in Category 1. All other areas of town are placed into Category 2 from a Title 5 perspective.

4. ***Nitrogen Management:*** As described above, each of the MEP watersheds in Harwich has a specific nitrogen reduction goal that will require the provision of offsite wastewater treatment and effluent recharge for some portion of the watershed. The properties that can account for the required nitrogen loads in each watershed requires an offsite solution and is placed into Category 1. There is flexibility, however, in the selection of which properties are included in Category 1 and which are placed in Category 2 to remain with onsite systems. Generally, the areas that are most cost-effective and efficient to sewer are the most densely developed areas with the highest water usage per acre. These areas tend to encompass village centers and areas with high density residential units. Areas with lower density are less cost-effective to sewer due

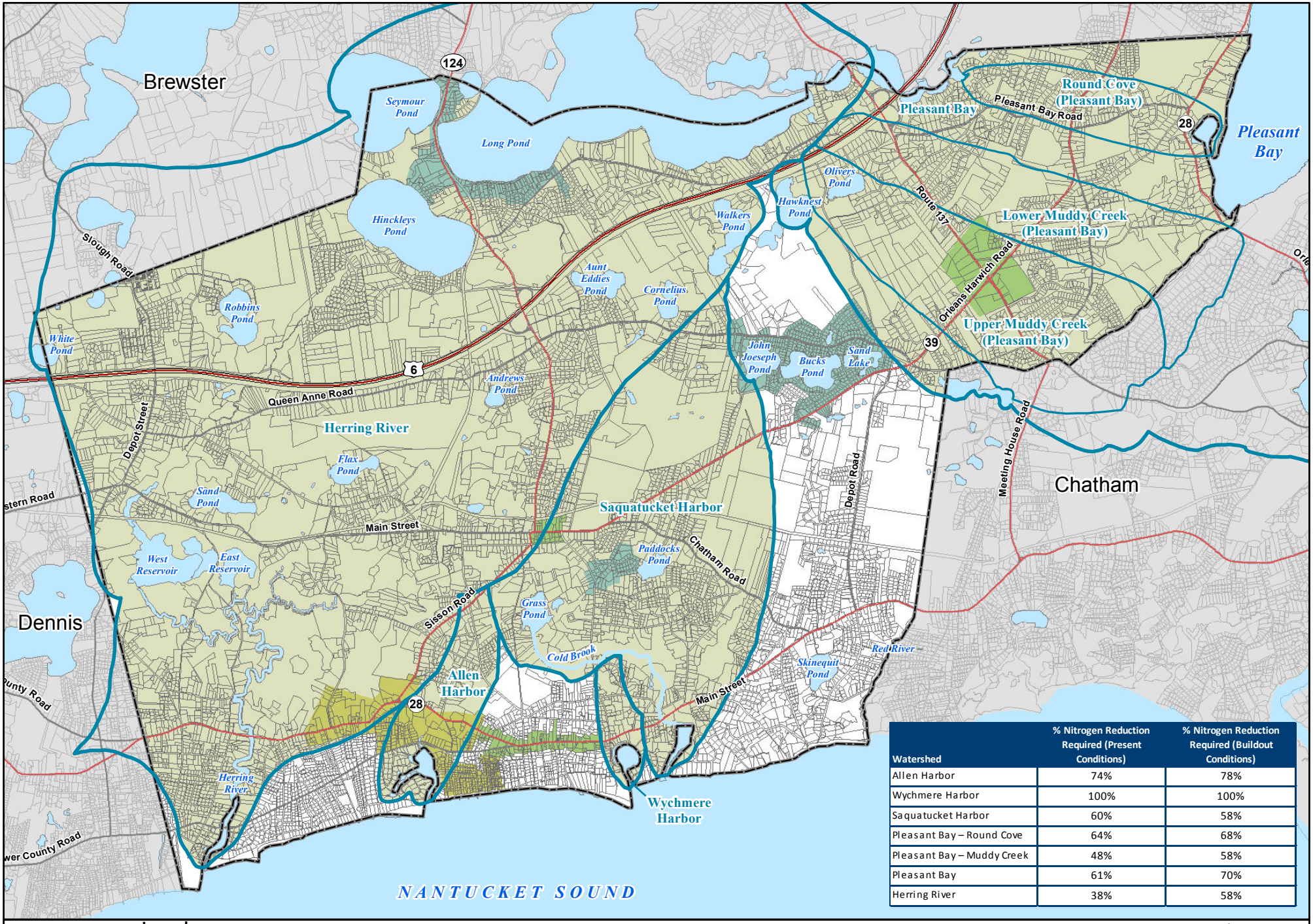
to the distance between properties which still requires infrastructure to convey wastewater to the treatment facility. Consideration was given to these issues when selecting the areas proposed for sewering within each watershed as presented in Sections 10 and 13.

5. ***Socio-Economic Needs:*** Each of the three village centers in town requires inclusion in Category 1 to provide the necessary infrastructure to support the town's economic development goals. Specifically, these areas include the commercial centers of East Harwich, Harwich Port, and Harwich Center.

Figure 8-12 shows each of the areas placed into Category 1 using the five factors described above. For the watersheds requiring a percentage of properties to be sewered, the outline of the entire watershed is shown, with an indication in the adjacent table as to what percentage of the watershed requires an offsite solution.

8.8 Summary and Conclusions

As shown in Figure 8-12, the majority of the areas in town requiring offsite wastewater management solutions are driven by the need to meet the MEP nitrogen reduction goals. As such, the wastewater management scenarios presented in Section 10 focus on the MEP goals as the main driver for the locations and layouts of offsite solutions. Where areas are included in Category 1 based on freshwater pond quality, Areas of Title 5 Concern, or socio-economic needs fall within the MEP watersheds, these areas were targeted first to help meet the required percentage nitrogen reduction in the development of the scenarios. Areas that fall outside the watersheds or outside the proposed sewered areas will need to be further evaluated by the town in terms of meeting overall town-wide goals. Some of these areas are included in the overall sewer service areas shown in the recommended plan in Section 13 of this CWMP but, due to lower priority needs, may be included in later phases of sewering. Since those needs areas are considered common to all options, they are not deemed necessary to include in the comparative analysis of alternatives as they would not impact the evaluation of scenarios. However, the final recommended program includes wastewater infrastructure improvements for all of the areas identified in Category 1 based on each of the factors described above.



Watershed	% Nitrogen Reduction Required (Present Conditions)	% Nitrogen Reduction Required (Buildout Conditions)
Allen Harbor	74%	78%
Wychmere Harbor	100%	100%
Saquatucket Harbor	60%	58%
Pleasant Bay – Round Cove	64%	68%
Pleasant Bay – Muddy Creek	48%	58%
Pleasant Bay	61%	70%
Herring River	38%	58%

Legend

Category 1 Areas

- Area of Concern for Pond Health
- Area of Title 5 Concern
- Socio-Economic Needs
- Nitrogen Management

Watershed Boundaries

Town of Harwich
Comprehensive Wastewater Management Plan

1 inch = 4,000 feet

0 1,000 2,000 4,000 Feet

Figure 8-12
Harwich Wastewater Needs Summary

CDM Smith

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