Chapter 2

Summary of Previous Documents Prepared for the Draft Chatham CWMP/DEIR

CHAPTER 2

SUMMARY OF PREVIOUS DOCUMENTS PREPARED FOR THE CHATHAM DRAFT CWMP/DEIR

2.1 INTRODUCTION

The purpose of this Chapter is to briefly summarize the findings of several reports and documents prepared as part of the CWMP process prior to the submittal of the Draft CWMP/DEIR in April 2008. These reports have been used to establish the wastewater facility needs for the Town, to identify alternatives to be considered as part of the CWMP, and to evaluate various wastewater and nitrogen mitigation solutions. Chapter 1 of this document summarizes those reports and documents prepared during the period between the submittal of the Draft CWMP and the Final CWMP.

2.2 NEEDS ASSESSMENT REPORT

This section includes excerpts and findings from the original "Needs Assessment Summary" of the 1999 NAR. A revision of these 1999 NAR findings is presented as part of Section 2.4. References to chapters, sections and appendixes in the 1999 NAR have been modified for clarity and the text has been updated.

The 1999 NAR findings were divided into the following major areas:

- Centralized Wastewater Facilities
- Nitrogen Loading to Coastal Embayments
- Water Supply Issues
- Areas of Concern
- No Action Alternative
- Implementation Issues

- Data Gaps

A. Centralized Wastewater Facilities.

1. **Administrative Consent Order**. The Town signed an Administrative Consent Order (ACO SE98-1002) with MassDEP (contained in Appendix H) due to MassDEP's concern that the Chatham WWTF effluent discharge causes groundwater mounding at the current recharge site that could impact the Town's existing water supply wells. That Administrative Consent Order required that the Town perform this Comprehensive Wastewater Management Planning Project to identify any wastewater problems, and to find appropriate solutions to those problems. The Administrative Consent Order established a schedule with the following milestones:

- Submittal of a Draft Environmental Impact Report (DEIR) and a Draft Comprehensive Wastewater Management Plan (DCWMP) to MassDEP and other State agencies in April 2000.
- Submittal of a Final Comprehensive Wastewater Management Plan (FCWMP) and Final Environmental Impact Report (FEIR) six months after the State approves the DEIR.
- Submittal of final plans and permit applications for any recommended centralized facilities to MassDEP, 15 months after the State approves the FEIR.
- Construction of those potential facilities to be complete by the end of 2004.

This consent order is currently out of date and discussions with MassDEP staff in 2004 indicated that the Consent Order should be revised as the Draft Comprehensive Wastewater Management Plan is prepared and/or reviewed.

2. **Centralized Wastewater Treatment Facilities.** The majority of the Chatham Wastewater Treatment Facility (WWTF), also referred to as the Water Pollution Control Facility, and collection systems were constructed in 1971, and are now approximately 36 years old. The facilities are well operated and maintained by the Town's Water and Sewer Department, and the contract operations company hired by the Town to operate these facilities, as well as the Town's water supply facilities. Several capital improvement projects are planned (and are on going) by the Water and Sewer Department to replace old equipment.

The wastewater treatment process was modified in 1996 to provide advanced nitrogen removal to meet the State's requirements for a Class I groundwater recharge. Since the new process (Modified Ludzack-Ettinger process or "MLE" process) was installed, the Chatham WWTF has consistently met Class I groundwater standards, which require nitrogen removal to ten parts per million (ppm) total nitrogen or less. In 1997, the NAR documented the average total nitrogen concentration in the WWTF treated water at 5.6 ppm which compares very favorably with the average effluent total nitrogen concentration of 25 to 40 ppm from a typical Title 5 system. As a result of this process modification, the Massachusetts Department of Environmental Protection (MassDEP) increased the permitted average-annual recharge flow from 100,000 gallons per day (gpd) to 150,000 gpd on an average annual basis.

The following problems were identified during the detailed evaluation of wastewater treatment facilities at the Chatham WWTF. Solutions for several of the problems have already been identified and addressed. Others will be addressed as part of the recommended Plan as discussed later in this document. Figure 2-1 illustrates the current (2007) layout of the Wastewater Treatment Facilities.

a. **Grit Removal.** The Chatham WWTF has no influent wastewater grit removal. Grit consists of sand and heavy wastewater solids that settle to the bottom of tanks and must be removed by hand. Grit also causes excessive wear on wastewater and sludge processing equipment.

b. **Aeration Tanks and Secondary Clarifiers.** As discussed above, the wastewater treatment process that occurs in the aeration tanks and secondary clarifiers works well. The biological treatment process has a capacity of 200,000 gpd on a maximum month basis. The following modifications were recommended in 1999 to be considered in the future as part of regular maintenance or as part of a future plant upgrade.

- Chemical feed equipment should be added to the aeration tanks to automatically regulate the pH of the system (add alkalinity).
- Diffused aeration equipment could be added to the aeration tanks to replace the existing surface aeration equipment and save on power costs.
- Dissolved oxygen controls to automatically control the aeration equipment would be useful especially with diffused aeration equipment.

- An uninstalled standby mixer and recycle pump are needed for the nitrogen removal process. In addition, flow meters for the recycle lines need to be recalibrated.
- The aeration tank effluent weirs and return sludge distribution box need repairs.
- The effluent weirs in the secondary clarifiers need to be adjusted to the same elevation.
- Older equipment needs to be replaced as identified in the Towns Capital Improvement Plan.

3. **Centralized Treated Water Recharge Facilities.** Four infiltration sand beds are used for treated water recharge to the groundwater system at the Chatham WWTF site. They have a total area of 166,000 square feet (3.8 acres) and have a total capacity of 410,000 gpd based on a loading rate of 5 gpd/sf, and resting half the beds at one time. MassDEP has limited the recharge at these beds to 150,000 gpd due to concerns that groundwater mounding (an increase in the groundwater elevation under the beds) could affect the natural groundwater flow pattern, which they believed could push groundwater from the landfill toward a water supply well.

4. **Centralized Wastewater Collection System.** The existing centralized wastewater collection system is well maintained and is operating well. It has sufficient capacity for existing sewered flows and does not have excessive extraneous flows (Inflow and Infiltration) entering from leaking gravity lines, roof leaders or other sources.

The collection system pumping stations are being renovated, as the equipment needs replacement. The system capacity has been evaluated, and this information will be used in future evaluations to define what additional wastewater can be handled by the system. Figure 2-2 illustrates the current (2007) extent of the Chatham collection systems.

B. **Nitrogen Loading to Coastal Embayments.** Coastal embayments are sensitive to nitrogen inputs because nitrogen is typically the limiting nutrient in these surface water systems. This means that coastal waters have more than enough phosphorus and other nutrients to support the growth of marine plants; and therefore the growth of these plants is limited by the nitrogen content in the water. Therefore, as more nitrogen is added to the system, more plant material is produced. As more plant material is produced, the water quality can be impacted.

Nitrogen enters a coastal embayment through its recharge area (watershed). The nitrogen originates from on-site septic systems; recharge from wastewater treatment plants; fertilization of lawns and agricultural lands; wetlands; atmospheric deposition and stormwater runoff. Wastewater treatment plants are currently designed to remove nitrogen whereas conventional septic systems (Title 5) are not. Therefore, the recharge of treated wastewater from wastewater treatment plants have lower nitrogen concentration than discharge from individual septic systems. Typical Title 5 approved systems provide minimal nitrogen removal, and are usually the largest source of nitrogen to coastal embayments. Typical Title 5 approved systems can be upgraded to remove nitrogen, and these systems (often called "Title 5 Plus" or Innovative/Alternative {I/A} systems) are evaluated in this project.

The assimilative capacity of a coastal embayment is a function of its depth and tidal flushing characteristics, and is unique to each embayment. Often coastal embayments are impacted by average embayment nitrogen concentrations as low as 0.35 mg/l. This is considerably lower than the State drinking water standard of 10 mg/l (a health limit that is rarely approached). The assimilative capacity is often called the critical nitrogen loading and must be determined for each embayment through a nitrogen loading assessment.

In 1999, the nitrogen loading (existing and projected future values) and critical nitrogen loading values were calculated for each of Chatham's embayments in the Pleasant Bay System, the Stage Harbor System, and the South Coast embayments of Taylors Pond/Mill Creek and Sulphur Springs/Bucks Creek. Back in 1999 comparison of the future nitrogen loading values and the critical nitrogen loading values (calculated using the most stringent water quality standard developed by the Cape Cod Commission at that time) indicated that the following embayments exceeded the surface water standard under existing conditions.

- Muddy Creek
- Little Mill Pond
- Taylors Pond
- Sulphur Springs

And in 1999 the following embayments are projected to exceed this CCC surface water standard under future conditions with no action.

- Muddy Creek
- Little Mill Pond
- Taylors Pond
- Sulphur Springs
- Mill Creek
- Ryder's Cove

Following the release of the 1999 NAR, the MEP project was initiated which expanded on the original evaluations and performed a more detailed analysis of Chatham's coastal embayments. Therefore, the initial NAR findings have since been superseded by the completion of the MEP reports for Chatham which sets the critical nitrogen loading to estuaries.

C. **Water Supply Issues.** Groundwater conditions, water system demand, and water system capacity were evaluated in 1999 for the existing and future conditions in Chatham. Chatham has high quality supplies and has established a Water Resource Protection District to protect the existing and projected future water supply zones of contribution. Nitrogen loading to the water supplies has been evaluated by the Cape Cod Commission in the Monomoy Capacity Study, and it is not expected to be a health threat.

The Indian Hill Well is currently not in service due to low concentrations of tetrachlorethylene (commonly called PCE). The source of PCE has not been determined.

The existing water supply system has an existing (1997) total capacity of 5.75 million gallons per day (mgd) and 4.75 mgd with the Indian Hill Well offline. This capacity is sufficient to meet the existing (1997) peak day demand of 3.07 mgd.

The peak day future water demand was projected in 1999 to be 5.2 mgd. This demand could not be met with the existing capacity. In 1999 the Town was in the process of developing and permitting two additional 1 mgd wells: one at the Town Forest area, and one at the Training Field area. Three additional sites had also been identified as potential supply well locations.

The current Water Resource Protection District was developed based on existing and planned supply wells being utilized. This District may need to be updated as new wells are brought into service.

D. Wastewater Areas of Concern.

1. **Introduction.** Several Wastewater Areas of Concern (AOC) were identified in 1999 as a result of Stearns & Wheler's evaluations, and as required by the Project Scope. These are illustrated on Figure 2-3.

2. **Coastal Embayment Watersheds.** Six coastal embayment watersheds were identified as Wastewater Areas of Concern as discussed in the preceding section. These AOCs have been revised due to the subsequent findings of the MEP.

3. **Industrially Zoned Areas.** Two areas of Town have industrial zoning which groups this land use into concentrated areas to support industrial activity, and provides year-round employment to the Town residents. The two areas are identified as the Enterprise Drive Industrial Area and the Commerce Park Industrial Area named for the two roads that access most of these industrial zoned properties. The properties in these areas are mainly car and boat repair businesses among other types. They have a potential to introduce contaminants into the groundwater system. Both areas are located adjacent to existing centralized wastewater facilities. Commerce Park is located completely within the Town's Water Resources Protection District; and both areas are located within Coastal Embayment Watershed AOCs.

These two areas will be evaluated for sewering due to the need to remove their wastewater discharges from the Water Resources Protection District and their coastal embayments.

4. **High Groundwater Areas and 100-Year Flood Zones.** Many properties in Chatham are located at low ground elevations where the groundwater is within three to four feet of the ground surface. Additional properties are located in 100-year flood zones as identified on mapping provided by the Federal Emergency Management Agency. Both of these areas would require raised septic systems to maintain a minimal distance between the top of the groundwater and the bottom of the soil absorption system.

A group of eight properties at the west end of Eliphamets Lane are located next to Mill Pond, and are in low elevation areas and the 100-year flood zone. Several of these properties are small, and have minimal area for raised on-site septic systems. The Town Health Agent has requested that this group of properties be evaluated for improved wastewater treatment facilities. This group of properties is called the Eliphamets Lane AOC.

Several properties on Tom's Neck along Morris Island Road and Little Beach Road have had to install raised systems to meet the requirements of Title 5 and the Town's health regulations on upgrading existing systems in 100-year flood zones. Several of these properties are small, and have installed soil absorption systems in concrete retaining walls. These raised systems are expensive to construct and are considered unsightly. This area was also identified to be evaluated for improved wastewater facilities. These areas were also recommended in 1999 for further evaluations.

5. **Areas with Low Permeability Soils.** Several areas of Chatham have low permeability soils that limit where on-site septic systems or treated water recharge systems could be located. The areas have been mapped and will be considered in future evaluations of where future treatment and recharge systems could be located.

6. **Buffer Areas Around Fresh Water Ponds and Lakes.** Available (as of 1999) water quality data was reviewed for the fresh water ponds and lakes in Chatham, and it was found that these fresh water bodies have good water quality based on this data. At the same time, it is understood that phosphorus in septic system effluent can impact fresh water bodies because phosphorus is the limiting nutrient in these waters. This means that the more phosphorus that enters the water body, the more algal growth will occur. Phosphorus is not as soluble as nitrogen in the groundwater and typically does not travel as far or as fast as nitrogen in the groundwater system. Early research indicated that phosphorus is retained by the soil within 300-feet from where it is discharged. More recently, research indicates that phosphorus can "desorb" from the soil and move (slowly) in the direction of groundwater flow.

The Cape Cod Commission (CCC) has established a Minimal Performance Standard (No. 2.1.1.2.B.1) that limits the siting of a subsurface disposal system within 300-feet of a fresh water body. Discussion with the Commission staff (in 1999) indicated that this 300-foot set back is appropriate for Cape Cod's sandy soils and conditions.

E. **Stormwater Discharges.** The 1999 NAR identified 18 separate stormwater discharge locations, their impacts, and on going efforts to modify or remediate the discharges. Stormwater discharge is the most common reason for shellfish closures in Chatham. The Town is pursuing funding opportunities to allow the stormwater mitigation plans to move forward more quickly.

F. **Institutional Issues.** At the time that the Needs Assessment Report was prepared in 1999, the Town needed to consider several institutional issues as reviewed below. Many of these issues have been resolved since 1999 and the remaining ones will be addressed as part of review of this document.

The Town developed a "Sewer Bank" and associated guidelines that provide direction on who can connect to the existing collection system and utilize the small amount of available treatment and recharge capacity at the Chatham WWTF. After completion of the Wastewater Management Plan, revised guidelines will be needed to guide future connections to the collection system.

The construction of cluster or centralized wastewater facilities for one or more of the Areas of Concern would be very expensive. Federal grants are no longer available for these projects. Low interest loans are available from the State, but there are many projects that compete for these loans. The Town has initiated discussions on how centralized facilities will be financed in the future, and the findings of these discussions are presented later in this document.

The need to sewer or to not sewer various Areas of Concern could be controversial due to the costs for centralized facilities, and the perception that the quality of life will change in areas that are connected to cluster or centralized wastewater facilities. The Town has initiated discussions with property owners in the Areas of Concern to learn if they are willing to pay their share of capital costs through property betterments.

G. **Data Gaps.** Several data gaps were identified as part of the 1999 NAR. These data gaps have been (or are continuing to be) addressed since 1999.

2.3 ACTION PLAN FOR THE TOWN OF CHATHAM PONDS

A. **Introduction and Scope.** This report (dated November 2003) summarizes the water quality and aquatic habitat conditions of the freshwater ponds of Chatham, and recommends measures for protection and restoration of this valuable resource. Twenty inland ponds are included in this report; the ponds range in size from 0.5 to 16.7 ha (1.2 – 41 acres) and are used by the public for aesthetic enjoyment, recreational fishing, swimming, and boating.

This report defines potential options for protection and improvement of the freshwater ponds of Chatham and develops a set of specific recommendations. The recommendations reflect an assessment of effectiveness (both short-term and long-term), cost, permitting issues, environmental and recreational impacts. The recommended actions include institutional, technical, and public education components. Some recommendations are town-wide, while others are directed to specific ponds. An overall implementation strategy is presented that defines priority actions and sequencing of recommendations. A copy of this report is attached as Appendix C.

Many of the recommendations apply to all the ponds and their surrounding watersheds. Specific observations and recommendations for the 20 ponds are summarized in Table 2-1, Summary of Major Findings and Recommendations for Chatham Ponds.

The Town has since acted on several of these recommendations and is proceeding with evaluation of phosphorus management options for Lovers Lake and Stillwater Pond.

2.4 SUPPLEMENTAL NEEDS ASSESSMENT

In 2004, a Supplemental Needs Assessment Report was drafted to act as a transition report between the 1999 NAR and the efforts, including the MEP project, that had taken place during that 5 year period. This draft report was never finalized, and it was decided to incorporate the Supplemental Needs Assessment information in this document. The following section summarizes the main findings of the Supplemental Needs Assessment and reviews more recent developments of the CWMP process that have happened since 2004. The following text is prepared to provide an update to the original findings of the 1999 NAR as reviewed earlier in this Chapter.

From 1999 until 2006 the CWMP Project proceeded slowly while updated threshold limits were developed for Chatham's coastal embayments, and freshwater data were developed and evaluated. These thresholds were developed and issued in 2003, for Stage Harbor, Sulphur Springs, Taylors Pond, Bassing Harbor and Muddy Creek, 2006 for Pleasant Bay and Cockle Cove Creek, and 2007 for an update to the original 2003 thresholds. Since 1999 there have also been several additional studies and evaluations to investigate the water quality in freshwater ponds as well as evaluate and regulate nitrogen loadings in Town.

A. **Update to 1999 NAR Summary.**

1. **Regulatory Issues.** In November 1987, the MassDEP issued an Administrative Consent Order to the Town requiring that the effluent flow from the Chatham wastewater treatment facility (WWTF) be limited to 100,000 gallons per day (gpd) annual average or less to minimize the risk of treated effluent migrating to public water supply wells. It also required that the Town begin efforts to upgrade the WWTF and undertake facilities planning. In October 1996, the Town completed modifications at the WWTF to remove nitrogen from the treated effluent to meet the Class I groundwater discharge standard of 10 parts per million (ppm) nitrate nitrogen. In September 1998, the Administrative Consent Order was modified to allow an increase in effluent flow to 150,000 gpd annual average, and to modify the schedule for completing the Comprehensive Wastewater Management Plan.

Since the 1999 NAR several regulatory changes have been implemented or are currently being prepared that could affect the Project. These include:

- Changes to Title 5 Regulations
- Revision to the MassDEP Regulation regarding Reclaimed Water
- Drafting of new phosphorous guidelines for groundwater discharge permits
- Revisions to the Town's "Interim Nitrogen Loading Regulation"
- Revisions to the Town's "Comprehensive Long Range Plan"
- Revisions to the Town's "Sewer Use Regulations"

2. **Nitrogen Loading to Coastal Embayments.** The Massachusetts Estuaries Project (MEP) has recently completed their re-evaluation of Chatham's embayment systems to determine the amount of nitrogen that is needed to be removed from the Town's watersheds to

meet proposed thresholds. Table 2-2 Summary of Wastewater Nitrogen Removal Needs summarizes the percentage of wastewater nitrogen that must be removed from the Town's watersheds to meet these limits.

Figure 2-4 illustrates these removals with the subwatershed where they are required. The embayment watersheds listed in Table 2-2 that require nitrogen removal have been identified as Wastewater Areas of Concern. Nitrogen management options will be developed for these areas in following phases of this Project.

3. **Centralized Wastewater Treatment Facilities.** The Chatham WWTF performs well at treating wastewater. The average effluent total nitrogen concentration from 2000-2002 (MEP analysis period) was 7.4 ppm, which is a marked improvement from the typical total nitrogen concentration of 20 to 40 ppm discharged from a standard Title 5 septic system.

The existing treatment process has a capacity of approximately 200,000 gallons per day, which is 33 percent greater than the Administrative Consent Order (average annual) cap 150,000 gpd. It is also approximately 25 percent greater than the existing (2002) maximum month flow of 160,000 gpd. This treatment capacity will need to be expanded to treat additional flows from areas of Chatham that want or need to connect to the centralized collection system.

4. **Centralized Wastewater Collection System.** The existing centralized wastewater collection system is well maintained and is operating well. It has sufficient capacity for existing sewered flows and does not have excessive extraneous flows (inflow and infiltration) entering from leaking gravity sewers, roof leaders or other sources. The collection system pumping stations are being maintained and there have been no major sewer extensions constructed.

5. **Water Supply Issues.** Groundwater conditions, water system demand, and water system capacity have been evaluated for the existing and future conditions in Chatham. Chatham has high quality supplies with the exception of one well, and has established a Water Resource Protection District to protect the existing and projected future water supply zones of contribution (Zone IIs). The current Water Resource Protection District was developed based on existing and planned supply wells being pumped. This area will need to be changed slightly as the two new wells are brought into service.

The Town's public water supply system has eight municipal wells with a total capacity of 6.42 million gallons per day (mgd). The Indian Hill Well is currently not in service due to low concentrations of tetrachlorethylene, commonly called PCE. With this well off line, the water supply system has a capacity of 5.32 mgd. Three additional wells are expected to be online between summer of 2004 and 2016 for an additional 3 mgd capacity.

The Town has also replaced an existing 0.4 mgd standpipe with a 1.35 mgd standpipe to provide sufficient storage capacity through 2018.

6. **On-Site Wastewater and Treatment Systems.** Chatham's wastewater needs are primarily served by individual on-site systems for individual properties. In general, Chatham's properties are large enough to fit the larger on-site systems now required by the Title 5 Regulations. Town Board of Health Regulations require that all cesspools be upgraded to Title 5 systems at the time of property transfer.

As mentioned in previous sections, Title 5 approved on-site systems provide minimal nitrogen removal. They are the largest source of nitrogen to Chatham's coastal embayments and drinking water supplies. Typical Title 5 approved systems can be upgraded to remove nitrogen, and these systems (often called "Title 5 Plus" systems) will be evaluated in Chapter 6 of this report.

7. **Wastewater Areas of Concern.** As a result of Stearns & Wheler's evaluations, nine Wastewater Areas of Concern (AOC) have been identified.

a. **Five Coastal Embayment Watershed AOCs.**

- Stage Harbor System
- Sulphur Springs System
- Taylors Pond System
- Bassing Harbor System
- Muddy Creek System

b. **Two Industrial Zoned AOCs.** Two areas of Town have industrial zoning, which groups this land use into concentrated areas to support industrial activity, and provide year-round employment to the Town residents. The two areas are identified as the Enterprise

Drive Industrial Area and the Commerce Park Industrial Area. Both areas are located adjacent to existing centralized wastewater facilities. The Commerce Park Industrial Area is located within the Town's Water Resource Protection District; and both areas are located within Coastal Embayment Watershed Areas of Concern. These two areas will be evaluated for sewering due to the need to remove their wastewater discharges from the Water Resource Protection District and their coastal embayments.

c. **Two High Groundwater and 100 Year Flood Zone AOCs.** Eliphamets Lane Area of Concern is a group of eight properties at the west end of Eliphamets Lane located next to Mill Pond, and are in low elevation areas and the 100-year flood zone. Several of these properties are small, and have minimal area for raised on-site septic systems. The Town Health Agent has requested that this group of properties be evaluated for improved wastewater treatment facilities.

Toms Neck AOC includes several properties on Tom's Neck along Morris Island Road and Little Beach Road. These properties have had to install raised systems to meet the requirements of Title 5 and the Town's health regulations on upgrading existing systems in 100-year flood zones. Several of these small properties have installed concrete retaining walls to construct Title 5 systems. These raised systems are expensive to build and are considered unsightly. This area will be evaluated for improved wastewater facilities in the next phase of this Project.

8. **Stormwater Discharge.** A total of 18 direct stormwater discharges from the road system in Chatham to various ponds and estuaries was documented in the Needs Assessment Report. The primary impact from the direct discharges is not nitrogen; it is road contaminants and sediment that is carried off the road by the stormwater and deposited in these surface waters. Fecal material deposited on the roads by wild and domestic animals will mix with the stormwater and raise the fecal coliform content in the water bodies which in turn will cause closure of shell fishing areas.

Since the Needs Assessment Report, the Town has entered into a stormwater discharge permit agreement with USEPA (Phase II Stormwater Permit) to regulate and improve these types of discharge (this is a country-wide program). Also, since the Needs Assessment Report, the Town has completely remediated six of the 18 discharges and is completing design on two more.

The Town will continue with the efforts to remediate the 12 remaining discharges in compliance with the USEPA permit and with overall Town goals.

B. **No-Action Alternative.** Under the "No-Action Alternative", future wastewater treatment at the Chatham WWTF would be limited to 150,000 gallons per day as directed by the Administrative Consent Order (ACO) agreed to by the Town of Chatham and MassDEP. No-Action would also mean that the Town would continue to deal with the majority of the Town's wastewater generation using on-site septic systems. With the majority of the Town designated an "Area of Nitrogen Concern" by the Board of Health, new construction will be regulated by the Interim Nitrogen Loading Regulations, however, existing facilities will continue to treat wastewater with on-site systems, typically not designed for nitrogen removal.

The impacts of nutrients and pathogens on coastal waters, drinking water supplies and other natural resources are well documented. Without addressing these needs Chatham will continue to lose natural and economic resources, including declines in the fin-fishing and shell-fishing resources, declines in property values, continued algal blooms in coastal embayments, beach closures and potential declines in tourism as the aesthetic impacts continue to impair the Town's water resources (coastal and fresh). For example, Chatham is currently experiencing the loss of naturally occurring oysters in Oyster Pond, increased algal blooms in Oyster Pond, and Little Mill Pond (among other embayments), loss of eel grass in the majority of the Town's coastal embayments and impacts to freshwater ponds. There is also the potential for impacts to the Town's drinking water supply and sole source aquifer.

In addition, if the Town does not comply with the existing Consent Order, by not finishing the CWMP Project, or not implementing recommendations of the plan, the Town could be fined $10,000 per day by MassDEP as allowed by the Order.

In the No-Action Alternative scenario, only existing substandard on-site systems identified through property transfer or system failure would be upgraded to meet the standards of Title 5 and the local Board of Health regulations. Because these regulations currently only address new systems with regards to nitrogen loading to coastal embayments, the Town's coastal embayments would continue be impacted by nitrogen discharges within the embayment's watershed. The Town of Chatham now has Draft and Final TMDLs for its coastal embayment systems. The TMDLs set the standard for which these embayments need to achieve to improve or preserve

their quality. Therefore, failure to address nitrogen loading to the embayments in Chatham would be in violation of the TMDL and subject to the enforcement regulations as stipulated by MassDEP.

Nitrogen loading assessments performed as part of the MEP have determined that existing and future nitrogen loading into Muddy Creek, the Stage Harbor System, Bassing Harbor System, Taylor Pond/Mill Creek, and Sulphur Springs watersheds exceed the nitrogen loading thresholds for those embayments. This indicates that continuation of nitrogen loading into these watersheds at current levels will further impact water quality in these embayments.

Nitrogen impacts to these coastal embayments will continue to threaten the shell-fishing industry and vacation economy that depends on the vitality of coastal embayments for their success.

Eutrophication from nitrogen impacts will result in "degraded water quality, adverse impacts to ecosystems and limits on the use of water resources." (MEP, 2003). Loss of eel grass, shell-fish, and fin-fish habitats, generation of algal blooms are just some of the impacts to the embayment ecosystems. As the water quality degrades, there is the potential for decline in property values and impacts to recreational uses in the impacted embayments.

2.5 TREATED WATER RECHARGE SITE EVALUATIONS

A. **Background.** A component of the CWMP Project calls for the identification of parcels of land, adjacent to or remote from the existing Chatham Wastewater Treatment Facility (WWTF) where treated water can be reclaimed by recharging it back to the groundwater system.

In the past there was the belief that recharge capacity at the existing treatment plant beds should be limited because of mounding resulting from the recharge of treated water. It was suspected that this mounding could lead to groundwater flow patterns that would result in the groundwater under the capped landfill carrying a landfill plume toward a public supply well. As a result, the Town had agreed to limit the recharge at the existing plant sand beds to 150,000 gpd as part of the Administrative Consent Order (ACO). In the technical memorandum dated July 11, 2005, (attached in Appendix D) it was found that the potential recharge at various sites (including the WWTF Site) "do not result in the capture of any landfill impacted groundwater by Indian Hill

Well". This was an important finding for the CWMP because it addressed the MassDEP concerns (and ACO) that were limiting flow to the WWTF.

Although this finding addresses one of the major rationales behind MassDEP's issuance of the ACO, the ACO remains a binding agreement between the Town and MassDEP. Therefore, the conditions of the ACO including the completion of the CWMP must be met before the Town can be released from this agreement. Based on these findings the Town has engaged in discussions with MassDEP to have the Consent Order modified to take into consideration these latest findings.

As part of the Alternative Screening portion of the project, Stearns & Wheler, LLC with the Town CWMP Technical Advisory Group (TAG) identified potential candidate locations for recharging treated water. Initially, fifteen sites were identified based primarily on the availability of large parcels of vacant land. After the initial fifteen sites were screened, Stearns and Wheler met with Town personnel to discuss the viability of each of the sites. The following six sites were identified for subsurface investigations.

- Treatment Plant North (Site 1)
- Volunteer Park (Site 2)
- Chatham Airport (Site 4)
- Chatham High School (Site 7)
- Chatham Seaside Links Golf Course (Site 9)
- Hamden Place (Site 10)

These sites are illustrated on Figure 2-5. Other sites had been identified but were rejected prior to the site investigation task based on site reconnaissance observations and conversations with Town personnel.

B. **Conclusions and Recommendations.** Each evaluated site has the potential to serve as a treated water recharge site. This is a result of the presence of the medium to coarse grain sands seen at each site. At each site, similar loading rates were assigned, based on the comparable percolation rates observed. In accordance with MassDEP guidance, that relates loading rate to percolation test infiltration rate, loading rates of 5 gpd/sf and 2.5 gpd/sf for sand beds or leaching

fields respectively, were assigned to each site. The various sites do have limitations which are primarily a function of the available acreage.

This report is included in Appendix E.

2.6 INFILTRATION LOADING TEST REPORT

A. **Background.** Based on findings and recommendation of the Treated Water Recharge Site Evaluations, the Town decided that development of infiltration sand beds at the existing WWTF Site and Site No. 1 would be the most cost effective and environmentally sound. This decision was also based on a number of other factors, including surrounding land use, proximity of sensitive receptors, size, and hydrogeologic properties.

It was also decided that a hydraulic loading test performed in accordance with USEPA requirements should be used to determine a design infiltration rate for these sites that may allow for higher than the 5 gpd/sf rate typically approved by MassDEP. If a higher rate is approved, smaller facilities could be designed, and the Town would save construction costs.

B. **Test Summary and Conclusions.** Hydraulic loading tests were completed between June 26 and July 7, 2006. Testing was performed at two 10-foot basins. Testing was comprised of:

1. One day of saturating the soils beneath the basins for a 24-hour period by sustaining a water level in the basins equivalent to what was infiltrating out of them.

2. One day of constant head testing, during which water was fed to the basin at the same rate that water drained from the basin, as indicated by a constant water level in the basin.

3. One day of falling head testing, recording the rate at which the water level in the basins dropped. The falling head test was repeated six times.

For the constant head testing, an average infiltration rate of 460 gpd/sf for the two basins was calculated. Applying the USEPA design factor of 10 percent to that result, an appropriate design loading rate is 46 gpd/sf.

In the falling head testing, an average infiltration rate of 297 gpd/sf for the two basins was calculated. If this rate is used and the USEPA design factor of 10 percent is applied to that result, an appropriate design loading rate is 30 gpd/sf.

The observed rate of 300 to 460 gpd/sf is not appropriate for sizing future facilities. As a result, USEPA guidance was used and a recommended design rate of 30 gpd/sf was identified for future infiltration facilities. It is noted that the Town will have several years of operational time to check the performance of this rate with the first beds to be used as the flows at the plant increase. The Town plans to reserve additional space nearby in case the sand beds do not perform as expected with this rate.

MassDEP review of the hydraulic load testing report agreed with the methodology and findings of the testing (letter from MassDEP dated December 2006) but requested groundwater modeling at the site of 15, 30 and 45gpd/sf to verify that this range of loading rates would not cause mounding impacts in the region. Also, there was interest to model the fate and transport of the treated water to Cockle Cove Creek as well as to other estuaries, freshwater ponds, and public water supply wells. (The December 2006 MassDEP letter is included in the attachments of Appendix G).

Groundwater modeling was completed in June 2007 and the findings are summarized in a Technical Memorandum (Appendix G). This modeling verified that the design infiltration rate of 30 gpd/sf is appropriate and identified the modeled transport of the treated water to the downstream estuaries for a 100 year period.

2.7 UPDATED WASTEWATER FLOWS AND LOADS

As part of the April 2006 preliminary design prepared for the Town of Chatham, the following Town-wide flows and loads information were developed for the project. This information was developed as an update to the flows and loads developed as part of the 1999 NAR. Although flows developed here were performed on a parcel by parcel basis, they were not developed as a basis for flow allocation to be used as part of a growth neutral regulation, but were developed to provide a reasonable estimate of the wastewater generated throughout the Town as part of the planning process. Flow allocation, although not recommended, is discussed in Chapter 8.

A. **Average Wastewater Flows Development.** To remain consistent with the facilities planning process to date and the Massachusetts Estuaries Project process, the Town's existing water consumption data was used as the basis for the future Wastewater Treatment WWTF design flows and loadings. The following is a summary of the Town's water data analysis and how it is applied to this project:

1. 2002-2003 water data (provided by the Town – summer to summer, and used as part of the Massachusetts Estuaries Project) was used as the basis for future flows. Approximately 90 percent of the Town is currently served by public water supplies.

2. A ten percent reduction was applied to the water data to convert actual water use to estimated wastewater generation. This 10% reduction is based on an analysis of the wastewater flows to the existing Chatham WWTF.

3. The average water use per parcel (for those parcels without known irrigation systems) was calculated.

4. The actual water data was used for the properties that are connected to public water supplies. If no water data was available for a property, the following approach was used:

    a. Average water use for existing single family homes was calculated to be 120 gpd/parcel (rounded to two significant figures) and used for this land use type.

    b. For non-single family homes, estimated water use assigned to these parcels was based on the average water use of parcels with the same state class code (similar property type).

    c. Build-out (future) parcels were assigned 120 gpd/parcel average flow.

5. Build-out projections were developed based on the approach established as part of the facilities planning effort and accepted by the Town and Cape Cod Commission (CCC).

6. The existing wastewater flow for developed-properties was compared to projected build-out flow for these properties, and the higher of the two values was used. For example, if an

existing developed property was potentially sub-dividable under current zoning by-laws, the build-out flow was estimated at 120 gpd/parcel created. This value was compared to the existing estimated wastewater flow for the property, and the higher value was used.

7. The following additional build-out criteria were used, as reviewed with the Town:

- Residential properties are redeveloped to the full extent based on current zoning.
- Commercial and Industrial, vacant-developable land is converted to residential use.
- All other existing uses remain the same.
- Maps depicting the buildout conditions were reviewed with the Town and site specific modifications were made.

B. **Wastewater Flows and Peaking Factors.** Table 2-3 presents the average flows seen at the existing Chatham wastewater treatment facility, generated from the existing collection system.

Average water use and wastewater flow seasonal peaking factors were evaluated and compared to accepted engineering criteria. (These criteria are summarized in the *Guides for the Design of Wastewater Treatment Works* prepared by the New England Interstate Water Pollution Control Commission in 1998. This document is called the TR-16 Guide.) Also, Chatham's seasonal nature which differs from many communities was recognized. The peaking factors considered for the preliminary design are presented in Table 2-4. As part of the evaluation to determine appropriate seasonal peaking factors, both the wastewater flows recorded at the existing WWTF and the drinking water well pumping records were evaluated for the following reasons:

- The limited size of the existing collection system may not be representative of the entire Town's demographics.
- Existing WWTF peaking factors may represent a more year-round population and might not be representative of the entire Town (if sewered).
- Town water supply well pumping records are more likely to show the seasonal impacts of the entire Town.
- Well pumping records also reflect higher peak pumping rates in the summer because of additional non-sewered discharge uses like car washing, lawn irrigation, etc, and therefore would require downward adjustments to the wastewater estimate.

- Well pumping does not equate to 100% wastewater generation, and therefore should not be considered as the sole means of estimating peaking factors.

Therefore, peaking factors falling between those seen at the WWTF and from the well pumping records were considered as a reasonable approximation of those for a Town-wide system and were compared to values presented in the TR-16 Guide for validation purposes. The peak day and peak hour estimates were well within the range recommended by the TR-16 Guide.

Summer average flows during the years 2002 through 2005 were evaluated for June through August, June through September and July through September. The highest average summer flow occurred during the June through August period, although all three periods yielded similar results.

Table 2-5 presents the Town-wide wastewater flow estimates. Existing average annual flow and build-out flows were based on the previously discussed approach. Peaking factors are then applied to calculate the other seasonal future (build-out) flows. Build-out is considered the design conditions for this project, though it may occur beyond the 20 year planning period for this project.

Inflow and infiltration (I/I) to the future collection system was calculated based on 8-inch diameter pipe and an I/I rate of 500 gpd/in-mile. I/I for future laterals is based on 500 gpd/in-mile, 4-inch connections, and each connection being approximately 80 feet long. Although 500 gpd/in-mile is on the high end of the range recommended by the TR-16 Guide for just infiltration, it is prudent for long term facilities planning of both infiltration and inflow given the character of Chatham.

It is noted that the future Chatham collection system is expected to be extended over very significant areas of Town. The new gravity PVC sewers and manhole joints and covers will be gasketed. Portions of the Town will be low pressure sewers. All new connections will be wye-connections with new laterals to the house, and no roof leaders or sump pumps and/or foundation drain connections will be allowed under any condition. In addition, public education programs should be employed to prevent illegal connections. Because of this, inflow should be low.

The potential future (buildout) I/I flows to the system are summarized in Table 2-6.

The Town-wide wastewater flows (Table 2-5) and the I/I (Table 2-6) estimates are combined to estimate the total estimated flows that would need to be considered for a Town-wide wastewater and collection treatment system. These flows are summarized in Table 2-7.

C. **Development of Wastewater Loadings to Consider for Future Wastewater Facilities.** The wastewater loading is the wastewater-constituent mass measured in pounds per day (lb/day) or kilograms per year (kg/yr) that must be treated at a treatment facility. The primary wastewater constituents are biochemical oxygen demand (BOD) which is a measure of the organic material in the waste; total suspended solids (TSS); and total nitrogen (TN).

Table 2-8 summarizes the existing loadings for the Chatham WWTF (2002-2005).

Table 2-9 summarizes the estimated future flows and loads for the entire Town. Loadings were based on concentrations currently seen at the existing WWTF, and factors from the TR-16 Guide were applied for Maximum Month and Peak Day conditions for TSS, and BOD.

Seasonal correlations between temperature conditions and maximum loading conditions were investigated. It is noted that the wastewater temperature affects biological treatment processes and in particular will influence the size of the aeration tanks.

D. **Other Flow Considerations.**

1. **Future Harwich Sewer Extensions.** The Town is currently in discussions with the Town of Harwich regarding the possible extension of a proposed collection system into Harwich. This would require an inter-municipal agreement between the two towns establishing the quantity of flow and other requirements. No flow estimate is available at this time.

2. **Septage.** As identified in the 1999 Needs Assessment Report "Septage and grease are treated in the sludge holding tanks and the decant liquid and belt filter press filtrate from these flows have minimal contributions to the wastewater treatment process." The existing Chatham WWTF only receives septage from the Town of Chatham. As more of the Town is sewered, an even smaller portion of the wastewater flow stream will originate from this source and the impact from septage will decline further. However, the septage will be considered in the sludge processing and disposal calculations.

2.8 PRELIMINARY DESIGN OF A TOWN-WIDE WASTEWATER COLLECTION AND TREATMENT SYSTEM FOR CHATHAM

In April 2006 the preliminary design of wastewater collection, treatment, and recharge facilities was completed to illustrate what a Town-wide centralized system would entail. It was developed at that time due to political desires to proceed more quickly with implementation of a wastewater solution. The wastewater planning project was on hold at that time due to delays by the MEP and the final developments of nitrogen limits. Once the nitrogen limits were developed, the preliminary design of a Town-wide system was compared with other potential scenarios.

During the development of the preliminary design, members of the TAG visited several wastewater treatment facilities to investigate various treatment processes and to decide on the most appropriate treatment process for a Town-wide system. Members of the TAG also visited other Towns that had standardized wastewater collection and pumping equipment as a possible model for an expanded collection system in Chatham.

The final identification of recommended collection, treatment, and recharge processes and components was made during this preliminary design process as discussed in subsequent chapters of this report.