CDM

Town of Wareham, Massachusetts

Comprehensive Wastewater Management Plan / Single Environmental Impact Report

March 2002

Report

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Summary of Comprehensive Wastewater Management Plan

1.1 Overview

This section summarizes the Comprehensive Wastewater Management Plan (CWWMP) developed for the Town of Wareham, Massachusetts. The following elements of the plan are discussed in the sections below.

- Background;
- Flows and Loads;
- Expansion and Improvement of the Collection System;
- Water Pollution Control Facility Modifications;
- Water Quality Impacts;
- Environmental Impact Report;
- Financing of Proposed Improvements;
- The Role of Local Government in Implementing the CWWMP;
- Implementation Schedule; and
- Supplemental Information Included in the CWWMP.

1.2 Background

The Town of Wareham first engaged Camp Dresser & McKee Inc. to prepare a wastewater collection and treatment facilities plan in 1995. The phase one draft (DEP approved facilities plan scope items 1-3) was completed in December 1995 and the phase two draft (all remaining scope items) was submitted in January 1998. The Final Draft Facilities Plan (July 2001) addressed DEP verbal comments to the January 1998 document; updated flows, loads and Wareham Water Pollution Control Facility (WPCF) data; and finalized the conceptual design of the recommended WPCF proposed upgrade. Responses to comments on the final draft wastewater facilities plan and Environmental Notification Form (July 2001) have been coupled with the required Single Environmental Impact Report (EIR) and are being submitted as a joint final CWWMP/EIR.

The facilities plan was prepared in accordance with the requirements of Section 201 of the Clean Water Act of 1977 (PL 95-217) to address the Town of Wareham's present and future wastewater collection and treatment needs, and to determine the most

practical and cost-effective solutions. The study covers a 20-year planning period for all wastewater facilities including wastewater collection, treatment, and disposal. Per the DEP Facilities Planning Guidelines, the plans presented were devised with the goals set forth in the federal and state laws, along with present and future needs and financial capabilities of the Town of Wareham in mind.

This Single Environmental Impact Report (EIR) addresses: (1) the upgrade of the existing Wareham Water Pollution Control Facility (WPCF); and (2) the extension of the sewage collection system to 12 sewage disposal needs areas. The design of these facilities will account for future flows and loads to provide a 20-year plan for wastewater collection, treatment and disposal to serve the town's needs. The EIR evaluates the environmental impacts of the proposed project, specifically addressing the issues raised in the Secretary's Certificate on the Environmental Notification Form (ENF), issued on August 31, 2001.

1.3 Flows and Loads

Future and present day flows and loads for the winter and summer months are shown in Table 1-1. This table constitutes much of the preliminary design criteria for the project. Refer to Section 3, Population, Flows, and Loads for a detailed discussion of how the values were derived.

1.4 Expansion and Improvement of the Collection System

As of 1997, approximately 37 percent of Wareham was connected to the existing wastewater collection system, leaving 63 percent of the town using some type of on-site sewage disposal system. The existing wastewater collection system was first constructed in the 1970s and consists of approximately 44.7 miles of pipelines ranging from 8- to 21-inches in diameter, and 29 pumping stations. The collection system services much of the developed areas in Wareham predominantly in the central and the southern portion of town as shown on Figure 5-1. Of the neighborhoods in Wareham with existing on-site disposal systems, 12 areas were identified by the Wareham Board of Health and/or the Department of Environmental Protection, Bureau of Resource Protection as having on-site disposal problems requiring evaluation in this study.

The evaluations revealed that all 12 study areas demonstrated problems with on-site sewage disposal systems, and an alternatives analysis for each study area was conducted. The alternatives that were considered include: conventional gravity sewers with some pressure sewers, small diameter gravity sewers with some pressure sewers, pressure sewers, STEP systems with pressure sewers, and a package plant with conventional gravity and some pressure sewers. In each of the study areas, the least costly alternative was the recommended mitigation measure. The only exception to this was the Beaver Dam Estates study area, where a competitively priced alternative was chosen, see Section 4.4.5.

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Table 1-1
Water Pollution Control Facility Design Criteria

	Present Winter (2000)	Present Summer (2000)	Future Winter (2020)	Future Summer (2020)
Wastewater Flow (mgd)				
Average	0.94	1.08	1.42	1.56
Maximum Month	1.47	1.31	2.23	1.89
Maximum Month Peaking Factor	1.6	1.2	1.6	1.2
Maximum Day	2.04	2.41	3.08	3.48
Maximum Day Peaking Factor	2.2	2.2	2.2	2.2
Peak Hour	3.58	4.08	5.12	5.39
Peak Hour Peaking Factor	3.8	3.8	3.6	3.5
Wastewater BOD (lb/day)				
Average	2180	3,000	3,640	4,270
Maximum Day	4,420	4,420	7,020	7,020
Maximum Day Peaking Factor	2.0	1.5	1.9	1.6
Wastewater TSS (lb/day)				
Average	1,220	1,610	1,980	2,300
Maximum Day	3,420	3,420	5,350	5,350
Maximum Day Peaking Factor	2.8	2.1	2.7	2.3
Septage Flow (gpd)				
Average	22,270	23,900	22,270	23,900
Maximum Day	40,680	40,570	40,680	40,570
Maximum Day Peaking Factor	1.8	1.7	1.8	1.7
Septage BOD (lb/day)				
Average	930	1,000	930	1,000
Maximum Day	5,090	5,080	5,090	5,080
Maximum Day Peaking Factor	5.5	5.1	5.5	5.1
Septage TSS (lb/day)				
Average	2,790	2,990	2,790	2,990
Maximum Day	5,090	5,080	5,090	5,080
Maximum Day Peaking Factor	1.8	1.7	1.8	1.7

Based on the sewage disposal needs assessment and alternatives analysis, all 12 of the sewage disposal needs areas listed below were recommended for conventional gravity collection systems with some pressure sewers:

- Agawam Beach;
- Beaver Dam Estates;
- Briarwood Beach;
- Cromesett Park;
- Linwood/Ladd Avenues;
- Mayflower Ridge;
- Oakdale;
- Parkwood Beach;
- Rose Point;
- Sunset Island (completed in 1999);
- Tempest Knob; and
- Weweantic Shores.

The priority list shown below for the recommended alternative was generated to determine the order of construction, shown in Table 4-5. The four major evaluation factors considered in determining priority list order were: water body nitrogen levels, needs area size and population density, Board of Health (BOH) records and questionnaire responses, and geographic construction constraints. Note that a map of the existing and proposed sewer collection systems is shown on Figure 4-2.

Contract Number	Sewage Disposal Needs Areas
1	Sunset Island (completed 1999) and Weweantic Shores
2	Briarwood Beach and Beaver Dam Estates
3	Tempest Knob and Agawam Beach
4	Parkwood Beach
5	Oakdale
6	Cromesett Park
7	Rose Point
8	Linwood and Ladd Avenues and Mayflower Ridge

A capacity analysis was conducted to determine if the existing collection system would be able to handle present and future flows in the Town. In addition, the six major pumping stations were evaluated for structural, mechanical, and operational control. A facility assessment report detailing the evaluation results and including status and deficiencies is included in Appendix D. Overall, it was found that the collection system and the pump stations are adequate to handle both present and future flows, and continuous flow monitoring is recommended to assess inflow and infiltration.

1.5 Water Pollution Control Facility Modifications

For the 1995 Facilities Plan submittal, CDM collected operating data, interviewed Town officials, toured the WPCF, and conducted a status and capacity evaluation for all existing facilities. For the 1998 draft, future NPDES permit limits were anticipated and four different process options were prepared. DEP made clear that future NPDES permit limits would impose some level of effluent discharge criteria on total nitrogen concentrations. As a result, four biological nutrient removal options to treat the future flows as well as remove nitrogen were developed and are shown below:

Option	Anticipated Regulatory Limit for Total Nitrogen (mg/L)	Recommended Process
1	10	Modified Ludzak Ettinger (MLE)
2	5	Bardenpho
3	3	Bardenpho
4	3	MLE with denitrification filters

Note, although Options 2 and 3 use the same process, Option 3 requires more tank volume than Option 2, and thus is able to facilitate more nitrogen removal than Option 2.

A cost estimate was prepared for the January 1998 Facilities Plan and is shown in Table 1-2. Reducing effluent nitrogen concentrations to 3 mg/l of total nitrogen with MLE and denitrification filters costs about the same as reducing effluent nitrogen concentrations to 10 mg/l of total nitrogen. Therefore, 3 mg/l of total nitrogen with MLE and denitrification filters was the preferred alternative for BNR. Finally, in 1998 through 2001, the recommended option, Option 4, was carried through a conceptual design phase where WPCF operating data was updated and design criteria refined.

Since the publication of the January 1998 Facilities Plan, significantly more information has been collected. Present and future flow and loads to the treatment plant have been reevaluated based on treatment plant data from 1996 through 2000. As a result, design criteria were reevaluated and new criteria established. Routine project related meetings with the Town revealed additional needs at the treatment plant not previously identified. As a result, all mechanical equipment at the treatment plant was evaluated, and the evaluation revealed that a great deal of the equipment at the plant had reached its useful life. The Town also identified the need for more administrative space and requested a new Administration Building. Also, a water quality study was conducted to gain a better understanding of nutrient loadings and contributing sources of those nutrients to the Agawam River. The study revealed that the Agawam River was more sensitive to phosphorus than to nitrogen loadings. In addition, improved communication with the DEP has led to a better understanding of likely changes to the existing NPDES permit. Based on verbal comments from the DEP on the January 1998 facilities plan and a courtesy draft NPDES permit, effluent limits are very likely to be placed on both total nitrogen and

Table 1-2
Recommended Plan Costs[1]

	Capital Cost	Annual O&M	EUAC	Present Worth
Collection System				
Agawam Beach	$1,330,000	$8,000	$137,000	$1,415,000
Beaver Dam Estates	$660,000	$5,000	$69,000	$715,000
Briarwood Beach	$1,210,000	$5,000	$122,000	$1,260,000
Cromesett Park	$1,330,000	$5,000	$134,000	$1,385,000
Linwood/Ladd Avenues	$515,000	$5,000	$55,000	$570,000
Mayflower Ridge	$1,050,000	$8,000	$109,000	$1,125,000
Oakdale	$2,350,000	$11,000	$239,000	$2,470,000
Parkwood Beach	$2,990,000	$20,000	$310,000	$3,200,000
Rose Point	$3,130,000	$8,000	$311,000	$3,210,000
Sunset Island	$1,060,000	$0	$15,000	$155,000
Tempest Knob	$980,000	$18,000	$113,000	$1,170,000
Weweantic Shores	$3,240,000	$31,000	$345,000	$3,560,000
Wastewater Treatment				
No Biological Nutrient Removal	$8,720,000	$890,000	$1,730,000	$17,800,000
10 mg/l Total Nitrogen Limit	$14,190,000	$1,050,000	$2,430,000	$25,000,000
5 mg/l Total Nitrogen Limit	$17,090,000	$110,000	$2,770,000	$28,500,000
3 mg/l Total Nitrogen Limit	$17,170,000	$1,150,000	$2,780,000	$28,600,000
3 mg/l Total Nitrogen Limit with denitrification filters	$14,640,000	$1,070,000	$24,900,000	$25,600,000

[1]1997 cost estimate using ENR cost index value of 5851.

phosphorus. These insights in conjunction with the research conducted prior to 1998, have generated the following list of recommended additions to the plant.

- Package headworks to include one rotary fine screen, one vortex grit chamber, and one by-pass screen in place of existing headworks building.
- One septage complete plant in new headworks building.
- Two equalization basins.
- Two anoxic selectors.
- One additional aeration tank.
- New distribution box structure.
- One additional secondary clarifier.
- Three denitrifying filters.
- Three banks of UV disinfection modules.
- Headworks biofilter.
- One new gravity belt thickener.
- New polymer storage and feed system.
- Sludge dewatering biofilter.
- Renovation of Operations Building.
- Renovation of Sludge Dewatering Building.
- New Process Equipment Building (filter/blower/UV disinfection building).
- New Administration Building.
- New Soda Ash Silo.

These improvements are discussed at length in Section 6.5. In addition, Figure 6-2 shows a site map of the upgraded treatment plant.

1.6 Water Quality Impacts

A water quality investigation of the Wareham River Estuary Complex was conducted by CDM and a draft published in June 2000. Some of the key findings are listed below:

- Water Quality Findings
  - Water quality in the Wareham River Estuary has a moderate amount of nutrient related water quality decline due to nitrogen loading.
  - The total nitrogen load to the Wareham River Estuary is estimated to be about 78,250 kg/yr. The following land uses comprise the majority of this load: WPCF (25%), residential (31%), cranberry bogs (10%), open water (9%).
  - The majority (90%) of the phosphorus load is from the treatment plant and this is in the form of inorganic phosphorus, which is the form algae prefer for rapid growth.
  - Phosphorus controls at the Water Pollution Control Facility (WPCF) would reduce algal growth within the upper Agawam estuary.
  - Nitrogen controls at the WPCF would show improvement in the area around the confluence of the Agawam River and Wankinko River estuaries and would improve the algal levels and increase dissolved oxygen. This will likely not have a discernable difference in the lower portion of the Wareham River Estuary.
- NPDES Permit Issues
  - The actual nitrogen load to the Agawam River Estuary was measured from the Agawam and Wankinco Rivers and compared to an updated (more recent land use and loading rates) land-use-based method and the 1998 estimate used to set limits in the draft NPDES permit. The following observations were noted:
    1. The current nitrogen load estimate is about 34% higher than the 1998 estimate. This increase is due both to increased development and changes in loading rates.
    2. The attenuation factor for the upper watershed is >50%. This, too, is higher than the 30% value used on only a portion of the watershed in the 1998 estimate.
  - CDM believes that a flushing period in the range of 56-99 hours should be used if future estimates of allowable loading limits for the Wareham River Estuary require this parameter.

- The estimated 7Q10 flow for the Agawam River is 17.3 cfs. This value should be used to establish NPDES permit limits for acute criteria.

- The dilution ratio that should be used to calculate average month permit limits for toxic pollutants is 12.5:1.

1.7 Environmental Impact Report

The environmental impacts of the CWWMP are discussed in Section 8. The main points discussed are outstanding issues pertaining to MEPA certification, existing environmental conditions in the Town, environmental impacts and mitigation measures for the recommended plan, statutory and regulatory standards and requirements, and proposed Section 61 findings.

1.7.1 MEPA Certification Issues

Velocity and flood zones, wetland resource areas, executive order #385, protection of shellfish resources, and responses to comments on the ENF are the MEPA certification issues discussed.

1.7.2 Existing Environmental Conditions, Impacts and Mitigation Measures

Existing environmental conditions and environmental impacts and mitigation measures are described with respect to the following parameters: topography, geology and soils; surface and groundwater hydrology and quality; air quality and noise; marine and terrestrial ecology; traffic; scenic qualities, open spaces and recreational resources; and historical and archaeological resources.

1.7.3 Statutory and Regulatory Standards

The following permits and authorizations are listed and discussed as necessary to obtain prior to the start of construction: NPDES permit to set effluent parameters; NPDES general stormwater permit; NPDES permit for stormwater after construction; sewer connection/extension permit; approval from the DEP to expand the WPCF; Massachusetts Highway Department Permit; Order of Conditions from Wareham Conservation Commission; Chapter 91 License; MA Historical Commission; Coastal Zone Management Federal Consistency Review; Major Sewer Extension Permit; Army Corps of Engineers Section 404/Section 10 Programmatic General Permit; and a Road Opening Permit.

1.7.4 Section 61 Findings

All feasible means and measures will be taken to avoid or minimize adverse impacts to the environment relating to construction and operation of the proposed utility services project.

1.8 Financing of Proposed Improvements

Costs for improvements to the wastewater collection system, pumping stations, and treatment facility were summarized below in Table 1-2. The Engineering News Record (ENR) cost index value of 5851 was used. The cost information presented in this report is identical to the cost information presented in the January 1998 Facilities Plan. The only exception, where current costs are presented, is summarized below and described in detail in Section 7.

The total capital project cost is estimated at $47.7 million. The total opinion of probable construction costs for the recommended improvements to the treatment plant is $24.3 million. Improvements to and expansion of the collection system make up the additional $23.4 million cost.

Section 7 evaluates the financial impacts of the proposed improvements and assesses the impacts on the Town and its ratepayers. The methodology involved using standard industry methods to estimate revenue requirements and using those requirements to determine the effect on sewer use rates over the next ten years (through 2012). A list of assumptions is contained in Section 7.

It was found that the total costs for the sewer system are projected to increase at an average annual rate of 30% between 2002 and 2012. The charge per equivalent housing unit (EDU) is expected to increase from $268/EDU annually to $464/EDU annually in the same time frame. The EDU system is how the Town currently assesses sewer use charges and a single family home is considered one EDU.

1.9 The Role of Local Government in Implementing the CWWMP

There are several institutional and legislative mechanisms for managing sewer related growth and the future connections and extensions of the sewer system in accordance with the approved plan and Executive Order #385. These mechanisms include the Town Master Plan and the Board of Sewer Commissioners.

1.9.1 Town Master Plan

In 1998, the Town completed its Comprehensive Community Plan (Master Plan). The Master Plan summarized the Town's vision and goals, and laid out specific recommendations for growth control. Many of the proposed zoning bylaw changes pursued by the Town have attempted to achieve effective growth management while balancing economic development with resource protection. Two of the goals of the Master Plan were to:

- Moderate residential growth so that the Town is able to meet future demand for services; and

- Encourage the creation of permanently open spaces, preferably in contiguous parcels.

In accordance with the Town's commitment to moderate residential growth, each study area was analyzed to assess potential for secondary growth, defined by individuals or developments connecting to the 12 planned sewer areas. Potential for secondary growth was described as nonexistent, low, moderate or high. It was determined that the overall potential for secondary growth as a result of these improvements is extremely low. Three of the twelve sewer areas had no secondary growth potential, six had low secondary growth potential, and three study areas had moderate potential for secondary growth.

Also in accordance with the Town's commitment to moderate residential growth, the Town has modified their bylaws to increase restrictions on construction in FEMA designated flood zones, particularly in velocity zones. Language for the zoning bylaw change approved at the October 2001 Town meeting is contained in section 8.2.1.

1.9.2 Board of Sewer Commissioners

The Board of Selectmen acting as the Board of Sewer Commissioners (Board) has discretionary authority to permit or reject applications for sewer extensions or connections to the sewer system. It is the understanding of the Board that any other areas requesting or demonstrating a need for sewers could only obtain approval after all of the 12 sewer areas are connected. Other sewer needs areas would have to be identified in future CWWMP efforts, which would be subject to future MEPA review. In addition, major sewer extension would require a DEP Sewer Extension Permit. One of the many provisions that DEP will consider when granting approval is whether the project is consistent with the latest approved CWWMP.

The Board also understands that the upgraded WPCF will have enough capacity for the 12 sewer areas and additional capacity for growth and in-fill within the existing sewer service area. However, there may not be available capacity for large sewer extensions not on the CWWMP priority list. Even if local and state government approvals are obtained for additional unplanned sewer extensions, the likelihood of sewer-related secondary growth due to constructing the 12 needs areas is low to moderate. As discussed above, many of the proposed sewer areas are in isolated densely developed areas that abut water or existing or proposed sewer areas. There is little contiguous vacant land that could be developed as a result of the recommended plan. Sewer extensions to these areas would require costly pumping stations and force mains to serve a relatively small number of homes.

A more detailed discussion of growth planning in accordance with Executive Order #385 is contained in Section 8.2.3.

1.10 Implementation Schedule

The following schedule is proposed to conduct the various elements of the project:

1.10.1 Wastewater Treatment Improvements

- Obtain funding from Town Meeting (obtained Spring 2001)
- Prepare design plans and specifications (began January 2001 and completed October 2001)
- Submit final design for approval (submitted October 2001)
- Bid and award construction contract (March 2002, estimated)
- Start construction (Spring 2002)
- Complete construction (end of year 2004, estimated)

1.10.2 Collection System Improvements

- Obtain funding from Town Meeting
- Perform infiltration/inflow investigations
- Perform pumping station rehabilitation

1.11 Supplemental Information

In addition to the summary provided in this section, the following documents are included in the appendices.

Appendix	Description
A	Massachusetts Surface Water Quality Standards
B	NPDES Permit
C	Sewer Needs Questionnaire
D	Existing Collection System Pump Station Evaluation
E	Basis for Cost Estimates and Cost-Effectiveness Analysis
F	Public Participation Program Documents
G	Reviews and Approvals
H	List of Abbreviations
I	MEPA Compliance Certificate
J	ENF Comment Letters
K	EIR Distribution List
L	DEP/EPA Comments/Responses on "*Water Quality Investigation of the Wareham River Estuary Complex*"

1.12 Acknowledgements

CDM extends our sincere appreciation to the representatives of the Town of Wareham—particularly, the Wastewater Subcommittee Town officials: the late Mr. Joseph F. Murphy, Jr., the former Town Administrator, Mary Jane Pillsbury and L. David Hanley for their patience, ideas, and support; Mr. Mark Gifford, Director of Municipal Maintenance, for his cooperation and valuable insights; Mr. Michael Hartman, Town Administrator; Mr. James Shaw, former Chief Operator; the Municipal Maintenance Department; and the Board of Selectmen.

This report was prepared under the direction of Mr. Robert A. Cutone, Senior Vice President and prepared by Mr. Gerald Furrier, Project Manager, Ms. Lisa H. Gove, Senior Project Engineer, Ms. Jane Wheeler, Environmental Scientist, and Ms. Katya Bilyk, Project Engineer, and Mr. Robert Mackie, former CDM Project Manager.

Section 2
Introduction

This section introduces the town's Comprehensive Wastewater Management Plan including a discussion of the background, purpose, and scope of the study; water quality objectives; planning area; and previous investigations.

2.1 Background

The Town of Wareham has a wastewater collection system totaling approximately 45 miles of sewer, which serves about 10,470 people during the summer. Twenty-nine pumping stations of which five are ejector stations are included in the collection system. The existing wastewater treatment facility was designed to provide advanced secondary treatment for an average daily flow of 1.8 mgd and dispose of treated effluent to the Agawam River. Past modifications have reduced the treatment capacity to an average day flow of approximately 1.6 mgd. The current winter and summer average daily flows are 0.94 mgd and 1.08 mgd, respectively.

2.2 Purpose and Scope of Study

The purpose of this facilities planning study is to develop a 20-year plan for wastewater collection, treatment, and effluent and sludge disposal for the Town of Wareham. Furthermore, the plan will be consistent with present and future needs and financial capabilities of the planning area residents.

The project scope includes the following tasks:

- Conduct a sewage disposal needs area questionnaire survey and evaluate disposal alternatives for each of the 12 sewage disposal needs areas;
- Determine existing and future population and wastewater flows and loads;
- Evaluate infiltration/inflow (I/I) contributions to the WPCF flows;
- Develop a sewer system expansion program, including a phased implementation plan;
- Evaluate the condition and performance of the existing WPCF; include a capacity analysis, biological nutrient removal (BNR) alternatives, and construction schedule;
- Develop an estimate of construction costs, total project costs, and anticipated state and local shares of these costs; prepare and estimate implementation schedule; develop alternative financing methods; develop a user charge program and update the existing sewer ordinance; and prepare a financial capability analysis to demonstrate community financial capability to fund initial capital costs and operation and maintenance (O&M) costs in accordance with the EPA guidelines;

- Prepare an environmental information document (EID) for the proposed facilities in accordance with EPA guidelines;

- Conduct a limited public participation program, including a public meeting and a public hearing;

- Summarize conclusions and recommendations in a Comprehensive Wastewater Management Plan; and

- Prepare an environmental notification form (ENF) and Environmental Impact Report (EIR) for the project in accordance with Massachusetts law.

2.3 Water Quality Objectives

2.3.1 Legal Background

During the past few decades, major federal and state legislation has been enacted to alleviate pollution of the nation's water resources. The basic Federal Water Pollution Control Legislation, Public Law (PL 84-660), approved on July 9, 1956, has been amended by:

- The Federal Water Pollution Control Act Amendments of 1961 (PL 87-88);

- The Water Quality Act of 1965 (PL 89-234);

- The Federal Water Pollution Control Act Amendments of 1972 (PL92-500);

- The Clean Water Act of 1977 (PL 95-217);

- Municipal Wastewater Treatment Construction Grant Amendments of 1981 (PL 97-117); and

- The Water Quality Act of 1987 (PL 100-4).

The Commonwealth of Massachusetts has its own body of legislation and regulations for water pollution control, including the Massachusetts Clean Water Act of 1966 and subsequent amendments.

All new and expanded facilities must meet applicable federal and state criteria and guidelines. Those criteria that are relevant to Wareham's wastewater effluent are discussed below.

2.3.2 Water Quality Standards and Criteria

The Massachusetts Division of Water Pollution Control classifies the uses for various maintained and protected waterbodies in the Commonwealth. The inland, or fresh water, classes are A, B, and C while the coastal and marine, or salt water, classes are SA, SB, and SC. The water quality classes range from A to C, where a Class A water is an outstanding resource with the best water quality; a Class B water is a high quality resource suitable for primary and secondary contact recreation; and a Class C water is acceptable as a habitat for fish or other aquatic and non-aquatic wildlife but is only suitable for secondary contact recreation. The minimum and additional criteria for classified waters are included in Appendix A, Massachusetts Surface Water Quality Standards.

Wareham's treated wastewater is discharged from the WPCF to the Agawam River, a Class SB water as shown in Figure 2-1. Class SB waters are marine and estuarine waters suitable for protection and propagation of fish, other aquatic life and wildlife; primary and secondary contact recreation; and shellfish harvesting without depuration in approved areas. Most of the waters in Wareham are classified as Class SA waters, with the exception of the Agawam River, which is classified as a Class SB water.

2.3.3 Required Degree of Treatment

Under the town's current National Pollution Discharge Elimination System (NPDES) permit, the effluent average monthly values of 5-day biochemical oxygen demand (BOD5) and suspended solids (SS) shall not exceed 10 mg/l. Total chlorine residual shall not result in any demonstrable harm to aquatic life or violate any promulgated water quality standards.

Copies of Wareham's current and latest draft future NPDES permits are included in Appendix B.

2.4 Planning Area

The planning area for this study is the entire Town of Wareham, located in Plymouth County in southeastern Massachusetts, bordered on the west by Marion and Rochester, on the south and east by Buzzards Bay, and on the north and east by Carver, Plymouth, and Bourne. Principal highways serving the town are I-195, I-495/25, and Route 6.

The Town of Wareham was incorporated in 1739. As of 2000, the US Census reported that the population is 20,355.

The Town of Wareham is primarily a residential community. Commercial and institutional establishments consist mainly of restaurants and schools. Industrial establishments are primarily in the northeast portion of the town.

Section 1
Summary of Comprehensive Wastewater Management Plan

1.1 Overview

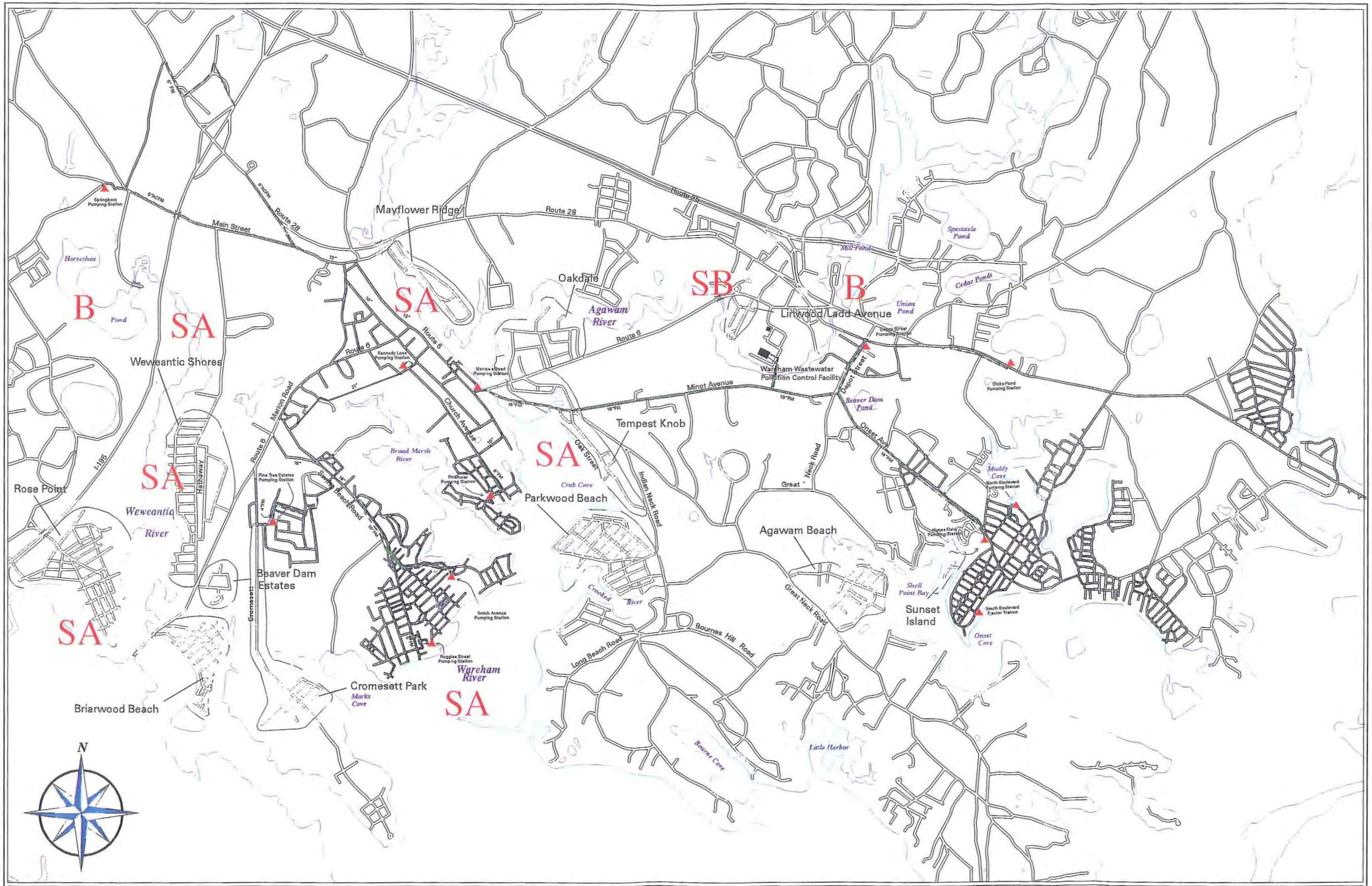
This section summarizes the Comprehensive Wastewater Management Plan (CWWMP) developed for the Town of Wareham, Massachusetts. The following elements of the plan are discussed in the sections below.

- Background;
- Flows and Loads;
- Expansion and Improvement of the Collection System;
- Water Pollution Control Facility Modifications;
- Water Quality Impacts;
- Environmental Impact Report;
- Financing of Proposed Improvements;
- The Role of Local Government in Implementing the CWWMP;
- Implementation Schedule; and
- Supplemental Information Included in the CWWMP.

1.2 Background

The Town of Wareham first engaged Camp Dresser & McKee Inc. to prepare a wastewater collection and treatment facilities plan in 1995. The phase one draft (DEP approved facilities plan scope items 1-3) was completed in December 1995 and the phase two draft (all remaining scope items) was submitted in January 1998. The Final Draft Facilities Plan (July 2001) addressed DEP verbal comments to the January 1998 document; updated flows, loads and Wareham Water Pollution Control Facility (WPCF) data; and finalized the conceptual design of the recommended WPCF proposed upgrade. Responses to comments on the final draft wastewater facilities plan and Environmental Notification Form (July 2001) have been coupled with the required Single Environmental Impact Report (EIR) and are being submitted as a joint final CWWMP/EIR.

The facilities plan was prepared in accordance with the requirements of Section 201 of the Clean Water Act of 1977 (PL 95-217) to address the Town of Wareham's present and future wastewater collection and treatment needs, and to determine the most



Legend

- Water Bodies
- Study Areas
- Pumping Station
- Current Sewer Collection System
- Roads
- Force Main

SA = Class A, coastal water
SB = Class B, coastal water
A = Class A, inland water
B = Class B, inland water

Water Quality Classification

0 500 1000 2000 3000 Feet

1 inch = 1000 feet

Town of Wareham, MA
Figure 2-1
Date: January, 1998

CDM Camp Dresser & McKee

2.5 Previous Investigations

Investigations, manuals, studies, and reports reviewed in the course of this study include:

1. Metcalf & Eddy, Inc., *Wareham Facilities Plan*, February 1986;

2. Metcalf & Eddy, Inc., *Final Environmental Impact Report*, June 1989;

3. Camp Dresser & McKee Inc., *Industrial Park/Sewer Study*, June 1996;

4. Camp Dresser & McKee Inc., *Water Quality Investigation of the Wareham River Estuary Complex*, June 2000; and

5. Camp Dresser & McKee Inc., *Wastewater Facilities Plan Environmental Notification Form*, July 2001.

Section 3
Population, Flows, and Loads

3.1 Introduction

Present day population, flows and loads were used to anticipate growth and evaluate needs of the wastewater collection and treatment system. Future wastewater flows are projected to evaluate the hydraulic capacity of the existing collection system, pumping stations, and treatment facility. Future wastewater organic loads are projected to evaluate the treatment facility's loading capacity and determine future treatment process requirements. Based on the existing and projected flows and loads, improvements and additions are suggested. Population, flow, and load data for the years 2000 (initial), and 2020 (design) is summarized on Table 3-1.

3.2 Planning Period

As required by the U.S. Environmental Protection Agency (EPA) Cost-Effectiveness Analysis Guidelines and the Department of Environmental Protection (DEP) Facility Planning Guidelines, the planning period for all cost-effectiveness analyses is 20 years. The start of the planning period for this study shall begin in 2000 and extend to the design year 2020.

3.3 Population Estimates

In evaluating and designing the collection system and treatment facility, the present population was estimated using population data obtained from the Massachusetts Census, U.S. Census, Massachusetts Institute for Social and Economic Research (MISER), and Southeast Regional Planning and Economic Development District (SRPEDD).

Due to large numbers of people who spend summers in Wareham but do not live there year-round, winter and summer population scenarios were evaluated. This is important because a large change in population within the sewered areas would likely cause a large variation in sewage flow over seasons. The winter months are defined as September 1st through April 30th (8 months), and summer months are defined as May 1st through August 31st (4 months). The present year-round population of 20,335 was obtained from US Census data. The summer population of 28,243 was calculated using U.S. Census housing data and a 28 percent winter vacancy rate (also from U.S. Census housing data).

The present population connected to the collection system or "sewered" population was determined using residential accounts data from the WPCF and a population density of 2.57 people per household (SRPEDD regional plan). The winter and summer estimates of 7,540 and 10,470 are related by the 28% vacancy rate.

Table 3-1
Population, Flow, and Loads

	2000		2020	
	Winter	Summer	Winter	Summer
Population[2]				
Total	20,335	28,243	27,720	38,500
Sewered	7540	10,470	12,157 [1]	15,196 [1]
Wastewater Flow (mgd)				
Domestic	0.51	0.72	0.83 [2]	1.04 [2]
Commercial and Industrial	0.16	0.17	0.26	0.27
Insitutional	0.08	0.02	0.08	0.02
Infiltration/Inflow	0.19	0.17	0.25	0.23
Total				
Average Day	0.94	1.08	1.42	1.56
Maximum Day	2.04	2.41	3.08	3.48
Maximum Month	1.47	1.31	2.23	1.89
Peak Hour	3.58	4.08	5.12	5.39
Septage Flows[3] (gpd)				
Total				
Average Day	22,270	23,900	22,270	23,900
Maximum Day	40,680	40,570	40,680	40,570
Maximum Month	26,720	28,680	26,720	28,680
Wastewater Loads[4] (lb/d)				
BOD				
Average Day	2,180	3,000	3,640	4,270
Maximum Day	4,420		7,020	
TSS				
Average Day	1,220	1,610	1,980	2,300
Maximum Day	3,420		5,350	
Septage Loads (lb/d)				
BOD				
Average Day	930	1,000	930	1,000
Maximum Day	5,090	5,080	5,090	5,080
TSS				
Average Day	2,790	2,990	2,790	2,990
Maximum Day	5,090	5,080	5,090	5,080

Notes:

[1] Does not include number of people who live in the Bourne sewer areas that contribute flow to Wareham as that number is unknown. However, the flow values do correctly include Bourne flows.

[2] Includes sewer extensions to the 12 study areas, and flows from the Town of Bourne.

[3] It was assumed that septage flows would remain constant because the decline in contribution from the sewer areas will be offset by growth in non-sewered areas.

[4] Existing wastewater and septage concentrations were assumed to be constant through the planning period.

Population projection data was obtained from SRPEDD, MISER, and Department of Environmental Management, Division of Water Resources was used to determine town-wide future populations. The Division of Water Resources uses the MISER model (which uses past population growth rates to project future population) to develop population projections. SRPEDD's population projections are based on a "compound cohort survival" which accounts for birth and death rates and migrations in and out of an area.

Both SRPEDD and MISER projections show a steady growth of 17 percent in the population (winter) over the next 20 years. However, the SRPEDD projection for the next 20 years is consistently 3,000 people greater than the MISER projection. Of the SRPEDD and MISER present population numbers, the SRPEDD model more clearly correlates with the present population data given in the annual town report and was therefore chosen as the more accurate source and therefore the values in the SPREDD population projection were used for this facilities plan. Thus, the 2020 winter and summer town-wide population estimates are 27,720 and 38,500, respectively. The winter population of 27,740 was determined by the selected projection. The summer population of 38,500 was calculated based on the projected winter population and an assumed 28 percent winter vacancy rate (U.S. Census housing data).

The future population serviced by the wastewater collection system was estimated based on the present sewer service population plus buildout population in the 12 sewer extension areas (recommended in Section 4). It is estimated that the future sewered population for the year 2020 will be 12,157 and 15,196 for the winter and summer, respectively. The number of residents in the Bourne sewer areas that contribute flows to the Wareham WPCF is unknown and therefore not included in this population projection value. However, flows from Bourne both present and future (up to 200,000 gal per the intermunicipal agreement) are included in the flow analysis presented in Section 3.4.2.

3.4 Wastewater Flows and Loads

Wastewater flow and load estimates of the current year and projections for the future year are needed to evaluate the existing wastewater facilities and make recommendations for WPCF upgrades. Flow is a term used to refer to the volume of wastewater received at the WPCF and is generally reported in a rate of gallons per day (gpd) or million gallons per day (MGD). Loads is a term used to describe the organic or solid content of the wastewater flows and is generally measured as a concentration (mg/L) and then multiplied by the flow rate and some conversion factors to determine a number of pounds per day (lb/d).

The 1998 Facilities plan contained wastewater flow estimates and projections based on WPCF operating date from 1991 thorough 1997. This 2001 facilities plan includes an updated flows and loads analysis based on WPCF operating data from 1996 through 2000. As done in the population discussions above, winter and summer values were evaluated separately due to the seasonal variations in population. Again winter represents 8 months of the year defined as September 1 through April 30 and summer is 4 months from May 1 through August 31.

All values for this analysis are presented in Table 3-1. A discussion of the methodology used is described in the following sub-sections.

3.4.1 Wastewater Flows

Present average and maximum day flow values were obtained from 1996 through 2000 WPCF operating data. A thirty-day moving average was used to determine the present maximum month. Peak hour present flows were determined using factors from the Merrimac Curve.

Future average daily flows include present flows plus projected flows from the 12 sewer expansion areas discussed in Section 4; the remainder of the 200,000 gpd intermunicipal agreement allotment to the Town of Bourne; and percentage increases from the commercial and industrial, institutional, and I/I components (see section 3.4.2). Future maximum day and maximum month values were projected as a ratio of the present average daily flow to the future average daily flow. Future peak hour flows were determined using factors from the Merrimac Curve.

3.4.2 Wastewater Flow Breakdown

Wastewater flows are typically broken down into categories representing the different types of wastewater contributors. For this plan, the four categories are commercial and industrial, institutional, infiltration and inflow (I/I) and domestic (or residential).

Wareham WPCF customer account data (that combines commercial and industrial records) was used to determine that this category presently contributes approximately 16- to 18-percent of the overall daily wastewater flow. Institutional contributions from public and private schools, public facilities, municipal buildings, etc. were estimated based on a survey of the existing types of facilities at each location i.e., number of bathrooms, number of employees, lockers rooms, cafeterias, etc. and applying both Title V and typical industry production rate factors. For this category it was assumed that there would be a significant decrease in flow contributions during the summer as schools would be out of session. I/I flows were estimated using the number of inch-miles of sewer in the collection system and DEP allowable flowrates of 200 gpd for new sewers and 500 gpd for old sewers.

Based on WPCF domestic account data and the balance of the average daily flow remaining once all other categories were accounted for, it was determined that this category presently contributes approximately 54-percent in the winter and 66-percent in the summer, of the overall daily wastewater flow. Another useful backcheck to the residential component estimates is the wastewater production per person in the sewer system. Dividing the residential flow by the sewered population, values of 68-gallons per capita (person) per day (gpcd) and 69-gpcd were calculated for winter and summer, respectively. These values agree with the per capita values developed in the 1998 Facilities Plan and were used for future flow projections.

3.4.3 Wastewater Loads and Characteristics

The most commonly used indicators of wastewater strength or loads are the five-day biochemical oxygen demand (BOD5 also shortened as just BOD) and total suspended solids (TSS). The BOD of a wastewater is the amount of oxygen required by microorganisms for the aerobic stabilization of organic material. The standard test for BOD, performed at 20 degrees Celsius for five days, reports milligrams of oxygen per liter of solution (mg/l). TSS in wastewater is measured by filtration, using a standard filter size and procedure. TSS are reported in terms of dry weight per unit volume, or mg/l. The sources of the BOD and TSS loadings in wastewater are based on typical loading rates.

Wastewater loads were determined using data from September 1997 through August 2000. BOD and TSS samples are taken from the headworks approximately once a week. This data was used to determine average day loads. Annual maximum day BOD loads were calculated as 1.85 times the annual average day. Annual maximum day TSS loads were calculated as 2.6 times the annual average day. Summer and winter maximum month BOD and TSS loads were calculated as 1.3 times the corresponding summer or winter average day load. It was assumed that BOD and TSS concentrations would remain the same in the future. Therefore, future average day, maximum day, and maximum month masses were determined using existing concentrations, future average day flows, and the existing ratios of maximum day and maximum month to average loads. Results are summarized in Table 3-1.

3.5 Septage Flows and Loads

Septage is the material pumped from residential and commercial septic tanks and cesspools. Septage flows are hauled to the WPCF from homes in Wareham and Bourne and are received and measured six days a week (Monday through Saturday). Approximately once per week, BOD and TSS samples are taken from the septage equalization basins where septage and sludge supernatant are mixed together before being fed into the aeration tank. Because the samples contain mixed side-streams as well as septage, concentrations from TR-16 were used. The concentration of BOD, TSS, and TKN are 5,000 mg/L, 15,000 mg/L, and 700 mg/L, respectively. Masses were determined using WPCF records for average and maximum day flows for each season. Maximum month flows were estimated to be 1.2 times average day flows. Results are summarized in Table 3-1.

Section 4
Sewage Disposal Needs Assessment and Alternatives Analysis

4.1 Introduction

The sewage disposal needs area assessment and alternatives analysis are used to determine a recommended wastewater disposal plan for both sewage disposal needs areas and the WPCF. In the needs area assessment, areas experiencing sewage disposal system problems are identified and studied based on a set of evaluation criteria. In the alternatives analysis, seven different sewage disposal alternatives are evaluated for each of the identified needs areas to determine a least costly and a recommended sewage disposal alternative. From the needs area recommendations, it is possible to determine which of the needs areas will be contributing sewage flow to the WPCF in the future. By delineating these future sewer service areas and determining the potential volume of wastewater flow to be treated, existing treatment facilities can be modified to treat increased flow based on future flow volumes.

4.2 Existing On-Site Disposal and Sewage Disposal Needs Area Identification

As of 1997 approximately 37 percent of Wareham is connected to the existing wastewater collection system, leaving 63 percent of town using some type of on-site sewage disposal system, such as septic tanks and leaching fields or cesspools. During the operation of an on-site disposal system, septage waste is generated and periodically removed. Typically, it is recommended that septic tanks be pumped out once every three to five years. The septage removed is then disposed of at a WWTP. The Wareham WPCF accepts septage from within the town as well as from the Towns of Bourne, Carver, Marion, Rochester, and Sandwich. Based on three years of septage receiving records from the Wareham WPCF, the total septage received per day was approximately 22,270 gallons in the winter and 23,900 gallons in the summer with a peak of 40,570 gallons per day in the summer. Of the neighborhoods in Wareham with existing on-site disposal systems, 12 areas have been identified by the Wareham Board of Health (BOH) and/or the Department of Environmental Protection (DEP), Bureau of Resource Protection as having on-site disposal system problems requiring evaluation in this facilities planning study and are listed alphabetically in Table 4-1.

4.3 Sewage Disposal Needs Assessment

A methodology for conducting the assessment included compiling a database of information concerning groundwater, general area soils and geological information, floodplains and wetlands, zoning and land use, Board of Health septic tank rehabilitation records, along with discussions with the Board of Health and the Municipal Maintenance Department. This information was supplemented with a questionnaire survey and the identification of frequently pumped or problematic on-site disposal systems.

Table 4-1
Sewage Disposal Needs Area Identification

Sewage Disposal Needs Area	Area Recommended By
Agawam Beach	BOH
Beaver Dam Estates	BOH
Briarwood Beach	DEP & BOH
Cromesett Park	BOH
Linwood/Ladd Avenues	BOH
Mayflower Ridge	BOH
Oakdale	BOH
Parkwood Beach	BOH
Rose Point	DEP & BOH
Sunset Island	BOH
Tempest Knob	BOH
Weweantic Shores	DEP & BOH

4.3.1 Sewage Disposal Needs Questionnaire Survey

The questionnaire survey was prepared and distributed to all homes in the identified needs areas to verify on-site systems performance. A copy of the questionnaire is included in Appendix C. The 1986 Town of Wareham Facilities Plan reported an 11 percent response to its town-wide questionnaire survey. To improve participation in the survey for this facilities plan, interviewers distributed questionnaires on a house-to-house basis. Whenever possible, the interviewers spoke directly with the occupant to ensure accurate completion of the questionnaire and to aid in the assessment of the on-lot disposal system problems and failures experienced by homeowners in the study area.

Of the 1,500 questionnaires distributed to residents during the summer of 1995, approximately 47 percent (712 questionnaires) were returned. About 77 percent (547 questionnaires) of the returns indicated a need for sewers. Table 4-2 provides a summary of responses to the questionnaire.

Approximately 18 percent of the questionnaires returned reported that they experienced problems with their on-site disposal system. Problems included inability to run dishwashers and washing machines, back-ups, excessive pump outs, groundwater in leaching fields, and Title 5 requirements failures. Problem disposal systems are shown in Figure 4-1 as a red dot.

4.3.2 Housing Density

An additional consideration on the suitability of on-site disposal systems for a particular area is housing density, more specifically lot size. With smaller lot sizes, there is a greater chance of having on-site disposal problems. This is especially important because Title 5 regulations have specific restrictions on lot sizes and setback distances required for on-site disposal. Town assessors information was used to determine the average number of square feet per lot in each of the study areas. This information is summarized in Table 4-2.

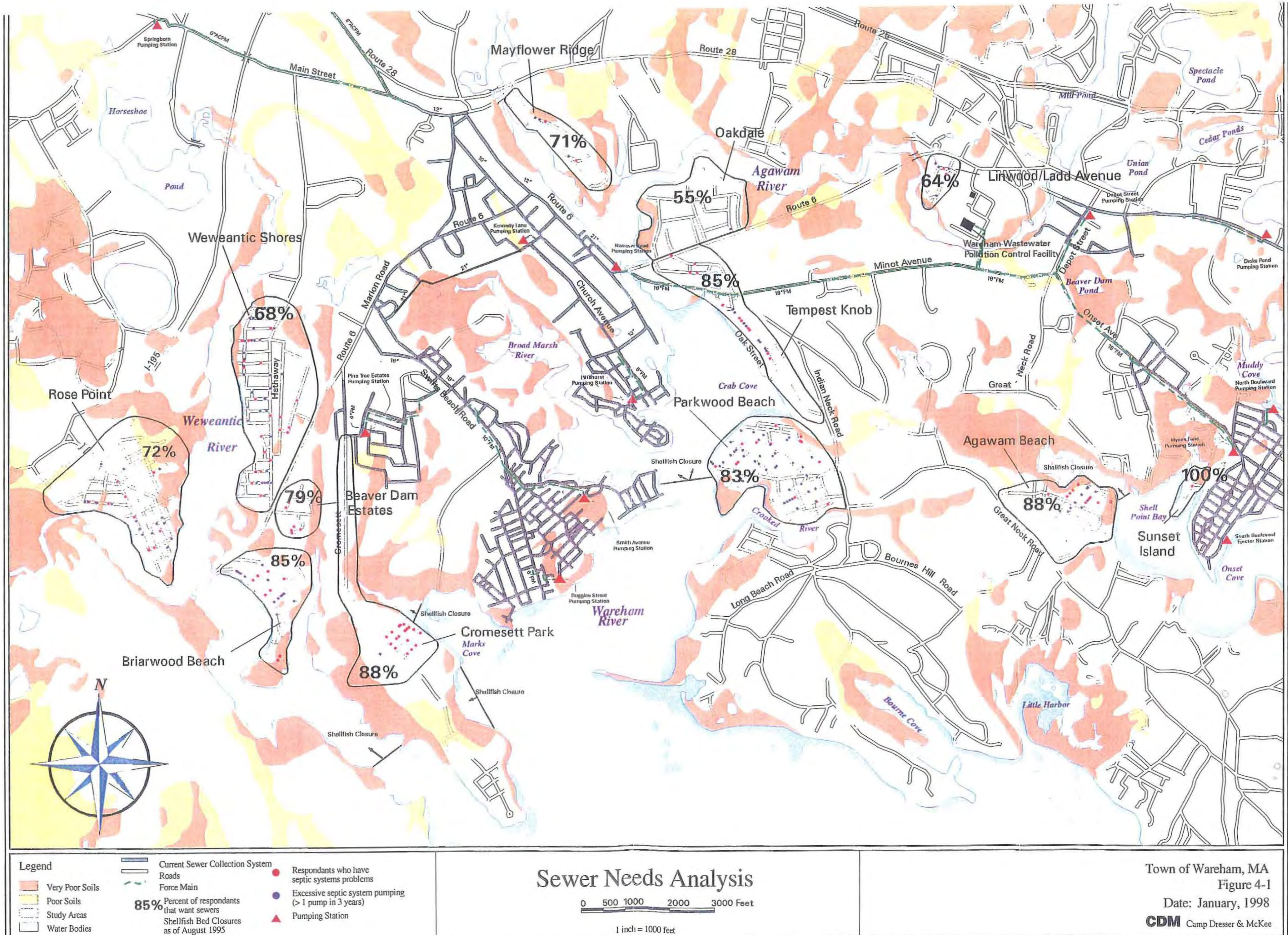
4.3.3 Soil Information

On-site disposal problems can result from poor soil conditions. Soils in the study areas were analyzed using Soil Conservation Service (SCS) data. The SCS maps the location of various soil types and rates each soil type for its suitability in supporting a subsurface disposal system. Soils are rated as slight, moderate, severe, or very severe. A severe rating indicates that intensive correction measures are required to overcome soil limitations. A very severe rating indicates that major and extremely costly corrective measures must be taken to overcome limitations. Severe and very severe soils within the study area are shown in Figure 4-1 in yellow and orange, respectively.

Table 4-2
Sewage Disposal Needs Assessment

Study Area	Sewage Disposal Needs Survey		Housing Density[1]		
	% of Area that Responded	% of Respondents that Want Sewers	Present Number of Residences	Future Potential Number of Residences (Includes Number of Developable Lots)	Average Lot Size (Acres)
Agawam Beach	42	88	75	142	0.19
Beaver Dam Estates	47	79	37	40	0.42
Briarwood Beach	69	85	136	159	0.18
Cromesett Park	64	88	93	93	0.17
Linwood/Ladd Avenue	35	64	32	32	0.38
Mayflower Ridge	16	71	41	46	0.53
Oakdale	42	55	142	218	0.32
Parkwood Beach	42	83	280	437	0.14
Rose Point	50	72	201	224	0.22
Sunset Island	60	100	17	24	0.13
Tempest Knob	23	85	73	74	0.47
Weweantic Shores	54	68	230	250	0.24
Overall	47	77	1,361	1,739	

Notes:
[1]Town of Wareham Accessors information on the Wareham GIS data system.



Sewer Needs Analysis

Town of Wareham, MA
Figure 4-1
Date: January, 1998
CDM Camp Dresser & McKee

4.3.4 Septage Pumping

If an on-site disposal system is not functioning properly, it will need to be pumped out more frequently. Board of Health septage hauling records were used to determine the frequency of septage pumping. This information was used to supplement the questionnaire results to better estimate the number of problems in each study area. It was assumed that an average on site system should be able to function correctly for 3 to 5 years between each pump. Those residences that pumped more than one time in three years were defined as potential problems and are shown in Figure 4-1 as blue dots.

4.3.5 Needs Assessment Findings

Based on the above information, all 12 study areas demonstrate problems with on-site sewage disposal systems and should be included in the alternatives analysis. Furthermore, based on the fairly uniform geographic distribution of problems within each study area, none of the areas have been reduced in size. The next step is to determine the most reasonable and cost-effective recommendation for each study area, whether it be package treatment, sewerage collection, septic system remediation, or other.

4.4 Alternatives Analysis

In keeping with good facilities planning practices and Section 4.4.3 of the Department of Environ-mental Protection's "Guide to Comprehensive Wastewater Planning," an analysis of alternatives considering several solutions to the wastewater disposal problems of on-site disposal systems in the identified problem areas were addressed, including:

- No-action;
- On-site wastewater disposal replacement conforming to the "State Environmental Code - Title 5";
- Local package treatment facilities;
- Small community disposal systems;
- Conventional gravity sewers;
- Small diameter sewers;
- Low pressure sewers with grinder pumps;
- Low pressure sewers with septic tank effluent pumps (STEP);
- Pumping stations and force mains; and

- Combination of alternatives.

Management practices, including water conservation and on-site disposal system management, were considered as a means of mitigating circumstances that may otherwise contribute to on-site disposal problems. Because most of the disposal problems are related to poor site conditions, management practices are insufficient solutions to the identified existing on-site wastewater disposal problems.

4.4.1 Description of Alternatives

The no-action alternative represents a baseline condition that other alternatives are compared to. It represents the future environmental conditions without expanding the existing sewer service area.

On-site septic systems are designed under the State Environmental Code -- Title 5, to stabilize wastes into a form suitable for disposal to the environment. The septic tank is a common component of the conventional septic system. It is usually constructed of reinforced concrete with compartments for separation of liquids and solids by settling, and for solids storage and anaerobic stabilization. Septic tank effluent is then discharged to a subsurface disposal system. The subsurface system usually consists of either a leaching field, trench, pit, or a mound system. Septic tank solids are pumped out and hauled to a wastewater treatment plant for disposal.

Local package treatment facilities are self-contained units that are designed to treat and dispose of wastewater from a remote community within a town. Rotating Biological Contactors (RBCs) were chosen for the evaluation of this alternative because of the ease of operation, reliability, and previous experience in Massachusetts for these small flow systems.

Small community disposal systems are usually designed to take advantage of a parcel of land near the community that is capable of disposing the wastewater generated by that community through groundwater discharge. Homes in that community would transport wastewater through a collection system to the local community disposal system. The restrictions and regulations for individual on-site disposal systems also apply to small community systems.

Conventional gravity sewers are normally circular pipes constructed of reinforced concrete or polyvinyl chloride (PVC). The minimum diameter is 8 inches to minimize clogging potential along with a minimum slope of 0.4 percent to minimize deposition of solids. Service connections are generally 6 inches in diameter. Much of the cost in constructing conventional gravity sewers is associated with excavation and surface restoration.

Small diameter gravity sewers can be used if preceded by a septic tank that settles and retains solids. Diameters are normally 6 inches and constructed of the same materials as conventional gravity sewers. While there may be a cost savings due to smaller pipe size than conventional gravity sewers, there are additional costs for the septic tank and its maintenance.

Low pressure sewers in a collection system are generally 6 inches in diameter or less. The slope of pressure sewers is not important since the system is pressurized which allows the pipes to follow the natural topography of the land. Therefore, low pressure sewers may be less expensive to construct than conventional gravity sewers. Pressure sewers must be preceded by pumps at each service connection. Two types of pumps can be used. In the pressure sewer alternative, a grinder pump is used to macerate all wastewater solids directly from the house plumbing and pump the sewage into the collection system. In the septic tank effluent pump (STEP) system alternative, a sump pump is installed at the end of a septic tank to pump tank effluent into the collection system. A STEP system also requires that the homeowner maintain their septic tank by having the solids pumped out on a regular basis, similar to having a septic system.

Pumping stations and force mains are typically used in conjunction with sewer alternatives (except pressure sewers). Wastewater in conventional gravity and small diameter sewers flows by gravity. If a section of the sewered community is located in a low lying area where gravity flow to the desired location is not possible, pumping stations and force mains are used to "lift" the wastewater to a location with a higher elevation where the wastewater can resume gravity flow toward the desired destination.

4.4.2 Screening of Alternatives

The no-action alternative was eliminated in all 12 of the needs areas due to the demonstrated problems with existing systems and the potential for associated public health problems.

The local package treatment plant alternative was eliminated from the Linwood/Ladd Avenues analysis due to the proximity of this area to the existing WPCF. The local package treatment plant alternative was also eliminated from the Sunset Island analysis based on land limitations and proximity to the existing sewer collection system.

The low pressure sewers with grinder pumps and low pressure sewers with STEP systems alternatives were eliminated from both the Mayflower Ridge and Rose Point analyses based on the existing ground slopes of these areas. In both cases, the use of low pressure sewers is appropriate on some roads within each area, but due to existing natural downward slopes of a majority of the roads towards a common low point, pressure sewers as a total area solution would be counterproductive because it would require pumping downhill. These alternatives were also eliminated from the Tempest Knob analysis for the above reason and also because of the resulting limitations this alternative would impose on any needs area to the south, such as Parkwood Beach or Agawam Beach.

Due to existing soil and space limitations in the sewage disposal needs areas and because all of the needs areas that have the available land area to support a small community system are also above the range of practical flows for a community system, this alternative was screened out of the cost-effective analysis.

Due to inadequate soil and site conditions in all needs areas and known existing disposal system problems, the rehabilitation and/or replacement of on-site systems alternative was considered infeasible and was eliminated from the cost-effective analysis.

The remaining alternatives were evaluated in the cost-effective analysis.

4.4.3 Cost-Effectiveness Analysis of Alternatives

Once the potentially viable alternatives were determined for each needs area, an analysis was conducted to determine the most cost-effective alternative. The basis of the cost-effectiveness analysis is described in Appendix E. The results of the cost-effectiveness analysis are presented in Table 4-3 in terms of annualized capital costs and annual operation and maintenance costs. Capital costs include costs of constructing local package plants, conventional gravity sewers, small diameter gravity sewers, pressure sewers, pumping stations, force mains, sump and grinder pumps, septic tanks, as well as a 40 percent allowance for engineering and contingencies. An apportioned amount of the cost to expand the hydraulic capacity of the WPCF was also added to the capital cost of each collection system alternative that would convey additional needs area wastewater flows to the treatment plant. Capital costs were then annualized based on a 20-year term at a discount rate of 7.375 percent. Costs for operation and maintenance of package treatment plants, pumping stations, and sump and grinder pumps also included in the analysis.

4.4.4 Least Costly Alternative for Sewage Disposal Needs Areas

Based on the cost-effectiveness analysis and a review of the available information, the least costly alternative for each need areas is highlighted in Table 4-4.

4.4.5 Recommended Alternative for Sewage Disposal Needs Areas

- <u>Agawam Beach</u> — Construct the least costly alternative: conventional gravity sewers with some pressure sewers, a pumping station, and force main to connect with the existing collection system.

- <u>Beaver Dam Estates</u> — Although pressure sewers with grinder pumps at every household and STEP systems are the two least costly alternatives to the town, the economic analysis values are based on town costs and do not include the additional homeowner costs. Homeowner costs include operation and maintenance, such as the power and maintenance costs of either a grinder or septic tank effluent pump as well as the cost of pumping out the septic tank required by a STEP system.

Table 4-3
Economic Comparison of Alternatives

Sewage Disposal	Conventional Gravity with Some Pressure Sewers			Small Diameter Gravity with Some Pressure Sewers			Pressure Sewers			STEP Systems with Pressure Sewers			Package Plant with Conventional Gravity and Some Pressure Sewers		
	Annualized Capital Cost	Annual O&M	Total Annual Cost	Annualized Capital Cost	Annual O&M	Total Annual Cost	Annualized Capital Cost	Annual O&M	Total Annual Cost	Annualized Capital Cost	Annual O&M	Total Annual Cost	Annualized Capital Cost	Annual O&M	Total Annual Cost
Agawam Beach	$129,000	$8,000	**$137,000**	$158,000	$8,000	$166,000	$148,000	$8,000	$156,000	$158,000	$8,000	$166,000	$246,000	$69,000	$315,000
Beaver Dam Estates	$64,000	$5,000	$69,000	$77,000	$5,000	$82,000	$48,000	$0	**$48,000**	$55,000	$0	$55,000	$77,000	$31,000	$108,000
Briarwood Beach	$117,000	$5,000	**$122,000**	$128,000	$5,000	$133,000	$155,000	$0	$155,000	$169,000	$0	$169,000	$274,000	$60,000	$334,000
Cromesett Park	$129,000	$5,000	$134,000	$129,000	$5,000	$134,000	$117,000	$5,000	**$122,000**	$146,000	$5,000	$151,000	$271,000	$66,000	$337,000
Linwood/Ladd Avenues	$50,000	$5,000	**$55,000**	$52,000	$5,000	$57,000	$57,000	$5,000	$62,000	$51,000	$5,000	$56,000	n/a[3]	n/a[3]	n/a[3]
Mayflower Ridge	$101,000	$8,000	**$109,000**	$107,000	$8,000	$115,000	n/a[4]	n/a[4]	n/a[4]	n/a[4]	n/a[4]	n/a[4]	$197,000	$46,000	$243,000
Oakdale	$228,000	$11,000	**$239,000**	$265,000	$11,000	$276,000	$234,000	$7,000	$241,000	$249,000	$7,000	$256,000	$384,000	$62,000	$446,000
Parkwood Beach	$290,000	$20,000	**$310,000**	$426,000	$20,000	$446,000	$371,000	$20,000	$391,000	$458,000	$20,000	$478,000	$526,000	$85,000	$611,000
Rose Point	$303,000	$8,000	**$311,000**	$345,000	$8,000	$353,000	n/a[4]	n/a[4]	n/a[4]	n/a[4]	n/a[4]	n/a[4]	$371,000	$64,000	$435,000
Sunset Island	$15,000	$0	**$15,000**	$21,000	$0	$21,000	$19,000	$0	$19,000	$24,000	$0	$24,000	n/a[5]	n/a[5]	n/a[5]
Tempest Knob	$95,000	$18,000	**$113,000**	$97,000	$18,000	$115,000	n/a[6]	n/a[5]	n/a[6]	n/a[5]	n/a[6]	n/a[6]	$423,000	$93,000	$516,000
Weweantic Shores	$314,000	$31,000	**$345,000**	$351,000	$31,000	$382,000	$394,000	$32,000	$426,000	$384,000	$32,000	$416,000	$704,000	$121,000	$825,000

Note: All values are rounded to the nearest thousand and least costly alternative is in bold.
1. Listed in alphabetical order.
2. Calculated using a discount rate of 7.375 percent compounded over twenty years.
3. Not an appropriate alternative based on proximity to the WPCF.
4. Not an appropriate alternative as a total solution based on existing ground slopes.
5. Not an appropriate alternative based on land limitations and proximity to the existing collection system.
6. Not an appropriate alternative as a total solution based on existing ground slopes and resulting limitations to the alternatives for Parkwood and Agawam Beach.

Table 4-4
Least Costly Alternative Summary

Sewage Disposal Needs Areas	Conventional Gravity with Some Pressure Sewers	Small Diameter Gravity with Some Pressure Sewers	Pressure Sewers	STEP Systems with Pressure Sewers	Package Plant with Conventional Gravity and Some Pressure Sewers
Agawam Beach	X				
Beaver Dam Estates			X		
Briarwood Beach	X				
Cromesett Park			X		
Linwood/Ladd Avenues	X				
Mayflower Ridge	X				
Oakdale	X				
Parkwood Beach	X				
Rose Point	X				
Sunset Island	X				
Tempest Knob	X				
Weweantic Shores	X				

Therefore, because the costs of each alternative as shown in Table 4-3 are reasonably close, it is recommended that conventional gravity sewers, a small pump station, and a force main to the existing collection system be constructed in this area.

- Briarwood Beach — Construct the least costly alternative: conventional gravity sewers with some pressure sewers, a pumping station, and force main to connect with the existing collection system.

- Cromesett Park — Although pressure sewers with grinder pumps at every household and STEP systems are the two least costly alternatives to the town, the economic analysis values are based on town costs and do not include the additional homeowner costs. Homeowner costs include operation and maintenance, such as the power and maintenance costs of either a grinder or septic tank effluent pump as well as the cost of pumping out the septic tank required by a STEP system. Therefore, because the costs of each alternative as shown in Table 4-3 are reasonably close, it is recommended that conventional gravity sewers, a pump station, and a force main to the existing collection system be constructed in this area.

- Linwood/Ladd Avenues — Construct the least costly alternative: conventional gravity sewers with some pressure sewers, a pumping station, and force main to the WPCF.

- Mayflower Ridge — Construct the least costly alternative: conventional gravity sewers with some pressure sewers, a pumping station, and force main to connect with the existing collection system.

- Oakdale — Construct the least costly alternative: conventional gravity sewers with some pressure sewers, two pumping stations, and force main to connect with the existing collection system.

- Parkwood Beach — Construct the least costly alternative: conventional gravity sewers with some pressure sewers, two pumping stations, and force main to connect with the existing collection system.

- Rose Point — Construct the least costly alternative: conventional gravity sewers with some pressure sewers, a pumping station, and a subaqueous force main to connect with the existing collection system.

- Sunset Island — Construct the least costly alternative: conventional gravity sewers with some pressure sewers to connect with the existing collection system.

- Tempest Knob — Construct the least costly alternative: conventional gravity sewers with some pressure sewers, two pumping stations, and force main to connect with the existing collection system.

- Weweantic Shores — Construct the least costly alternative: conventional gravity sewers with some pressure sewers, two pumping stations, and force main to connect with the existing collection system.

A map of the recommended plan for all of the 12 sewage disposal needs areas is included in Figure 4-2.

4.4.6 Priority List for Recommended Alternatives

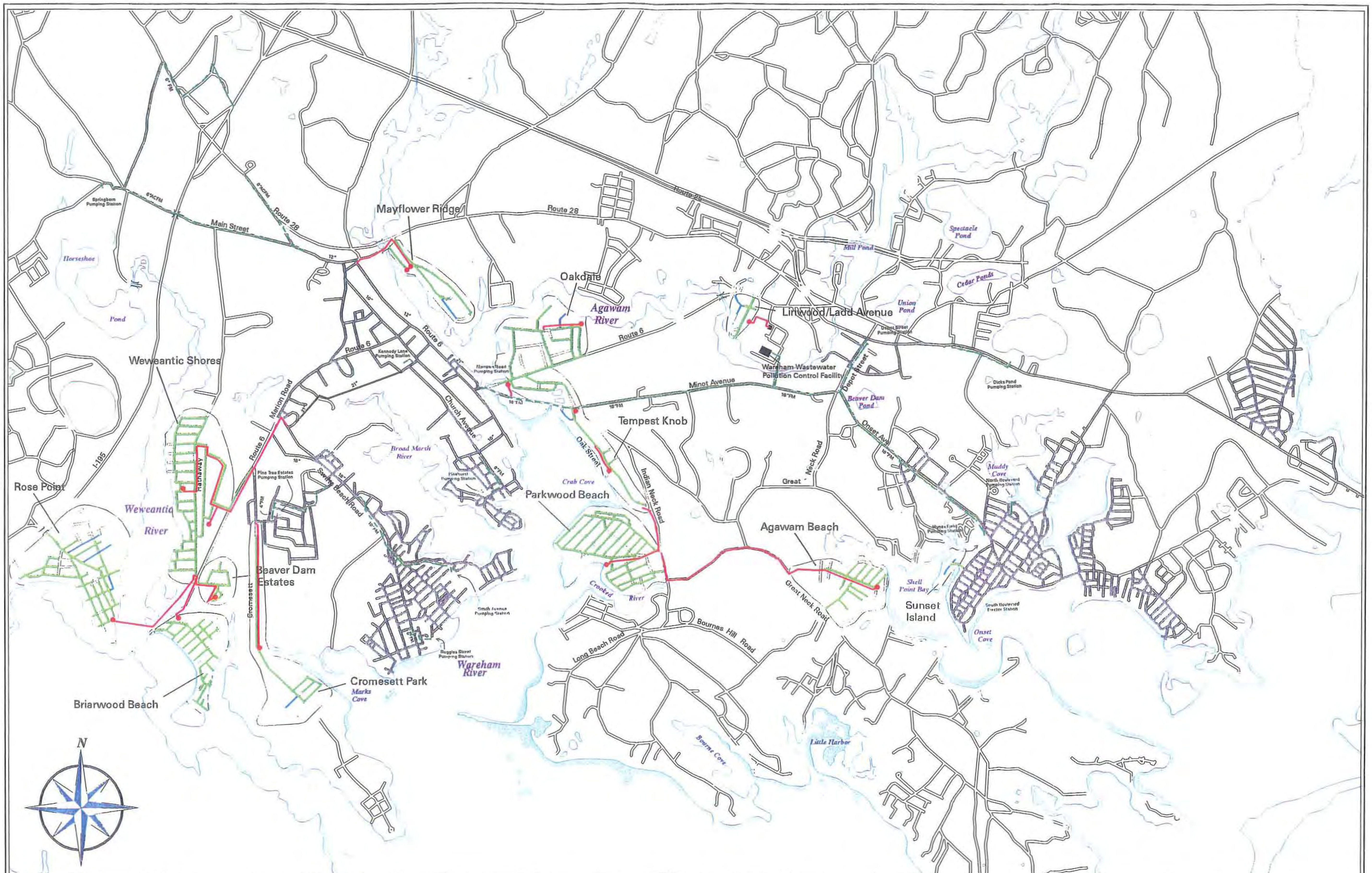
A recommended priority list to determine the order of construction of the recommended alternatives was developed and shown in Table 4-5. The priority list evaluation criteria and the Recommended Priority List were presented at the January 7, 1997 Selectmen's Meeting and unanimously approved in a vote by the Board. The four major evaluation factors considered in determining priority list order were: water body nitrogen levels, needs area size and population density, Board of Health (BOH) records and questionnaire responses, and geographic construction constraints.

Nitrogen loading in Wareham water bodies can come from a number of sources, one of which can be failing disposal systems. The sooner a failing system is eliminated, through connection to a sewer collection system, the sooner any potential nitrogen source is removed. According to the Buzzards Bay Project and CDM's supplemental review of that report, the Weweantic River has the highest level of nitrogen loading followed by the Wareham River and Onset Bay. Therefore, any needs area bordering the Weweantic River, such as Weweantic Shores, was given a higher priority.

Priority was given to large areas having a high density of homes to alleviate the bigger concentration of Title 5 problems. An example of a large, high density area is Parkwood Beach.

Wareham BOH records and the facilities plan questionnaire responses were evaluated to determine the degree of disposal system problems, failures, and excessive septage pumping. Those areas having known Title 5 problems and excessive disposal system pumping were given high priority. For example, Briarwood Beach is an area of high priority to the BOH.

As part of the recommended alternatives section of this report, sewer layouts for each of the 12 sewage disposal needs areas (Figure 4-2) were developed from previous consultant's layout groundwork and field investigations with Wareham's Director of Municipal Maintenance. Based on geographic location of areas and the layouts, certain needs areas must be constructed prior to others because they are either closer to the existing collection system or are part of an interdependent project. For example, Tempest Knob must be constructed prior to either Agawam Beach or Parkwood Beach and Weweantic Shores must be constructed prior to Beaver Dam Estates, Briarwood Beach, and Rose Point, etc.



Legend

Water Bodies	Proposed Sewer	Proposed Pump Stations
Future Sewer Areas	Proposed Pressurized Sewer	Force Main
	Propsed Force Main	
	Current Sewer Collection System	
	Roads	

Recommended Sewage Disposal Needs Plan

0 500 1000 2000 3000 Feet

1 inch = 1000 feet

Town of Wareham, MA
Figure 4-2
Date: January, 1998
CDM Camp Dresser & McKee

Table 4-5
Recommended Priority List

Contract	Needs Area	Capital Cost per Area	Capital Cost per Contract
1	Sunset Island		
	Weweantic Shores[1]	$4,237,000	$4,237,000
2	Briarwood Beach[2]	$1,487,000	
	Beaver Dam Estates[3]	$864,000	$2,351,000
3	Tempest Knob[4]	$1,256,000	
	Agawam Beach	$1,763,000	$3,019,000
4	Parkwood Beach	$3,613,000	$3,613,000
5	Oakdale	$2,951,000	$2,951,000
6	Cromesett Park	$1,744,000	$1,744,000
7	Rose Point	$3,428,000	$3,428,000
8	Linwood & Ladd Avenue	$688,000	
	Mayflower Ridge	$1,370,000	$2,058,000
	Total	**$23,401,000**	**$23,401,000**

Notes:
[1]Must be constructed prior to Beaver Dam Estates, Briarwood Beach, and Rose Point. Located within Weweantic River watershed.
[2]Board of Health's recommendation for the next sewer area. Located within Weweantic River watershed.
[3]Located within Weweantic River watershed. Proximity to Briarwood Beach construction.
[4]Must be constructed prior to Agawam Beach and Parkwood Beach.
[5]Capital costs updated September 2001.

4.5 Previous Sewage Disposal Needs Recommendations

The 1986 Facilities Planning Study by Metcalf & Eddy studied several areas of town and recommended either central collection of wastewater via sewers or continued use of on-lot disposal systems in 14 areas. Metcalf & Eddy's report areas and recommendations are listed in Table 4-6.

Since the 1989 planning study, collection sewers have been built in Cranberry Highway, East Wareham, Jefferson Shores/Indian Mound Beach, Pine Tree Estimates, and Point Independence. Construction of collection sewers in Riverside and Oneset Heights was recently completed in 1997.

Table 4-6
Previous Study Recommendations

Previous Areas of Study	Previous Study Recommended Disposal Alternative	Current Status
Cranberry Highway	Provide Sewers	Built
East Wareham	Provide Sewers	Built
Jefferson Shores/Indian Mound Beach	Provide Sewers	Built
Gateway Shores	Continue On-Lot Disposal	Not Part of Scope of this Facilities Plan
Great Hill Estates	Provide Sewers	Not Part of Scope of this Facilities Plan
Oakdale	Continue On-Lot Disposal	Sewers Recommended in this Facilities Plan
Oneset Heights	Provide Sewers	Built
Onset Island	Continue On-Lot Disposal	Not Part of Scope of this Facilities Plan
Parkwood Beach	Continue On-Lot Disposal	Sewers Recommended in this Facilities Plan
Pine Tree Estates	Provide Sewers	Built
Riverside	Provide Sewers	Built
Shangri-La	Continue On-Lot Disposal	Not Part of Scope of this Facilities Plan
Weweantic Shores	Continue On-Lot Disposal	Sewers Recommended in this Facilities Plan

Section 5
Wastewater Collection System

5.1 Introduction

The existing condition of the wastewater collection system was evaluated to identify any facilities that would be affected by the recommended alternatives for the sewage disposal needs areas. This section describes the existing collection system and provides a capacity analysis of the impacted interceptor sewers and pumping stations. A recommended collection system operation and maintenance program is presented at the end of this section.

5.2 Existing Collection System

5.2.1 Gravity Sewers

The existing collection system consists of approximately 45 miles of public sewer. Approximately 37 percent of the overall population of Wareham is serviced by the wastewater collection system.

5.2.2 Pumping Stations

The Town of Wareham presently operates 29 pumping stations of which five are ejector stations as shown in Figure 5-1 and listed in Table 5-1.

A report on field evaluations of each pump station are included in Appendix D.

5.3 Evaluation of Impacted Wastewater Collection System

5.3.1 General Methodology

In evaluating the existing wastewater collection system, it is necessary to include an analysis of the hydraulic capacity of facilities conveying additional proposed wastewater flows. Future flows, through the year 2017, will include existing wastewater flows as well as flows contributed from the recommended extensions to the sewer service area.

5.3.2 Pumping Stations

Of the 29 pumping stations in the Wareham wastewater collection system listed in Table 5-1, only three stations will be impacted by additional flows from proposed sewer extensions. The impacted pump stations are Hynes Field, Kennedy Lane, and the Narrows. The Hynes Field station will only be impacted by the addition of flows from the Sunset Island needs area. Because this is a relatively small area and the additional flow is only a fraction of the existing flow, it was assumed that any impact would be minor and therefore did not require further evaluation. The Kennedy Lane and the Narrows pump stations were evaluated for existing capacity, existing flow, and the impact of future flows from the recommended sewer extension areas. The peak hour capacity analysis is shown below.

Legend

Water Bodies
Study Areas
Pumping Station
Current Sewer Collection System
Roads
Force Main

Existing Sewers and Pumping Stations

0 500 1000 2000 3000 Feet

1 inch = 1000 feet

Town of Wareham, MA
Figure 5-1
Date: January, 1998
CDM Camp Dresser & McKee

Table 5-1
Wareham Pump Stations

Number on Figure 5-1	Pump Station Name
1	Cohasset Narrows
2	Hill Street (Jefferson Road)
3	Saltworks Road
4	Dick's Pond
5	Depot Street
6	Minot Avenue
7	Hynes Field
8	North Boulevard
9 (1)	South Boulevard
10	Onset Pier
11 (1)	East Boulevard
12	South Water
13 (1)	Greene Street
14 (1)	Bay Street
15 (1)	Woodbury Street
16	Industrial Park I
17	Industrial Park II
18	Kennedy Lane
19	Narrows
20	Pinehurst (Franconia Avenue)
21	Smith Avenue
22	Ruggle
23	Pine Tree Estates (Terry Lane)
24	Springbourne
25	Nanumett
26	Peter Copper Drive
27	Police Station
28	Riverside
29	Oneset Heights

Notes:
(1) Ejector station.

Pump Station	Number of Pumps	Capacity of Each Pump (gpm)	Existing Peak Hour Flow (gpm)	Future Peak Hour Flow (gpm)
Kennedy Lane	2	2,800	664.2	1079.2
Narrows	3	2 @ 1,600 & 1 @ 1,000	1229.8	1672.8

Based on the above, both of the impacted pump stations have capacity to handle the additional flow.

5.3.3 Gravity Sewers

The sewer system extensions recommended in Section 4 are generally located along the periphery of the existing collection system. Wastewater flows generated from these sewer system extensions would be conveyed along sewer routes to the existing collection system. An analysis was performed on the impacted collection system interceptors. Four existing system interceptors will be impacted be the future needs area sewer extensions. Impacted interceptors include a 12-inch pipe on Main Street, an 18-inch and a 21-inch pipe reach on a cross country route from Swifts Beach Road to the Kennedy Pump Station, and a 21-inch pipe on Main Street before the Narrows Pump Station.

Manning's equation was used to calculate the capacity of a gravity flow pipe flowing full at normal (non-surcharged) flow.

$$V = 1.486/n^* R\ (2/3) * S\ (½)$$

where:

V = velocity (fps)
n = Manning roughness coefficient (0.013)
R = hydraulic radius (ft)
S = pipe slope (ft/ft)

$$Q = A * V$$

where:

Q = pipe capacity (cfs)
A = cross sectional area (sf)
V = velocity (fps)

Existing flows through these interceptors were estimated and added to the projected sewer flow from the recommended sewer extension areas. The interceptor capacity analysis is shown below.

Pipe Size (inches)	Pipe Location	Minimum Slope	Velocity (fps)	Capacity (cfs)	Existing Peak Hour Flow (cfs)	Future Peak Hour Flow (cfs)
12	Main Street	0.0022	2.128	1.671	0.721	0.781
18	Cross Country	0.0012	2.059	3.639	1.115	1.558
21	Cross Country	0.0010	2.083	5.011	1.395	2.320
21	Main Street	0.0010	2.083	5.011	2.656	3.873

Based on the above, all four of the impacted interceptors have capacity to handle the additional flow.

5.4 Wastewater Collection System Improvements

In evaluating the existing wastewater collection system for present and future flows, the sewer collection system and the pump stations are adequate to handle both the present and future flows in the town. Other factors that will affect the collection system include I/I. Recommendations for impacted facilities and I/I reduction is summarized below.

5.4.1 Recommendations for Impacted Pumping Stations and Interceptors

Based on the capacity analyses discussed in Section 5.3.2 and 5.3.3 both the existing pump stations and gravity interceptors have capacity to handle existing flow and additional future flows from the recommended sewer extension areas.

5.4.2 Recommendations for Infiltration/Inflow

Based on the flows and loads analysis in Section 3, an infiltration rate of approximately 203,000 gpd occurs during the winter period. Inflow for the present collection system appears to be negligible based on rainfall records and WPCF data. It is recommended that the town start with a continuous flow monitoring program and, if necessary, followed by flow isolation and television inspection programs to identify the locations of collection system deficiencies and reduce infiltration.

5.5 Collection System Operation and Maintenance Program

Proper operation and maintenance of a collection system can significantly effect future operation and maintenance costs, as well as the effectiveness of the gravity sewers, pumping stations, and treatment facility.

There are two types of maintenance — preventative and emergency. Preventative maintenance is performed to keep the collection system operating smoothly with minimum stoppages, odor complaints, and pumping station failures. Emergency maintenance is performed when there is a problem within the collection system that needs immediate attention.

An operation and maintenance program should emphasize preventative maintenance of the sewers, pumping stations, and treatment facilities. Preventative maintenance minimizes emergency maintenance; therefore, it maximizes the effectiveness of the system. The town should commit to the proper execution of this program.

5.5.1 Gravity Sewers

As part of a complete preventative maintenance program, gravity sewers should be inspected and cleaned on a regular basis. Inspection of the collection system is necessary to identify and evaluate existing or potential problem areas in the collection system. Inspection includes visual inspection of manholes and mirroring of sewers. Inspection serves two main purposes: preventing leaks and identifying existing leaks in the collection system. CDM recommends the town develop a schedule for routine inspection of the collection system.

Cleaning is a necessity in any collection system. Cleaning prevents the development of blockages. There are numerous types of cleaning equipment available, each with certain applications, advantages, and limitations.

5.5.2 Pumping Stations

Routine maintenance of pumping stations is essential to keeping the collection system running smoothly. Pumping station failure in the system could mean sewerage backups, homeowner complaints, and possibly public health concerns.

Preventative maintenance of pumping stations includes routinely inspecting and testing the pumps, controls, motors, flow measurement devices, valves, electrical cables, generator, and any other equipment in the station. Also included would be a routine schedule for replacing bearings, packings, seals, lubricating equipment, and regular checking of pumps by an outside vendor (i.e., vibrations, motor efficiency, and pump balance). The town should establish the frequency of routine maintenance based on experience and familiarity with equipment in each station.

Section 6
Wastewater Treatment

6.1 Introduction

This section identifies and evaluates capacity, performance, and adequacy of the existing Water Pollution Control Facility (WPCF). This section presents the alternatives analysis completed in the January 1998 Draft Facilities Plan. Also included are updated WPCF loads, flows, and design criteria used in the final recommended alternative prepared in 2001. The recommended alternative includes consideration of pending NPDES permit limits and is currently under final design.

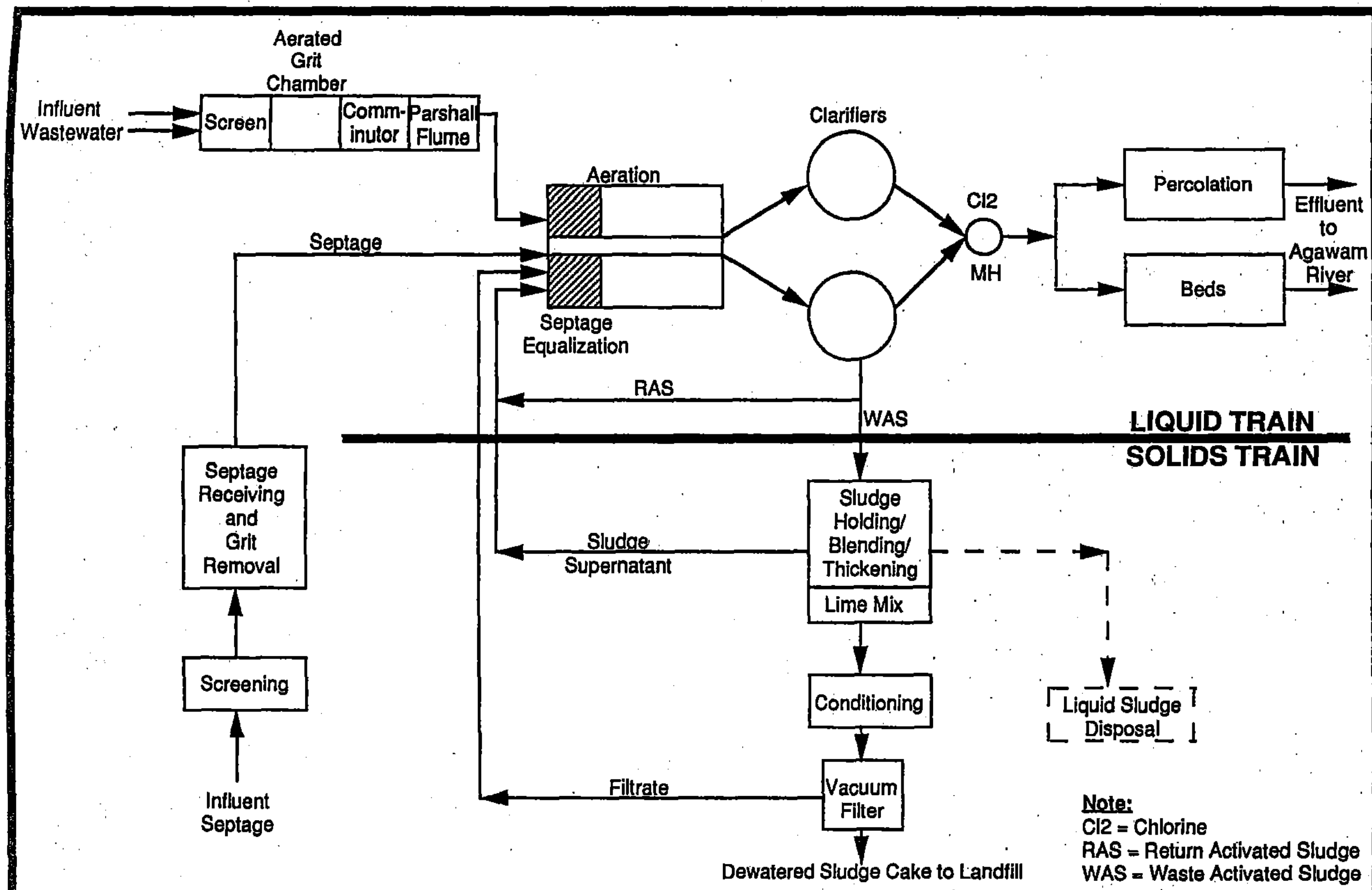
6.2 Existing Water Pollution Control Facility

6.2.1 History of Operations

Wareham's existing secondary WPCF has been operating since 1972 as a conventional activated sludge facility. A process schematic of the facility is shown on Figure 6-1. Wastewater for the entire sewerage system is collected and enters the WPCF through two 18-inch force mains. Once flow enters the facility, preliminary treatment is provided by a manually cleaned bar screen, aerated grit chamber, and a comminutor. Following preliminary treatment, flow passes to secondary treatment comprised of two aeration tanks; two 55-foot diameter clarifiers; a chlorine mixing manhole; and eight sand percolation beds. Flow from the percolation beds is collected into one of four outfall pipes that convey flow to the Agawam River.

Septage is received at the Sludge Dewatering Building in one of two covered channels where the septage is screened with manually cleaned coarse screens. Grit is removed by gravity as septage passes through two in-line grit sumps prior to the septage receiving tanks. Flow then passes through a "muffin monster" grinder and is pumped up to one of four septage equalization tanks located adjacent to the aeration tanks. The septage is aerated and then slowly blended into the aeration tank wastewater stream.

The sludge facilities or "solids train" is comprised of four sludge holding tanks, two vacuum filters, two on-site sludge landfill lagoons, and odor control. There are no primary clarifiers, so all sludge is waste activated (WAS). Previous to 1995, sludge was dewatered on-site using vacuum filters located in the Sludge Dewatering Building. Processing included lime stabilization, ferric chloride or polymer addition, and sludge cake disposal at the Town of Bourne Landfill. Disposal at the Bourne Landfill was stopped on July 1, 1997, per order of the Town of Bourne Board of Selectmen. Currently WAS is pumped to sludge holding tanks where it is decanted and pumped to trucks for liquid disposal by an outside contracted hauler.



Town of Wareham, Massachusetts
Wastewater Facilities Plan
Process Schematic
Figure 6-1

CDM Camp Dresser & McKee

6.2.2 Evaluation of Existing WPCF Liquid Train

Headworks

The headworks consists of three parts: screening, grit removal, and comminuting. Overall, the condition of the headworks is poor. The mechanical and concrete surfaces below the headworks cover are extremely deteriorated from hydrogen sulfide attack. The grit chamber is often by-passed due to mechanical problems with equipment. As a result, grit enters the aeration tanks and periodically must be removed by lowering a Bobcat tractor to scrape out several feet of sand.

Septage Receiving and Septage Equalization

Septage is received at the Sludge Dewatering Building where it is screened, degritted, aerated and temporarily stored in a 14,000-gal septage receiving tank. The manually cleaned screens and bar rack are in fair condition. The grit settling in the two settling chambers seems to remove grit well for the septage stream but require manual removal of grit from the sumps. Based on the volume of the septage received a more efficient system should be installed. The receiving tank is in good condition.

The pumps and grinders used to pump septage from the receiving tank to the equalization tanks are in good condition and appear adequate for the future. Once in the septage equalization tanks, septage is mixed with plant sidestreams, aerated for a period of time and then bled into the receiving stream of the wastewater aeration basins via four septage equalization pumps. Two of the four septage equalization pumps were installed in 1979, and two in 1992. These pumps are located in two mirror-image Septage Equalization Pump and Blower Buildings that were installed in a converted portion of the original aeration tanks. The condition of the 1979 septage equalization pumps is poor and they should be replaced, and the newer pumps are in fair condition.

Aeration Basins and Secondary Clarifiers

There are two aeration basins (96-ft x 48-ft x 13.3-ft) and two secondary clarifiers (55-ft diam. x 10-ft SWD). Based on a MLSS of 3,400 mg/L, an SRT of 5 days, and an SVI of 200 ml/g, the capacity of each component was evaluated. The capacity of the aeration tank was found to be 1.55 mgd at maximum monthly flow. The secondary clarifiers were found to have a capacity of 3.53 mgd at peak hour flow and 2.71 mgd at maximum daily flow.

Based on this information, the aeration basins appear to have adequate volume to handle existing flows and the first two sewer expansion areas, however, there is not enough capacity in the existing tanks to nitrify, which will be required by the NPDES in the future. The secondary clarifiers do not have adequate capacity to handle the existing peak hour flow. Therefore, neither the aeration tank nor the clarifiers are adequate to treat future flows and meet anticipated permit limits.

Disinfection

Chlorine gas is used for wastewater disinfection. It is injected via a baffled manhole located between the secondary clarifiers and the sand percolation bed distribution system. The contact time is achieved in the manhole, distribution system and sand percolation beds prior to discharge of effluent to the Agawam River. Chlorine storage and feed equipment is located in the Operations Building. The facilities are adequate but future permits may pose new limits on chlorine residuals, therefore, alternate disinfection systems should be considered in future modifications.

Sand Percolation Beds and Outfall Pipes

Filtration is accomplished with eight 0.5-acre sand percolation beds. These beds provide final polishing and generally work well although there have been some ponding problems in the past. Operators found that excessive compaction of bed media was partly responsible for the low percolation rates and corrected this by using a small Bobcat tractor to work on the media instead of larger earth moving equipment.

Plant effluent is collected from the sand percolation beds via 4 outfall pipes that convey flow to the Agawan River. An important issue regarding the outfalls is the likelihood that the open-jointed outfall pipes are under the influence of groundwater during seasonal high groundwater periods. Therefore, an alternate method of effluent collection and discharge should be evaluated. Based on a design loading rate of 9.4 gpd/ft2, the existing beds have some additional capacity but not enough to accommodate all of the future flows. Either more beds or an alternate filter system should be incorporated into WPCF upgrades.

6.2.3 Evaluation of Existing WPCF Solids Train

Sludge Holding

Waste activated sludge (WAS) from the secondary clarifiers is pumped to one of four sludge holding tanks at an average rate of 30,000 gal/day. There is a total of 312,000 gallons of storage capacity, providing approximately 10 days of storage (assuming no decanting and average flow). This is sufficient for the current conditions plus some collection system expansion. Each tank is equipped with both mixers and aeration. Presently, the aeration equipment is not used because of excessive foaming problems.

The current decanting practice is not in accordance with the original odor control design and is contributing to odor control problems in the sludge holding tank area. Thus, a more efficient way of decanting that is compatible with the odor control system should be evaluated.

Sludge Dewatering and Disposal

Two vacuum filters were used to dewater the WAS prior to 1995. Lime and ferric were added to condition the sludge resulting in an average dewatered cake of about 16-percent solids. Dewatered sludge cake had been mixed with wood chips and sand

and trucked to the Bourne landfill for disposal. As of July 1, 1997 the Town of Wareham has discontinued sludge landfilling per order of the Bourne Board of Selectmen. In response, the town of Wareham (through CDM) issued a request for proposals (RFP) in 1997, to dispose of the sludge generated at the plant. Both dewatered cake and liquid sludge alternatives were included. Liquid disposal was the most cost-effective bid received. Sludge is presently removed in liquid form and hauled to the Cranston, Rhode Island WWTP for dewatering and incineration. A cost analysis should be done to determine if off-site liquid hauling is an economical solution for future Wareham WPCF sludge disposal.

Odor Control in the Sludge Dewatering Building

Odor control for this facility is comprised of four carbon units located on the second floor. The carbon media in two of the units was replaced within the last 8 years while the other two units have never had the media replaced. Dehumidifiers were not installed, resulting in a constant water level in the units. Based on field observations and discussions with neighbors, the odor control system is not effective and if sludge dewatering commences, the town should consider replacing the carbon units with a biofilter or packed tower scrubber.

On-Site Sludge Landfill

Construction of an on-site sludge landfill complete with leachate collection system was completed in 1995, and is located adjacent to the existing percolation beds. At this time, the town does not intend to use the landfill for sludge disposal, but maintains the landfill as an emergency backup.

6.3 Biological Nutrient Removal Alternatives Analysis

At the time the January 1998 Facilities Plan was prepared, effluent guidelines for the NPDES permit were uncertain. In order to determine the level of treatment that would be most cost-effective as well as meet the lowest anticipated nitrogen effluent guideline the state was likely to impose, upgrades for three levels of nitrogen discharge was evaluated. The three levels are a total effluent nitrogen value of 10 mg/L, 5 mg/L, and 3 mg/L. For a total nitrogen limit of 3 mg/L, two methods of treatment were evaluated. Innovative nitrogen removal technologies were compared to biological treatment and were not found to be cost effective. Note, headworks, clarification, disinfection, and filtration upgrades would remain the same for all biological nutrient removal alternatives. Each alternative is described below.

6.3.1 Description of Biological Nutrient Removal Alternatives

Option 1 – Designing for a 10 mg/L Total Nitrogen Limit

For a total nitrogen limit of 10 mg/L, the recommended treatment process would be to remove the nitrogen biologically using a method referred to as the Modified Ludzack Ettinger (MLE) Process. This process uses anoxic and aerobic zones with a high recycle rate (around four times the influent flow rate) to accomplish nitrification and denitrification. Based on the MLE requirements, the future process train would consist of four 0.43 MG anoxic tanks, three 1.10 MG aeration tanks, and eight 800-gpm recycle pumps.

Option 2 – Designing for a 5 mg/L Total Nitrogen Limit

For a total nitrogen limit of 5 mg/L, the recommended treatment would be using a Bardenpho process. This process uses an anoxic zone followed by an aeration zone (with recycle back to the anoxic zone) followed by a second anoxic zone followed by a final reaeration zone. Based on the Bardenpho requirements, the future process train would consist of four 0.47 MG anoxic tanks, three 1.10 MG aeration tanks, four 0.17 MG second anoxic zone tanks, one 0.072 MG reaeration tank, and eight 1000-gpm recycle pumps.

Option 3 – Designing for a 3 mg/L Total Nitrogen Limit using Bardenpho

The first 3 mg/L total nitrogen option is a Bardenpho process. For the Bardenpho process, the future process train would consist of four 0.50 MG anoxic tanks, three 1.10 MG aeration tanks, four 0.17 MG second anoxic zone tanks, one 0.072 MG reaeration tank, and eight 1000-gpm recycle pumps.

Option 4 – Designing for a 3 mg/L Total Nitrogen Limit using MLE and Denitrifying Filters

The second 3 mg/L total nitrogen option is an MLE followed by denitrifying filters. Like Option 1, the MLE facilities include four 0.43 MG anoxic tanks, three 1.10 MG aeration tanks, and eight 800-gpm recycle pumps. Additionally, Option 4 includes three 9.5□ft x 35□ft x 6□ft denitrifying filters. The MLE process can achieve total nitrogen removals such that effluent nitrogen concentrations are on the order of 8.5 mg/L, and a properly operating and well maintained MLE system followed by denitrifying filters can achieve total nitrogen concentrations of approximately 3 mg/l.

6.3.2 Summary of Costs and Best Alternative

A comparative cost analysis was performed in the January 1998 Facilities Plan. The present worth and equivalent uniform annual cost for the various biological nutrient removal (BNR) alternatives are presented in Table 6-1. The cost estimating factors used are presented in Table 6-2. These costs were used to evaluate the relative capital and O&M costs differences as they relate to the degree of treatment (nitrogen removal).

The cost estimate shows that reducing effluent nitrogen concentrations to 3 mg/l of total nitrogen with MLE and denitrification filters costs is the most cost effective option offering the most nitrogen removal. Therefore, the recommended alternative is Option 4, the Modified Ludzack Ettinger (MLE) process with denitrification filters.

6.4 Conceptual Design Period (1998-2001)

Since the publication of the January 1998 Draft Facilities Plan, significantly more information has been collected. The previous subsections (6.2 and 6.3) were based on

Table 6-1
Summary of WPCF Upgrade Costs

Alternative	Capital Cost	O&M Cost	Present Worth Entire Plant	EUAC Entire Plant
10 mg/l Total Nitrogen	$14,190,000	$1,050,000	$25,000,000	$2,430,000
5 mg/L Total Nitrogen	$17,090,000	$1,105,000	$28,500,000	$2,770,000
3 mg/L Total Nitrogen	$17,170,000	$1,107,000	$28,600,000	$2,780,000
3 mg/L Total Nitrogen with Denite Filters	$14,640,000	$1,063,000	$25,600,000	$2,490,000

Table 6-2

Cost Estimating Factors

Operations & Maintenance Assumptions

Electric ($/kw)	$0.11	
Labor ($/hr)	$17.00	
Chlorine ($/lb)	$0.30	
Bisulfite ($/gal)	$2.50	
Maintenance	3%	of Equipment Cost
Miscellaneous	10%	of Power+Chem+Labor+Main.
Land Cost	$80,000	per Acre

Capital Cost Factors

Site Work	30%
Contractor Overhead & Profit	15%
Engineering & Contingency	40%

Cost-Effective Analysis Factors

Discount Rate	7.375%	
Planning Period	20	Years
Useful Equipment Life	20	Years w/No Salvage Value
Useful Structure Life	40	Years
Useful Land Life	100%	of Salvage Value
Engineering News Record	5,851	
Installation Cost for Equp.	50%	
EUAC Factor	0.0972	20 Years @ 7.375%
Dewatered Sludge Disposal	$65	$/Wet Ton
Total Dewatered Sludge	17.50	Wet Tons/d @ 20%

data collected between 1991 and 1997. Since then, present and future flow and loads to the treatment plant have been reevaluated based on treatment plant data from 1996 through 2000. As a result, design criteria were reevaluated and Table 6-3 summarizes the new criteria that were established. Routine project related meetings with the Town revealed additional needs at the treatment plant not previously identified. As a result, all mechanical equipment at the treatment plant was evaluated, and the evaluation revealed that a great deal of the equipment at the plant had reached its useful life. The Town also identified the need for more administrative space and requested a new Administration Building. Also, a water quality study was conducted by CDM to gain a better understanding of nutrient loadings and contributing sources of those nutrients to the Agawam River. The study revealed that the Agawam River estuary in the vicinity of the WPCF discharge was more sensitive to phosphorus than to nitrogen loadings. In addition, improved communication with the DEP has led to a better understanding of likely changes to the existing NPDES permit. Based on verbal comments from the DEP on the January 1998, Draft Facilities Plan and a courtesy draft NPDES permit, effluent limits are very likely to be placed on both total nitrogen and phosphorus. These insights in conjunction with the research conducted prior to 1998, have generated the following recommendations.

6.5 Recommended Modifications

A plan view of the treatment plant, which includes the recommended modifications, is shown in Figure 6-2.

6.5.1 Recommended Modifications to the Liquid Train

Grit/Headworks/Septage Receiving

Based on the age of the headworks, O&M problems associated with the aerated grit unit, and the excessive concrete spawling, it was recommended that the existing headworks be demolished. A new headworks building will be constructed nearby. Proposed headworks facilities will include a new inlet box to accept influent flows from the two existing 18-inch force mains, a parshall flume, a new cylindrical fine screen, a hand-cleaned bypass screen, vortex grit removal chamber, a grit classifier, a septage receiving package plant, and a flow distribution box. Additionally, per request of the Board of Selectmen, equipment to monitor the quantity and source of each septage load will be provided using a pin-code keypad access system and an inline flow meter.

Influent Wastewater Flow Equalization

Two new one million gallon off-line equalization basins will be constructed for dampening peak flows, optimizing the size of downstream treatment processes, and providing more operator flexibility. The proposed location for the equalization basins is in the vicinity of the existing sand percolation beds 3 and 4. The basins will be constructed of earthen materials with a geomembrane liner. The basins will have a grid of coarse bubble diffusers to provide mixing and odor control. At times when not in use, during "non-freezing" times of the year, the basins will be pumped dry

Table 6-3
Design Criteria

Wastewater Flows and Loads

Parameters	Value
Influent Flow (mgd)	
Annual Average Day	1.56
Maximum Day	3.48
Peak Hour	5.39
Secondary Treatment Flow (mgd)	
Annual Average Day	1.56
Maximum Day	2.00
Peak Hour	2.00
Septage Flow (gpd)	
Annual Average Day	23,900
Maximum Day	40,600
Maximum Month	28,700
Wastewater Loads (Average Day - lbs/day)	
BOD	3,800
TSS	2,060
TKN	455
Septage Loads (Average Day - lbs/day)	
BOD	1,000
TSS	3,000
TKN	140
Total Design Loads (Average Day - lbs/day)	
BOD	4,800
TSS	5,060
TKN	595

Preliminary Treatment

Parameters	Value
Influent Screen	
Type	Cylindrical
Number	1
Spacing (inches)	0.25
Grit Tank	
Number	1
Dimensions (feet)	
Diameter	9
Depth	10.75
Septage Receiving Plant	
Number	1
Capacity (gpm)	400
Headworks Blowers	
Number	2
Type	Pos. Displac.
Air Lift Capacity (scfm)	70 at 5.5 psig
SRP Blower Capacity	8 at 4 psig
Influent Equalization Basins	
Number	2
Volume per Unit (gal)	1,100,000
Influent Equalization Blowers	
Number	3 (1 standby)
Type	Pos. Displac.
Capacity per Unit (scfm)	1,845
Influent Equalization Pumps	
Number	2
Type	Vert. Cert./VFD
Capacity per Unit (gpm)	700

Table 6-3 (Continued)
Design Criteria

Biological Treatment

Parameter	Value
Anoxic Selectors	
Number of Selectors	2
Zones per Selector	3
Number of Mixers	6
Mixer Hp (each)	3
Aeration Tanks	
Number of Tanks (Existing)	2
Number of Tanks (New)	1
Dimensions - New Tank (feet)	
Length	96
Width	48
Depth	13.33
Total Effective Volume (mg)	1.38
SRT - Winter (days)	9.8
SRT - Summer (days)	7
MLSS (mg/l)	4,400
Aeration Blowers	
Number	3 (1 standby)
Type	Pos. Displac.
Capacity per Unit (scfm)	5,397
Secondary Clarifiers	
Number of Clarifiers (Existing)	2
Number of Clarifiers (New)	1
Dimensions (feet)	
Diameter	55
Depth	10.17
Total Surface Area (sf)	7,127
Max-Day Overflow Rate (gpd/sf)	281
Max Solids Load Rate (lb/d/sf)	18
Return Sludge Pumping	
Number	4 (1 standby)
Type	Horz. Non-Clog/VFD
Capacity per Unit (gpm)	575
Waste Sludge Pumping	
Number	2 (1 standby)
Type	Screw-Imp. Cent./VFD
Capacity per Unit (gpm)	390
Internal Recycle Pumping	
Number	3 (1 standby)
Type	Vert. Non-Clog, VFD
Capacity per Unit (gpm)	2,220 at 26 feet

Solids Handling

Parameter	Value
Sludge Thickening	
Type	Gravity Belt Thickener
Size (meters)	1.5
Loading Rate (gpm)	450 Max.
Feed Sludge Concent. (mg/l)	8,000
Operating Schedule (hr/day)	7
Processing Rate (dry lb/day)	7,800
Thickened Sludge Conc. (%)	4
Thickened Sludge Transfer Pumping	
Number	2 (1 standby)
Type	Prog. Cavity/VFD
Capacity per Unit (gpm)	90 Max.
Sludge Storage Transfer Pumping	
Number	2 (1 standby)
Type	Prog. Cavity/VFD
Capacity per Unit (gpm)	450 (New Pump) 300 (Existing Pump)
Filtrate Transfer Pumping	
Number	2 (1 standby)
Type	Vert. Non-Clog/VFD
Capacity per Unit (gpm)	420

Table 6-3 (Continued)
Design Criteria

Filtration

Parameter	Value
Type	Downflow/Denitrification
Number	3
Dimensions (feet)	
Length	9.5
Width	16
Depth	6
Total Surface Area (sf)	456
Hydraulic Loading (gpm/sf)	
Average	2.3
Maximum	3

Disinfection

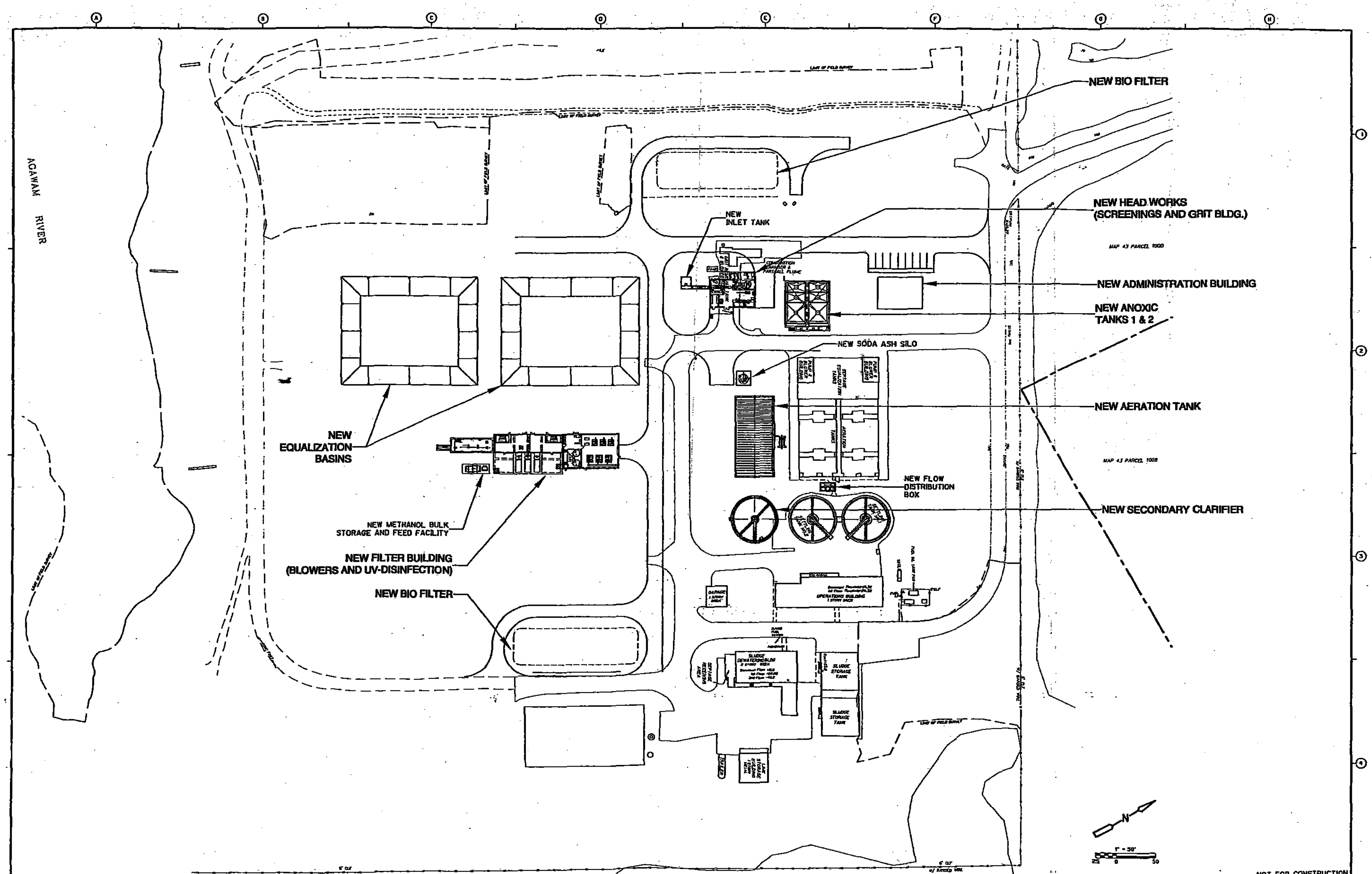
Parameter	Value
Type	Ultraviolet Irradiation
Number of Channels	1
Number of Banks/Channels	3
Number of Modules/Banks	4
Number of Lamps/Modules	6
Number of Lamps	72

pH Control

Parameter	Value
Chemical	Soda Ash (Na_2CO_3)
Feed Rate (lbs/day)	870 - 3,490
Silo Capacity (cf)	2,700
Silo Dimensions (feet)	
Diameter	12
Depth	24

Effluent Quality

Parameter	Value
Total Nitrogen	Variable based on NPDES Permit Requirements - WPCF design based on a future technology limit of 3 mg/l (rolling annual average)
Total Phosphorus	Variable based on NPDES Permit Requirements - WPCF design based on a future technology limit of 0.2 mg/l (rolling annual average)
BOD	<10 mg/l avg. monthly/15 mg/l avg. weekly/20 mg/l max. daily
TSS	<10 mg/l avg. monthly/15 mg/l avg. weekly/20 mg/l max. daily
Fecal Coliform	Geometric mean MPN of 14 organisms/100 ml (<10% greater than 28 organsims/100 ml)



NOT FOR CONSTRUCTION

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY:
DRAWN BY: P. SZAWLOWSKI
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: SEPTEMBER, 2001

CDM Camp Dresser & McKee Inc.

TOWN OF WAREHAM, MASSACHUSETTS
WASTEWATER SYSTEM IMPROVEMENTS
WATER POLLUTION CONTROL FACILITY UPGRADE

NEW FACILITIES GENERAL PLAN

Figure 6-2

and sprayed down via water cannons located along the perimeter of each basin. During winter months the basins will be filled up to 4-ft with plant effluent water to cover and prevent ice damage to the diffusers. All flows to the equalization basins will first go through the headworks facility for screening and grit removal. Wastewater will be diverted to the equalization basins when WPCF influent flows are greater than 2.0 mgd. When flows fall below 2.0 mgd, two new pumps (located in the filter/blower building) will be used to pump wastewater from the basins back into the main treatment facilities. Blowers for the equalization basin aeration system will also be located in the filter/blower building.

Septage Equalization

The four existing equalization tanks for septage will continue to be utilized for purposes of supplementing low flow periods and preventing shock loading to the biological nutrient removal (BNR) system. Septage will flow by gravity from the headworks building to the septage equalization basins. Septage will be blended with in-line flow as needed by pumping to a distribution box with four septage equalization pumps. There are 2 older (installed 1982) septage equalization pumps, and 2 newer pumps (installed 1992) located in two separate septage equalization pump and blower buildings. The 2 older pumps (septage equalization pumps 1 and 2) will be repaired or replaced.

The two newer pumps (septage equalization pumps 3 and 4) were added in 1992 and will remain. New instrumentation and level sensors will be installed in each of the four tanks.

Nutrient Removal

Nutrient removal was discussed in Section 6.3 and the MLE process with denitrifying filters was selected as the recommended treatment process. The MLE process requires the addition of two new anoxic selector tanks, one additional aeration basin, one additional secondary clarifier, and both internal and return activated sludge recycle pumps. The new components are described in the following paragraphs. Note, influent wastewater flow equalization was not incorporated into the January 1998 Draft Facilities Plan, which examined the BNR options. Therefore, the recommended size of the tanks below is different from the volumes outlined in Option 4.

The following flows and loads were used to size the BNR system:

Flows

Average

Annual	1.49 mgd
Summer	1.56 mgd
Winter	1.42 mgd

Peak
Annual 2.0 mgd (based on the use of equalization basins)

Loads

BOD

Annual Average	4,758 lb/d
Maximum Day	8,713 lb/d
Maximum Month	5,841 lb/d winter; 6,752 lb/d summer

TSS

Annual Average	4,946 lb/d
Maximum Day	10,427 lb/d
Maximum Month	5,905 lb/d winter; 6,574 lb/d summer

TKN

Annual Average	590 lb/d
Maximum Day	1,079 lb/d
Maximum Month	723 lb/d winter; 834 lb/d summer

Anoxic Selectors
Two new 0.12-MG anoxic selector tanks will be installed upstream of the existing aeration tanks (26-ft x 52-ft x 12-ft, each tank). These tanks will support microorganisms that consume nitrate and BOD. Each tank will contain three zones. Each zone is designed to select for a different type of microorganism by varying the F/M ratio. The following table describes each zone.

Zone	Length (ft)	Volume (MG)	F/M Ratio
1	13	0.030	3.1
2	13	0.030	1.5
3	26	0.060	0.77

Note that the selector F/M ratios are based on summer maximum monthly BOD loadings (6687 lb/day removed) and 4400 mg/L MLSS, and thus will vary as a function of influent BOD.

Aeration
One new aeration tank will be required to accommodate future flows. The tank will be approximately the same size as the two existing tanks (96-ft x 48-ft x 13.33-ft). The total installed capacity of the three aeration tanks will be 1.38 MG. A tapered fine bubble diffused aeration system will be installed in all three tanks. Thus, the mechanical aerators in the two existing tanks should be replaced with fine bubble diffused air systems. Aeration equipment will be housed in the new filter/blower/UV building, see below. Adding the new tank will require modifications to the existing distribution box between the aeration basins and the clarifiers. An existing soda ash chemical feed system will be used to maintain alkalinity.

Aeration volume was sized to handle the parameters outlined below:

Maximum Month Flow Rate	2.0 mgd
Maximum Day Flow Rate	2.0 mgd
Average BOD Loading Rate	4758 lb/d
Maximum BOD Loading Rate	8713 lb/d
Average BOD Removal Rate (based on 5 mg/L soluble effluent BOD)	4696 lb/d
Maximum BOD Removal Rate (based on 5 mg/L soluble effluent BOD)	8394 lb/d
Alpha	0.55
Beta	0.95
Minimum Winter Temperature	-29°C
Maximum Summer Temperature	38°C
Maximum Summer Wastewater Temperature	20°C
SRT	7.0 days summer; 9.8 days winter
MLSS	4400 mg/L
MLVSS/MLSS	0.80
Oxygen Requirements	5635 lb/d carbonaceous 1152 lb/d nitrogenous
Oxygen Recovered from Denitrification	621 lb/d
Average Day Design Oxygen Requirements	6166 lb/d
Maximum Day Design Oxygen Requirements	11,284 lb/d
Fine Bubble Transfer Efficiency	22.6% standard 9.3% actual

Clarification

One new secondary clarifier will be required to accommodate future flows. The tank will be approximately the same size as the two existing clarifiers (55-ft diam. X 10-ft

SWD). The clarifier mechanisms that were replaced in 1992 have recently been inspected and are in good condition. The mechanisms should be inspected periodically to determine if repair and/or replacement is needed. An alum chemical feed system will be installed with chemical feed points prior to the aeration tanks and at the junction box that distributes water to the three clarifiers to meet the phosphorus discharge limit. A properly operating and well maintained alum chemical feed system is capable of reducing phosphorus concentrations to approximately 2 mg/L.

Secondary clarifiers were sized according to the design criteria below:

Average Day Future Flow Rate	1.49 mgd
Peak Hour Flow Rate	2.0 mgd
Hydraulic Average Day Overflow Rate	209 gpd/sf
Hydraulic Peak Hour Overflow Rate	281 gpd/sf
SVI	150 ml/g
Maximum RAS Concentration	10,000 mg/l
Flow Recycle Rate	1.57 mgd

Internal Recycle
Activated sludge from the aeration tank will be recycled to the anoxic tanks to provide denitrification. This will require the installation of three variable frequency drive pumps, each capable of pumping 3.2 mgd.

Return Activated Sludge (RAS)
A total of 4 new pumps will be installed to replace the existing RAS pumps. One pump will serve each clarifier with the fourth pump to serve as a backup. RAS piping will be extended to convey RAS to the anoxic selector tanks.

Denitrifying Filters
To ensure that the plant is capable of meeting effluent standards, three denitrifying filters will be added after clarification. Methanol must be added to serve as a carbon source for the microorganisms in this filter because of the low effluent BOD coming from the clarifiers. Approximately 3-lb of methanol are required per pound of nitrate-N that has to be removed. Methanol storage is sited for outside the new filter/UV/blower building (see below). A properly operating and well maintained MLE system followed by denitrifying filters can achieve total nitrogen concentrations of approximately 3 mg/L and phosphorus concentrations of approximately 0.2 mg/L with alum addition.

Disinfection

The existing gas chlorine disinfection system will be abandoned and an ultraviolet (UV) disinfection system will be installed. UV disinfection was chosen for its effectiveness at inactivating viruses, bacteria and protozoa as well as its greatly reduced safety concerns, as compared to chlorine. In addition, UV disinfection does have not produce THM by-products and UV is not pH dependent. Three UV banks were chosen. The banks are designed such that one bank will be on at average flow, two banks will be on at peak flow, and the third bank will serve as a backup. This meets the TR-16 requirement which states that treatment plants must be able to disinfect wastewater at peak flow with one bank out of service. The UV banks will be installed in series in one channel to be located outside the Filter/Blower Building under a canopy. The proposed UV system is an in channel, low pressure, high intensity, variable output, self cleaning system.

Outfall

The existing four open jointed pipe outfalls will be abandoned and one new closed joint pipe will be installed to convey treated water from the parshall flume located post UV disinfection to the point of discharge on the Agawam River. To maximize mixing and dispersion with the receiving water, a submerged outfall is proposed.

Biofilter

Two biofilters will be installed for odor control. The headworks biofilter will treat air originating from the inlet box, headworks building, grit chamber and from the septage equalization tanks. The sludge dewatering biofilter will treat air from the GBT and first floor of the sludge dewatering building, filtrate/decantrate intermediate tank (existing septage receiving area), the thickened waste activated sludge storage tank (see below), and sludge storage tanks. The untreated process emissions will not trigger emission levels necessary for permitting. The biofilter is intended to remove odorous compounds from non-hazardous levels to non-detectable levels at the fenceline.

Summary of Recommended Modifications to the Liquid Train

To upgrade the WPCF to meet the existing permit and anticipated future permit goals, the following unit processes are recommended:

- Package headworks to include one rotary fine screen, one vortex grit chamber, and one by-pass screen in place of existing headworks building;
- One septage complete plant in new headworks building;
- Two equalization basins;
- New distribution box structure;
- Two anoxic selectors;

- One additional aeration tank;
- One additional secondary clarifier;
- Three denitrifying filters;
- Three banks of UV disinfection modules;
- Biofilter; and
- Outfall.

6.5.2 Recommended Modifications to the Solids Train

Thickening

Waste activated sludge (WAS) originating in the clarifier bottom will be pumped directly to one new 1.5-m gravity belt thickener (GBT). The GBT will be installed to replace the vacuum filters and will be located on the second floor of the Sludge Dewatering Building. Gravity belt thickening can achieve high solids capture with minimum polymer and high achievable thickened solids concentrations. Although other processes such as dissolved air flotation and centrifuge thickening have similar abilities, gravity belt thickening is recommended for its relatively low capital cost and power consumption. GBTs can thicken the polymer dosed WAS to 4 to 6% solids. The current method of gravity thickening in the sludge holding tanks only thickens to approximately 3% solids, but can be used as a back-up thickening and disposal option. Generally speaking, 5% solids are less expensive to dispose of using liquid haul disposal than 3% solids on an annual basis.

Thickened sludge exiting the GBT will drop into a 250-gallon hopper that will be used to feed one of two new thickened waste activated sludge (TWAS) transfer pumps. The TWAS transfer pumps will pump TWAS to the sludge storage tanks.

Filtrate from the GBT will flow by gravity to the existing septage receiving area. From there, two new filtrate transfer pumps will pump the filtrate to the headworks for further treatment.

Thickened Sludge Storage

Thickened sludge will be stored in the sludge storage tanks until tanker trucks arrive to haul the sludge off-site for ultimate disposal. The storage tanks will have the following characteristics, assuming a dry peak solids loading of 7823 lb/day and a dry average solids loading of 4300 lb/day, and also assuming that 0.8% solids are thickened to 3% or 5% solids.

Volume of TWAS Storage Available	312,000 gal

	3% Solids	5% Solids
Peak Day Volume in TWAS Tank (gal/d)	31,177	18,706
Days of Storage at Peak Day Conditions	10	16.7
Average Day Volume in TWAS Tank (gal/d)	17,154	10,282
Days of storage at Average Day Conditions	18.2	30.3

One new and one existing (Moyno Model No. 1H115) progressive cavity pumps are recommended to transfer sludge to either feed tanker trucks from the sludge storage tanks or pump WAS to the GBT in the backup mode of operation, discussed below. The new pump will be sited near the existing pump in the basement of the Sludge Dewatering Building.

Conditioning

A new polymer system is recommended to condition sludge for gravity belt thickening. The new system will be able to utilize both liquid and dry polymer. Polymer selection is typically based on performance testing by the GBT manufacturer. No sludge samples will be available to use in performance testing until after the plant transitions to the new process. Thus, polymer type (cationic, anionic, neutral) will have to be determined in the start-up phase. Two new polymer feed pumps are recommended as well.

Disposal

Liquid hauling of sludge for off-site disposal will continue. The current disposal contract allows Wareham to haul liquid sludge to Cranston, Rhode Island. Fitchburg, Massachusetts is a back-up disposal site.

Backup Method of Solids Treatment

WAS can be pumped directly to the GBT, and if the GBT cannot be operated WAS can be diverted to the sludge storage tanks with the same pumps. Thus, in addition to storing thickened sludge, the existing sludge holding tanks may also be used to store WAS. When the GBT is fully operational, the sludge transfer pumps located in the basement of the Sludge Dewatering Building will pump WAS from the storage tanks to the GBT. If the GBT is not operational and the tanks fill up, the sludge transfer pumps also have the ability to pump WAS directly to trucks for liquid haul disposal, as is standard protocol for TWAS.

The existing sludge holding tanks are adequate for the anticipated 20-year WAS flows. The following table summarizes sludge holding capacities under future conditions and assumes an influent solids concentration of 0.8% to the tanks.

Volume Available for Sludge Storage	312,000 gal
Average Future WAS production rate	65,000 gal/day

Peak Future WAS production rate	117,000 gal/day
Average Wasting Rate	4,300 lb/day
Days of Storage Under Average Conditions	5.7
Days of Storage Under Peak Conditions	2.7

Supernatant from stored WAS will be pumped to the headworks for treatment using the supernatant transfer pumps in the basement of the Operations Building.

Odor Control

The four existing carbon filter units in the sludge dewatering building will be removed. Ductwork will be installed to convey odors from this building and the sludge storage tanks to a new biofilter.

Summary of Recommended Modifications to the Solids Train

To meet the existing permit, the following unit processes are recommended to upgrade the WPCF solids train:

- One new gravity belt thickener;
- New polymer storage and feed system; and
- New biofilter.

6.5.3 Other Recommended Modifications

In addition to the wastewater treatment and sludge handing upgrades, the following improvements are recommended.

Renovation of the Existing Operations Building

The Operations Building needs to be upgraded to comply with current Handicapped Access and Americans with Disabilities Act Codes. A new women's locker room is also necessary as one does not currently exist. The women's locker room will be located where the men's and women's restrooms are now located. The existing chlorine gas facilities will be abandoned and converted to a comparable men's locker room. Also suggested is the relocation of the breakroom from the basement near all of the WAS and RAS pumps to the ground floor level in the current reception area. Laboratory space will be expanded into the electrical and instrumentation systems room, as that equipment will be relocated to the head operator's office. The electrical and instrumentation systems will also require some replacement and modifications. The remaining existing administrative staff area will be converted into an office.

Renovation of the Existing Sludge Dewatering Building

All equipment on the first floor of the building will be removed. Space will be left on the second floor for future sludge dewatering equipment and conveying system. The mechanical and chemical storage areas will also be upgraded.

New Process Equipment Building (Filter and Blower Building)

A new building is needed to house the denitrifying filter equipment and wetwells, aeration blowers, flow equalization basin pumps, and internal recycle pumps. Keeping these components indoors will extend the useful life of these processes as well as protect equipment from extreme weather conditions. The UV disinfection system will be located underneath a canopy roof just to the side of the new process equipment building. The canopy roof is sufficient to protect the UV equipment from extreme weather conditions. Denitrifying filters will also be located outside, although all critical components listed above will be housed indoors.

New Administration Building

A new administration building constructed from a prefabricated wood frame is recommended. The building will contain administrative office space, the water pollution control facility's main control room, a conference room, restrooms, and file storage space. The building will be wired to run the plant using a SCADA system, which would allow the operators to monitor plant performance from a single location. SCADA would also allow for future control of the Town's 29 pumping stations.

New Soda Ash Silo

A new soda ash silo will be built outside on a concrete pad near the existing aeration tanks. This system is needed to maintain the pH requirements of the MLE process.

Class I Reliability

The mechanical and electrical systems of the upgraded facility must be designed for Class I reliability per EPA-430-99-74-001. A wastewater treatment works would require Class I reliability if it discharges into navigable waters that could be permanently or unacceptably damaged by the effluent which was degraded in quality for only a few hours. Class I reliability is also required for discharges into shellfish waters. The major requirements of Class I reliability are as follows:

1. Provide physical protection of the treatment facilities from the 100-year flood and operation during the 25-year flood;

2. Provide standby or backup components and equipment to enable the plant to handle design flow rates; and

3. Provide two separate and independent power sources consisting of utility service and an in-plant generator.

To address the first point, access to all WPCF buildings, equipment, and systems are above elevation 20.0. This is well above the 100-year flood elevation of the Agawan River is the vicinity of the WPCF (El. 15.0).

To address the second point, standby units are recommended for all mechanical equipment (i.e. pumps, blowers, UV disinfection, etc.). These standby units will allow the plant to operate with its largest unit out of service. A detailed description of equipment and standby units provided for each process is contained in Table 6-3.

To address the third point, two separate and independent power sources are recommended and provided in the design. The primary power source is the electrical utility service provided at the site. The other power source is generators. One existing generator and a new 1000 kW, 1250 kva rated generator will supply 480 volt, 60 Hz, 3-phase power to the WPCF. The generators are capable of supplying power to all vital processes during peak wastewater flow conditions and sufficient power for critical lighting and ventilation.

6.5.4 Cost of Recommended Modifications

The total opinion of probable construction costs for the recommended improvements is 24.3 million dollars. This cost includes engineering and contingencies.

6.5.5 Impact on Staffing

The recommended modifications to the WPCF will affect staffing. Staff size, organizational structure, and work schedules are discussed below.

Staff Size

At this stage it is recommended that the Town remain open to the idea of hiring additional staff once the modifications are completed due to the increased complexity of the future plant. A facility staff of 11 persons is presently in place to oversee and maintain the wastewater treatment facility and 29 associated off-site facilities. Tasks performed by the staff include operation and maintenance of equipment, sampling and laboratory testing required by the discharge permit, and administrative functions associated with WPCF operation. At this time it is believed that the need for additional staff will be offset by the automation afforded by the supervisory control and data acquisition (SCADA) system, but final recommendation is being deferred to the startup phase.

Organizational Structure

The current organizational structure of treatment plant staff is shown on Table 6-4. Current staff members, positions held, and highest license grade obtained if applicable are included.

Table 6-4
Organizational Structure of the Wareham WPCF

Title	Name	License Grade
Superintendent/Chief Operator	David Simmons	7-C
Assistant Chief Operator	Will be filled March 2002	
Lead Maintenance Technician	Daniel Meadows	6-C
Laboratory Technician	Patricia Nieman	6-C
Operator/Maintenance	Jack Paczosa	5-C
Operator/Maintenance	Brian Miller	5-C
Operator/Maintenance	Peter Mooney	4-C
Motorized Equipment Operator	Anthony Pires	
Laborer	Louis Gonzalez	
Department Assistant III	Anna Davis	
Department Assistant II	Deborah Correia	

Because Wareham will be upgrading to a more sophisticated and complex treatment process, increasing the technical expertise of the upper level staff is suggested. The job descriptions for a Superintendent/Chief Operator and an Assistant Chief Operator presently require a Grade 5 operator's license. The Town should consider upgrading this requirement to at least a Grade 6 since that level license will be required for the upgraded facility. Note that the current Superintendent/Chief Operator holds a Grade 7-C license and would not require further certification to maintain his position once the new plant comes online.

In addition, the Town should consider adding a position entitled *Lead Operations and Maintenance Technician* in place of one of the Operator/Maintenance positions. In addition to monitoring and adjusting process control parameters, this individual would be responsible for addressing and resolving complex facility maintenance issues.

The open positions and recommended *Lead Operations and Maintenance Technician* position could be staffed through promotions of members of the existing staff. This would allow the Town to fill these important positions with well-qualified staff that have shown dedication to the operation and maintenance of the existing facility.

Work Schedules

All staff is typically assigned to work Monday through Friday with weekend coverage through overtime on a rotational basis. Saturday coverage follows the current practice of one staff member doing plant rounds and receiving septage for 8 hours. Two other staff members do liftstation rounds for 4 hours each. Sunday and holiday coverage consists of two staff members doing an abbreviated version of a weekday check of the plant operations followed by liftstation rounds for 4 hours each. Based on this schedule, overtime comprises 12.1% of the labor budget.

An alternative scheduling approach is staggered work weeks. For example, staff is divided into two parts where one half works a Sunday through Thursday workweek while the other half works a Tuesday through Saturday workweek. This arrangement can reduce some of the scheduled overtime, but requires an additional employee [what position?]. A few drawbacks to this system are that when a regularly scheduled employee goes on vacation or is sick, staff covering these shifts will likely earn overtime and staffing will be "light" on Mondays and Fridays between the two work weeks.

The Town can reevaluate these options and determine if they want to deviate from the standard Monday through Friday workweek.

The Town of Wareham will continue to coordinate with the DEP on major changes to the Wareham WPCF staffing plan.

Section 7
Financial Impacts of Proposed System Improvements

7.1 Introduction

As described elsewhere in this report, the Town of Wareham (the "Town") is undertaking a major capital improvement program to construct and upgrade its existing Water Pollution Control Facility (WPCF) and extend its sewer system. The purpose of this section is to evaluate the financial impacts of the proposed improvements and to assess the impacts on the Town and its ratepayers.

The total estimated project capital costs for the recommended project is $47.7 million. The estimated construction costs of the Water Pollution Control Facility (WPCF) will be $24.3 million and the remaining $23.4 million will be spent on improving or extending the collection systems in eleven areas of the Town.

7.2 Methodology

We have projected expenses, revenue requirements, and rates using standard industry methods. Our analysis relies heavily on data and information provided by the Town. Our approach has been to project sewer revenue requirements with and without the project for a ten year forecast period (through 2012). These costs are then allocated to ratepayers and taxpayers in accordance with current town funding principles. We then illustrate the impact on typical households.

CDM assessed the Town's required revenue requirement taking into account likely changes in capital and operating costs, outstanding debt service and likely changes in sewer demand. The basis for these projections is the Town's FY 2002 approved budget. CDM developed a spreadsheet based forecasting model that allowed us to quickly and systematically evaluate alternatives.

7.3 General Assumptions

We have developed projections of the potential impacts of the planned wastewater improvements for FY 2003 through 2012 using the following key assumptions:

- The cost of operating and maintaining the sewer system will be recovered through sewer user fees assessed to retail customers.

- Labor costs, operation and maintenance expenses and other expense data used in the wastewater rate model are based on the FY 2002 sewer budget and inflated to future years assuming a 3 percent annual inflation rate. Future utility expenses are based on the FY 2002 sewer budget and inflated to future years assuming a 4 percent annual inflation rate.

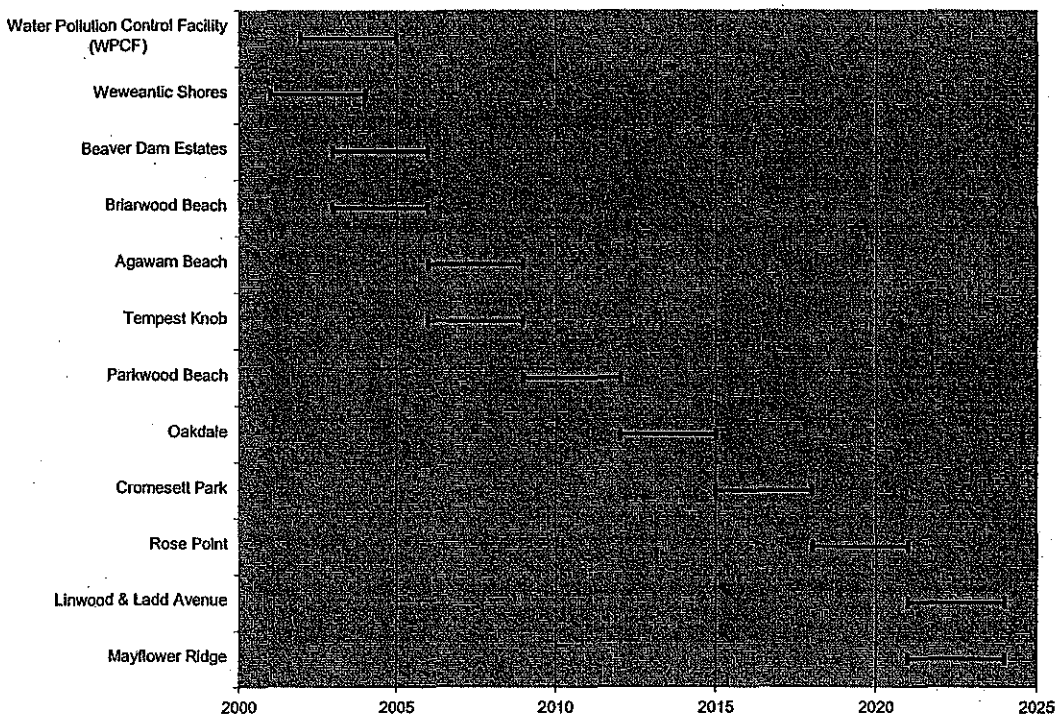
- Miscellaneous revenues and other revenue data used in the wastewater rate model are based on FY 2002 sewer budget and held constant at the FY 2002 levels.
- Existing debt service is based on the current debt schedules provided by the Town of Wareham.
- The Town's current customer billing system (Equivalent Dwelling Units) is assumed to remain in effect. Currently, based on the Town's data, there are 7,370.4 Equivalent Dwelling Units (EDU). EDUs are expected to increase by approximately 100 annually as a result of in-fill. There will also be increases in EDUs as the Town completes improvements in the eleven sewer areas.
- The Town will fund its capital improvements of $24.3 million for the wastewater treatment plant (the "WPCF") with SRF debt assumed to carry a 0 percent interest rate for a 20-year term. The $10 million costs for the WPCF will be financed in FY 2004 and the remaining $14.3 million in FY 2005. The Town will begin paying debt service on each financing phase one year after the loan is executed. At this time, the Town only has a firm commitment from the SRF for $10 million at the zero percent rate. The remaining $14.3 million will be carried over to FY 2002 and FY 2003 SRF funding periods.
- Debt service associated with the WPCF will be recovered through the EDU.
- The Town will fund its sewer improvements of $23.4 million for the eleven service areas with SRF debt assumed to carry a 2.5 percent interest rate for a 20-year term. Beginning in FY 2003, at least one of the eleven service areas will be rehabilitated on average every 2.5 years. It is likely that the Town will not receive SRF funding for all of its collection system projects. If SRF funding is not available, then the Town will be required to issue general obligation debt of which is assumed to carry a 20-year term and a 6 percent interest rate. Debt service associated with these sewer extension projects will be recovered through 100 percent betterment charges on the affected properties.
- Beginning in FY 2003, current outstanding short-term debt will be converted into long-term debt. The General Obligation Bond is assumed to carry a 6 percent interest rate for a 20-year term.
- The current user rate is $224 per EDU.

In addition, we have assumed that the Town's funding policy for the sewer system will continue. Under that policy, the capital costs for treatment plant upgrades and modifications are paid through the EDU charge and by the Town of Bourne. Sewer system operating and maintenance costs will be recovered through the EDU charge and capital costs associated with sewer extensions are recovered through betterments on affected property owners.

7.4 Implementation Schedule

Figure 7-1 shows the Implementation Schedule for the planned improvements. The WPCF will be implemented in FY 2005 and the improvements to the eleven service areas will begin in FY 2003.

Figure 7-1
Implementation Schedule



7.5 Financial Analysis

In this section, we describe the impact the proposed improvements have on the financial requirements of the Town.

7.6 Revenue Requirements and Projections

This section defines revenue requirements for the sewer system. The three main components of revenue requirements include operations and maintenance expenses, capital costs, and miscellaneous revenues. For purposes of this presentation, we project the total revenue requirement.

The costs associated with operations and maintenance expenses are departmental salaries, operating expenses, and administration and general expenses. The capital costs include existing debt service of principal outside debt limit, long and short-term debt; capital outlay consists of improvement projects and equipment replacement;

and new CIP system improvements. The last main component of revenue requirements is miscellaneous revenues that consist of utility interests and liens and other miscellaneous revenues that offset total expenses.

Table 7-1 summarizes the operations and maintenance costs for FY 2002 and FY2012. In FY 2005, it is also projected that the operating costs will increase by approximately $95,000 for hiring two additional staff and by approximately $300,000 for chemicals and utilities as a result of the treatment plant modifications.

Total operating and maintenance expenses are projected to increase from approximately $2.2 million in FY 2002 to nearly $3.5 million in FY 2012, an average annual increase of approximately 4.8 percent. This includes the impact of the upgrade project.

Table 7-1
Operations and Maintenance Costs

Expenses	FY 2002	FY 2005	FY 2012
Salaries and Wages	$524,760	$668,419	$822,072
Utilities Expense	$275,525	$301,231	$370,951
General Operating Expenses	$238,670	$562,874	$698,508
Administrative Expenses	$870,000	$950,672	$1,169,207
Sludge Disposal	$249,089	$272,186	$334,755
Reserve Account	$60,000	$65,564	$80,635
Total Expenses	**$2,218,044**	**$2,820,947**	**$3,476,127**

Table 7-2 summarizes the existing and new debt service. The debt service for the Town will increase from $652,000 in FY 2002 to $1.97 million in FY 2012. This assumes that the Town incurs approximately $1.4 million in debt service in FY 2004 and 2005 to implement the proposed project. In addition, total town debt service will increase by approximately $200,000 every 2.5 years due to the improvement costs of the eleven sewer areas. However, this debt service will not affect the EDU charge since it will be recovered through 100 percent betterments.

Table 7-2
Debt Service

Debt Service	FY 2002	FY 2012
Total Existing Debt Service	$652,429	$467,904
New GO Debt	$---------	$287,361
New SRF Debt	$---------	$1,214,904
Total Debt Service	**$652,429**	**$1,970,169**

Miscellaneous revenues are the third element of revenue requirement. In 2002, the Town estimates that it will receive approximately $900,000 from these sources including interest and liens and other miscellaneous revenues. Beginning in 2005, revenue from Bourne sewer usage will increase as Bourne will assist in paying for 17.9% of WPCF's debt service and operational and maintenance costs. Miscellaneous revenues will be $903,065 in 2005 and $1.05 million in 2012. As noted above, the Town uses sewer customer usage for services to support debt service. This is assumed to continue for both current outstanding and new debt.

Table 7-3 summarizes the total operational & maintenance costs, existing and new debt service, and miscellaneous revenues to calculate rate revenue requirements for FY 2002 and FY 2012. Total expenses are projected to increase from $2.9 million in FY 2002 to $5.45 million in FY 2012. Net rate revenue requirement will increase from $2.0 million in FY 2001 to $4.4 million in FY 2012.

Table 7-3
Sewer Revenue Requirement

	FY 2002	FY 2012
O&M Costs	$2,218,044	$3,476,127
Existing Debt Service	$652,429	$467,904
New Debt Service	$--------	$1,502,265
Total Expenses	**$2,870,473**	$5,446,296
Miscellaneous Revenues	$897,360	$1,047,286
Net Rate Revenue Requirement	**$1,973,113**	**$4,399,010**

7.7 Impact on Customers

We evaluate the impact on customers in two stages. The first is to project the impact of the plant upgrade on the revenue requirement and the underlying EDU charge. The second stage is to illustrate the impact of the anticipated betterment charges resulting from the collection system projects.

7.8 Sewer Rate Projections

Sewer customers are obligated to pay through use fees the costs of operating and maintenance expenses, plus the debt service associated with the plant upgrade. As seen above, total operations and maintenance costs are projected to increase from approximately $2.9 million in 2002 to $4.2 million in 2005 to $5.5 million in 2012. Sewer use fees will need to generate an average total of $4.7 million to maintain the solvency of the sewer fund.

Table 7-4 summarizes the sewer customer user rate based on the net rate revenue requirement and the number of EDUs. It is also assumed that there will be an increase of 100 EDUs per year served by the sewer system. The number of EDU's will increase from 7,340.4 in FY 2002 to 9,472.4 EDU's in FY 2012. The sewer rate will increase from $268 per EDU in FY 2002 to approximately $464 per EDU in FY 2012.

Table 7-4
Sewer User Rate Per Equivalent Dwelling Unit

	2002	2005	2012
Net Rate Revenue Requirement	$1,973,113	$3,268,160	$4,399,010
Number of EDUs	7370.4	7920.4	9472.4
User Rate	$268	$413	$465

If the Town is unable to obtain SRF financing for the WPCF at 0 percent, but receives 2.5 percent financing instead, the EDU cost is estimated to be approximately $35 higher in FY 2012.

As mentioned previously, the Town also intends to finance the sewer collection projects with betterments. Benefiting households will be assessed betterments ranging from approximately $8,300 to $30,000 depending on the project and the size of their parcel. Property owners that elect to repay these betterments over time will also be liable for interest.

7.9 Summary

The Town of Wareham faces a major capital improvement program to rehabilitate and upgrade its existing sewer system. This program will have a significant impact on the Town's ratepayers. The total costs for the sewer system are projected to increase at an average annual rate of 30 percent between 2002 and 2012. The EDU charge will increase from $268 to approximately $465 during that same time frame.

Section 8
Environmental Impact Report

8.1 Summary

8.1.1 Introduction

This Single Environmental Impact Report (EIR) addresses: (1) the upgrade of the existing Wareham Water Pollution Control Facility (WPCF); and (2) the extension of the sewage collection system to 12 sewage disposal needs areas. The design of these facilities will account for future flows and loads to provide a 20-year plan for wastewater collection, treatment and disposal to serve the town's needs. The EIR evaluates the environmental impacts of the proposed project, specifically addressing the issues raised in the Secretary's Certificate on the Environmental Notification Form (ENF), issued on August 31, 2001 (see Appendix I). The EIR and CWWMP are combined as one document and will be distributed to all organizations and individuals contained on the distribution list in Appendix J.

8.1.2 Description of the Recommended Plan

The recommended course of action, as outlined in Sections 4 and 6, calls for the improvement and expansion of the Town of Wareham's WPCF and sewer system. Some issues considered during the development of the recommended improvements included the minimization of environmental impacts, the long-term health of the public and environment, the ability to handle future wastewater flows, and economics. The actions outlined in the recommended improvements will result in a sewer and treatment system that conforms to applicable state and federal regulations, meets the future needs of the town, and safeguards the public and environmental health.

Expansion of the Existing WPCF

A list of recommended additions to the WPCF is provided below:

- Package headworks to include one rotary fine screen, one vortex grit chamber, and one by-pass screen in place of existing headworks building;
- One septage acceptance plant in new headworks building;
- Two equalization basins;
- Two anoxic selector tanks;
- One additional aeration tank;
- New distribution box structure;
- One additional secondary clarifier;

- Three denitrifying filters;
- Three banks of UV disinfection modules;
- Biofilters;
- Outfall (abandonment of existing four open-jointed outfalls and installation of one new closed joint pipe);
- One gravity belt thickener; and
- New polymer storage and feed system.

In addition to these process improvements, the following new construction is proposed.

- Modifications to existing sludge dewatering building to accommodate new equipment;
- New process equipment building (filter and blower building);
- New administration building; and
- New soda ash silo.

Recommended plan details and discussion are included in Section 6 of this document.

Rehabilitation of Existing Wastewater Pumping Stations

Rehabilitation of the existing pump stations, including correcting the minor deficiencies, is recommended under this alternative. Work to be done on the existing pump stations is detailed in Appendix D. Completion of the recommended work will bring these pump stations into compliance.

Sewer Expansion

As described in Section 4, it is recommended that municipal sewer service be extended to 12 "needs areas" in Wareham. The first sewer expansion area, Sunset Island, was constructed in 1999. The remaining areas are further described in Section 4 and in Section 8.4.5 below.

Additional Sewer System Improvements

- Infiltration/Inflow. Present infiltration and inflow (I/I) was developed using five years of water supply and wastewater flow records. An estimated infiltration rate of approximately 211,000 gpd occurs during the winter period. The current Wareham collection system is about 390-inch miles, and combined with the infiltration flow of 211,000 gpd, an infiltration rate of 540 gpd/in-mi was calculated. In the remaining summer months, infiltration appears to decrease to a rate of 475 gpd/in-mi. Inflow for the present collection system appears to be negligible based on rainfall records and WPCF data.

In the future, an additional 210 in-mi will be added to the current system if Riverside, Oneset Heights, and all 12 of the study areas are sewered within the design 20-year period. Applying the same infiltration rates used for the present calculations along with an allowable infiltration rate of 100 gpd/in-mi for new sewers, future infiltration values of 232,000 gpd and 206,000 gpd were determined for winter and summer, respectively. As in the present I/I evaluation, inflow was considered negligible.

- <u>Sewer System Operation and Maintenance Program</u>. To ensure the sewer system operates with a minimum of stoppages, odor complaints, and pumping station failures, a preventive maintenance program for the sewers, pumping stations, and treatment facilities is recommended. A preventive maintenance program would reduce the amount of emergency maintenance needed and would have a significant effect on operation and maintenance costs and effectiveness of the system. Specific measures for a preventive maintenance program include the periodic inspection and cleaning of the gravity sewers and routine preventive maintenance of all pump station equipment.

8.1.3 MEPA History

An Expanded ENF was filed in July 2001 on the current project and included an "Updated Draft Wastewater Facilities Plan" and a "Water Quality Investigation of the Wareham River Estuary Complex." Together, these documents provide a comprehensive review of the project, its impacts, alternatives, and mitigation. The Expanded ENF also included a request to allow for the filing of a Single EIR. The Secretary issued a Certificate on August 31, 2001, stating that the project is subject to the Mandatory EIR provisions of the MEPA Regulations since it involves construction of more than 10 miles of new sewers. However, the Secretary also granted the request to proceed with preparation and filing of a Single EIR and provided a scope of issues to be addressed in that document. The issues are specifically addressed in Section 8.2 of this CWWMP/EIR and include:

- Restriction of Development in Velocity and Flood Zones;
- Description of Impacts and Mitigation Affecting Wetland Resource Areas;
- Legal and Institutional Means to Ensure Compliance with EO #385 (Planning for Growth); and
- Provisions to Protect Shellfish Resources in the Wareham River.

8.1.4 Project Schedule

The construction contract for the WPCF facilities upgrade is expected to be awarded in March 2002, with construction commencing in the spring of 2002 and ending in late 2004. The collection system extension will be divided into a number of construction contracts, in order of priority as follows:

Contract Number	Sewage Disposal Needs Areas
1	Weweantic Shores
2	Briarwood Beach and Beaver Dam Estates
3	Tempest Knob and Agawam Beach
4	Parkwood Beach
5	Oakdale
6	Cromesett Park
7	Rose Point
8	Linwood and Ladd Avenues and Mayflower Ridge

The approximate dates for construction of the sewer extensions are not currently known.

8.1.5 Summary of Alternatives

This section of the report evaluates several alternatives for improvements to the Town of Wareham's wastewater system. The alternatives considered are:

1. Expansion of the existing WPCF and public sewer system (the recommended plan);

2. Localized wastewater disposal; and

3. The no-action alternative.

Further discussion of alternatives is provided in Section 4 of the CWWMP/EIR.

Expansion of the Existing WPCF and Public Sewer System

A variety of measures were considered while developing a plan for the expansion of the existing wastewater treatment facility and sewer system. Because of potential changes in the facility's National Pollutant Discharge Elimination System (NPDES) permit and the need to increase flow capacity at the WPCF, maximizing the existing facility along with other alternatives that use portions of the facility and/or replace the facility were evaluated. Sludge treatment and disposal alternatives were also investigated because some alternatives generate additional sludge that would have effected sludge process recommendations.

Wareham's existing secondary WPCF has been operating since 1972. All wastewater for the entire sewerage system is collected and enters the WPCF through two 18-inch force mains. Once flow enters the facility, preliminary treatment is provided by a manually cleaned bar screen, aerated grit removal, and a comminutor. Following preliminary treatment, flow passes to secondary treatment comprised of two aeration tanks, each with two 50 hp aerators; two 55-foot diameter clarifiers; a chlorine mixing manhole; and eight sand percolation beds. An underdrain system collects flow from the percolation beds and conveys flow to the Agawam River through one of four outfalls.

Septage is received into two covered channels where the septage is screened with manually cleaned coarse screens. Before flow enters the septage receiving tank, it passes through the grit sumps where grit is removed using gravity. Flow then passes through a grinder and is pumped into septage equalization tanks where it is aerated. In the present mode of operation, the aerated septage is slowly blended into the wastewater stream during off-peak hours.

Sludge that is produced from the WPCF is entirely waste activated sludge (WAS). In the present mode of operation, WAS is pumped to sludge holding tanks, decanted, and pumped to hauling trucks for liquid disposal at the Cranston, RI WWTP.

When sludge was dewatered on-site, WAS was pumped to lime stabilization tanks where lime is added to help stabilize the sludge. From there, sludge was pumped to vacuum filters where ferric chloride or polymer and lime are added. Sludge cake was then discharged into a sludge truck for landfill disposal. Disposal of the dewatered sludge at the Town of Bourne landfill was stopped on July 1, 1997, per order of the Town of Bourne Board of Selectmen. In the future if sludge is to be dewatered on-site, a disposal site will have to be procured for the dewatered sludge.

Options for final disinfection of the effluent are either chlorination or ultraviolet disinfection. A chlorine residual limit has been set in the NPDES permit, so dechlorination is required if chlorine is used. Under the chlorination option, a detention time of 30 minutes would be required in the chlorination chamber and an additional five minutes of contact in the dechlorination chamber. With ultraviolet disinfection, the effluent can be disinfected in one process and discharged directly.

There are currently 29 pumping stations of which five are ejector stations. The stations have the capacity required for the projected design flows. Minor deficiencies in all of the pumping stations need to be corrected to bring the stations up to Environmental Protection Agency (EPA) and Occupational Safety and Hazard Agency (OSHA) code.

Problems have developed in several areas in the town that are not connected to the municipal wastewater system. Some of these areas have poor soils and high groundwater that prevent the rehabilitation of the existing on-site septic systems. To connect these areas into the present system several types of centralized collection systems were considered. Types of collection systems alternatives evaluated were:

conventional 8-inch sewers and small diameter gravity sewers, along with pressure sewers with grinder pumps, or pressure sewers with septic tanks and effluent pumps.

Localized Wastewater Disposal

Alternatives considered under the localized wastewater disposal plan included both the rehabilitation of existing on-site septic systems, the construction of small package treatment plants and the construction of community leaching field systems. Rehabilitation of existing on-site septic systems would be done where soil and groundwater conditions are favorable. To serve areas where conditions prevent the construction of on-site septic systems, small package neighborhood treatment plants or community leaching fields would be constructed. Depending on site conditions, these package plants would discharge effluent to either the groundwater or surface water.

Under the State Environmental Code Title 5: 310 CMR 15.00 (Title 5) effective March 31, 1995, any wastewater system that discharges more than 10,000 gpd into the ground must be treated to meet certain parameters before discharge into the ground. Groundwater discharges in excess of 15,000 gpd require a groundwater discharge permit per 314 CMR 5.00 and 6.00. In addition, the regulations state that a system cannot be located within 400 feet of a surface water supply or within 200 feet of a tributary to a surface water supply and that the system cannot be located in a nitrogen sensitive area without treatment before discharge. The regulations also require that for each system, a proper maintenance, monitoring and reporting plan be carried out.

No-Build Alternative

Continued use of the existing treatment facility and sewer system as they now presently operate is the basis of the no-build alternative. Repairs of the sewer system will continue on an "as-needed" basis. Scheduled and emergency maintenance of the pump stations and treatment facility will continue as well.

New building or development construction in sewered areas would be connected to the existing sewer system. All new building or development construction in the unsewered areas would have to include construction of on-site septic systems meeting Title 5 requirements.

8.1.6 Environmental Impacts of Alternatives

Expansion of the Existing WPCF and Public Sewer System

The adverse environmental impacts associated with the expansion of the existing wastewater treatment facility and public sewer system are for the most part only short-term construction impacts, which can be mitigated with proper construction procedures. Major gains in the improvement of the environment and public health would result from the WPCF expansion and new sewer connections because discharges to the groundwater and leachate breakout from failing on-site septic system would be eliminated. If new pump stations are needed, minor land use impacts would occur as a result of construction of the new facilities. Further discussion of this recommended plan is provided in Section 8.4.

Localized Wastewater Disposal

Under the localized wastewater disposal alternative, small community treatment systems and the rehabilitation of existing on-site septic systems would be used to service the sewer needs areas.

Short-term construction impacts such as noise, odor, traffic, land use and air quality can be expected from the construction of these small community treatment facilities. Long-term impacts on land use, noise, odor, and aesthetics may also result from these facilities. In addition, operating and maintaining many small treatment plants could prove costly and difficult since each facility would require daily inspection, maintenance, periodic repairs, chemicals, and utilities. These costs escalate every year and every ten to fifteen years the facilities would require major overhauls and/or replacement.

Rehabilitation of existing on-site septic systems would be done where local soil and groundwater are suitable. In these cases, the rehabilitation would have to be undertaken by an individual owner at their expense. The Town would need to investigate ways of assisting in the financing of these systems. Sometimes localized site conditions might make it impossible to adequately repair or replace a failing system, or if deemed possible could cost a homeowner $20,000 to $50,000. Possible long-term impacts on both the public and environmental health could result from any failing individual septic system that is not adequately repaired or replaced.

No-Build Alternative

- <u>Wastewater Treatment Facility</u>. The current NPDES permit has stated values for effluent quality and sets flow limits. The existing secondary treatment facility meets these requirements throughout the year. As the equipment in the WPCF ages and the sewered population of Wareham increases, problems in meeting the permit requirements under the no-build alternative will likely result. The draft NPDES permit renewal (expected to be finalized in December 2001) will have permit limits for total nitrogen and phosphorus that the current plant would not meet. Under the no-build alternative, frequent permit violations are predicted.

- <u>Sewage Disposal Needs Areas</u>. Under the no-build alternative no new sewage disposal needs areas would be added to the municipal wastewater system. Any development in an area outside the present sewer system would have to dispose of wastewater on-site to conform with Title 5 regulations. Several areas of town that are not presently sewered have inadequate soils and development of a common on-site septic system in these areas is not possible. The existing failing septic systems in the sewage disposal needs areas that would need to be replaced by their individual owners would be very costly or totally infeasible. The public and environmental health and groundwater could be adversely affected by the contamination of the groundwater from the failing septic systems.

Table 8-1 presents a summary of potential impacts associated with the alternatives discussed in this EIR.

8.1.7 Recommended Plan Impacts and Mitigation Measures

Most impacts associated with the recommended plan are construction-related and can be adequately controlled through application of sedimentation and erosion controls, dust controls, equipment noise controls, and development and implementation of traffic management plans. Wetlands impacts that cannot be avoided will be minimized to the extent possible and wetland areas will be restored following construction. Further discussion of impacts is provided in Sections 8.2 and 8.4. Mitigation is addressed in Section 8.6.

8.2 MEPA Certificate Issues

8.2.1 Velocity and Flood Zones

Wareham is a relatively low-lying coastal town and subsequently has a significant portion of its land in the 100-year flood zone as determined by the Federal Emergency Management Agency (FEMA). Velocity zones are of particular concern because the most damage will occur in these zones during coastal storm events. There are several velocity zone areas in Wareham that have been developed as residential and commercial areas. Swifts Beach, Cromesett Point and Onset Island are examples of such areas.

The MEPA Certificate on the ENF notes that portions of the project will include sewering of areas within velocity and flood zones, including unbuilt lots. Therefore, the Secretary requires that the SEIR carefully define those areas within velocity and flood zones and provide a description of and a commitment to implementation of bylaws to restrict development in those areas.

Construction of sewers in velocity zones (V-zones) is of concern due to (1) the potential for damage of the wastewater system during storms; and (2) the potential for development in V-zones once a sewer is constructed. V-zones are defined as coastal areas within the 100-year flood zone, which because of their specific location are also subject to wave action. The base flood elevation in the Federal Emergency Management Agency's (FEMA) designated V-zone is based on a detailed hydraulic analysis that considers the effect of a three-foot high breaking wave on water surface elevations for a 100-year storm.

Based on an evaluation of the FEMA Flood Insurance Rate Maps, portions of four of the twelve needs areas, Briarwood Beach, Cromesett Park, Parkwood Beach, and Tempest Knob, fall within the V-zone boundaries. In these areas the following streets

Table 8-1
Summary of Impacts of the Various Alternatives

Issue/Resource	Expansion of WWTF and Public Sewer System	Localized Wastewater Disposal	No-Build Alternative
Public/Environmental Health	**Positive** long term impacts-discharges from failing private systems eliminated.	**Adverse** long term impacts-discharges from dispersed treatment systems spread over greater area.	**Adverse** long term impacts-discharges from failing private septic systems continue.
Hydrologic Resources	**Positive** long term impacts-discharge from plant meets higher standards, receiving water less impacted.	**Adverse** long term impacts-discharges from dispersed treatment systems spread over greater area.	**Adverse** impacts- continued contamination of surface water and groundwater.
Topography, Geology and Soils	No effect, other than minor re-grading.	No effect, other than minor re-grading.	No effect.
Terrestrial/Wetland Resources	**Adverse** short-term impacts from off-road construction; **Positive** long term impacts-discharges from failing private systems eliminated.	**Adverse** short-term impacts from off-road construction; Potential **adverse** long term impacts-construction of shared or package systems in or adjacent to sensitive areas.	**Adverse** impacts-continued damage from failing septic systems.
Aquatic Resources	**Positive** long term impacts-cleaner effluent discharged.	Potential **adverse** long term impacts-construction of shared or package systems in or adjacent to sensitve areas.	**Adverse** impacts-continued damage from failing septic systems.
Air Quality	**Adverse** short term impacts-dust from construction.	**Adverse** short term impacts-dust from construction.	**Adverse** impacts-odors from failing septic systems.
Noise	**Adverse** short term impacts-noise from construction.	**Adverse** short term impacts-noise from construction and dispersed treatment systems.	No effect.
Land Use	**Adverse** impacts if new pump stations are located on undeveloped land.	**Adverse** long term impacts-construction of new neighborhood treatment facilities.	No effect.

Table 8-1 (Continued)
Summary of Impacts of the Various Alternatives

Issue/Resource	*Expansion of WWTF and Public Sewer System*	*Localized Wastewater Disposal*	*No-Build Alternative*
Historic Resources	No effect.	Possible **adverse** impact, depending on the location of neighborhood treatment facilities.	No effect.
Archeological Resources	Possible **adverse** impacts from construction of pump stations in previously undeveloped areas (to be addressed through consultation with MHC).	Possible **adverse** impacts from construction of new treatment facilities and sewers.	No effect.
Traffic	**Adverse** short term impacts-construction of sewers will impact traffic.	Potential **adverse** short term impacts-construction of sewers may impact traffic.	No effect.
Scenic Qualities; Open Space and Recreational Resources	Potential **adverse** short term impacts during construction. No long term effects.	Potential **adverse** short term impacts during construction. Potential **adverse** long term effects depending on locations of treatment facilities.	No effect.
Velocity Zones	Potential **adverse** effects will be addressed in zoning bylaw	Possible **adverse** impact, depending on the location of neighborhood treatment facilities.	No effect.

fall within the boundary:

- <u>**Cromesett Park**</u> - A 150 foot section of Walnut Street, a 150 foot section of Burr Avenue, a 130 foot section of Mattapoisett Road, a 600 foot section of Connie Hasset Road, and a 460 foot section of Cromesett Road;

- <u>**Parkwood Beach**</u> - A 150 foot section of Parkwood Drive; and

- <u>**Tempest Knob**</u> - A 70 foot section of Oak Hill Road.

No streets in Briarwood Beach fall within the V-zone boundaries. Seven lots including three homes are affected in Briarwood Beach. Thirty lots including eleven homes are affected in Cromesett Park. Fourteen lots including twelve homes are affected in Parkwood Beach. Twelve lots including eleven homes are affected in Tempest Knob. Thus, a total of sixty-three lots, thirty-seven developed and thirty vacant lots, are located in velocity zones in the proposed sewer areas. Velocity zone and 100-year flood plain boundaries in relation to the 12 needs areas are shown on Figures 8-1 through 8-12.

However, there are no proposed pumping stations in V-zones. Furthermore, there are no proposed sewers in V-zones with one exception. In Parkwood Beach, a 700-foot section of Parkwood Drive and a 150-foot section of River Terrace have proposed sewers paralleling their routes underground. However, all lots that border these stretches of road are already developed. Therefore, adding sewers to this area would not promote any new development as there are no lots available to develop and Town bylaws would govern the existing structures. In addition, watertight manhole covers are recommended in areas below the 100-year base flood elevation, which would apply to this area.

In its review comments on the updated facilities plan provided in the ENF, DEP states that new sewers cannot be constructed in areas that fall within the velocity zones unless a specific zoning bylaw is in place to protect wastewater facilities and discourage growth in V-zones.

Based on discussions with DEP and Massachusetts Office of Coastal Zone Management staff, the following velocity zone by-law was developed and adopted on October 15, 2001.

Wareham CWWMP/EIR
FEMA Flood Zone Delineation
Agawam Beach

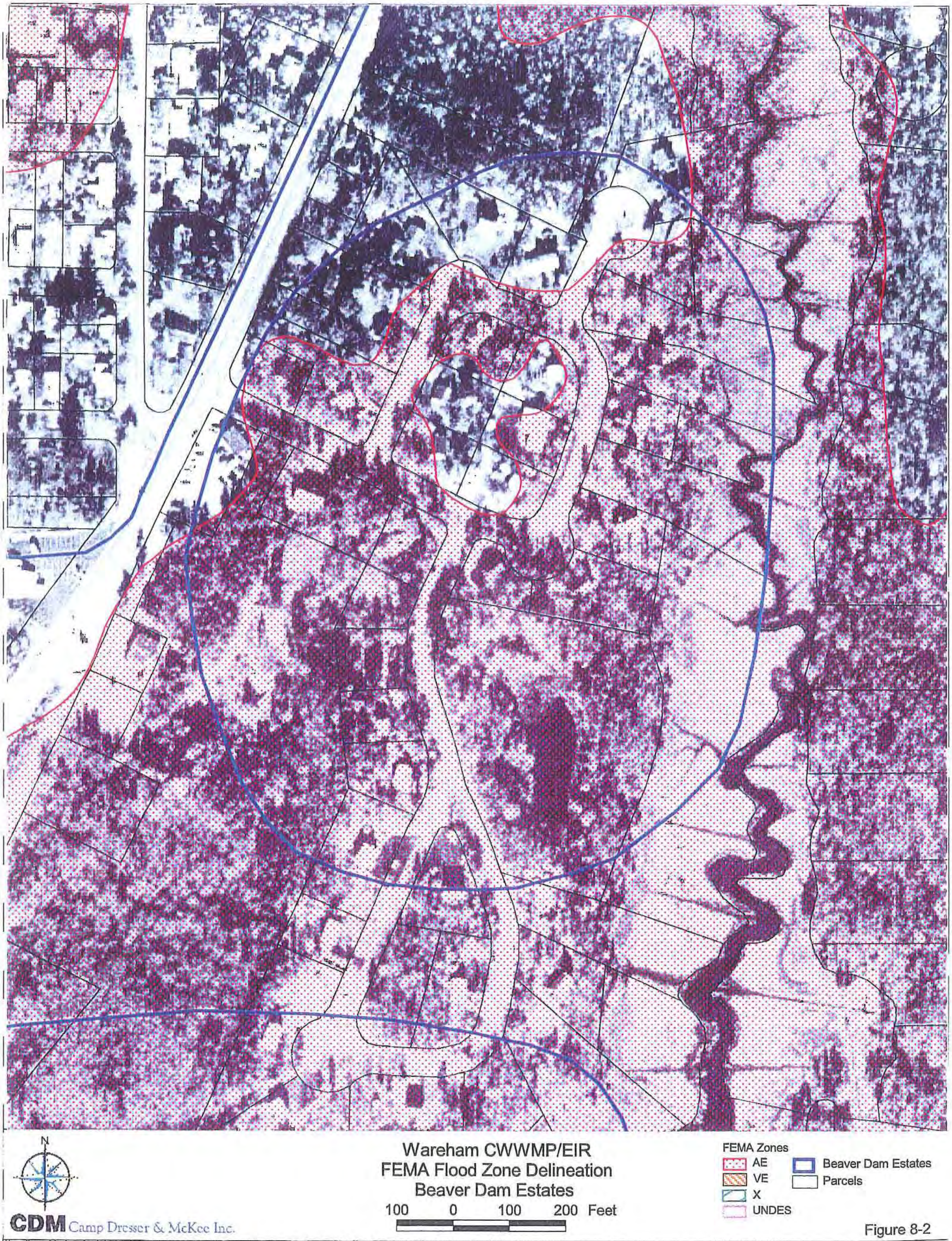
300 0 300 600 Feet

FEMA Zones
AE
VE
X
UNDES
Agawam Beach
Parcels

CDM Camp Dresser & McKee Inc.

Figure 8-1

\\bradleymb\c:\projects\wareham\plots\10-25-01\Agawam_Beach.ps MB letter portrait projFEMA_Zones.apr



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Wareham CWWMP/EIR
FEMA Flood Zone Delineation
Briarwood Beach

200 0 200 400 Feet

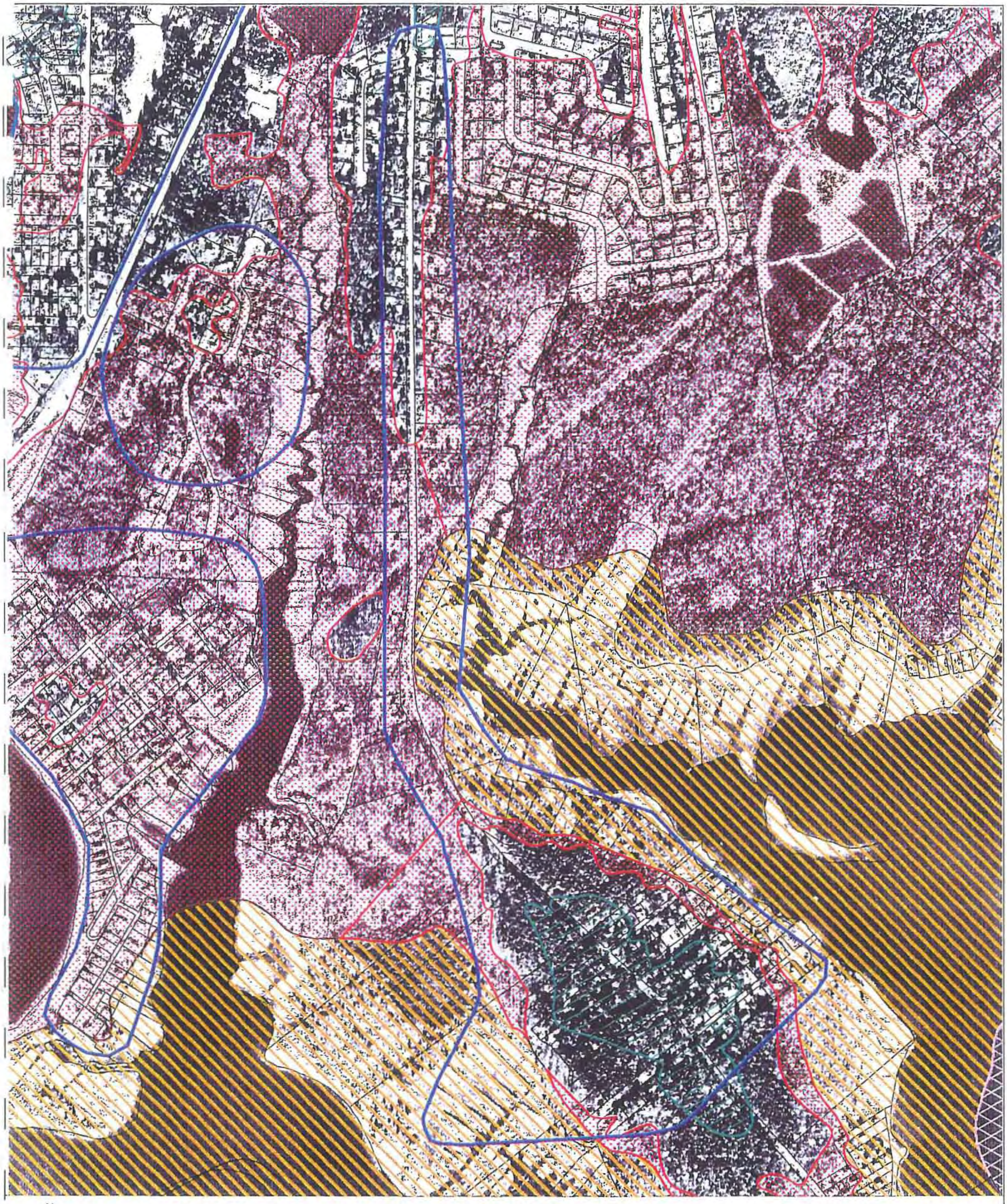
FEMA Zones
AE
VE
X
UNDES

Briarwood Beach
Parcels

CDM Camp Dresser & McKee Inc.

Figure 8-3

\\bradleymb\c:\projects\wareham\plots\10-25-01\Briarwood_Beach.ps MB letter portrait projFEMA_Zones.apr



Wareham CWWMP/EIR
FEMA Flood Zone Delineation
Cromesett Park

400 0 400 800 Feet

FEMA Zones
AE
VE
X
UNDES

Cromesett Park
Parcels

N

CDM Camp Dresser & McKee Inc.

Figure 8-4

\\bradleymb\c:\projects\wareham\plots\10-25-01\Cromesett_Park.ps MB letter portrait projFEMA_Zones.apr

Wareham CWWMP/EIR
FEMA Flood Zone Delineation
Linwood/Ladd Avenue

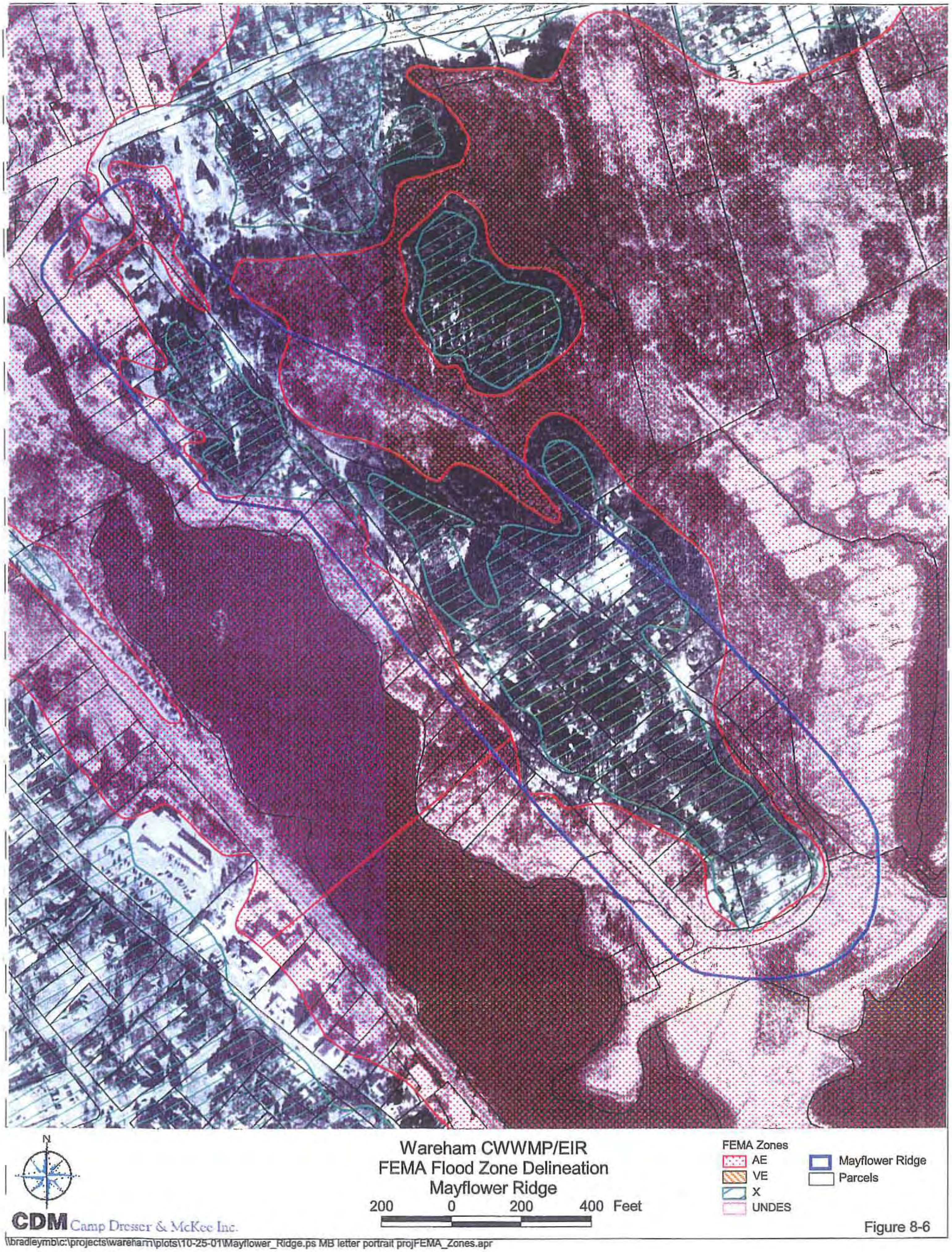
100 0 100 200 Feet

FEMA Zones
AE
VE
X
UNDES
Linwood/Ladd Avenue
Parcels

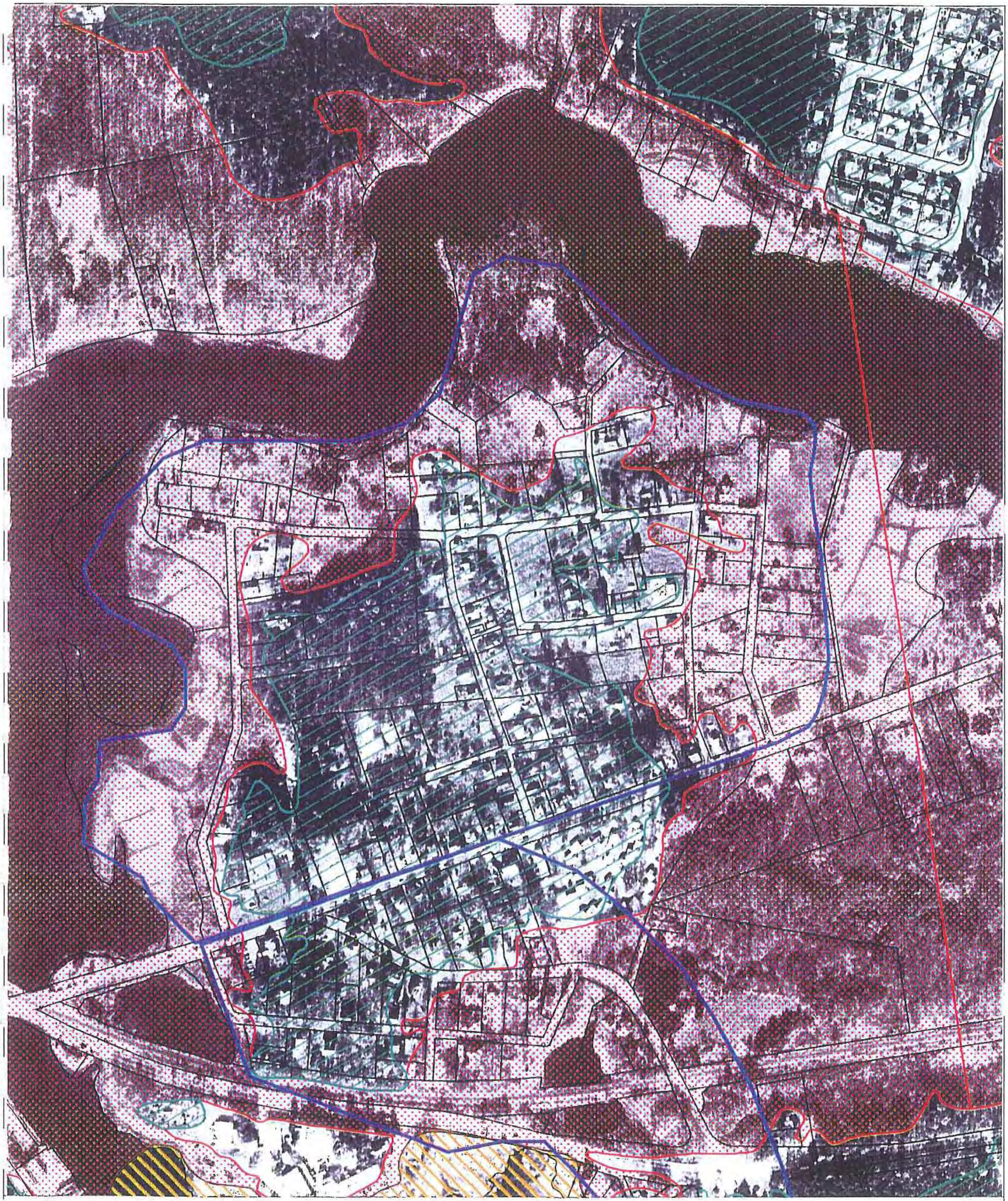
CDM Camp Dresser & McKee Inc.

Figure 8-5

\\bradleymb\c:\projects\wareham\plots\10-25-01\Linwood_Ladd_Ave.ps MB letter portrait projFEMA_Zones.apr



\\bradleymb\c:\projects\wareham\plots\10-25-01\Mayflower_Ridge.ps MB letter portrait projFEMA_Zones.apr



N

Wareham CWWMP/EIR
FEMA Flood Zone Delineation
Oakdale

300 0 300 600 Feet

FEMA Zones
AE
VE
X
UNDES
Oakdale
Parcels

CDM Camp Dresser & McKee Inc.

Figure 8-7

\\bradleymb\c:\projects\wareham\plots\10-25-01\Oakdale.ps MB letter portrait projFEMA_Zones.apr

Figure 8-8

\\bradleymb\c:\projects\wareham\plots\10-25-01\Parkwood_Beach.ps MB letter portrait projFEMA_Zones.apr

Wareham CWWMP/EIR
FEMA Flood Zone Delineation
Rose Point

300 0 300 600 Feet

FEMA Zones
AE
VE
X
UNDES

Rose Point
Parcels

CDM Camp Dresser & McKee Inc.

Figure 8-9

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N
CDM Camp Dresser & McKee Inc.
Wareham CWWMP/EIR
FEMA Flood Zone Delineation
Sunset Island
100 0 100 200 Feet
FEMA Zones
AE
VE
X
UNDES
Sunset Island
Parcels
Figure 8-10
adleymb\c:\projects\wareham\plots\10-25-01\Sunset_Island.ps MB letter portrait projFEMA_Zones.apr

CDM Camp Dresser & McKee Inc.

Wareham CWWMP/EIR
FEMA Flood Zone Delineation
Tempset Knob

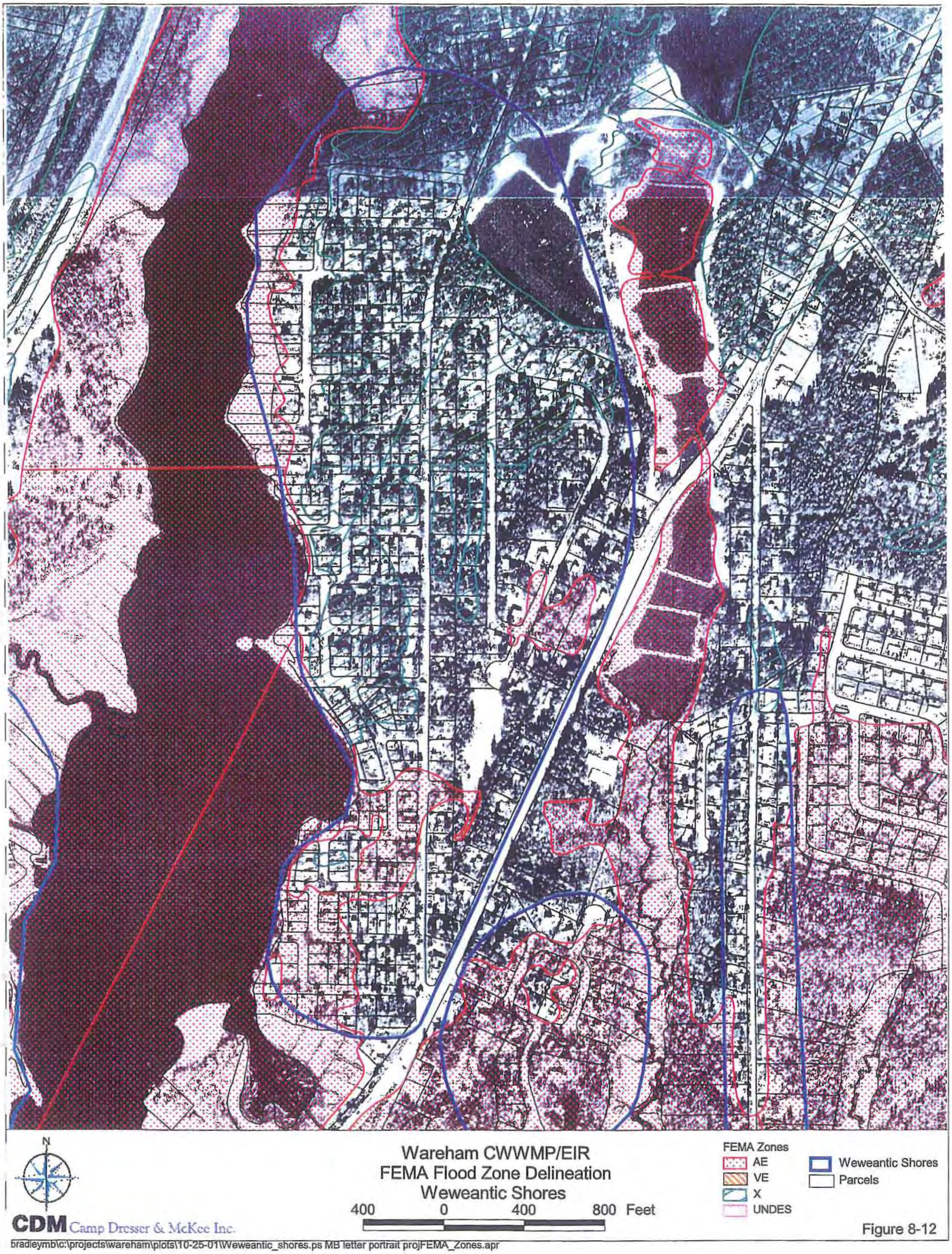
400 0 400 800 Feet

FEMA Zones
AE
VE
X
UNDES

Tempest Knob
Parcels

Figure 8-11

\bradleymb\c:\projects\wareham\plots\10-25-01\Tempset_Knob.ps MB letter portrait projFEMA_Zones.apr



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Proposed By-law Change (Fall 2001 Town Meeting Article No. 25)

Article 25

To see if the Town will vote to amend the Wareham Zoning By-law as follows:

Section VII - ADMINISTRATION AND EXCEPTIONS

Under Paragraph M. Flood Plain District Regulations, delete sub-paragraph (b)1 and replace it with the following:

1. (A.) Within Zones A, AE, AH, AD, A99 all new construction and substantial improvements (the cost of which equals or exceeds 50 percent of the market value of the structure) of residential and nonresidential structures (including the placement of manufactured/mobile homes) shall have the lowest floor, including basement, elevated to or above the base flood elevation (the 100-year flood elevation designated on the FIRM) or in the case of nonresidential structures be flood proofed watertight to the base flood level.

   (B.) Located within the Flood Plain District are areas designated as coastal high hazard areas (FEMA V-Zone or AO-Zone or their equivalent). Since these areas are extremely hazardous due to high velocity waters from tidal and storm surges, no development or redevelopment shall be permitted within a FEMA V-Zone or AO-Zone or their equivalent. Notwithstanding the foregoing, structures damaged or destroyed from fire, storm, or similar disaster may be redeveloped/repaired only in accordance with current local, state, and federal regulatory standards when damage to or loss of the structure is equal to or greater than 50 percent of the market value of the building. When damage to or loss of the structure is less than 50 percent of the market value of the building, redevelopment/repairs may be allowed to return the structure to pre-damaged conditions. In all instances, reconstruction, renovation or repairs to structures may be authorized as stated herein, provided that there is no increase in floor area.

Inserted by the Board of Selectmen/Sewer Commissioners

The above article as written in the Fall Town Meeting warrant was adopted on Monday, October 15, 2001 by a vote of 124 for and 5 against.

This new by-law will prevent new development or redevelopment of existing structures in velocity zones except for certain situations, accidents, or natural disasters that are identified in the new zoning bylaw. This new by-law complies with the velocity zone requirements of the MEPA Certificate and DEP's comment letter.

8.2.2 Wetland Resource Areas

The MEPA Certificate requires that the SEIR contain a clear definition and description of any resource areas to be affected by the project and a description of the mitigation proposed for any adverse impacts.

The proposed outfall location, pump station locations, and directional drilling site across the Weweantic River were evaluated in the field for presence of inland and coastal wetlands. Approximate wetland boundaries, based on MassGIS orthophotos, in relation to these project components are presented in Figures 8-13 through 8-26. More specific wetland information than is depicted on the figures was obtained during field visits and is summarized below. Many of the pump station locations were adjusted after field visits to avoid or minimize wetland impacts. (Although presence of riverfront area is noted, work associated with this project would be exempt from the Riverfront Act requirements.) Wetland boundaries will be flagged and surveyed to support project permitting.

All sewers are in roadways, with the exception of one force main from Avenue A to Narrows Road, which extends approximately 250 feet cross-country. This cross-country portion was also evaluated in the field and is shown on Figure 8-19.

The following paragraphs summarize the field investigations at the following locations: outfall, pump stations, Weweantic River Crossing, and one cross-country force main.

Outfall Location

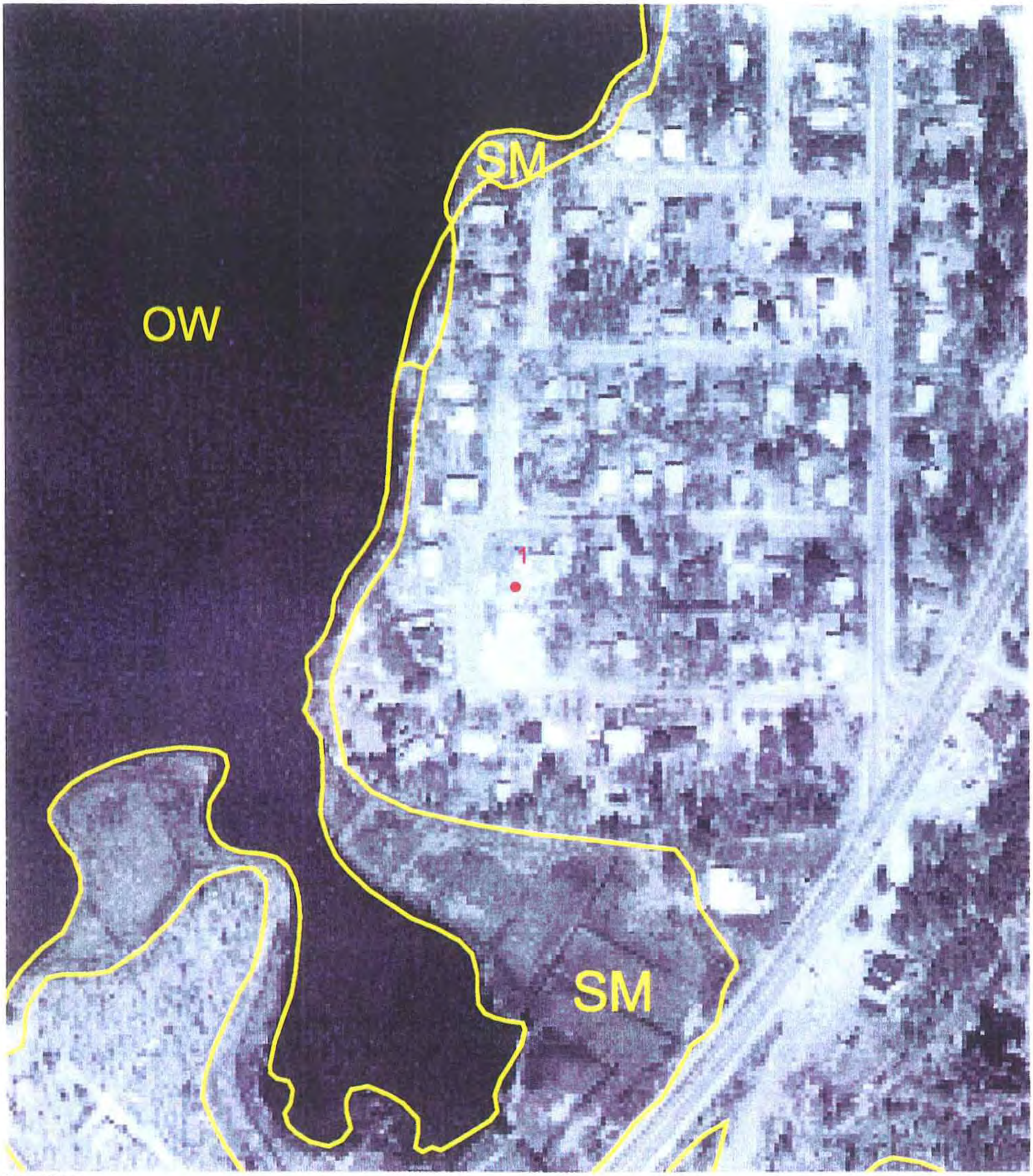
To minimize alteration of salt marsh, the new outfall will be located to the right side of the existing outfall 1. The existing outfall 1 is located at the toe-of-slope of a steep embankment with a shelf of salt marsh between the bottom of the slope and the river channel. Flow from the outfall is conveyed in a narrow channel about 3 - 4 feet wide. From the bank looking to the river, the salt marsh to the right of the outfall is approximately 15 feet wide and supports a narrow fringe (about 3 feet wide) of *Spartina alterniflora* with sedges (*Carex sp.*) dominating the community to the toe of slope. Salt marsh to the left of the outfall is approximately 30 feet wide with a 5-foot wide fringe of *S. alterniflora* and sedges dominant on the rest of the shelf. Evidence of tidal action to the toe-of-slope was observed. The approximate outfall location is shown on Figure 8-25.

Pump Station Locations

(Numbers correspond to sites shown on Figures 8-13 through 8-26.)

- <u>Site 1: Weweantic Shores Highland Bay Drive Pump Station (P.S.)</u> - This site is located on Highland Bay Drive between 1st and 2nd Street between two developed upland parcels. The parcel is located within the 200-foot Riverfront Area of the Weweantic River.

- <u>Site 2: Weweantic Shores 13th Street P.S.</u> - This site is located on the north side of 13th Street, on a vacant upland parcel.



Wetland Codes:
BG Bog
CB Cranberry Bog
TF Tidal Flat
SM Salt Marsh
BE Coastal Beach
BB Barrier Beach
DM Deep Marsh
M Shallow Marsh, Meadow, or Fen
SS Shrub Swamp
D Coastal Dune
RS Rocky Intertidal Shore
OW Open Water
BA Coastal Bank, Bluff, or Sea Cliff
U Upland

Wooded Swamp Dominated by:
WS1 Decidous Trees
WS2 Coniferous Trees
WS3 Mixed Trees

N

Wareham CWWMP/EIR
Wetland Resource Areas
AREA: WEWEANTIC SHORES
Figure 8-13

200 0 200 Feet
1 inch = 200 feet

● Pump Station

SOURCE: MassGIS Orthophotos 1997
CDM Camp Dresser & McKee Inc.

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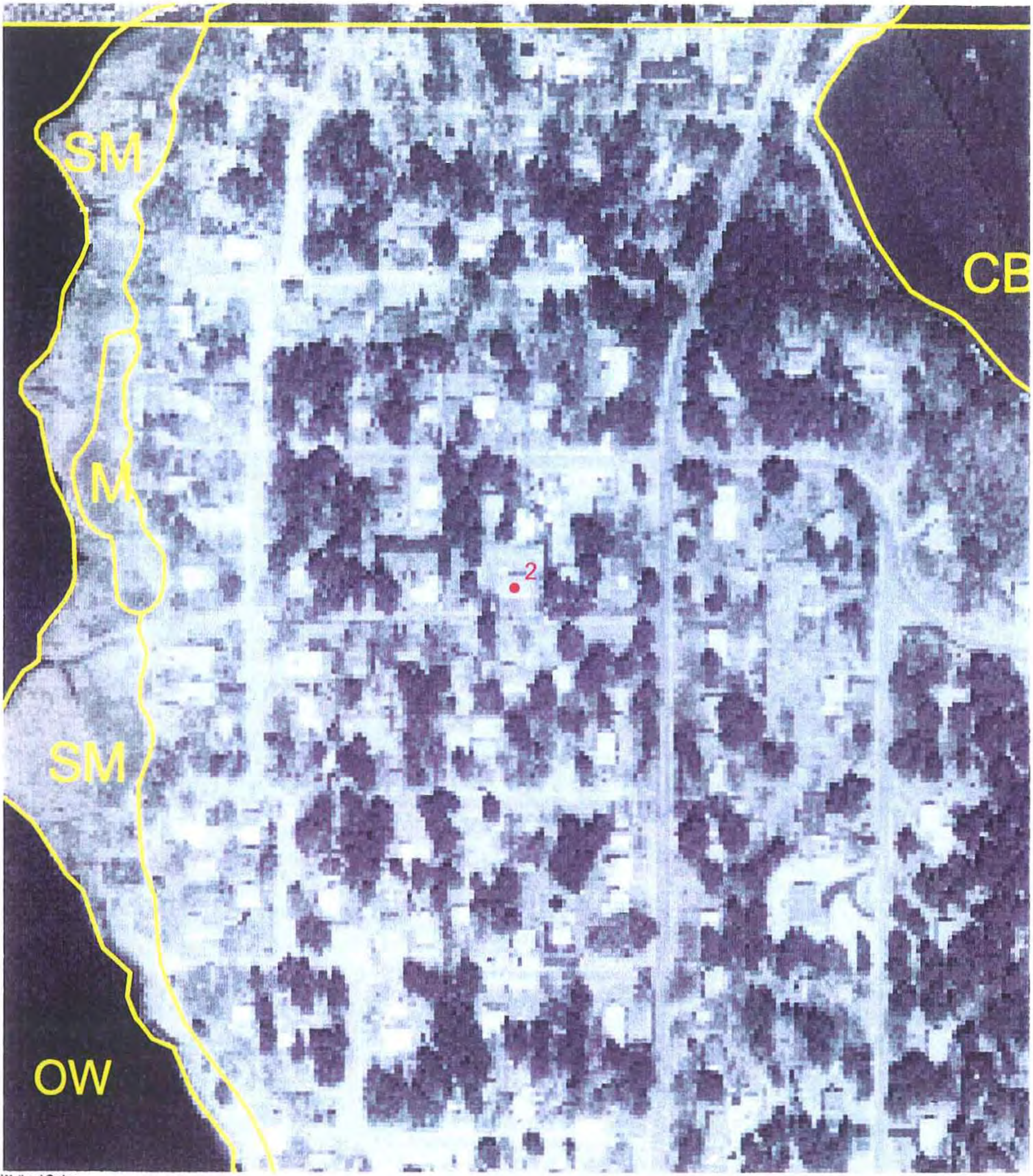

Wetland Codes:
BG Bog
CB Cranberry Bog
TF Tidal Flat
SM Salt Marsh
BE Coastal Beach
BB Barrier Beach
DM Deep Marsh
M Shallow Marsh, Meadow, or Fen
SS Shrub Swamp
D Coastal Dune
RS Rocky Intertidal Shore
OW Open Water
BA Coastal Bank, Bluff, or Sea Cliff
U Upland

Wooded Swamp Dominated by:
WS1 Decidous Trees
WS2 Coniferous Trees
WS3 Mixed Trees

Wareham CWWMP/EIR
Wetland Resource Areas
AREA: WEWEANTIC SHORES
Figure 8-14

● Pump Station

N

200 0 200 Feet
1 inch = 200 feet

SOURCE: MassGIS Orthophotos 1997
CDM Camp Dresser & McKee Inc.

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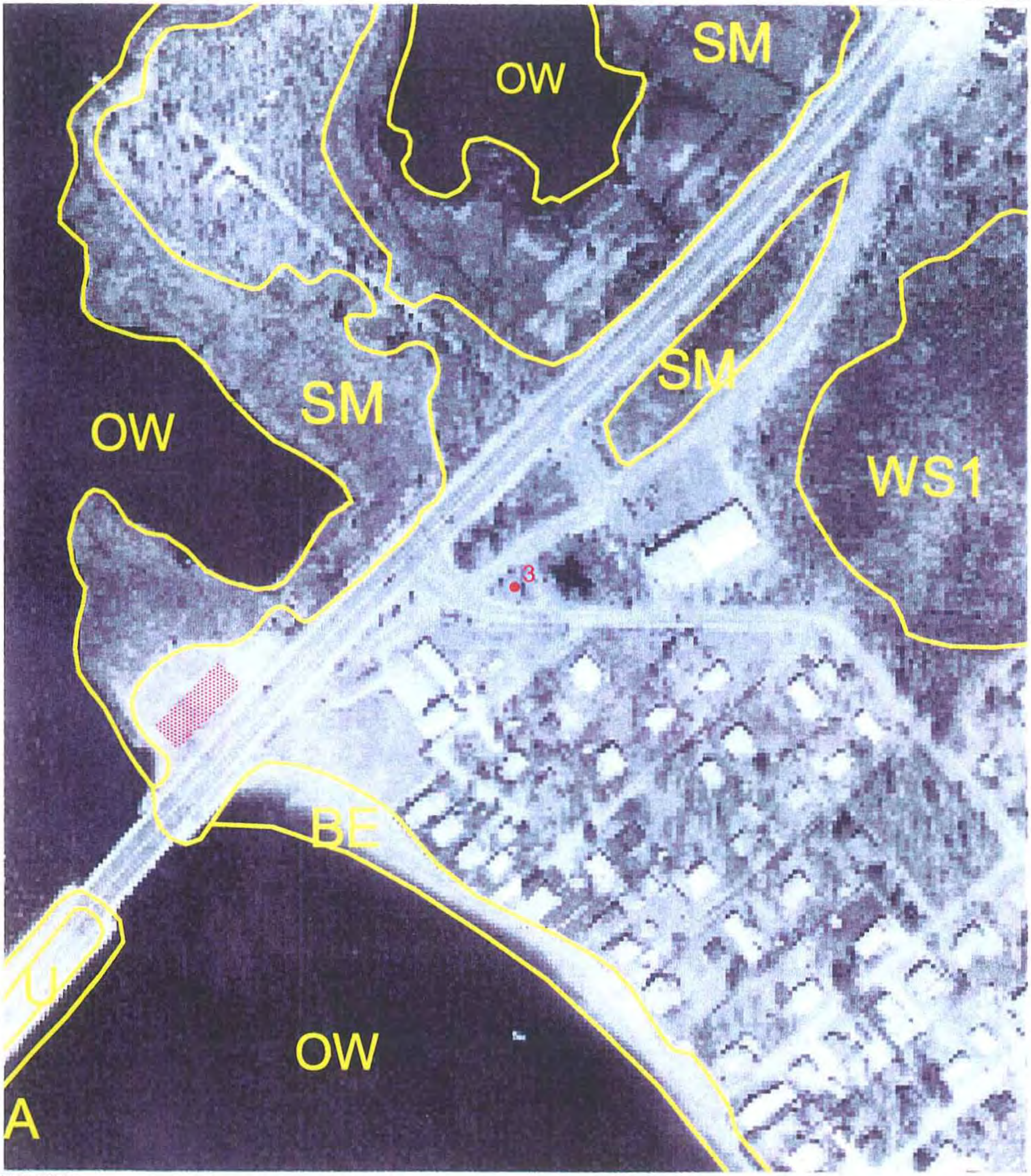

Wetland Codes:
BG Bog
CB Cranberry Bog
TF Tidal Flat
SM Salt Marsh
BE Coastal Beach
BB Barrier Beach
DM Deep Marsh
M Shallow Marsh, Meadow, or Fen
SS Shrub Swamp
D Coastal Dune
RS Rocky Intertidal Shore
OW Open Water
BA Coastal Bank, Bluff, or Sea Cliff
U Upland

Wooded Swamp Dominated by:
WS1 Decidous Trees
WS2 Coniferous Trees
WS3 Mixed Trees

N

Wareham CWWMP/EIR
Wetland Resource Areas
AREA: BRIARWOOD BEACH
Figure 8-15

200 0 200 Feet
1 inch = 200 feet

● Pump Station
Directional Drill Staging Area for Rose Point

SOURCE: MassGIS Orthophotos 1997
CDM Camp Dresser & McKee Inc.

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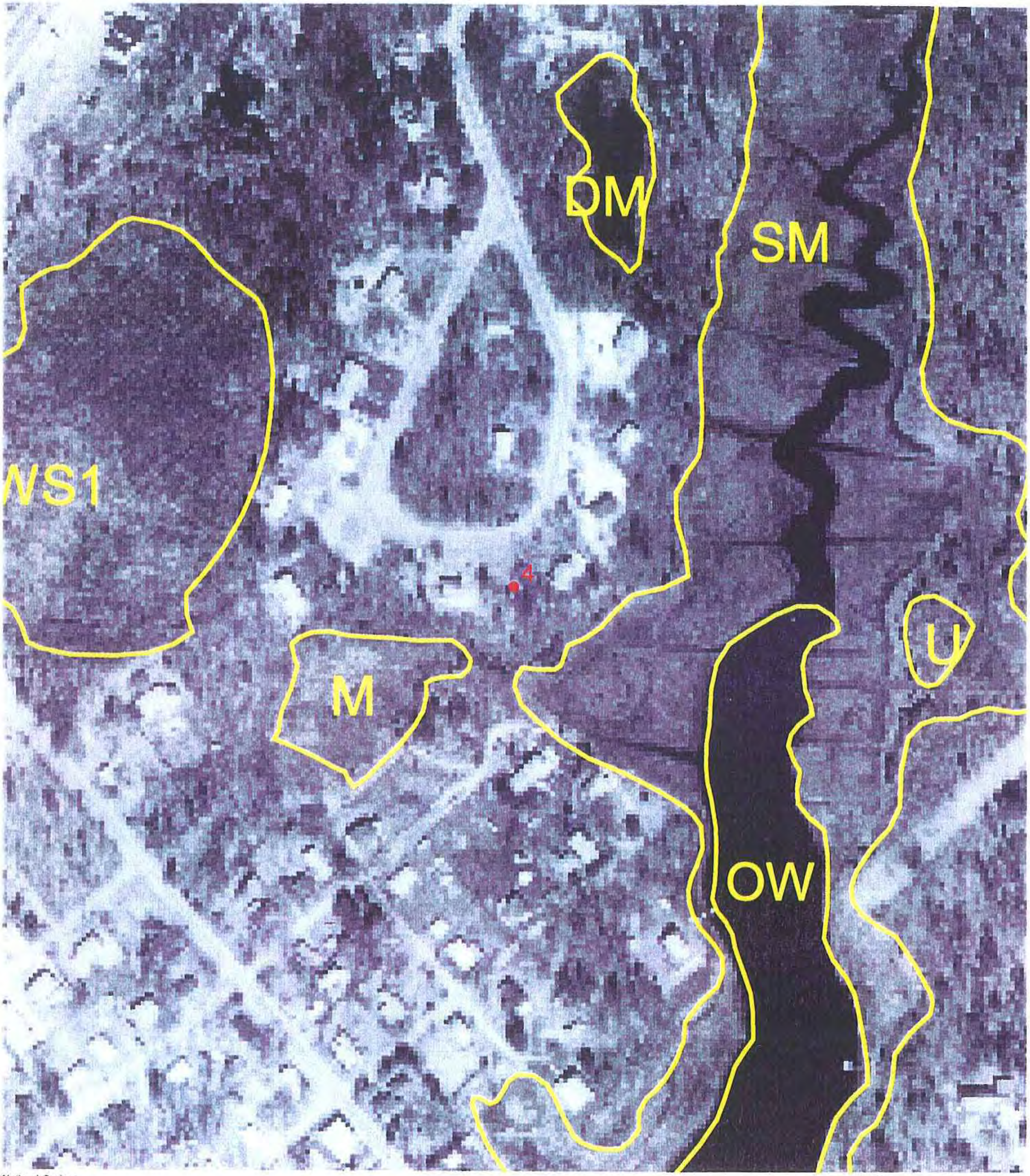

Wetland Codes:
BG Bog
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BE Coastal Beach
BB Barrier Beach
DM Deep Marsh
M Shallow Marsh, Meadow, or Fen
SS Shrub Swamp
D Coastal Dune
RS Rocky Intertidal Shore
OW Open Water
BA Coastal Bank, Bluff, or Sea Cliff
U Upland

Wooded Swamp Dominated by:
WS1 Decidous Trees
WS2 Coniferous Trees
WS3 Mixed Trees

N

Wareham CWWMP/EIR
Wetland Resource Areas
AREA: BEAVER DAM ESTATES
Figure 8-16

200 0 200 Feet
1 inch = 200 feet

● Pump Station

SOURCE: MassGIS Orthophotos 1997
CDM Camp Dresser & McKee Inc.

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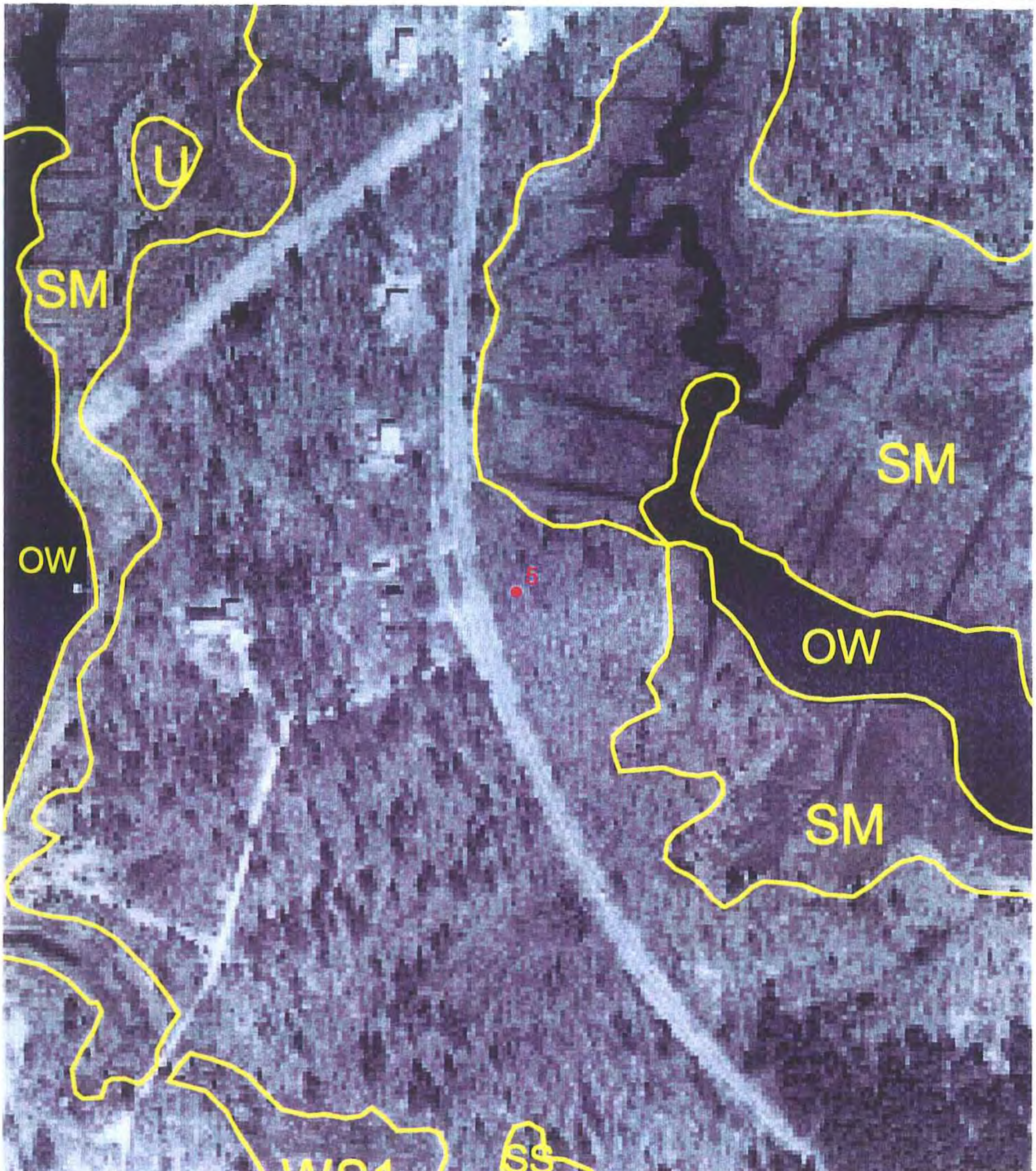

Wetland Codes:
BG Bog
CB Cranberry Bog
TF Tidal Flat
SM Salt Marsh
BE Coastal Beach
BB Barrier Beach
DM Deep Marsh
M Shallow Marsh, Meadow, or Fen
SS Shrub Swamp
D Coastal Dune
RS Rocky Intertidal Shore
OW Open Water
BA Coastal Bank, Bluff, or Sea Cliff
U Upland

Wooded Swamp Dominated by:
WS1 Decidous Trees
WS2 Coniferous Trees
WS3 Mixed Trees

N

Wareham CWWMP/EIR
Wetland Resource Areas
AREA: CROMESETT PARK
Figure 8-17

200 0 200 Feet
1 inch = 200 feet

● Pump Station

SOURCE: MassGIS Orthophotos 1997
CDM Camp Dresser & McKee Inc.

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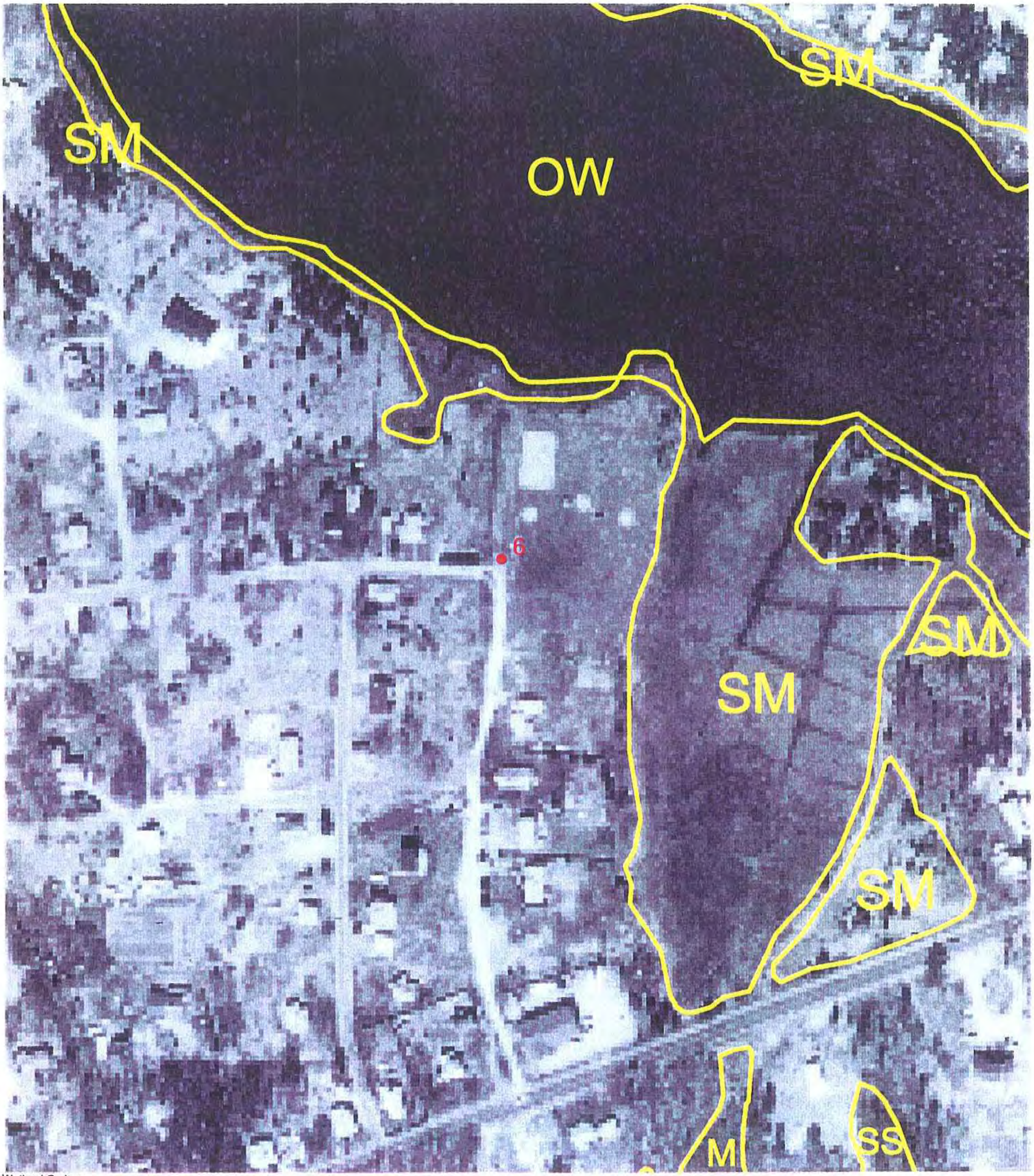

Wetland Codes:
BG Bog
CB Cranberry Bog
TF Tidal Flat
SM Salt Marsh
BE Coastal Beach
BB Barrier Beach
DM Deep Marsh
M Shallow Marsh, Meadow, or Fen
SS Shrub Swamp
D Coastal Dune
RS Rocky Intertidal Shore
OW Open Water
BA Coastal Bank, Bluff, or Sea Cliff
U Upland

Wooded Swamp Dominated by:
WS1 Decidous Trees
WS2 Coniferous Trees
WS3 Mixed Trees

Wareham CWWMP/EIR
Wetland Resource Areas
AREA: OAKDALE
Figure 8-18

N

200 0 200 Feet
1 inch = 200 feet

● Pump Station

SOURCE: MassGIS Orthophotos 1997
CDM Camp Dresser & McKee Inc.

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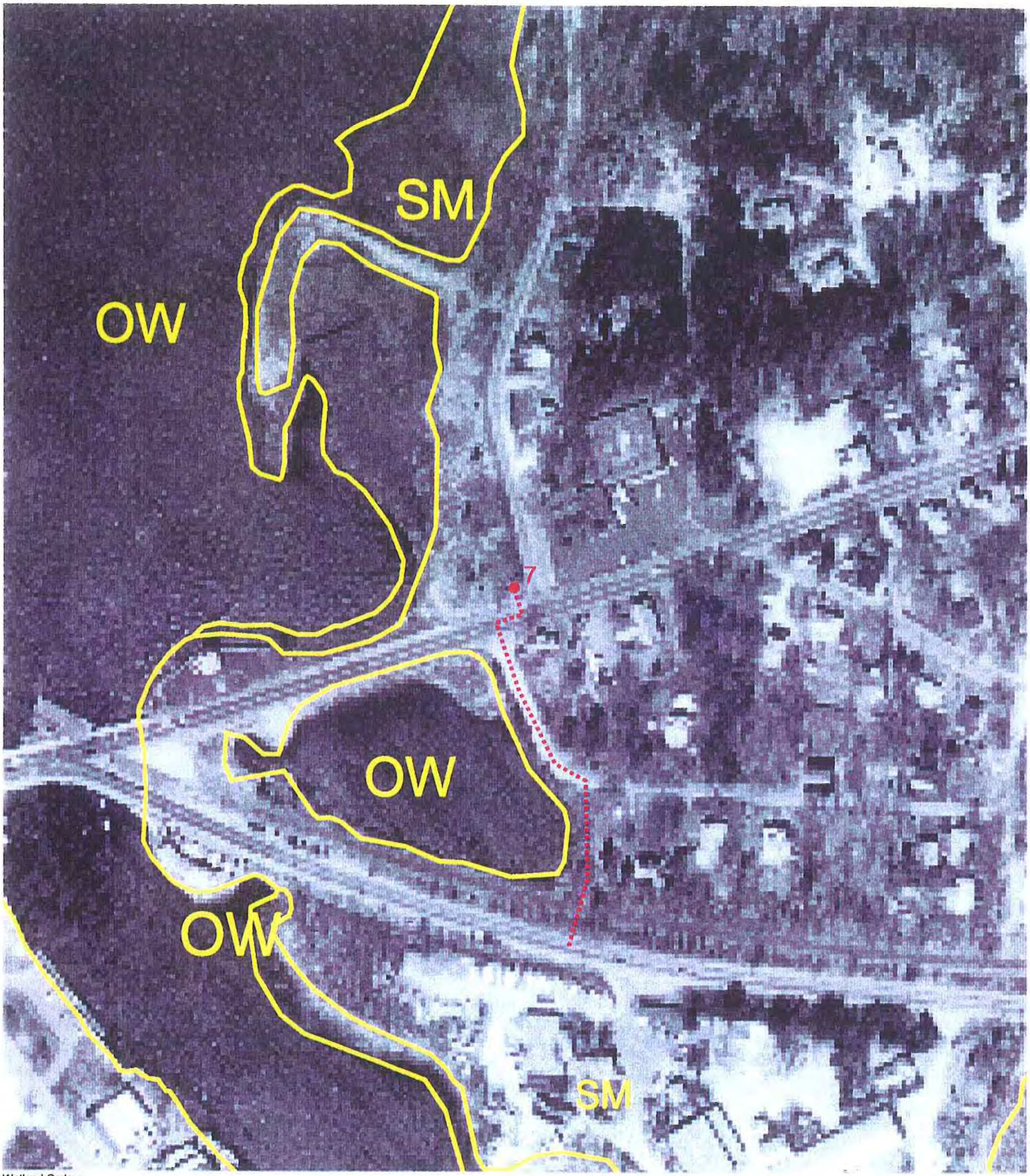

Wetland Codes:
BG Bog
CB Cranberry Bog
TF Tidal Flat
SM Salt Marsh
BE Coastal Beach
BB Barrier Beach
DM Deep Marsh
M Shallow Marsh, Meadow, or Fen
SS Shrub Swamp
D Coastal Dune
RS Rocky Intertidal Shore
OW Open Water
BA Coastal Bank, Bluff, or Sea Cliff
U Upland

Wooded Swamp Dominated by:
WS1 Decidous Trees
WS2 Coniferous Trees
WS3 Mixed Trees

N

Wareham CWWMP/EIR

Wetland Resource Areas

AREA: OAKDALE

Figure 8-19

200 0 200 Feet

1 inch = 200 feet

Pump Station

Proposed Force Main

SOURCE: MassGIS Orthophotos 1997

CDM Camp Dresser & McKee Inc.

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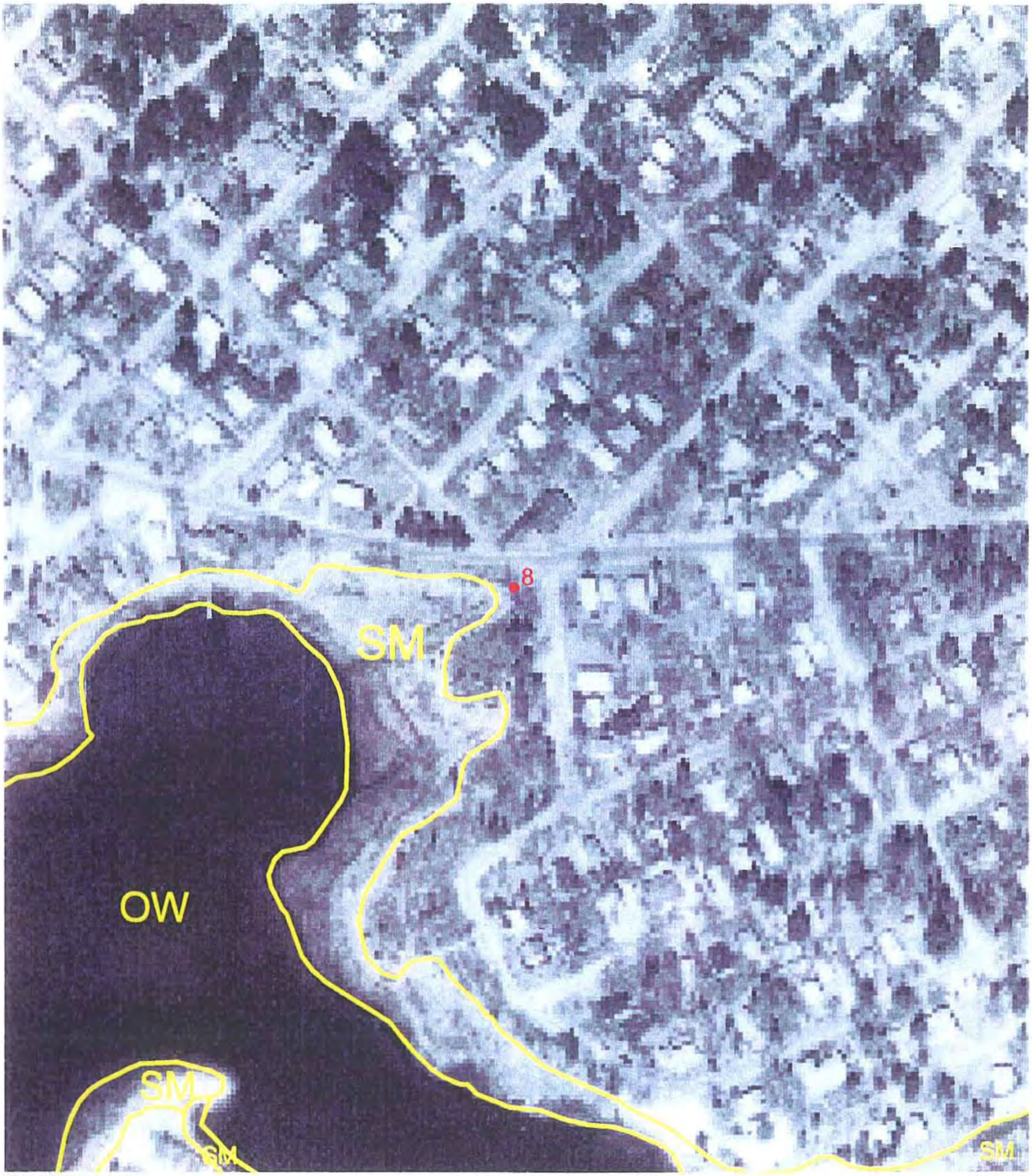

Wetland Codes:
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SM Salt Marsh
BE Coastal Beach
BB Barrier Beach
DM Deep Marsh
M Shallow Marsh, Meadow, or Fen
SS Shrub Swamp
D Coastal Dune
RS Rocky Intertidal Shore
OW Open Water
BA Coastal Bank, Bluff, or Sea Cliff
U Upland

Wooded Swamp Dominated by:
WS1 Decidous Trees
WS2 Coniferous Trees
WS3 Mixed Trees

N

Wareham CWWMP/EIR
Wetland Resource Areas
AREA: PARKWOOD BEACH
Figure 8-20

200 0 200 Feet
1 inch = 200 feet

● Pump Station

SOURCE: MassGIS Orthophotos 1997
CDM Camp Dresser & McKee Inc.

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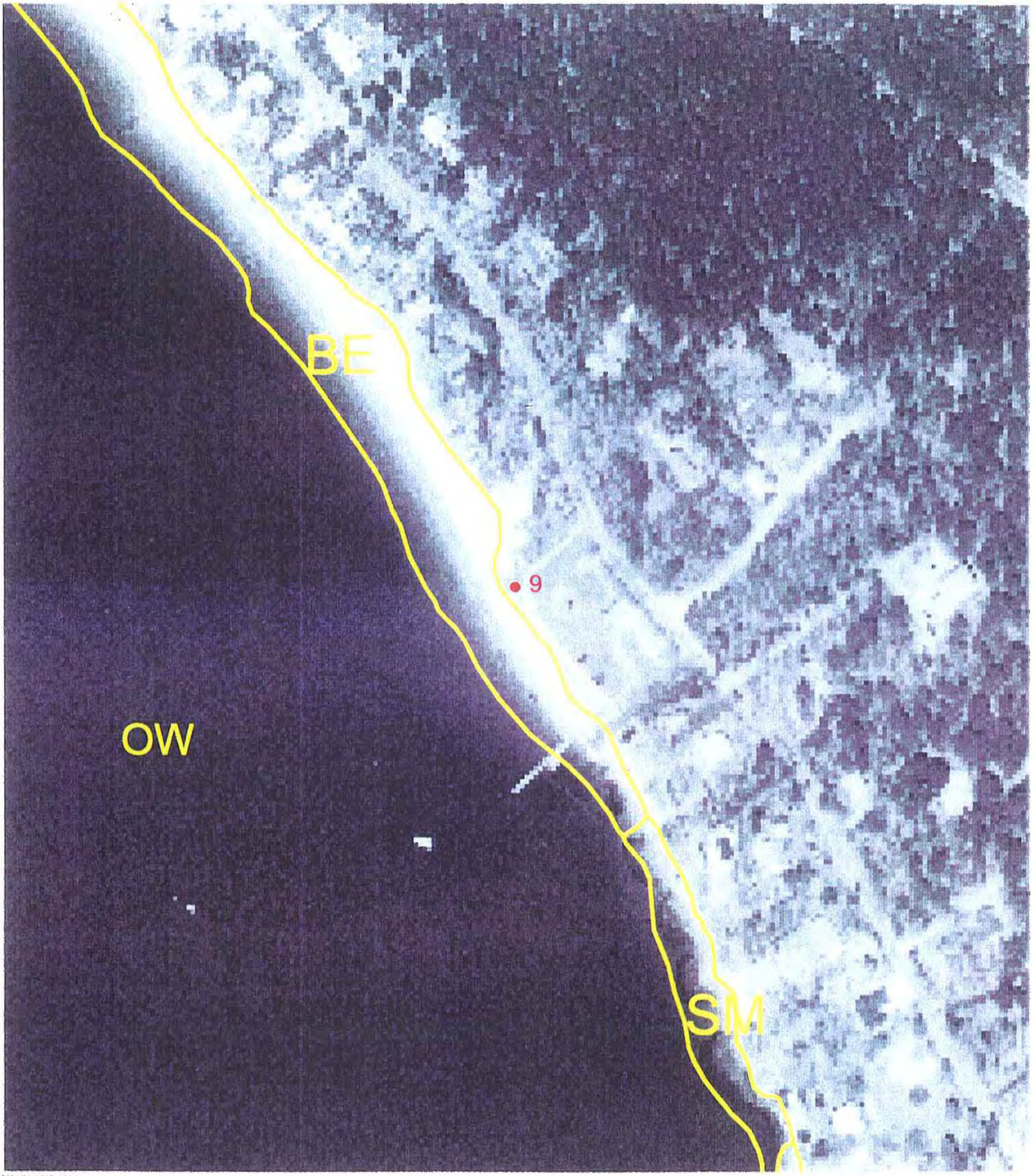

● Pump Station

Wetland Codes:
BG Bog
CB Cranberry Bog
TF Tidal Flat
SM Salt Marsh
BE Coastal Beach
BB Barrier Beach
DM Deep Marsh
M Shallow Marsh, Meadow, or Fen
SS Shrub Swamp
D Coastal Dune
RS Rocky Intertidal Shore
OW Open Water
BA Coastal Bank, Bluff, or Sea Cliff
U Upland

Wooded Swamp Dominated by:
WS1 Decidous Trees
WS2 Coniferous Trees
WS3 Mixed Trees

N

Wareham CWWMP/EIR
Wetland Resource Areas
AREA: TEMPEST KNOB
Figure 8-21

200 0 200 Feet
1 inch = 200 feet

SOURCE: MassGIS Orthophotos 1997
CDM Camp Dresser & McKee Inc.

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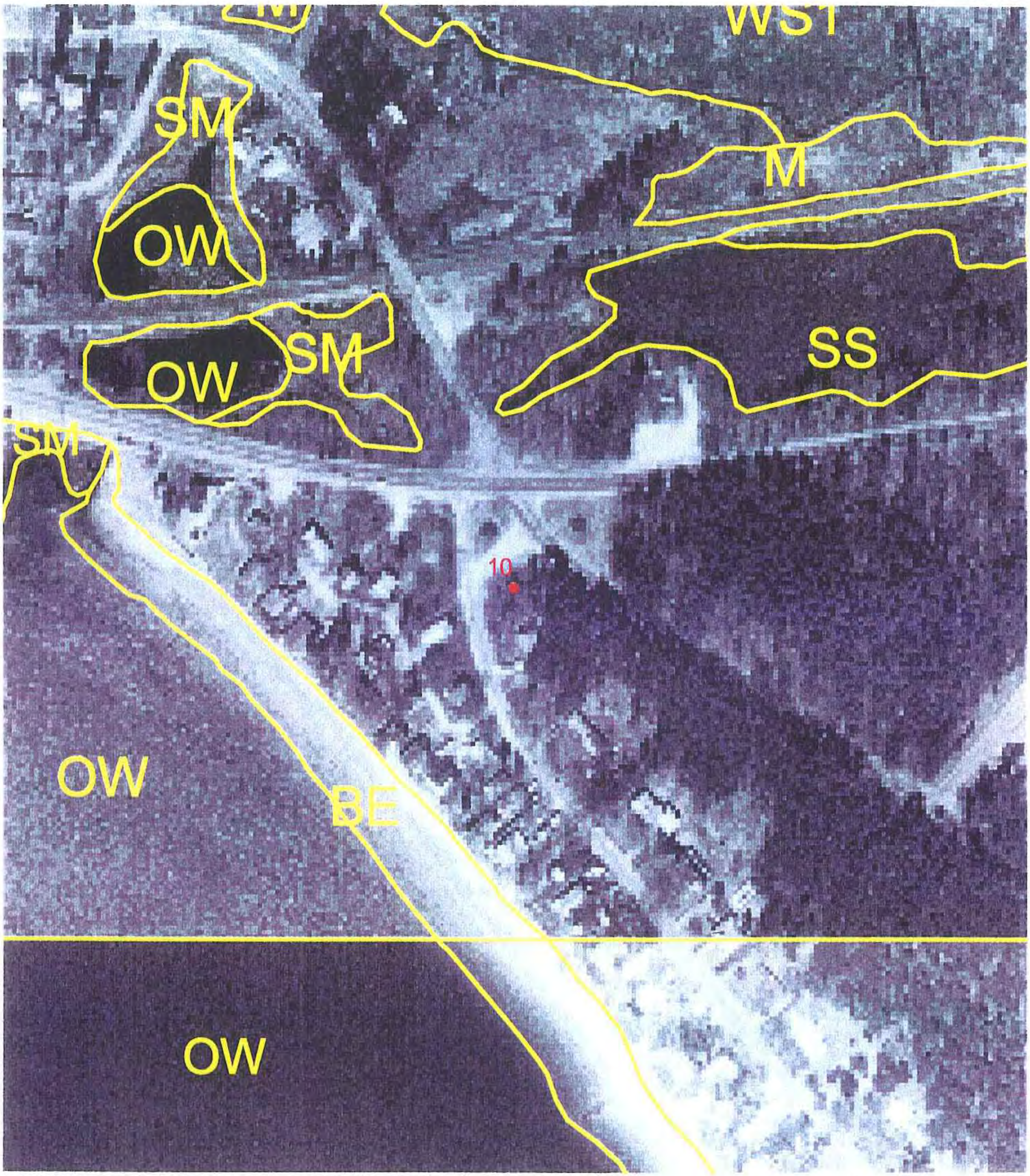

Wetland Codes:
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SS Shrub Swamp
D Coastal Dune
RS Rocky Intertidal Shore
OW Open Water
BA Coastal Bank, Bluff, or Sea Cliff
U Upland

Wooded Swamp Dominated by:
WS1 Decidous Trees
WS2 Coniferous Trees
WS3 Mixed Trees

N

Wareham CWWMP/EIR
Wetland Resource Areas
AREA: TEMPEST KNOB
Figure 8-22

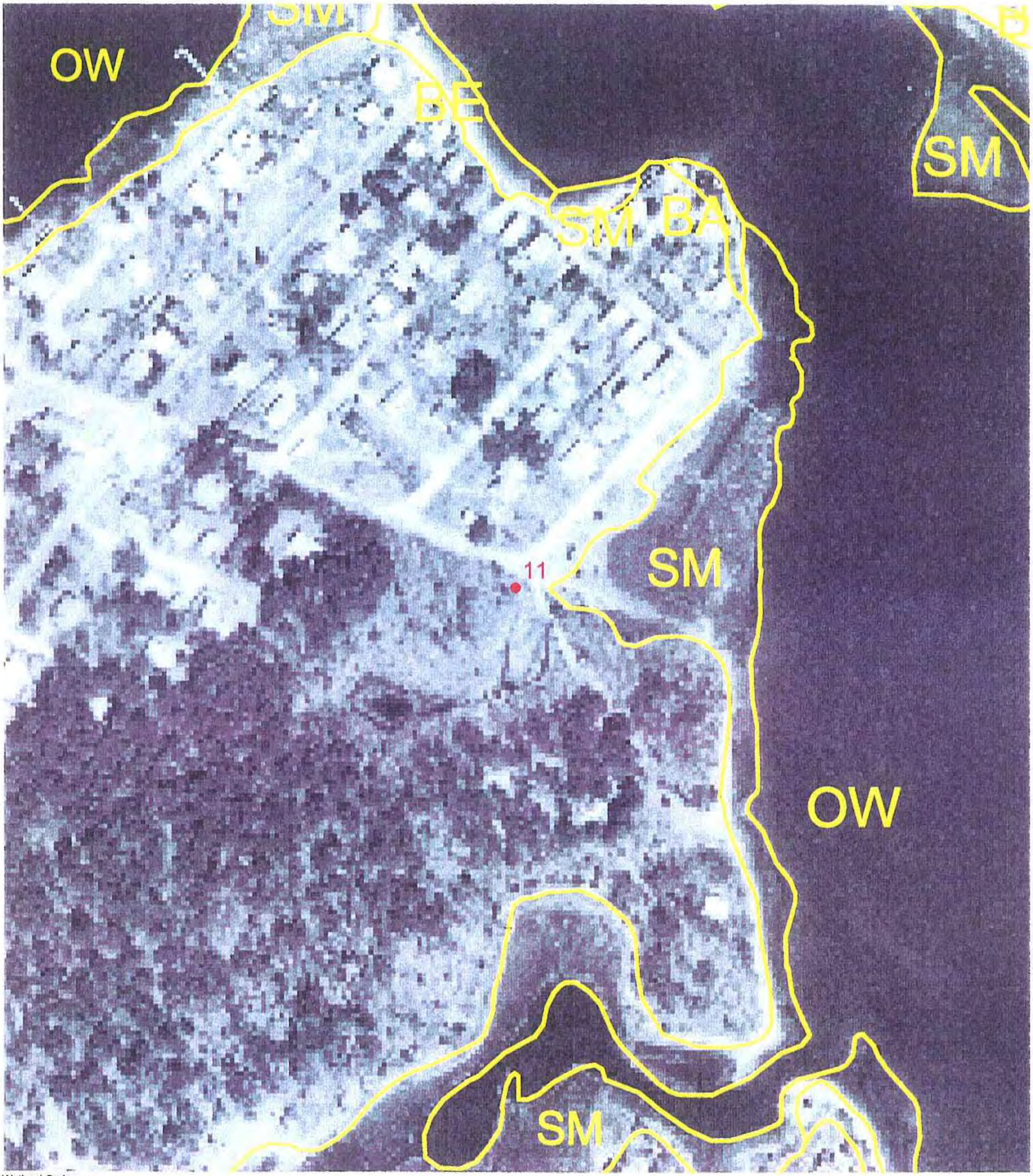
200 0 200 Feet

1 inch = 200 feet

● Pump Station

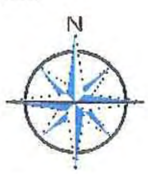
SOURCE: MassGIS Orthophotos 1997
CDM Camp Dresser & McKee Inc.

tg005278 d:\projects\wareham\wetlands.apr



Wetland Codes:
BG Bog
CB Cranberry Bog
TF Tidal Flat
SM Salt Marsh
BE Coastal Beach
BB Barrier Beach
DM Deep Marsh
M Shallow Marsh, Meadow, or Fen
SS Shrub Swamp
D Coastal Dune
RS Rocky Intertidal Shore
OW Open Water
BA Coastal Bank, Bluff, or Sea Cliff
U Upland

Wooded Swamp Dominated by:
WS1 Decidous Trees
WS2 Coniferous Trees
WS3 Mixed Trees



Wareham CWWMP/EIR
Wetland Resource Areas
AREA: AGAWAM BEACH
Figure 8-23

● Pump Station

200 0 200 Feet

1 inch = 200 feet

SOURCE: MassGIS Orthophotos 1997
CDM Camp Dresser & McKee Inc.

tg005278 d:\projects\wareham\wetlands.apr

Wetland Codes:
BG Bog
CB Cranberry Bog
TF Tidal Flat
SM Salt Marsh
BE Coastal Beach
BB Barrier Beach
DM Deep Marsh
M Shallow Marsh, Meadow, or Fen
SS Shrub Swamp
D Coastal Dune
RS Rocky Intertidal Shore
OW Open Water
BA Coastal Bank, Bluff, or Sea Cliff
U Upland

Wooded Swamp Dominated by:
WS1 Decidous Trees
WS2 Coniferous Trees
WS3 Mixed Trees

N

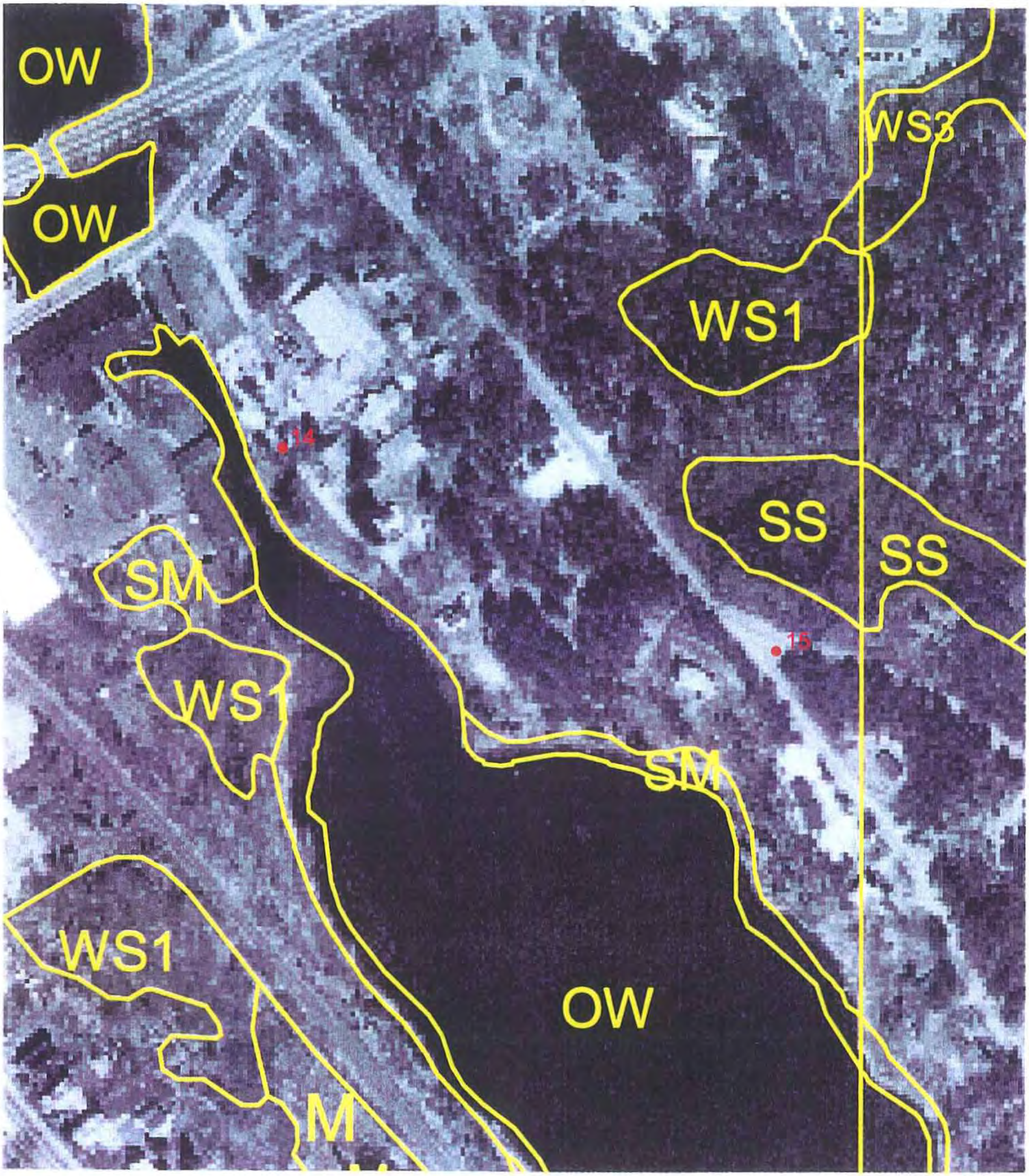
Wareham CWWMP/EIR
Wetland Resource Areas
AREA: ROSE POINT
Figure 8-24

200 0 200 Feet
1 inch = 200 feet

● Pump Station
Proposed Force Main (subaqueous)
Directional Drill Staging Area

SOURCE: MassGIS Orthophotos 1997
CDM Camp Dresser & McKee Inc.

tg005278 d:\projects\wareham\wetlands.apr



Wetland Codes:
BG Bog
CB Cranberry Bog
TF Tidal Flat
SM Salt Marsh
BE Coastal Beach
BB Barrier Beach
DM Deep Marsh
M Shallow Marsh, Meadow, or Fen
SS Shrub Swamp
D Coastal Dune
RS Rocky Intertidal Shore
OW Open Water
BA Coastal Bank, Bluff, or Sea Cliff
U Upland

Wooded Swamp Dominated by:
WS1 Decidous Trees
WS2 Coniferous Trees
WS3 Mixed Trees

N

Wareham CWWMP/EIR
Wetland Resource Areas
AREA: MAYFLOWER RIDGE
Figure 8-26

200 0 200 Feet
1 inch = 200 feet

● Pump Station

SOURCE: MassGIS Orthophotos 1997
CDM Camp Dresser & McKee Inc.

tg005278 d:\projects\wareham\wetlands.apr

- **<u>Site 3: Briarwood Beach P.S.</u>** – In order to avoid impacts to an isolated wetland, the pump station needs to be located adjacent to the intersection of Briarwood Drive and the paved road that leads to the parking lot by the "Body Clinic" and the "Red Dragon Martial Arts Academy." An isolated wetland is located 105 feet from this intersection adjacent to the paved road. This wetland can also be classified as isolated land subject to flooding (ILSF) and is not mapped as a resource area on the Massachusetts Orthophoto Map of the area. ILSF has no buffer zone. This site is located within the 100-year floodplain (el. 16 ft).

- **<u>Site 4: Beaver Dam Estates P.S.</u>** – This site is located between house #16 and #20 Fairfield Drive in the 100-foot buffer zone of a bordering vegetated wetland (BVW). A wooded wetland bordering a salt marsh is located approximately 60 feet from the edge of maintained lawn. The salt marsh is located approximately 160 feet from the maintained lawn. Dominant vegetation in the wooded wetland adjacent to the proposed pump station site is red maple (*Acer rubrum*), sweet pepperbush (*Clethra alnifolia*), and highbush blueberry (*Vaccinium corymbosum*). The site is also located within the 100-year floodplain (el. 16 ft).

- **<u>Site 5: Cromesett Park P.S.</u>** – This site is located on Cromesett Road in an upland area adjacent to a woods road. The proposed pump station may be within the 100-foot buffer zone of salt marsh depending on where on the upland parcel the pump station will be located. The site is within the 100-year floodplain (el. 16).

- **<u>Site 6: Oakdale/Apple Street P.S.</u>** – This site is located in uplands at the intersection of Avenue A and Apple Street; the site is used as a playground (Oakdale Playground). The site is located within the 100-year floodplain (el. 15).

- **<u>Site 7: Oakdale/South end of Avenue A P.S.</u>** – This site is located within a wetland that can be characterized as an emergent marsh (dominated by *Phragmites australis*) bordering on open water. Wetland impacts can be avoided if the pump station is built on the east side of the pond, adjacent to a residence on Mayflower Avenue. The site is located within riverfront area and 100-year floodplain (el. 15).

- **<u>Site 8: Parkwood Beach P.S.</u>** – The proposed pump station site as shown on the preliminary design drawings is a salt marsh. However, Doris M. Doyle Park is located adjacent to Parkwood Drive and Ivy Street and parts of the park are upland. Regardless of where on this parcel the pump station is constructed, it will be located within the 100-foot buffer zone to salt marsh, riverfront area, and bordering land subject to flooding. The pump station will be located outside the park limits.

- **<u>Site 9: Tempest Knob/Town Pier P.S.</u>** – The proposed pump station site is upland/parking lot located within the 100-foot buffer zone of coastal beach, land subject to coastal storm flowage, and riverfront area.

- **<u>Site 10: Tempest Knob/North End of Oak Street</u>** – This site is upland.

- Site 11: Agawam P.S. - The proposed Agawam pump station site is located at the end of Arlington Road and Gladstone Road in an upland area. The site is within 100-foot buffer zone of a BVW (shrub swamp) and salt marsh. The site is also within the 100-year floodplain (el. 15).

- Site 12: Rose Point P.S. - The proposed site for the Rose Point pump station can be characterized as 10 feet of uplands adjacent to the street with salt marsh adjacent to the Weweantic River. The proposed site is at the end of Rose Point Avenue near the intersection at Bradford Street. The site is located within riverfront area and 100-year floodplain (el. 15 ft).

- Site 13: Linwood/Ladd Avenue P.S. - This site is located on a vacant parcel within the 100-year floodplain (el. 15 ft).

- Site 14: Mayflower Ridge/End of Private Way - This site is located at the end of a private way of a daycare facility. The pump station will be located within buffer zone and bordering land subject to flooding (el. 15).

- Site 15: Mayflower Ridge/Mayflower Drive - This site is upland.

Directional Drilling for Weweantic River Crossing

Approximately 40 feet of salt marsh is present between the edge of water and the upland on the east side of the river at the proposed crossing. Dominant plants within the salt marsh are common glasswort (*Salicornia europaea*), salt hay grass (*Spartina patens*), and spike grass (*Distichlis spicata*). A large upland area is located landward of the salt marsh between the river and Route 6 (Marion Road). This area is proposed for use as a staging area for directional drilling. The site is located in riverfront area and within 100-year floodplain (el. 16).

In order to avoid impacts to salt marsh on the west side, the directional drill receiving pit will be located within the Bradford Street right-of-way and in a private yard off Bradford Street. Locations are shown on Figures 8-15 and 8-24.

Cross-Country Force Main

About 250 feet of force main will be located from the Avenue A pump station to Narrows Road. The route is located within 100-foot buffer zone to coastal bank, riverfront area and is also within the 100-year floodplain.

8.2.3 Executive Order #385 - Planning for Growth

The MEPA Certificate states that implementation of sewering programs may open certain lands to development that would not typically be developed in the absence of sewers. In order to prevent uncontrolled growth resulting from installation of sewers, the SEIR should include the legal and institutional means to be used by the Town to ensure compliance with Executive Order #385, which stipulates that infrastructure projects minimize unnecessary loss or depletion of environmental quality.

Institutional Controls

There are several institutional and legislative mechanisms for managing sewer related growth and the future connections and extensions of the sewer system in accordance with the approved plan and Executive Order #385. The development of the CWWMP represents one of the first steps in the Town's shifting growth management philosophy that strives to be consistent with the elements of EO #385. Over the past several years, the Town has taken steps to control growth. In 1998, the Town completed its Comprehensive Community Plan (Master Plan). The Master Plan summarized the Town's vision and goals, and laid out specific recommendations for growth control. Many of the Plan's recommendations have been debated at previous Town Meetings. Many of the proposed zoning bylaw changes pursued by the Town have attempted to achieve effective growth management while balancing economic development with resource protection. Two of the goals of the Master Plan were to:

- Moderate residential growth so that the Town is able to meet future demand for services; and

- Encourage the creation of permanently open spaces, preferably in contiguous parcels.

The following summarizes the current status of selected Master Plan growth control and zoning recommendations.

1. Zoning Bylaws should strictly limit development in environmentally sensitive areas such as areas with poor soils, high groundwater table, in flood velocity zone, or in a primary aquifer basin.

   Status: A bylaw restricting development and redevelopment within flood velocity zones was approved at the October 2001 Town Meeting. See Section 8.2.1 for details of the new bylaw. Wareham bylaws require a minimum lot size of 130,000 square feet of land area within the Zone II recharge area. Also, Title 5 requires all new subsurface disposal systems to be nitrogen reducing in an Interim Wellhead Protection Area or mapped Zone IIs of public water supplies.

2. Limit the number of new building permits issued annually to balance growth rate against infrastructure improvements (roads, utilities, town facilities, schools).

   Status: An article was inserted in the Spring 2000 Town Meeting warrant that proposed an annual cap on the number of building permits that could be issued annually. The article was withdrawn for further study. The Wareham Town Planner expects another similar article to be considered in the next few years.

3. Mandate open space dedication in all new subdivisions. Require that a minimum of 25 percent of developable land (including wetlands) must remain open.

Status: The Wareham Planning Board inserted Article 30 in the October 2001 Town Meeting that created a bylaw that allowed Open Space Development (OSD). The intent of the OSD bylaw was to provide attractive neighborhoods that maintain the rural character of the town, reducing sprawl, promoting the conservation of open space and other historic, environmental, and cultural features, and the efficient use of land in harmony with its natural features. The proposed OSD bylaw would allow open space zoning outside of current sewered areas and provide another growth control tool that acts to preserve open space, protects natural resources and minimizes the need for roads and other Town-maintained infrastructure that places undue tax burdens on residents. The article was voted for further study and is expected to be reconsidered at a future Town Meeting.

4. Zoning bylaws should require phasing of all new subdivisions of more than 20 lots, but should extend zoning protection during the period of such phasing.

   Status: The Wareham Director of Planning and Community Development is evaluating this recommendation. Future action is likely.

5. Focus commercial expansion near Interstate highway interchanges of Route 195 and 28 and along Route 28 from the Bypass to Depot Street.

   Status: Articles 11 and 12 at the October 2001 Town Meeting attempted to accomplish these efforts. Article 11 that established a Highway Commercial Overlay District was recommended and voted for further study. The petitioner withdrew article 12 that proposed a zoning overlay district known as the Master Planned Community Overlay District (MPCOD). The MPCOD, also known as the Makepeace article, focused commercial zoning near interstate interchanges.

6. Allow cluster subdivisions in areas without public water and sewer, but limit to single family dwellings, eliminate density bonuses, and require that 25 percent or more of the preserved open space be developable land.

   Status: The Director of Planning and Community Development and the Planning Board are preparing a zoning bylaw that would set conditions and requirements for cluster developments and open space districts. The Makepeace article attempted to gain approval for cluster development, but faced opposition from Town officials. A cluster development and open space district bylaw is expected to be considered at an upcoming Town Meeting.

7. Public efforts should be taken to establish a community land bank program ......to increase the amount of permanently protected open space.

   Status: Articles 13 and 14 of the October 2001 Town Meeting voted to accept the provisions of Sections 3 to 7 of Chapter 44B of the General Laws, otherwise known as the Massachusetts Community Preservation Act. The Act would allow

Wareham to charge a surcharge of 3 percent of the real estate tax due after an exclusion of $100,000.00 on the original assessed valuation of a piece of property. The resources would be matched dollar for dollar from a State fund and then Wareham could use the funds to purchase property for open space, housing, recreation, and historic preservation. The articles were approved and a committee will be established. Wareham voters will vote to accept or reject the Community Preservation Act in April 2002.

8. Create incentives to encourage owners of undeveloped land to preserve the land through deed restrictions, local tax concessions, and donation of development rights, gift, or other means.

   Status: The Town hopes to work with private land trusts to protect open space and prevent growth. Much of the vacant land obtained by the Town through tax title is sold with covenants on the deed requiring the land to remain open space.

9. The Town should urgently form a broad-based committee to revisit the zoning bylaws to consider amendments proposed herein, bring it up to date, eliminate ambiguous statements, improve enforcement capabilities, and make the document more user-friendly. The committee should include local business owners, neighborhood groups, town officials, and citizens-at-large.

   Status: The Wareham Director of Planning and Community Development anticipates hiring a consultant to help the Town update the zoning bylaws. Forecast in fiscal year 2002.

10. Increase minimum lot sizes in areas without water and sewer service to a minimum of 60,000 square feet.

11. Increase minimum lot sizes north of Route 495/25 to 130,000 square feet to protect groundwater resources and retain rural character.

    Status: The current zoning bylaws require at least 60,000 square feet minimum lot size in these areas. Article 28 of the October 2001 Town Meeting attempted to increase minimum lot sizes for land north of Route 25 and Interstate 195 from 60,000 square feet minimum to 130,000 square feet minimum. The article was voted for further study due to poor wording. Article 28 attempted to modify a wellhead protection area bylaw, and much of the land area has little relationship to wellhead protection. The article will likely be reconsidered without reference to the wellhead protection areas.

12. Require a 25-foot vegetative buffer, as defined in the buffer requirements of the Zoning Bylaws, where commercial uses abut residential uses or districts, and define long-term maintenance responsibilities/penalties in deed.

Status: Approval of Article 30 of the October 2000 Town Meeting modified the zoning bylaws to provide standards for minimum landscape buffers and landscape standards for various proposed uses.

Board of Sewer Commissioners

The Board of Selectmen acting as the Board of Sewer Commissioners (Board) has discretionary authority to permit or reject applications for sewer extensions or connections to the sewer system. The CWWMP was initiated in 1997 and will be completed in 2001. Throughout that period, various elected members of the Board have participated in its development. The Board has approved the proposed sewer area priority list and is committed to implementation of the remaining 11 sewer contracts by their order on the priority list. It is the understanding of the Board that any other areas requesting or demonstrating a need for sewers could only obtain approval after all of the 12 sewer areas are connected. Other sewer needs areas would have to be identified in future CWWMP efforts, which would be subject to future MEPA review. In addition, major sewer extension would require a DEP Sewer Extension Permit. One of the many provisions that DEP will consider when granting approval is whether the project is consistent with the latest approved CWWMP.

The Board also understands that the upgraded WPCF will have enough capacity for the 12 sewer areas and additional capacity for growth and in-fill within the existing sewer service area. However, there may not be available capacity for large sewer extensions not on the CWWMP priority list. Even if local and state government approvals are obtained for additional unplanned sewer extensions, the likelihood of sewer-related secondary growth due to constructing the 12 needs areas is low to moderate. As discussed below, many of the proposed sewer areas are in isolated densely developed areas that abut water or existing or proposed sewer areas. There is little contiguous vacant land that could be developed as a result of the recommended plan. Sewer extensions to these areas would require costly pumping stations and force mains to serve a relatively small number of homes.

The Town of Wareham is equally concerned about non-sewer related growth. A majority of the future growth in town is expected to be non-sewer related. Properties will continue to be developed with on-site disposal systems. Much of Wareham has dry sandy soils that would accept on-site subsurface disposal systems. The exception is in low-lying areas near receiving water where there are poorly drained organic or mineral soils. Because of the ease at which on-site subsurface disposal systems can be sited in these areas of Wareham, growth in these areas is forecast with or without the aid of sewers.

Secondary Growth Potential

Each study area was analyzed to assess potential for secondary growth, defined by individuals or developments connecting to the 12 planned sewer areas. Potential for secondary growth is described as either nonexistent, low, moderate or high. A brief description of the secondary growth potential in each study area is below.

proposed sewer area is to the north-northeast. The area to the east along Indian Neck Road is protected Town Forest and is undevelopable.

- Agawam Beach: Potential exists for secondary growth in existing land along Great Neck Road. Sewering those areas would require expensive pumping stations and collection system expansion and is likely to be cost prohibitive. Therefore, the potential is considered low.

- Tempset Knob: Potential exists for secondary growth in existing vacant land areas south of Marion Road in the northern portion of Tempest Knob. The southern portion is bordered by water to the west and protected Town Forest to the east along Indian Neck and Great Neck Roads. Therefore, the overall growth potential is considered moderate.

- Mayflower Ridge: There is moderate potential for secondary growth to the northeast of Mayflower Ridge. Water, poor soils and wetlands border the other sides of the study area.

In summary, the potential for secondary growth associated with 9 of the 12 proposed sewer areas is either low or there is no potential. The potential growth for the remaining three areas is classified as moderate. Many of the proposed sewer areas are in isolated low-lying, densely developed areas that abut water or existing or proposed sewer areas. In areas where the growth potential is moderate, the likelihood of sewering is low. In general, these areas are in low-density areas that would require expensive sewers, pumping stations, and long force mains to connect to the existing sewer system. Also, these areas could only be connected after the 12 proposed sewer priority areas have been constructed. The Wareham Board of Sewer Commissioners (Board of Selectmen) are not likely to approve of new sewers ahead of any proposed sewer areas. After the WPCF upgrade, capacity will exist for the 12 proposed sewer areas, in-fill of existing sewer areas, some growth in commercial, industrial, and institutional sources. However, there is no capacity allocated for new sewers in currently unsewered areas, including areas identified above, where moderate secondary growth exists. As a result, sewering of these moderate potential growth areas would have to be part of future Comprehensive Wastewater Management Planning.

8.2.4 Protection of Shellfish Resources

The MEPA Certificate requires that the SEIR contain a detailed discussion of provisions to be implemented at the WPCF to ensure the protection of shellfish resources in the Wareham River.

Invertebrates inhabiting Wareham's waters include oysters, hard- and soft-shelled clams, bay scallops, and lobsters. The hard-shell clam, or quahog, is the most abundant species, but soft-shelled clams and bay scallops are also found in significant quantities.

Hard-shelled clams are generally found in waters of salinity above 15 ppt with sandy and shelly substrate. Soft-shelled clams are usually found in the intertidal and subtidal zones in sandy substrate. The bay scallop is found in shallow waters and eelgrass beds.

The value of Wareham's shellfish resources is diminished by closures in some areas because bacteria levels exceed state standards. Areas within the Weweantic River and Onset Bay are consistently closed to shellfishing by the Division of Marine Fisheries (DMF) due to bacteria contamination. However, DMF has indicated that it anticipates reclassifying areas closed to shellfish harvesting between Parkwood Beach and the Agawam River Narrows Bridge to "seasonally approved status."

DMF has indicated that shellfish harvesting areas downstream of the WPCF outfalls between Parkwood Beach and Agawam River Narrows Bridge that are currently closed may be reclassified to seasonally approved status before December 2001. In addition, DMF and DEP recommend that the WPCF NPDES permit for fecal coliform be upgraded to a geometric mean most probable number (MPN) limit of 14 organisms per 100 milliliters (ml) with no more than 10 percent of the samples exceeding a MPN of 28 organisms per 100 ml. The design of the ultraviolet disinfection system included in the recommended plan was based on DMF's and DEP's recommended fecal coliform limits.

DMF has requested that the Town of Wareham implement a Shellfish Area Management Plan (Plan) and Memorandum of Understanding (MOU). The Plan and MOU is currently being prepared by DMF. The Plan and MOU will provide a description of the WPCF discharge and shellfish resource area classifications and status. The responsibilities and agreements of procedures for implementation and enforcement of shellfish closures based on pre-determined events will be outlined in the plan and MOU. The Plan and MOU will also outline the coordination and cooperation required between DMF, WPCF staff, Wareham Board of Health, Board of Sewer Commissioners, and the Wareham Shellfish Constable.

DMF and DEP have requested that the WPCF upgrade include the provision that a minimum of six hours of plant effluent detention time/effluent travel time to the shellfish beds during pre-determined events outlined in the proposed Shellfish Area Management Plan. The six hours would provide DMF or local officials time to respond to WPCF malfunctions, planned or unplanned maintenance events, or elevated fecal coliform levels. The following analysis of Agawam River tidal velocities and Wareham River tidal velocities provides an estimate of effluent travel times to shellfish beds. The analysis concludes that with the use of two equalization basins included in the recommended plan, the plant effluent travel time will be greater than six hours.

Estimated Travel Time to Shellfish Beds

Hourly tidal velocity data were collected on two separate occasions (9/2/99 and 10/17/99) at the two bridges that cross the Wareham River Estuary, the Route 6 bridge near the WPCF, and the Tobey Hospital at the confluence of the Agawam and Wankinco Rivers. These data were used to estimate the amount of time it would take a particle to leave the WPCF and travel down the Agawam River to the shellfish beds just outside of the Tobey Bridge (4400 meters downstream of the WPCF).

The tidal velocities were plotted and the 9/2/99 sampling date was close to a Spring tide, while the 10/17/99 was a Neap tide. These two data sets represent the two extreme tides (monthly high and monthly low) that occur in the Agawam River Estuary. To estimate the travel time for the effluent to reach the closest shellfish beds, the average tidal velocities were calculated for each data set over the Ebb tide (outgoing tide). The average tidal velocity over the Ebb tide is 22.7 cm/s and 22.2 cm/s for the 9/2/99 and 10/17/99 data sets, respectively. The associated travel time for these two data sets were similar at 5.4 hours and 5.5 hours. This travel time is less than 1/2 of the tidal period (6.2 hours), meaning that if a particle left the WPCF at the beginning of the Ebb tide, it would reach the shellfish beds within that same tidal cycle. If the particle were to leave at any other time during the tidal cycle, (during the flood tide) the travel time would be compounded by tidal interactions, which would make the travel times longer but more complicated to estimate.

These calculations are based on the averages of hourly tidal velocities collected during the summer 2000 sampling program on the Wareham River Estuary and therefore are just estimates of average travel times. More accurate travel times, including minimum and maximum travel times could be calculated using the computer model of the Wareham River Estuary.

If no on-site detention of effluent is provided, effluent from the WPCF will travel for approximately 5.4 hours before it reaches the nearest shellfish beds. As indicated in Section 6.5, two 1.0 million gallon off-line equalization basins will be constructed at the WPCF. These basins will be used to dampen diurnal flows and during emergency situations to stop the plant discharge for up 24 hours (based on average daily flows). During emergency periods, all flow that is pumped to the WPCF will be diverted to the equalization basins and no flow will feed the treatment system causing the outfall flow to stop.

The outfall travel time to the shellfish beds and the time that influent flow is diverted to equalization will provide DMF and the Town greater than 6 hours of time needed to take required actions at Wareham shellfish beds. DMF will prepare and submit the draft Shellfish Management Plan and Memorandum of Understanding to the Town of Wareham for review and comment.

8.2.5 Response to ENF Comments

This section summarizes comments received on the ENF and provides responses and references to appropriate sections of this document for additional information. All of the comment letters are contained in Appendix K and are indexed to match Table 8-2.

Table 8-2
Wareham ENF Comments

Comment Letter Number	Issue
1	**Buzzards Bay Project (BBP) - Joseph E. Costa**
1.1	EIR should address water quality improvements that will be achieved with the proposed reductions in nitrogen loading to the facility.
1.2	EIR should address water quality or habitat improvements that might occur as a result of reduced nitrogen discharges from the facility.
1.3	EIR should identify a specific watershed nitrogen loading target for the Wareham and Agawam River estuaries necessary to achieve at least "Good" water quality in those estuaries.
1.4	EIR should address to what degree nitrogen from new growth could offset improvements to the facility.
1.5	EIR should describe what strategies the Town will consider to achieve the watershed loading targets.
2	**EOEA Office of Coastal Zone Management - Tom Skinner, Director**
2.1	EIR should document the location of the proposed sewer system components relative to flood zones.
2.2	EIR should include a complete delineation of all resource areas in the project area.
2.3	EIR should include an evaluation of the alternatives that will avoid potential adverse impacts to each resource area, measures to minimize impacts, and a mitigation plan.
2.4	EIR should further discuss outfall constraints, construction sequencing and methodology, appropriate erosion and sedimentation controls, and de-watering measures.

Table 8-2 (Continued)
Wareham ENF Comments

Comment Letter Number	Issue
2 (Continued)	**EOEA Office of Coastal Zone Management - Tom Skinner, Director**
2.5	EIR should discuss disposal of tailings from the directional drilling and impacts to biota in the staging area.
2.6	EIR should analyze existing roads relative to actual rights-of-way and minimize any proposed changes to paved area.
2.7	EIR should discuss how growth-related increases in wastewater flow, nitrogen, and phosphorous loading could offset proposed improvements.
2.8	EIR should describe how the Town intends to achieve the watershed loading limits proposed in the ENF.
2.9	EIR should discuss the prohibited increase of discharges to the Agawam River and state if the Town is seeking a variance.
2.10	EIR should discuss 28% winter vacancy rate. If needed, update using 2000 U.S. Census data.
2.11	EIR should discuss why Great Hills Estates was not recommended for sewering. The 1986 Facilities Plan by Metcalf & Eddy recommended that this area be sewered.
2.12	EIR should describe the calculations used to determine the dilution ratio at the proposed outfall location. This calculation should use daily maximum flow rates, not average flow rates.
2.13	EIR should describe the status of the overlay district. Special Legislation is needed for the implementation of growth controls.
2.14	EIR should describe how this project is consistent with E.O. 385 and E.O 149.
2.15	EIR should include a public education program explaining growth management measures adopted as part of the project.
2.16	Project appears subject to CZM federal consistency review.

Table 8-3 (Continued)
Wareham ENF Comments

Comment Letter Number	Issue
3	**Department of Environmental Protection - Robert P. Fagan**
3.1	EIR should have a recommended plan section including: elements of the recommended plan, existing and projected loads, preliminary design criteria, site map, map of existing and proposed sewer system, costs of elements, implementation plan, proposed financing program, per household costs, WWPCF operation plan and staffing requirements, legal and institutional mechanisms for managing future connections, and compliance with E.O. 385.
3.2	EIR should include response to DEP and EPA comments on the draft water quality report and status of discussions regarding new NPDES effluent limits.
3.3	Proposed bylaw language on page 4-17 on ENF is consistent with past language approved by DEP and CZM.
3.4	Town must hold a public hearing on the recommended plan.
3.5	It is unclear whether the projected flows include infilling within the existing collection system. If not, they should.
3.6	Statement on page 4-15 of the ENF regarding SRF limits on funding is incorrect and should be deleted.
3.7	EIR should discuss potential odors from the two proposed equalization basins and how the odors will be dealt with.
3.8	EIR should address how the treatment plant will meet the potential coliform limit of 14 organisms per 100 milliliters.
3.9	EIR should propose recommended approach in addressing Division of Marine Fisheries criteria for protection of shellfish areas including: Class 1 reliability standards, combination of wastewater storage, travel time in Agawam River, and a town shellfish management system.
3.10	Bureau of Waste Site Cleanup has found several disposal sites located in project area. A Licensed Site Professional may need to be retained to determine if notification is required pursuant to 310 CMR 40.0300.

Table 8-3 (Continued)
Wareham ENF Comments

Comment Letter Number	Issue
4	**Department of Food and Agriculture**
4.1	Cranberry farms may be vulnerable to additional growth causing environmental impacts to bog water quality.
4.2	140 acres of agricultural upland and 75 acres of cranberry bog and associated wetlands are in needs areas, therefore project must comply with E.O. 193.
4.3	According to MGL Chapter 80 Section 1, sewer betterment fees should not be levied on farmlands while they are classified under Chapter 61A or under agricultural preservation restriction.
4.4	EIR should confirm that the project capacity is limited to present uses and projected growth within the 12 identified service areas, and further discuss growth controls.
5	**Division of Fisheries and Wildlife - Christine Vaccaro**
5.1	Project site intersects four Priority/Estimated Habitats.
6	**Division of Marine Fisheries - Paul J. Diodati**
6.1	Concerned that the proposed increase in discharge will prevent maintaining the area between Parkwood Beech and the Agawam River Narrows Bridge at the new classification of seasonally approved for shellfish harvesting.
6.2	Requests that the discharge permitted fecal coliform limit be upgraded to not exceed a geometric mean MPN (most probable number) of 14 organisms per 100 ml.
6.3	Upgrading the discharge controls for nitrogen and phosphorus would help to improve overall water quality in the receiving waters.

Table 8-3 (Continued)
Wareham ENF Comments

Comment Letter Number	Issue
7	**Massachusetts Highway Department - J. Lionel Lucien**
7.1	MassHighway permit will be required for work within the state highway layout of Routes 6 and 28.
7.2	Sewer work must be coordinated with the reconstruction of Route 6/28 from the Bourne town line westbound to its intersection with the East Wareham By-Pass Road, currently under design.
8	**Massachusetts Historical Commission - Eric S. Johnson**
8.1	Request to review project plans to determine if proposed pump stations are located in archaeologically sensitive areas.
9	**The Coalition for Buzzards Bay - Mark Rasmussen**
9.1	Project will promote sprawl. EIR should assess the full development build-out that project may cause.
9.2	Suggests that a decentralized sewerage system could prevent sprawl.
9.3	Table 8-1 of the ENF is inadequate. More review of the decentralized alternative is needed.
9.4	Opposes any on site landfill for sewage sludge, even as a "back-up", due to possible contamination of the Agawam River from high nitrogen concentrations.
9.5	EIR should provide a full stormwater management plan.
9.6	ENF incorrectly stated that there is no water quality data available for the Agawam and Wareham Rivers.

Comment Letter 1: Buzzards Bay Project, Joseph E. Costa

Comment 1.1:
EIR should address water quality improvements that will be achieved with the proposed reductions in nitrogen loading to the facility.

Response 1.1:
Attachment 5 of the ENF qualitatively addresses the improvements that will be achieved with reduced nitrogen and phosphorus loading in the receiving water (nitrogen loading to the facility, as stated in the comment, will actually be increased as additional areas in Town are sewered).

Comment 1.2:
EIR should address water quality or habitat improvements that might occur as a result of reduced nitrogen discharges from the facility.

Response 1.2:
Again, these are qualitatively discussed in Attachment 5 of the ENF. Expected improvements include a reduction in algal growth in the upper Agawam River estuary due to phosphorus controls at the WPCF. Nitrogen controls at the WPCF could show improvement in the area of the confluence of the Agawam River and Wankinco River estuary (head of the Wareham River estuary). Control of nutrients at the WPCF would likely result in an increase in dissolved oxygen levels there. There would likely be no discernable difference in water quality in the lower Wareham River estuary.

Comment 1.3:
EIR should identify a specific watershed nitrogen loading target for the Wareham and Agawam River estuaries necessary to achieve at least "Good" water quality in those estuaries.

Response 1.3:
It is beyond the scope of the EIR to identify specific watershed nitrogen loading targets, which would require conduct of a TMDL-like study (responsibility of the state) that links receiving water nitrogen levels (or some derivative thereof like chlorophyll) with the state water quality classifications.

The Town of Wareham has, however, conducted a receiving water study to understand their water quality. As discussed in Response 1.2, this study found there to be degraded water quality in the Agawam River estuary that seems to be linked to phosphorus discharges from the WPCF. We believe that phosphorus controls at the WPCF would reduce the significant algal blooms found in this estuary and improve water quality. Nitrogen discharged from all sources appears to contribute to some degradation in water quality around the confluence of the Agawam and Wankinco Rivers defined as dissolved oxygen levels just below the Massachusetts SB water quality standards in the August sampling round, though it is possible that the high chlorophyll levels due to phosphorus loads are partial contributors. We did not find significantly degraded water quality in the lower Wareham River estuary. Thus, we believe that water quality in Agawam-Wareham River estuary complex can currently be categorized as good in terms of nitrogen loads.

Comment 1.4:
EIR should address to what degree nitrogen from new growth could offset improvements to the facility.

Response 1.4:
It is difficult to respond to the comment as the form or location of growth and the type of wastewater service is not known. Obviously, additional development in Town or the remainder of the watershed has the potential to increase nutrient loads to the receiving water. If the development occurs in the portion of the watershed tributary to the Agawam or Wankinco Rivers, then we believe that the water quality investigation has shown that a large part of the increased nutrient input has the potential to be retained in the freshwater linked-ponds that form these rivers. If the development occurs along the Agawam River estuary, the impact is more direct, and more significant if the development is served by septic tanks rather than sewers.

Comment 1.5:
EIR should describe what strategies the Town will consider to achieve the watershed loading targets.

Response 1.5:
As watershed loading limits for the Wareham River estuary have not be agreed to and since a TMDL for this estuary has not been performed, it is not the purpose of this EIR to discuss how the Town might meet limits that have not been established.

Comment Letter 2: CZM, Tom Skinner

Comment 2.1:
EIR should document the location of the proposed sewer system components relative to flood zones.

Response 2.1:
Figures showing the location of the sewer needs areas relative to flood zones are presented as Figures 8-1 through 8-12 in Section 8 of this document. Portions of four of the twelve needs areas are within V zones. However, there are no pumping stations proposed in V-zones and only 850 linear feet of sewer proposed in V-Zones. All lots bordering these sewers are already developed. See Section 8.2.1 for further discussion.

Comment 2.2:
EIR should include a complete delineation of all resource areas in the project area.

modeling study that provided Wareham River estuary specific information that could be used to compare to watershed loads (not limits) developed by using a land use-based loading method. One purpose of the study was to show that the land use-based loading method may not be able to be universally applied because of site-specific factors such as denitrification in the linked-pond complex that dominates the riverine (freshwater) portion of the Wareham River estuary.

Since no one has agreed on watershed loading limits for the Wareham River estuary and since a TMDL for this estuary has not been performed, it is not the purpose of this EIR to discuss how the Town might meet limits that have not been established.

Comment 2.9:
EIR should discuss the prohibited increase of discharges to the Agawam River and state if the Town is seeking a variance.

Response 2.9:
The ENF does not include the statement cited in the comment. Further, 314 CMR 4.04(3) provides antidegradation provisions relevant for outstanding natural resource waters (ONRW). The receiving water for Wareham's wastewater effluent is included in the Massachusetts Water Quality Standards (Table 30) as "Agawam River: Wareham STP to confluence, " which is designated as a restricted shellfishing SB water, not an ONRW.

Comment 2.10:
EIR should discuss 28 percent winter vacancy rate. If needed, update using 2000 U.S. Census data.

Response 2.10:
The 1997 draft Facilities Plan used 1990 U.S. Census data. However, the draft and final CWWMP did use 2000 U.S. Census data. The WPCF was designed using population and flow data for the peak period (Summer months). The design flow assumes growth and in-fill within existing and proposed sewer areas. Conversion of the design flows and loads into a per capita consumption would result in an assumed lower future vacancy rate.

Comment 2.11:
EIR should discuss why Great Hills Estates was not recommended for sewering. The 1986 Facilities Plan by Metcalf & Eddy recommended that this area be sewered.

Response 2.11:
The focus of this investigation was on neighborhoods with onsite disposal systems that have been identified by the Wareham Board of Health and/or the Department of Environmental Protection, Bureau of Resource Protection, as having onsite disposal problems.

Comment 2.12:
EIR should describe the calculations used to determine the dilution ratio at the proposed outfall location. This calculation should use daily maximum flow rates, not average flow rates.

Response 2.12:
The Attachment 5 of the ENF (the *Water Quality Investigation of the Wareham River Estuary Complex* report) provides a detailed description of flow criteria (pg. 4-13 through 4-19) that could be used to establish permit limits. The commenter suggests that the dilution should be developed using maximum flow rates - this is not the method used by EPA to establish permit limits. The flow rates used in these calculations match what EPA uses for flow rates.

Specifically, the criteria discussed in Attachment 5 to the ENF are 17.3 cfs as the 7Q10 flow to be used for acute water quality criteria to set maximum day permit limits, and a dilution ratio of 12.5:1 for chronic water quality criteria to set average day permit limits. The dilution ratio of 12.5:1 was determined from the dilution provided in a numeric model and is based on a flow rate of 1 mgd, which is the current average daily flow for the treatment plant. As the plant flow increases over the next 20 years, the dilution ratio for the chronic water quality criteria would decrease. At the end of the 20 year period and using the projected flow of 1.47 mgd, the dilution ratio would be 9:1.

Comment 2.13:
EIR should describe the status of the overlay district. Special legislation is needed for the implementation of growth controls.

Response 2.13:
We do not agree with CZM that special legislation is required for control of growth in velocity zones. A velocity zone bylaw was prepared and adopted in the October 2001 Town Meeting. See Section 8.2.1 for further details of the new zoning bylaw.

Comment 2.14:
EIR should describe how this project is consistent with E.O. 385 and E.O. 149.

Response 2.14:
The project will be consistent with E.O. 385 (secondary growth) and E.O. 149 (construction in flood prone areas), as discussed in Section 8.2. The Town has adopted a new bylaw that addresses construction in velocity zones and secondary growth potential is limited.

Comment 2.15:
EIR should include a public education program explaining growth management measures adopted as part of the project.

Comment 3.4:
Town must hold a public hearing on the recommended plan.

Response 3.4:
The Town will hold a public meeting on the recommended plan. The hearing will be on December 4, 2001 at 7:05 PM in Room 320 of the Wareham Multi-Service Center, 48 Marion Road, Wareham, MA 02571.

Comment 3.5:
It is unclear whether the projected flows include infilling within the existing collection system. If not, they should.

Response 3.5:
The projected flows include infilling within the existing collection system. In projecting future flows and loads, it was estimated that 1800 additional equivalent dwelling units (EDUs) will be added to the system by 2020. This value represents infilling in both the existing collection system and the twelve proposed sewer areas.

Comment 3.6:
Statement on page 4-15 of the ENF regarding SRF limits on funding is incorrect and should be deleted.

Response 3.6:
The statement has been deleted.

Comment 3.7:
EIR should discuss potential odors from the two proposed equalization basins and how the odors will be dealt with.

Response 3.7:
Influent wastewater flows will pass through the headworks facilities before entering the basins. A reduction in odor is achieved prior to the equalization basins. Odorous air is drawn out of the headworks junction box and headworks building and directed to the new headworks biofilter. The headworks biofilter will treat air originating from the inlet box, headworks building, grit chamber and from the septage equalization tanks. The agitation and mixing that occur in the headworks processes will facilitate the expulsion of many of the offensive odors, including hydrogen sulfide. Second, the two proposed off-line equalization basins will have a grid of coarse bubble diffusers to provide mixing and mitigate odors. This aeration system will be on whenever the basins contain wastewater thus preventing septic or anaerobic conditions from forming. At times when the basins are not in use, during "non-freezing" times of the year, they will be pumped out, sprayed down via water cannons located along the perimeter of each basin, and pumped dry to minimize odors. During "freezing" winter months the basins will

be filled up to 4-ft with plant effluent water to cover and the diffusers and prevent ice damage.

Odor control measures are also being evaluated for the Hynes Field, Kennedy Lane, and Narrows pumping stations. These are the three largest pumping stations that provide all flows to the WPCF. Control of odors prior to flows reaching the WPCF is recommended.

Comment 3.8:
EIR should address how the treatment plant will meet the potential coliform limit of 14 organisms per 100 milliliters.

Response 3.8:
The original CWWMP and proposed design included a UV system based on the existing NPDES permit limits of "fecal coliform shall not exceed a monthly median or geometric mean of 88 colonies per 100 mL, nor shall more than 10 percent of the samples in a month exceed 260 colonies per 100 mL." In August 2001, at a meeting with MEPA and DEP, CDM was made aware that the Division of Marine Fisheries ENF comment letter requested the future permit limit to include "fecal coliform shall not exceed a geometric mean most probable number (MPN) of 14 organisms per 100 milliliters with no more than 10 percent of the samples in a month exceeding a MPN of 28 organisms per 100 mL," and that the DEP intended to honor this request in the future NPDES permit. Therefore, the UV design was modified, through consultation with UV manufacturers, to include an additional module of lamps per bank in order to meet such limits.

Comment 3.9:
EIR should propose recommended approach in addressing Division of Marine Fisheries criteria for protection of shellfish areas including: Class 1 reliability standards, combination of wastewater storage, travel time in Agawam River, and a town shellfish management system.

Response 3.9:
The WPCF upgrade will bring the facility up to Class 1 reliability standards. See Section 8.2.4 for the discussion of protection of shellfish resources.

Comment 3.10:
Bureau of Waste Site Cleanup has found several disposal sites located in project area. A Licensed Site Professional may need to be retained to determine if notification is required pursuant to 310 CMR 40.0300.

Response 3.10:
Comment noted. During the sewer designs, the engineer should take required steps to determine the location of all disposal sites and their potential impact to sewer construction. See Section 8.6.5 for a discussion of mitigation measures

associated with potential hazardous materials encountered prior to or during construction.

Comment Letter 4: Department of Food and Agriculture

Comment 4.1:
Cranberry farms may be vulnerable to additional growth causing environmental impacts to bog water quality.

Response 4.1:
Growth potential and growth controls are discussed in Section 8.2.3.

Comment 4.2:
140 acres of agricultural upland and 75 acres of cranberry bog and associated wetlands are in needs areas, therefore project must comply with E.O. 193.

Response 4.2:
The proposed sewer projects are primarily in existing streets and rights-of-ways. The recommended plan does not convert any agricultural land to other uses.

Comment 4.3:
According to MGL Chapter 80 Section 1, sewer betterment fees should not be levied on farmlands while they are classified under Chapter 61A or under agricultural preservation restriction.

Response 4.3:
Comment noted. Betterments will be assessed in accordance with all state laws governing the issuance of sewer betterments.

Comment 4.4:
EIR should confirm that the project capacity is limited to present uses and projected growth within the 12 identified service areas, and further discuss growth controls.

Response 4.4:
See Section 3.4 for discussion of wastewater flows and loads. The projected flows include infilling within the existing collection system and increases in existing commercial, industrial, institutional, and Infiltration/Inflow flow components. In projecting future flows and loads, it was estimated that 1800 additional equivalent dwelling units (EDUs) will be added to the system by 2020. This value represents infilling in both the existing collection system and the 12 proposed sewer areas. Town of Wareham efforts regarding growth controls are discussed in Section 8.2.3.

Comment Letter 5: Division of Fisheries and Wildlife, Christine Vaccaro

Comment 5.1:
Project site intersects four Priority/Estimated Habitats.

Response 5.1:
Most sewer construction will occur in roadways. Approximate pump station locations, directional drilling locations and outfall location are indicated in Figures 8-13 through 8-26 for review by MNHESP.

Comment Letter 6: Division of Marine Fisheries, Paul J. Diodati

Comment 6.1:
Concerned that the proposed increase in discharge will prevent maintaining the area between Parkwood Beech and the Agawam River Narrows Bridge at the new classification of seasonally approved for shellfish harvesting.

Response 6.1:
Flow in the Agawam River is dominated by the tides. Tidal flows are very much larger than the river flow, which is larger than the flow from the wastewater treatment plant. The increase in treatment plant flow should not result in a perceptible change in coliform bacteria concentration at the area that MDMF would like to reclassify for seasonally approved shellfishing status.

Comment 6.2:
Requests that the discharge permitted fecal coliform limit be upgraded to not exceed a geometric mean MPN (most probable number) of 14 organisms per 100 ml.

Response 6.2:
See response to comment 3.8.

Comment 6.3:
Upgrading the discharge controls for nitrogen and phosphorus would help to improve overall water quality in the receiving waters.

Response 6.3:
This statement is correct, particularly for the Agawam River estuary.

Comment Letter 7: Massachusetts Highway Department, J. Lionel Lucien

Comment 7.1:
MassHighway permit will be required for work within the state highway layout of Routes 6 and 28.

Response 7.1:
Permits will be sought for work affecting state highways. Traffic impacts, including the location of temporary impacts to MHD rights-of-way (Routes 6 and 28) are discussed in Section 8.4.2.

Comment 7.2:
Sewer work must be coordinated with the reconstruction of Route 6/28 from the Bourne town line westbound to its intersection with the East Wareham By-Pass Road, currently under design.

Response 7.2:
There is no proposed sewer work within this section of state highway.

Comment Letter 8: Massachusetts Historical Commission, Eric S. Johnson

Comment 8.1:
Request to review project plans to determine if proposed pump stations are located in archaeologically sensitive areas.

Response 8.1:
MHC will be provided with design plans of pump station sites, and any other work outside of disturbed areas.

Comment Letter 9: The Coalition for Buzzards Bay, Mark Rasmussen

Comment 9.1:
Project will promote sprawl. EIR should assess the full development build-out that project may cause.

Response 9.1:
As discussed in Section 8.2.3, the potential for secondary growth as a result of sewering is low to moderate. Many of these areas are isolated densely populated areas surrounded by water or other existing or proposed sewer areas. The CWWMP/EIR addresses the projected flow including build-out or infilling within the proposed sewer areas. Growth or sprawl outside of the proposed sewer areas is likely to happen without connections to the sewer system. In fact, there is no WPCF capacity for extensive connections outside of the existing system or proposed sewer areas.

Comment 9.2:
Suggests that a decentralized sewerage system could prevent sprawl.

Response 9.2:
See response to comment 9.1. Decentralized systems are evaluated in the CWWMP.

Comment 9.3:
Table 8-1 of the ENF is inadequate. More review of the decentralized alternative is needed.

Response 9.3:
The decentralized alternative is evaluated under the Localized Wastewater Disposal alternative.

Comment 9.4:
Opposes any onsite landfill for sewage sludge, even as a "back-up", due to possible contamination of the Agawam River from high nitrogen concentrations.

Response 9.4:
The new onsite sludge landfill is currently empty. The landfill was constructed in 1994 with a liner and leachate collection system. The contention that the landfill could possibly leak is pure speculation. There is no information that would lead to the conclusion that the landfill is defective or would leak.

Comment 9.5:
EIR should provide a full stormwater management plan.

Response 9.5:
Erosion and sedimentation controls are described generally in Section 8.6 and will be developed further during project permitting. The contractor(s) will also be required to develop more specific stormwater management plans.

Comment 9.6:
ENF incorrectly stated that there is no water quality data available for the Agawam and Wareham Rivers.

Response 9.6:
Since the commenter does not provide the location in the ENF where this statement is made, we cannot verify it. Clearly, however, the statement, if found in the ENF, is inaccurate. Water quality data were collected specifically as part of this project and are found in Attachment 5 of the ENF.

8.3 Existing Conditions

8.3.1 Introduction

This section describes the existing conditions in the town with respect to the following parameters:

- Topography, Geology and Soils;
- Surface and Groundwater Hydrology and Quality;
- Marine and Terrestrial Ecology;
- Traffic;
- Scenic Qualities, Open Space and Recreational Resources; and
- Historical and Archaeological Resources.

Conditions pertaining to those parameters mentioned specifically in the Secretary's ENF Certificate (i.e., wetlands, velocity and flood zones, growth control, and shellfish resources) were described previously in Section 8.2.

8.3.2 Topography, Geology and Soils

Continental glaciation and shoreline erosion and depositions have been the major physical process shaping Wareham's geology. The land surfaces in Wareham are predominantly covered by glacial till.

The land surface in Wareham rises gradually from sea level in the south to an altitude of 70 feet in the north, with only a few hills above the 100-foot level.

Nearly all of Wareham is located in the Carver-Peat general soil association. This soil is characterized by considerable variability with nearly level to steep slopes, excessively drained soils formed in deep outwash sands, and very poorly drained organic soils in low areas.

There are five general soil associations in Wareham. The largest of these is made up of dry, sandy soils formed over thick sand deposits. This soil type occupies approximately 56 percent of the land area in Wareham and occurs on nearly level to moderately sloping terrain. The other major soil type in Wareham is referred to as the Sanded Muck - Tidal Marsh – Scarboro - Peat association, covering about 25 percent of Wareham. This association is made up of very poorly drained organic and mineral soils. This association is typified by low-lying nearly level terrain along the shoreline, swamps, and streams in Wareham.

Approximately 10 percent of Wareham is mapped with Gloucester-Essex association. This association is typified by a series of low hills with smooth side slopes. The Carver-Gloucester association and the Hinkeley-Merrimac association account for the remainder.

8.3.3 Surface and Groundwater Hydrology and Quality

The town is at the northern most end of Buzzards Bay. Other significant water resources include the Weweantic River along Wareham's western border; the Wareham River, the Agawam River, a tributary to the Wareham River; Bourne Cove, Onset Bay, and Broad Marsh. The Town of Wareham has 57 miles of coastline.

The meandering coastline creates numerous saltwater resource areas including coves, bays, rivers, and estuaries. Onset Harbor is the largest and most important of the local saltwater resource areas.

Other smaller water bodies include Marks Cove, Bournes Cove, Butlers Cove, Broad Cove, Shell Point Bay, Muddy Cove, Bass Cove, Widows Cove, Sunset Cove, Little Harbor, Buttermilk Bay, and the Broad Marsh River Area, the Crooked River, and the East River.

Freshwater resources include the upper reaches of the three major river systems that flow through the town and eventually empty into Buzzards Bay: the Wareham, Weweantic, and Sippican Rivers. The Wareham River Basin is made up of the

Wankinco and Agawam Rivers. The Wareham River Basin drains an area of approximately 29,795 acres. The Weweantic and Sippican Rivers, along with their tributaries, drain an area of 55,438 acres.

In addition to the river systems, freshwater ponds include Blackmore Pond, Glen Pond, White Island Pond, Dicks Pond, Sand Pond, Bartlett Pond, Tremont Pond, Horseshoe Pond, Union Pond, Spectacle Pond, Tihonet Pond, Black Johnny Pond, and Agawam Pond.

Massachusetts Surface Water Classifications and Standards

The Massachusetts Surface Water Quality Standards classify the state's surface waters and define the purposes and uses of waters under each classification. Specific water quality standards are established with the intention of protecting resources and allowing designated uses.

Within Wareham, all coastal and fresh water are classified as SA, SB and B respectively. The Weweantic River and Wareham Rivers are each divided into two segments by the limit of tidal influence.

Onset Bay, Broad Marsh, lower Weweantic River and lower Wareham River are classified as Class SA Waters (314 CMR 4.06 Table 30). Class SA waters are designated for marine fishery, primary and secondary contact recreation, and for shellfish harvesting without depuration, in approved areas.

The upper reaches of the Weweantic River and Agawam River are classified as Class B waters (314 CMR 4.06 Table 30). Class B waters are designated for uses of "protection and propagation of fish, other aquatic life and wildlife, and for primary and secondary contact recreation." The lower Agawam River (past the WPCF) is classified as SB waters (314 CMR 4.06 Table 30).

In addition to the water quality standards, the entire lengths of the Weweantic River, Wareham River, Agawam River, and all other surface waters not subject to the rise and fall of the tide are protected by the anti-degradation provision for low-flow waters (314 CMR 4.04(3)).

The anti-degradation provision prohibits any new or increased discharge to waters so designated. A variance to this provision may be granted by the Massachusetts Department of Environmental Protection to allow new or increased discharges.

Hydraulic and Water Quality Data

A limited amount of water resources data has been collected within the Town of Wareham. The mean tidal range has been computed for the areas at approximately 4.5 feet, (Mean low tow to mean spring high; New England Division, Corps of Engineers).

Water quality information for surface waters in Wareham includes the Massachusetts Division of Marine Fisheries (DMF) sampling for shellfish areas, that covers 33-36 sampling sites which are sampled five times per year.

- Weweantic River. Extending 15.6 miles, the Weweantic River is the longest single river within the Buzzards Bay Drainage Basin. The Weweantic originates in Carver and flows north to south through Wareham, powering a 300 megawatt (MW) hydroelectric facility. The Weweantic joins the Sippican River and enters Buzzards Bay.

  Water quality information for the Weweantic River is limited to sampling and analyses conducted by the DMF. Because the river contains shellfish resources, the DMF regularly monitors the harbor for bacteria levels. Samples are taken approximately five times a year at seven sampling stations.

- Onset Bay. Onset Harbor is the largest of the local coastal water bodies. Water quality information for Onset Bay is limited to sampling and analyses conducted by the DMF. Because the river contains shellfish resources, the DMF regularly monitors the harbor for bacteria levels, and in 1989, conducted a sanitary survey for Onset Bay. Samples are taken approximately nine times a year for the northern bay and five times a year for the southern portion of the bay. The samples are taken from approximately ten sampling stations.

- Bourne Cove. Water quality information for Bourne Cove is limited to sampling and analyses conducted by the DMF. Because the river contains shellfish resources, the DMF regularly monitors the harbor for bacteria levels, and in September 1993, the department conducted a sanitary survey for Bourne Cove. Samples are taken approximately five times a year at two sampling stations.

- Broad Marsh. Water quality information for Broad Marsh is limited to sampling and analyses conducted by the DMF. Because the river contains shellfish resources, the DMF regularly monitors the marsh for bacteria levels. Samples are taken approximately five to ten times a year at two to five sampling stations.

- Agawam River/Wareham River. Water quality information for the Agawam and Wareham Rivers is limited to sampling and analyses conducted by the DMF. Because the rivers contains shellfish resources, the DMF regularly monitors the harbor for bacteria levels. Samples are taken approximately five times a year at twelve sampling stations.

Drinking Water

Water is supplied to residents of Wareham by private wells and the water departments of the Onset Fire District and the Wareham Fire District. The Onset Fire District is currently served by four wells. The district serves an area of approximately five square miles that includes Onset Village and adjacent land as far north as the

Route 25 Extension. As of June 30, 1995, the district had 2,936 active services and provided 194.8 million gallons of water in 1995.

The Wareham Fire District encompasses an area of approximately 20 square miles that includes land in many different parts of Wareham. The water source for the district is two wellfields located in northeastern Wareham. The Maple Springs wellfield has four active wells, while the Seawood Springs wellfield has one active well. All five wells have a capacity of approximately 600 gallons per minute.

8.3.4 Marine and Terrestrial Ecology

Marine Ecology

The U.S. Fish and Wildlife Service has divided the Atlantic Coast into 12 ecosystems under three zones. All of Buzzards Bay is classified as part of the southern New England coast section of the Middle Atlantic zone. This zone is characterized by a temperate climate. The temperatures of near shore waters and waters of the larger estuaries and bays are influenced by the cold Labrador current and by the warm gulf Stream. The mixing of these two significant Atlantic currents make this area habitable by various marine life during the year.

As part of the greater ecosystem of Buzzards Bay, Wareham's coastal waters support communities of benthic and phytoplantonic organisms, finfish, macroinvertebrates, and other marine life.

Finfish

Wareham's coves and estuaries plan an important role for a variety of finfish. Anadromous finfish migrate from the ocean through estuaries to spawn in brackish or fresh waters, and among those which inhabit Buzzard's Bay are alewife, shad, herring, striped bass, and sturgeon. Alewife, shad and herring are important sport, commercial, and forage species. Striped bass are popular recreational fish. Atlantic sturgeon was once an important commercial fish, but its population has declined and it is now considered endangered or threatened by some states.

Estuarine-dependent fish likely to be found in Buzzards Bay include menhaden, weakfish, silverperch, and bluefish. These finfish use estuaries for spawning, nursery, and/or feeding, but are also found along the continental shelf. According to the U.S. Fish and Wildlife Service, "Menhaden is the most valuable finfish in the Middle Atlantic zone and has the highest commercial yield of any finfish or shellfish" (Beccasio et al, 1980). Bluefish and summer and winter flounder are also of major importance as recreational catch.

American eels are widely distributed throughout estuaries of the Middle Atlantic zone. Tautog is another fish found mainly inshore.

Pelagic species that are present in Buzzards Bay include black sea bass, scup, and mackerel, which feed on estuarine-dependent species.

Overall, scup, striped anchovy, bluefish, American eel, fluke, herring, and silverside are most abundant in the Buzzards Bay area. Striped bass, tautog, cunner, winter flounder, butterfish, black sea bass, and bluefin tuna are also important species.

Vegetation

Approximately 52 percent of Wareham is forested. A large area of land is also classified as wetlands. The forest provides watershed land for the town's wells as well as providing wildlife habitat. Hardwood forests found in Wareham are generally made up of scarlet and black oak, sugar and red maple, white ash, American beech and blackgum. The softwoods include Eastern hemlock, Atlantic white cedar, pitch pine and white pine.

Terrestrial Ecology

Wareham's upland forests support a variety of wildlife species. Over 14,631 acres of forest, wetland and open land exist in Wareham. The densely wooded areas are habitat for snowshoe hare, white-tail deer, cottontail rabbit, gray squirrel, raccoon, ruffed grouse, woodchuck, opossum, skunk and fox.

Wetlands Ecology

Wareham's coastal wetlands and estuaries play an important role in the greater ecosystem of Buzzards Bay. Estuarine and salt marsh environments represent biologically productive ecosystem, providing nursery areas and breeding sites for shellfish, finfish, and other invertebrates. In addition to the marine species, a variety of bird species have shoreline habitats.

Inland wetlands also provide valuable habitat. Mammals, amphibians, and birds which inhabit Wareham freshwater wetlands are probably similar to species found in upland forests Examples of such mammals are: snowshoe hare, deer, cottontail rabbit, gray squirrel, flying squirrel, raccoon, ruffed grouse, woodchuck, opossum, skunk and fox. Black ducks, mallards and wood ducks nest along rivers, swamps, marshes and cranberry bogs.

Species of Special Concern

The Massachusetts Natural Heritage and Endangered Species Program (MNHESP) has indicated the presence of one animal species of special concern within the project area – spotted turtle.

MNHESP has also indicated that the project area intersects Priority/Estimated Habitats containing the following plant species: Purple Needlegrass, Longs' Bitter-Cress, Pygmyweed, Estuary Pipewort, Salt Reedgrass, River Arrowhead, Climbing Fern, and Pod-grass.

8.3.5 Traffic

Wareham is served by several highways. Interstate 195 and U.S. Route 6 enter Wareham from Marion and terminate in Wareham. Interstate 495 enters Wareham from Rochester and terminates in Wareham. Route 25 starts in Wareham and runs southeasterly to Plymouth and the Cape Cod Canal. Route 28 starts in Wareham and runs northeasterly to Bourne.

Primary local streets are Onset Avenue, Fearing Hill Road, Minot Avenue, Narrows Road and Main Street. Transportation issues identified in the Wareham Open Space and Recreational Plan 1997-2002 include considerable traffic congestion along portions of Route 25 and Route 6/28 during the summer months.

8.3.6 Scenic Qualities, Open Space and Recreational Resources

Conservation and Recreation Land

Wareham's town officials and citizens are very conscious of the value of conservation and recreation land. The Town of Wareham has current Inventory of Lands of Conservation and Recreation Interest which includes 573 parcels of land covering to over 8,980 acres.

Prime Agricultural Land

Approximately 6,071 acres in Wareham are enrolled under the State Chapter 61A program for active agricultural lands. These acres include cranberry bogs and upland. The cranberry bogs provide much of the open space in the outskirts of the town.

Scenic Views

Wareham's coastal waters play a dominant role in the town's scenic resources. Scenic Vistas were also identified in Wareham's Open Space and Recreation Plan. These include Onset Village, Narrows Bridge, the Parker Mills Bridge, Little Harbour, Horshoe Pond and Tremont Dam.

8.3.7 Historical and Archaeological Resources

Wareham, incorporated in 1739, has a deep and rich history, beginning with the Native Americans the first settlers of the Wareham area. Historic industries of Wareham have included agriculture, shipbuilding, whaling, iron products and industries such as hollow ware, cotton and paper.

Wareham has a number of historic structures and sites that have been catalogued by the Massachusetts Historical Commission. The most important structures in Wareham are the Tremont Nail Complex and the Tobey Homestead, both of which are listed on the National Register of Historic Places. Other historic resources include the following: Roland Thatcher House, Fearing Tavern, Prince Burgess House, Onset Avenue Bridge, and the Great Neck Cemetery. The Great Neck Road area contains a concentration of fourteen structures of historical importance. Wareham has established local historic districts at Parker Mills, Center Park and the Narrows, including Mary Besse Park.

8.4 Environmental Impacts Associated with the Recommended Plan

8.4.1 Introduction

Any adverse impacts that might result from the implementation of the recommended improvements would, for the most part, be short-term construction impacts. Few long-term adverse impacts are expected with the possible exception of some minor land use impacts resulting from the construction of the new pump stations. Most sewer construction will be in existing roads. Direct wetland resource area impacts have been minimized by selecting pump station sites in upland areas, minimizing cross-country sewers, and using directional drilling for the Weweantic River crossing to the extent feasible. There will be some unavoidable temporary impacts associated with outfall construction but disturbed wetlands will be restored. No work will occur in the velocity zone with the exception of 850 feet of new sewer in the Parkwood Beach area.

Overall, the long-term health of the environment and public will be positively affected by the increase in dependability of the sewer and treatment system. Another positive impact to the public and environmental health will be the elimination of homes with failing septic systems that are either contaminating the groundwater and surface waters or have leachate breakout.

The remainder of this Section 8.4 is divided into general project impacts (Section 8.4.2), followed by more specific impacts associated with various project components (Sections 8.4.3 through 8.4.6). A summary of project mitigation is provided in Section 8.4.7.

8.4.2 General Project Impacts

Introduction

This section summarizes general impacts that may occur as a result of the project with respect to the following parameters:

- Topography, Geology and Soils;
- Surface and Groundwater Hydrology and Quality;
- Air Quality and Noise;
- Marine and Terrestrial Ecology;
- Traffic;

- Scenic Qualities, Open Space and Recreational Resources; and
- Historic and Archaeological Resources.

Impacts related to velocity zones, wetlands, shellfish, and secondary growth were described previously in Section 8.2. Mitigation measures to alleviate any identified impacts are addressed in Section 8.6.

Topography, Geology and Soils

No permanent impacts to topography, geology or soils are anticipated as a result of the project, other than minor re-grading at the plant site and pump station sites as needed. However, soil erosion during construction due to pipeline excavation and directional drilling activities is possible. There is also the potential for Massachusetts Contingency Plan (MCP) sites along portions of the pipeline routes.

Excess materials excavated during pipeline excavation will be removed and taken offsite. Areas with potential subsurface contamination will be avoided if possible during construction. If avoidance is not possible, or if contamination is encountered during construction, mitigation measures described in Section 8.6 will be implemented.

Surface and Groundwater Hydrology and Quality

Construction

The primary impact associated with surface water during construction is erosion and sedimentation. Erosion occurs whenever water, wind or other forces such as gravity, remove soil materials. Sedimentation occurs when these materials are deposited in low-lying areas, such as water bodies and wetlands. The potential for erosion and sedimentation increases during construction because soils are exposed and thus are more susceptible to erosion. During construction, regrading, and restoration of the project areas, erosion caused by water is the greatest concern. Measures to control erosion and sedimentation are addressed in Section 8.6.

During construction, it is likely that dewatering of excavated areas will be required to provide a dry work area. Discharges during dewatering operations may contain high levels of turbidity and suspended solids that can impact receiving waters. These discharges may also cause localized erosion problems at the point of discharge and may adversely impact receiving waters, unless appropriate mitigation measures are in place, as discussed in Section 8.6.

Operations

Removal of approximately 374,000 gallons per day of wastewater that currently goes to individual septic systems will result in a reduction in contaminants entering the ground water system underlying Wareham. Although there will be increased discharges at the plant as a result, the effluent will be treated to a higher degree than currently occurs, resulting in a decrease in nutrient loading to the watershed.

Attachment 5 of the ENF (Water Quality Investigation of the Wareham River Estuary Complex) evaluated the future watershed nutrient loading including the benefits of sewering of the 12 needs areas.

When the contents of the septic tank are discharged to a properly operating soil absorption system, BOD and TSS concentrations can be reduced to approximately 30 mg/l. Phosphorus can be nearly entirely absorbed in soil. However, nitrogen in the ammonia form and fecal coliforms with an average concentration of 1000/100 ml are released into the groundwater. When conditions exist that are not optimal (e.g., less than 5 feet groundwater depth separation), soil adsorption system wastewater concentrations can be much higher.

Because much of Wareham is near water, some of the proposed sewers and pumping stations are located in within the 100-year flood zone. All new pumping stations and WPCF structures will be built above the 100-year flood elevation. All sewers of manholes in flood zones will be constructed with watertight manhole covers. Except for an 800-feet of gravity sewer in Parkwood Beach, there are no other sewers, pumping stations, or force mains in velocity zones. Due to their location in flood zones and proximity to tidal waters, many proposed sewer facilities will be in areas of high groundwater. The high groundwater is generally tidally influenced and will be mitigated during construction using Best Management Practices.

Air Quality and Noise

- Construction. During construction, activities such as site clearing, excavation, grading, fill placement, and truck travel on unpaved roads generate airborne dust (suspended particulate matter). Particulate matter less than 10 microns in diameter (PM10) has the potential to lodge in the lungs (instead of being coughed out or trapped in nasal passages) and to be a health hazard as well as a nuisance. Testing conducted for the U.S. EPA has found that the dominant source of construction PM10 emissions is not passive wind erosion, but the movement of heavy vehicles over unpaved surfaces (U.S. EPA, AP-42, Fifth Edition, Office of Air Quality Planning and Standards, Research Triangle Park, NC, 1999). These emissions are a function of vehicle activity, weight, speeds, soil silt, and moisture content.

  The NAAQS for PM10 are occasionally exceeded on and near very large construction sites (tens to hundreds of acres). However, construction dust impacts are expected to be minor for the project because:

  - Although the sewer installation will span a number of years, the actual construction in a particular areas is only expected to last a few weeks; and

  - All construction sites will employ proper dust control measures as described in Section 8.6.

It is anticipated that at each construction area there will be trucks, backhoes, and other diesel-powered equipment. Recently, U.S. EPA and MDEP have been focusing on controlling diesel exhaust emissions from construction sites. Diesel exhaust emissions include PM10, CO, volatile organic compounds (VOCs), NOx, and air toxic emissions. Emissions from diesel-powered construction equipment can be significantly reduced by retrofitting construction equipment with particulate filters and oxidation catalysts.

During construction, noise levels will increase in areas surrounding the work sites due to heavy equipment use (excavators, dump trucks, bulldozers, drill rigs at directional drilling sites, dewatering pumps, jack hammers, and generators). A prediction of noise impacts is difficult since it depends on:

- Type of equipment expected to be used;
- Quantity of equipment expected to be used;
- Sound level for full power operation of each type of equipment;
- Percentage of time equipment typically operates at full power;
- Noise attenuation from energy dissipation with distance; and
- Noise attenuation from portable and temporary barriers adjacent to construction area.

Noise mitigation described in Section 8.6 will help control noise levels, but there will be some temporary impacts to residents immediately adjacent to a particular work area due to the nature of the work and equipment that is required. Pipeline construction is expected to occur at one location for a limited period of time; therefore impacts will be transitory.

■ <u>Operations</u>. There is a potential for odors to be generated at pump station sites, primarily related to hydrogen sulfide emissions.

Odor control at the plant is described in Section 6.5.

Odors within pumping stations are primarily due to excessive detention times in the wet wells. In general, odors are worst during the summer months when wastewater and ambient temperatures are the highest. The primary odor concern is hydrogen sulfide due to its high odor potential and corrosivity. Hydrogen sulfide is generated when wastewater is anaerobic or "septic." Hydrogen sulfide can also cause corrosion of structures and force mains if not mitigated. Effective pump and force main sizing and selection is crucial to reduce lengthy wet well detention times. If odors are a concern, they can be reduced through chemical addition. Ferric salts, calcium hydroxide, hydrogen peroxide, or potassium permanaganate can be used to reduce odors. Excessive odors are not expected at any of the pumping stations in the proposed sewer areas because wastewater is "freshest." Odor reduction using chemical addition is recommended at the existing larger downstream pumping stations that the new pumping stations will eventually discharge to, such as the Narrows, Kennedy Lane, and Hynes Field pumping stations. WPCF staff are currently evaluating odor control measures for the Kennedy Lane, Narrows, and Hynes Field pumping stations.

Marine and Terrestrial Ecology

The proposed project has been designed to avoid and minimize impacts to marine and terrestrial ecology as much as possible. Most impacts are temporary, construction period impacts. However, most pipeline construction will occur in existing roads, plant construction will occur on the existing plant site, pump stations will be located primarily in previously disturbed areas, and directional drilling will be used to avoid impacts to biota of the Weweantic River. Impacts related to wetlands and shellfish resources are addressed in Section 8.2. The water quality of the Wareham River Estuary Complex and estimated watershed nutrient loading benefit as a result of the recommended alternative is discussed in Sections 4.3 and 4.4 of the Water Quality Report included in the ENF.

One major purpose of the sewer expansion, and a long-term beneficial impact of this project, will be the removal of existing subsurface sewage disposal systems. Many of the existing systems pre-date Title 5 of the State Sanitary Code, and do not meet current Title 5 standards. Therefore, sewage is not adequately treated by these outdated systems. Removal of these systems will benefit surface and groundwater quality especially in terms of bacterial and nutrient contamination. It is presumed that there is some interaction between groundwater and the surrounding surface waters in Wareham. Removing this pollution source will prevent continued discharge of nitrogen and bacteria to these natural systems, thus serving to protect water quality and preserve ecosystems. Potential impacts to endangered or threatened species, if any, will be discussed with the MA Natural Heritage and Endangered Species Program. Since most construction will occur in previously disturbed areas, impacts are anticipated to be insignificant.

Traffic

- Construction. Traffic impacts are primarily associated with construction activities. For pipeline installation, these impacts will be minimized by the staggered construction contracts. Contractors will be responsible for preparing traffic management plans which will give high priority to maintaining access for emergency vehicles at all times, minimizing disturbance to local businesses, ensuring safety of school children, and maintaining access to residences along affected routes.

  The MA Highway Department (MHD) noted, in their August 24, 2001 comment letter on the ENF (see Appendix K), that overall traffic impacts to the state highway system will be minimal. However, MHD recommended that the contractor be careful when working around signalized intersection equipment to ensure that the signals remain in operation at all times. Any damaged equipment would have to replaced in accordance with MHD's Standard Specifications for Highway and Bridge.

The Oakdale, Linwood/Ladd, Mayflower Ridge, Parkwood Beach, and Rose Point proposed sewer areas will require temporary impacts to designated state-highways. Approximately 2000 ft of gravity sewer in Oakdale will be required in Route 6. Connections to existing gravity sewers within Route 28 (Cranberry Highway) are required for the Linwood/Ladd and Mayflower Ridge sewer areas. Sewer force mains for Rose Point and Briarwood Beach will impact approximately 1000-ft at Route 6. All work is proposed off of the existing paved traveled way.

- Operations. Traffic impacts associated with project operations will be negligible (occasional chemical deliveries and maintenance/employee vehicles at the plant, similar to existing traffic patterns). Infrequent chemical deliveries will be required at the WPCF and existing pumping stations. No chemical deliveries are expected at proposed pumping stations. Delivery of liquid methanol, bulk soda ash, bulk polymer, potassium permanganate drums, and sodium hypochlorite will be made at the WPCF. Access to the WPCF will be through the designated truck route from the WPCF to Route 25 using Marion Road (Route 6). The additional truck traffic is insignificant when compared to the existing 25 to 35 trips per day related to disposal of sludge and septage.

Scenic Qualities, Open Space and Recreational Resources

During construction, access will be maintained to the major areas of interest as well as smaller parks and open space locations adjacent to work activities. Some short-term, temporary impacts due to noise from construction may occur in adjacent areas, which may temporarily disturb the serenity many people seek when visiting these areas. However, as construction noise is not continuous, impacts are anticipated to be minimal.

Pipeline installation will not affect the aesthetics of the project area. The pump stations will be constructed to blend in with the surrounding area. New plant facilities will be constructed on the existing plant site; therefore no additional impacts to open space or recreational resources will occur.

Historic and Archaeological Resources

In their August 21, 2001 comment letter on the ENF for this project (see Appendix K), the Massachusetts Historical Commission (MHC) indicated that sewer installation in existing streets would not impact sensitive archaeological resources. However, work in off-road areas, such as for the pump stations, may impact archaeological resources. MHC requested the opportunity to review detailed project plans showing the precise locations of the pump stations and existing and proposed conditions within the project area for each pump station. This information will be provided to MHC, along with plans showing any other construction areas that are not within previously disturbed areas.

8.4.3 Expansion of the Existing WPCF

All of the proposed work at the existing WPCF will be within the existing site boundaries. The existing sand filters will be removed/replaced with equalization basins, methanol bulk storage and feed facilities, and a new filter building and new biofilter. However, in addition to these upgrades, there will be a new outfall that consolidates the four existing outfalls.

The four outfall locations were evaluated in the field to determine which is the most feasible for replacement. The preferred location is adjacent to the existing outfall 1, due to its minimal wetland impacts, compared to the other three locations. The other three locations are also less desirable because of the shallow depth and the greater outfall length that would be required as a result. Further discussion of the wetland resources present at each of the four existing outfalls is presented below.

Outfall 1

The outfall is located at the toe-of-slope of a steep embankment with a shelf of salt marsh between the bottom of the slope and the river channel. Flow from the outfall is conveyed in a narrow channel about 3-4 feet wide. From the bank looking to the river, the salt marsh to the right of the outfall is approximately 15 feet wide and supports a narrow fringe (about 3 feet wide) of *Spartina alterniflora* with sedges (*Carex sp.*) dominating the community to the toe of slope. Salt marsh to the left of the outfall is approximately 30 feet wide with a 5 foot wide fringe of *S. alterniflora* and sedges dominant on the rest of the shelf. Evidence of tidal action to the toe-of-slope was observed. Therefore, the entire shelf would be regulated as salt marsh per the Massachusetts Wetlands Protection Act and Regulations (310 CMR 10.00 *et seq.*).

To minimize alteration of salt marsh, the replacement outfall is proposed to be located to the right side of the existing Outfall 1. This would significantly decrease salt marsh alteration during construction (assuming a 7 foot wide trench – 210 square feet alteration to the left compared to 105 square feet to the right). The work zone would be re-graded with excavated topsoil to match pre-construction contours and replanted with salt marsh grasses. In addition, the new outfall would be subsurface under the salt marsh. This would allow for the restoration of about 50 square feet of salt marsh within the existing channel.

Outfall 2

This outfall is located at the toe-of-slope of a very steep slope. Based on this site visit it was decided not to locate a new outfall in this location.

Outfall 3

This outfall is located at the toe-of-slope of a fairly steep slope. There is about a 6 foot wide fringe of salt marsh grass to the left of the outfall and a 10 foot wide fringe of slat marsh to the right of the outfall. An unvegetated channel conveys flow from the outfall to the river.

Outfall 4

This outfall is located at the toe-of-slope of a fairly steep slope. There is about a 5 foot wide fringe of salt marsh grass to the left of the outfall and a variable width (varies from 5 to 10 feet wide) fringe of salt marsh to the right of the outfall. An unvegetated channel conveys flow from the outfall to the river.

8.4.4 Existing Pump Stations

Adverse environmental impacts associated with the upgrading of the existing pump stations to repair mechanical deficiencies and meet OSHA regulations are all short-term construction impacts related to traffic, air quality and noise. Long-term positive impacts of rehabilitating the pump stations can be expected in the area of public and environmental health. These long-term positive impacts are due to the decreased likelihood of a system failure that could lead to a backup of wastewater into low lying areas or receiving waters. No short-term impacts on the public and environmental health will occur since the stations will remain in operation while the repairs are taking place.

8.4.5 Sewer System Improvements and Extensions by Sewer Needs Area

This section describes the anticipated impacts associated with sewer extension in each needs area, including the construction of pump stations. Overall, long-term positive impacts to public health and the environment can be expected from the implementation of these sewer extensions since the new sewers will replace any failing septic systems. Pump station locations, with respect to wetlands, are described in Section 8.2.2.

Agawam Beach

The recommended improvements call for approximately 5,120 linear feet of PVC sewer and 8,745 linear feet of force main in the area. Adverse short-term impacts on traffic, noise, and air quality can be expected during construction of the sewers as described above. The new sewers will be constructed under existing streets, which will minimize impacts to the natural environment.

The proposed pumping station for the area will be located at the end of Arlington Road will have no adverse long-term impacts other than land use. This potential impact is considered minor because of the small size of the submersible station and because the surrounding area is already developed.

The station will discharge to a force main under Arlington Road, Great Neck Road, Crooked River Road and Indian Neck Road to a gravity sewer in Oak Street. The potential for impacts is minor because the sewer will be constructed under existing roads.

There is the potential for an adverse impact on archeological resources if the construction of the station is on previously undisturbed soils. Plans for the pump station will be provided to MHC when available.

Beaver Dam Estates

The recommended improvements call for approximately 3,520 linear feet of PVC sewer and 1,160 linear feet of force main in the area. Adverse short-term impacts on traffic, noise, and air quality can be expected during construction of the sewers as described above. The new sewers will be constructed under existing streets, which will minimize impacts to the natural environment.

The proposed pumping station for the area, located at the end of Fairfield Drive, will have no adverse long-term impacts other than land use. This potential impact is considered minor because of the small size of the submersible station and the already developed surrounding area.

The station will discharge to a force main under Fairfield Drive and Springhill Road. The potential for impact is minor because the new force main will be constructed under existing streets.

There is the potential for an adverse impact on archeological resources if the construction of the station is on previously undisturbed soils. Plans for the pump station will be provided to MHC for review.

Briarwood Beach

The recommended improvements call for approximately 7,560 linear feet of PVC sewer and 1,525 linear feet of force main in the area. Adverse short-term impacts on traffic, noise, and air quality can be expected during construction of the sewers as described above. The new sewers will be constructed under existing streets, which will minimize impacts to the natural environment.

The proposed pumping station for the area, located at Briarwood Road across from Carter Avenue, will have no adverse long-term impacts other than land use. This potential impact is considered minor because of the small size of the submersible station and the already developed surrounding area.

The station will discharge to a force main under an abandoned Route 6 rest area driveway. The potential for impacts is minor because the new force main will be constructed under existing roads.

There is the potential for an adverse impact on archeological resources if the construction of the station is on previously undisturbed soils. Plans for the pump station will be provided to MHC when available.

Cromesett Park

The recommended improvements call for approximately 7,711 linear feet of PVC sewer, 755 linear feet of pressure sewer and 3,015 linear feet of force main in the area. Adverse short-term impacts on traffic, noise, and air quality can be expected during construction of the sewers.

The proposed pumping station for the area, located on Cromesett Road, will have no adverse long-term impacts other than land use. This potential impact is considered minor because of the small size of the submersible station and the already developed surrounding area.

The station will discharge to a force main under Cromesett Road. The force main will connect into an existing gravity sewer under Cromesett Road near Pine Tree Estates. The potential for impact is minor because the new force main will be constructed under an existing street.

There is the potential for an adverse impact on archeological resources if the construction of the station is on previously undisturbed soils. Plans for the pump station will be provided to MHC when available.

Linwood and Ladd Avenues

The recommended improvements call for approximately 1,220 linear feet of PVC sewer, 465 linear feet of pressure sewer and 2,415 linear feet of force main in the area. Adverse short-term impacts on traffic, noise, and air quality can be expected during construction of the sewers.

The proposed pumping station for the area will be located on Linwood Avenue will have no adverse long-term impacts other than land use. This potential impact is considered minor because of the small size of the submersible station and because the surrounding area is already developed.

The station will discharge to a force main that will run under from property at the WPCF discharge at the existing WPCF headworks. The potential for impacts is minor because the force main will be on WPCF property.

There is the potential for an adverse impact on archeological resources if the construction of the pump station is on previously undisturbed soils. Plans for the pump station will be provided to MHC when available.

Mayflower Ridge

The recommended improvements call for approximately 4,460 linear feet of PVC sewer, 510 linear feet of pressure sewer and 2,975 linear feet of force main in the area. Adverse short-term impacts on traffic, noise, and air quality can be expected during construction of the sewers.

The two proposed pumping stations for the area will be located at the end of a private way and on Mayflower Drive, approximately 900 feet from the intersection of Mayflower Road and Elm Street. These pump stations will have no adverse long-term impacts other than land use. This potential impact is considered minor because of the small size of the submersible stations and because the surrounding area is already developed.

The Mayflower Road station will discharge to a force main. The force main will need to cross a bridge and railroad tracks. A more detailed determination of impacts as a result from this crossing will be determined during final design.

There is the potential for an adverse impact on archeological resources if the construction of the station is on previously undisturbed soils. Plans for the pump station will be provided to MHC when available.

Oakdale

The recommended improvements call for approximately 12,466 linear feet of PVC sewer, 955 linear feet of pressure sewer and 1,458 linear feet of force main in the area. Adverse short-term impacts on traffic, noise, and air quality can be expected during construction of the sewers. The new sewers will be constructed under existing streets, which will minimize impacts to the natural environment.

The two proposed pumping stations for the area will be located at the northern end of Apple Street and the southern end of Avenue A. The pump stations will have no adverse long-term impacts other than land use. This potential impact is considered minor because of the small size of the submersible stations and because the surrounding area is already developed.

The Apple Street station will discharge to a force main under the existing roads. The potential for impact is minor because the new force main will be constructed under existing streets. The Avenue A station will discharge to a force main of approximately 450 feet under a cross-country section and will require a railroad crossing.

There is the potential for an adverse impact on archeological resources if the construction of the station is on previously undisturbed soils. Plans for the pump station will be provided to MHC when available.

Parkwood Beach

The recommended improvements call for approximately 20,175 linear feet of PVC sewer and 1,540 linear feet of force main in the area. Adverse short-term impacts on traffic, noise, and air quality can be expected during construction of the sewers. The new sewers will be constructed under existing streets, which will minimize impacts to the natural environment.

The two proposed pumping stations for the area will be located at the end of Fir Road and on Crab Cove Terrace. The proposed location for the pump station will be adjacent to, but outside the limits of, Doris M. Doyle Park. However, due to the small size of the underground submersible stations, the potential impact is considered minor.

The Fir Street station will discharge to a force main under Fir Road, Indian Neck Road to a gravity sewer in Oak Street. The Crab Cove Terrace station will discharge to a force main under Crab Cove Terrace to a gravity sewer under Parkwood Drive. The potential for impacts is minor because the sewer will be constructed under existing roads.

There is the potential for an adverse impact on archeological resources if the construction of the station is on previously undisturbed soils. Plans for the pump station will be provided to MHC when available.

Rose Point

The recommended improvements call for approximately 10,960 linear feet of PVC sewer, 2,015 linear feet of pressure sewer and 3,110 linear feet of force main in the area. Adverse short-term impacts on traffic, noise, and air quality can be expected during construction of the sewers. The new sewers will be constructed under existing streets, with exception of a force main under the Weweantic River, thereby minimizing impacts to the natural environment.

The proposed pumping station for the area will be located at the end of Rose Point Avenue and will have no adverse long-term impacts other than land use. This potential impact is considered minor because of the small size of the submersible station and the already developed surrounding area.

The station will discharge to a 6-inch diameter, 500-ft long force main under the Weweantic River. This crossing has the potential to affect several resource areas but will be minimized through the use of a micro-tunneling (e.g., directional drilling) installation, as described further below.

The purpose of directional drilling is to minimize impacts to sensitive areas – in this case, the Weweantic River. For the drilling process, a staging area of about 7500 square feet will be required for the rig setup on the east side of the river, and a smaller area will be needed for the receiving area on the west side. Soil borings will be conducted during design to verify that directional drilling can be employed. If direction drilling is used, no open cut excavation will take place in wetlands or in the river. The drill end of the operation requires a fresh water supply and an area for the re-circulation of driller's mud. The driller's mud is actually a bentonite clay slurry which serves as a lubricant and provides a means of removing drilled material. A holding tank will be provided for the slurry; no slurry or drilled material will be discharge back to the water. Little excess material is expected to be generated from the drilling operations; sediments will be compressed to either side of the drill.

There is the potential for an adverse impact on archeological resources if the construction of the station or the directional drilling staging/receiving areas are on previously undisturbed soils. More detailed plans will be provided to MHC when available.

Tempest Knob

The recommended improvements call for approximately 4,530 linear feet of PVC sewer, 535 linear feet of pressure sewer and 565 linear feet of force main in the area. Adverse short-term impacts on traffic, noise, and air quality can be expected during construction of the sewers. The new sewers will be constructed under existing streets, which will minimize impacts to the natural environment.

One of the two proposed pumping stations for the area will be located on Oak Street near Oak Terrace Road. The station will discharge to a force main in Oak Street. The force main will connect to a gravity sewer in Oak Street. The potential for impact is minor because the new force main will be constructed under existing streets. The second pump station will be located at the northern end of Oak Street and discharge into a force main beneath the road for connection with an existing force main under Minot Avenue. The pump station will have no adverse long-term impacts other than land use. The potential impact of both pumping stations is considered minor because of the small size of the underground submersible stations and because the surrounding area is already developed.

There is the potential for an adverse impact on archeological resources if the construction either station is on previously undisturbed soils. Plans will be provided to MHC when available.

Weweantic Shores

The recommended improvements call for approximately 21,410 linear feet of PVC sewer and 6,283 linear feet of force main in the area. Adverse short-term impacts on traffic, noise, and air quality can be expected during construction of the sewers. The new sewers will be constructed under existing streets, which will minimize impacts to the natural environment.

The area will have two pump stations, one will be located on the north side of 13th Street and one located on Highland Bay Drive. The pump stations will have no adverse long-term impacts other than land use. This potential impact is considered minor because of the small size of the submersible stations and because the surrounding area is already developed.

The stations will discharge to a force main under existing roads. The potential for impact is minor because the new force main will be constructed under existing streets.

There is the potential for an adverse impact on archeological resources if the construction of the stations is on previously undisturbed soils. Plans will be provided to MHC when available.

8.4.6 Additional Sewer System Improvements

Infiltration/Inflow

By establishing a program to reduce inflow/infiltration, various positive long-term impacts will occur. A benefit will be the increase in the structural and operational integrity of the entire system. This reduces the chances of future breaks and back-ups that will adversely affect environmental and public health. Since the work related to implementation of the infiltration/inflow program will be performed using existing manholes, no archeological, geological, land use, sensitive features, or public facilities impacts will occur.

Sewer System Operation and Maintenance Program

An operation and maintenance program for the sewer system will have impacts similar to those resulting from an infiltration/inflow reduction plan. Long-term positive impacts on the environment and public health as a result of the decrease likelihood of future breaks, back-ups and other system failures will occur.

8.4.7 Mitigation Measures

Developing sound construction procedures will reduce many of the impacts associated with the implementation of the recommended plan. The following steps will negate or minimize most of the construction impacts:

- The contractor will notify Dig Safe a minimum of 72 hours, excluding Saturdays, Sundays, and holidays, before any excavations.
- Ensure that when working around signalized intersections that signals remain operational at all times.
- A dust control program consisting of water or calcium chloride and sweeping the streets will serve to protect the air quality in construction zones.
- Sedimentation and erosion control measures will protect wetlands and other sensitive receptors in the area.

- Directional drilling beneath the Weweantic River is proposed to install sewers instead of open cut construction.

- Restricting work to weekdays between 7:00 am and 4:00 pm will mitigate most of the potential noise impacts to local residents.

- Construction will also be sequenced so that no loss of any utility service will occur at anytime.

- Access to all homes and businesses will be maintained during construction.

- Consultation with MHC regarding approval of pump station locations (and other off-road work) will occur prior to construction.

More specific mitigation measures are described in Section 8.6.

8.5 Statutory and Regulatory Standards and Requirements

8.5.1 Description of Permits and Approvals

Under the recommended plan the following permits would have to be obtained before the start of construction:

- NPDES Permit to set effluent parameters. A NPDES Permit setting the guidelines for the effluent has already been issued to the WPCF. This permit will have to be renewed and new guidelines may be established by the EPA.

- NPDES General Stormwater Permit for dewatering trenches for sewer installation and for stormwater control on plant site during construction.

- NPDES Permit for stormwater discharges from the plant site after construction.

- Approval from the DEP to expand the WWTF.

- Massachusetts Highway Department Permit to work on State Roads (Routes 6 and 28).

- Order of Conditions from Wareham Conservation Commission for work in wetland resource areas and buffer zones.

- Chapter 91 License for outfall and for placement of a new structure (sewer) beneath the Weweantic River, assuming directional drilling occurs seaward of the mean high water line.

- MA Historical Commission review for potential impacts to archaeological resources (pump station sites and cross-country sewers).

- <u>**Coastal Zone Management Federal Consistency Review**</u> for the WPCF NPDES permit and any work in the coastal zone, which requires a federal permit.

- <u>**Major Sewer Extension Permit**</u> from DEP for new sewers.

- <u>**Army Corps of Engineers Section 404/Section 10 Programmatic General Permit**</u> for outfall and possibly for river crossing.

- <u>**Road Opening Permit**</u> for work in town roads.

- <u>**Bay Colony Railroad**</u> approval for railroad crossing (new force main connection to an existing force main on Narrows Road).

Other agencies may address the project, although specific permits are not expected to be required. These agencies include:

- <u>**US Coast Guard and Town Harbor Master**</u> for crossing of the Weweantic River and the outfall construction to ensure that navigation is not obstructed during construction.

- <u>**MA Division of Fisheries and Wildlife**</u> for any potential impacts to Estimated Habitats of Rare Wetlands Wildlife and High Priority Sites of Rare Species Habitats and Exemplary Natural Communities in Wareham.

In addition, local boards may have review authority, especially for above-ground structures such as pump stations.

8.6 Proposed Section 61 Findings

8.6.1 Introduction

These Section 61 Findings for the proposed Wareham Comprehensive Wastewater Management Plan have been prepared to comply with the requirements of Massachusetts General Laws Chapter 30, Section 61. Under M.G.L. c.30 s.61, state agencies and authorities are required to review, evaluate, and determine the impacts on the natural environment of all work, projects, or activities conducted by them and to undertake all feasible means and measures to minimize and prevent damage to the environment. As part of any determination made, this law requires that state agencies and authorities issue a "finding" describing any impacts of the project and certifying that all feasible measures have been undertaken to either avoid or minimize these impacts.

These findings address the activities necessary for the construction of improvements to the wastewater pollution control facility (WPCF) and extension of new sewers to 12 needs areas in the Town of Wareham.

8.6.2 Project Schedule

The construction contract for the wastewater treatment improvements is expected to be awarded in March 2002, with construction commencing in the spring of 2002 and ending in late 2004. The collection system extension will be divided into a number of construction contracts, in order of priority. The schedule for sewer construction is not known at this time but would occur after the WPCF upgrade.

8.6.3 History of MEPA Review

An Expanded Environmental Notification Form was filed with MEPA in July 2001 and included a request to allow for the filing of a Single EIR. The Secretary issued a Certificate on August 31, 2001 stating that the project is subject to the Mandatory EIR provisions of the MEPA regulations since it involves construction of more than 10 miles of sewers. However, the Secretary also granted the request to proceed with the preparation and filing of a Single EIR.

8.6.4 Intent of These Proposed Section 61 Findings

These Section 61 Findings have been prepared to comply with the Town of Wareham's responsibilities under Massachusetts General Law Chapter 30, Section 61. This Section requires that an overview of the mitigation program for the project be completed and be made available to the public. These Section 61 Findings describe measures to avoid, minimize and/or mitigate identified impacts to the maximum extent practicable, and discusses an implementation schedule to ensure that mitigation measures will be implemented at the appropriate times.

8.6.5 Discussion of Mitigation Measures

The area of impact includes the installation of 22 miles of new sewers in 12 needs areas of the town, as well as 15 pump stations and WPCF improvements (including a new outfall). While most of this construction will occur within existing roadways or in previously disturbed areas (e.g., the plant site), some pump stations will be constructed in off-road areas and installation of the new plant outfall will require temporary disturbance to the Agawam River and associated salt marsh. Careful layout of all facilities has taken place to ensure that impacts to the environment are minimal. Most impacts are construction-related and temporary. The most significant post-construction impact is beneficial – protection of environmental quality and public health by providing sewer service and enhanced treatment of wastewater.

Mitigation measures for the project have been developed for the following broad areas of concern:

- Topography, Geology, and Soils;
- Surface and Groundwater Hydrology and Quality;
- Air Quality and Noise;

- Wetlands and Ecology;
- Traffic;
- Scenic Qualities, Open Space and Recreational Resources;
- Historical and Archaeological Resources; and
- Growth Controls.

Topography, Geology, and Soils

Construction of the new sewers, WPCF improvements, and new pump stations will require excavation in many areas of town. In an effort to protect the surrounding features during construction, specific measures for impact mitigation are summarized below to address soil erosion and sedimentation control, as well as hazardous materials.

Soil Erosion and Sedimentation Control

The following mitigation measures will be employed to address potential impacts associated with soil erosion and sedimentation control:

- Standard erosion control measures will be employed to reduce soil erosion and siltation during construction. This includes the use of hay bales and silt barriers around work areas, and maintaining these structures through completion of construction.
- Work will be completed such that excavated material is backfilled or removed from the site efficiently, so as to minimize the quantity of soil exposed at any given time, as well as the length of time that soil is left exposed to the elements.
- Measures will be implemented that are designed to reduce the velocity and quantity of storm water runoff through the work area. Storm water runoff will be redirected with temporary controls, such as water bars and filter strips.
- Permanent erosion control measures, including vegetation, will be established throughout the work area as soon as possible after the completion of construction.
- Direct discharges of stormwater to vegetated wetlands and water bodies throughout the work area will be prevented. All discharges must be set back and treated by filtering through hay bales, or by some other effective method, prior to discharge.
- Construction areas will be inspected regularly. Thorough inspections will occur after storm events and faulty controls will be repaired and/or replaced as necessary.

- More specific mitigation measures will be developed as required by the municipal wetlands permitting process with the Town Conservation Commission.

Hazardous Materials

The following mitigation measures will be employed to address potential impacts associated with subsurface contamination throughout the project area:

- Contract specifications will be prepared to include provisions for managing excavated materials in accordance with applicable Massachusetts Contingency Plan (MCP) requirements. These provisions will include identification of contaminated materials, segregation, proper stockpiling or containment, and sampling and analysis to determine the appropriate facility for either reuse, recycling or disposal of these materials.

- Contract specifications will be prepared to include provisions for managing dewatering discharges in accordance with applicable MCP requirements. These provisions will include the identification of contaminated ground water, proper containment and pretreatment, and required sampling and analysis.

- Contract specifications will be prepared to include provisions requiring the Contractor to submit a Hazardous Material Health and Safety Plan (HMH&SP) detailing procedures and protocols to protect workers and the general public from potential hazards during the construction work.

- Contract specifications will be prepared to include provisions requiring the Contractor to submit an Emergency Response Plan (ERP) detailing procedures to address the discovery of hazardous materials that could pose an imminent hazard to workers and the public, and procedures to address emergencies that involve fires and/or explosions.

- Contract specifications will be prepared to require that these activities be conducted under the supervision of an LSP in accordance with MCP Utility-Related Abatement Measure (URAM) or Immediate Response Action (IRA) provisions, as appropriate.

- Contract documents will be prepared to include locations of known contamination associated with MCP sites.

Surface Water and Groundwater Hydrology and Quality

Dewatering

Throughout construction, it is important that contractors implement a dewatering system that maintains a dry, undisturbed subgrade at all times. The following mitigation measures will be employed to address potential impacts associated with dewatering throughout the project area:

- Each Contractor will be limited to dewatering no more than 100,000 gpd (on average) from each active work area.

- The dewatering system will be designed to maintain the stability of the trench sides and bottom.

- Hose intakes used for trench dewatering will be kept off the trench bottoms to minimize the pumping of silt.

- Proper filter stone will be provided to prevent the uptake of fines by the dewatering pumps. Fine material must be settled out before flow is discharged to a nearby receptor.

- Excavation work and placing of bedding and backfill will be conducted "in-the-dry". Excavate will be maintained "in-the-dry" until construction has been completed so that the fill will not be floated or otherwise damaged.

- The dewatering system will be designed by a Professional Engineer retained by the Contractor.

Air Quality and Noise

The project will incorporate provisions to uphold the National Ambient Air Quality Standards as mandated by the Clean Air Act Amendments of 1970. The following mitigation measures will be employed to address potential impacts associated with air quality and noise throughout the project area.

Air Quality

The following construction mitigation measures will be implemented:

- Paved streets adjacent to work areas will be swept regularly.

- Dump trucks will be covered with tarpaulins and will have tightly fitting tailgates.

- Truck tires will be cleaned before the truck leaves the plant site.

- Construction equipment and material storage will be restricted to staging areas.

To control odors at the plant site, two biofilters will be installed. The headworks biofilter will treat air originating from the inlet box, headworks building, grit chamber and from the septage equalization tanks, which also receive filtrate/decantrate. The sludge dewatering biofilter will treat air from the GBT and first floor of the sludge dewatering building, filtrate/decantrate intermediate tank, the thickened waste activated sludge storage tank, and sludge storage tanks. The untreated process emissions will not trigger emission levels necessary for permitting. The biofilter is intended to remove odorous compounds from non-hazardous levels to non-detectable levels at the fenceline.

Noise

During construction, the following measures will be used to control noise:

- Loud pieces of equipment will be substituted with quieter equipment.
- Effective intake and exhaust mufflers will be used on internal combustion engines.
- Truck loading, unloading and hauling operations will be conducted in a manner that keeps noise and vibration to a minimum.

Operational noise at the WPCF will be kept to a minimum. Site fans, air handlers, and louvers have been placed in such a manner to minimize noise. On-site back-up power generators will be installed at the WPCF and pumping stations. Generators will be equipped with mufflers and enclosures to minimize noise. Audible noise levels from generators will be detectable during power outages, emergencies, or during infrequent exercising.

Routine maintenance of existing equipment at the WPCF will prevent noise from malfunctioning equipment. If necessary, partitions or other noise enclosures will be installed around outside equipment. Pumps, motors, and equipment associated with pumping stations will either be below ground or within buildings.

Wetlands and Ecology

A significant portion of the project area, and the region immediately adjacent to the project area, is comprised of various wetland resources areas. The following mitigation measures will be employed to address potential impacts associated with wetlands and ecology throughout the project area:

- Locating all sewer lines in existing roadways, to the maximum extent practicable, avoids impacts to wetland resource areas.
- Utilizing directional drilling to cross the Weweantic River avoids impacts to the substrate of the river.

In addition, during construction, specific sedimentation and erosion control measures will be developed and implemented. A detailed sedimentation and erosion control plan (S&E plan) will be developed for permit applications including a NPDES General Permit for Construction Activities. The S&E plan will include and refer to best management practices (BMPs). The final plan will include more detail and include figures/diagrams of typical BMPs for use on the project.

- Prior to commencement of work, staked silt fence will be installed at the limit of work, where the work area abuts salt marsh or waterways, to prevent the transport of sediment to downgradient wetlands and waterways during construction. The silt fence barrier will be inspected weekly and after all storm events of ½-inch or greater and repaired as needed. The barrier will be left in place until the area is permanently stabilized. A stockpile of silt fence will be maintained on site under a protective cover for routine maintenance and emergency repairs. The silt fence/hay bale barrier will not be removed until exposed soils are stabilized.

- Work adjacent to salt marsh and waterways will proceed as rapidly as possible. Limiting the exposure time of disturbed soils to wind and precipitation will minimize the soil erosion and subsequent sedimentation.

- Storm drain inlet protection will be provided for all storm drains which collect runoff from the work area during construction. This protection will prevent sediment from entering the storm drain system and being conveyed to receiving wetlands or waterways.

- Water from trench de-watering operations will be filtered to remove sediment prior to discharging to upland areas, adjacent storm drains or wetlands, if needed.

- All disturbed areas will be stabilized upon completion of utility installation work. Roadways will be re-paved and vegetated areas will be re-seeded to match pre-construction conditions. Grassed areas will be maintained and re-seeded to ensure that at least 80 percent ground coverage is achieved.

- The outfall location will be regraded with excavated topsoil to match pre-construction contours and replanted with salt marsh grasses. In addition, the new outfall will be subsurface, beneath the salt marsh. This will allow for restoration of about 50 square feet of salt marsh that has been impacted within the existing channel.

An important part of a S&E plan are the procedures for maintaining, handling and storing construction equipment and supplies (especially fuel, hydraulic oil and other potentially hazardous materials). To guard against an accidental release of fuel, oil or other potentially hazardous materials, the following guidelines will be followed. Note, these are only guidelines from which a more detailed material handling plan that will be developed for the S&E plan.

- Routine vehicle and equipment maintenance and re-fueling will only occur in designated areas (staging areas) located more than 100-feet from salt marsh, coastal bank and land under the ocean. At each staging area, spill clean-up equipment (shovels, brooms, absorbent pads and material, e.g. speedy dry, will be maintained on-site for use in the event of an accidental spill.

- All fuel, oil, solvents, etc will be stored in original containers, or in containers manufactured for storing such material that are clearly labeled as to the contents of the container. Fuel, oil and other potentially hazardous materials will be kept secured in a locked storage locker designed and properly vented for storing such material.

- Copies of Material Safety Data Sheets (MSDS) for all applicable materials will be maintained at the construction trailer and/or in the storage locker where the materials are stored. They will be readily accessible for employees and inspection officials.

- The contractor(s) will immediately clean-up any and all spills of fuel, oil or other potentially hazardous materials. Any and all reportable spills will be reported to the proper authorities (local fire department, board of health, DEP, etc.).

Traffic

The project area has a network of very narrow roadways. The use of large construction machinery and equipment in and around these roadways will pose significant challenges to maintaining traffic flow in and through the project area. The following mitigation measures will be employed to address potential impacts associated with construction traffic throughout the project area:

- All traffic control work performed by the Contractor shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), and Massachusetts Highway Department of Transportation (MHD) Work Zone Traffic Control Standard Plans and Standard Specifications.

- The Contractor shall furnish, install, operate, and maintain equipment, services, and personnel, with traffic control and protective devices, as required to expedite vehicular traffic flow during construction.

- The Contractor shall develop traffic control plans detailing all temporary changes in traffic control equipment, street or road closures, detours, etc. The Contractor shall make every effort to adhere to the plan. When necessary, the Contractor shall update this plan and forward these changes to the Town for approval.

- The Contractor shall remove temporary equipment and facilities when no longer required and restore grounds to original or specified conditions.

- The Contractor shall notify all property owners in advance of any work that will interfere with access to their residence or place of business.

- No road shall be closed to traffic without the prior consent of the Town.

- Traffic control, including but not restricted to signing devices, shall be provided for all openings in roads by the Contractor in accordance with Town and State Standards.

- The Contractor shall provide for access to all buildings including business and parking areas at all times.

- Police detail may be required at certain times in order to maintain safe traffic control within the project area. This will be determined by the Town.

- The Contractor shall make every reasonable effort to avoid detours. No detour shall be allowed without prior approval from the Town and the agency responsible for the road. A detailed Traffic Control Detour Plan shall be submitted to the Town showing schedule, signing and control for the proposed detour.

- The Contractor shall submit traffic management and traffic control-phased plans for shop drawing review by the Town prior to commencing any work within the roadway or sidewalk rights-of-way. The plans shall be to scale and will include, but not be limited to: MUTCD signing and striping for construction operations, construction staging areas and setup, police or flagman detail requirements, temporary detours, partial residential or business closures, and a time-line schedule of when the phased work is to begin and be completed by. These plans may require more detailed information based upon the duration of phased work, location and/or as directed by the Town.

- The Contractor shall provide and operate traffic control and directional signals required to direct and maintain an orderly flow of traffic in all areas under all Contractors control, or affected by all Contractors operations.

- Provide traffic control and directional signs, mounted on barricades or standard posts at the following locations: each change of direction of a roadway and each crossroads, detours, parking areas, and for businesses within detour routes.

- Existing permanent traffic control signing and devices, including guardrails, shall not be removed unless called for on the Contract Plans or without the prior consent of the agency responsible for the road and the Town.

- After completion of the project, the Contractor shall remove all construction signing and support systems and patch the disturbed area to match the existing as closely as possible and to the satisfaction of the Town.

- Detours around construction will be subjected to the approval of the Town. Where detours are permitted the Contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured the Contractor shall expedite construction operations and periods when traffic is being detoured will be strictly controlled by the Town.

- The Contractor shall take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist, or police protection for traffic while work is in progress. The Contractor shall be fully responsible for damage or injuries whether or not police protection has been provided.

- The Contractor shall control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Public Works Department operations, or construction operations.

- The Contractor shall monitor parking of construction personnel's private vehicles, maintain free vehicular access to and through parking areas and prohibit parking on or adjacent to access roads or in non-designated areas.

Scenic Qualities, Open Space and Recreational Resources

The scenic qualities, open space and recreational resources of Wareham and the surrounding area play a significant role in shaping the character of the community. The following mitigation measures will be employed to address potential impacts associated with scenic qualities, open space and recreational resources throughout the project area:

- Access to all public recreation areas, scenic points, and designated areas will be maintained throughout the duration of construction. Care will be taken to minimize, to the maximum extent practicable, the impact that construction will have on the serenity and natural beauty of these open space and recreational resources.

Historical and Archaeological Resources

Further coordination with the Massachusetts Historical Commission will occur to ensure that construction of pump stations, and any other off-road work, does not result in impacts to archaeological resources.

Secondary Growth

Executive Order 385 requires all state agencies to undertake proactive and coordinated planning to promote the management of growth, in a manner that balances sustainable economic development and resource protection. In addition, state agency actions must consider local and regional growth management plans. The issues related to potential growth-inducing impacts of infrastructure investments and making sure that land use and open space goals are not undermined by those investments are central to the Wareham Comprehensive Wastewater Management Plan. As described in Section 8.2.3, the growth inducing aspects of the proposed project are expected to be minimal and are being addressed through the adoption of a bylaw for activities in flood-prone areas and other anticipated local controls.

8.6.6 Implementation Schedule

The mitigation measures proposed for this project, as reviewed in these Section 61 Findings, involve differing time frames for implementation, depending on the type of impact involved and when it occurs. Some of the mitigation measures will be implemented prior to construction, including preparation and approval of required control plans (such as a traffic control plan and a Sedimentation and Erosion Control Plan). Other mitigation measures involve following specified procedures during construction, and implementation of these measures coincides with the performance of the specific construction activities. After completion of construction, some mitigation measures will be instituted to restore disturbed areas to pre-construction conditions or to provide mitigation for impacts incurred during construction. Operational mitigation (such as odor and noise controls) will also be in place following construction.

8.6.7 Summary of Impacts and Findings of Limitation of Impacts

The Town of Wareham finds that the environmental impacts resulting from construction of the proposed project are those impacts described in this Single Environmental Impact Report, which will be updated as necessary in permit applications submitted for compliance with federal and state environmental laws. The Town of Wareham finds that, with implementation of the mitigation measures described, all feasible means and measures will have been taken to avoid or minimize adverse impacts to the environment relating to construction and operation of the proposed utility services project.

8.7 Summary

At the present time, the capacity of the Town of Wareham's wastewater treatment and sewer system is inadequate to meet the future needs of the town. Because of failing septic systems, sewage disposal needs areas in the town have been identified. If left uncorrected, any one of these problems could result in an adverse environmental impact.

In searching for a solution to meet the town's wastewater needs, many factors were considered. The most important factor considered was the protection of the public and environmental health. Developing a plan that meets the Town's future needs, addresses existing problems, and minimizes future impacts entailed looking at various potential solutions and combinations of solutions. Alternatives that did not meet the Town's needs were eliminated and potential solutions were examined according to their long-term impacts. As a result of this careful examination the recommended plan was developed. Implementation of the actions outlined in the recommended plan would result in a sewer and treatment system that will best meet the future needs of the town and protect the environment.

Section 9
Public Participation Summary

9.1 General

Public participation in the facilities planning process ensures community support through direct involvement in identifying wastewater management solutions that are environmentally-acceptable, as well as technically-sound.

9.2 Review Committee

The Review Committee consists of the Board of Selectmen, Town Administrator, Municipal Maintenance Director, and WPCF Chief Operator. CDM project team members made monthly presentations at the Sewer Commission meetings to update the Review Committee on the progress of the facilities plan and to determine whether the alternatives presented were acceptable for the town. All of the meetings were open to the public.

9.3 Wareham Public Participation Program

In accordance with EPA Regulation 40 CFR 25 and 40 CFR 365 Subpart E and DEP's Guide to Comprehensive Wastewater Management Planning, January 1996, all facilities planning projects are subject to public participation requirements. The program is intended to directly involve the public sector and other interested groups in the decision making process.

For this study, the public participation program consisted of a public meeting and a public hearing to give the public opportunities to review the recommended plans for wastewater collection and treatment. Additionally, all Board of Selectmen review meetings were open to the public, providing additional opportunities for public input.

Informational presentations were prepared for the public meeting and hearing to describe progress, results, and project direction. Responsiveness summaries were prepared following each meeting to present major questions raised during meetings, along with a summary of the responses and/or responsive actions taken for each. These documents are in Appendix F. Copies of these documents are available for review in the Wareham Town Hall.

9.4 Summary of Public Participation Program

The first public information meeting to discuss the Wareham Wastewater Facilities Plan was held on Monday, November 17, 1997 at 7:00 p.m. in the Wareham Town Hall Selectman's meeting room. The purpose of the meeting was to provide an overview of the planning project and to obtain public comments on the recommendations for sewage disposal needs areas. Representatives of the town, the Facilities Plan Review Committee, and the CDM project team were present. The CDM project team presented information on the project background, needs areas, sewage disposal needs analysis, wastewater collection and treatment system recommendations. Following the presentation, public comments and questions were discussed.

On December 4, 2001, at 7:05 pm, a public hearing was held at the Multi-Source Center, 48 Marion Road, Wareham, MA 02571. The hearing was dually advertised in the *Wareham Courier*, a local newspaper, 2 and 4 weeks prior to the hearing date. The hearing was also taped and shown on a local cable channel.

The hearing was sponsored by the Wareham Board of Sewer Commissioners and included a presentation of the recommended plan. The Board of Sewer Commissioners requested comments and/or testimony from the public. There were no verbal or written comments on the recommended plan from the community at the meeting nor in the period that followed. A copy of the presentation given by CDM is included in Appendix F, as is the sign-in sheet and a copy of one of the newspaper advertisements.

Appendix A

314 CMR 4.00 MASSACHUSETTS SURFACE WATER QUALITY STANDARDS

SECTION

4.01 General Provisions

(1) Title. 314 CMR 4.00 shall be known as the "Massachusetts Surface Water Quality Standards."

(2) Organization of the Standards. These standards comprise six (6) sections, General Provisions (Section 4.01) Definitions (Section 4.02), Application of Standards (Section 4.03), Antidegradation Provisions (Section 4.04), Classes and Criteria (Section 4.05), and Basin Classification and Maps (Section 4.06).

(3) Authority. The Massachusetts Surface Water Quality Standards are adopted by the Division pursuant to the provisions of M.G.L. c.21, s.27.

(4) Purpose. The Massachusetts Act charges the Division with the duty and responsibility to protect the public health and enhance the quality and value of the water resources of the Commonwealth. It directs the Division to take all action necessary or appropriate to secure to the Commonwealth the benefits of the Federal Act. The objective of the Federal Act is the restoration and maintenance of the chemical, physical, and biological integrity of the Nation's waters. To achieve the foregoing requirements the Division has adopted the Massachusetts Surface Water Quality Standards which designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected; which prescribe the minimum water quality criteria required to sustain the designated uses; and which contain regulations necessary to achieve the designated uses and maintain existing water quality including, where appropriate, the prohibition of discharges.

4.02 Definitions

(1) Aquatic Life - A native, naturally diverse, community of aquatic flora and fauna.

(2) Background Conditions - That water quality which exists or would exist in the absence of discharges of pollutants requiring permits and other controllable cultural factors, including but are not limited to, water withdrawals, proposed hydrologic modifications, contaminated stormwater runoff or other identifiable nonpoint sources of pollution.

(3) Beneficial Use - The uses designated in 314 CMR 4.05 and any other uses that do not impair the designated uses; except that in no case shall the assimilation or transport of pollutants be considered a beneficial use.

(4) Coastal and Marine Waters - The Atlantic Ocean and all contiguous saline bays, inlets and harbors within the jurisdiction of the Commonwealth including areas where fresh and salt waters mix and tidal effects are evident or any partially enclosed coastal body of water where the tide meets the current of a stream or river.

(5) Cold Water Fishery - Waters in which the maximum mean monthly temperature generally does not exceed 68°F (20°C) and, when other ecological factors are favorable (such as habitat), are capable of supporting a year-round population of cold water stenothermal aquatic life such as trout (salmonidae).

(6) Combined Sewer Overflow or CSO - Any intermittent overflow, bypass or other discharge from a municipal combined sewer system which results from a wet weather flow in excess of the dry weather carrying capacity of the system.

(7) Director - The Director of the Division of Water Pollution Control or his designee.

(8) Discharge or Discharge of Pollutants - Any addition of any pollutant or combination of pollutants to the waters of the Commonwealth from any source.

(9) Division - The Massachusetts Division of Water Pollution Control, as established by M.G.L. c.21, s.26.

(10) EPA - The United States Environmental Protection Agency.

(11) Epilimnion - The upper circulating layer of a stratified lake or pond.

(12) Federal Act - The Federal Water Pollution Control Act, as amended, 33 U.S.C. s.1251, *et seq*.

(13) Hypolimnion - The deep layer in a stratified lake or pond which is not subject to wind-induced mixing.

(14) Inland Waters or Fresh Waters - Any surface water body not subject to tidal action or not subject to the mixing of fresh and ocean waters.

(15) Lakes and Ponds - Waterbodies situated in a topographic depression or a dammed river channel with water usually not flowing and an area greater than 20 acres; or less than 20 acres if the water depth in the deepest part of the basin exceeds 2 meters (6.6 feet) or if a descrete shoreline makes up all or part of the boundary. Exceptions include impervious man-made retention basins; river impoundments with flowing water; and harbors and bays which have year-round navigable access to the ocean.

(16) Massachusetts Act - The Massachusetts Clean Waters Act, as amended, M.G.L. c.21, §.26-53.

(17) Nonpoint Source - Any conveyance from which pollutants are or may be discharged that is not a point source.

(18) Point Source - Any discernable, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding

operation, vessel or other floating craft, from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture.

(19) Pollutant - Any element or property of sewage, agricultural, industrial or commerical waste, runoff, leachate, heated effluent, or other matter in whatever form, and whether originating at a point or nonpoint source, that is or may be discharged, drained or otherwise introduced into any sewerage system, treatment works or waters of the Commonwealth.

(20) Primary Contact Recreation - Any recreation or other water use in which there is prolonged and initimate contact with the water with a significant risk of ingestion of water. These include, but are not limited to, wading, swimming, diving, surfing and water skiing.

(21) Rivers and Streams - Waterbodies contained within a channel (naturally or artificially created) which periodically or continuously contains flowing water or form a connecting link between two bodies of standing water.

(22) Secondary Contact Recreation - Any recreation or other water use in which contact with the water is either incidental or accidental. These include but are not limited to fishing, boating and limited contact incident to shoreline activities.

(23) Segment - A finite portion of a water body established by the Division for the purpose of classification.

(24) Surface Waters - All waters other than groundwaters within the jurisdiction of the Commonwealth, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, coastal waters and vernal pools.

(25) Toxic Pollutants - Any pollutant or combination of pollutants, including disease causing agents, that are capable of producing an adverse effect in an organism or its offspring, according to information available to the Division. The effect may be the result of direct or indirect exposure and may injure structure, function or cause death to the organism. These pollutants include but are not limited to, those identified in 314 CMR 3.16.

(26) Toxic Unit - A unit for measuring the aggregate toxic effect of an effluent, measured directly with a toxicity test, equal to 100 divided the toxicant concentration killing 50% of the exposed organisms at a given exposure period.

(27) Vernal Pool - A waterbody that has been certified by the Massachusetts Division of Fisheries and Wildlife as a vernal pool.

(28) Warm Water Fishery - Waters in which the maximum mean monthly temperature generally exceeds 68°F (20°F) during the summer months and are not capable of sustaining a year-round population of cold water stenothermal aquatic life.

(29) Waters of the Commonwealth - All waters within the jurisdiction of the Commonwealth, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, coastal waters, groundwaters and vernal pools.

4.03 Application of Standards

(1) Establishment of Effluent Limitations. The Division will limit or prohibit discharges of pollutants to surface waters to assure that surface water quality standards of the receiving waters are protected and maintained or attained. The level of treatment for an individual discharger will be established by the discharge permit in accordance with 314 CMR 3.10 (Permit Conditions). In establishing water quality based effluent limitations the Division shall take into consideration background conditions and existing discharges. Discharges shall be limited or prohibited to protect existing uses and not interfere with the attainment of designated uses in downstream and adjacent segments. The Division shall provide a reasonable margin of safety to account for any lack of knowledge concerning the relationship between the pollutants being discharged and their impact on water quality.

(2) Mixing Zones - In applying these standards the Division may recognize a limited area or volume of a waterbody as a mixing zone for the initial dilution of a discharge. Waters within a mixing zone may fail to meet specific water quality criteria provided the following conditions are met:

(a) Mixing zones shall be limited to an area or volume as small as feasible. The location, design and operation of the discharge shall minimize impacts on aquatic life and other beneficial uses.

(b) Mixing zones shall not interfere with the migration or free movement of fish or other aquatic life. There shall be safe and adequate passage for swimming and drifting organisms with no deleterious effects on their populations.

(c) Mixing zones shall not create nuisance conditions, accumulate pollutants in sediments or biota or otherwise diminish the beneficial uses of the segment disproportionately.

(3) Hydrologic Conditions. The Director will determine the most severe hydrologic condition at which water quality criteria must be met. The Director may further stipulate the magnitude, duration and frequency of allowable excursions from criteria in order to prevent adverse impacts of discharges on beneficial uses.

(a) For rivers and streams lowest flow condition at and above which criteria must be met is the lowest mean flow for seven consecutive days to be expected once in ten years. When records are not sufficient to determine this condition, the flow may be estimated by methods approved by the Director.

(b) In artificially regulated waters, the lowest flow condition at which criteria must be met is the flow equaled or exceeded 99 percent of the time on a yearly basis, or another equivalent flow agreed upon by the Director and the federal, state or private interest controlling the flow. The minimum flow established in such an agreement will become the critical low flow for those waters covered by the agreement.

(c) In coastal and marine waters and for lakes and ponds, the Director shall establish extreme hydrologic conditions at which criteria must be met on a case-by-case basis. In all cases existing uses shall be protected and the selection will not interfere with the attainment of designated uses.

(d) Where appropriate, the Director may select an extreme precipitation event or design storm at which criteria must be met. The selection shall provide for the maximum protection of beneficial uses based on an evaluation of site-specific factors including actual and projected uses of the waterbody, availabiity of control technologies and costs verses benefits. Each evaluation and selection shall be subject to full intergovernmental coordination and public participation. The application of criteria due to design storm considerations shall be independent of any determination made persuant to paragraphs (a), (b) or (c).

(4) Natural Background Conditions. Excursions from criteria due to natural conditions shall not be interpreted as violations of standards and shall not affect the water use classifications adopted by the Division.

(5) Short-term Variance - The Director may issue a short term variance from criteria estabished in Sction 4.05 of these regulations when necessary to accommodate essential activities, respond to emergencies or protect the public interest. Short-term variances shall be authorized at the discretion of the Director under conditions prescribed by the Director even though the activities may result in a temporary violation of the water quality criteria for the water involved.

A short-term variance will be granted only after the applicant has affirmitively demonstrated to the satisfaction of the Director that the activity for which the variance is sought:

(a) Will have no adverse impact on designated uses beyond the term of the variance granted;

(b) Will be kept to a minimum impact and time frame using all known available and feasible methods of mitigation;

(c) When completed the water quality will return within the shortest feasible time to the conditions that existed before the variance was granted and not result in continuing or recurring reduction of water quality.

(6) Procedures for Sampling and Analyses. All procedures used for the purpose of collecting, preserving and analyzing samples in connection with these standards shall be approved by the Director. Approved procedures include:

(a) Standard Methods for the Examination of Water and Wastewater, American Public Health Association, et. al., 16th edition, 1985;

(b) National Handbook of Recommended Methods for Water Resources Investigations prepared cooperatively by agencies of the United States Government;

(c) Techniques of Water-Resources Investigations of the United States Geological Survey; and

(d) Strickland, J.D.H. and T.R. Parsons. A Practical Handbook of Seawater Analysis. Fisheries Research Board of Canada, Bull. 167, 311. 1982.

(7) Severability. If any provision of these standards is held invalid, the remainder of these standards shall not be affected.

(8) Repealer. "The Massachusetts Surface Water Quality Standards" published December 31, 1983 are hereby repealed, except that all permits, orders, determinations, or other actions of the Division, based upon such standards, and any court actions seeking to enforce such standards, permits, orders and determinations shall remain in full force and effect until modified, amended, revoked or reissued by the Division and/or the courts of the Commonwealth, as appropriate.

(9) Effective Date. These standards shall become effective upon publication by the Secretary of the Commonwealth pursuant to the provisions of M.G.L. C30A, s.6.

4.04 Antidegradation Provisions

(1) Protection of Existing Uses - In all cases, from and after the date these regulations become effective, existing water uses and the level of water quality necessary to protect the existing uses shall be protected and maintained. Existing uses shall be those attained since April 7, 1978 as determined by the Director.

(2) Protection of High Quality Waters - In all cases, from and after the date these regulations become effective, waters classified B or SB in these regulations which exceed minimum criteria at critical conditions shall be protected and maintained for that higher water quality. No new or increased discharge of pollutants shall be authorized to these waters except where:

(a) The Director determines that the discharge is insignificant in nature and will neither impair existing water uses nor cause any long-term lowering of existing water quality; or

(b) The applicant for the discharge affirmitively demonstrates to the Division that:

1) The activity associated with the discharge serves an important social or economic purpose in the area in which the waters are located and the benefits to the public resulting from the activity override the benefits from maintaining higher water quality;

2) No appropriate less environmentally damaging alternative site for the activity, source for disposal, or method for elimination of the discharge is available; and

3) The discharge will not impair existing water uses nor lower water quality below receiving water standards.

(c) Any authorized discharge shall be provided with a level of treatment equal to or exceeding the requirements of the Massachusetts Surface Water Discharge Permit Program (314 CMR 3.00). All reasonable best management practices to control nonpoint source pollution shall be implemented. Before authorizing a discharge to these waters all appropriate public participation and intergovernmental coordination shall be conducted persuant to the Permit Procedures (314 CMR 2.00).

(3) Protection of Outstanding Resource Waters - In all cases, from and after the date these regulations become effective, waters classified as A or SA in these regulations shall be protected and maintained as outstanding resource waters. Existing discharges shall be required to cease and connect to a Publically Owned Treatment Works unless such a connection is unavailable or infeasible. No new or increased discharge of pollutants shall be authorized to these waters except where:

(a) The Director determines that the discharge is insignificant in nature and will neither impair existing water uses nor cause any long-term lowering of existing water quality; or

(b) After full intergovernmental coordination and public participation a limited area or volume of the water is reclassified B or SB to accommodate the new or increased discharge from a Publically Owned Treatment Works. Any such discharge must be in accordance with a plan developed under the provisions of Section 27(6) of the Massachusetts Act, been the subject of a Public Hearing and approved by the Director. Any such discharge shall be subject to the discharge restrictions for high quality waters, Section 4.04 (2) (b) and (c) of these regulations.

(4) Control of Eutrophication. From and after the date these regulations become effective there shall be no new or increased point source discharge of nutrients, primarily phosphorus and nitrogen, directly to lakes and ponds or to tributaries of lakes and ponds that would encourage eutrophication or the growth of weeds or algae in these lakes or ponds. Any existing point source discharge containing nutrients in concentrations which encourage eutrophication or growth or weeds or algae shall be provided with the highest and best practicable treatment to remove such nutrients. Activities which result in the nonpoint source discharge of nutrients to lakes and ponds shall be provided with all reasonable best management practices for nonpoint source control.

4.05 Classes and Criteria

(1) Classes and Uses - The surface waters of the Commonwealth shall be segmented and each segment assigned to one of the Classes listed below. Each class is identified by the most sensitive, and therefore governing water uses to be achieved and protected. Surface waters may be suitable for other beneficial uses, but shall be regulated by the Division to protect and enhance the designated uses.

(2) Criteria - Minimum criteria for each Class accompany each class description. Additional minimum criteria for all surface waters are listed in Section 4.05(5) and shall be applicable unless criteria specified for individual classes are more stringent.

(3) Inland Water Classes:

(a) Class A - These waters are designated as an outstanding resource as determined by their ecological, social or recreational value. They shall be an excellent habitat for fish, other aquatic life and wildlife and suitable for primary and secondary contact recreation. Where specifically designated they serve as a raw source for a public water supply. These waters shall have excellent aesthetic value. Discharge prohibitions in accordance with Section 4.04(3) of these regulations apply.

(1) Dissolved Oxygen - Shall not be less than 7.0 mg/l unless naturally lower. Natural seasonal and daily variations above this level shall be maintained; the D.O. shall not be lowered more than 0.5 mg/l from background conditions due to the discharge of pollutants.

(2) Temperature - (a) shall not exceed 68°F (20°C) in cold water fisheries, nor 83°F (28.3°C) in warm water fisheries. The rise in temperature due to a discharge shall not exceed 1.5°F (0.8°C); and (b) natural seasonal and daily variations shall be maintained. There shall be no changes from background conditions that would impair any use assigned to this Class, including site-specific limits necessary to protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms.

(3) pH - Shall be in the range of 5.0 - 9.0 standard units but not more than 0.2 units outside of the normally occuring range. There shall be no change from background conditions that would impair any use assigned to this Class.

(4) Fecal Coliform Bacteria - Shall not exceed an arithmetic mean of 20 organisms per 100 ml in any representative set of samples, nor shall 10 percent of the samples exceed 100 organisms per 100 ml.

(5) Solids - These waters shall be free from floating, suspended and settlable solids in concentrations or combinations that would impair any use assigned to this class; none aesthetically objectionable; and none that would impair the benthic biota or degrade the chemical composition of the bottom. Suspended solids due to a discharge shall not raise background levels by more than an average of 3 mg/l.

(6) Color and Turbidity - These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this class. Color shall not exceed 15 color units unless naturally higher and the rise in turbidity over background conditions shall not exceed 5 N.T.U.

(7) Oil and Grease - These waters shall be free from oil and grease, petrochemicals and other volatile or synthetic organic pollutants.

(8) Taste and Odor - None other than of natural origin.

(9) Posphate-Phosphorus - Shall not be in concentrations that exceed site-specific limits necessary to control cultural eutrophication (see Section 4.04(4) of these regulations) nor shall the average concentration exceed 0.05 mg/l in rivers and streams or 0.03 mg/l in lakes and ponds unless background conditions are higher.

(10) Ammonia-Nitrogen - Shall not exceed the site-specific limits necessary to protect the most sensitive water use nor shall the maximum level exceed 0.5 mg/l.

(11) Chlorine (Residual) - Shall not exceed 0.005 mg/l.

(12) Toxicity - Shall not exceed 0.01 toxic units as a monthly median nor 0.05 toxic units as a daily maximum.

(b) Class B - These waters are designated as high quality waters. They shall be suitable for all high quality uses including a habitat for fish, other aquatic life and wildlife and for primary and secondary contact recreation. They shall be acceptable for public water supply with appropriate treatment and for agricultural and certain industrial cooling and process uses. They shall have excellent aesthetic value. Discharge restrictions in accordance with Section 4.04(2) of these regulations apply.

(1) Dissolved Oxygen - Shall not be less than 6.0 mg/l in cold water fisheries nor less than 5.0 mg/l in warm water fisheries unless naturally lower. Natural seasonal and daily variations above these levels shall be maintained; the D.O. shall not be lowered more than 1.5 mg/l in cold water fisheries nor 2.5 mg/l in warm water fisheries due to the discharge of pollutants.

(2) Temperature - a) Shall not exeed 68°F (20°C) in cold water fisheries nor 83°F (28.3°C) in warm water fisheries. The rise in temperature due to a discharge shall not exceed 3°F (1.7°C) in rivers and streams designated as cold water fisheries nor 5°F (2.8°C) in rivers and streams designated as warm water fisheries (based on the minimum expected flow for the month). In lakes and ponds the rise shall not exceed 3°F (1.7°C) in the epilimnion (based on the monthly average of maximum daily temperature); and b) Natural seasonal and daily variations shall be maintained. There shall be no changes from background conditions that would impair any use assigned to this Class, including site-specific limits necessary to

(October through May) nor 1.5 during the summer months (June through September) in waters with a background pH of less than 7.5 standard units: nor exceed 1.0 mg/l in the winter or 0.5 mg/l in the summer in waters with a background pH equal to or greater than 7.5 standard units.

(11) Chlorine (Residual) - Shall not exceed 0.005 mg/l in cold water fisheries nor 0.02 mg/l in warm water fisheries.

(12) Toxicity - Shall not exceed a monthly median of 0.05 toxic units nor a daily maximum of 0.1 toxic units.

(c) Class C - These waters shall be acceptable as a habitat for fish, other aquatic life and wildlife; and for secondary contact recreation. These waters shall be suitable for certain industrial cooling and process uses and for the irrigation of crops used for consumption after cooking. They shall have good aesthetic value. This Class shall be assigned only where a higher use Class is not attainable. (See Section 4.06(1) of these regulations).

(1) Dissolved Oxygen - Shall not be less than 5.0 mg/l at least 16 hours of any 24-hour period and not less than 3.0 mg/l at anytime unless naturally lower. Natural seasonal and daily variations above these levels shall be maintained. The D.O. shall not be lowered below 50 percent of saturation due to a discharge.

(2) Temperature - a) Shall not exceed 85°F (29.4°C) nor shall the rise due to a discharge exceed 5°F (2.8°C); and b) Natural seasonal and daily variations shall be maintained. There shall be no changes from background conditions that would impair any use assigned to this Class, including the site-specific limits necessary to protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms.

(3) pH - Shall be in the range of 6.5 - 9.0 standard units and not more than 1.0 standard unit outside of the naturally occurring range. There shall be no change from background conditions that would impair any use assigned to this Class.

(4) Fecal Coliform Bacteria - Shall not exceed a geometric mean of 1000 organisms per 100 ml nor shall 10 percent of the samples exceed 2000 per 100 ml.

(5) Solids - These waters shall be free from floating, suspended and settleable solids in concentrations and combinations that would impair any use assigned to this Class; none aesthetically objectionable; and none that would impair the benthic biota or degrade the chemical composition of the bottom. Suspended solids shall not exceed 80 mg/l.

(6) Color and Turbidity - These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would imair any use assigned to this Class.

protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms.

(3) pH - Shall be in the range of 6.5 - 8.3 standard units and not more than 0.5 units outside of the background range. These shall be no change from background conditions that would impair any use assigned to this Class.

(4) Fecal Coliform Bacteria - Shall not exceed a geometric mean of 200 organisms per 100 ml in any representative set of samples nor shall more than 10 percent of the samples exceed 400 organisms per 100 ml. This criterion may be applied on a seasonal basis at the discretion of the Division.

(5) Solids - These waters shall be free from floating, suspended and settleable solids in concentrations and combinations that would impair any use assigned to this Class; none aesthetically objectionable; and none that would impair the benthic biota or degrade the chemical composition of the bottom. Suspended solids shall not exceed 25 mg/l or shall the rise over background due to a discharge exceed 10 mg/l.

(6) Color and Turbidity - a) These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this Class; b) Color due to a discharge shall not increase background levels by more than 10 percent nor exceed a maximum of 50 color units. c) Turbidity due to a discharge shall not increase background levels by more than 5 N.T.U. in waters with background levels 50 N.T.U. or less, nor more than 10 percent in waters with background levels above 50 N.T.U.; the maximum increase above background shall not exceed 25 N.T.U.

(7) Oil and Grease - These waters shall be free from oils, grease and petrochemicals that produce a visible film on the surface of the water; impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life; Coat the banks or bottom of the water course, or are deleterious or become toxic to aquatic life.

(8) Taste and Odor - None in such concentrations or combinations that are aesthetically objectionable; that would impair any use assigned to this Class; or that would cause tainting or undesirable flavors in the edible protions of aquatic life.

(9) Phosphate-Phosphorus - Shall not be in concentrations that exceed the site-specific limits necessary to control cultural eutrophication (See Section 4.04(4) of these regulations) nor shall the average concentration exceed 0.1 mg/l in rivers and streams or 0.03 mg/l in lakes or ponds unless background conditions are higher.

(10) Ammonia-Nitrogen - Shall not exceed the site-specific limits necessary to protect the most sensitive water use. The concentration shall not exceed 2.0 mg/l during the winter months

(7) Oil and Grease - These waters shall be free from oils, grease and petrochemicals that produce a visible film on the surface of the water; impart an oily taste to the edible portions of aquatic life; coat the banks or bottom of the water course; or are deleterious or become toxic to aquatic life.

(8) Taste and Odor - None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to this Class; or that would cause tainting or undesirable flavors in the edible portions of aquatic life.

(9) Phosphate-Phosphorus - Shall not be in concentrations that exceed the site-specific limits necessary to control cultural eutrophication (See Section 4.40(4) of these regulations).

(10) Ammonia-Nitrogen - Shall not exceed the site specific limits necessary to protect the most sensitive water use. The concentration shall not exceed 2.0 mg/l during the winter months (October through May) nor 1.0 mg/l during the summer months (June through September).

(11) Chlorine (Residual) - Shall not be in concentrations that would impair any uses assigned to this Class.

(12) Toxicity - Shall not exceed a monthly median of 0.1 toxic units nor a daily maximum of 0.3 toxic units.

(4) Coastal and Marine Classes

(a) Class SA - These waters are designated as an outstanding resource as determined by their ecological, social or recreational value. They shall be an execllent habitat for fish, other aquatic life and wildlife and suitable for primary and secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting without depuration (Open Shellfish Areas may be subject to more stringent regulation by the Division of Marine Fisheries). These waters shall have excellent aesthetic value. Discharge prohibitions in accordance with Section 4.04 (3) of these regulations apply.

(1) Dissolved Oxygen - Shall not be less than 6.0 mg/l unless naturally lower. Natural seasonal and daily vairations above this level shall be maintained; the D.O. shall not be lowered more than 0.5 mg/l from background conditions due to a discharge.

(2) Temperature - a) Shall not exceed 85°F (29.4°C) nor a maximum daily mean of 80°F (26.7°C). The rise in temperature due to a discharge shall not exceed 1.5°F (0.8°C); and b) natural seasonal and daily variations shall be maintained. There shall be no changes from background that would impair any uses assigned to this class including site-specific limits necessary to protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms. Any determinations concerning thermal discharge limitations in accordance with Section 316(a) of the Federal Act will be considered site-specific limitations in compliance with these regulations.

(3) pH - Shall be in the range of 6.5 - 8.5 standard units and not more than 0.2 standard units outside of the normally occurring range. There shall be no change from background conditions that would impair any use assigned to this class.

(4) Fecal Coliform Criteria - Shall not exceed a geometric mean MPN of 14 organisms per 100 ml and not more than 10 percent of the samples exceed any MPN of 43 per 100 ml. More stringent regulations may apply in approved shellfishing areas (See Section 4.06(2) of these regulations).

(5) Solids - These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class; none aesthetically objectionable; and none that would impair the benthic biota or degrade the chemical composition of the bottom. Suspended solids due to a discharge shall not raise the average background levels by more than 3 mg/l.

(6) Color and Turbidity - These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this class.

(7) Oil and Grease - These waters shall be free from oil and grease and petrochemicals.

(8) Taste and Odor - None other than of natural origin.

(9) Phosphate-Phosphorus - Shall not be in concentrations that exceed the site-specific limits necessary to control cultural eutrophication (See Section 4.04(4) of these regulations); nor shall the average concentration exceed 0.05 mg/l.

(10) Ammonia-Nitrogen - Shall not exceed the site-specific limits necessary to protect the most sensitive water use nor shall the maximum level exceed 0.2 mg/l.

(11) Chlorine (Residual) - Shall not exceed 0.005 mg/l. 30 day moving average

(12) Toxicity - Shall not exceed a monthly median of 0.01 toxic units nor a daily maximum of 0.05 toxic units.

(b) Class SB - These waters are designated as high quality waters. They shall be suitable for all high quality uses, including a habitat for fish other aquatic life and wildlife and for primary and secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting with depuration (Restricted Shellfish Areas may be subject to more stringent regulation by the Division of Marine Fisheries). These waters shall have excellent aesthetic value. Discharge prohibitions in accordance with Section 4.04(2) of these regulations apply.

(1) Dissolved Oxygen - Shall not be less than 5.0 mg/l unless naturally lower. Natural seasonal and daily vairations above this level shall be maintained; the D.O. shall not be lowered more than 1.0 mg/l from background conditions due to a discharge.

(2) Temperature - a) Shall not exceed 85°F (29.4°C) nor a maximum daily mean of 80°F (26.7°C). The rise in temperature due to a discharge shall not exceed 1.5°F (0.8°C) during the summer months (July through September) nor 4°F (2.2 °C) during the winter months (October through June); and b) natural seasonal and daily variations shall be maintained. There shall be no changes from background that would impair any uses assigned to this class including site-specific limits necessary to protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms. Any determinations concerning thermal discharge limitations in accordance with Section 316(a) of the Federal Act will be considered site-specific limitations in compliance with these regulations.

(3) pH - Shall be in the range of 6.5 - 8.5 standard units and not more than 0.2 units outside of the normally occurring range. There shall be no change from background conditions that would impair any use assigned to this class.

(4) Fecal Coliform Bacteria - Shall not exceed a geometric mean of 200 organisms per 100 ml in any representative set of samples nor shall more than 10 percent of the samples exceed 400 organisms per 100 ml. This criterion may be applied on a seasonal basis at the discretion of the Division. More stringent regulations may apply to Restricted Shellfish areas (See Section 4.06(2) of these regulations).

(5) Solids - These waters shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to this class; none aesthetically objectionable; and none that would impair the benthic biota or degrade the chemical composition of the bottom. Suspended solids shall not exceed 25 mg/l nor shall the rise over background due to a discharge exeed 10 mg/l.

(6) Color and Turbidity - These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this class.

(7) Oil and Grease - These waters shall be free from oils, grease and petrochemicals that produce a visible film on the surface of the water; impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life; coat the banks or bottom of the water course; or are deletereous or become toxic to aquatic life.

(8) Taste and Odor - None in such concentrations or combinations that are aesthetically objectionable; that would impair any use assigned to this class; or that would cause tainting or undesirable flavors in the edible portions of aquatic life.

(9) Phosphate-Phosphorus - Shall not be in concentratons that exceed the site specific limits necessary to control cultural eutrophication (See Section 4.04(4) of these regulations), nor shall the average concentration exceed 0.1 mg/l.

(10) Ammonia-Nitrogen - Shall not exceed the site-specific limits necessary to protect the most sensitive water use. The concentration shall not exceed 2.0 mg/l during the winter months (October through June) nor 1.0 mg/l during the summer months (July through September) in waters with a background pH of less than 7.5 standard units; nor exceed 0.5 mg/l during the winter months nor 0.25 mg/l during the summer months in waters with a background pH equal to or greater than 7.5 standard units.

(11) Chlorine (Residual) - Shall not exceed 0.01 mg/l.

(12) Toxicity - Shall not exceed a monthly median of 0.05 toxic units nor a daily maximum of 0.1 toxic units.

(c) Class SC - These waters shall be acceptable as a habitat for fish, other aquatic life and wildlife; and for secondary contact recreation. They shall also be suitable for certain industrial cooling and process uses. These waters shall have good aesthetic value. This class shall be assigned only where a higher use class is not attainable (See Section 4.06(1) of these regulations).

(1) Dissolved Oxygen - Shall not be less than 5.0 mg/l at least 16 hours of any 24-hour period and not less than 4.0 mg/l at any time unless naturally lower. Natural seasonal and daily variations above these levels shall be maintained; the D.O. shall not be lowered below 50 percent of saturation due to a discharge.

(2) Temperature - a) shall not exceed 85°F (29.4°C) nor shall the rise due to a discharge exceed 5°F (2.8°C); and b) Natural seasonal and daily variations shall be maintained. There shall be no changes from background conditions that would impair any use assigned to this class, including the site-specific limits necessary to protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms. Any determinations concerning thermal discharge limitations in accordance with Section 316(a) of the Federal Act will be considered site-specific limitations in compliance with these regulations.

(3) pH - Shall be in the range of 6.5-9.0 standard units and not more that 0.5 standard units outside of the naturally occurring range. There shall be no changes from background conditions that would impair any use assigned to this class.

(4) Fecal Coliform Bacteria - Shall not exceed a geometric mean of 1000 organisms per 100 ml nor shall 10 percent of the samples exceed 2000 per 100 ml.

(5) Solids - These waters shall be free from floating, suspended and settleable solids in concentrations and combinations that would impair any use assigned to this class; none aesthetically objectionable; and none that would impair the benthic biota or degrade the chemical composition of the bottom. Suspended solids shall not exceed 80 mg/l.

(6) Color and Turbidity - These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this class.

(7) Oil and Grease - These waters shall be free from oils, grease and petrochemicals that produce a visible film on the surface of the water; impart an oily taste to the edible portions of aquatic life; coat the banks or bottom of the water course; or are deleterious or become toxic to aquatic life.

(8) Taste and Odor - None in such concentrations or combinations that are aesthetically objectionable; that would impair any use assigned to this Class; or that would cause tainting or undesirable flavors in the edible portions of aquatic life.

(9) Phosphate-Phosphorus - Shall not be in concentrations that exceed the site-specific limits necessary to control cultural eutrophication (See Section 4.04(4) of these regulations).

(10) Ammonia-Nitrogen - Shall not exceed the site-specific limits necessary to protect the most sensitive water use. The concentration shall not exceed 2.0 mg/l during the winter months (October through May) nor 0.5 mg/l during the summer months (July through September).

(11) Chlorine (Residual) - Shall not be in concentrations that would impair any uses assigned to this class.

(12) Toxicity - Shall not exceed a monthly median of 0.1 toxic units nor a daily maximum of 0.3 toxic units.

(5) Additional minimum criteria applicable to all surface waters:

(a) Aesthetics - All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undersirable or nuisance species of aquatic life.

(b) Bottom Pollutants or Alterations - All surface waters shall be free from pollutants in concentrations or combinations or from alternations that adversely affect the physical or chemical nature of the bottom; interfere with the progagation of fish or shellfish; or adversely affect populations of non-mobile or sessible benthic organisms.

(c) Radioactivity - All surface waters shall be free from radioactive substances in concentrations or combinations that would be harmful to human, animal or aquatic life or the most sensitive designated use; result in radionuclides in aquatic life exceeding the recommended limits for consumption by humans; or exceed Massachusetts Drinking Water Regulations as set forth in 310 CRM 22.09.

(d) Toxic Pollutants - All surface waters shall be free from pollutants in concentrations or combinations that:

(1) are toxic to humans, aquatic life or wildlife according limits to information available to the Division. For recommended limits for specific pollutants not listed in these regulations that may affect designated uses the Division shall use information published persuant to Section 304(a) of The Federal Act including Quality Criteria for Water 1986 (EPA 440/5-86-001);

(2) persist in the environment or accumulate in organisms to levels that result in unacceptable concentrations in edible portions of marketable fish or shellfish or for the recreational use of fish, shellfish, other aquatic life or wildlife for human consumption; or

(3) exceed site-specific safe exposure limits determined by risk assessment, toxicity testing or comprehensive biomonitoring studies in accordance with procedures approved by the Division. Where appropriate, site-specific limits shall supercede recommended limits or other criteria established in these regulations for the establishment of specific water quality based effluent limitations. In each case, they shall be subject to full intergovernmental coordination and public participation as set forth in the Massachusetts Surface Water Discharge Permit Program (314 CMR 3.00).

4.06 BASIN CLASSIFICATION AND MAPS

(1) Classification - In determining the appropriate classification for a particular surface water, the Division will designate the national goal uses of protection and propagation of fish, shellfish, other aquatic life and wildlife and recreation in and on the water wherever attainable. These uses correspond to Class A, B, SA and SB. Waters shall be classified C or SC only where a higher classification is not attainable because:

(a) natural background conditions prevent attainment of the use;

(b) human - caused modifications of the environment prevent the attainment of the use and these changes are considered permanent and the use is incapable of being restored or regained; or

(c) the benefits of attaining the use do not bear a resonable recationship to the costs.

(2) Other Applicable Regulations - Waters classified by the Division may be subject to additional restrictions pursuant to federal or Massachusetts statues and regulations. These include but are not limited to:

(a) Class A waters that are used as a source of public drinking water are subject to the Massachusetts Drinking Water Regulations (310 CMR 22.00) persuant to M.G.L. C.111. These waterbodies may have restricted use; and

(b) approved and restricted shellfish harvest waters in Class SA and SB waters are subject to the rules and regulations of the Massachusetts Division of Marine Fisheries persuant to M.G.L. C. 130, S.75. These include applicable criteria of the National Shellfishing Sanitation Program.

(3) Tables and Maps - For the purpose of applying these regulations the surface waters of the Commonwealth are hereby classified as shown in the following tables and maps which are part of these regulations. Columns 1 and 2 of the tables describe the segment. Column 3 designates the applicable water use Class. Column 4 identifies water uses that may carry other restrictions such as public water supplies, approved shellfish harvest waters ("shellfishing (O)") and restricted shellfish harvest waters ("shellfishing (R)"). It also designates cold water fisheries ("cold water") and warm water fisheries ("warm water"). In waters designated for "aquatic life" Class C dissolved oxygen and temperature criteria apply to that segment. Column 4 shall also be used to designate site-specific limitations or restrictions for individual segments.

Inland surface waters not listed in the tables are Classified B except for vernal pools which are Classified A. Coastal and marine waters not listed in the tables are classified SA.

TABLE 30

BUZZARDS BAY COASTAL DRAINAGE AREA (95)

BOUNDARY	MILE POINT	CLASS	OTHER RESTRICTIONS
Buttermilk Bay	-	SA	Shellfishing (O)
Onset Bay	-	SA	Shellfishing (O)
Agawam River			
Source to Wareham STP	Above 2.2	B	Warm Water
Wareham STP to confluence	2.2 - 0.0	SB	Shellfishing (R)
Wareham River			
Entire Length	-	SA	Shellfishing (O)
Wewantic River			
Source to outlet of Horseshore Pond	Above 4.4	B	Warm Water
Horseshoe Pond to confluence	4.4 - 0.0	SA	Shellfishing(O)
Sippican River			
Source to County Road, Marion, Wareham	Above 2.1	B	Warm Water
County Road to confluence	2.1 - 0.0	SA	Shellfishing (O)
Sippican Harbor	-	SA	Shellfishing (O)
Aucoot Cove	-	SA	Shellfishing (O)
Mattapoisett Harbor	-	SA	Shellfishing (O)
Nasketucket Bay	-	SA	Shellfishing (O)
New Bedford Reservoir			
Source to outlet	Above 8.2	B	Warm Water

Appendix B

DO NOT REMOVE!!!

Lydia's Copy

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

TOM SPEARIN
JIM SHAW
CPB
10/3/91

September 30, 1991

OCT - 3 1991

Mr. Manuel J. Sylvia, Jr.
Chairman, Board of Selectmen
Town of Wareham
Town Hall, Route 6-Marion Road
Wareham, Massachusetts 02571

Re: NPDES Application No. MA0101893

Dear Mr. Sylvia:

Enclosed is your final National Pollutant Discharge Elimination system (NPDES) permit issued pursuant to the Clean Water Act (the "Federal Act"), as amended, and the Massachusetts Clean Waters Act (the "State Act"), 21 M.G.L. §§43-45, as amended. The Environmental Permit Regulations, at 40 C.F.R. §124.15, 48 Fed. Reg. 14271 (April 1, 1983), require this permit to become effective on the date specified in the permit.

Also enclosed is a copy of the Agency's response to the comments received on the draft permit and information relative to hearing requests and stays of NPDES permits. Should you desire to request a formal hearing, your request should be submitted to the Agency as outlined in the enclosure and a similar request should also be filed with the Director of the Massachusetts Division of Water Pollution Control in accordance with the provisions of the Massachusetts Administrative Procedures Act, the Division's Rules for the Conduct of Adjudicatory Proceedings and the Timely Action Schedule and Fee Provisions (see enclosure).

We appreciate your cooperation throughout the development of this permit. Should you have any questions concerning the permit, feel free to contact William Eng of my staff at 617/565-3583.

Sincerely,

Clyde F. Shufelt for

Edward K. McSweeney, Chief
Wastewater Management Branch

Enclosures

cc: State Water Pollution Control Agency
All Interested Parties

Olga Vergara
CMU
EPA Eng
OEF

Information for Filing an Adjudicatory Hearing Request with the Commonwealth of Massachusetts Department of Environmental Protection

Within thirty days of the receipt of this letter the adjudicatory hearing request along with a valid check payable to the Commonwealth of Massachusetts in the amount of $100 must be mailed to:

Commonwealth of Massachusetts
Department of Environmental Protection
P.O. Box 4062
Boston, MA 02211

The hearing request to the Commonwealth will be dismissed if the filing fee is not paid, unless the appellant is exempt or granted a waiver.

The filing fee is not required if the appellant is a city, town (or municipal agency), county, district of the Commonwealth of Massachusetts, or a municipal housing authority. The Department may waive the adjudicatory hearing filing fee for a permittee who shows that paying the fee will create an undue financial hardship. A permittee seeking a waiver must file, along with the hearing request, an affidavit setting forth the facts believed to support the claim of undue financial hardship.

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Clean Water Act as amended, (33 U.S.C. §§1251 *et seq.*; the "CWA", and the Massachusetts Clean Waters Act, as amended, (M.G.L. Chap. 21, §§26-53),

Town of Wareham, MA
Board of Sewer Commissioners

is authorized to discharge from a facility located at

Wareham Water Pollution Control Facility
Route 6, off Sandwich Road
Wareham, Massachusetts

to receiving waters named Agawam River

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on 30 days from date signature.

This permit and the authorization to discharge expire at midnight, five years from effective date.

This permit supersedes the permit issued September 30, 1985.

This permit consists of 7 pages in Part I including effluent limitations, monitoring requirements, etc., and 22 pages in Part II including General Conditions and Definitions.

Signed this 30th day of September, 1991

Director
Water Management Division
Environmental Protection Agency
Boston, MA

Director, Division of Water Pollution Control
Department of Environmental Protection
Commonwealth of Massachusetts
Boston, MA

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning the effective date and lasting through expiration, the permittee is authorized to discharge from outfalls 001, 002, 003, and 004 (treated sanitary wastewater):

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations						Monitoring Requirement	
	kg/day (lbs/day)			(specify units)				
	Average Monthly	Average Weekly	Maximum Daily	Average Monthly	Average Weekly	Maximum[1] Daily	Measurement Frequency	Sample Type
Flow (MGD)				(1.8)			Continuous	Note 2
BOD[1]	68(150)	102(225)	136(300)	10 mg/l	15 mg/l	20 mg/l	1/Week	8-hr Comp[10]
TSS[1]	68(150)	102(225)	136(300)	10 mg/l	15 mg/l	20 mg/l	1/Week	8-hr Comp[10]
Settleable Solids[1]					0.1 ml/l	0.3 ml/l	1/Day	Grab
pH[1]	(See Part I A 1.a on Page 4 of 7)						1/Day	Grab
Fecal Coliform[1]				88/100ml[3]	88/100ml[3]	88/100ml[3]	1/Week	Grab[8]
Chlorine Residual[1]						91 ug/l[9]	1/Day	Grab[8]
Kjeldahl Nitrogen, Nitrogen as NH_3, and Nitrate/Nitrite					report		2/Month	Grab[8]
C-NOEC[4]						14%[11]	See Attachment A[7]	Composite
LC50[6]						100%[5]	See Attachment A[7]	Composite

The discharge shall not cause a violation of the water quality standards of the receiving water. Sampling must be done on all Outfalls in use at the time.

Footnotes: See page 3 of 7

Footnotes:

1) Required for state certification.

2) Report maximum and minimum daily rates and total daily flow.

3) The Fecal Coliform limit of 88/100ml is refered to MPN. If the facility is unable to conduct MPN testing, verification from DEP-LES should be obtained which concurs that membrance filtration is an acceptable option to MPN.

4) Chronic-No Observed Effects Concentration (C-NOEC) is the highest concentration of toxicant or effluent to which organisms are exposed in a life-cycle or partial life-cycle which causes no adverse effect (on growth, survival or reproduction).

5) The "100%" limit is defined as a sample which is composed of 100% or greater effluent, the remainder being dilution water. The limit shall be consider to be a maximum day limit.

6) "LC50" is defined as the concentration of wastewater that causes mortality to 50% of the test organisms.

7) ~~The~~ permittee shall conduct toxicity testing four time a year, during the months of April, June, August, and December. The test species are: Mysid Shrimp, Sea Urchin, and Inland Silverside. The biomonitoring protocols for the test species are to be found in Attachment-A1, A2, and A3. Both acute and chronic testings are required. The acute biomonitoring test species are Mysid Shrimp and Inland Silverside. The chronic biomontoring test species are Inland Silver and Sea Urchin.

8) The grab sample should be taken at the end of the discharge pipe at low tide when the end of the pipe is above the river.

9) The permittee shall use chemical titration method in the measurement of total chlorine residual.

10) The composite sample shall be flow proportioned from each of the four pipes for each hourly sample taken.

11) The "14%" limit is defined as a sample which is composed of 14% or greater effluent, the remainder being dilution water. The limit shall be consider to be a maximum day limit.

a. The pH of the effluent shall not be less than 6.5 nor greater than 8.5 standard units and not more than 0.2 standard units outside of the normally occurring range.

b. The discharge shall not cause objectionable discoloration of the receiving waters.

c. The effluent shall contain neither a visible oil sheen, foam, nor floating solids at any time.

d. The permittee's treatment facility shall maintain a minimum of 85 percent removal of both total suspended solids and biochemical oxygen demand. The percent removal shall be based on monthly average values.

e. When the effluent discharged for a period of 90 consecutive days exceeds 80 percent of the designed flow, the permittee shall submit to the permitting authorities a projection of loadings up to the time when the design capacity of the treatment facility will be reached, and a program for maintaining satisfactory treatment levels consistent with approved water quality management plans.

f. The total chlorine residual (and/or other toxic components) of the effluent shall not result in any demonstrable harm to aquatic life or violate any water quality standard which has been or may be promulgated. Upon promulgation of any such standard, this permit may be revised or amended in accordance with such standards, the permittee being so notified.

2. All POTWs must provide adequate notice to the Director of the following:

   a. Any new introduction of pollutants into that POTW from an indirect discharger in a primary industry category discharging process water; and

   b. Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

   c. For purposes of this paragraph, adequate notice shall include information on:

      (1) quality and quantity of effluent introduced to the POTW;

      (2) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW

B. Limitations for Industrial Users:

Pollutants introduced into POTW's by a nondomestic source (user) shall not Pass Through the POTW or Interfere with the operation or performance of the works.

C. Sludge Conditions

1. The permittee shall comply with all existing federal and state laws and regulations that apply to sewage sludge use and disposal practices and with the CWA Section 405(d) technical standards when promulgated.

   If an applicable management practice or numerical limitation for pollutants in sewage sludge more stringent than existing federal and state regulations is promulgated under Section 405(d) of the Clean Water Act (CWA), this permit shall be modified or revoked and reissued to conform to the promulgated regulations.

   The permittee shall comply with the limitations no later than the compliance specified in the applicable regulations as required by Section 405(d) of the Clean Water Act.

2. The permittee shall give prior notice to the Director of any change(s) planned in the permittee's sludge use or disposal practice.

3. A change in the permittee's sludge use or disposal practice is a cause for modification of the permit. It is a cause for revocation and reissuance of the permit if the permittee requests or agrees.

4. The permittee shall annually monitor and report the 126 pripority pollutants as well as monitor and report for:benzene, benzo(a)pyrene, Bis(2)ethylhexylphthalate, chlordane, DDT/DDE/DDD (Total), dimethyl nitrosamine, lindane, PCBs, toxaphene, trichloroethylene,arsenic, boron, cadmium, chromium (total), copper, lead,mercury, molybdenum, nickel, selenium, and zinc six months later. Result for the 126 pripority pollutants is to be submitted on September 30 each year.

D. STATE PERMIT CONDITIONS

This Discharge Permit issued jointly by the U. S. Environmental Protection Agency and the Division of Water Pollution Control under Federal and State law, respectively. As such, all the terms and conditions of this permit are hereby incorporated into and constitute a discharge permit issued by the Director of the Massachusetts Division of Water Pollution Control pursuant to M.G.L. Chap. 21, §43.

Each Agency shall have the independent right to enforce the terms and conditions of this Permit. Any modification, suspension or revocation of this Permit shall be effective only with respect to the Agency taking such action, and shall not affect the validity or status of this Permit as issued by the other Agency, unless and until each Agency has concurred in writing with such modification, suspension or revocation. In the event any portion of this Permit is declared invalid, illegal or otherwise issued in violation of State law such permit shall remain in full force and effect under Federal law as an NPDES Permit issued by the U. S. Environmental Protection Agency. In the event this Permit is declared invalid, illegal or otherwise issued in violation of Federal law, this Permit shall remain in full force and effect under State law as a Permit issued by the Commonwealth of Massachusetts.

E. MONITORING AND REPORTING

1. Reporting

Monitoring results obtained during the previous month shall be summarized for each month and reported on separate Discharge Monitoring Report Form(s) postmarked no later than the 15th day of the month following the effective date of the permit.

Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Director and the State at the following addresses:

Environmental Protection Agency
Permit Processing Section
P.O. Box 8127
Boston, Massachusetts 02114

The state agency is:

Massachusetts Department of Environmental Protection
Massachusetts Division of Water Pollution Control
Southeast Regional Office
Lakeville Hospital
Lakeville, Massachusetts 02346

Signed copies of all other notification and reports required by this permit shall be submitted to the State at:

Massachusetts Department of Environmental Protection
Massachusetts Division of Water Pollution Control
Regulatory Branch
1 Winter Street
Boston, Massachusetts 02108

Toxicity test reports shall be submitted by June 15, August 15, October 15, and February 15 to:

Technical Services Branch, Biology Section
Massachusetts Division of Water Pollution Control
40 Institute Road
Grafton, Massachusetts 01519
and
United States Environmental Protection Agency
New England Regional Laboratory, Biology Section
60 Westview Street
Lexington, Massachusetts 02173

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
OFFICE OF WATERSHED MANAGEMENT

WILLIAM F. WELD
Governor

ARGEO PAUL CELLUCCI
Lt. Governor

TRUDY COXE
Secretary

DAVID B. STRUHS
Commissioner

March 25, 1996

Mr. Jim Shaw
Wareham Water Pollution Control Facility
Route 6, Sandwich Road
Wareham, Massachusetts 02751

Dear Mr. Shaw:

Upon reviewing the toxicity reports required by your NPDES permit (MA0101893) it has come to our attention that a modification of the toxicity testing protocols (Attachment A1) is warranted.

Specifically, please delete the reference to **"Inland Silverside (<u>Menidia</u> <u>beryllina</u>) definitive 48 hour test"** in Attachment A1. This acute toxicity information can be reported from the **"Chronic (and Modified Acute) Toxicity Test Procedure and Protocol: Inland Silverside (<u>Menidia</u> <u>beryllina</u>) growth and survival test"** which is required in Attachment A3.

Please advise your toxicity testing laboratory that the "modified acute" endpoints need to be clearly reported from the chronic test.

If you have any questions do not hesitate to call Laurie Kennedy, DEP (508-792-7470) or David Pincumbe, EPA (617-565-4429).

Sincerely,

Paul Hogan

Paul Hogan
Surface Water Program Manager

cc: D. Pincumbe

RECEIVED
APR 1 1996
TOWN OF WAREHAM
WATER POLLUTION CONTROL

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

August 31, 1993

Joseph F. Murphy, Town Administrator
Town Hall
Route 6 - Marion Road
Wareham, MA 02571

Re: NPDES Permit No. MA0101893

Dear Mr. Murphy:

New England Bioassay, Inc., has brought to our attention an inconsistency between the toxicity testing requirements and the reporting dates under the referenced permit. The testing requirements are found on page 3 of 7 of the permit while the reporting dates are found on page 7 of 7.

In order to correct this inconsistency we are modifying page 7 of 7 as follows:

> April
> Toxicity test reports shall be submitted by ~~June~~ 15, ~~August~~ 15, ~~October~~ 15, and ~~February~~ 15 to:
> June August Dec

Enclosed for your information is a corrected page 7 of 7 with the noted change. Substitute this page in your copy of the permit.

This change in the reporting dates constitutes a minor modification of your NPDES permit in accordance with 40 CFR Part 122.63(a).

You may direct any questions or concerns to either Joy Palmer at 617/565-3487 or Roger Janson at 617/565-4877.
565-9554 3589

Sincerely,

Edward K. McSweeney, Chief
Wastewater Management Branch

cc: Paul Hogan, MADEP
James Shaw, Wareham WPCF

enc: page 7 of 7

Steve Conto:
617-565-3909
II
617-565-1141 [illegible]
Steve [illegible]

FAX TRANSMISSION

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION I
1 CONGRESS STREET
SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

Fax: 617 918-1505
Tel No. 617 918-~~1570~~ 1693

TO: Gerry Furrier Date: 8/26/99

OFFICE: CDM Mail Code:

Telephone: Fax: (617) 621-2565

FROM: Sonpy Saxer

OFFICE: EPA Mail Code:

Telephone: (617) 918-1693 Fax: (617) 918-1505

SUBJECT: Wareham Permit

COMMENTS: CZM certification.

Number of Pages to Follow: 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

August 12, 1999

Mr. James C. Shaw
Chief Operator/Superintendent
Wareham Water Pollution Control Plant
6 Tony's Lane
Wareham, MA 02571

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Re: NPDES No. MA0101893

Dear Mr.Shaw:

In accordance with Chapter 21, Sections 43-45 of the Massachusetts Clean Waters Act, as amended, and Section 402 of the Federal Clean Water Act, as amended, the Commonwealth of Massachusetts and the Environmental Protection Agency, Region I, intend to issue a National Pollutant Discharge Elimination System (NPDES) permit to your facility.

The enclosed draft permit has been developed by this office and the Massachusetts Department Environmental Protection (MADEP) containing effluent limitations and conditions to assure that the discharge receives adequate treatment and will not violate water quality standards. Also, enclosed is the statement of basis or fact sheet which briefly describes the basis for the permit conditions. You are encouraged to closely review all terms and conditions contained in this draft. If you believe the permit does not accurately describe your discharge or contain a reasonable compliance schedule (where appropriate), you should notify each office, in writing, no later than the last day of the Public Comment Period as noted in the Public Notice. Particular attention should be given to the following sections:

A. Effluent Limitations and Monitoring Requirements Under Part I.A.

This section contains listings of effluent characteristics, discharge limitations and monitoring requirements. The effective dates for various requirements are listed.

B. Monitoring and Reporting Under Part I.D.

This section contains your responsibilities for reporting monitoring results.

Federal and Commonwealth laws require public notice to be given of the preparation of a draft permit to allow opportunity for public comments and, if necessary, a public hearing. Concurrently with this letter, EPA and the MADEP have proceeded to publish the

Public Notice of the proposed issuance of this Draft Permit. In order to preserve the right to a formal hearing to contest provisions in a final permit, all persons, including the applicant, who believe any condition of the draft is inappropriate must raise all reasonably ascertainable issues and submit all reasonably available arguments and factual grounds supporting their position, including all supporting material, by the close of the public comment period. See 40 C.F.R. §124.13, 48 Fed. Reg. 14271 (April 1, 1983). Following the close of the public comment period, your final permit will be issued providing no new substantial questions are raised. If new questions develop during the comment period, it may be necessary to draft a new permit, revise the statement of basis or fact sheet, and/or reopen the public comment period.

You should be aware that, if you discharge in the coastal zone, under the provisions of the Coastal Zone Management Act, 16 U.S.C. §1451 et seq., and its implementing regulations, EPA cannot issue an NPDES permit for your facility until you submit a certification that your activities will be consistent with the Massachusetts Coastal Zone Management ("CZM") policies and the state CZM office concurs with your certification. See 15 C.F.R. §930 et seq. and 40 C.F.R. §122.49(d). If you discharge in the coastal zone, you should therefore provide EPA and the state CZM office the following statement: "The proposed activity complies with the policies of the Massachusetts approved coastal management program and will be conducted in a manner consistent with such policies". Further information about this process may be obtained from the Massachusetts Coastal Zone Management Office, 100 Cambridge Street, Boston, MA 02202 Telephone 727-9530.

If you have any questions or would like to discuss any of the conditions contained in this draft permit, do not hesitate to contact Suprokash Sarker of my staff at 617/918-1693.

Sincerely,

B. Pitt

Brian Pitt, Chief
MA NPDES Permit Program Unit
Office of Ecosystem Protection
Environmental Protection Agency

Enclosure

cc: Bryant Firman MADEP; Jane Meade MA CZM

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Clean Water Act as amended, (33 U.S.C. §§1251 et seq.; the "CWA", and the Massachusetts Clean Waters Act, as amended, (M.G.L. Chap. 21, §§26-53),

Town of Wareham, MA

is authorized to discharge from a facility located at

Wareham Water Pollution Control Facility
6 Tony's Lane
Wareham, Massachusetts

to receiving waters named Agawam River

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on

This permit and the authorization to discharge expire at midnight, five years from the effective date of the permit.

This permit supersedes the permit issued September 30, 1991.

This permit consists of 7 pages in Part I and Attachment A including effluent limitations, monitoring requirements, etc., and 35 pages in Part II including General Conditions and Definitions.

Signed this day of

Director,
Office of Ecosystem Protection
Environmental Protection Agency
Boston, MA

Director, Division of
Watershed Management
Department of Environmental
Protection
Commonwealth of
Massachusetts, Boston, MA

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning the effective date and lasting through expiration, the permittee is authorized to discharge from outfalls 001, 002, 003, and 004 (treated sanitary wastewater). Samples shall be taken prior to sand filter beds.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations (specify units)			Monitoring Requirement	
	Average Monthly	Average Weekly	Maximum[1] Daily	Measurement Frequency	Sample Type
Flow MGD	1.8			Continuous	Note 2
BOD[1]	10 mg/l	15 mg/l	20 mg/l	3/Week	Comp.[8]
TSS[1]	10 mg/l	15 mg/l	20 mg/l	3/Week	Comp.[8]
pH[1]	(See Part I A 1.a on Page 4)			1/Day	Grab[8]
Fecal Coliform[1]	88/100ml[3]	-	Report	1/Week	Grab[8]
Chlorine Residual[1]	36.8 ug/l	-	63.7 ug/l[9]	1/Day	Grab[8]
Copper - Total	18.3 ug/l	-	-	1/Month	Comp[8]
Nitrogen-Total (Apr-Oct)	105 #/day[10,11,12]	-	-	3/Week	Comp.[8]
Nitrogen-Total (Nov-Mar)	Report[12]	-	-	1/Week	Comp.[8]
NH_3	Report (mg/l)	-	Report (mg/l)	1/Week	Comp.[8]
C-NOEC[4]	-	-	20.4%	1/Quarter[7]	Comp.[8]
LC50[6]			100%[5]	1/Quarter[7]	Comp.[8]

The discharge shall not cause a violation of the water quality standards of the receiving water.

.no Se ge 7

Footnotes:

1) Required for state certification.

2) Report maximum and minimum daily rates and total daily flow.

3) Fecal Coliform shall not exceed a monthly median or geometric mean of 88 colonies per 100 ml,nor shall more than 10% of the samples in a month exceed 260 colonies per 100ml.

4) Chronic-No Observed Effects Concentration (C-NOEC) is the highest concentration of toxicant or effluent to which organisms are exposed in a life-cycle or partial life-cycle which causes no adverse effect (on growth, survival or reproduction).

   20.4% is defined as a sample containing 20.4% effluent, the reminder being dilution water.

5) The "100%" limit is defined as a sample which is composed of 100% or greater effluent, the remainder being dilution water. The limit shall be consider to be a maximum day limit.

6) "LC50" is defined as the concentration of wastewater that causes mortality to 50% of the test organisms.

7) The permittee shall conduct chronic and modified acute toxicity testing four time a year, during the months of April, June, August, and December. The test species are: Sea Urchin (1 hour fertilization test) and Inland Silverside (chronic and modified acute tests). The biomonitoring protocols for the test species are to be found in Attachment-A. The results are to be submitted by the end of the next month respectively.

8) Until such time as the permittee has the capability of monitoring the effluent after the sand filter beds but prior to mixing with groundwater, all effluent composites and grab samples for compliance monitoring requirements must be taken prior to the sand filter beds.

9) Total Residual Chlorine shall be tested using Amperometric Titration or the DPD spctrophotometric method. The EPA approved methods are found in Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-cl E and method 4500-cl G or U.S.E.P.A. Manual of Methods of Analysis of Water and Wastes, Method 330.5. For TRC, reportable concentrations will be based on the minimum level (ML). It has been determined that the ML

for the TRC is 50 ug/l.For effluent limitations less than 50 ug/l, the compliance/noncompliance shall be determined based on the ML.This value may be reduced by permit modification as more sensitive test methods are approved by the EPA and the State.

10) This limit is a seven month average consisting of the average of the monthly average mass loadings from April to October each year. The seven month average shall be reported by November 15 each year.

11) The total nitrogen load limit is based on achieving standards in the Wareham Estuary given current loadings from existing homes that will remain on septic systems and assuming that the homes proposed for sewering (see Table 3 of the August 11, 1998 report "Evaluation of Nitrogen Loading and Water Quality of the Wareham Estuary as it Relates to the Wareham Wastewater Treatment Facility" by Joseph E. Costa, Ph.D.) are actually sewered. Future growth in Town that relies on septic systems or a change in sewering plans may result in a more stringent nitrogen loading limit in order to achieve standards. The permittee shall submit an annual report that summarizes the number and type of building permits issued that include the use of new on-site wastewater treatment systems and summarizes sewer extension activities.

12) The monthly average discharge shall be reported in mg/l and lbs./day for each month.

(Part I continued)

a. The pH of the effluent shall not be less than 6.5 nor greater than 8.5 at anytime, unless these values are exceeded due to natural causes nor shall the discharge result in a change of more than 0.2 standard units in the naturally occurring instream pH range.

b. The discharge shall not cause objectionable discoloration of the receiving waters.

c. The effluent shall contain neither a visible oil sheen, foam, nor floating solids at any time.

d. The permittee's treatment facility shall maintain a minimum of 85 percent removal of both total suspended solids and biochemical oxygen demand. The percent removal shall be based on monthly average values.

e. When the effluent discharged for a period of 90 consecutive days exceeds 80 percent of the designed flow, the permittee shall submit to the permitting authorities a projection of loadings up to the time when the design capacity of the treatment facility will be reached, and a program for maintaining satisfactory treatment levels consistent with approved water quality management plans.

f. The total chlorine residual (and/or other toxic components) of the effluent shall not result in any demonstrable harm to aquatic life or violate any water quality standard which has been or may be promulgated. Upon promulgation of any such standard,this permit may be revised or amended in accordance with such standards, the permittee being so notified.

g. After submitting 4 consecutive, acceptable tests for WET , demonstrating compliance with the permit limit, the permittee may request a reduction of the testing requirement. The permittee is required to continue testing as specified in the permit until notice is received by certified mail from the EPA that the requirement for WET testing has been modified.

2. All POTWs must provide adequate notice to the Director of the following:

   a. Any new introduction of pollutants into that POTW from an indirect discharger in a primary industry category discharging process water; and

   b. Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

   c. For purposes of this paragraph, adequate notice shall include information on:

      (1) quality and quantity of effluent introduced to the POTW;

      (2) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW

B. Limitations for Industrial Users:

Pollutants introduced into POTW's by a nondomestic source (user) shall not Pass Through the POTW or Interfere with the operation or performance of the works.

C. Sludge Conditions

1. The permittee shall comply with all existing federal and state laws and regulations that apply to sewage sludge use and disposal practices and with the CWA Section 405(d) technical standards when promulgated.

   If an applicable management practice or numerical limitation for pollutants in sewage sludge more stringent than existing federal and state regulations is promulgated under Section 405(d) of the Clean Water Act (CWA), this permit shall be modified or revoked and reissued to conform to the promulgated regulations.

2. The permittee shall give prior notice to the Director of any change(s) planned in the permittee's sludge use or disposal practice.

3. A change in the permittee's sludge use or disposal practice is a cause for modification of the permit. It is a cause for revocation and reissuance of the permit if the permittee requests or agrees.

D. MONITORING AND REPORTING

1. Monitoring results obtained during the previous month shall be summarized for each month and reported on separate Discharge Monitoring Report Forms(s) postmarked no later than the 15th day of the month following the completed reporting period.

   a. Signed originals of all Discharge Monitoring Reports, and allother report required herein, shall be submitted to the Director at the following address:

      Environmental Protection Agency
      Water Technical Unit (SEW)
      P.O. Box 8127
      Boston, Massachusetts 02114

   b. One signed copies of all monitoring reports and all other reports shall be submitted to the State at:

      Massachusetts Department of Environmental Protection
      Southeast Regional Office
      20 Riverside Drive
      Lakeville, MA 02347

c. Signed copies of toxicity test reports and all other notifications and reports required by this permit shall be submitted to the State at:

Massachusetts Department of Environmental Protection
Division of Watershed Management
Watershed Planning and Permitting Section
627 Main Street
Worcester, Massachusetts 01608

E. STATE PERMIT CONDITIONS

This Discharge Permit is issued jointly by the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection under Federal and State law, respectively. As such, all the terms and conditions of this permit are hereby incorporated into and constitute a discharge permit issued by the Commissioner at Massachusetts Department of Environmental Protection pursuant to M.G.L. Chap. 21, Section 43.

Each agency shall have the independent right to enforce the terms and conditions of this Permit. Any modification, suspension or revocation of this Permit shall be effective only with respect to the Agency taking such action, and shall not affect the validity or status of this Permit as issued by the other Agency, unless and until each Agency has concurred in writing with such modification, suspension or revocation. In the event any portion of this Permit is declared invalid, illegal or otherwise issued in violation of State law such permit shall remain in full force and effect under Federal law as an NPDES Permit issued by the U.S. Environmental Protection Agency. In the event this Permit is declared invalid, illegal or otherwise issued in violation of Federal law, this Permit shall remain in full force and effect under State law as a Permit issued by the Commonwealth of Massachusetts.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
1 CONGRESS STREET, SUITE 1100, (CMA)
BOSTON, MASSACHUSETTS 02114-2023

FACT SHEET

DRAFT NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE TO WATERS OF THE UNITED STATES.

NPDES PERMIT NO.: MA0101893

NAME AND ADDRESS OF APPLICANT:

Mr. James C.Shaw, Superintendent
Wareham Water Pollution Control Plant
6 Tony's Lane
Wareham, Massachusetts 02571

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

Wareham Water Pollution Control Plant
6 Tony's Lane
Wareham, Massachusetts 02571

RECEIVING WATER: Agawam River. Buzzards Bay Watershed.

CLASSIFICATION: SB

I. Proposed Action, Type of Facility, and Discharge Location.

The above named applicant has requested that the U.S. Environmental Protection Agency reissue its NPDES permit to discharge into the designated receiving water. The facility is engaged in collection and treatment of domestic wastewater. The discharge is from the wastewater treatment plant.

II. Description of Discharge.

A quantitative description of the discharge in terms of significant effluent parameters based on recent monitoring data is shown on Attachment A.

III. Limitations and Conditions.

The effluent limitations of the draft permit and the monitoring requirements may be found in the draft NPDES permit.

IV. Permit Basis and Explanation of Effluent Limitation Derivation

The Town has a 1.8 mgd (average) advanced secondary wastewater treatment facility. The first unit process is preliminary treatment, consisting of grit and screenings removal. There is no primary treatment in this facility. After preliminary treatment, the liquid enters the aeration basins followed by secondary clarifiers. Final treatment consists of disinfention (by chlorine gas) and sand percolation beds (eight). Final effluent is discharged through four outfalls (identical effluent characteristics) to the Agawam River.

The waste activated sludge (WAS) is taken from the secondary clarifiers and pumped to the sludge thickening/holding tanks. The WAS is then slowly decanted to about 3 - 6 percent solids. The liquid sludge is then pumped to a tanker truck and hauled to the Cranston, RI WPCF for dewatering and incineration.

A. POTW Discharges

EPA is required to consider technology and water quality requirements when developing permit effluent limits. Technology based treatment requirements represent the minimum level of control that must be imposed under Sections 402 and 301(b) of the Act (see 40 CFR 125 Subpart A) to meet Best Practicable Control Technology Currently Available (BPT), Best Conventional Control Technology (BCT) for conventional pollutants and Best Available Technology Economically Achievable (BAT) for toxic pollutants.

EPA regulations require NPDES permits to contain effluent limits more stringent than technology-based limits where more stringent limits are necessary to maintain or achieve federal or state water quality standards.

Under Section 301(b) (1)(B) of the CWA, POTWs must have achieved effluent limitations based upon secondary treatment by July 1, 1977. The secondary treatment requirements are set forth at 40 CFR Part 133. Under Section 301(b)(1)(C) of the Clean Water Act (CWA), discharges are subject to effluent limitations based on Water Quality Standards. The Massachusetts Surface Water Quality Standards include the requirements for the regulation and control of toxic constituents and also require that EPA criteria established pursuant to Section 304(a) of the CWA shall be used unless site specific criteria are established. The State will limit or prohibit discharges of pollutants to surface waters to assure that surface water quality standards of the receiving waters are protected and maintained or attained.

In the absence of technology-based guidelines, EPA is authorized to use Best Professional Judgement (BPJ) to establish effluent limitations, in accordance with Section 402 (a)(1) of the CWA. The permit must limit any pollutant or pollutant parameter (conventional, non-conventional, toxic, and whole effluent toxicity) that is or may be discharged at a level that caused, has reasonable potential to cause, or contributes to an excursion above any water quality criterion. An excursion occurs if the projected or actual instream concentrations exceed the applicable criterion. In determining reasonable potential, EPA considers existing controls on point and non-point sources of pollution, variability of the pollutant in the effluent, sensitivity of the species to toxicity and, where appropriate, the dilution of the effluent in the receiving water.

A permit may not be renewed, reissued, or modified with less stringent limitations or conditions than those contained in the previous permit unless in compliance with the anti-backsliding requirement of the CWA.

EPA's anti-backsliding provisions found in 40 CFR 122.44(l) restrict the relaxation of permits, standards, and conditions. Therefore, the technology-based effluent limits in the reissued permit must be at least as stringent as those of the previous permit. Relaxation of these limits is only allowed when cause for permit modification is met (see 40 CFR 122.62). Effluent limits based on BPJ, water quality, and state certification requirements must also meet the anti-backsliding provisions found under Section 402(o) and 303(d)(4) of the CWA, as described in 40 CFR 122.44(1).

<u>7Q10</u>

Agawam 7Q10 = 6.7 sq miles x 1.0 cfs/sq mile + 10.3 sq miles x 0.40 cfs/sq mile = 10.8 cfs.
[This information has been obtained from Water Resources of the Coastal Drainage Basins of Southeastern Massachusetts, Plymouth to Weweantic River, Wareham, by John R. Williams and Gary D. Tasker 1974. 6.7 sq miles are in region 1 of the drainage basin which has a flow factor of 1.0 cfs/sq mile and 10.3 sq miles are in region 2 of the drainage basin which has a flow factor of 0.4 cfs / sq mile.]

Plant Flow = 1.8 mgd or 2.785 cfs; Dilution Factor = 10.8 + 2.785/2.785 = 4.9

<u>Conventional Pollutants:</u>

The effluent limitations for BOD, TSS, fecal coliform, and pH are the same as those limits found in the previous permit.These limits are based on state certification requirements under Section 401(a)(1) of the CWA, as described in 40 CFR 124.53 and 124.55 and State Water Quality Standards.

<u>Toxic Pollutants:</u>

The receiving water has been classified as a Class SB waterway by the state. The designated uses for a Class SB water are 1) the protection and propagation of fish, other aquatic life and wildlife and 2) for primary and secondary contact recreation.

Under Section 301(b)(1)(C) of the CWA, discharges are subject to effluent limitations based on water quality standards. The Massachusetts Surface Water Quality Standards include requirements for the regulation and control of toxic constituents and also require that EPA criteria, established pursuant to Section 304(a) of the CWA, shall be used unless a site specific criteria is established. The State will limit or prohibit discharges of pollutants to surface waters to assure that surface water quality standards of the receiving waters are protected and maintained, or attained.

Chlorine and chlorine compounds produced by the chlorination of wastewater can be extremely toxic to aquatic life. Effluent limits for Total Residual Chlorine (TRC) are based on EPA-recommended criteria found at FR Vol. 63 No. 237, dated December 10, 1998, which have been adopted by reference by the State as Water Quality Standards. The monthly average limit is based on the chronic value of 7.5 ug/l ; the maximum daily limit is based on the acute value of 13 ug/l. Using the calculated dilution factor of 4.9, the resulting limits are 36.8 ug/l for the monthly average and 63.7 ug/l for the maximum daily.

Copper

Copper is toxic to aquatic life. The effluent contains copper in quantities which have a reasonable potential for toxicity. Therefore, monitoring requirements and effluent limitations have been established for Total Recoverable Copper based on EPA- recommended creteria found at FR Vol. 63 No. 237, dated December 10, 1998, which have been adopted by reference by the State as Water Quality Standards. The monthly average limit is based on the chronic dissolved copper criteria of 3.1 ug/l, a conversion factor of 0.83 to convert the dissolved criteria to total recoverable criteria and a dilution factor of 4.9. The resulting equation is 3.1 ug/l x 4.9/ 0.83 = 18.3 ug/l.

Nutrients

The 1991 Buzzards Bay Comprehensive Conservation and Management Plan (CCMP) defines the Wareham River estuary as a nitrogen impacted embayment. This signifies that the embayment under current conditions exceeds its critical nitrogen loading limit, and that the contributing sources of nitrogen should be reduced through remedial action. In addition, the CCMP prescribes that growth should be managed to limit future nitrogen loading. In 1994, the Buzzards Bay Project (BBP) published a subwatershed evaluation that further refined an understanding of the nitrogen problem in the Wareham River through an analysis of the residence time, or hydraulic turnover, of the estuary.

Recently, during August 1998, the BBP completed a Total Maximum Daily Load (TMDL) for the estuary by conducting a thorough evaluation of the major sources contributing nitrogen to the Wareham River based upon the most current land-use information (Evaluation of Nitrogen Loading and Water Quality of the Wareham River Estuary as it relates to the Wareham Wastewater Treatment Facility by Joseph E. Costa, Ph.D). The TMDL indicates that the Wareham wastewater treatment plant is the dominant source of nitrogen now, and its contribution would increase significantly when the facility reaches its design limitation of 1.8 mgd. For this reason it is imperative to place a nitrogen limit on the treatment facility.

The BBP evaluation demonstrates that a limit of 7.0 mg/l (6.0 mg/l of bioavailable nitrogen and an assumed 1.0 mg/l refractory organic nitrogen in the final effluent) or 105 #/day (7 mg/l*8.34*1.8mgd = 105) of total nitrogen will bring total loadings closer to the recommended limit for SA waters. However, future residential growth within the watershed in areas that will be utilizing on-site systems or a reduction in the current proposed sewering flow, may dictate a more stringent nitrogen limit when this permit is re-issued. This situation could be mitigated through planning and management measures initiated by the town.

It is unclear now whether a phosphorus limit is required to improve water quality conditions in the Agawam River in the vicinity of the treatment plant discharge. A lack of water quality data and a thorough understanding of the saltwater/fresh water interface in this part of the Agawam/Wareham system precludes a decision at this time. However, the phosphorus question will be studied over the course of the next few years. The Town should be cognizant of the potential for a phosphorus limit, as well as a more stringent nitrogen limit in the future, and evaluate treatment technologies that can be readily adapted for additional treatment if the need arises.

Whole Effluent Toxicity

National studies conducted by the Environmental Protection Agency have demonstrated that domestic sources contribute toxic constituents to POTWs. These constituents include metals, chlorinated solvents and aromatic hydrocarbons among others. The Region's current policy is to include toxicity testing requirements in all municipal permits, while Section 101(a)(3) of the CWA specifically prohibits the discharge of toxic pollutants in toxic amounts.

Based on the potential for toxicity resulting from domestic sewage, and in accordance with EPA regulation and policy, the draft permit includes chronic and acute toxicity limitations and monitoring requirements. (See, e.g., "Policy for the Development of Water Quality-Based Permit Limitations for Toxic Pollutants", 50 Fed. Reg. 30,784 (July 24, 1985); see also, EPA's Technical Support Document for Water Quality-Based Toxicities Control). EPA Region I has developed a toxicity control policy. The policy requires wastewater treatment facilities to perform toxicity tests on their effluents. The Commonwealth of MADEP requires bioassay toxicity testing for State certification. The frequency and the type of WET test depends on dilution ratio and risk factor. The dilution ratio of the receiving water is estimated at 10.8 : 2.785 or 3.9 : 1 with a dilution factor of 4.9. Pursuant to EPA Region I policy, a discharge having a dilution ratio of 3.9 : 1 requires chronic and acute toxicity testing four times per year with C-NOEC = 20.4% (100/4.9 = 20.4) and LC50 = 100%. The principal advantages of biological techniques are: (1) the effects of complex discharges of many known and unknown constituents can be measured only by biological analyses; (2) bioavailability of pollutants after discharge is best measured by toxicity testing including any synergistic effects of pollutants; and (3) pollutants for which there are inadequate chemical analytical methods or criteria can be addressed. Therefore, toxicity testing is being used in conjunction with pollutant specific control procedures to control the discharge of toxic pollutants.

The draft permit requires that the Wareham WTF conduct chronic and modified acute WET testing of the effluent four times per year and that each test include the use of Sea Urchin and Inland Silverside in accordance with EPA Region I protocol to be found in permit attachment A.

As a condition of this permit, the testing requirements may be reduced by a certified letter from the EPA. This permit provision anticipates that the permittee may wish to request a reduction in WET testing. After four consecutive WET tests, demonstrating compliance with the permit limits for whole effluent toxicity, the permittee may submit a written request to the EPA seeking a review of the toxicity test results. The EPA will review the test results and pertinent information to make a determination. The permittee is required to continue testing at the frequency and species specified in the permit until the permit is either formally modified or until the permittee receives a certified letter from the EPA indicating a change in the permit conditions.

The limits of settleable solids requirement have been removed from the draft permit. This is no longer required as a condition for state certification.

The sand beds are saturated with underground water due to infiltration. The effluent is diluted with the underground water before it discharges through outfall pipes into the Agwam River. Therefore, all compliance monitoring requirements apply prior to sand beds.

V. Sludge

In February 1993, the Environmental Protection Agency (EPA) promulgated standards for the use and disposal of sewage sludge. The regulations were promulgated under the authority of section 405(d) of the Clean Water Act (CWA). Section 405(d) of the CWA requires that sludge conditions be included in all municipal permits. The sludge is disposed off site at the Cranston water pollution control facility in Rhode Island for dewatering and incineration. The sludge conditions in the draft permit satisfy this requirement.

VI. Pretreatment

The permittee does not have any major industry which contributes industrial wastewater in the WTF. There are only two minor industries.

Pollutants introduced into POTWs by a nondomestic source shall not pass through the POTW or interfere with the operation or performance of the treatment.

VII. Antidegradation

This draft permit is being reissued with an allowable wasteload identical or more stringent than the current permit and no change in outfall location. The State of Massachusetts has indicated that there will be no lowering of water quality and no loss of existing water uses and that no additional antidegradation review is warranted.

VIII. Essential Fish Habitat Determination (EFH)

Under the 1996 Amendments (PL 104-267) to the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. ' 1801 et seq.(1998)), EPA is required to consult with NMFS if EPA's action or proposed actions that it funds, permits, or undertakes,may adversely impact any essential fish habitat.16 U.S.C. ' 1855(b). The Amendments broadly define essential fish habitat as: waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. 16 U.S.C. ' 1802(10). Adversely impact means any impact which reduces the quality and/or quantity of EFH.

50 C.F.R. ' 600.910(a). Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

Essential fish habitat is only designated for fish species for which federal Fisheries Management Plans exist. 16 U.S.C. ' 1855(b)(1)(A). EFH designations for New England were approved by the U.S. Department of Commerce on March 3, 1999.

Enclosed (see Attachment B) is the list of 17 managed species that are believed to be present during one or more lifestage within EFH Area 73 (Volume II), which encompasses the existing discharge site. No "habitat areas of particular concern", as defined under §600.815(a)(9) of the Magnuson-Stevens Act, have been designated for this site. Although EFH has been designated for this general location, EPA has concluded that this activity is not likely to adversely affect EFH or its associated species for the following reasons:

- This is a reissuance of an existing permit, but with stricter effluent limits;
- The quantity of discharge from the WWTF is 1.8 mgd monthly average;
- The wastewater is largely domestic in nature;
- Effluent receives advanced secondary treatment using an activated sludge process;
- Effluent is discharged into the Agawam River with an estimated dilution factor of 4.9;
- Limits specifically protective of aquatic organisms are established for chlorine and copper, based on EPA water quality criteria;
- Acute and chronic toxicity tests will be conducted on sea urchins and inland silversides four times per year;
- The permit will prohibit the any violation of state water quality standards.

Accordingly, EPA has determined that a formal EFH consultation with NMFS is not required. If adverse impacts to EFH are detected as a result of this permit action, NMFS will be notified and an EFH consultation will be promptly initiated.

IX. STATE CERTIFICATION REQUIREMENTS

EPA may not issue a permit unless the Massachusetts Department of Environmental Protection with jurisdiction over the receiving waters certifies that the effluent limitations contained in the permit are stringent enough to assure that the discharge will not cause the receiving water to violate State Water Quality Standards. The staff of the Massachusetts Department of Environmental Protection has reviewed the draft permit. EPA has requested permit certification by the State pursuant to 40 CFR 124.53 and expects that the draft permit will be certified.

X. PUBLIC COMMENT PERIOD, PUBLIC HEARING, AND PROCEDURES FOR FINAL DECISION

All persons, including applicants, who believe any condition of the draft permit is inappropriate must raise all issues and submit all available arguments and a supporting material for their arguments in full by the close of the public comment period, to the U.S. EPA, MA Office of Ecosystem Protection, 1 Congress Street, Suite 1100 (CMA), Boston, Massachusetts 02114-2023. Any person, prior to such date, may submit a request in writing to EPA and the State Agency for a public hearing to consider the draft permit. Such requests shall state the nature of the issues proposed to be raised in the hearing. A public hearing may be held after at least thirty days public notice whenever the Regional Administrator finds that response to this notice indicates significant public interest. In reaching a final decision on the draft permit, the Regional Administrator will respond to all significant comments and make these responses available to the public at EPA's Boston Office. Following the close of the comment period, and after a public hearing, if such hearing is held, the Regional Administrator will issue a final permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments or requested notice. Within 30 days following the notice of the final permit decision, any interested person may submit a request for a formal hearing to reconsider or contest the final decision. Request for formal hearings must satisfy the requirements of 49 CFR 12474, 48 Fed. Reg. 14279-14280 (April 1, 1983).

X. EPA CONTACT

Additional information concerning the draft permit may be obtained between the hours of 9:00 a.m. and 5:00 p.m., Monday through Friday, excluding holidays from:

Suprokash Sarker
MA NPDES Permit Program Unit
U.S. Environmental Protection Agency
1 Congress Street, Suite 1100 (CMA)
Boston, MA 02114-2023
Telephone: (617) 918-1693

____
date

Linda M. Murphy, Director
Office of Ecosystem Protection
U.S. Environmental Protection Agency
Boston, MA

Appendix C

August, 1995

Dear Resident:

The Town of Wareham is considering extending its sanitary sewer collection system. We are interested in determining areas that are experiencing problems with their current sewage disposal systems where extending sanitary sewers would be merited. We ask for your assistance in filling out and returning the following questionnaire.

We assure you that the information obtained in this survey will be used solely for the purposes of statistical analysis and all responses will be kept strictly confidential.

Thank you for your help.

Sincerely,

Mark Gifford
Director of Municipal Facilities

1.) Street Address:____
2.) How many years have you lived at the above address? _______
3.) Do you have a septic tank and leaching field?___ or cesspool?___
4.) How old is your present disposal system? ____ years
5.) How many persons use the system? ____
6.) Do you feel sewers are needed in your neighborhood?____
7.) Have you had problems with your disposal system? yes ___ no ____

<u>The following questions apply only if you answered yes to question #7.</u>
8.) Has frequent pumping of the septic tank or cesspool been necessary? yes ___ no ___
9.) Has repair of your septic tank of leaching field been necessary? yes ___ no ___
10.) Have you experienced all or any of the following sewage disposal problems?
____ leaching of sewage to the ground surface
____ odor problems
____ slow drain or backups
___ other problems (please explain)______________________________
____
11.) Do you have exposed ledge or large rocks on your property? yes ___ no ___
12.) Has your disposal system affected your well (if applicable)? yes ___ no ___
13.) Is the groundwater near the surface? yes ____ no____ unknown ____
14.) Do you have any high groundwater problems such as: water in your basement? ___ water in your yard?___
If so, what season(s) does the problem (s) occur? summer ___ fall ___ winter____ spring___
15.) If you have a sump pump, indicate: frequency of operation __________,time of year _________,
and duration ____________.
16.) What is the distance from your septic system to a surface water body, stream, or wetland?
less than 50 ft. ____ 50-100 ft. ____ over 100 ft. ____ unknown _____
17.) What is the average maintenance cost for your system? ________
18.) Do you use chemicals or other additives to improve septic tank operation? yes ____no ____
If yes, how often _________ and what products?____________________________
____
19.) When do you generally have problems? (Check all that apply)
____summer ____fall _____ winter _____spring

Appendix D

APPENDIX D

TOWN OF WAREHAM, MASSACHUSETTS

FACILITY ASSESSMENT OF SIX WAREHAM WPCF PUMPING STATIONS

SAVIN ENGINEERS, P.C.

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Section 2 - Pumping Stations (continued)

Section 3.0 - Recommendations

Attachments

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SECTION 1.0 - INTRODUCTION

1.1. Background and Scope of Work

The Town of Wareham, Massachusetts retained Camp Dresser & McKee, (CDM) to prepare a wastewater facilities plan for the Wareham Water Pollution Control Facilities (WPCF). Savin Engineers, P.C. has been retained by CDM to provide professional engineering services in connection with the assessment of the six major pump stations in the Wareham collection system. This report summarizes the assessments and makes recommendations for improvements for these stations. The six pumping stations investigated include:

- Cohasset Narrows,
- Dicks Pond,
- Depot Street,
- Hynes Field,
- The Narrows, and
- Kennedy Lane.

1.2. Methodology

Savin Engineers, P.C. investigated the pump stations on March 24 and 25, 1997. These investigations were based solely on visual inspection of readily accessible portions of each facility. Areas such as submerged portions of wet wells were not inspected. Physical testing such as sounding of concrete was not conducted.

Field observations for each pumping station, discussed in Section 2.0, are organized by the following categories: site work, structural/architectural, process mechanical, operations/control, and miscellaneous.

Recommended repairs and/or upgrades, outlined in Section 3.0, were made based on the inspection observations and supplemented by input from current plant personnel and historical pumping records and curves.

SECTION 2.0 – PUMPING STATIONS

All six wastewater pumping stations are the wet well/dry well type and have similar configurations. The wet wells receive influent wastewater from local gravity sewers and use vertical centrifugal pumps, located in the dry well, to discharge flow through a forcemain. All stations have either a two or three floor reinforced concrete superstructure.

2.1. Cohasset Narrows Pumping Station

2.1.1. Existing Conditions

2.1.1.1. Site Work

The asphalt driveway appears to be in good condition, as seen in Attachment B, Photo 1C. There is a small pothole on the right hand side of the driveway facing the station (Photo 2C). The stone retaining wall on either side of the station appears to be in good condition. This facility does not have a surrounding fence. The station is located behind an existing restaurant.

2.1.1.2. Structural/Architectural

The superstructure consists of a single gable shingled roof on concrete masonry unit (CMU) walls with a wooden shingle facade (Photos 3C and 4C). Louvers and vent openings are located at several elevations. The exterior of the superstructure appears to be in good condition. On one side of the station, the foundation walls actually protrude into the bay, but appear to be in good condition.

Inside the dry well and wet well, the walls, floor and ceiling appear to be in good condition. Handrails have kickplates. All walls are painted but are chipping in several areas. The concrete appears to be in good condition without signs of spalling or cracking. The attic is accessed through a ceiling hatch. The insulated timber rafters appear to be in good condition.

A single toilet facility, located in the top level of the dry well, has a slop sink, toilet fixture, exhaust blower and a 5-gallon water heater, all of which appear to be in good working order.

There is only one exterior light at the pump station, which appears to be inadequate. Interior lighting in both the dry well and wet well is adequate. Interior lighting in the wet well is explosion proof as is all equipment in the wet well including a half-ton Yale monorail hoist located in the upper level.

2.1.1.3. Process Mechanical

Two identical pumps are located in the dry well with provision for a third pump in the middle (Photos 17C and 20 C). The pumps are electric motor driven vertical centrifugal wastewater pumps manufactured by Fairbanks Morse. They are the original pumps installed circa 1990. The motors are located on a mezzanine level and the MCC and switchgear is located on the top level of the dry well. The motors are manufactured by Marathon Electric and are each 40 Hp.

The pumps are supported on a steel frame mounted on a 6-inch concrete pad. The pumps and motors appear to operate smoothly with no significant noise or vibration. An existing seal water system consisting of a steel day tank, duplex pumps, valves and appurtenances is located on the mezzanine level, but is disconnected and not used. The pumps have packed seals and show little to no sign of leakage. The bolts connecting the bearing frame to the backhead of the pump show signs of corrosion. A local shutoff box is mounted in front of each pump. A manually operated, 1-inch diameter PVC bleeder/drain line extends from the pump volute to the sump pit. A 4-inch diameter plastic pressure gauge with stainless steel diaphragm seal and shutoff valve is located on the discharge of each pump. Pressure during pump operation was approximately 18 psi. Pressure gauges are not present on either suction line. During the visit, pump drawdown tests were performed. The pumping characteristics for this facility are shown in Table 2-1.

Table 2-1
Cohasset Narrows Pumping Station Characteristics

Historical Pumping Data (per 24 hour period):	▪ 3/19/97 – 163,000 gal ▪ 3/20/97 – 143,000 gal ▪ 3/21/97 – 123,000 gal ▪ 3/22/97 – 125,000 gal ▪ Max: 505,000 gal ▪ Min: 109,000 gal
Pumps and Motors:	▪ Two identical parallel Fairbanks Morse vertical-shaft electric motor driven centrifugal pumps. ▪ Serial Nos. K3T1059965-01,-1. ▪ Marathon Electric motor- 40 hp, 3 phase, 460 volts ▪ Rated capacity (each pump): 980gpm @ 83 ft TDH (certified pump curve) ▪ Measured capacity: 775gpm @ 59 ft pump discharge pressure reading @ 90%± of full speed (Pump No. 1) ▪ Max. capacity: (with 2 existing pumps) 1120 gpm (estimated). Impeller diameter: 15.1"
Current Operation:	▪ Bubbler system senses levels. ▪ Lead pump starts at low speed at on level of VFD. ▪ Lead pump revs higher if level rises. ▪ If lead maxes out, lag pump starts at low speed until it maxes out. ▪ Lead/lag alternate manually.

The suction and discharge piping appear to be in good condition (Photo 18C and 19C). The size and layout of the piping conforms with the design drawings. A sump pit with duplex submersible pumps is located in the dry well. The pumps are controlled by a float and appear to be in good condition. The sump pit is covered with an aluminum checkered plate (Photo 23C).

The station has a back up natural gas engine driven generator located at the top level of the dry well. The generator is manufactured by Superior, rated for 75 kW at 3 phase 60 Hz and 277/480 volts, and is in very good condition.

A single stainless steel bar rack is located in the main influent channel in the lower level of the wet well (Photo 25C). Screenings are cleared daily. The bar rack appears in good condition. Odor control consists of a 55-gallon plastic drum of potassium permanganate located near the influent channel that dispenses into the influent flow by means of a small chemical metering pump.

2.1.1.4. Operation/Control

A control panel with chart recorder and built in VFD controls is located on the top level of the dry well (Photos 9C and 11 C). An air compressor bubbler system, located on the mezzanine, senses level the liquid level in the wet well and displays the level on the control panel. VFD's located on the mezzanine level, control pump speed from 50% to 100% of full speed (1180 rpm). Each pump is provided with a local start/stop switch containing a lockout device. The pumping station has the following alarms:

- wet well – high level
- wet well – low level
- dry well – high level
- power outage
- pump failure

All alarms are connected to one chatterbox that activates a pager. When paged, the operator knows which station activated the alarm but not what caused it until he arrives on site. All alarms are in working order.

2.1.1.5. Miscellaneous

A fire extinguisher and first aid kit are located on the upper level of the dry well. There is also a fire alarm on the exterior of the building.

2.2. Dicks Pond Pumping Station

2.2.1. Existing Conditions

2.2.1.1. Site Work

Dicks Pond Pumping Station is located off Cranberry Highway within an 8-ft. high barbed wire chain link fence that appears to be in good condition. There is an asphalt driveway, some landscaping, and gravel around the facility. These all appear to be in good condition.

2.2.1.2. Structural/Architectural

The superstructure consists of a single gable asphalt shingled roof on CMU walls with a wooden shingle facade (Photos 1 Dk - 6 Dk). Louvers and vent openings are located on several elevations. The exterior of the superstructure appears to be in good condition. Just below the wall shingles are reinforced concrete walls which comprise the wet and dry wells. These appear to be in good condition.

Inside the dry well and wet well, the walls, floors and ceilings appear to be in good condition. Handrails have kickplates. All walls are painted but show signs of chipping in several areas. The concrete appears in good condition without any signs of spalling or cracking. The attic is accessed through a ceiling hatch. The insulated timber rafters appear to be in good condition. The mezzanine level of the dry well contains an aluminum platform.

The access stairway to the lower level of the dry well has a clear landing area of less than 1.7 square feet, which is less than code requirements (Photo 13Dk).

A single toilet facility, located in the top level of the dry well, has a slop sink, toilet fixture, exhaust blower, and a 5-gallon water heater, all of which appear to be in good working order (Photos 19 Dk and 20 Dk).

There is only one exterior light at the pump station and it appears to be inadequate. Interior lighting in both the dry well and wet well is adequate. Interior lighting in the wet well is explosion proof as is all equipment in the wet well including a half-ton Yale monorail hoist located in the upper level.

2.2.1.3. Process Mechanical

Two identical pumps are located in the dry well with provision for a third pump in the middle (Photos 9Dk and 10 Dk). The pumps are electric motor driven vertical centrifugal wastewater pumps manufactured by Fairbanks Morse. They are the original pumps installed circa 1990. The motors are located on a mezzanine level and the MCC and switchgear is located on the top level of the dry well. The motors are manufactured by Marathon Electric and are each 40 Hp (Photo 12 Dk).

The pumps are supported on a steel frame mounted on a 6-inch concrete pad. The pumps and motors appear to operate smoothly without significant noise or vibration. An existing seal water system consisting of a steel day tank, duplex pumps, valves and appurtenances, located on the mezzanine level, is disconnected and not used. The pumps have packed seals and show little or no sign of leakage. The bolts connecting the bearing frame to the backhead of the pump show signs of corrosion. A local shutoff box is mounted in front of each pump. A manually operated, 1-inch diameter PVC bleeder/drain line extends from the pump volute to the sump pit. A 4-inch diameter plastic pressure gauge with stainless steel diaphragm seal and shutoff valve is located on the discharge of each pump. The pumping characteristics for this facility are shown in Table 2-2.

The suction and discharge piping appear to be in good condition. The size and layout of the piping conforms with the design drawings. A sump pit with duplex submersible pumps is located in the dry well. The sump pumps are controlled by a float and appear to operate well. The sump pit is covered with an aluminum checkered plate.

The station has a back up natural gas engine driven generator, located at the top level of the dry well. The generator is manufactured by Superior, rated for 75 kW at 3 phase 60 Hz and 277/480 volts, and is in very good condition.

pumps manufactured by Fairbanks Morse. They are the original pumps installed circa 1990. The motors are located on a mezzanine level and the MCC and switchgear is located on the top level of the dry well. The motors are manufactured by Marathon Electric and are each 75 Hp.

The pumps are supported on a steel frame mounted on a 6-inch concrete pad. The pumps and motors appear to operate smoothly without significant noise or vibration. An existing seal water system consisting of a steel day tank, duplex pumps, valves and appurtenance is located on the mezzanine level but is disconnected and not used. The pumps have packed seals. Pump No. 2 has some packing leakage that is removed from the station by the sump pumps (Photo 17Dp). The bolts connecting the bearing frame to the backhead of the pump show signs of corrosion. A local shutoff box is mounted in front of each pump. A manually operated, 1-inch diameter PVC bleeder/drain line extends from the pump volute to the sump pit. A 4-inch diameter plastic pressure gauge with stainless steel diaphragm seal and shutoff valve is located on the discharge of each pump. Pressure during pump operation was approximately 16 psi. The pumping characteristics for this facility are shown in Table 2-3.

Table 2-3
Depot Street Pumping Station Characteristics

Historical Pumping Data (per 24 hour period):	▪ 3/20/97 – 191,000 gal ▪ 3/21/97 – 178,000 gal ▪ 3/22/97 – 202,000 gal ▪ 3/23/97 – 226,000 gal ▪ 3/24/97 – 225,000 gal ▪ Max: 326,000 gal ▪ Min: 127,000 gal
Pumps and Motors:	▪ Two identical parallel Fairbanks Morse vertical-shaft electric motor driven centrifugal pumps. ▪ Serial Nos. K3T1059963-01,-1. ▪ Marathon Electric motor: 75 hp, 3 phase, 460 volts. ▪ Rated capacity (each pump): 1880gpm @ 81 ft TDH (certified pump curve) ▪ Measured capacity: 2345gpm @ 56 ft pump discharge pressure reading @ 80%± of full speed (Pump No. 1) ▪ Max. capacity: (with 2 existing pumps) 3450 gpm (estimated) Impeller diameter: 16"
Current Operation:	▪ Bubbler system senses levels. ▪ Lead pump starts at low speed at on level of VFD. ▪ Lead pump revs higher if level rises. ▪ If lead maxes out, lag pump starts at low speed until it maxes out. ▪ Lead/lag alternate manually.

The suction and discharge piping appears to be in good condition (Photo 19Dp). The size and layout of the piping conforms with the design drawings. A sump pit with duplex submersible pumps is located in the dry well. The pumps are controlled by a float and appear to well. The sump pit is covered with an aluminum checkered plate.

The station has a back up natural gas engine driven generator located at the top level of the dry well. The generator is manufactured by Superior, rated for 140 kW at 3 phase 60 Hz, 1800 rpm, and 277/480 volts, and is in very good condition.

A single stainless steel bar rack is located in the main influent channel in the lower level of the wet well. Screenings are cleared daily. The bar rack appears in good condition. The station does not have a potassium permanganate odor control system.

2.3.1.4. Operation/Control

A control panel with chart recorder and built in VFD controls is located on the top level of the dry well (Photo 11Dp and 14Dp). An air compressor bubbler system, located on the mezzanine level, senses the liquid level in the wet well. Wet well level is displayed on the control panel. VFD's for each pump located on the mezzanine level, control the speed from 50% to 100% of full speed (1180 rpm).

Each pump is provided with a local start/stop switch containing a lockout device, which are operable according to plant personnel. The pumping station has the following alarms:

- wet well – high level
- wet well – low level
- dry well – high level
- power outage
- pump failure

All alarms are connected to one chatterbox that activates a pager. When paged, the operator knows which station activated the alarm but not what caused it until he arrives on site. All alarms are in working order.

2.3.1.5. Miscellaneous

A fire extinguisher and first aid kit are located on the upper level of the dry well. There is also a fire alarm on the exterior of the building.

2.4. Hynes Field Pumping Station

2.4.1. Existing Conditions

2.4.1.1. Site Work

The Hynes Field Pumping Station is enclosed by a 6-foot high chain link fence with three rows of barbed wire. One side of the fence adjacent to a playground does not have barbed wire. The fence and gate appear to be in good condition. The site has a small paved area and the rest is grassed. An empty 500-gallon underground diesel tank located next to the structure is going to be removed. The fill valve for this underground tank is shown in Photo 5H.

2.4.1.2. Structural/Architectural

As seen in Photos 1H through 4H, the structure consists of a single story flat-roofed superstructure with a brick facade and a reinforced concrete substructure. The structure has a reinforced concrete porch with a stairway that up several feet to the main entrance. The entrance door to the dry well has a broken glass pane (Photo 7H) and the door is in poor condition. The roof of the building is made of precast pre-stressed slabs that are in good condition. The CMU walls also appear to be in good condition. The CMU walls and underside of roof slabs are painted. The walls in the mezzanine and lower level are unpainted and in good condition.

Handrails do not have kickplates with the exception of the stairway to the mezzanine level (Photo 9H). The spiral stairs between levels (Photo 17H) are difficult to negotiate.

The exterior of the building has three light fixtures that are not functioning. Interior lighting in the dry well is sufficient with three incandescent light fixtures on each level.

A single toilet facility, located in the top level of the dry well, has a slop sink, toilet fixture, exhaust blower and a single faucet for cold water.

Equipment and lighting in the upper level of the wet well is explosion proof. The lighting is adequate with two incandescent light fixtures. The light fixtures, conduit, heaters, blower and supports show signs of mild to severe corrosion.

Access from the upper level of the wet well to the lower level is provided by very steep ship ladders that are mildly corroded. The lower level of the wet well is divided in two sections with a concrete walkway along the length of both sections.

The concrete walls and walkways in the wet well appear to be in good condition with few signs of deterioration (Photo 30H). The concrete is not painted.

Handrails in the lower wet well level are mildly corroded and do not have kickplates. Ductwork in the lower level is severely corroded and portions of it are missing (Photos 26H through 29 H and 31H).

Lighting in the lower level of the wet well consists of two incandescent light fixtures that are severely corroded, as are the conduits (Photo 28H). Lighting does not appear adequate in the lower level.

2.4.1.3. Process Mechanical

Two identical pumps are located in the dry well with provision for a third pump at the end (Photos 18H through 21H). The pumps are electric motor driven vertical centrifugal wastewater pumps manufactured by Fairbanks Morse. They are the original pumps installed circa 1970's. The motors are located on a mezzanine level and the MCC and switchgear is located on the top level of the dry well (Photos 11H and 12H). The motors are manufactured by Continental

Electric and are each 60 Hp (Photo 16H).

The pumps are supported on a steel frame mounted on a 6-inch concrete pad (Photos 19H through 21H). The pumps and motors appear to operate smoothly without significant noise or vibration. The pumps have packed seals. The bolts connecting the bearing frame to the backhead of the pump show signs of corrosion (Photos 24H and 25H). A 2-inch diameter pressure gauge and shutoff valve is located on the discharge of each pump. The pumping characteristics for this facility are shown in Table 2-4.

Table 2-4
Hynes Field Pumping Station Characteristics

Historical Pumping Data (per 24 hour period):	▪ None available
Pumps and Motors:	▪ Two identical parallel Fairbanks Morse vertical-shaft electric motor driven centrifugal pumps. ▪ Serial No. K2R1062764-1. ▪ Continental Electric motor:,60 hp, 3 phase, 460 volts ▪ Rated capacity (each pump): 2400gpm @ 70 ft TDH (certified pump curve) ▪ Measured capacity: 227gpm @ 50 ft pump discharge pressure reading @ 50%± of full speed (Pump No. 1) ▪ Max. capacity: (with 2 existing pumps) 3525 gpm (estimated). Impeller diameter: 16"
Current Operation:	▪ Bubbler system senses levels. ▪ Lead pump starts at low speed at on level of VFD. ▪ Lead pump revs higher if level rises. ▪ If lead maxes out, lag pump starts at low speed until it maxes out. ▪ Lead/lag alternate manually.

The suction and discharge piping appears to be in good condition. The size and layout of the piping conforms with the design drawings. There is an existing Fischer-Porter magnetic flowmeter on the discharge piping but it is not operational. A float operated sump pump is located in the dry well. The pump appears to be original and appears to be in fair condition.

The station has a back up diesel engine driven generator (Photo 14H) located at the top level of the dry well. The generator manufactured by Cummins is rated for 125 kW at 3 phase 60 Hz and 240/416 volt (Photo 13H and 14H). The generator looks like it is the original and has about 600 hours running time. The generator runs on diesel from a 55-gallon drum located in the engine room.

A bar rack is located in each section in the lower level of the wet well (Photos 34H and 35H). Screenings are cleared daily. The bar racks appears to be in good condition.

A small wet well washdown pump and steel storage tank are located on the upper level of the dry well (Photo 10H). The washdown pump is manufactured by Peerless and operates at approximately 40 psi.

2.4.1.4. Operation/Control

A control panel with chart recorder and built in VFD controls is located on the top level of the dry well (Photo 15H). An air compressor bubbler system located on the mezzanine senses liquid level in the wet well. The wet well level is displayed on the control panel. New AC Tech VFD's located on the mezzanine level control the speed from 50% to 100% of full speed (1112 rpm).

Each pump is provided with a local start/stop switch containing a lockout device. The pumping station has the following alarms:

- wet well – high level
- wet well – low level
- dry well – high level
- power outage

All alarms are connected to one chatterbox that activates a pager. When paged, the operator knows which station activated the alarm but not what caused it. All alarms are working according to plant personnel.

2.4.1.5. Miscellaneous

A fire extinguisher is located on the upper level of the dry well. The facility does not have a first aid kit.

2.5. Narrows Pumping Station

2.5.1. Existing Conditions

2.5.1.1. Site Work

The Narrows Pumping Station is located in front of Merchant's Way. It does not have a surrounding fence. The site has a small paved area near the front and the rest of the site is grass. An empty 500-gallon underground diesel tank is located next to the structure and is going to be removed.

2.5.1.2. Structural/Architectural

The structure consists of a single story flat-roofed superstructure with a brick facade and a reinforced concrete substructure (Photos 1N through 4N). The structure has a reinforced concrete porch with a stairway that goes up several feet to the main entrance. The entrance door to the dry well appears to be in good condition. The roof of the building is made of precast pre-stressed slabs which are in good condition. CMU walls appear to be in good condition. CMU walls and the underside of the roof slabs are painted. The walls in the mezzanine and lower level are unpainted and in good condition.

Handrails do not have kickplates with the exception of the stairway to the mezzanine level. Like the Hynes Field station, access between station floor levels is through a series of spiral stairs which are difficult to negotiate.

The exterior of the building has two new working light fixtures and a third is being added. Interior lighting in the dry well is sufficient with three incandescent light fixtures on each level.

A single toilet facility located in the top level of the dry well has a slop sink, toilet fixture, exhaust blower and a single faucet for cold water (Photo 10N).

The access door to the wet well is in poor condition and shows signs of severe corrosion (Photo 21N).

Equipment and lighting in the upper level of the wet well is explosion proof. The lighting is inadequate with only one of two incandescent light fixtures working. Light fixtures, conduit, heaters, blower and supports show signs of mild to severe corrosion.

Access from the upper level of the wet well to the lower level is provided by very steep ship ladders that are mildly corroded. The lower level of the wet well is divided in two sections with a concrete walkway the length of both sections (Photo 23N).

The concrete walls and walkways in the wet well appear to be in good condition with few signs of deterioration. None of the concrete is painted.

Handrails are mildly corroded and do not have kickplates. The duct work is severely corroded but it is in intact.

Lighting in the lower level of the wet well is by two incandescent light fixtures that are severely corroded, as are the conduits.

2.5.1.3. Process Mechanical

Three pumps are located in the dry well. The pumps are electric motor driven vertical centrifugal wastewater pumps manufactured by Fairbanks Morse. They are the original pumps installed circa 1970's. The motors are located on a mezzanine level and the MCC and switchgear is located on the top level of the dry well. The motors are manufactured by Continental Electric and are each 60 Hp.

The pumps are supported on a steel frame mounted on a 6-inch concrete pad. The pumps and motors appear to operate smoothly without significant noise or vibration. The pumps have packed seals. Pump No. 1 was running at the time of inspection and shows signs of packing wear and leakage at the seal (Photo 17N). The bolts connecting the bearing frame to the backhead of the pump show signs of corrosion (Photo 20N). A 4-inch diameter plastic pressure gauge and shutoff valve is located on the discharge of each pump. The pumping characteristics for this facility are shown in Table 2-5.

Table 2-5
The Narrows Pumping Station Characteristics

Historical Pumping Data (per 24 hour period):	▪ None available
Pumps and Motors:	▪ Three parallel Fairbanks Morse vertical-shaft electric motor driven centrifugal pumps in, serial Nos. K2R1062762-1, K2R1062763. ▪ Continental Electrical motor: 60 hp, 3 phase, 460 volts ▪ Rated capacity: 1600gpm Nos. 1&3 @ 87 ft TDH, 1000 gpm No. 2 (pump name plate) ▪ Measured capacity: 1972 gpm @ 83 ft pump discharge pressure reading @ 85%± of full speed (Pump No. 1) ▪ Max. capacity: (with 3 existing pumps) 3200 gpm (estimated). Impeller diameter: 15.375"
Current Operation:	▪ Bubbler system senses levels. ▪ Lead pump starts at low speed at on level of VFD. ▪ Lead pump revs higher if level rises. ▪ If lead maxes out, lag pump starts at low speed until it maxes out. ▪ Lead/lag alternate manually.

The suction and discharge piping appears to be in good condition. The size and layout of the piping conforms with the design drawings. There is an existing Fischer-Porter magnetic flowmeter on the discharge piping but it is not operational. A float operated sump pump is located in the dry well. The sump pump is driven by a single-phased 120 volt motor and is one year old.

The station has a back up diesel engine driven generator located at the top level of the dry well. The generator manufactured by Cummins is rated for 150 kW at 3 phase 60 Hz, 240/416 volts and 1800 rpm. The generator appears to be the original and has about 425 hours running time. The generator runs on diesel from a 55-gallon drum located in the engine room.

A bar rack is located in each section in the lower level of the wet well (Photo 23N). Screenings are cleared daily. The bar racks appears to be in good condition. The sluice gate operator that connects the two sections of the wet well appears to be corroded to the point of being frozen in place (Photo 24N).

A small washdown pump and 55-gallon steel storage tank for washing down the wet well are located on the upper level of the dry well (Photo 7N). The pump is manufactured by Peerless and operates at approximately 35 psi.

2.5.1.4. Operation/Control

A control panel with chart recorder and built in VFD controls is located on the top level of the dry well (Photo 14N). An air compressor bubbler system located on the mezzanine senses the liquid level in the wet well. The wet well level is displayed on the control panel. New AC Tech VFD's located on the mezzanine level control the speed from 50% to 100% of full speed. Pump No. 3 is constant speed.

Each pump is provided with a local start/stop switch containing a lockout device, which are operable according to plant personnel. The pumping station has the following alarms:

- wet well – high level
- wet well – low level
- dry well – high level
- power outage

All alarms are connected to one chatterbox that activates a pager. When paged, the operator knows which station activated the alarm but not what caused it until he arrives on site. All alarms are in working order.

2.5.1.5. Miscellaneous

A fire extinguisher is located on the upper level of the dry well. The facility does not have a first aid kit.

2.6. Kennedy Lane Pumping Station

2.6.1. Existing Conditions

2.6.1.1. Site Work

The Kennedy Lane Pumping Station is surrounded by a 6-foot high chain link fence with three rows of barbed wire. The fence appears to be in good condition with some mild corrosion. The site is paved in the front and on the right-hand side of the building the rest is grassed. An empty 500-gallon underground diesel tank is located next to the structure is going to be removed (Photos 1K and 2K).

2.6.1.2. Structural/Architectural

The structure consists of a single story flat-roofed superstructure with a brick facade and a reinforced concrete substructure (Photos 1K through 6K). There is a 5-ft by 5-ft concrete pad in front of the dry well and wet well entries. The entrance door to the dry well is in fair condition. The reinforced concrete roof is painted on the underside and appears to be in good condition. CMU walls are painted and is chipping in some areas but otherwise is in good condition. The walls in the lower level are unpainted and in good condition. There is no mezzanine level at this facility.

Handrails do not have kickplates. The spiral stairs between levels are difficult to negotiate.

The exterior of the building has light fixtures that are not operational. Interior lighting in the dry well is sufficient with fluorescent light fixtures on upper level and four incandescent light fixtures on lower level.

There is no toilet facility at Kennedy Lane. A slop sink is located near the washdown pump (Photos 9K and 10K).

The wet well entrance door is in poor condition with significant corrosion (Photo 23K).

Equipment and lighting in the upper level of the wet well is explosion proof. The lighting is inadequate and only one of two incandescent light fixtures working. All the equipment including light fixtures, conduit, heaters, blower and supports show signs of mild to severe corrosion.

Access from the upper level of the wet well to the lower level is through very steep ship ladders that are mildly corroded. The lower level of the wet well is divided in two sections with a concrete walkway the length of both sections.

The concrete walls and walkways in the wet well appear to be in good condition with few signs of deterioration (Photos 25 and 26 K). None of the concrete is painted.

Handrails are mildly corroded and do not have kickplates. The ductwork is in fair condition.

Lighting in the lower level of the wet well is by two incandescent light fixtures that are severely corroded, as are the conduits.

2.6.1.3. Process Mechanical

Two identical pumps are located in the dry well with provision for a third pump in the middle (Photos 14K, 18K, and 19K). The pumps are electric motor driven vertical centrifugal wastewater pumps manufactured by Fairbanks Morse. They are the original pumps installed circa 1970's. The motors are located on a mezzanine level and the MCC and switchgear is located on the top level of the dry well. The motors are manufactured by Continental Electric and are each 60 Hp.

The pumps are supported on a steel frame mounted on a 6-inch concrete pad. The pumps and motors appear to operate smoothly without significant noise or vibration. The pumps have packed seals. The bolts connecting the bearing frame to the backhead of the pump show signs of corrosion (Photos 16K and 17K). A 2-inch diameter pressure gauge and shutoff valve is located on the discharge of each pump. Pressure during pump operation was approximately 20 psi. The pumping characteristics for this facility are shown in Table 2-6.

The suction and discharge piping appears to be in good condition (Photos 13K through 15K). The size and layout of the piping conforms with the design drawings. A float operated sump pump is located in the dry well (Photo 21K). The pump is driven by a single-phased 120 volt motor and is one year old.

The station has a back up diesel engine driven generator located at the top level of the dry well. The generator manufactured by Deco Synchronous is rated for 75 kW at 3 phase and 1800 rpm. The engine is International Harvester. The generator appears to be original and has about 525 hours running time. The generator runs on diesel from a 55-gallon drum located in the engine room.

Table 2-6
Kennedy Lane Pumping Station Characteristics

Historical Pumping Data (per 24 hour period):	▪ 3/19/97 – 205,000 ▪ 3/20/97 – 127,000 ▪ 3/21/97 – 102,000 ▪ 3/22/97 – 226,000 ▪ 3/23/97 – 182,900 ▪ Max: 277,000 ▪ Min: 102,000
Pumps and Motors:	▪ Two identical parallel Aurora vertical-shaft electric motor driven centrifugal pumps. ▪ Serial Nos. 70-14541, 2. ▪ Continental Electric motor: 60 hp, 3 phase, 460 volts ▪ Rated capacity (each pump): 2800gpm @ 37 ft TDH (certified pump curve) ▪ Measured capacity: 501gpm @ 62 ft pump discharge pressure reading @ 20%± of full speed (Pump No. 1) ▪ Max. capacity: (with 2 existing pumps) 2700 gpm (estimated)
Current Operation:	▪ Bubbler system senses levels. ▪ Lead pump starts at low speed at on level of VFD. ▪ Lead pump revs higher if level rises. ▪ If lead maxes out, lag pump starts at low speed until it maxes out. ▪ Lead/lag alternate manually.

There are no bar screens at Kennedy Lane (Photos 27K).

A wet well small washdown pump and steel storage tank are located on the upper level of the dry well (Photos 9K). The washdown pump is manufactured by Peerless and operates at approximately 35 psi.

2.6.1.4. Operation/Control

A control panel with chart recorder and built in VFD controls is located on the top level of the dry well (Photos 12K). An air compressor bubbler system located in the engine room senses the liquid level in the wet well. The wetwell level is displayed on the control panel. New AC Tech VFDs located on the mezzanine level control the speed from 50% to 100% of full speed.

Each pump is provided with a local start/stop switch containing a lockout device, which are operable according to plant personnel. The pumping station has the following alarms:

- wet well – high level
- wet well – low level
- dry well – high level
- power outage

All alarms are connected to one chatterbox that activates a pager. When paged, the operator knows which station activated the alarm but not what caused it. All alarms are working according to plant personnel

2.6.1.5. Miscellaneous

Two fire extinguishers are located on the upper level of the dry well and one on the lower level. The facility does not have a first aid kit.

SECTION 3.0 – RECOMMENDATIONS

Recommended repairs and/or upgrades were made for each of the six pumping stations investigated and are outlined below.

3.1. Cohasset Narrows

- Add additional outside lighting.
- Repair driveway pothole.
- Replace discharge gauges with new gauges mounted on diaphragm seals.
- Add suction gauges mounted on diaphragm seals for each pump.
- Add vibration isolation on both suction and discharge piping of each pump.
- Add high pressure washdown pump and two inch hose for cleaning wet well.

3.2. Dicks Pond

- Add additional outside lighting.
- Replace discharge gauges with new gauges mounted on diaphragm seals.
- Add suction gauges mounted on diaphragm seals for each pump.
- Add vibration isolation on both suction and discharge piping of each pump.
- Add high pressure washdown pump and two inch hose for cleaning wet well.
- Modify stairs to the lower level wet well to increase landing area.

3.3. Depot Street

- Add additional outside lighting.
- Repair hole in fence.
- Repair/replace damaged downspout.
- Replace discharge gauges with new gauges mounted on diaphragm seals.
- Add suction gauges mounted on diaphragm seals for each pump.
- Add vibration isolation on both suction and discharge piping of each pump.
- Add high pressure washdown pump and two inch hose for cleaning wet well.

3.4. Hynes Field

- Repair/replace exterior lights.
- Replace discharge gauges with new gauges mounted on diaphragm seals.
- Add suction gauges mounted on diaphragm seals for each pump.
- Add vibration isolation on both suction and discharge piping of each pump.
- Repair/replace existing magnetic flowmeter.
- Add additional lighting in the wet well lower level.
- Replace ductwork in lower level of wet well.
- Replace entrance door to dry well.
- Provide first aid kit.

- Replace all corroded equipment in wet well.
- Install kickplates on all handrails.

3.5. The Narrows

- Replace entrance door to wet well.
- Add additional lighting in wet well.
- Add suction gauges mounted on diaphragm seals for each pump.
- Add vibration isolation on both suction and discharge piping of each pump.
- Repair/replace existing magnetic flowmeter.
- Provide VFD for third pump.
- Provide first aid kit.
- Replace discharge gauges with new gauges mounted on diaphragm seals.
- Repack pump seals.

3.6. Kennedy Lane

- Replace entrance door to wet well.
- Replace discharge gauges with new gauges mounted on diaphragm seals.
- Add suction gauge mounted on diaphragm seals for each pump.
- Add vibration isolation on both suction and discharge piping of each pump.
- Provide VFD for second pump.
- Provide first aid kit.
- Replace all corroded equipment in wet well.
- Install kickplates on all handrails.

Appendix E

Appendix E
Basis for Cost Estimates and Cost-Effectiveness Analysis

1. Construction cost estimates include 40 percent for engineering and contingencies. The period of construction is estimated to be three years.

2. Present worth analysis was performed using an interest rate of 7.375[1] percent with a 20-year life cycle.

3. Operation and maintenance costs were calculated with the following unit costs: labor—$17/hr and electricity—$0.09/kwh.

[1] Fiscal Year 1997 discount rate from U.S. Environmental Protection Agency calculated in accordance with Section 80(a) P.L. 93-2510 (8 stat. 34) and 18 CFR 704.39.

Appendix F

Town of Wareham, Massachusetts
Facilities Plan
First Public Information Meeting

Attendance List

Name	***Address***
Jack Nolan	One Mill Street, W. Wareham, MA
Francys McKinlay	621 Main Street, Wareham, MA
Marion B. Santry	29 Wilson Street, Briarwood Beach
Gertrude Sullivan	3 Kingwood Street, Wareham, MA
Howard Smith	2324 CranHwy, W. Wareham, MA
Claire Smith	2324 CranHwy, W. Wareham, MA
Joseph M. Giglio	4 Wamquinquoah Road, Wareham, MA
Katherine M. Horne-Day	5 Connehassett Road, Wareham, MA
(Secretary Cromesett Park Improvement Assoc.)	
Robert J. Luoma	7 Diamond Avenue, Wareham, MA
Todd Valicenti	184 Main Street, Wareham, MA
Oinnie Perrone	8 Swift Avenue, Wareham, MA
Floyd Taylor	31 Hartley Road, Rochester, MA
Steven Currey (Rose Point Improvement Assoc.)	4 Rose Point Avenue, W. Wareham, MA
Bob Mackie	CDM
Lisa Hiscock	CDM
Board of Selectmen w/o Wayne Sylvester	Wareham, MA
Joe Murphy, Town Administrator	Wareham, MA
Mark Gifford, DPW	Wareham, MA
Glenn Spillane	Linwood Avenue, Wareham, MA

First Public Information Meeting Handout

Town of Wareham, MA
Wastewater Facilities Plan

First Public Information Meeting
November 17, 1997

Agenda

Public Information Meeting
November 17, 1997

- Introduction
- Meeting Purpose
- Project History
- Background Information
- Needs Area Analysis
- Existing System Analysis
- What's Next
- Questions

CDM

Meeting Purpose

- Provide Progress Report
- Discuss Recommendations
- Provide Public an Opportunity to Comment
- Obtain Public Comments and Incorporate into the Facilities Plan

CDM

Project History

- Facilities Plan originally completed by M&E in 1986.
- 1986 Facilities Plan focused on Needs Areas.
- Recommended sewering 7 of 13 areas.
- M&E prepared Environmental Impact Report in 1989
- 1989 EIR focused on WWTP.
- Board of Health and DEP decided to re-evaluate all Needs Areas.
- CDM hired in 1995 to prepare a Supplemental Facilities Plan.

CDM

Background Information

- What is a Facilities Plan?
  - Plan for operating the existing system for the next 20 years.
  - Required by the DEP to gain funding assistance and major upgrade approvals.
  - Provide a means to generate 20 year cash flow.
  - Provide insight for land purchase, etc.

CDM

Background Information (Continued)

- Facilities Planning Goals
  - Re-evaluate 12 needs areas
  - Re-evaluate WWTP
  - Evaluate Collection System
- 12 Needs Areas Identified
- Existing Means of Disposal
  - 36% sewered
  - 64% unsewered

CDM

Needs Areas
(Alphabetical Order)

Needs Area	*Recommended By*
Agawam Beach	BOH
Beaver Dam Estates	BOH
Briarwood Beach	DEP & BOH
Cromesett Park	BOH
Linwood/Ladd Avenues	BOH
Mayflower Ridge	BOH
Oakdale	BOH
Parkwood Beach	BOH
Rose Point	DEP & BOH
Sunset Island	BOH
Tempest Knob	BOH
Weweantic Shores	DEP & BOH

CDM

Needs Area Analysis

- Data Collection
  - Board of Health Records
  - USGS Soil Survey Maps
  - Housing Densities
  - Discussions with Town Officials

CDM

Needs Area Analysis (continued)

- Questionnaire Survey
  - Supplement existing data
  - Provide residents an opportunity to comment
  - 1,500 questionnaires distributed
  - Approximately 700 returned (47%)
  - 77% of returns indicated a desire for sewers
  - 18% of returns indicated on-site system disposal problems

CDM

Needs Area Analysis **(continued)**

- Re-evaluated 12 Needs Areas
- Prioritized Listing for Sewering Needs Areas
- Questionnaire Results
  - Surface Water Nitrogen Levels
  - Needs Area Size and Housing Density
  - Construction Constraints
  - SRF Loan Policies
- Needs Areas Project Costs

CDM

Needs Areas

(Recommended Priority Order)

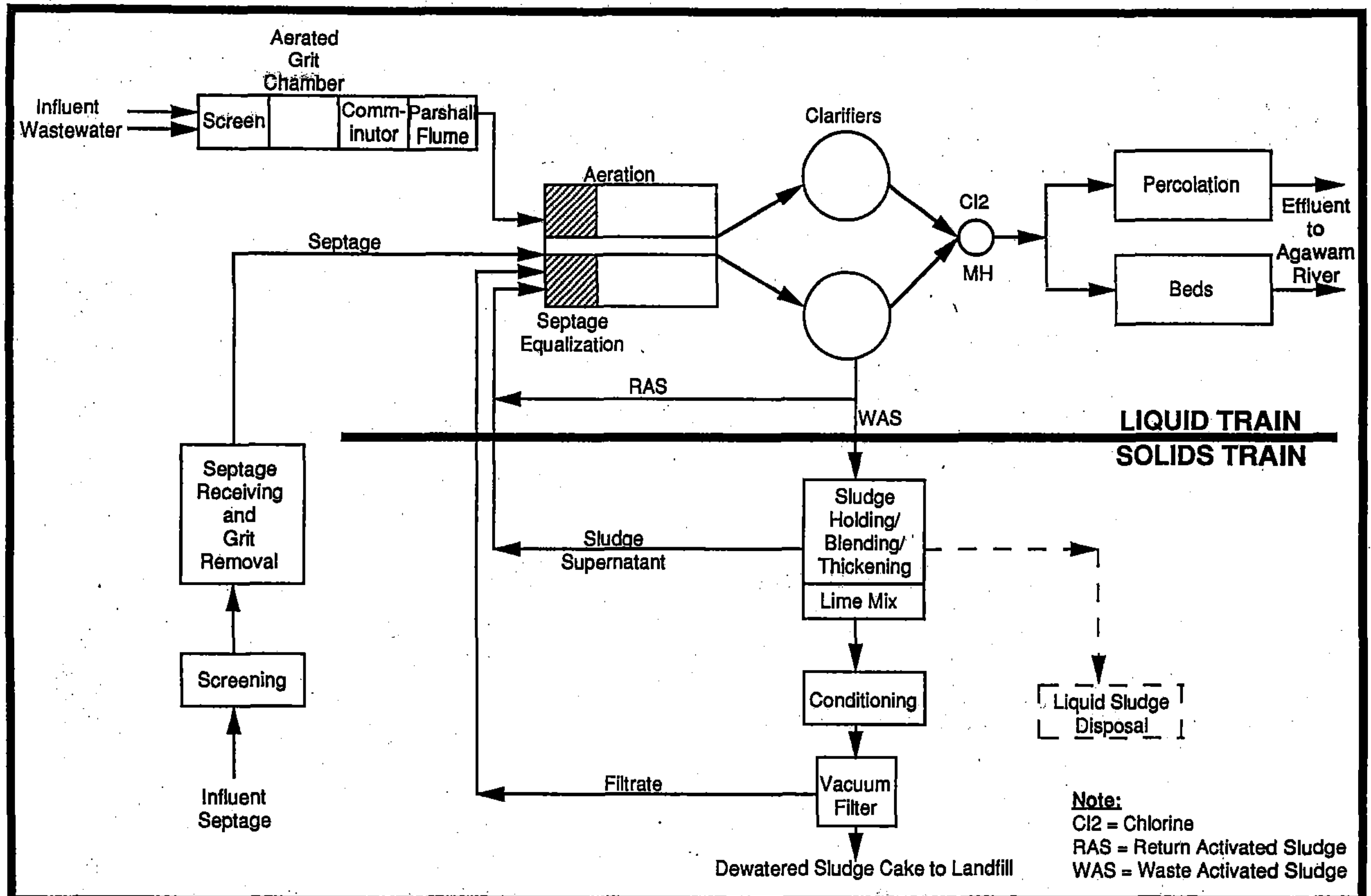
Contract	Needs Area	Capital Cost per Contract
1	Sunset Island	
	Weweantic Shores	$3,162,208
2	Briarwood Beach	
	Beaver Dam Estates	$1,703,450
3	Tempest Knob	
	Agawam Beach	$2,120,720
4	Parkwood Beach	$2,625,840
5	Oakdale	$2,165,415
6	Cromesett Park	$1,249,752
7	Rose Point	$2,928,520
8	Linwood/Ladd Avenue	
	Mayflower Ridge	$1,489,600
	TOTAL	**$17,445,505**

CDM

Existing System Analysis

- Existing Sewers and Pumping Stations
  - Sewers have adequate capacity for next 20 years.
  - Pumping Stations have adequate capacity for next 20 years.
- Existing WWTP
  - Overview of WWTP.
  - Presently WWTP is near its capacity.

CDM



Town of Wareham, Massachusetts
Wastewater Facilities Plan

Process Schematic

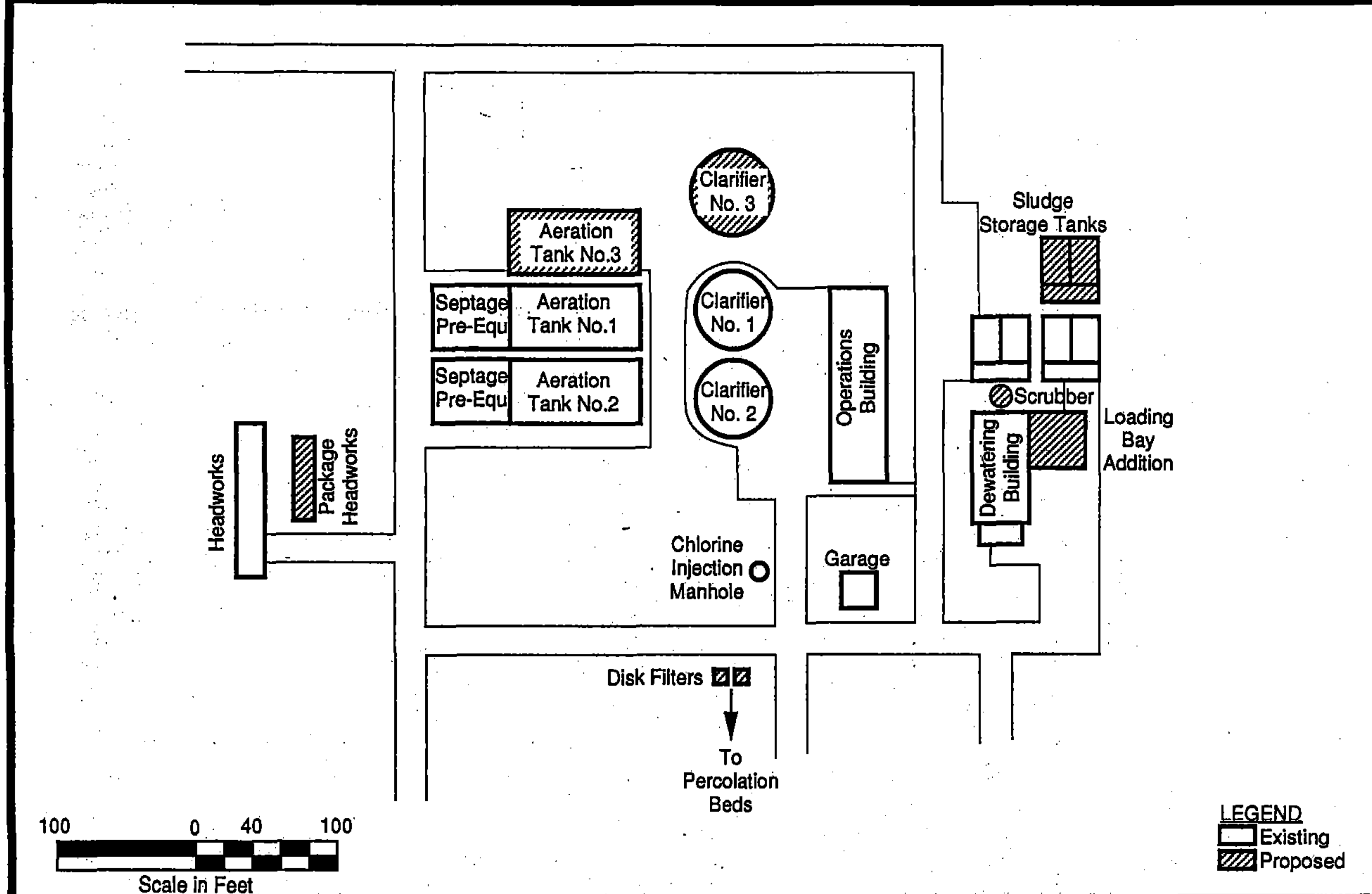
Figure 6-1

CDM Camp Dresser & McKee

Existing System Analysis **(continued)**

- Future WWTP
  - Two Options: with or without Biological Nutrient Removal (BNR)
  - Four possible WWTP upgrades:
    - No BNR
    - 3 Possible Levels of BNR
  - Least Costly: No BNR [Minimum Upgrade]
  - Upgrade Costs

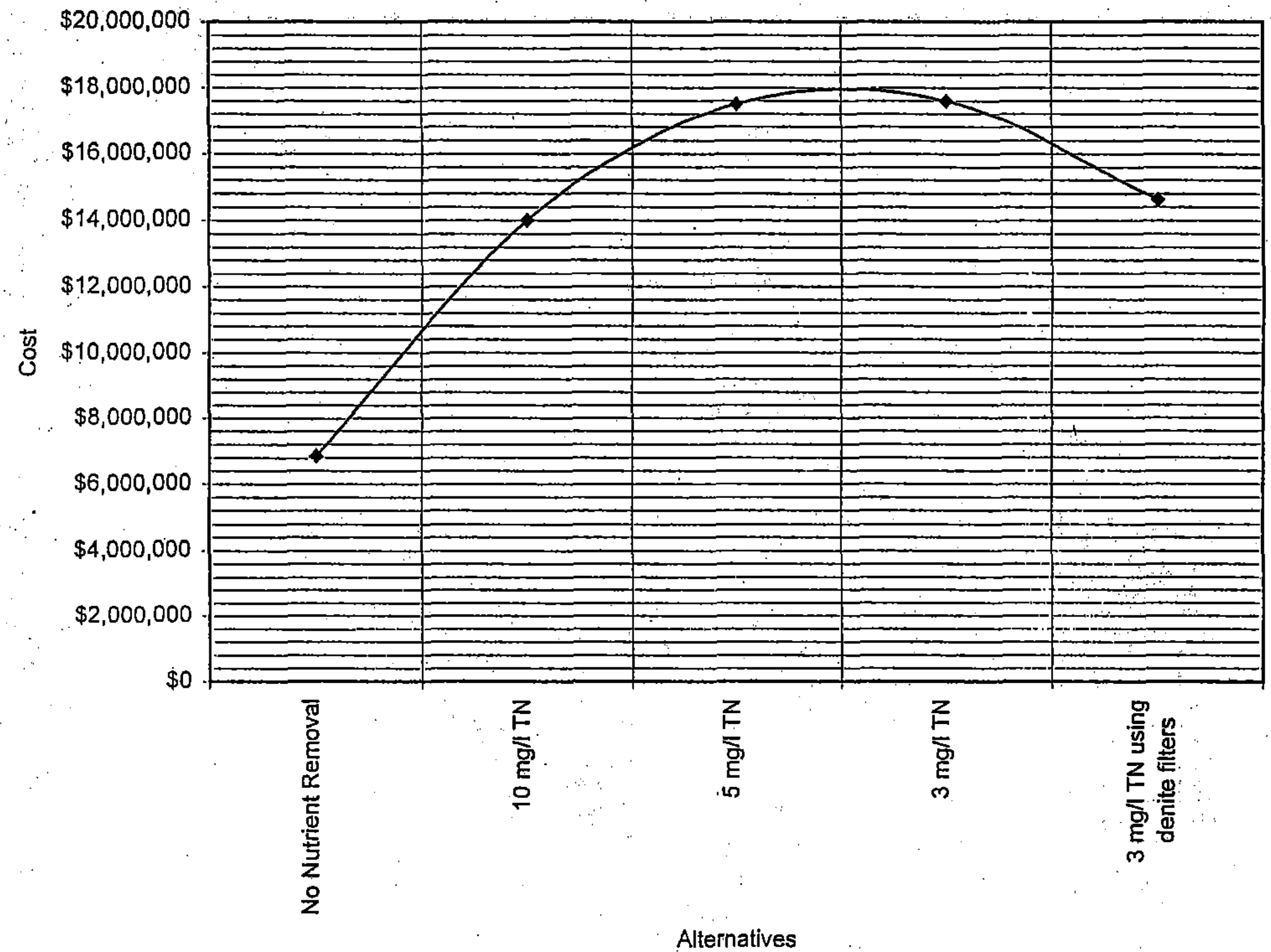
CDM



Town of Wareham, Massachusetts
Wastewater Facilities Plan
Recommended Plan
Figure 6-3

CDM Camp Dresser & McKee

Figure 6-2
Present Worth Cost of Liquid Train Upgrade



What's Next

- Incorporate Public Meeting Comments into Facilities Plan.
- Submit to DEP.
- Obtain DEP Comments.
- Address and Incorporate DEP Comments.
- Release Final Draft Report.
- Schedule Public Hearing.
- Incorporate Hearing Comments into Draft.
- Release Final Report.

CDM

First Public Information Meeting Responsiveness Summary

Wareham, Massachusetts
Wastewater Facilities Plan
First Public Information Meeting
Responsiveness Summary

1. How many areas are to be sewered based on this report and how were these areas identified?

   - There are 12 areas that this facilities plan focused on. These areas were delineated prior to the start of this facilities planning effort. The areas were not selected as part of this report, rather, they were selected by a combination of sources. The 1986 Facilities Plan, prepared by another consultant, identified 13 areas. Of these 13 areas, 6 were built, 4 were dropped in priority, and 3 were carried into this report. Both the Board of Health and Department of Environmental Protection were involved in determining the 12 areas studied by this report.

2. What is this cost of moving from conventional secondary treatment to tertiary treatment?

   - The lowest level of nutrient removal (limit effluent to maximum of 10 mg/l of total nitrogen) would result in a capital cost of about $7 million dollars. If the maximum total nitrogen level was lowered to 3 or 5 mg/l, the cost would rise to about $14 million dollars.

3. Does the existing collection system have adequate capacity for present and future flows.

   - Yes, both the sewers and pumping stations impacted by the 12 areas have adequate capacity to handle existing plus future flows from the 12 areas.

4. How will the capital costs be financed?

   - Historically, it has been the town's policy to handle capital costs of sewer improvements with sewer rates. Capital improvements for septage are handled with septage fees. There have been no changes in the tax rate as a result of capital improvements at the water pollution control facility (WPCF).

5. What is the WPCF policy for handling sludge now and in the future?

   - Right now sludge is hauled off-site in liquid form, meaning minimal treatment (thickening) of the sludge is performed at the WPCF. It is difficult to predict exactly what the WPCF will do with sludge in the future. If prices remain similar (between liquid and dewatered cake disposal), then liquid disposal will likely continue. If dewatered cake disposal becomes more attractive, then the existing dewatering equipment will be upgraded to belt filter presses, an addition will be built onto the dewatering building for filling and storing containers, and a new odor control system would be installed.

6. What do the percolation beds do and if they have to be expanded, is there enough room or does the town need to purchase land?

   - The percolation beds are merely filters. They filter out solids prior to discharging the effluent to the Agawam River. The percolation beds will have to be expanded, but not with additional beds. Disk filters are proposed. These filters take only a fraction of the space that a percolation bed requires and are more efficient. Because of the disk filters, no additional land would need to be purchased.

Final Public Hearing

Legal Notices

Legal Notices Legal Notices Legal Notices Legal Notices Legal Notices Legal Notices Legal Notices

Public Hearings

TOWN OF WAREHAM ZONING BOARD OF APPEALS NOTICE OF PUBLIC HEARING

The Zoning Board of Appeals will hold a public hearing on **November 28, 2001, at 7:30 P.M., at the Multi-Service Center, Room 307, 48 Marion Road, Wareham, MA**, to consider Petition #68-01, for the issuance of a Variance/Special Permit to Kenneth Nelson, 19 Stonehill Road, North Attleboro, MA 02760, to construct an addition located on Assessor's Map 5, Lot A, 4 Shanley Way, Onset, MA. A Variance/Special Permit is required uner Wareham Zoning By-Laws, Article IV, Dimensional Regulations, Table 3: R-43 District and Article VII, Section A, Non-Conforming Uses.

Kenneth R. Ferreira, R.P.E., R.L.S., Chairman
November 1, 8

WAREHAM FIRE DISTRICT NOTICE OF PUBLIC HEARING

In accordance with the Massachusetts General Laws, Chapter 40, Section 56, the Wareham Fire District Prudential Committee will conduct a public hearing on Wednesday, November 21, 2001 at 7:15 P.M., in the Wareham Fire District Office, 2550 Cranberry Highway, Wareham, MA to receive public input relative to their decision regarding the determination of the fiscal year 2002 residential factor. The residential factor determines the allocation of the real and personal property tax burden between various classes of property. Oral and written information on the views of the taxpayers of the District with respect to this matter will be received and considered up until the evening of the hearing, November 21, 2001. Comments may be sent by mail to the Wareham Fire District Office, c/o George T. Barrett, Chairman, 2550 Cranberry Highway, Wareham, MA 02571. All comments received before the hearing will be read into the record at the hearing. Oral presentations may be made at the hearing.

WAREHAM FIRE DISTRICT PRUDENTIAL COMMITTEE
George T. Barrett, Chairperson
R. Renee Fernandes-Abbott
Courtney W. DeBlois
James R. Gilbert
Richard S. Sleightholm
November 1

ONSET FIRE DISTRICT NOTICE OF PUBLIC HEARING

In accordance with the Massachusetts General Laws, Chapter 40, Section 56, the Onset Fire District Prudential Committee will conduct a public hearing on Thursday, November 15, 2001 at 9:30 A.M., in the Onset Fire District Office, 240 Onset Avenue, Onset, MA to receive public input relative to their decision regarding the determination of the fiscal year 2002 residential factor. The residential factor determines the allocation of the real and personal property tax burden between various classes of property. Oral and written information on the views of the taxpayers of the District with respect to this matter will be received and considered up until the morning of the hearing, November 15, 2001. Comments may be sent by mail to the Onset Fire District Office, c/o Jovina Dean, Chairman, 240 Onset Avenue, P.O. Box 44, Onset, MA 02558. All comments received before the hearing will be read into the record at the hearing. Oral presentations may be made at the hearing.

ONSET FIRE DISTRICT PRUDENTIAL COMMITTEE
Jovina Dean, Chairperson
Lionel Lacasse
Mary McCoy
November 1

TOWN OF WAREHAM BOARD OF SEWER COMMISSIONERS NOTICE OF PUBLIC HEARING

Comprehensive Wastewater Management Plan
Tuesday, December 4, 2001, 7:05 PM
Room 320, Multi Service Center, 48 Marion Road, Wareham, Massachusetts 02571

The Town's engineering consultant will present the Town of Wareham's Comprehensive Wastewater Management Plan (October 2001). The Board of Sewer Commissioners will solicit comments and testimony from the public. All are invited to attend.

Town of Wareham, Massachusetts Board of Sewer Commissioners
November 1 & 22

Bids

TOWN OF WAREHAM Legal Notice to Bidders INVITATION TO BID

SEALED BIDS for the purchase and delivery of One (1) new 2002 24' Hardtop Cuddy Cabin Commercial Vessel and Two (2) 2002 Outboard Motors shall be received on behalf of the Awarding Authority, the Town Administrator. Bids shall be received at the Office of Procurement, Memorial Town Hall, 54 Marion Road, Wareham, MA 02571, until 2:00 P.M. o'clock, on Thursday, November 15, 2001 and at that time and place be publicly opened and read. Phone calls, telegrams, postmarks, etc. shall not be considered. Bids not submitted on original bid forms shall be deemed non-responsive. Bid submissions must be made in a sealed envelope clearly marked "Boat and Motors - 2:00 P.M., November 15, 2001." The Town of Wareham assumes no liability for bids mistakenly opened due to improperly labeled envelopes and will return same to bidder without notice.

Specifications may be obtained from the Office of the Procurement at the above address on or after 10:00 a.m. on Thursday, November 1, 2001.

The Town of Wareham reserves the right to reject any and all bids, in whole or in part, and to make awards in a manner deemed in the best interest of the Town as provided by M.G.L.

The Town of Wareham is an Equal Opportunity Employer. Bids from Women and Minority Business Enterprises are strongly encouraged.

Kathy A. Corradi
Purchasing Administrator
November 1

TOWN OF WAREHAM Legal Notice REQUEST FOR PROPOSALS

SEALED PROPOSALS for the purchase and delivery of ONE USED 1997 OR 1998 77 PASSENGER, STANDARD TYPE D, SCHOOL BUS shall be received at the Office of Procurement, on behalf of the Awarding Authority, the School Committee, Memorial Town Hall, 54 Marion Road, Wareham, MA 02571, until 3:00 p.m., Thursday, November 15, 2001, and at that time and place be opened. Proposals will not be publicly opened. Phone calls, telegrams, postmarks, etc. shall not be considered. Proposals must be submitted in TWO (2) sealed envelopes: one clearly marked **"Non-Price Submission - Used School Bus"** and the second clearly marked **"Price Submission - Used School Bus"**. The Town of Wareham assumes no liability for proposals mistakenly opened due to improperly labeled envelopes and will return same to proposer without notice.

Specifications may be obtained from the Office of the Procurement at the above address on or after 10:00 a.m., Thursday, November 1, 2001.

The Town of Wareham reserves the right to reject any and all proposals, in whole or in part, and to make awards in a manner deemed in the best interest of the Town as provided by M.G.L.

The Town of Wareham is an Equal Opportunity Employer. Proposals from Women and Minority Business Enterprises are strongly encouraged.

Kathy A. Corradi
Purchasing Administrator
November 1

Announcements

COMMONWEALTH OF MASSACHUSETTS PLYMOUTH, SS

WAREHAM, MASSACHUSETTS

WARRANT OF THE WAREHAM FIRE DISTRICT SPECIAL MEETING

To the Constables of the Town of Wareham:

Greetings:

In the name of the Commonwealth of Massachusetts, you are hereby directed to notify and warn the legal voters of the Wareham Fire District, Wareham, Massachusetts, qualified to vote in Fire District affairs to meet in the Wareham Free Library, 59 Marion Road, Wareham, Massachusetts on Monday, November 5, 2001 at seven o'clock p.m. to act on the following articles:

ARTICLE 1.

To choose by ballot a moderator to preside at said meeting.

Inserted by the Prudential Committee: 4-0-0

ARTICLE 2.

To see if the District will vote to raise and appropriate or transfer the sum of $35,000.00 to establish a fund for the taking of necessary easements, and the installation of a water main, hydrant, valves, and curb stops on Gauvin Street. Said amount shall include the costs for design, survey, permits, easements, materials, equipment, labor, and previously installed improvements to make water available to residents on Gauvin Street.

Explanation: This betterment is by petition of a majority of the property owners on Gauvin Street. Said petition was accepted by the Board of Water Commissioners April 26, 2000. Costs associated with this betterment shall be recovered by the District per the provisions of MGL 80.

Inserted by the Board of Water Commissioners
Prudential Committee Vote: 4-0-0

ARTICLE 3.

To see if the District will vote to raise and appropriate or transfer the sum of $55,000.00 to be added to Article 14 of the Warrant dated April 10, 2000. Said amount shall include $30,000.00 to be used for the replacement of the water main between Main Street and Tower Terrace, and $25,000.00 to establish a contingency fund for the Route 6/Main Street water main replacement project.

Explanation - Main Street to Tower Terrace Improvement: This work was intended to be part of the original warrant, but was not included in the plans and specifications to which the District received bids. As such, this article is placed on this warrant for the following reasons:

• The existing water line to Tower Terrace off Main Street contributes to water quality problems in the service area.

• The existing water main is unlined cast iron pipe installed in 1907.

• The existing line once served a standpipe, hydrant, and several connections which are no longer active and represent potential sources for contamination or leakage.

• The existing line transgresses private property.

The amount shall include the costs for design, survey, permit, easements, materials, equipment, and labor to install the water main within the public right-of-way, and to decommission the existing main which transgresses private property.

Explanation - Route 6/Main Street Contingency: The bids received for the RT 6/Main St. Water Main Replacement Project exceeded the authorized warrant amount by $299,808; the scope of work for the project was subsequently reduced by $312,397. However, even with the reduced scope of work, no funds are available to meet unanticipated expenses. This fund would only be used to fund necessary, but unanticipated expenses.

Inserted by the Board of Water Commissioners
Prudential Committee Vote: 4-0-0

ARTICLE 4.

To see if the District will vote to authorize the payment of an unpaid bill totaling $4,609.00 due to Hart Insurance Company for a debt incurred in a prior fiscal year, or to act anything thereon or thereunto.

Explanation: Coverage was included on FY02 Policy, although endorsement was not received from the insurance company until September 6, 2001.

Inserted by the Treasurer
Prudential Committee Vote: 4-0-0

Hereof fail not and make due return of the Warrant with doings thereon to the District Clerk at the time and place of said meeting.

Given into our hands at Wareham this nineteenth day of October in the year 2001.

Att. True Copy
Robert E. Short
Constable of Wareham
Prudential Committee
George T. Barrett, Chairman
James R. Gilbert, Clerk
Courtney W. DeBlois
Richard S. Sleightholm, Sr.
R. Renee Fernandes-Abbott
Oct. 25; Nov. 1

COMMONWEALTH OF MASSACHUSETTS THE TRIAL COURT PROBATE AND FAMILY COURT DEPARTMENT PLYMOUTH Division

Docket No. 01P1767-EP1

In the Estate of DOMINGA MATTHEWS ALSO KNOWN AS DOMINGA MATHEWS
Late of WAREHAM
In the County of PLYMOUTH
Date of Death June 3, 1992

NOTICE OF PETITION FOR PROBATE OF WILL

To all persons interested in the above captioned estate, a petition has been presented praying that the copy of will of said decedent be proved and allowed, and that MARY MATTHEWS DEPINA of MARION in the County of PLYMOUTH be appointed executrix, named in the will to serve without surety.

IF YOU DESIRE TO OBJECT THERETO, YOU OR YOUR ATTORNEY MUST FILE A WRITTEN APPEARANCE IN SAID COURT AT PLYMOUTH ON OR BEFORE TEN O'CLOCK IN THE FORENOON (10:00 AM) ON NOVEMBER 16, 2001.

In addition, you must file a written affidavit of objections to the petition, stating specific facts and grounds upon which the objection is based, within thirty (30) days after the return day (or such other time as the court, on motion with notice to the petitioner, may allow) in accordance with Probate Rule 16.

WITNESS, HON. CATHERINE P. SABAITIS, ESQUIRE, First Justice of said Court at PLYMOUTH this day, October 19, 2001.

ROBERT E. McCARTHY
Register of Probate
November 1

DEPARTMENT OF ENVIRONMENTAL PROTECTION WATERWAYS REGULATION PROGRAM

Notice of License Application pursuant to M.G.L. Chapter 91
Waterways License Application Number W 01-0305D
Town of Wareham

NOTIFICATION DATE: November 2, 2001

Public notice is hereby given of the Waterways application by the Town of Wareham to maintenance dredge approximately 2,060 cubic yards of material off of Onset Avenue, Onset Pier, map # 1, lot 1052B, the municipality of Wareham in and over the waters of Onset Bay. A portion of the spoils will be used as beach nourishment at an adjacent beach with the remainder to be stock piles on town facilities. The proposed project has been determined to be water-dependent.

The Department will consider all written comments on this Waterways application received by within 15 days subsequent to the "Notification Date". Failure of any aggrieved person or group of ten citizens or more to submit written comments to the Waterways Regulation Program by the Public Comments Deadline will result in the waiver of any right to an adjudicatory hearing in accordance with 310 CMR 9.13(4)(c).

Additional information regarding this application may be obtained by contacting the Waterways Regulation Program at (508) 946-2734. Project plans and documents for this application are on file with the Waterways Regulation Program for public viewing, by appointment only, at the address below.

Written comments must be addressed to: Mitch Ziencina, Environmental Analyst, DEP Wetlands and Waterways Program, 20 Riverside Drive, Lakeville, MA 02347.

November 1

MORTGAGEE'S NOTICE OF SALE OF REAL ESTATE

Premises:
25 Windsor Drive
Wareham, Massachusetts

By virtue and in execution of the Power of Sale contained in a certain mortgage given by **Peter Lydon and Patricia Lydon to The First National Bank of Boston** dated July 31, 1996 and recorded with Plymouth County Registry of Deeds in Book 14550, Page 174, of which mortgage the undersigned is the present holder, for breach of the conditions of said mortgage and for the purpose of foreclosing the same will be sold at Public Auction on the 30th day of November, 2001, A.D. at 11:00 A.M. at or upon the mortgaged premises, 25 Windsor Drive, Wareham, Massachusetts, as described below, being all and singular the premises described in said mortgage,

To wit:

the land together with the buildings thereon, situated in Wareham, Plymouth County, Massachusetts, bounded and described as follows:

NORTHERLY by land now or formerly of David B. Mann, as shown on a plan hereinafter referred to, one hundred fifty (150.00) feet;

EASTERLY by Lot #70 as shown on said plan, one hundred sixty-seven and 44/100 (167.44) feet;

SOUTHERLY by Windsor Drive as shown on said plan, in two (2) courses measuring one hundred one and 92/100 (101.92) feet and a curved line having a radius of 200.00 feet and a distance of fifty-five and 97/100 (55.97) feet;

WESTERLY by lot No. 68 as shown on said plan, one hundred forty-seven and 13/100 (147.13) feet.

Meaning and intending to convey Lot No. 69 (House No. 25) Windsor Drive, containing 22,402 square feet, more or less as shown on a plan of land of Linwood Estates, Inc., said plan formerly entitled "Subdivision of Land known as Melwood, owned by Henry L. and Jayne A. Cerkovitz, between Hathaway St. and Marion Rd., Wareham, MA, Scale 1" = 100', September 22, 1971, Walter E. Rowley & Associates, Inc. West Wareham, MA" which plan is duly recorded Plymouth County Registry of Deeds at Plan Book 16, Page 407.

Together with all rights, privileges and easements connected therewith and subject to restrictions and easements of record and are hereby conveyed subject to any building and zoning law requirements which may be in force and applicable.

TERMS OF SALE: Said premises will be sold and conveyed subject to all outstanding municipal or other public taxes, tax titles, assessments, liens or claims in the nature of liens, rights of tenants and parties in possession, and existing encumbrances of record, if any, which take precedence over the said mortgage above described.

FIVE THOUSAND DOLLARS and NO/100 ($5,000.00) must be paid by certified, bank, treasurer's or cashier's check at the time and place of the sale by the purchaser as a deposit. The balance of the purchase price is to be paid in cash, or by certified check, bank cashier's check or bank treasurer's check within 30 days thereafter at the Law Offices of Shapiro & Kreisman, Chiswick Park, 490 Boston Post Road, Sudbury, MA 01776 (978) 443-8800. The description for the premises contained in said mortgage shall control in the event of a typographical error in this publication.

Other terms to be announced at the sale.

Fleet National Bank
successor by merger
to BankBoston, N.A.,
PRESENT HOLDER OF SAID MORTGAGE
November 1, 8, 15

NOTICE OF MORTGAGEE'S SALE OF REAL ESTATE

By virtue and in execution of the Power of Sale contained in a certain mortgage given by **Linda J. Dauphinais** to **First Trust Financial, Inc.**, dated December 9, 1998 and recorded with the Plymouth County Registry of Deeds at Book 16930, Page 257, of which mortgage **Wells Fargo Bank Minnesota NA, as Trustee for Delta Funding Home Equity Loan Trust 1999-1** is the present holder by assignment, for breach of the conditions of said mortgage and for the purpose of foreclosing, the same will be sold at Public Auction at 2:00 p.m. on November 21, 2001, on the mortgaged premises located at 19 Indian Neck Road, Wareham, Plymouth County, Massachusetts, all and singular the premises described in said mortgage,

TO WIT:

A certain parcel of land with the structures thereon, situated in Wareham, Plymouth County, Massachusetts in that part of Wareham known as Fearings Park on the Southerly side of Great Neck Road, as shown as Lot #56A on plan of land of Thomas H. Welch and Margaret A. Welch situated in Wareham, Massachusetts, duly recorded with Plymouth County Registry of Deeds, Plan Book 6, Page 184, and bounded and described as follows:

Beginning at a bound on the Southerly side of and in line of Great Neck Road thence running Southerly by Lot #57 as shown on said plan 183.6 feet to the Northerly line of Mayflower Avenue thence running South 6 dfeg. 32' 40" East 56.7 feet to an iron bar on the corner of Mayflower Avenue, thence running North 42 deg. 20' 40" East by Mayflower Avenue 63.37 feet to a pipe thence North 62 deg. 22' 40" West by Lot #56B as shown on said plan 37.9 feet to a pipe thence running North 27 deg. 37' 20" East by lot 56B as shown on said plan 130.8 feet to the Southerly line of Great Neck Road thence turning and running Northwesterly by Great Neck Road 60.2 feet to the point of beginning.

For mortgagor's title see deed recorded with Plymouth County Registry of Deeds in Book 2455, Page 156.

These premises will be sold and conveyed subject to and with the benefit of all rights, rights of way, restrictions, easements, covenants, liens or claims in the nature of liens, improvements, public assessments, any and all unpaid taxes, tax titles, tax liens, water and sewer liens and any other municipal assessments or liens or existing encumbrances of record which are in force and are applicable, having priority over said mortgage, whether or not reference to such restrictions, easements, improvements, liens or encumbrances is made in the deed.

TERMS OF SALE:

A deposit of Five Thousand ($5,000.00) Dollars by certified or bank check will be required to be paid by the purchaser at the time and place of sale. The balance is to be paid by certified or bank check at Harmon Law Offices, P.C., 150 California Street, Newton, Massachusetts 02458, or by mail to P.O. Box 610389, Newton Highlands, Massachusetts 02461-0389, within thirty (30) days from the date of sale. Deed will be provided to purchaser for recording upon receipt in full of the purchase price. The description of the premises contained in said mortgage shall control in the event of an error in this publication.

Other terms, if any, to be announced at the sale.

WELLS FARGO BANK MINNESOTA NA, AS TRUSTEE FOR DELTA FUNDING HOME EQUITY LOAN TRUST 1999-1
Present holder of said mortgage
By its Attorneys,
HARMON LAW OFFICES, P.C.
Ernest H. Pelletier, Jr., Esquire
150 California Street
Newton, MA 02458
(617) 558-0500
Oct. 25; Nov. 1, 8

SIGN-IN SHEET

DEC 4 2001 PUBLIC HEARING
WASTEWATER FACILITIES PLAN

Dave Simmons
PATRICIA A. NIEMAN
Elizabeth [illegible]
Ruth Thompson
James Foy
John D[illegible]
ROBERT CUTONE, CDM
GERRY FURMER, CDM
BOARD OF SELECTMEN / SEWER COMMISSIONERS
MICHAEL HARTMAN, TOWN ADMINISTRATOR
L. DAVID HANLEY

CDM

Wareham's Comprehensive Wastewater Management Plan

Public Hearing

December 4, 2001

Agenda

- *Introduction*
- *Meeting Purpose*
- *Background Information*
- *Summary of Findings*
- *Financial Considerations*
- *Current Actions/Next Steps*
- *Public Comments*

CDM

Purpose of Hearing

- *Second Final Public Participation Meeting*
- *Meet Federal & State Requirements*
- *Present the Recommended Plan*
- *Provide for Public Comment*
- *Respond to Questions*
- *Review Implementation Schedule*

CDM

Project History

- *Facilities Plan originally completed by M&E in 1986.*
- *Recommended sewering 7 area of 13 areas.*
- *M&E prepared Environmental Impact Report in 1989*
- *Board of Health and DEP decided to reevaluate all Needs Areas.*
- *1995 CDM starts new Wastewater Facilities Plan (Wastewater Management Plan).*

CDM

What is a CWWMP?

- *Comprehensive Wastewater Management Plan*
  - *Plan next 20 years*
  - *Required by Mass. DEP for funding*
  - *Provide insight for long-term wastewater planning (land purchases, financial planning, etc.)*

CDM

Existing Wastewater System

- *45 miles of public sewer*
- *29 pumping stations*
- *Average Daily WPCF Flows*
  - *0.94 Million Gallons per Day (Winter) **
  - *1.08 Million Gallons per Day (Summer) **
- *WPCF receives Wareham's and Bourne's septage*

** approximately 100,000 gpd from Bourne*

CDM

Background Information

- *EPA/DEP - National Pollutant Discharge Elimination System (NPDES) Permit*
- *Receiving Water Quality*

CDM

NPDES Permit

- *NPDES permit expired September 1996*
- *WPCF operating under expired permit*
- *New permit expected in January 2002*
- *New permit will include:*
  - *Stringent total nitrogen*
  - *Stringent total phosphorus*

CDM

Receiving Water Quality

- *June 2000 Water Quality Report submitted*
  - *Nitrogen moderate effect on water quality*
  - *WPCF contributes 25% of total nitrogen*
  - *WPCF contributes 90% of phosphorus total*
  - *Phosphorus removal at WPCF reduces algal growth*

CDM

Needs Areas
(Alphabetical Order)

Needs Area	Recommended By
Agawam Beach	BOH
Beaver Dam Estates	BOH
Briarwood Beach	DEP & BOH
Cromesett Park	BOH
Linwood/Ladd Avenues	BOH
Mayflower Ridge	BOH
Oakdale	BOH
Parkwood Beach	BOH
Rose Point	DEP & BOH
Sunset Island	BOH
Tempest Knob	BOH
Weweantic Shores	DEP & BOH

CDM

Needs Area Analysis

- *Data Collection*
- *Questionnaire Survey*
- *Re-evaluated 12 Needs Areas*
- *Questionnaire Results*
- *Prioritized Listing for Sewering*
- *Estimated Project Costs*

CDM

Needs Areas
(Recommended Priority Order)

Contract	Needs Area	Capital Cost per Contract
1	Sunset Island	constructed
	Weweantic Shores	$4,237,000
2	Briarwood Beach	$1,487,000
	Beaver Dam Estates	$864,000
3	Tempest Knob	$1,256,000
	Agawam Beach	$1,763,000
4	Parkwood Beach	$3,613,000
5	Oakdale	$2,951,000
6	Cromesett Park	$1,744,000
7	Rose Point	$3,428,000
8	Linwood/Ladd Avenue	$688,000
	Mayflower Ridge	$1,370,000
	TOTAL	**$23,401,000**

CDM

Evaluation of Existing System

- *Existing Sewers and Pumping Stations*
  - *Adequate capacity for next 20 years*
- *Existing WPCF*
  - *Parts of existing WPCF near its capacity*
  - *Will not meet new NPDES permit limits*
  - *WPCF Upgrade required*

CDM

WPCF Upgrade

- *Four biological nutrient removal treatment schemes evaluated.*
  - *MLE Process reduce to 10 mg/l TN*
  - *Bardenpho Process reduce to 5 mg/l TN*
  - *Bardenpho Process reduce to 3 mg/l TN*
  - *MLE w/ Denitrificatrion Filters reduce to 3 mg/l TN*
- *MLE Process with Denitrification Filters recommended treatment scheme*
  - *most cost effective*
  - *adapts well to current WPCF*
  - *adaptable to future more stringent levels of TN*

CDM

WPCF Upgrade

- *Headworks*
- *Septage Receiving Plant*
- *Equalization basins*
- *Two anoxic selectors*
- *Aeration tank*
- *Clarifier*
- *Mod. of existing buildings/structures*
- *Odor control systems*
- *Filter/blower and UV disinfection process building*
- *Three denitrifying filters*
- *UV disinfection system*
- *Gravity belt thickener*
- *Chemical storage & feed systems*
- *New administration building*

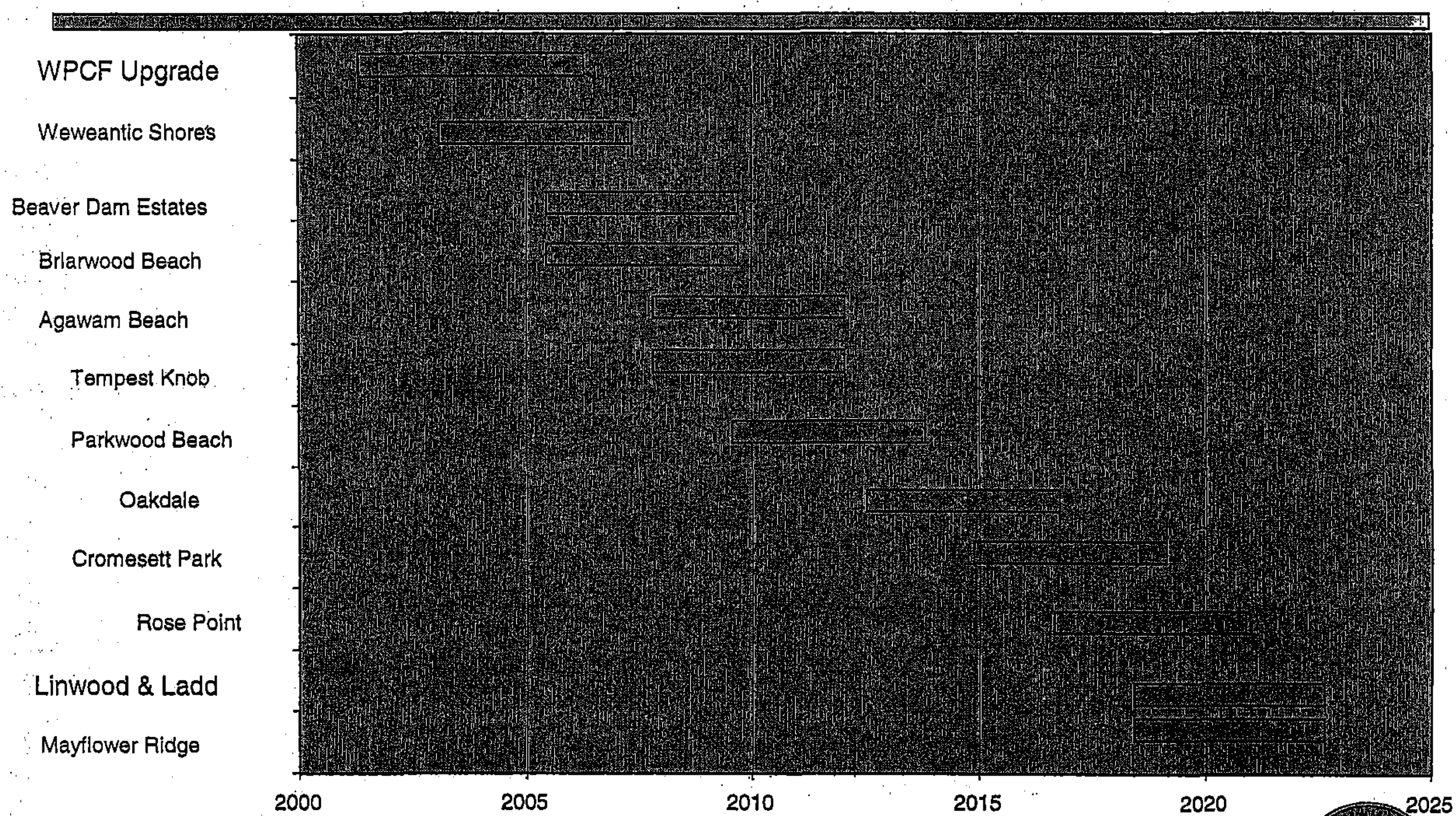
CDM

WPCF Flows and Loads

	Present Winter (2000)	Present Summer (2000)	Future Winter (2020)	Future Summer (2020)
Wastewater Flow (mgd)				
Average	0.94	1.08	1.42	1.56
Maximum month	1.47	1.31	2.23	1.89
Maximum month peaking factor	1.6	1.2	1.6	1.2
Maximum day	2.04	2.41	3.08	3.48
Maximum day peaking factor	2.2	2.2	2.2	2.2
Peak hour	3.58	4.08	5.12	5.39
Peak hour peaking factor	3.8	3.8	3.6	3.5
Wastewater BOD (lb/day)				
Average	2180	3000	3640	4270
Maximum day	4,420	4,420	7,020	7,020
Maximum day peaking factor	2.0	1.5	1.9	1.6
Wastewater TSS (lb/day)				
Average	1220	1610	1980	2300
Maximum day	3,420	3,420	5,350	5,350
Maximum day peaking factor	2.8	2.1	2.7	2.3

CDM

Implementation Schedule



CDM

Financial Impacts

- *WPCF Upgrade Project*
  - *Wareham pays 72%*
  - *Bourne pays 18%*
- *Outside Funding Sources*
  - *State Revolving Fund Loan (SRF)*
  - *Other Federal & State Grants*
- *Impact to Ratepayers*
  - *Rate increase due to WPCF Upgrade*
  - *Sewer project betterments*

CDM

Impact to Ratepayers

- *Sewer rates will increase due to additional debt service and O&M expenses*
  - *Year 2003: $268*
  - *Year 2006: $413*
  - *Year 2013: $465*

- *Assumes New Users Through Sewer Expansion*
  - *New project every 2.5 years*
  - *Assumes growth in existing users*

- *SRF 0% Interest Loan for WPCF Upgrade*

- *Sewer projects debt Service*
  - *Costs recovered through betterments*

CDM

Next Steps

- *Bid and Award WPCF Upgrade: Spring 2002*
- *Apply for SRF Loan for future sewer project(s)*
- *Finish design of Weweantic Shores sewers (January 2002)*
- *Bid and Award Weweantic Shores construction contract*

CDM

Questions and Public Comments

CDM

Appendix G

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON MA 02108 (617) 292-5500

RECEIVED
MAR 10 1997
TOWN OF WAREHAM
BD OF SELECTMEN

WILLIAM F. WELD
Governor

ARGEO PAUL CELLUCCI
Lt. Governor

TRUDY COXE
Secretary

DAVID B. STRUHS
Commissioner

February 24, 1997

Mary Jane Pillsbury, Chairman
Board of Selectmen
54 Marion Road
Wareham, MA 02571

Re: Wareham
20-1001-01
Supplemental Facilities
Planning - Phase II
Project Approval Certificate
No. 95-31 (Revised)

Dear Ms. Pillsbury:

The Division of Municipal Services is pleased to inform you that the revised Project Approval Certificate for the above-referenced project has been signed and forwarded to the Massachusetts Water Pollution Abatement Trust (the "Trust"). The attached copy of your executed revised Project Approval Certificate allows you to proceed with your project without loss of potential eligibility in accordance with the provisions of 310 CMR 41.13.

The Trust will now conduct an analysis of the financial information contained in your application. Loan commitments will then be made to you by the Trust, pending an affirmative vote from the Board of Trustees. The process of finalizing the actual loan agreements will begin once the commitments have been executed.

Please refer to Exhibit B contained in your Project Approval Certificate. Exhibit B contains the schedule for the project.

Funding for additional phases to complete this project should be requested for continuation on the FY '98 Priority List.

We look forward to working with you. Should any issues or questions arise, particularly as they relate to scheduling, please contact Robert M. Cady, of this office at (617) 292-5713.

Sincerely,

Andrew Gottlieb, Director
Division of Municipal Services

AG/RMC/nm
Attachment: Project Approval Certificate
cc: Scot Butcher, MWPAT w/attachment
Wareham Town Administrator, Joseph F. Murphy, Jr.
Camp Dresser & McKee, Attn: John Gall

COPY TO: BOS
MM. Dir.

DATE: 3/10/97

Certificate No. 95-31 New ____ Revision No./Date 1 - 2/4/97

DEPARTMENT OF ENVIRONMENTAL PROTECTION
WATER POLLUTION ABATEMENT REVOLVING LOAN PROGRAM

PROJECT APPROVAL CERTIFICATE

A. PROJECT DESCRIPTION

1. Applicant: Town of Wareham
2. Address: 54 Marion Road, Wareham, MA 02571
3. Project Contact: Joseph F.Murphy,Jr. Phone: 508-291-3100
4. Reviewer: Charles H. Campbell
5. Project Number: 20-1001-01 Description: Preparation of Supplemental Facilities Planning Project - Phase II
6. Federal Eligible Project: Y X N ____
7. Equivalency Project: Y ____ N X

B. APPROVED LOAN FUNDING

1. Project Costs:

a)	Eligible Costs:	$ 208,738.
b)	Ineligible Costs (Not to exceed 15% of Eligible Project Costs):	$ 0.
c)	Total Approved Costs:	$ 208,738.

2. Financial Assistance (Eligible Costs Only):

	Grant Equivalency Level
Base Level:	25 %
Additional Authorized Financial Assistance	25 %
Total Financial Assistance:	50 %

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON MA 02108 (617) 292-5500

WILLIAM F. WELD
Governor

ARGEO PAUL CELLUCCI
Lt. Governor

TRUDY COXE
Secretary

DAVID B. STRUHS
Commissioner

November 4, 1996

Mr. Joseph Murphy, Jr.
Town Administrator
54 Marion Road
Wareham, MA 02571

Re: Wareham
Supplemental Wastewater
Management Plan
BMF-20-1001-01

Dear Mr. Murphy:

The Bureau of Resource Protection (BRP), Division of Municipal Services (DMS), of the Department of Environmental Protection (DEP) has reviewed, at the request of the town's consultants, the draft sections 3, 4, and 6 of the supplemental wastewater management plan; the draft scope of Phase II of the plan; and the draft of the nitrogen loading analysis. The following are our comments on each of these items:

Draft Sections 3, 4, and 6:

Section 3:

(1) In general, we agree with the analysis provided in this section, but we have compared these flows and loads projections with those presented in the previous facilities plan, and there are some significant differences that should be addressed in the refinement during Phase II. These flows and loads are, in general, much lower than those presented previously, and there should be a more detailed comparison between the two and an explanation of why the current updated estimates are reasonable and accurate.

(2) The monthly flow figure (Figure 3-3) shows a high flow for January of 1995 of approximately 1.4 mgd. This flow does not seem to match up with the narrative discussion of flows, particularly I/I, in Section 3.4. Please clarify this during the refinement of the section during Phase II.

Section 4:

We had previously asked that four areas be addressed as part of the supplemental planning effort, and only three of these are listed among the twelve study areas in Table 4-1. The Muddy River area should be added to this list.

Section 6:

The analysis presented in this section is preliminary, and will be refined in the next phase of the planning, but we also have noted the significant differences between some of the process criteria shown here and the design criteria proposed in the previous facilities plan, and there should be a comparison and explanation of these differences provided during the Phase II work.

Phase II Draft Scope:

The scope of work for Phase II is acceptable, provided that the following concerns are addressed during the rest of the wastewater management planning effort:

(1) The wastewater management plan should be developed, organized, and presented in accordance with the Guide to Comprehensive Wastewater Management Planning (January, 1996) that the Department has developed. The Phase II scope contains the basic elements that are described in this guidance document, but the organization and presentation should be done in accordance with the Guide.

(2) Because the nitrogen loading issue is of significant concern, the town's consultants should specifically analyze alternatives for nitrogen reduction at the wastewater treatment plant. The various regulatory agencies will work with the town and their consultants during Phase II to discuss the different scenarios for nitrogen removal that may be appropriate to consider.

(3) The analysis of treatment plant alternatives should demonstrate how the current loading limits for BOD and TSS in the NPDES permit would be able to be met, and what, if any, treatment process improvements would be required.

(4) Based on discussions with the MEPA office, our recommendation is that the town file an ENF for the remainder of the wastewater management planning with MEPA so that a joint wastewater plan and EIR can be developed and reviewed in a streamlined manner. The Secretary's Certificate on the Final EIR for the previous wastewater plan requires a new ENF filing and indicates that it is probable that a supplemental EIR may be required to respond to the water quality issues. Since that time, we and the MEPA office have found that developing a joint wastewater planning and EIR process is the most efficient manner in which to proceed for such projects.

Nitrogen Loading Analysis:

The Department is currently reviewing the draft nitrogen loading analysis in conjunction with staff of EPA and CZM, but has not completed that review. We will be arranging a meeting in the near future to discuss the analysis and its implications with the town and CDM. As indicated in our comment above, the Phase II work should proceed, and we will be having a continuing discussion in regard to the nitrogen issue as the wastewater planning proceeds.

If you have any questions regarding these comments, please contact Ron Lyberger of my staff.

Sincerely yours,

Glenn Haas,
Deputy Asst. Commissioner

cc: Robert Cutone, CDM
Robert Mackie, CDM
Paul Taurasi, DEP-SERO
Dave Johnston, DEP-SERO
Robert Fagan, DEP-SERO
Jeff Gould, DEP-SERO
Rick Zeroka, CZM
David Janik, CZM
Dave Pincumbe, EPA
Bruce Rosinoff, EPA
Dick Foster, MEPA

CDM Camp Dresser & McKee Inc.

environmental services

Ten Cambridge Center
Cambridge, Massachusetts 02142
Tel: 617 252-8000 Fax: 617 621-2565

October 2, 1996

Mr. Robert Cady
Bureau of Resource Protection
One Winter Street
Boston, Massachusetts 02108

Subject: Wareham, Massachusetts

Dear Mr. Cady:

As you know, we have completed Phase I of the Town of Wareham Facilities Planning Study, delivered to your office in December 1995. The town is very anxious to continue and complete this project. In response to their request we are submitting the scope of work for Phase II of the study for your review. Please review this document at your earliest convenience. Should you have any questions or require any additional information, please contact me at your earliest convenience.

Very truly yours,

CAMP DRESSER & McKEE INC.

Robert A. Cutone
Senior Vice President

RAC/dmd

Enclosure

cc: Mr. Paul Taurasi, DEP, Southeast Region
Mr. Joseph Murphy, Wareham
Mr. Mark Gifford, Wareham
Mr. Robert Mackie, CDM

501-GG-RACBD

Task 3—Alternatives Evaluation

The purpose of this task is to determine the most feasible method(s) for wastewater disposal in the 11 areas listed below:

- Agawam Beach
- Briarwood Beach
- Linwood/Ladd Avenues
- Oakdale
- Rose Point
- Weweantic Shores
- Beaver Dam Estates
- Cromesett Park
- Mayflower Ridge
- Parkwood Beach
- Sunset Island

3.1 Evaluate the feasibility of the following alternatives in each of the 11 areas:

- Pressure Sewers
- Step Systems
- Gravity Sewers

3.2 Recommend an alternative for each area.

Task 4—Sewerage System Expansion Program

The purpose of this task is to develop a comprehensive sewerage plan for those areas recommended in Task 3.

4.1 Delineate the location and size of the proposed facilities (sewers, force mains, pumping stations, etc.) for each area recommended.

4.2 Create sewer maps showing location and size of proposed facilities.

Task 5—Phasing of Sewer System Improvements

The objective of this task is to develop an implementation plan for sewering the areas recommended under Task 3.

5.1 Develop ranking criteria based on the following:

- Existing Septic System Problems
- Public Health Impacts
- Environmental Impacts
- Soil Limitations
- Desire to Sewer
- Proximity to the Existing Sewer System

- Construction Cost per Property Served
- Population Density

5.2 Develop a construction phasing plan based on the ranking determined in Task 5.1, availability of funds, and town input.

Task 6—Water Pollution Control Facility (WPCF) Evaluation

The purpose of this task is to assess the impact of future flows and loads from the comprehensive sewerage expansion program, Bourne (Mass Maritime), and Environmental Protection Agency (EPA) 503 sludge regulations on the WPCF.

6.1 Update the WPCF capacity analysis in the *1989 Environmental Impact Report (EIR)* prepared by Metcalf & Eddy, Inc. to address the additional flow from the recommended expansion areas.

6.2 Examine the capacity of existing unit processes, identify needs, and recommend improvements.

6.3 Provide a site plan showing required modifications and preliminary design criteria

6.4 Conduct a separate capacity analysis to evaluate the potential impact of expanding service to accommodate Mass Maritime in Bourne.

6.5 Evaluate EPA 503 sludge regulations and review "on-going" sludge studies to determine required improvements.

6.6 Evaluate impacts associated with National Pollutant Discharge Elimination System (NPDES) permit renewal, meet with the Department of Environmental Protection (DEP) and EPA to determine anticipated limit modifications, and estimate plant impacts of such modifications.

6.7 Provide a construction schedule for recommended improvements which incorporates sewer expansion phasing.

Task 7—Cost Estimates

7.1 Develop capital and operations and maintenance cost estimates for all proposed facilities (comprehensive sewerage expansion plan and WPCF) and coordinate with the construction schedule to provide a cash flow overview for the recommended program.

Task 8—Financial Affordability Analysis and Implementation Plan

8.1 Establish an implementation schedule for proposed WPCF treatment improvements and collection system expansion and develop the cost of wastewater service to the Wareham ratepayer while considering fiscal improvements of the project, the *EPA's Financial Capability Guidebook*, and town input.

8.2 Provide information related to sewer systems and treatment improvements including:

- Permit Requirements
- Construction Phasing
- Project Financing Information, Grants, Loans, and Betterments
- Construction Issues, such as traffic and access to private property

<u>Task 9—Environmental Information Document (EID)</u>

9.1 Examine each area's environmental features which may be impacted in both the short- and long-term by the recommended solutions including:

- Archeological and Historical Sites
- Coastal Zone Impacts
- Environmentally Sensitive Area
- Water Quality
- Air Quality
- Soils
- Public Impacts, such as traffic and noise
- Potential Secondary Growth Impacts

9.2 Present mitigative measure to lessen impacts, if environmental impacts are evident for the recommended solutions.

9.3 Prepare an Environmental Notification Form (ENF) for any area requiring structural solutions which are not "Exempt" under the Massachusetts Environmental Policy Act.

<u>Task 10—Public Participation Program</u>

This task provides the public with information gathered, alternatives considered, and recommendations proposed in the facilities planning study.

10.1 Conduct a basic public participation consisting of:

- One public meeting, at which information gathered on sewer needs, environmental issues, and preliminary solutions will be discussed, and

- One public hearing, at which alternatives and recommendations, cost estimates, and phasing of capital improvements will be presented.

10.2 Prepare responsiveness summaries after each public event and distribute as required.

<u>Task 11—Report</u>

11.1 Produce a draft and final report that documents the results of the above tasks.

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts 02202

MICHAEL S. DUKAKIS
GOVERNOR

JAMES S. HOYTE
SECRETARY

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ON THE ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME	: Wareham Sewer Project
PROJECT LOCATION	: Wareham
EOEA NUMBER	: 6389
PROJECT PROPONENT	: Town of Wareham
DATE NOTICED IN MONITOR	: January 12, 1987

Pursuant to the Massachusetts Environmental Policy Act (G.L. c.30, s.61-62H) and Sections 11.04 and 11.06 of the MEPA regulations (301 CMR 11.00), I hereby determine that the above project requires the preparation of an Environmental Impact Report.

The Environmental Impact Report for this project is intended to focus on the capacity of the Wareham Sewage Treatment Plant, and should not interfere with the initial priority efforts of the Town of Wareham to deal with septic problems along Cranberry Highway (Route 28) and other critical areas. Generally, the proposals to extend street sewers in 8 areas of the town should address local environmental problems associated with failing septic systems. The proposed pumping stations also appear feasible without impacting local beaches or wetlands. Because of the existing problems with septic system failures, the priority projects listed in the Facilities Plan for sewer construction may proceed immediately.

The primary unresolved issue is the capacity of the treatment plant to handle the proposed sewage loadings. Existing summer day loading of 0.6 MGD are well within the hydraulic capacity of 1.3 MGD for the plant. However, the 8 areas proposed for sewering were analysed in the 201 Draft Facilities plan, and total system loading when all 8 areas are sewered would appear to exceed 2.0 MGD. Generation of sewage sludge would also increase.

The Environmental Impact Report should be completed before total system loadings at the Wareham plant exceed 1.3 MGD.

The capacity issue for the Wareham STP is important also for neighboring communities. The Town of Bourne has pollution problems at Buzzards Bay which would be aided by connection to the new Wareham sewer line proposed for construction along Route 28. Bourne is encouraged to coordinate with and assist the Town of Wareham in assessing plant capacity in the EIR.

SCOPE

The report should be relatively brief and should summarize the key assumptions of future wastewater loadings, with special focus on the year 2000 conditions. All generation rates should be listed for summer day conditions.

The treatment plant should be described generally in terms of total STP summer day capacity, and the capacities of various components of the plant. Capacities should be described in terms of both hydraulic and pollutant loadings. Peak loadings and capacities should also be compared. Sludge disposal capacities should be assessed.

Where future capacity deficiencies are determined, appropriate mitigating responses should be identified, including both actions and official responsibilities. Reductions in infiltration/inflow and reduced water consumptions should also be discussed in terms of degree of reduction in treatment plant hydraulic loadings.

OTHER ENVIRONMENTAL ISSUES :

The Route 28 sewer line will present special challenges for the effective maintenance of traffic, including access to roadside properties. Similarly the Town of Wareham has hopes of landscaping and other visual improvements along this heavily commercial roadway.

Because traffic maintenance and landscaping are issues which must be resolved at a later stage of project design, these issues are not included within the scope for the EIR. The Towns of Wareham and Bourne are encouraged to work closely with the Massachusetts Department of Public Works and abutting landowners to maintain traffic flow, and contribute towards restoring lands disturbed by the sewer line construction, with suitable landscaping.

CIRCULATION :

The EIR should be circulated to state agencies involved (DEQE, DPW, CZM) and local officials in Wareham and Bourne (Selectmen's Office, Planning Board, and Conservation Commission). Five copies of the report should be made available to the general public, upon request.

February 11, 1987
DATE

JAMES S. HOYTE, SECRETARY

JSH/SK/bk

Appendix H

List of Abbreviations

AC	—	asbestos-cement
BOD_5	—	biochemical oxygen demand (five day, 20°C)
CFR	—	Code of Federal Regulations
cfm/ft	—	cubic feet per minute per foot
cfs	—	cubic feet per second
Cl_2	—	chlorine
COD	—	chemical oxygen demand
ft^3	—	cubic foot (feet)
yd^3	—	cubic yard(s)
diam	—	diameter
DO	—	dissolved oxygen
DEP	—	Department of Environmental Protection
DPW	—	Department of Public Works
El	—	elevation above mean sea level
ENR	—	Engineering News Record Construction Cost Index
EPA	—	Environmental Protection Agency
ft/sec	—	feet per second
ft	—	foot, feet
gal	—	gallons
gpd	—	gallons per day
gpd/in-mi	—	gallons per day per inch diameter per mile
gpd/ft^2	—	gallons per day per square foot
gpd/ac	—	gallons per day per acre
gpm	—	gallons per minute
gpm/ft^2	—	gallons per minute per square foot
hp	—	horsepower
hr	—	hour
hrs/wk	—	hours per week
I/I	—	infiltration/inflow
I/A	—	innovative and alternative
in	—	inch
in-mi	—	inch-miles
in/mo	—	inches per month
in/wk	—	inches per week
kW	—	kilowatt
lb	—	pound(s)
lb/d	—	pounds per day
$lb/ft^2/d$	—	pounds per square foot per day
lb/ac/d	—	pounds per acre per day
lb/hr	—	pounds per hour
mg/l	—	milligram per liter
mgd	—	million gallons per day

mgd/mi^2	—	million gallons per day per square mile
mi	—	mile
MG	—	million gallons
min	—	minute, minutes
MDWPC	—	Massachusetts Division of Water Pollution Control
MSL	—	mean sea level
N	—	nitrogen
NH_3-N	—	ammonia-nitrogen
NO_3-N	—	nitrite-nitrogen
NO_3-N	—	nitrate-nitrogen
NPDES	—	National Pollution Discharge Elimination System
°F	—	degrees Fahrenheit
°C	—	degrees Celsius
p	—	phosphorus
pH	—	hydrogen ion concentration
PVC	—	polyvinyl chloride
RBC	—	rotating biological contractor
RC	—	reinforced concrete
rpm	—	revolutions per minute
sec	—	second
ft^2	—	square foot
mi^2	—	square mile
SS	—	suspended solids
SSES	—	sewer system evaluation survey
swd	—	side water depth
TDH	—	total dynamic head
TKN	—	total Kjeldahl nitrogen
TS	—	total solids
TSS	—	total suspended solids
TV	—	television
µg/l	—	micrograms per liter
USGS	—	United States Geological Survey
VC	—	vitrified clay
VSS	—	volatile suspended solids
WWTF	—	wastewater treatment facility
X-Country	—	cross-country
yr	—	year

Appendix I

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
251 Causeway Street, Suite 900
Boston, MA 02114-2119

JANE SWIFT
GOVERNOR

BOB DURAND
SECRETARY

Tel. (617) 626-1000
Fax (617) 626-1181
http://www.magnet.state.ma.us/envir

August 31, 2001

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME	:	Comprehensive Wastewater Management Plan
PROJECT MUNICIPALITY	:	Wareham
PROJECT WATERSHED	:	Buzzards Bay
EOEA NUMBER	:	12562
PROJECT PROPONENT	:	Town of Wareham
DATE NOTICED IN MONITOR	:	July 25, 2001

Pursuant to the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and Section 11.03 of the MEPA regulations (301 CMR 11.00), I hereby determine that this project **requires** the preparation of an Environmental Impact Report.

This project involves the upgrading of the existing Wareham Water Pollution Control Facility (WWPCF) and the extension of sewers to serve twelve previously defined needs areas. Upgrades at the WWPCF will include increased nutrient removal, improved odor control, and a new Ultraviolet disinfection system. Full implementation of the plan will result in an increase in average flows at the WWPCF from approximately 1 million gallons per day (mgd) to approximately 1.5 mgd.

The project is subject to the Mandatory EIR provisions of the MEPA Regulations since it involves construction of more than 10 miles (22 miles) of new sewers. The Town has requested permission to accomplish the required MEPA review using the Single EIR provisions of the Regulations and has filed a Expanded ENF in support of that request. I have reviewed the Expanded ENF and I find that it meets the requirements for an Expanded ENF set forth in Section 11.06(8) of the MEPA Regulations. Consequently, I will allow the review to proceed with a Single EIR.

The Single EIR should follow the direction provided in Section 11.07 of the MEPA Regulations for form and content and shall address the following specific issues.

VELOCITY AND FLOOD ZONES

Portions of the project will include sewering of areas within velocity and flood zones, including unbuilt lots. The SEIR should carefully define those areas within velocity and flood zones and provide a description of and a commitment to implementation of by-laws to restrict development in those areas.

RESOURCE AREAS

The sewering portion of the project will occur primarily within existing public ways, but there will be a limited number of cross-country sewers. The SEIR should contain a clear definition and description of any resource areas to be affected by the project and a description of the mitigation proposed for any adverse impacts to resource areas.

EXECUTIVE ORDER #385, PLANNING FOR GROWTH

The implementation of sewering programs typically open certain lands to development that would not typically be developed in the absence of the sewers. In order to prevent uncontrolled growth resulting from installation of sewers, the SEIR should include the legal and institutional means to be used by the Town to ensure compliance with EO #385.

PROTECTION OF SHELLFISH RESOURCES

The SEIR should contain a detailed discussion of provisions to be implemented at the WWPCF to ensure the protection of shellfish resources in the Wareham River. These provisions could include wastewater storage and early warning systems for upsets at the WWPCF. The Town should consult with the Division of Marine Fisheries and the DEP, as well as local officials, during development of this information.

COMMENTS

I received a number of thoughtful and detailed comment letters on this project that address some of the issues identified above and other issues. The SEIR should provide equally detailed and thoughtful responses to the issues raised in those comment letters.

August 31, 2001
Date

Bob Durand

Comments received :

Buzzards Bay Project
Coastal Zone Management
Department of Environmental Protection
Department of Food and Agriculture
Division of Fisheries and Wildlife
Division of Marine Fisheries
Massachusetts Highway Department
Massachusetts Historical Commission
The Coalition for Buzzards Bay

BD/rf

Appendix J

EIR Distribution List

Secretary of Environmental Affairs
Executive Office of Environmental Affairs
Attn: MEPA Office
251 Causeway Street, Suite 900
Boston, MA 02114

Executive Office of Environmental Affairs
Waste Policy
251 Causeway Street, Suite 900
Boston, MA 02114

MA Department of Environmental Protection
Attn: David Murphy, Commissioner's Office
One Winter Street
Boston, MA 02108

DEP/ Southeastern Regional Office
Department of Environmental Protection
Attn: MEPA Coordinator
20 Riverside Drive
Lakeville, MA 02347

Executive Office of Transportation & Construction (EOTC)
Attn: Environmental Reviewer
10 Park Plaza, Room 3510
Boston, MA 02116-3969

Massachusetts Highway Department
Public/Private Development Unit
10 Park Plaza
Boston, MA 02116

MHD - District #5
Attn: MEPA Coordinator
Box 111
1000 County Street
Taunton, MA 02780

Massachusetts Aeronautics Commission
Attn: MEPA Coordinator
10 Park Plaza, Rm. 6620
Boston, MA 02116-3966

Massachusetts Historical Commission
The MA Archives Building
220 Morrissey Boulevard
Boston, MA 02125

Southeastern Regional Planning
& Economic Development District
88 Broadway
Taunton, MA 02780

Coastal Zone Management
Attn: Project Review Coordinator
251 Causeway Street, Suite 500
Boston, MA 02114

Division of Marine Fisheries
Attn: Environmental Reviewer
50 A Portside Drive
Pocasset, MA 02559

Department of Public Health (DPH)
Director of Environmental Health
250 Washington Street
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Appendix K

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MEPA

Buzzards Bay Project
National Estuary Program

Richard Foster, Director
MEPA Unit, EOEA
251 Causeway St., 8th Floor
Boston, MA 02114

August 22, 2001

RE: EOEA #12562 – Wastewater Facilities Plan, Environmental Notification Form; Wareham

Mr. Foster:

The Buzzards Bay Project National Estuary Program has completed its review of the above-referenced Environmental Notification Form (ENF), noticed in the Environmental Monitor dated July 25, 2001. Based upon our review of the document, and other information prepared by the Town's consultant, we recommend the preparation of an Environmental Impact Report (EIR).

The proposed project will include approximately 21.8 miles of new sewers that will serve hundreds of additional lots. As part of the project, the existing Wastewater Facility will be upgraded to address existing problems and limitations of the facility in treating and disposing of wastewater, as well as allowing for increased capacity resulting from proposed new sewer extensions. These improvements include construction of denitrifying filters, ultraviolet disinfection modules, an odor control system, a new outfall in the Agawam River, and construction of an administration building on the Wastewater Facility site.

While there are many aspects of the ENF that will need to be addressed in an EIR, and no doubt other agencies and organizations will raise these points, we wish to limit our comments to one issue where it is vital for the Town to address in it's EIR: nitrogen loading to the Wareham River Estuary.

It is worth noting that the Town of Wareham initiated the funding of a study of nitrogen loading and water quality of the Wareham and Agawam River watersheds which was completed of June 2000[1]. We commend the Town of Wareham for funding this study and showing leadership in better quantifying water quality conditions and nitrogen loading estimates in an estuary so clearly valued by Town officials and residents alike. This information complimented 9 years of water quality monitoring conducted by the Coalition for Buzzards Bay. This water quality data and information on nitrogen attenuation in the watershed will not only assist the US EPA in determining an appropriate discharge limit for the Wareham Wastewater Treatment Facility, but

[1] *Water Quality Investigation of the Wareham River Estuary Complex*, prepared Dartmouth and Camp Dresser and McKee (CDM), June 2000.

adds measurably to our understanding of how this estuary ecosystem has responded to existing nitrogen inputs.

Attached is a review of the 2000 report that was sent by the Buzzards Bay Project in December 2000 to the US Environmental Protection agency to address certain limitations within that report. Based on our review of the CDM report, we believe it is important that the EIR address these three key issues:

1) Water quality monitoring of Buzzards Bay embayments suggest that the Wareham River Estuary is among the most eutrophic estuaries in Buzzards Bay. The Buzzards Bay Project has proposed water quality standards for Buzzards Bay embayments. To achieve "good" water quality standards, we have proposed mean summertime conditions not to exceed 0.54 total nitrogen and 7 ug/l chlorophyll, and not score below 50 in the Buzzards Bay Eutrophication Index. The upper third of the Wareham and Agawam River estuary now routinely exceed these recommended limits in most years. Proposed BBP water quality standards for "Good to Excellent" water quality are more stringent. The EIR
1.1 should address what water quality conditions will be achieved with the proposed reductions in nitrogen loading to the facility, and what water quality or habitat
1.2 improvements (e.g., recovery of lost eelgrass beds, etc.) might occur as a result of reduced nitrogen discharges from the facility.
2) Based on the CDM study, existing water quality data, and potential water quality targets
1.3 such as those identified in item #1 above, the EIR should identify a specific watershed nitrogen loading target for the Wareham and Agawam River estuaries necessary to achieve at least "Good" water quality in those estuaries.
3) Finally, there is considerable growth potential in the Agawam and Wareham River
1.4 watersheds, both in the Town of Wareham, and in the adjoining Towns of Plymouth and Carver. The EIR should address to what degree nitrogen from new growth could offset improvements to the facility, and describe what strategies the Town of Wareham will
1.5 consider to achieve the watershed loading targets the Town proposes in item #2 above.

Sincerely,

Joseph E. Costa, Ph.D.

cc: David Janik, CZM Buzzards Bay Regional Coordinator/ BB Team Leader
Elizabeth Kouloheras, Section Chief, Southeast Regional Office, MA DEP
Dave Pincumb, US EPA
Camp Dresser & McKee Inc.

attachment: December 2000 letter from BBP to EPA

Buzzards Bay Project
National Estuary Program

December 19, 2000

David Pincumbe
US EPA
Boston, MA 02203

re: CDM June 2000 report on Nitrogen loading in the Wareham River watershed

Dear Mr. Pincumbe:

The Buzzards Bay Project has conducted a review of the June 2000 report titled *Water Quality Investigation of the Wareham River Estuary Complex*, prepared by Dr. Brian Howes of UMass Dartmouth and Camp Dresser and McKee (CDM). We have limited our review at this time to four areas: the validity of flushing rate estimates, nitrogen loading estimates, attenuation coefficient estimates, and application of proposed new BBP standards.

Before addressing these specific areas, we commend the authors for their important contributions in refining estimates of nitrogen loading to the Wareham River Estuary, quantifying attenuation coefficients for the upper watershed, estimating contributions from point and non-point sources of nitrogen, and for more precisely determining flushing rates of the estuary. This new data and information will not only assist the US EPA in determining an appropriate discharge limit for the Wareham Wastewater Treatment Facility, but adds measurably to our understanding of how this estuary ecosystem has responded to existing nitrogen inputs. In particular, the approach for determining an upper watershed nitrogen attenuation coefficient, although we disagree with the final estimated range, will have transferability to other large drainage basins in Buzzards Bay and southern New England. We commend the Town of Wareham for funding this study and showing leadership in better quantifying water quality conditions and nitrogen loading estimates in an estuary so clearly valued by Town officials and residents alike.

While we agree with many of the conclusions and summaries presented in the report, there are some important calculation errors and questionable assumptions that are germane in the establishment of a nitrogen discharge limit for the facility. These issues are summarized below.

Flushing rate analysis

The hydraulic residence time of an estuary is widely believed to have considerable significance to the susceptibility of an estuary to anthropogenic nitrogen inputs. That is to say, given two

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estuaries of identical volume and bathymetric profiles, the estuary with the longer hydraulic residence time is more prone to eutrophication impacts than an estuary with a shorter hydraulic turnover time. This concept is incorporated in the Buzzards Bay Project's nitrogen loading methodology. As a result, recommended nitrogen loading limits for an estuary are nearly directly inversely proportional to the hydraulic turnover time in days.[1]

While the Buzzards Bay Project specified that "hydraulic turnover time," "residence time," or "flushing rate" of an estuary be considered, no methodology was specified. This was because no single method was appropriate to all estuaries. The choice of method depended upon whether the system was a typical wedge-shaped estuary with high river flows at the head of the estuary or a coastal lagoon with low freshwater inputs. The method also depended upon other factors such as the shape and volume of the estuary, and the locus of nitrogen inputs (e.g., are they primarily from septic systems near a well-flushed mouth of a bay or from an upstream or groundwater source entering the poorly flushed portion of the upper estuary?).

The choice of a flushing rate value is so fundamental to setting a nitrogen loading limit for an estuary. Because there are a number of potential methodologies that could be used, each with inherent weaknesses when applied to the concept of nitrogen impacts in an estuary, the selection of a residence time for an estuary remains one of the most difficult decisions facing coastal managers. For these reasons also, it is important to use salinity data or dye studies to validate any flushing model adopted.

In 1998, the Buzzards Bay Project prepared a preliminary report of nitrogen loading estimates and recommended limits for the Wareham River estuary[2]. In that report, we used a preliminary estimate of 5.75 days as an approximation of flushing for the Wareham River estuary based on other studies. In the 2000 CDM report, CDM recommended the use of a lower flushing rate of 2.33 to 4.13 (56-99 hours). This estimate was based on the Ketchum fractional freshwater method for calculating "freshwater replacement time" for the upper 1/3 of the estuary. The ranges given were equivalent to the observations on two dates, one near spring tide, one near neap tide conditions. In this method, the total volume of freshwater in an estuary is calculated based on salinities, and this total volume of freshwater is divided by the estimate of daily freshwater flows from stream and groundwater discharges into the estuary. Below are our specific comments on how this method was applied to this study.

1) Freshwater replacement time methodology is acceptable

The use of "freshwater replacement time" as a proxy hydraulic turnover time of seawater in an

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[1]The use of the Vollenweider expression, makes this relationship slightly less than a simple direct proportional relationship.

[2]Costa, J. E. A Preliminary Evaluation of Nitrogen Loading and Water Quality of the Wareham River Estuary as it Relates to the Wareham Wastewater Treatment Facility. Joseph E. Costa, Ph.D., Buzzards Bay Project National Estuary Program, June 2, 1998

estuary is most valid in wedge shaped, relatively vertically well mixed riverine estuaries like the Wareham River Estuary complex. The method also seems appropriate, because most nitrogen inputs such as the sewage treatment facility and other upper watershed sources, enter the head of the estuary, like most freshwater inputs. Septic system inputs to the lower estuary probably equal less than 20% of all watershed nitrogen inputs. Thus, the modeling of freshwater inputs is also a good proxy for the modeling of nitrogen inputs to the estuary. Moreover, given the size and complexity of the estuary system, the freshwater fraction method may be one of the most reliable methodologies, and this study is the best estimate of Wareham River flushing to date. For these reasons, we do not object to the use of this methodology for the Wareham River, as long as the limitations on the application of the freshwater fraction time are understood.

2) Calculation errors resulted in underestimates freshwater replacement time
In Table 4-3 and Table 4-4, the salinities of the various segments of the estuary are reported for August 11 and September 26, 2000 respectively. Estimates of MLW volume and half-tide volume of each segment are also reported for calculating freshwater replacement time. In Table 4-4, half tide volume was correctly used in segment 1, but in segments 2 to 21, mean low water segment volume is used. Attached is the corrected Table 4-4. As shown, when half tide volume is correctly used, total system flushing rate is found to be 7.87 days, not 4.43 days as reported. This error was not made in Table 3, where half tide volumes were correctly used to obtain the 5.74 day flushing rate. Thus, the average freshwater replacement time for the two dates is 6.15 days.

In the CDM report, two contradictory boundaries for the estuary are defined. These boundary definitions have important implications for estimating flushing rates. If the whole system is defined as WASP segments 2 to 21, freshwater replacement rates for the two survey dates are 5.68 and 5.68 days respectively. If the whole system is defined as WASP segments 3 to 21, freshwater replacement rates for the two dates are 4.05 and 4.21 days respectively. The implications of these delineations are discussed in a latter section of this comment letter.

3) Calculation method incorrect for upper 1/3 of estuary, may not be applicable
The Buzzards Bay Project recommended that the residence time of water in the upper 1/3 of an estuary be used as the basis of establishing a limit. This recommendation was made in recognition that a parcel of water in the upper 1/3 of an estuary tends to remain longer in an estuary than parcels near the mouth. That is to say, the replacement time or residence time of seawater in the upper estuary is longer. Certain types of models of flushing can demonstrate this.

If it were appropriate for the freshwater fraction for the upper 1/3 of the estuary (for example, for WASP model segment 5-21 as proposed in the report), the appropriate reference salinity is outside of the last segment in the analysis. In this case, segment 4 should be used, not segment 0 as used for the whole estuary calculation. This is because with the freshwater fraction method, freshwater replacement time is measured relative to exchange of salinities outside the last segment, using this salinity as the "background" value for the calculations. If this were not the case, a reference salinity of 31 ppt should be used to evaluate the whole system flushing, because this is the offshore salinity of typical of Buzzards Bay water as noted in the report. If this salinity reference value were used, dramatically longer freshwater replacement times would be reported. For example, on August 11, a value of 28.60 was observed at the mouth of the estuary. If a 31 ppt Buzzards Bay salinity was used as a reference, the whole system freshwater replacement time would be 12.7 days, not 5.7 days as reported. This also illustrates the importance of having a good estimate of salinity just outside the last segment.

When the freshwater fraction method is correctly performed on the upper 1/3 of the estuary using segment 4 as the reference, the fresh water replacement time values are 3.00 and 3.52 days respectively for the August and September Surveys (mean= 3.26 days), not 4.14 and 2.35 (includes calculation error as per comment 2) as reported.

Because of the morphology of the Wareham estuary, which includes some very low salinity segments on the Agawam River, a case could be made for including WASP model segment 4 in the "upper 1/3" analysis. Inclusion of WASP Segment 4 means theses "upper 1/3" of the estuary actually accounts for 43% of all WASP segment areas shown, but WASP segment 4 would have to be included if the Broad Marsh River and Crooked River parts of the Wareham River were included in the calculation, or if the low salinity segments of the upper Agawam were not included as part of the entire surface area of the "estuary." WASP Model segment 4 is an area where eutrophic conditions and loss of eelgrass have been reported. With WASP model segment 4, the upper 1/3 analysis results in upper 1/3 freshwater replacement times of 3.57 and 3.83 days respectively, or 3.7 days for a mean.

However, a more critical issue, is that the freshwater fraction method when applied to smaller upstream areas of an estuary result in shorter freshwater replacement times, not longer times. While this method is an accurate assessment of freshwater replacement times, it may not be appropriate for characterizing seawater residence times in the upper estuary. This contrasts with other types of models that show that a particle of water in the upper portion of an estuary, tends on average to reside longer in an estuary than a particle near the mouth. This nuance of the freshwater fraction model suggests that whole system freshwater replacement times and not upper 1/3 estuary freshwater replacement times be used as the proxy for seawater residence times for the purpose of establishing nitrogen loading limits.

4) Model not robust, results uncertain.
The results of the freshwater fraction method are not particularly robust in this study because out of 21 segments in the WASP model, segments 1 to 3 at the mouth account for 37% of total half-tide volume used in the calculations, and 31% and 46% of total freshwater volume on the two dates. Thus, if salinity values in either of these segments, or the reference salinity were not representative of the average salinity in that segment during the respective tide period, the freshwater replacement times will change considerably.

For example, on the August data set, using a salinity reference of 28.6 ppt for "outside" the estuary, a whole system freshwater replacement rate of 5.74 days was calculated. If the reference salinity were actually 29.0 ppt (a 1.4 % increase), calculated freshwater replacement time would be 6.98 days, a 22% increase in flushing time. A 5% increase in the reference salinity would increase freshwater replacement time 10.0 days, a 75% increase.

It is difficult to evaluate whether the reference salinities used in this study are appropriate. The location of the sampling stations differ on the two sampling dates. It appears that a single station 13 at the boundary of segment 1 was used as the reference station in Survey 2 in September. This left a single station 13A to characterize salinity in segment 1, which was 0.66 ppt higher in salinity than segment 2. In the Survey 1sampling in August, all the "outside" stations were near the mouth of the Weweantic River, and could have resulted in a somewhat lower reference salinity than appropriate. Presumably stations 13A and 13 were used on that date for the reference salinity. The complexities of characterizing a reference salinity using these locations are illustrated by the salinity profiles in figures 4-1 and 4-2. Station 13A, closer than 13 to the Weweantic mouth, is slightly higher in salinity than station 13. Moreover, in absolute value, station 13A is lower in salinity, especially near the surface during flood tides. Other problems include the fact that most of Broad Marsh River was not included in the model, and the portion that was included had no sampling station or data. These observations, together with the fact that the model is very sensitive to slight changes in reference salinity values suggest that estimates of freshwater replacement time in this study have wide confidence limits.

If the whole system estuary is defined as WASP model segments 2-21 or segments 3-21, the calculation is more robust because the first few segments have a lesser percent volume of the whole system, and replacement time is less sensitive to small changes in reference salinities. Also the adjoining "outside" segments used as a reference appears better sampled. This is illustrated by the reduced differences between the two sampling dates.

5) Summary of freshwater replacement times

A summary of the freshwater replacement times in the CDM study, corrected for calculation errors are as follows:

Table 1. Summary of flushing time calculations.

	Freshwater replacement time in days		
Area	survey 1	survey 2	mean
whole system (WASP segments 1-21)	5.74	7.87	6.81
whole system, defined as segs 2-21	5.68	5.68	5.68
whole system, defined as segs 3-21	4.05	4.21	4.13
upper 1/3, using segments 4-21	3.57	3.83	3.70
upper 1/3, using segments 5-21	3.00	3.52	3.26

Note: survey 1 was at neap tide, survey 2 was at spring tide.

Estimates of nitrogen loading

In 1998, the Buzzards Bay Project estimated that loading to the Wareham River estuary was 67,900 kg per year. In the current report, CDM estimates nitrogen load to the estuary to be 78,250 kg per year. This higher estimate by CDM was due to a number of factors, such as somewhat higher loadings for some types of land use, and inclusion of some new development. Most importantly, however, it was due to the fact that he lower watershed boundary now includes an additional highly developed area near the mouth of the Wareham River. In the CDM report, the Wareham estuary entrance is defined as a line between the tip of Cromset Point and an area near Swifts Beach, instead of the more inward natural constriction defined by the spit of land at Swifts Beach across the entrance as used by the Buzzards Bay Project in its 1998 report. As a result, the CDM report now includes densely developed areas around Marks Cove, including all of the Swifts Beach area, and additional areas of Great Neck. While the increased nitrogen loading rate caused by this more expansive watershed may at first suggest that more restrictive nitrogen limits may apply to the estuary, the inclusion of the large deep area at the entrance of the Wareham River has important effects on establishing a nitrogen limit as discussed below.

Other watershed boundary differences exist in the CDM report which appears to be based on land surface topography. In 1990, the Buzzards Bay project rejected this delineation and instead worked with USGS to develop a watershed boundary based on groundwater elevation. However, the differences in nitrogen loading resulting from these different upper watershed boundaries are probably modest, because the upper watershed is largely undeveloped, and because inclusions or omissions in one upper watershed boundary appear offset by comparable omissions or inclusions in the other upper watershed boundary.

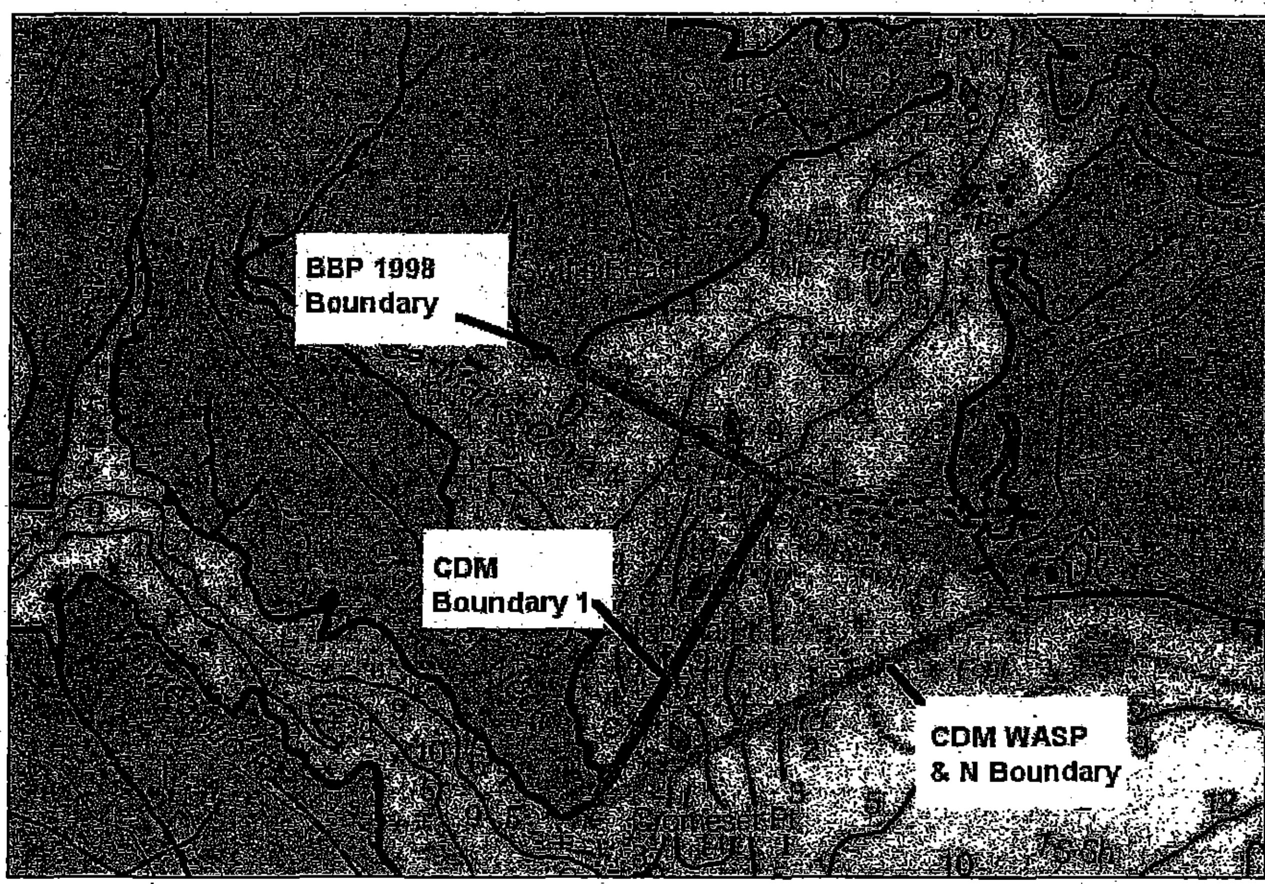
The additional loading projections in the CDM report are partly offset by a higher assumed attenuation rate for the upper watershed. CDM estimated that upper watershed attenuation is between 53% and 61% of land use loads. In the 1998 Buzzards Bay Project report, a preliminary upper watershed attenuation of 30% was adopted until specific data could be collected for this watershed. The CDM approach used in this study, namely comparing stream loads (concentration times flow) to land use loading estimates, is a sound one. However, several confounding variables could have contributed to an overestimate of attenuation. First, stream flow was lower during the period studied because of drought conditions. Lower flow would have lead to lower stream load compared to average land use loading contributions. During a wetter year, stream flow would have been high, and nitrogen concentrations at least as high resulting in a better agreement between annual loading by the stream and expected annual loading from land use.

Another factor that was not considered was the fact that there is a lag time between groundwater discharges from new development, and discharges to the surface waters. This lag time for some parts of the watershed may be 10 to 20 years. This lag could also account for part of the lower than expected loadings in the stream, and should be accounted for.

Finally, it appears that concentrations and loadings in the stream were volume weighted in the report's calculation of river nitrogen flux. That is important because during high flow periods, nitrogen concentrations were sometimes quite high in the stream. This is consistent with observations elsewhere that overland runoff of nitrogen occurs during heavy rains, and DIN in estuaries tend to be much higher during wet periods. However, loadings were only estimated for the period of March to October. Stream flows and DIN concentrations tend to be much higher in winter, and there is also less biological uptake in freshwater wetlands during this period. If the stream flows of the period November to February were accounted for, annual stream loading would be much closer to annual loadings projected from land use. The implications of choosing the lower flow stream period for evaluating upper watershed attenuation should be discussed.

Application of results to Nitrogen Loading standards

For the purposes of setting nitrogen loading limits, there must be agreement as to the boundary of the estuary, its area, volume, and flushing rate. Unfortunately, the delineation of the estuary boundary in Figure 1-1, the WASP model, the BBP 1998 report, and earlier flushing analyses all differ somewhat. The BBP questions CDM's proposed new boundary from Cromset Point to Long Beach Point as shown in Figure 1-1 of their report because the boundary does not agree with the estuary boundary as defined in their WASP model or land use a loading model in their report. It also differs from the BBP 1998 proposed boundary.



Roughly, the CDM estuary boundary in Fig. 1-1 of the CDM report corresponds to WASP model segments 2-21, and the BBP 1998 boundary corresponds to WASP segments 3-21. The position of the estuary boundary is important, because it defines the watershed boundary and watershed nitrogen loading estimates. What is more important, both flushing times, and acceptable loading limits can be greatly affected by boundary position. For example, the further outward into Buzzards Bay that the estuary is defined, the longer the whole system residence time, reducing proposed allowable nitrogen inputs. On the other hand, including the deeper areas at the mouth increases bay volume used in the nitrogen limit calculations, which in turn increases proposed allowable nitrogen limits.

There may also be a discrepancy on the estuary areas. The WASP model does not include upper Broad Marsh River and Upper Crooked River, and estuary area is reported to be 394 ha. Based on digitizing the entire area from a USGS quad maps, the total area of the estuary is 407 ha, which matches the omitted area of 13.8 hectares in the upper Broad Marsh River and upper Crooked River in segment 4. The depth of these areas was assumed to be 0.3 meters at half tide, with a volume equal to 41,000 cu m.

In reports issued in September 1999 and January 2000, the Buzzards Bay Project proposed more stringent nitrogen loading strategies for all Buzzards Bay embayments and recommended that regulatory agencies and municipalities adopt these more stringent standards for planning growth and upgrading wastewater treatment plants. The proposed "BBP-SB" standard corresponds to "eutrophic" water quality, "BBP-SA" standard corresponds to "fair" water quality, and the "BBP-ORW" limit corresponds to "Good to Excellent" in the Eutrophic Index scoring scheme, with no specific standard for "Excellent." There is concern and debate among regulators that the proposed Buzzards Bay Project standards may be too lenient for water quality designations under the clean water act and for application to TMDLs. For an estuary, like the Wareham River, the new proposed BBP-SA standard is 150 mg per cubic meter during the Vollenweider term adjusted residence time of water in the estuary, and .50 mg per cubic meter during the Vollenweider term adjusted residence time of water in the estuary for the BBP-ORW.

Below we show how the proposed standards apply to the estuary using the different assumed flushing times and estuary boundaries with their resulting differing bay volumes. To show the sensitivity of the analysis to salinity in the last segment, we also include loading limits if salinities in the reference segment were underestimated by 0.2 ppt. All bay volumes include the Broad Marsh River and Crooked River margin areas not included in the WASP Model. It is worth noting that when whole system freshwater replacement times are used for the three potential definitions of the estuary, and when the half tide volume appropriate to that definition of the estuary, the resulting recommended limits under the three definitions do not vary greatly (i.e., 71,100, 77,200, and 78,500). Use of the upper 1/3 of the estuary flushing time, and applying it to the whole system WASP 1-21 definition of the estuary results in a much more lenient limit, nearly twice existing nitrogen loadings.

Table 2. Summary of potential nitrogen limits for the Wareham Estuary. Use of "upper 1/3 flushing" using freshwater replacement time is not recommended for application to BBP methodology.

Estuary Definition	area (ha)	½ tide[b] Vol x10^6	"flushing" (days)	"BBP-SA"= "Fair" WQ recom. limit" (kg/y)	"BBP-ORW"= "Good to Excel." recom. limit (kg/y)
Whole system, WASP 1-21	407	8.45	6.15	77,200	25,800
w/ upper 1/3 flushing, seg 4	" "	" "	*3.70*	*137,600*	*45,900*
w/ upper 1/3 flushing, seg 5	" "	" "	*3.26*	*155,300*	*51,800*
Whole System, WASP 2-21	329	6.56	5.68	71,100	23,700
same, but salinity 0.2 ppt higher	329	6.56	6.22	65,300	21,800
whole system WASP 3-21[a] whole system	264	5.35	4.13	78,500	26,200

[a] This boundary is nearly equivalent to the BBP estuary delineation of 1998. The area is somewhat larger than reported in the 1998 report because the uppermost reaches of the Agawam were not included in that analysis.

[b] mean of two dates

Conclusions and recommendations

1) Currently the Wareham River estuary is among the most eutrophic in Buzzards Bay. It therefore appears inappropriate to apply the freshwater replacement time methodology using only the "upper 1/3" of the estuary segments in their flushing model, since that approach results in a proposed allowable limit for the estuary of twice existing nitrogen inputs. As noted earlier, the upper 1/3 estuary calculation using the freshwater replacement time methodology is inconsistent with the BBP methodology where it is recognized that waters in the upper 1/3 of the estuary remain longer in the estuary than waters near the mouth. Consequently, we recommend that whole estuary system flushing times be used when if the flushing time is approximated by the freshwater replacement time methodology. In this respect, flushing times for the whole estuary system defined as WASP model segments 2-21, are most consistent with CDM's definition of the estuary in Figure 1-1 of their report. This suggests a nitrogen loading limit of 71,120 kg per year if the BBP-SA standard ("fair" water quality) is to be applied. This is higher than the 57,800 kg per year limit proposed in 1998 by the Buzzards Bay Project for a small estuary area and volume than currently defined in this report.

2) The flushing model used is highly sensitive to the salinity measured in the last segment. For example, if the salinity of the reference segment was 0.2 ppt higher (that is, less than 0.8% error), allowable loading would be 8% lower (65,350 kg per year instead of 71,120 kg per year). A margin of safety may need to be considered for this calculation because only one station was generally measured in these reference segments, and variations in salinity between top and

bottom salinities and ebb and flow tides often exceed 0.2 ppt.

3) Attenuation may have been overestimated for the upper watershed, and a sensitivity analysis should be conducted to evaluate potential underestimates of river flow or lag times between nitrogen discharges to groundwater and discharge to rivers and streams.

4) In its 1998 preliminary analysis, the Buzzards Bay Project estimated that existing nitrogen loading to Wareham River estuary was about 18% over recommended limits. The current nitrogen load by CDM using an expanded definition of the watershed and estuary boundaries is about 10% over recommended limits, using whole estuary flushing times. This finding is consistent with eutrophic conditions observed in the estuary compared to other Buzzards Bay embayments. Specifically, many of the SA water quality targets proposed for SA waters by the Buzzards Bay Project are exceeded for this estuary. The estuary far exceeds BBP-ORW targets for "good to excellent" water quality. These facts suggest that it is appropriate to undertake actions to reduce nitrogen inputs to the estuary.

Sincerely,

Joe Costa

Joseph E. Costa, Ph.D.

cc. Dr. Brian Howes (CMAST)
Camp Dresser and McKee
Dave Janik (EOEA)
Todd Callaghan (MCZM)
Ron Lyberger, DEP
Rick Dunn, DEP
Chuck Gricus, Wareham Planning Department
Mark Rasmussen, CBB

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MEPA

MEMORANDUM

TO: Bob Durand, Secretary, EOEA
ATTN: Dick Foster, MEPA Unit
FROM: Tom Skinner, Director, CZM
DATE: August 23, 2001
RE: EOEA #12562 – Comprehensive Wastewater Management Plan; Wareham

The Massachusetts Office of Coastal Zone Management (CZM) has completed its review of the above-referenced Environmental Notification Form (ENF), noticed in the Environmental Monitor dated July 25, 2001, and recommends that the following matters be addressed in an Environmental Impact Report (EIR).

The ENF provides an analysis of on-site disposal systems and identifies the presence of disposal system problems in 12 "needs areas". The ENF evaluates several alternatives for meeting the wastewater collection and disposal needs in these 12 areas. Sewer service is recommended in the ENF because poor site conditions and excessive costs limit opportunities for on-site or community solutions to sewage collection and disposal. The applicant's preferred alternative is to extend the Town's sanitary sewer system using gravity sewers and to upgrade the Water Pollution Control Facility (WPCF). The proposed project will include approximately 21.8 miles of new sewers, the majority of which will be installed under paved roadways. No new pump houses will need to be constructed because it was determined that the existing pump houses will have the capacity to manage future flows. The WPCF will be upgraded and its capacity increased. The proposed upgrade also includes the construction of denitrifying filters, ultraviolet disinfection modules, an odor control system, a new outfall in the Agawam River, and construction of an administration building on the WPCF site.

The ENF states that the project area will include at least 63 lots in Velocity Zones. Of these 63 lots, 30 are currently undeveloped. The ENF also indicates that the Town is developing language to be incorporated into their zoning regulations to address potential growth and development that could occur once the sewer is in place.

A June, 2000 report entitled *Water Quality Investigation of the Wareham River Estuary Complex*, performed by UMass-Dartmouth for Camp Dresser & McKee, Inc. (CDM), provided an in-depth investigation of flushing rate and nutrient assimilation capability of the Wareham River Estuary. This report is included in the ENF as a reference for proposed allowable nutrient loads to the Wareham estuary and the technological upgrades to the Wareham WPCF that would be required to attain specific reductions in the nutrient loadings from the facility. A December 19, 2000 letter from Dr. Joe Costa of the Buzzards Bay Project to David Pincumbe of the U.S. Environmental Protection Agency (EPA) reviewed the CDM Water Quality Investigation document and highlighted several important points including that 1) the CDM study methodology provides a flushing time for the Wareham estuary that is likely too great and therefore overestimates the estuary's nutrient assimilation capability, and 2) the CDM flushing model is extremely sensitive to changes in salinity and therefore a margin of safety should be incorporated when using this model to calculate allowable nutrient loads.

In a December 7, 2000 memo to David Pincumbe of EPA, CZM commented on the CDM Water Quality Investigation study (copy attached). CZM commented that 1) the low flow (7Q10) estimate for the Agawam River was more accurately estimated using the EPA methodology detailed in the Fact Sheet of the Draft NPDES permit for the Wareham WPCF than using the CDM methodology, 2) the dilution ratio calculated by CDM was not as accurate as EPA's proposed dilution ratio, 3) the land use data used by CDM to calculate nutrient loadings from land-based sources was more current and therefore likely produced a more accurate estimate than previous studies, and 4) the attenuation factor for nutrient loads to the Wareham estuary may need a safety factor since a major mode of attenuation (denitrification in the sediments of freshwater ponds and streams of the watershed) could be impacted by future growth and land use patterns.

CZM offers the following comments on the proposed sewer extension and facility upgrade:

Natural Resources

2.1
- The EIR should document the location of the proposed sewer system components relative to flood zones, as designated by the Federal Emergency Management Agency (FEMA) on their Flood Insurance Rate Maps (FIRM), to ensure that these elements are protected from inundation by significant storm events and that utility connections are capable of withstanding storm forces without damage or contamination of nearby resources. FEMA updated regulations in 1988 regarding the delineation of flood zones in coastal dune areas. If there are coastal dunes in the project area, the flood zones may need to be updated for planning and design purposes. CZM is available to provide technical assistance to update the flood zone boundaries for this project.

2.2
- The EIR should include a complete delineation of all resource areas in the project area, including coastal dune, coastal beach, land subject to coastal storm flowage, salt marsh, coastal bank, and endangered and threatened species habitat.

2.3
- The EIR should include an evaluation of the alternatives that will avoid potential adverse impacts to each resource area. If impacts are unavoidable, the EIR should also include a complete description of proposed measures that will be undertaken to minimize short- and long-term impacts, as well as a mitigation plan to address those impacts (i.e., restoration of any dune areas, revegetation of dune and marsh areas, etc.).

2.4
- The EIR should further include a discussion of outfall constraints, construction sequencing and methodology, appropriate erosion and sedimentation controls, and de-watering measures.

- 2.5 Regarding directional drilling under the Weweantic River to Rose Point, the EIR should discuss disposal of tailings from the drilling and impacts to biota in the staging area.
- 2.6 The EIR should include an analysis of the location of the existing roads relative to the location of the actual right-of-ways and should minimize any proposed changes to the paved area (i.e. shifting or enlarging the footprint).

Impacts of Additional Wastewater Flow

- 2.7 Because of the potential for growth in the Agawam and Wareham River watersheds, the EIR should discuss how growth-related increases in wastewater flow and concomitant increases in nitrogen and phosphorus loading could potentially offset the proposed improvements to the WPCF. 2.8 In light of this potential, the EIR should describe how the Town of Wareham intends to achieve the watershed loading limits proposed in the ENF.
- 2.9 The ENF indicates that any new or increased discharge to the Agawam River is prohibited under the anti-degradation provision for low-flow water (314 CMR 4.04(3)). The EIR should address this issue and state if the Town is seeking a variance to this policy.
- 2.10 The EIR should further discuss the basis of the 28% winter vacancy rate. If this value was determined using the 1990 U.S. Census housing data, it should be updated using the 2000 U.S. Census data. It is likely that over the lifetime of the proposed facility (20 years) that this value will decrease, especially if new sewer facilities make year-round habitation more feasible. Even small refinements to this value may be important, especially since vacancy rate is used to determine maximum monthly biochemical oxygen demand (BOD) loadings and this, in turn, drives the nutrient removal design for the facility.
- 2.11 The EIR should describe why Great Hills Estates was recommended for sewering in the 1986 Facilities Planning Study by Metcalf & Eddy, but not included for sewering in the current proposal.
- 2.12 The EIR should clearly describe the calculations used to determine the dilution ratio at the proposed outfall location. In order to be most conservative, this calculation should use daily *maximum* flow rates from the WPCF. It appears that the dilution ratio presented in the ENF was calculated using daily *average* flow rates.

Growth Management

- 2.13 As discussed above, this project will provide sewer services to existing dwellings located in velocity zones. Since the project will receive federal funds, appropriate measures must be adopted to ensure that the proposed services do not encourage growth and development in hazard prone areas. The EIR should clearly define and describe the status of the overlay district referenced in the ENF. Due to the Commonwealth's sewer laws, special legislation is necessary for the implementation of growth controls.
- 2.14 The EIR should describe how this project is consistent with the parameters of Executive Order 385, "Planning for Growth" and Executive Order 149 regarding flood hazards to public facilities.
- 2.15 To ensure effectiveness, Wareham property owners should fully understand the new regulations that will be implemented. CZM recommends, therefore, that the EIR include a public education program explaining growth management measures adopted as part of the project.

2.16 The proposed project appears to be subject to CZM federal consistency review, in which case the project must be found to be consistent with CZM's enforceable program policies. For further information on this process, please contact Jane W. Mead, Project Review Coordinator, at 617-626-1219 or visit the CZM web site at www.state.ma.us/czm/fcr.htm.

TWS/tpc/rh

cc: Philip Kennedy
    Camp Dresser & McKee Inc.
  David Janik
    CZM South Coastal Regional Coordinator
  Elizabeth Kouloheras, Section Chief
    Southeast Regional Office, MA DEP
  Sharon Pelosi, Acting Section Chief
    Waterways Program, MA DEP
  Karen Kirk Adams, Chief
    Regulatory Branch, US Army Corps of Engineers
  Vincent Malkoski
    Division of Marine Fisheries, Pocasset Office
  Wareham Conservation Commission

To: Internet Mail@Gateways@state.ma.us [david.pincumbe@epa.gov]
From: Todd Callaghan@CZM@EOEA
Cc: David Janik@CZM@DEP SERO, Internet Mail@Gateways@state.ma.us [dave.pincumbe@epa.gov], Joe Costa@bbp@EOEA
Subject: CDM's Wareham study comments
Attachment:
Date: 12/7/00 1:24 PM

Dave,

It's been a while since I read this study but I do have some comments. Most of my comments relate to the points that CDM made on p.4-59 regarding how the CDM study relates to NPDES permitting issues.

1. It appears to me that the 7Q10 for the Agawam River (10.8 cfs) calculated by EPA in the Fact Sheet of Wareham's NPDES Draft Permit is more accurate that the 7Q10 calculated by CDM (17.3 cfs; p.4-18). The main difference in calculation method seems to be that the EPA method takes into account the fact that the Agawam River watershed covers 2 basins; one with a flow factor of 1.0 cfs/sq. mile and one with a flow factor of 0.4 cfs /sq. mile.

If this in fact the case, I would argue that the EPA method is more accurate because the CDM method assumes that all of the Agawam watershed has the same flow rate (1.0 cfs/sq. mile). This generalization happens to be in Wareham's favor since it in effect raises the Dilution Factor and loosens Wareham's pollutant limitations.

2. I don't follow the logic involved in CDM's determination of the dilution ratio (p.4-19). I would agree with the EPA Fact Sheet that the dilution Factor is 4.9 and not 12.5 as suggested by CDM (p. 4-19).

3. It appears to me that because CDM's land use data is more current than the BBP's data, that the CDM estimate for N loading due to residential, commercial, and cranberry bog uses is more accurate than the BBP's (p.4-49). I also believe that the CDM study more accurately depicts the load contribution of the WPCF because the CDM estimate was based upon 6 years of DMR data (I'm assuming they used the most recent data), whereas the BBP study used an assumed flow rate and N discharge concentration.

4. It is interesting to note that CDM predicts that the total N load eliminated from the watershed due to sewering is approximately equal to the load added to the estuary through the WWTF from outside the watershed (p.4-50).

5. Other than the differences in land use, it appears that the major difference between the CDM study and the BBP study is the attenuation factor. CDM makes a reasonable claim that this difference is likely due to denitrification in the sediments of freshwater ponds and streams in the watershed. If it is in fact the case that 53- 61% of all N loads from land use are attenuated by these waterbodies, couldn't degradation of these waterbodies decrease their attenuating abilities? Is it possible that future uses to the lands bordering these waterbodies would diminish the capacity to reduce N?

If this is a possibility, perhaps a more conservative estimate of attenuation, say something between 30% (BBP's assumption) and 60% would be more reasonable for long-term planning purposes?

I am sorry I will not be able to attend the meeting on Monday (I am leaving tonight for a backpacking trip in NH and will be back Tuesday). Please keep me informed about any major discussions and developments.

Todd

____

Todd Callaghan
Water Quality Specialist
Massachusetts Coastal Zone Management
251 Causeway St., Suite 900
Boston, MA 02114-2136
617 626 1233

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COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION

20 RIVERSIDE DRIVE, LAKEVILLE, MA 02347 508-946-2700

JANE SWIFT
Governor

By email 8-29-01

RECEIVED
AUG 30 2001
MEPA

BOB DURAND
Secretary

LAUREN A. LISS
Commissioner

August 28, 2001

Secretary Bob Durand
Executive Office of
Environmental Affairs
251 Causeway Street, 9th Floor
Boston, Massachusetts 02202

RE: WAREHAM – ENF Review
EOEA #12562 – Wareham
Comprehensive Wastewater
Management Plan, Route 6
(Sandwich Road)

Dear Secretary Durand,

The Southeast Regional Office (SERO) of the Department of Environmental Protection (DEP), in conjunction with the Division of Watershed Management-Boston, has reviewed the ENF for the Town of Wareham's wastewater management plan (EOEA #12562). The ENF indicates that the project triggers the requirement for an EIR because the proposed sewering program exceeds 10 miles of sewers. The Town has requested that they be allowed to prepare a Single EIR under the MEPA regulations, and DEP has reviewed the expanded ENF that has been filed in accordance with that request. The project proponent provides the following information for the project:

"The Town of Wareham Comprehensive Wastewater Management Plan involves: (1) the upgrade of the existing Wareham Water Pollution Control Facility (WPCF) and (2) the extension of the sewage collection system. The project extends over 12 "sewage disposal needs areas" and the WPCF. The design will account for future flows and loads to provide a 20-year plan for wastewater collection, treatment and disposal. As a result, the annual average daily wastewater flows of the plant will increase from 0.99 million gallons per day in 2000 (summer average day: 108 mgd; winter average day: 0.94 mgd) to 1.47 mgd in 2020 (summer average day: 1.56 mgd; winter average day: 1.42 mgd).

The WPCF has been in operation since 1972 and currently meets the National Pollutant Discharge Elimination system (NPDES) permit requirements. The current NPDES permit expired in 1997 and the WPCF is operating under the expired permit until EPA and DEP issue the new permit (expected in Fall 2001). The new NPDES permit will have limits for nitrogen and phosphorus that the existing facility will not be able to meet. The proposed upgrades to the plant include a new headworks facility with a new septage receiving system, two flow equalization basins, a new biological nutrient removal process, a UV

disinfection system, a biofiltration odor control system, a new outfall pipe, a new solids thickening process, renovations to existing buildings, and new building construction.

Permits listed in the ENF to be sought for the project include the following:

NPDES Permit to Set Effluent
NPDES General Permit for Construction Dewatering
Conservation Commission NOI
Local Building Permits
Chapter 91 License
MHD or MDC Access Permit
DEP or MWRA Sewer Connection/Extension Permit
DEP Approval to Expand the WPCF"

The Department has been working with the Town and their consultants over the last several years as they have been preparing this update of the town's wastewater management plan. The waters within and adjacent to Wareham have high value for shellfishing, recreation, and aquatic habitat. There are existing impacts to these waters as evidenced by shellfish closures and eutrophication. The proposed wastewater treatment plant upgrade and sewer extensions will significantly improve these conditions and provide an alternative solution for property owners with Title 5 compliance problems.

The Town should complete the final wastewater management plan and Single EIR to address the following items:

3.1

1. The final plan and SEIR should have a recommended plan chapter that includes a complete presentation of all elements of the plan (the wastewater treatment plant and existing collection system improvements, as well as the proposed sewer extensions). The chapter should summarize the proposed program; present the existing and projected flows and loads; include the preliminary design criteria for the proposed facilities; provide a site map of the upgraded treatment plant; include a map of the existing and proposed sewer collection system; present the costs of the different elements; include an implementation plan for the different phases; present a proposed financing plan and the costs per household for the complete program; describe how the town will manage the operation of the treatment plant and collection system, including what the preliminary staffing requirements will be; and describe the potential legal and institutional mechanisms for managing the future connections and extensions to the sewer system in accordance with the approved plan, and how those mechanisms will comply with Executive Order 385;

3.2

2. The final plan and SEIR should include a response to the DEP and EPA comments on the draft water quality report, and the status of discussions regarding the projected new NPDES effluent limits. DEP strongly suggests that the response to our and EPA's comments be provided as soon as possible so that further discussions can take place before the final plan and SEIR is submitted. The Department does believe, however, that the current design should be able to comply with the anticipated more stringent limits that will be imposed by the next NPDES permit.

3.3

3. Because there will be some limited sewering of properties within velocity zones, the town will be required to implement appropriate bylaws to restrict the type and degree of construction within those zones. Similar bylaws have been implemented in several

3.3 communities, and the proposed language on page 4-17 of the expanded ENF is consistent with the language developed for the Town of Kingston, which was approved by DEP and CZM in 1999.

3.4 4. The town must hold a public hearing on the recommended plan in order to comply with the public participation requirements of the SRF program.

3.5 5. On page 3-3, it is unclear whether the projected flows include infilling within the existing collection system. The flows from infilling should be included in the projected flows if they have not been.

3.6 6. On page 4-15, the text indicates that the SRF program generally limits the amount of funding per year for collection system projects to 2 million dollars. That statement is incorrect, and should be deleted.

3.7 7. The proposed upgrade for the wastewater treatment plant includes two new equalization basins, as discussed on page 6-9 and shown on figure 6-2. The final wastewater management plan and EIR should address the potential for odors from these basins and how they will be dealt with.

3.8 8. The final wastewater management plan and EIR should address how the treatment plant will be able to meet a potential coliform limit of 14 organisms per 100 milliliters (as discussed in the letter of August 20, 2001, from the Division of Marine Fisheries). Although this issue will be further discussed during the NPDES permit review process, the Department and EPA have included this limit in other recent treatment plant expansions and upgrades that discharge into areas with shellfish resources downstream over the last several years (Cohasset, Scituate, and Plymouth). 3.9 In addition, the treatment plant will be required to meet Class 1 reliability standards, and have a combination of wastewater storage, travel time in the Agawam River, and a town shellfish management system (for warnings when a problem occurs at the treatment plant) to adequately address Division of Marine Fisheries criteria for protection of shellfish areas. These provisions have also been applied in several other recent projects, such as Scituate, and the final wastewater management plan and EIR should discuss the issue and propose a recommended approach. The town and their consultants should consult with DMF and DEP to further define the specific conditions for this treatment plant prior to the submittal of the final wastewater management plan and EIR.

3.10 Based on the location information provided in the ENF, the Bureau of Waste Site Cleanup (BWSC) has searched its database for disposal sites and release notifications and found several disposal sites located in the vicinity of the proposed project. The Project Proponent is advised, if oil and/or hazardous material pursuant to 310 CMR 40.0000, the Massachusetts Contingency Plan (MCP) is identified during the implementation of this project, a Licensed Site Professional (LSP) should be retained to determine if notification is required pursuant to 310 CMR 40.0300 and if necessary, render opinions as stated in 310 CMR 40.0000. In addition, an LSP may be engaged to evaluate whether risk reduction measures pursuant to 310 CMR 40.0400 are necessary or prudent. The BWSC may be contacted for guidance if questions regarding cleanup.

In summary, the Department strongly supports the implementation of this project, and with adequate responses to our comments, believes that a Single EIR should be adequate.

The DEP Southeast Regional Off...

project. If you have any questions regarding these comments, please contact Sharon Stone at (508) 946-2846.

Very truly yours,

Robert P. Fagan,
Regional Engineer,
Bureau of Resource Protection

RPF/SS

Enclosure

cc: DEP/SERO
ATTN: David DeLorenzo,
Deputy Regional Director

David Johnston,
Deputy Regional Director

John Viola,
Deputy Regional Director

Paul L. Grady Jr.
Service Center Manager

Elizabeth Kouloheras
Chief, Wetlands

Jeffrey Gould
Team Leader, Buzzards Bay Watershed and
Chief, Water Pollution Control Program

Deborah Marshall
Acting Chief, Audits/Site Management

Cc: DEP/Boston
ATTN: David Murphy
Commissioner's Office

Ronald Lyberger
Division of Watershed Management

Paul Hogan
Division of Watershed Management

Robert Cady
Division of Municipal Services

cc: EOEA/SERO
ATTN: David Janik
EOEA Basin Team Leader
Buzzards Bay Watershed

cc: EPA/Boston
ATTN: David Pincumbe

cc: Coastal Zone Management
ATTN: Todd Callaghan

cc: Division of Marine Fisheries
ATTN: Michael Hickey

Michael Hartman
Wareham Town Administrator

Gerry Furrier
Camp Dresser & McGee

Joseph Costa
Buzzards Bay Project

Mark Rasmussen
Coalition for Buzzards Bay

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COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF FOOD AND AGRICULTURE

251 CAUSEWAY STREET, SUITE 500, BOSTON, MA 02114-2151
TELEPHONE: (617) 626-1700 FAX: (617) 626-1850

JANE SWIFT
Governor

BOB DURAND
Secretary

JONATHAN L. HEALY
Commissioner

RECEIVED
AUG 24 2001
MEPA

MEMORANDUM

To: Bob Durand, Secretary
Executive Office of Environmental Affairs

Attn: Dick Foster, MEPA Office

From: Marcia Starkey MS

Re: EOEA #12562 ENF Wastewater Facilities Plan Wareham

Date: 23 August 2001

This Environmental Notification Form proposes a Comprehensive Wastewater Management Plan in which the existing Wareham Water Pollution Control Facility will be upgraded and the sewer system will be extended to 12 needs areas in a 20 year expansion plan. According to the ENF, the project is on the DEP Fiscal Year 2001 Intended Use Plan list of projects to receive a State Revolving Fund Loan (SRF).

Our comments relate to the issue raised through the statement in the ENF that "To control growth in the newly sewered areas, the Town will enact zoning restrictions." The Wareham Open Space and Recreation Plan 1997-2002, as cited in the ENF, states that 7,071 acres of farmland in the town are classified under Chapter 61A. These include many cranberry farms with a majority of upland which may be vulnerable to unplanned growth pressures causing consequent environmental impacts to bog water quality as well to the overall environment.

4.1

Wareham's significant cranberry areas and unique agricultural soils lie primarily to the north and west of the sewer route, however, several farms are in close proximity to the needs areas. Our files identify over 140 acres of agricultural upland and 75 acres of cranberry bog and associated wetlands in this section of the town. The Department applies the provisions of Executive Order 193 to state-assisted wastewater projects which will extend sewer lines along or across unprotected agricultural land. We also remind

4.2

4.3 proponents that, consistent MGL Chapter 80 Section 1, sewer betterment fees should not be levied on farmlands while they are classified under Chapter 61A or under an agricultural preservation restriction. .

4.4 We ask that the EIR confirm that the project (WPCF and sewer line) capacity is limited to present uses and projected growth within the 12 identified service areas, and further describe the intended or assured growth controls such as zoning or sewer use rules and regulations mentioned in the ENF.

C/Philip C. Kennedy, Camp Dresser & McKee Inc.
Michael Hartman, Town Administrator
Ron Lyberger, DEP

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

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Wayne F. MacCallum, *Director*

July 19, 2001

Phillip C. Kennedy
Camp, Dresser, & McKee, Inc.
One Cambridge Place
50 Hampshire Street
Cambridge, MA 02139

Re: Comprehensive Wastewater Management Plan
Wareham, MA
NHESP File: 01-9176

Dear Mr. Kennedy,

Thank you for contacting the Natural Heritage and Endangered Species Program for information regarding state-protected rare species in the vicinity of the above referenced site. I have reviewed the site and would like to offer the following comments.

5.1 Our database indicates that the site intersects the following Priority/Estimated Habitats: PH 1479/WH 5062, PH 1480/WH 412, PH 1484/WH 417, and PH 512/WH 7276. Enclosed please find a list of species found within these designations. These species are protected under the Massachusetts Endangered Species Act (M.G.L. c. 131A) and its implementing regulations (321 CMR 10.00) as well as the state's Wetlands Protection Act (M.G.L. c. 131, s. 40) and its implementing regulations (310 CMR 10.00). Fact sheets for most of these species can be found on our website at www.state.ma.us/dfwele/dfw.

This evaluation is based on the most recent information available in the Natural Heritage database, which is constantly being expanded and updated through ongoing research and inventory. Should your site plans change, or new rare species information become available, this evaluation may be reconsidered.

Please do not hesitate to call me at (508)792-7270 x154 if you have any questions.

Sincerely,

Christine Vaccaro

Christine Vaccaro
Environmental Review Assistant

Natural Heritage & Endangered Species Program
Route 135, Westborough, MA 01581 Tel: (508) 792-7270 x 200 Fax: (508) 792-7821
An Agency of the Department of Fisheries, Wildlife & Environmental Law Enforcement

PRIORITY/ESTIMATED HABITATS

Species	Taxon	Status
PH 1479/WH 5062		
Estuary Pipewort (*Eriocaulon parkerii*)	plant	endangered
Pygmyweed (*Crassula aquatica*)	plant	threatened
Salt Reedgrass (*Spartina cynosuroides*)	plant	special concern
PH 1480/WH 412		
Spotted Turtle (*Clemmys guttata*)	reptile	special concern
PH 1484/WH 417		
Estuary Pipewort (*Eriocaulon parkerii*)	plant	endangered
Long's Bitter-cress (*Cardamine longii*)	plant	endangered
Purple Needlegrass (*Aristida purpurascens*)	plant	threatened
Pygmyweed (*Crassula aquatica*)	plant	threatened
River Arrowhead (*Sagittaria subulata var. subulata*)	plant	endangered
Salt Reedgrass (*Spartina cynosuroides*)	plant	special concern
Spotted Turtle (*Clemmys guttata*)	reptile	special concern
PH 512/WH 7276		
Climbing Fern (*Lygodium palmatum*)	plant	special concern
Pod-grass (*Scheuchzeria palustris*)	plant	threatened

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Commonwealth of Massachusetts

Division of Marine Fisheries
251 Causeway Street • Suite 400
Boston, Massachusetts 02114
(617) 626-1520
fax (617) 626-1509

Paul J. Diodati
Director

August 20, 2001

Bob Durand, Secretary
Executive Office of Environmental Affairs
Attention: MEPA Office
Rick Foster, EOEA no. 12562
251 Causeway Street, Suite 900
Boston, MA 02114

Dear Secretary Durand:

The Division of Marine Fisheries (the Division) has reviewed the Environmental Notification Form (ENF) #12562 and expanded application submitted on behalf of the Town of Wareham (the proponent). The project will result in upgrading the wastewater treatment facility in Wareham and increase the discharge of treated wastewater from 0.99 million gallons per day (mgd) to a maximum of 1.47 mgd. The Division is providing the following comments.

6.1 The Division anticipates reclassifying areas closed to shellfish harvesting between Parkwood Beach and the Agawam River Narrows Bridge to seasonally approved status within the next four months. We are concerned that the proposed increased discharge of nearly half a million gallons a day of wastewater at the current discharge permit fecal coliform limitation will prevent maintaining these areas at the new classification. 6.2 The Division requests that the discharge permit fecal coliform limit be upgraded to not exceed a geometric mean MPN (most probable number) of 14 organisms per 100 milliliters (ml) with no more than ten percent of the samples exceeding a MPN of 28 organisms per 100 ml. 6.3 Upgrading the discharge controls for nitrogen and phosphorus will also help to improve overall water quality in the receiving waters.

The Division appreciates the opportunity to comment and will provide further assistance as needed. Please contact Mr. Michael Hickey at our Pocasset office (508.563.1779 x 122) if we may of further assistance.

Sincerely,

Paul Diodati

Paul J. Diodati
Director

cc: Selectboard, Town of Wareham
Mike Parola, Shellfish constable, Town of Wareham
Jim Fair, MDMF
Mike Hickey, MDMF
Greg Sawyer, MDMF
Jack Schwartz, MDMF
Paul Hogan, DEP
Brian Pitt, EPA

6-2

MASS HIGHWAY

Jane Swift
Governor

Kevin J. Sullivan
Secretary

Matthew J. Amorello
Commissioner

DF

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RECEIVED
AUG 27 2001
MEPA

August 24, 2001

Robert Durand, Secretary
Executive Office of Environmental Affairs
251 Causeway Street, 9th floor
Boston, MA 02114

RE: Wareham – Comprehensive Wastewater Management Plan – Expanded ENF (EOEA #12562)

ATTN: MEPA Unit
Richard Foster

Dear Secretary Durand:

The Massachusetts Highway Department (MassHighway) has reviewed the Expanded Environmental Notification Form (ENF) for the proposed Comprehensive Wastewater Management Plan in Wareham. The project involves the upgrade of the existing Wareham Water Pollution Facility and extension of the sewage collection system. A MassHighway permit will be required for work within the state highway layout of Routes 6 and 28.

We believe that the overall traffic impacts of this project to the state highway system will be minimal, and we recommend that no further environmental review be required based on traffic issues. However, the proponent should be very careful when working around signalized intersection equipment to ensure that the signals remain in operation at all times. We will
7.1 require the proponent to replace any damaged equipment, as a result of the sewer installation, in accordance with MassHighway's Standard Specifications for Highway and Bridges most recent edition. There is also a project under design, which will reconstruct Route 6/28 from the Bourne town line westbound to its intersection with the East Wareham By-Pass road. We will require
7.2 that the proponent coordinate any sewer line work in the area with the aforementioned project. The details of the traffic management plan can be handled during the MassHighway permitting process for this project.

7-1

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THE COALITION FOR BUZZARDS BAY

August 20, 2001

#12562

RECEIVED AUG 23 2001 MEPA

Mr. Robert Durand, Secretary
Massachusetts Executive Office of Environmental Affairs
MEPA Unit
251 Causeway Street, Suite 900
Boston, Massachusetts 02214

Re: Wareham Comprehensive Wastewater Management Plan ENF

Dear Secretary Durand:

The Coalition for Buzzards Bay has reviewed the Environmental Notification Form for the Wareham Comprehensive Wastewater Management Plan dated July 2001 and posted for public comment in the July 25, 2001 Environmental Monitor. The Coalition is a non profit, membership organization dedicated to the restoration, protection, and sustainable use and enjoyment of Buzzards Bay and its watershed. We represent more than 1,500 individuals, families, organizations and businesses in southeastern Massachusetts. We are very interested in the upgrade of the Wareham Wastewater Facility as a fundamental step toward improving water quality and living resources in the Wareham River system.

The Coalition for Buzzards Bay would like to express its support for the approach proposed in the Wareham Comprehensive Wastewater Management Plan regarding necessary upgrades to the Wastewater Treatment Facility. We applaud the efforts of the Town of Wareham over the past two years to conduct the "Water Quality Investigation of the Wareham River Complex" which complemented and expanded upon the water quality data set we had developed in the Wareham River over the past eight years. The results of that study provide a strong foundation from which to establish nitrogen and phosphorous limits for the discharge. Based on that study, we concur with CDM that the 3 mg/l Total Nitrogen limit through Modified Ludzack Ettinger (MLE) process with denitrification filters should be the preferred alternative. Finally, we are also very supportive of the Plan's proposal to eliminate the use of chlorine for disinfection and replace it with ultraviolet light.

Despite our support for the improvements proposed for the Wastewater Treatment Plant, the Plan raises a number of other concerns that should be addressed in the required Environmental Impact Report for the project.

I. The Plan will Promote Sprawl

9.1 By adding 21.8 miles of new sewer mains to new areas of town, the Wastewater Comprehensive Wastewater Management Plan will promote sprawl development in many

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undeveloped areas, particularly on Indian and Great Necks where sewer lines proposed for Parkwood and Agawam Beach neighborhoods will deliver sewer to hundreds of acres of upland forest. Parkwood Beach is projected to have an additional 157 new developable lots & Agawam Beach has 65 new lots projected just within the neighborhood, nevermind lands outside the neighborhood that will have new access to sewer. Growth impacts will be seen elsewhere as well, as lots limited to development by poor soils or presence of wetlands become developable due to the availability of sewer. Despite the amount of new growth these sewer lines will produce, the ENF only refers to possible zoning changes for areas in the flood velocity zone.

9.1

The Environmental Impact Report should assess the full development build-out that the new sewer lines will produce throughout the town and propose growth management measures to address it. Without a plan to manage growth, improvements made to water quality from new sewer will be diminished by nonpoint source pollution from new development.

9.2 The Coalition for Buzzards Bay does not contest that the neighborhoods identified in the 12 sewage disposal needs areas have problems and we support town planning to provide wastewater solutions for these areas. We believe that one possible solution to these areas – that will also reduce the sprawl-related impacts associated with traditional sewer - is available through decentralized sewer options.

Advancements in local package treatment facilities and community leaching field systems have reduced the space and soil requirements for these systems. We estimate that nearly all of the neighborhoods proposed for new sewer service have vacant lots and municipal roads and right of ways are capable of supporting some form of on-site community sewage treatment. Despite the ENF's claim that decentralized sewer options "had problems with the lack of available land close to the 12 need areas." (ENF, pg.4), each of the 12 Sewer Needs Areas shows large spots of soils not listed as "Very Poor" or "Poor" soils, implying that there a likely areas in each Area that could support localized disposal. (Figure 4-1, Sewer Needs Analysis Map).

9.3 Table 8-1 (pg. 8-14) is a completely inadequate summary of why local sewer options were rejected. Overall, the benefits offered by decentralized sewer for providing high quality wastewater treatment and controlling sprawl development deserve a better review as an alternative for the 12 Sewer Needs Areas. We urge you to include a full review of this alternative in the EIR.

II. On Site Sludge Disposal should be eliminated

9.4 The ENF states that "At this time, the town does not intend to use the landfill for sludge disposal, but maintains the landfill as an emergency backup." CDM 6-5. The Coalition for Buzzards Bay strongly opposes any on site landfill for sewage sludge, even as a "backup". This "backup" site should be eliminated from the Plan as the site is (1) too close to the Agawam River and (2) sewage sludge contains exceptionally high nitrogen concentrations which will contaminate the river.

III. Site Stormwater should be Treated Prior to Discharge

9.5 The ENF dismisses stormwater control for the wastewater treatment facility site completely. Due to its proximity to the Agawam River and its large amount of impervious area, stormwater treatment should be required as part of the plant's proposed upgrade. The EIR should provide a full stormwater management plan for the WWTP facility.

9.6 Finally, the ENF and Facilities Plan are in error where they state that there is was body of water quality data available for the Agawam and Wareham Rivers. The Coalition for Buzzards Bay has been monitoring nutrient concentrations and dissolved oxygen levels in the rivers since 1992. That data set is discussed in the Water Quality Study completed by Dr. Brian Howes and attached to the ENF and has been provided to the Town of Wareham as well as MA DEP and US EPA staff.

Thank you for the opportunity to comment on this important Environmental Notification Form. We urge you to require that the town address issues related to Sprawl and Growth Management, Decentralized Sewer Alternatives, Stormwater Treatment and On-site Sludge Disposal in the required Environmental Impact Report.

Sincerely,

Mark Rasmussen

Mark Rasmussen
Executive Director

cc: Andrew Gottlieb, Massachusetts Department of Environmental Protection
Jeff Gould, MA DEP Southeastern Regional Office, Lakeville
Bruce Rosinoff, US Environmental Protection Agency, Region I
David Pincumbe, US Environmental Protection Agency, Region I
Wareham Board of Selectmen, Board of Health, Conservation Commission
State Representative Ruth Provost
State Senator Therese Murray
Dr. Joseph Costa, Buzzards Bay Project National Estuary Program/MCZM
David Janik, Massachusetts Office of Coastal Zone Management

Appendix L

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

December 28, 2000

Gerald S. Furrier
Camp Dresser McKee, Inc
One Cambridge Place
50 Hampshire Street
Cambridge, MA 02139

Dear Mr. Furrier:

I am writing to formally submit comments on the CDM June 2000 report Water Quality Investigation of the Wareham River Estuary Complex. Attached to this letter are comments from EPA, the Buzzards Bay Project, and MADEP.

Upon receipt of these comments, we would appreciate some feedback as to the time frame necessary for CDM to provide a response to these comments. It is EPA's intent to develop a new draft permit in the near future and then public notice the draft permit as soon thereafter as possible.

An issue that may be of particular concern relative to the design of the new treatment facilities is the need for phosphorus controls. The Agawam River data clearly indicate that there is excessive phytoplankton growth upstream of the Wareham discharge. However, the data also indicate that the effluent loading of orthophosphorus is an order of magnitude higher than the upstream orthophosphorus loading during the peak growing season. Virtually all of the orthophosphorus in the effluent is converted to biomass in the first reach or two below the discharge. The fact that the phosphorus in the effluent is clearly contributing to the excessive phytoplankton growth in the Agawam River suggests that the effluent phosphorus loading should be reduced to the maximum extent feasible.

If you have any questions please contact me at (617) 918-1695.

Sincerely,

David L. Pincumbe

cc: Rick Dunn (MADEP
Ron Lyberger (MADEP)
Joseph Costa (BBP)
Chuck Gricus, Wareham Planning Department

I have reviewed the CDM June 2000 report Water Quality Investigation of the Wareham River Estuary Complex and have the following comments:

1. The section on estimating 7Q10 flows for the Agawam River refers to flows in 1999 only dropping below the estimated 7Q10 of 17 cfs after a stop log was added upstream. Reference is also made to irregularities in gage data being matched to stop log movements. A full discussion of stop log usage needs to be included in the report. This should include all stop log locations, a description of stop log capabilities and practices, and detailed information on stop log usage in 1999. This is clearly a highly regulated river and this needs to be accounted for in any estimate of 7Q10 flows.

2. Is the nutrient concentration data for April and May based on a daily grab sample while the data for June - October is based on 12 hour composite samples? How were loadings calculated prior to April 28th when flow measurements began?

3. Paired unacidified and acidified grab samples for nitrogen were taken for QA purposes but I could not find this data in the report. What time of day were these grab sample taken?

4. It appears as if composite samples were not flow weighted. Since concentrations of nitrogen increase with increased flow rates, sampling that is not flow weighted would underestimate loadings. The significance of this should be evaluated.

5. Further justification of the assumption that April - October average loading rates can be used to estimate average loadings for November - March. A review of nearby gage data indicates that average flows for April - October are significantly less than annual average flows.

6. The report does not include an evaluation of the effect that the 1999 drought would have on the measured nutrient loadings. Precipitation, groundwater, and stream flow levels were all significantly lower than typical years The relative difference between these levels and typical levels should be evaluated in order to determine an appropriate correction factor for the loadings measured during a severe drought condition.

7. The effluent total nitrogen data appears to correlate quite well with seasonal ground water levels. Lower concentrations occur during high groundwater periods and higher concentrations occur during low groundwater periods. The highest effluent concentration value measured occurred during a period when stream flows were the lowest as a result of the 1999 drought. This is not unexpected since it is well understood that the outfalls often contain significant quantities of groundwater in addition to effluent. Given this, it is inappropriate to use a long term average outfall concentration with an average influent flow concentration to estimate treatment plant loads. It is unfortunate that actual outfall flows were not measured as part of the study. In the absence of outfall flow data, effluent loadings should be based on effluent concentrations during the extreme low flow periods when groundwater dilution of the effluent would be minimal.

8. The original BBP land use based loadings estimate was based on an estimated number of housing units. CDM subsequently provided information indicating that the actual number of housing units was higher. The new CDM nitrogen loadings estimate for the subwatersheds contributing to the freshwater loads had to rely on the original BBP methodology since the actual number of housing units for each individual subwatershed is unknown. It is unclear however, if the new estimate is corrected for the under estimation of housing units made in the original BBP methodology.

9. The future sewer needs analysis estimates the change in nitrogen loading that is expected to result from sewering these areas. It is unclear however, what level of effluent flow is anticipated as a result of this sewering. Will sewering all of the needs areas result in effluent flows approaching the 1.6 MGD design flow?

David Pincumbe
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Buzzards Bay Project
National Estuary Program

December 19, 2000

David Pincumbe
US EPA
Boston, MA 02203

re: CDM June 2000 report on Nitrogen loading in the Wareham River watershed

Dear Mr. Pincumbe:

The Buzzards Bay Project has conducted a review of the June 2000 report titled *Water Quality Investigation of the Wareham River Estuary Complex*, prepared by Dr. Brian Howes of UMass Dartmouth and Camp Dresser and McKee (CDM). We have limited our review at this time to four areas: the validity of flushing rate estimates, nitrogen loading estimates, attenuation coefficient estimates, and application of proposed new BBP standards.

Before addressing these specific areas, we commend the authors for their important contributions in refining estimates of nitrogen loading to the Wareham River Estuary, quantifying attenuation coefficients for the upper watershed, estimating contributions from point and non-point sources of nitrogen, and for more precisely determining flushing rates of the estuary. This new data and information will not only assist the US EPA in determining an appropriate discharge limit for the Wareham Wastewater Treatment Facility, but adds measurably to our understanding of how this estuary ecosystem has responded to existing nitrogen inputs. In particular, the approach for determining an upper watershed nitrogen attenuation coefficient, although we disagree with the final estimated range, will have transferability to other large drainage basins in Buzzards Bay and southern New England. We commend the Town of Wareham for funding this study and showing leadership in better quantifying water quality conditions and nitrogen loading estimates in an estuary so clearly valued by Town officials and residents alike.

While we agree with many of the conclusions and summaries presented in the report, there are some important calculation errors and questionable assumptions that are germane in the establishment of a nitrogen discharge limit for the facility. These issues are summarized below.

Flushing rate analysis

The hydraulic residence time of an estuary is widely believed to have considerable significance to the susceptibility of an estuary to anthropogenic nitrogen inputs. That is to say, given two

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estuaries of identical volume and bathymetric profiles, the estuary with the longer hydraulic residence time is more prone to eutrophication impacts than an estuary with a shorter hydraulic turnover time. This concept is incorporated in the Buzzards Bay Project's nitrogen loading methodology. As a result, recommended nitrogen loading limits for an estuary are nearly directly inversely proportional to the hydraulic turnover time in days.[1]

While the Buzzards Bay Project specified that "hydraulic turnover time," "residence time," or "flushing rate" of an estuary be considered, no methodology was specified. This was because no single method was appropriate to all estuaries. The choice of method depended upon whether the system was a typical wedge-shaped estuary with high river flows at the head of the estuary or a coastal lagoon with low freshwater inputs. The method also depended upon other factors such as the shape and volume of the estuary, and the locus of nitrogen inputs (e.g., are they primarily from septic systems near a well-flushed mouth of a bay or from an upstream or groundwater source entering the poorly flushed portion of the upper estuary?).

The choice of a flushing rate value is so fundamental to setting a nitrogen loading limit for an estuary. Because there are a number of potential methodologies that could be used, each with inherent weaknesses when applied to the concept of nitrogen impacts in an estuary, the selection of a residence time for an estuary remains one of the most difficult decisions facing coastal managers. For these reasons also, it is important to use salinity data or dye studies to validate any flushing model adopted.

In 1998, the Buzzards Bay Project prepared a preliminary report of nitrogen loading estimates and recommended limits for the Wareham River estuary[2]. In that report, we used a preliminary estimate of 5.75 days as an approximation of flushing for the Wareham River estuary based on other studies. In the 2000 CDM report, CDM recommended the use of a lower flushing rate of 2.33 to 4.13 (56-99 hours). This estimate was based on the Ketchum fractional freshwater method for calculating "freshwater replacement time" for the upper 1/3 of the estuary. The ranges given were equivalent to the observations on two dates, one near spring tide, one near neap tide conditions. In this method, the total volume of freshwater in an estuary is calculated based on salinities, and this total volume of freshwater is divided by the estimate of daily freshwater flows from stream and groundwater discharges into the estuary. Below are our specific comments on how this method was applied to this study.

1) Freshwater replacement time methodology is acceptable

The use of "freshwater replacement time" as a proxy hydraulic turnover time of seawater in an

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[1]The use of the Vollenweider expression, makes this relationship slightly less than a simple direct proportional relationship.

[2]Costa, J. E. A Preliminary Evaluation of Nitrogen Loading and Water Quality of the Wareham River Estuary as it Relates to the Wareham Wastewater Treatment Facility. Joseph E. Costa, Ph.D., Buzzards Bay Project National Estuary Program, June 2, 1998

estuary is most valid in wedge shaped, relatively vertically well mixed riverine estuaries like the Wareham River Estuary complex. The method also seems appropriate, because most nitrogen inputs such as the sewage treatment facility and other upper watershed sources, enter the head of the estuary, like most freshwater inputs. Septic system inputs to the lower estuary probably equal less than 20% of all watershed nitrogen inputs. Thus, the modeling of freshwater inputs is also a good proxy for the modeling of nitrogen inputs to the estuary. Moreover, given the size and complexity of the estuary system, the freshwater fraction method may be one of the most reliable methodologies, and this study is the best estimate of Wareham River flushing to date. For these reasons, we do not object to the use of this methodology for the Wareham River, as long as the limitations on the application of the freshwater fraction time are understood.

2) Calculation errors resulted in underestimates freshwater replacement time
In Table 4-3 and Table 4-4, the salinities of the various segments of the estuary are reported for August 11 and September 26, 2000 respectively. Estimates of MLW volume and half-tide volume of each segment are also reported for calculating freshwater replacement time. In Table 4-4, half tide volume was correctly used in segment 1, but in segments 2 to 21, mean low water segment volume is used. Attached is the corrected Table 4-4. As shown, when half tide volume is correctly used, total system flushing rate is found to be 7.87 days, not 4.43 days as reported. This error was not made in Table 3, where half tide volumes were correctly used to obtain the 5.74 day flushing rate. Thus, the average freshwater replacement time for the two dates is 6.15 days.

In the CDM report, two contradictory boundaries for the estuary are defined. These boundary definitions have important implications for estimating flushing rates. If the whole system is defined as WASP segments 2 to 21, freshwater replacement rates for the two survey dates are 5.68 and 5.68 days respectively. If the whole system is defined as WASP segments 3 to 21, freshwater replacement rates for the two dates are 4.05 and 4.21 days respectively. The implications of these delineations are discussed in a latter section of this comment letter.

3) Calculation method incorrect for upper 1/3 of estuary, may not be applicable
The Buzzards Bay Project recommended that the residence time of water in the upper 1/3 of an estuary be used as the basis of establishing a limit. This recommendation was made in recognition that a parcel of water in the upper 1/3 of an estuary tends to remain longer in an estuary than parcels near the mouth. That is to say, the replacement time or residence time of seawater in the upper estuary is longer. Certain types of models of flushing can demonstrate this.

If it were appropriate for the freshwater fraction for the upper 1/3 of the estuary (for example, for WASP model segment 5-21 as proposed in the report), the appropriate reference salinity is outside of the last segment in the analysis. In this case, segment 4 should be used, not segment 0 as used for the whole estuary calculation. This is because with the freshwater fraction method, freshwater replacement time is measured relative to exchange of salinities outside the last segment, using this salinity as the "background" value for the calculations. If this were not the case, a reference salinity of 31 ppt should be used to evaluate the whole system flushing, because this is the offshore salinity of typical of Buzzards Bay water as noted in the report. If this salinity reference value were used, dramatically longer freshwater replacement times would be reported. For example, on August 11, a value of 28.60 was observed at the mouth of the estuary. If a 31 ppt Buzzards Bay salinity was used as a reference, the whole system freshwater replacement time would be 12.7 days, not 5.7 days as reported. This also illustrates the importance of having a good estimate of salinity just outside the last segment.

When the freshwater fraction method is correctly performed on the upper 1/3 of the estuary using segment 4 as the reference, the fresh water replacement time values are 3.00 and 3.52 days respectively for the August and September Surveys (mean= 3.26 days), not 4.14 and 2.35 (includes calculation error as per comment 2) as reported.

Because of the morphology of the Wareham estuary, which includes some very low salinity segments on the Agawam River, a case could be made for including WASP model segment 4 in the "upper 1/3" analysis. Inclusion of WASP Segment 4 means theses "upper 1/3" of the estuary actually accounts for 43% of all WASP segment areas shown, but WASP segment 4 would have to be included if the Broad Marsh River and Crooked River parts of the Wareham River were included in the calculation, or if the low salinity segments of the upper Agawam were not included as part of the entire surface area of the "estuary." WASP Model segment 4 is an area where eutrophic conditions and loss of eelgrass have been reported. With WASP model segment 4, the upper 1/3 analysis results in upper 1/3 freshwater replacement times of 3.57 and 3.83 days respectively, or 3.7 days for a mean.

However, a more critical issue, is that the freshwater fraction method when applied to smaller upstream areas of an estuary result in shorter freshwater replacement times, not longer times. While this method is an accurate assessment of freshwater replacement times, it may not be appropriate for characterizing seawater residence times in the upper estuary. This contrasts with other types of models that show that a particle of water in the upper portion of an estuary, tends on average to reside longer in an estuary than a particle near the mouth. This nuance of the freshwater fraction model suggests that whole system freshwater replacement times and not upper 1/3 estuary freshwater replacement times be used as the proxy for seawater residence times for the purpose of establishing nitrogen loading limits.

4) Model not robust, results uncertain.
The results of the freshwater fraction method are not particularly robust in this study because out of 21 segments in the WASP model, segments 1 to 3 at the mouth account for 37% of total half-tide volume used in the calculations, and 31% and 46% of total freshwater volume on the two dates. Thus, if salinity values in either of these segments, or the reference salinity were not representative of the average salinity in that segment during the respective tide period, the freshwater replacement times will change considerably.

For example, on the August data set, using a salinity reference of 28.6 ppt for "outside" the estuary, a whole system freshwater replacement rate of 5.74 days was calculated. If the reference salinity were actually 29.0 ppt (a 1.4 % increase), calculated freshwater replacement time would be 6.98 days, a 22% increase in flushing time. A 5% increase in the reference salinity would increase freshwater replacement time 10.0 days, a 75% increase.

It is difficult to evaluate whether the reference salinities used in this study are appropriate. The location of the sampling stations differ on the two sampling dates. It appears that a single station 13 at the boundary of segment 1 was used as the reference station in Survey 2 in September. This left a single station 13A to characterize salinity in segment 1, which was 0.66 ppt higher in salinity than segment 2. In the Survey 1sampling in August, all the "outside" stations were near the mouth of the Weweantic River, and could have resulted in a somewhat lower reference salinity than appropriate. Presumably stations 13A and 13 were used on that date for the reference salinity. The complexities of characterizing a reference salinity using these locations are illustrated by the salinity profiles in figures 4-1 and 4-2. Station 13A, closer than 13 to the Weweantic mouth, is slightly higher in salinity than station 13. Moreover, in absolute value, station 13A is lower in salinity, especially near the surface during flood tides. Other problems include the fact that most of Broad Marsh River was not included in the model, and the portion that was included had no sampling station or data. These observations, together with the fact that the model is very sensitive to slight changes in reference salinity values suggest that estimates of freshwater replacement time in this study have wide confidence limits.

If the whole system estuary is defined as WASP model segments 2-21 or segments 3-21, the calculation is more robust because the first few segments have a lesser percent volume of the whole system, and replacement time is less sensitive to small changes in reference salinities. Also the adjoining "outside" segments used as a reference appears better sampled. This is illustrated by the reduced differences between the two sampling dates.

5) Summary of freshwater replacement times

A summary of the freshwater replacement times in the CDM study, corrected for calculation errors are as follows:

Table 1. Summary of flushing time calculations.

	Freshwater replacement time in days		
Area	survey 1	survey 2	mean
whole system (WASP segments 1-21)	5.74	7.87	6.81
whole system, defined as segs 2-21	5.68	5.68	5.68
whole system, defined as segs 3-21	4.05	4.21	4.13
upper 1/3, using segments 4-21	3.57	3.83	3.70
upper 1/3, using segments 5-21	3.00	3.52	3.26

Note: survey 1 was at neap tide, survey 2 was at spring tide.

Estimates of nitrogen loading

In 1998, the Buzzards Bay Project estimated that loading to the Wareham River estuary was 67,900 kg per year. In the current report, CDM estimates nitrogen load to the estuary to be 78,250 kg per year. This higher estimate by CDM was due to a number of factors, such as somewhat higher loadings for some types of land use, and inclusion of some new development. Most importantly, however, it was due to the fact that he lower watershed boundary now includes an additional highly developed area near the mouth of the Wareham River. In the CDM report, the Wareham estuary entrance is defined as a line between the tip of Cromset Point and an area near Swifts Beach, instead of the more inward natural constriction defined by the spit of land at Swifts Beach across the entrance as used by the Buzzards Bay Project in its 1998 report. As a result, the CDM report now includes densely developed areas around Marks Cove, including all of the Swifts Beach area, and additional areas of Great Neck. While the increased nitrogen loading rate caused by this more expansive watershed may at first suggest that more restrictive nitrogen limits may apply to the estuary, the inclusion of the large deep area at the entrance of the Wareham River has important effects on establishing a nitrogen limit as discussed below.

Other watershed boundary differences exist in the CDM report which appears to be based on land surface topography. In 1990, the Buzzards Bay project rejected this delineation and instead worked with USGS to develop a watershed boundary based on groundwater elevation. However, the differences in nitrogen loading resulting from these different upper watershed boundaries are probably modest, because the upper watershed is largely undeveloped, and because inclusions or omissions in one upper watershed boundary appear offset by comparable omissions or inclusions in the other upper watershed boundary.

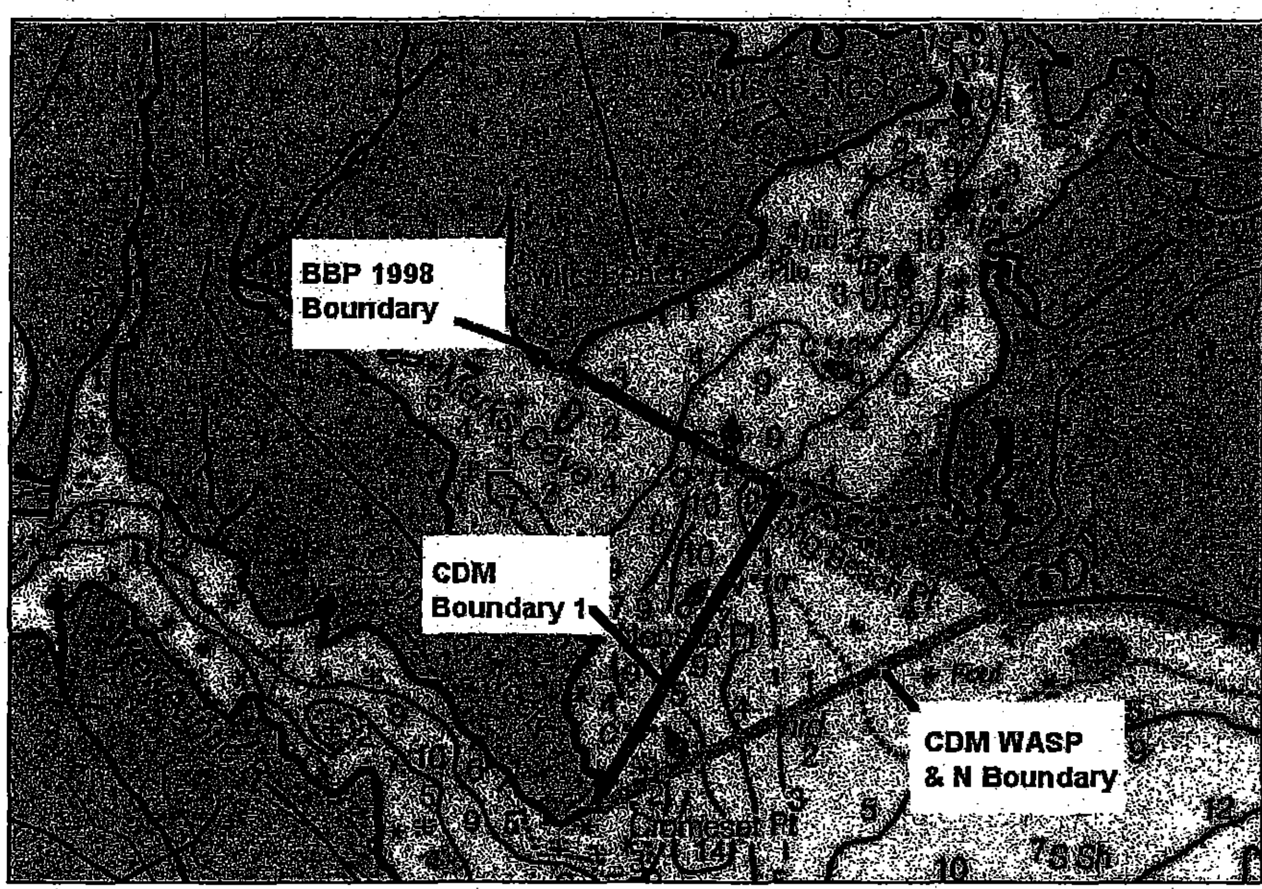
The additional loading projections in the CDM report are partly offset by a higher assumed attenuation rate for the upper watershed. CDM estimated that upper watershed attenuation is between 53% and 61% of land use loads. In the 1998 Buzzards Bay Project report, a preliminary upper watershed attenuation of 30% was adopted until specific data could be collected for this watershed. The CDM approach used in this study, namely comparing stream loads (concentration times flow) to land use loading estimates, is a sound one. However, several confounding variables could have contributed to an overestimate of attenuation. First, stream flow was lower during the period studied because of drought conditions. Lower flow would have lead to lower stream load compared to average land use loading contributions. During a wetter year, stream flow would have been high, and nitrogen concentrations at least as high resulting in a better agreement between annual loading by the stream and expected annual loading from land use.

Another factor that was not considered was the fact that there is a lag time between groundwater discharges from new development, and discharges to the surface waters. This lag time for some parts of the watershed may be 10 to 20 years. This lag could also account for part of the lower than expected loadings in the stream, and should be accounted for.

Finally, it appears that concentrations and loadings in the stream were volume weighted in the report's calculation of river nitrogen flux. That is important because during high flow periods, nitrogen concentrations were sometimes quite high in the stream. This is consistent with observations elsewhere that overland runoff of nitrogen occurs during heavy rains, and DIN in estuaries tend to be much higher during wet periods. However, loadings were only estimated for the period of March to October. Stream flows and DIN concentrations tend to be much higher in winter, and there is also less biological uptake in freshwater wetlands during this period. If the stream flows of the period November to February were accounted for, annual stream loading would be much closer to annual loadings projected from land use. The implications of choosing the lower flow stream period for evaluating upper watershed attenuation should be discussed.

Application of results to Nitrogen Loading standards

For the purposes of setting nitrogen loading limits, there must be agreement as to the boundary of the estuary, its area, volume, and flushing rate. Unfortunately, the delineation of the estuary boundary in Figure 1-1, the WASP model, the BBP 1998 report, and earlier flushing analyses all differ somewhat. The BBP questions CDM's proposed new boundary from Cromset Point to Long Beach Point as shown in Figure 1-1 of their report because the boundary does not agree with the estuary boundary as defined in their WASP model or land use a loading model in their report. It also differs from the BBP 1998 proposed boundary.



Roughly, the CDM estuary boundary in Fig. 1-1 of the CDM report corresponds to WASP model segments 2-21, and the BBP 1998 boundary corresponds to WASP segments 3-21. The position of the estuary boundary is important, because it defines the watershed boundary and watershed nitrogen loading estimates. What is more important, both flushing times, and acceptable loading limits can be greatly affected by boundary position. For example, the further outward into Buzzards Bay that the estuary is defined, the longer the whole system residence time, reducing proposed allowable nitrogen inputs. On the other hand, including the deeper areas at the mouth increases bay volume used in the nitrogen limit calculations, which in turn increases proposed allowable nitrogen limits.

There may also be a discrepancy on the estuary areas. The WASP model does not include upper Broad Marsh River and Upper Crooked River, and estuary area is reported to be 394 ha. Based on digitizing the entire area from a USGS quad maps, the total area of the estuary is 407 ha, which matches the omitted area of 13.8 hectares in the upper Broad Marsh River and upper Crooked River in segment 4. The depth of these areas was assumed to be 0.3 meters at half tide, with a volume equal to 41,000 cu m.

In reports issued in September 1999 and January 2000, the Buzzards Bay Project proposed more stringent nitrogen loading strategies for all Buzzards Bay embayments and recommended that regulatory agencies and municipalities adopt these more stringent standards for planning growth and upgrading wastewater treatment plants. The proposed "BBP-SB" standard corresponds to "eutrophic" water quality, "BBP-SA" standard corresponds to "fair" water quality, and the "BBP-ORW" limit corresponds to "Good to Excellent" in the Eutrophic Index scoring scheme, with no specific standard for "Excellent." There is concern and debate among regulators that the proposed Buzzards Bay Project standards may be too lenient for water quality designations under the clean water act and for application to TMDLs. For an estuary, like the Wareham River, the new proposed BBP-SA standard is 150 mg per cubic meter during the Vollenweider term adjusted residence time of water in the estuary, and .50 mg per cubic meter during the Vollenweider term adjusted residence time of water in the estuary for the BBP-ORW.

Below we show how the proposed standards apply to the estuary using the different assumed flushing times and estuary boundaries with their resulting differing bay volumes. To show the sensitivity of the analysis to salinity in the last segment, we also include loading limits if salinities in the reference segment were underestimated by 0.2 ppt. All bay volumes include the Broad Marsh River and Crooked River margin areas not included in the WASP Model. It is worth noting that when whole system freshwater replacement times are used for the three potential definitions of the estuary, and when the half tide volume appropriate to that definition of the estuary, the resulting recommended limits under the three definitions do not vary greatly (i.e., 71,100, 77,200, and 78,500). Use of the upper 1/3 of the estuary flushing time, and applying it to the whole system WASP 1-21 definition of the estuary results in a much more lenient limit, nearly twice existing nitrogen loadings.

Table 2. Summary of potential nitrogen limits for the Wareham Estuary. Use of "upper 1/3 flushing" using freshwater replacement time is not recommended for application to BBP methodology.

Estuary Definition	area (ha)	½ tide[b] Vol x10^6	"flushing" (days)	"BBP-SA"= "Fair" WQ recom. limit" (kg/y)	"BBP-ORW"= "Good to Excel." recom. limit (kg/y)
Whole system, WASP 1-21	407	8.45	6.15	77,200	25,800
w/ upper 1/3 flushing, seg 4	" "	" "	*3.70*	*137,600*	*45,900*
w/ upper 1/3 flushing, seg 5	" "	" "	*3.26*	*155,300*	*51,800*
Whole System, WASP 2-21	329	6.56	5.68	71,100	23,700
same, but salinity 0.2 ppt higher	329	6.56	6.22	65,300	21,800
whole system WASP 3-21[a] whole system	264	5.35	4.13	78,500	26,200

[a] This boundary is nearly equivalent to the BBP estuary delineation of 1998. The area is somewhat larger than reported in the 1998 report because the uppermost reaches of the Agawam were not included in that analysis.

[b] mean of two dates

Conclusions and recommendations

1) Currently the Wareham River estuary is among the most eutrophic in Buzzards Bay. It therefore appears inappropriate to apply the freshwater replacement time methodology using only the "upper 1/3" of the estuary segments in their flushing model, since that approach results in a proposed allowable limit for the estuary of twice existing nitrogen inputs. As noted earlier, the upper 1/3 estuary calculation using the freshwater replacement time methodology is inconsistent with the BBP methodology where it is recognized that waters in the upper 1/3 of the estuary remain longer in the estuary than waters near the mouth. Consequently, we recommend that whole estuary system flushing times be used when if the flushing time is approximated by the freshwater replacement time methodology. In this respect, flushing times for the whole estuary system defined as WASP model segments 2-21, are most consistent with CDM's definition of the estuary in Figure 1-1 of their report. This suggests a nitrogen loading limit of 71,120 kg per year if the BBP-SA standard ("fair" water quality) is to be applied. This is higher than the 57,800 kg per year limit proposed in 1998 by the Buzzards Bay Project for a small estuary area and volume than currently defined in this report.

2) The flushing model used is highly sensitive to the salinity measured in the last segment. For example, if the salinity of the reference segment was 0.2 ppt higher (that is, less than 0.8% error), allowable loading would be 8% lower (65,350 kg per year instead of 71,120 kg per year). A margin of safety may need to be considered for this calculation because only one station was generally measured in these reference segments, and variations in salinity between top and

bottom salinities and ebb and flow tides often exceed 0.2 ppt.

3) Attenuation may have been overestimated for the upper watershed, and a sensitivity analysis should be conducted to evaluate potential underestimates of river flow or lag times between nitrogen discharges to groundwater and discharge to rivers and streams.

4) In its 1998 preliminary analysis, the Buzzards Bay Project estimated that existing nitrogen loading to Wareham River estuary was about 18% over recommended limits. The current nitrogen load by CDM using an expanded definition of the watershed and estuary boundaries is about 10% over recommended limits, using whole estuary flushing times. This finding is consistent with eutrophic conditions observed in the estuary compared to other Buzzards Bay embayments. Specifically, many of the SA water quality targets proposed for SA waters by the Buzzards Bay Project are exceeded for this estuary. The estuary far exceeds BBP-ORW targets for "good to excellent" water quality. These facts suggest that it is appropriate to undertake actions to reduce nitrogen inputs to the estuary.

Sincerely,

Joseph E. Costa, Ph.D.

cc. Dr. Brian Howes (CMAST)
Camp Dresser and McKee
Dave Janik (EOEA)
Todd Callaghan (MCZM)
Ron Lyberger, DEP
Rick Dunn, DEP
Chuck Gricus, Wareham Planning Department
Mark Rasmussen, CBB

Memorandum

TO: Dave Pincumbe, EPA Region 1
FROM: Rick Dunn, DEP
Russ Isaac, DEP
DATE: December 26, 2000
SUBJECT: Comments on CDM Report for the Town of Wareham, June 2000

The MA DEP has completed its review of the report titled "Water Quality Investigation of the Wareham River Estuary Complex dated June 2000 prepared by Camp Dresser and McKee and Dr. Brian Howes from the Center of Marine Science and Technology. We have also reviewed previous comments developed by both David Pincumbe of EPA as well as those provided by the Buzzards Bay Project. This memorandum is intended to provide comments by DEP, over and above those provided by EPA and the Buzzards Bay Project relative to that report and/or to place emphasis in areas deemed to be appropriate by our agency.

DEP commends the efforts of the authors for developing and implementing this detailed water quality analysis. The new data will assist both EPA and DEP in developing an appropriate discharge limit for the Wareham Wastewater Treatment Facility and provides valuable information which is necessary to determine how the estuary responds to nutrient inputs both from the facility itself as well as the watershed.

General Comments:

While we agree with many of the conclusions and summaries presented in the report we believe the report clearly documents water quality problems within the Agawam River Estuary with chlorophyll a values reaching nearly 100 ug/L. While nitrogen appears to be the controlling factor in the system, phosphorus also plays a role but in a more restricted area in the vicinity of the discharge from Wareham's wastewater treatment facility. The information on water quality impacts is extensive and a strong case is made that nutrients are the driving force for these impacts. While it is clear that reduction of nutrients (nitrogen and possibly phosphorus) is needed, the most significant deficiencies of the report are that it does not 1) identify what loads are acceptable and therefore how much control is required either from the treatment facility nor the watershed, nor 2) account for future watershed loadings from changes in land use (such as implementation of the Makepeace Development) . These are, in our opinion, the major limitations of the report that need to be addressed.

Specific Comments and Observations:

1. Beyond the fundamental limitations associated with the state of the art, there are several which limit this study although less so than many similar efforts. The limitations include:

a. Attached aquatic plants are not mentioned, so presumably they were not encountered, but this should be verified.

b. DEP is concerned with projecting data over a twelve-month period when data was only collected from April through November in 1999. This certainly affects the accuracy of the estimates for the annual loads and thus introduces additional uncertainty beyond that which would be associated with a full year study. As a result DEP is concerned that the watershed loadings may be underestimated since a significant amount of watershed loading occurs during spring runoff conditions when groundwater is high. In addition, based upon previous reports, a large amount of nutrient loading (particularly phosphorus), is generated from cranberry bogs when winter and spring floodwaters are released.

c. the report apparently only estimates existing loadings from the wastewater treatment facility and does not address either design flow loadings of the existing facility nor what estimated loadings are expected to be in the future and what their resultant impact would be on water quality conditions.

2. The total yearly volume nearly always influences annual loads. As such, data from any one year is likely to be very different from the long-term average. Thus, estimating attenuation factors using one year's data is fraught with pitfalls. Also, the impact of travel time for N transported through groundwater further clouds the validity of any estimates for estimating an attenuation factor.

3. The estimate of flushing time varies widely. Even using the narrower range of 56 to 99 hours recommended in the report represents a factor of nearly 2. This range illustrates the inherent uncertainties that accompany any projections of water quality and suggests that control measures need to be accompanied by monitoring of the system to ascertain its actual response.

4. More discussion on the similarities of the hydrology of the Agawam and Eel Rivers is needed (how they are similar during low flow periods needs to be explained). Exactly which value to use for 7Q10 will have to be discussed.

5. The Agawam River is classified SB and the Wareham River is classified SA. The dissolved oxygen criteria are 5mg/L, 60% saturation and 6 mg/L, 80% saturation respectively. There is some confusion about this as exemplified by statements on page 4-56, the last several lines.

6. The first bullet on page 4-58 notes high (> 90 ug/L) chlorophyll a and supersaturated dissolved oxygen. Both are indicative of excessive nutrients. However, the low dissolved oxygen values are not noted. These too can be an indication of excessive productivity when they occur in combination with high or supersaturated concentrations of dissolved oxygen. While plots of dissolved oxygen are provided, the actual data should be included in the appendix.

7. C/N ratios of particulate matter are reported, but not discussed. There should be some discussion relative to the ratios significance in the report. In addition, the ratio of chlorophyll_a to C is of interest for the samples analyzed and should be presented and discussed as well.

8. The report (page 4-18) discusses salinity and increased dilution resulting in tidal influence however there appears to be an assumption that no additional pollutant loading remains as a result of tidal action. DEP believes that some additional pollutant loading gets brought back into the estuary and the report should account for it in its calculations.

9. DEP disagrees with the discussion relative to table 4-13 (page 4-43). DEP does NOT believe the data imply significant nitrogen removal in freshwater ponds (at least from this data set). We believe it is unreasonable to compare 1999 loading to the long-term average loading since 1999 was a dry year and the data were not collected during the entire year.

To: Internet Mail@Gateways@state.ma.us[david.pincumbe@epa.gov]
From: Todd Callaghan@CZM@EOEA
Cc: David Janik@CZM@DEP SERO,Internet Mail@Gateways@state.ma.us[dave.pincumbe@epa.gov],Joe Costa@bbp@EOEA
Subject: CDM's Wareham study comments
Attachment:
Date: 12/7/00 1:24 PM

Dave,

It's been a while since I read this study but I do have some comments. Most of my comments relate to the points that CDM made on p.4-59 regarding how the CDM study relates to NPDES permitting issues.

1. It appears to me that the 7Q10 for the Agawam River (10.8 cfs) calculated by EPA in the Fact Sheet of Wareham's NPDES Draft Permit is more accurate that the 7Q10 calculated by CDM (17.3 cfs; p.4-18). The main difference in calculation method seems to be that the EPA method takes into account the fact that the Agawam River watershed covers 2 basins; one with a flow factor of 1.0 cfs/sq. mile and one with a flow factor of 0.4 cfs /sq. mile.

If this in fact the case, I would argue that the EPA method is more accurate because the CDM method assumes that all of the Agawam watershed has the same flow rate (1.0 cfs/sq. mile). This generalization happens to be in Wareham's favor since it in effect raises the Dilution Factor and loosens Wareham's pollutant limitations.

2. I don't follow the logic involved in CDM's determination of the dilution ratio (p.4-19). I would agree with the EPA Fact Sheet that the dilution Factor is 4.9 and not 12.5 as suggested by CDM (p. 4-19).

3. It appears to me that because CDM's land use data is more current than the BBP's data, that the CDM estimate for N loading due to residential, commercial, and cranberry bog uses is more accurate than the BBP's (p.4-49). I also believe that the CDM study more accurately depicts the load contribution of the WPCF because the CDM estimate was based upon 6 years of DMR data (I'm assuming they used the most recent data), whereas the BBP study used an assumed flow rate and N discharge concentration.

4. It is interesting to note that CDM predicts that the total N load eliminated from the watershed due to sewering is approximately equal to the load added to the estuary through the WWTF from outside the watershed (p.4-50).

5. Other than the differences in land use, it appears that the major difference between the CDM study and the BBP study is the attenuation factor. CDM makes a reasonable claim that this difference is likely due to denitrification in the sediments of freshwater ponds and streams in the watershed. If it is in fact the case that 53- 61% of all N loads from land use are attenuated by these waterbodies, couldn't degradation of these waterbodies decrease their attenuating abilities? Is it possible that future uses to the lands bordering these waterbodies would diminish the capacity to reduce N?

If this is a possibility, perhaps a more conservative estimate of attenuation, say something between 30% (BBP's assumption) and 60% would be more reasonable for long-term planning purposes?

I am sorry I will not be able to attend the meeting on Monday (I am leaving tonight for a backpacking trip in NH and will be back Tuesday). Please keep me informed about any major discussions and developments.

Todd

--

Todd Callaghan
Water Quality Specialist
Massachusetts Coastal Zone Management
251 Causeway St., Suite 900
Boston, MA 02114-2136
617 626 1233

Responses to Comments on Water Quality Investigation of the Wareham River Estuary Complex (June 2000)

EPA and Similar DEP Comments

EPA Comment #1: The section on estimating 7Q10 flows for the Agawam River refers to flows in 1999 only dropping below the estimated 7Q10 of 17 cfs after a stop log was added upstream. Reference is also made to irregularities in gage data being matched to stop log movements. A full discussion of stop log usage needs to be included in the report. This should include all stop log locations, a description of stop log capabilities and practices, and detailed information on stop log usage in 1999. This is clearly a highly regulated river and this needs to be accounted for in any estimate of 7Q10 flows.

CDM Response: Although there may be many other less significant stop log stations, there are essentially only two main stop log stations located throughout the Wareham River Estuary watershed, both of which are owned and operated by the AD Makepeace Company. One of these stations is located on the Agawam River at the Route 12 bridge, just downstream of Mill Pond, while the other is located on the Wankinco River at the Tremont Nail Company along at the head of the herring run, just downstream of the Parker Mills Pond. These stations contain multiple stop logs, each measuring about 8 inches in height. Each of these stations affects the amount of freshwater that enters into the up stream end of the estuary.

According to AD Makepeace, there are basically two operations that require stop log activity. The first is a result of cranberry activity (fertilization, harvesting and winter storage) and the second is due to bog water level maintenance.

In a typical cranberry growing season stop log activity is described below. This type of activity is more relevant to stop log movement at individual bogs than at the two main stop log stations described above.

- During the winter (December – March) the cranberry bogs are flooded and allowed to freeze to protect the plants from winter injury. This practice requires a significant amount of water, and therefore in December when the bogs are flooded, stop logs are placed, thus reducing the river flow.

- In mid-March, when the ice melts from the winter freeze, the stop logs are taken out and the excess water is released, leading to significant increases in water flow in the rivers.

- Between mid-May and late August, the bogs may need to be flooded from time-to-time to apply pesticides and fertilizers. These applications are usually done in series, where one cranberry bog is flooded by the placement of stop logs and then the pesticides/fertilizers are applied. When the necessary time has passed, the bog is subsequently drained into the next bog where the operation is repeated. This

A.D. Makepeace Company
158 Tihonet Road
Wareham, MA 02571
(508) 291-4307
Fax: (508) 295-4385

FAX TRANSMISSION COVER SHEET

Date: 3/21/00

To: Camp Dresser McKee

Attn: Joel Melanson

Fax: 617 452 8360

Re: Wankinco River

Sender: George Rogers, V.P., Operations

8:35 AM (EST)

YOU SHOULD RECEIVE 7 PAGE(S), INCLUDING THIS COVER SHEET. IF NOT, PLEASE CALL (508) 291-4307.

MESSAGE:

Joel

Here's a log of field notes Craig has kept since last May. Hope this helps you. Don't forget I would like to know what the flows are in both the Agawam and Wankinco Rivers when you complete your work.

Thanks
George

TREMONT NAIL / LOWER PARKER MILLS

plank are	Date	Time	# plank in	#plank out	pond level			
8"x60"	5/1/99	1700	0	0	1.1 1/4			
	5/2/99	1030	1	0	1.1			
	5/3/99	655	0	0	1.0 3/4			
	5/4/99	702	0	1	1.3			
	#2	1130	0	1	1.3 1/2			
	5/5/99	705	0	1	1.3			
	5/6/99	728	0	0	1.2			
	5/7/99	858	0	0	1,0 3/4			
	5/8/99	1008	0	0	1			
	5/9/99	1140	0	0	1.0 3/4			
	5/10/99	659	1	0	1			
	#2	1515	1	0	1			
	5/12/99	645	1	0	1			
	5/15/99	710	0	0	1			
	5/16/99	1320	0	0	1.0 1/2			
	5/18/99	648	0	1	1.2			
	#2	1245	0	1	1.2			
	5/19/99	645	0	1	1.2			
	#2	1540	0	1	1.1			
	5/20/99	1037	0	0	0.9 1/2			
	5/22/99	1048	2	0	0.7			
	5/24/99	656	0	0	0.9			
	#2	1150	0	0	0.9 1/2			
	#3	1615	0	1	0.9 1/2			
	5/25/99	700	0	0	1.1 3/4			
	#2	1630	0	0	1.1 1/4			
	5/26/99	645	0	0	1.0 1/4			
	5/27/99	1630	0	0	0.9 3/4			
	5/28/99	650	1	0	0.9			
	5/30/99	900	0	0	1			
	5/31/99	900	0	0	1			
	6/1/99	645	1	0	0.9			
	6/2/99	645	0	0	1			
	6/3/99	645	0	0	1.0 1/2			
	6/4/99	1430	0	0	1.0 3/4			
	6/5/99	900	0	0	1			
	6/6/99	1010	0	0	0.9 1/2			
	6/7/99	715	0	0	1.0 1/4			
	6/8/99	645	2	0	0.8 1/2			
	6/9/99	655	2	************	0.6 1/2	************kids pulled planks		
	6/10/99	645	2	************	0.6	************kids pulled planks		
	6/11/99	715	0	0	0.9			

	6/12/99	915	1	0	0.9 3/4			
	6/13/99	1345	0	0	1.0 3/4			
	6/14/99	1000	0	1	1.2			
	6/15/99	600	0	1	1.2 1/4			
	6/16/99	1205	0	0	1.1 1/4			
	6/17/99	600	0	0	1.0 1/2			
	6/19/99	1000	0	0	0.9 3/4			
	6/20/99	1230	0	0	1.0 1/2			
	6/21/99	1005	0	0	1.1			
	6/22/99	1455	0	0	1.1			
	6/23/99	920	0	0	1.1 1/2			
	6/24/99	700	*****	0	1.0 1/2	*****	kids pulled plank	
	6/25/99	600	0	0	1.1 1/2			
	6/26/99	900	0	0	1.1 1/2			
	6/28/99	600	0	0	1.1 1/2			
	6/29/99	830	0	0	1.1 1/4			
	6/30/99	600	0	0	1.1 1/4			
	7/1/99	755	0	0	1.1 1/4			
	7/2/99	845	0	0	1.1			
	7/3/99	820	0	0	1.1 1/4			
	7/4/99	1030	0	0	1.1			
	7/5/99	950	0	0	1.1 1/4			
	7/6/99	900	0	0	1.1 1/4			
	7/7/99	600	0	0	1.1 3/4			
	7/8/99	1200	0	2	1.2			
	7/9/99	720	1	0	0.9			
	7/10/99	950	1	0	0.8 1/2			
	7/11/99	1015	*****	0	0.8 1/4	*****	kids pulled plank	
	7/12/99	1215	*****	0	0.8 1/2	*****	kids pulled plank	locks i
	7/13/99	600	0	0	0.9 1/4			
	7/14/99	600	0	0	1.0 1/4			
	7/15/99	600	0	0	1.1 1/4			
	vacation							
	7/26/99	600	0	1	1.2 1/2			
	7/27/99	600	0	0	1.1 1/4			
	7/28/99	930	1	0	1.0 3/4			
	7/30/99	900	0	0	0.9 3/4			
	vacation							
	8/9/99	550	0	0	0.9 3/4			
	8/10/99	555	1	0	0.7 3/4			
	8/11/99	600	1	0	0.7 1/2			
	8/12/99	545	0	0	0.9 1/2			

			PC	PO				
	8/13/99	545	0	1	1.1			
	8/14/99	925	0	0	1.0 1/4			
	8/15/99	1015	0	0	1.1 3/4			
	8/16/99	555	0	0	1.1 1/2			
	8/17/99	555	0	0	1.1			
	vacation							
	8/25/99	555	0	0	1			
	8/26/99	610	0	0	1.0 1/4			
	8/27/99	530	0	2	1.0 1/4			
	8/28/99	900	0	0	0.8 1/2			
	8/29/99	1045	0	0	0.7 1/2			
	8/30/99	645	0	0	0.7			
	8/31/99	700	1	0	0.7 1/2			
	9/1/99	650	0	0	0.9			
	9/2/99	755	0	0	0.9 1/2			
	9/4/99	1130	0	0	0.9 1/2			
	9/5/99	930	0	0	0.9 1/2			
	9/6/99	1050	1	0	0.9 1/2			
	9/7/99	649	0	0	1.0 1/4			
	9/8/99	653	0	0	1.0 1/2			
	9/9/99	645	0	0	1.1 1/4			
	#2	1900	0	2	1.1 1/4			
	9/10/99	652	0	2	1			
	#2	1733	0	2	1.1			
	9/11/99	852	1	0	0.9 1/2			
	9/12/99	1030	2	0	0.7 1/2			
	9/13/99	647	0	0	0.9			
	9/14/99	646	0	0	0.8			
	9/15/99	824	0	0	0.6 1/2			
	9/16/99	1311	0	8	0.7			
	9/17/99	730	8	0	0.4 1/2			
	9/18/99	632	1	0	0.7			
	#2	1826	1	0	0.7 1/2			
	9/19/99	912	0	0	0.8 1/2			
	9/20/99	650	0	0	0.9 1/4			
	9/21/99	648	0	0	0.9 3/4			
	9/22/99	645	0	0	0.9			
	9/23/99	644	0	0	0.9 1/2			
	9/24/99	638	0	0	1			
	9/25/99	846	0	0	1.0 1/4			
	9/26/99	1215	0	0	1.0 1/4			
	went picking							
	11/2/99	645	0	1	1.1			
	11/3/99	645	0	0	0.8 1/2			
	11/4/99	658	1	0	0.8 1/2			

	11/5/99	700	1	0	0.9			
	11/6/99	1016	1	0	0.9 3/4			
	11/7/99	900	0	0	1.1			
	11/8/99	650	0	0	1.0 3/4			
	11/9/99	642	0	0	1.0 1/2			
	11/10/99	647	0	0	1			
	vacation							
	11/15/99	656	0	0	1.0 3/4			
	11/16/99	652	0	0	1.0 3/4			
	11/17/99	1453	0	0	1.0 1/4			
	11/20/99	847	0	0	1			
	11/21/99	933	0	0	1			
	11/22/99	655	0	0	1			
	11/23/99	651	0	0	1			
	11/24/99	647	0	0	1			
	11/25/99	908	0	0	1			
	11/26/99	926	0	0	1			
	11/27/99	931	0	0	1.1			
	11/29/99	647	0	0	1.1 1/4			
	11/30/99	646	0	0	1.0 3/4			
	12/1/99	639	0	0	1.0 1/4			
	12/2/99	643	0	0	0.9 3/4			
	12/3/99	654	2	0	0.9 1/4			
	12/5/99	948	0	1	1.2			
	12/6/99	651	0	0	1.1			
	12/7/99	659	0	0	1.3 1/4			
	12/8/99	647	0	0	1.5			
	12/9/99	650	0	0	1.5			
	12/10/99	657	0	0	1.4 1/2			
	#2	1634	0	2	1.4 1/2			
	12/11/99	913	1	0	1.3			
	12/12/99	857	0	0	1.2 3/4			
	12/13/99	657	0	0	1.2 1/2			
	12/14/99	648	0	0	1.1 3/4			
	12/16/99	643	1	0	1.0 1/2			
	12/19/99	1137	0	0	1.2 3/4			
	12/20/99	650	0	0	1.3			
	12/21/99	659	0	0	1.1 1/2			
	12/22/99	642	0	0	1.1			
	12/23/99	741	0	0	0.9 3/4			
	12/24/99	935	0	0	1			
	12/26/99	1010	0	0	1.2			

	12/27/99	637	0	0	1.2 1/4			
	12/29/99	641	0	0	1.1			
	12/30/99	949	0	0	1.1			
	12/31/99	946	0	0	1.2 1/4			
	1/2/00	945	0	0	1.3 1/2			
	1/3/00	645	0	0	1.3 3/4			
	1/5/00	741	0	0	1.3 3/4			
	1/6/00	738	0	0	1.4			
	1/7/00	747	0	0	1.4			
	1/8/00	1034	0	1	1.3 3/4			
	1/9/00	918	0	0	1.2			
	1/10/00	738	0	0	1.1			
	1/11/00	751	1	0	1.2			
	1/12/00	739	0	0	1.2 1/4			
	1/13/00	741	1	0	1.1 1/2			
	1/14/00	750	0	0	1.2 3/4			
	1/15/00	1017	0	0	1.2 1/2			
	1/16/00	959	0	0	1.3			
	1/17/00	738	0	0	1.3 1/2			
	1/18/00	650	0	0	1.3 1/2			
	1/19/00	649	0	0	1.4			
	1/20/00	647	0	0	1.2			
	1/21/00	750	0	0	1.2			
	1/22/00	913	0	2	1.2			
	1/23/00	937	0	0	1.2			
	1/24/00	753	0	6	0.9 1/4			
	#2	1247	0	0	0.9 3/4			
	#3	1600	0	0	1.0 1/2			
	1/25/00	634	0	0	0.9 1/4			
	#2	1408	0	0	1.1			
	1/26/00	830	3	0	1			
	1/28/00	627	0	0	1.1 1/2			
	1/29/00	657	0	0	1.1 1/2			
	1/31/00	1045	2	0	0.9 1/4			
	2/1/00	726	2	0	0.8			
	2/3/00	1639	0	0	1.3			
	2/5/00	1017	0	0	1.2			
	2/6/00	1016	2	0	0.9			
	2/7/00	734	0	0	1.1 3/4			
	2/8/00	738	0	0	1.3 1/4			
	2/9/00	737	0	0	1.3 3/4			
	2/10/00	756	0	1	1.5			
	2/11/00	754	0	1	1.3 3/4			
	2/12/00	1018	0	0	1.0 1/2			

	2/13/00	1005	1	0	0.7 3/4			
	2/14/00	749	0	0	0.9			
	2/15/00	747	1	0	0.9 3/4			
	2/16/00	753	0	0	1.1			
	2/17/00	742	0	0	1.1			
	2/18/00	741	0	0	1.1			
	2/19/00	1031	0	0	1.1 1/2			
	2/20/00	1003	0	0	1.1 1/4			
	2/21/00	933	0	0	1.1 1/4			
	2/22/00	745	0	0	1.1			
	2/23/00	741	0	0	1.1			
	2/24/00	759	0	0	1.1			
	2/25/00	759	0	0	1.1			
	2/26/00	1007	0	0	1.2 1/2			
	2/27/00	858	0	0	1.2			
	2/28/00	733	0	1	1.2 1/2			
	2/29/00	735	0	0	0.9			
						end		

technique requires less water than if the operation was done to all of the bogs simultaneously.

- In the fall (mid-September – early November) when the cranberries are harvested, the cranberry bogs are flooded, requiring stop log placement. As with fertilization and pesticide application, this operation is usually done in series.

Water level maintenance in the cranberry bogs is the other major operation that requires stop log activity. To prevent flooding in the bogs and in upstream areas during large rainstorms, stop logs will be adjusted (lowered) so that the rain storage in the ponds upstream can be increased. It is during this time where the most significant changes in river flow are observed. When the storm has passed and the runoff has made its way through the upstream system, the stop logs will be replaced to their original position. In addition, during dry periods when the water in the bogs may drop due to excessive evaporation and low water input, stop logs may be placed to maintain adequate water levels in the bogs. This activity may produce artificially low flows in the rivers.

The AD Makepeace Company recorded stop log activity at the Wankinco River stop log station in a log book during our field program but kept no such records for the Agawam River station. This log book (see attached) indicates that for the summer of 1999 the stop logs stations were visited on a regular basis, between 1 and 2 times a day. The stop log activity ranged from about 14 stop log movements (putting in and taking out) per month (May 1999) to 5 (July and August 1999). Typically only one log is put in or taken out at a time, but during large rain storms, as in 9/10/99 (2.53 inches), 9/15/99 (1.13 inches) and 9/16/99 (1.12), several stop logs (up to 8) were taken out to drain the upstream ponds. The goal of most stop log activities is to maintain the water level in the cranberry bogs and ponds located upstream of the stop logs.

EPA Comment #2: Is the nutrient concentration data for April and May based on a daily grab sample while the data for June - October is based on 12-hour composite samples? How were loadings calculated prior to April 28th when flow measurements began?

CDM Response: Yes, nutrient concentration data for April and May are based on daily grab samples, while June through October data is based on 12-hour composites. Between April 5 and April 28, a constant flow of 0.916 m3/s for the Agawam River and 1.072 m3/s for the Wankinco River was used to calculate the loads. These flows were based on manual flow measurements. During this period there were only two rainstorms with significant rain. It is likely that the river flows for a few days was underestimated, though we believe the error is small given that river flows for similar rainstorms in the record increased by no more than 0.2 m3/s for up to 4 days after the storm.

EPA Comment #3: Paired unacidified and acidified grab samples for nitrogen were taken for QA purposes but I could not find this data in the report. What time of day were these grab sample taken?

CDM Response: These samples were collected at various times of day typically sometime between 7:00 a.m. to 7:00 p.m., though most were taken in the morning.

EPA Comment #4: It appears as if composite samples were not flow weighted. Since concentrations of nitrogen increase with increased flow rates, sampling that is not flow weighted would underestimate loadings. The significance of this should be evaluated.

CDM Response: The data show that there were no significant increases in river flows that were not captured within the 12-hour composited sampling period.

EPA Comment #5: Further justification of the assumption that April - October average loading rates can be used to estimate average loadings for November - March. A review of nearby gage data indicates that average flows for April - October are significantly less than annual average flows.

And

DEP Specific Comment #1b: DEP is concerned with projecting data over a twelve month period when data was only collected from April through November in 1999. This certainly affects the accuracy of the estimates for the annual loads and thus introduces additional uncertainty beyond that which would be associated with a full year study. As a result DEP is concerned that the watershed loadings may be underestimated since a significant amount of watershed loading occurs during the spring runoff conditions when groundwater is high. In addition, based upon previous reports, a large amount of nutrient loading (particularly phosphorus) is generated from cranberry bogs when winter and spring floodwaters are released.

And

DEP Specific Comment #4: More discussion on the similarities of the hydrology of the Agawam and Eel Rivers is needed (how they are similar during low flow periods needs to be explained). Exactly which value to use for 7Q10 will have to be discussed.

CDM Response: We acknowledge the agencies concerns about extrapolating the data up from 7 months to one year. We point out, however, that these 7 months of data provide real estimates of the nutrient loads during the critical algal growing season, and we believe that these data are the best data to use if one wanted to look at annual loads.

To address the agency's concerns about April to October average flows being less than annual average flows, CDM completed an analysis of flow records for rivers located in the proximity of Wareham using long-term data (1966 to 2000) from the USGS. This analysis was conducted to see what percentage of each river's annual flows occurred during our main sampling period (4/1 to 10/31). The flows for each river were summed into two periods, April 1 to October 31 and January 1 to December 31 using the entire available flow records. Further, we separately examined these periods for the year we conducted the sampling program (4/1/99 to 3/31/00) to see how our sampling year compared to average years. The results of these analyses are shown in Table 1.

Table 1
Summary of Average River Flows

	Segreganset River	*Indian Head River*	*Three Mile River*	*Jones River*	*Eel River*[1]
Average flow for 4/1 to 10/30 (cfs)[2]	13.6	42.5	116.6	25.6	26.9
Average flow for entire year (cfs)[2]	22.3	63.3	167.3	32.1	27.9
Ratio	0.61	0.67	0.70	0.80	0.96
Average flow for 4/1/99 to 10/30/00 (cfs)	5.8	33.4	62.8	23.3	N/A
Average flow for 4/1/99 to 3/31/00 (cfs)[3]	14.1	47.2	105.9	27.8	N/A
Ratio	0.41	0.71	0.59	0.84	

1 Eel River flow data collected from 1970 to 1971
2 Calculations performed on entire record of flow data available from the USGS.

EPA and DEP have commented that the average flows observed over our sampling period are typically less than annual average flows. In most river systems, this is to be expected as our sampling period includes the summer low flow season. The ratio of average flow from April 1 to October 30 to average flow over the entire record produces some interesting results. Table 1 (first two rows) provides these values for several rivers in southeastern Massachusetts, with the ratio in the third row. The ratios show that average flows during a main sampling period are 0.61 to 0.80 of the average flows for the entire year. The columns of Table 1 are arrange in ascending order, with the final column being the ratio of average flows for the Eel River (0.96), which only has about 1.5 years of data.

It is interesting to note that the ascending order of these rivers matches exactly the responsiveness of the rivers to low flow periods for the 1969-71 sampling period for which we have Eel River flows (Figure 4-12). That the ratio of average summer flows to average annual flows should be consistent among the rivers suggests that they have different hydrologic factors that affect low flows. (Note that we also considered the degree to which each river is regulated. According to narrative descriptions provided in USGS water year reports, all of these rivers have some degree of regulation, with the only clear distinction being less regulation on the Segreganset River.)

Similar data for April 1999 to March 2000 sampling year are shown in the last three rows of Table 1. These data show that lower average flows than is found in the entire record, which is to be expected because the summer of 1999 was a dry summer. They also show that the Segreganset River was more affected by the dry summer (by having proportionately lower average flows) than the other rivers. Interestingly, the Jones River, which had the most similar April-October vs. annual average flows (0.80) using the entire record, continued to have a high ratio (0.84) for the 1999-2000 year.

After the conclusion of the scheduled sampling program, Dr. Brain Howes left the pressure transducers in the Agawam and Wankinco River and continued to monitor flow until June 27, 2000, for a total of 14 months of measured river flow. Similar calculations were performed for these data and are shown in Table 2.

Table 2
Summary of 1999-2000 Average River Flow

	Agawam River	*Wankinco River*
Average flow for 4/1/99 to 10/30/00 (cfs)	27.6	30.6
Average flow for 4/1/99 to 3/31/00 (cfs)[3]	30.5	29.3
Ratio	0.91	1.04

Table 2 supports our contention that the Agawam and Wankinco Rivers are most hydrologically similar to the Eel River. That is, our studies have found that the gauged rivers in southeastern Massachusetts seem to behave similar during high flows. The differences occur during low flow periods, when the Agawam and Wankinco Rivers do not have as extreme low flow differences as most other rivers in the region.

In addition to the additional river flow measurements, Dr. Brian Howes also continued nutrient data collection in the Agawam and Wankinco Rivers. This work was not funded and thus the frequency of data collection was reduced. Dr. Howes' lab staff collected approximately weekly grab samples throughout this period. We have not completed analysis of these data but they suggest the calculated annualized flow and total nitrogen loads were within 10% of the values presented in the report. Annual total phosphorus loads, on the other hand, appear to have been overestimated in the report, perhaps by as much as 30%. For the period between November 1999 and March 2000, loads were computed assuming the measured nutrient concentrations were constant between sampling periods. A draft of the revised TN and TP flux data is attached as Revised Figure 3-26. We would be willing to share these data when we are done analyzing them.

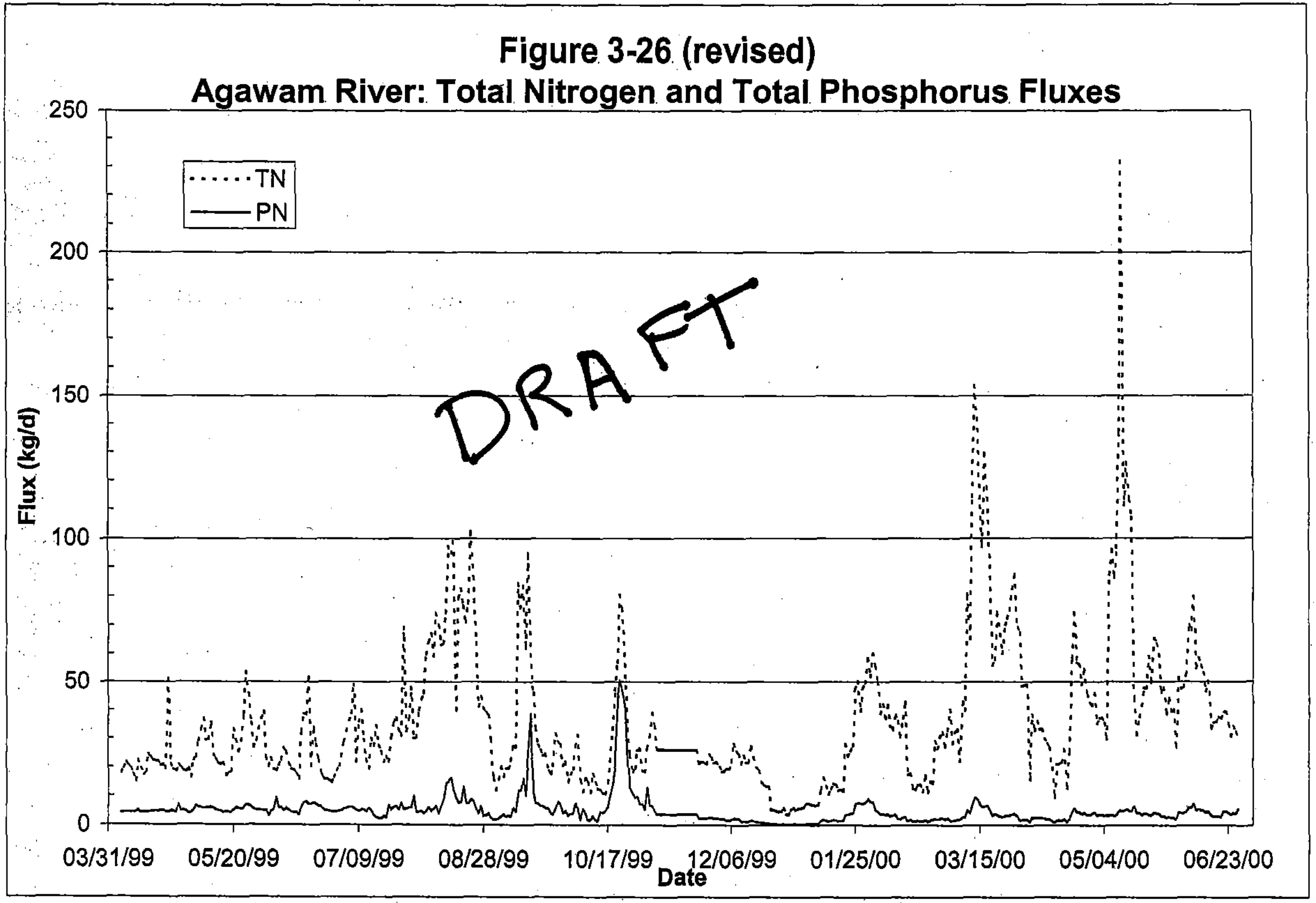


Figure 3-26 (revised)
Agawam River: Total Nitrogen and Total Phosphorus Fluxes
TN
PN
DRAFT
Flux (kg/d)
250
200
150
100
50
0
03/31/99
05/20/99
07/09/99
08/28/99
10/17/99
12/06/99
01/25/00
03/15/00
05/04/00
06/23/00
Date

EPA Comment #6: The report does not include an evaluation of the effect that the 1999 drought would have on the measured nutrient loadings. Precipitation, groundwater, and stream flow levels were all significantly lower than typical years. The relative difference between these levels and typical levels should be evaluated in order to determine an appropriate correction factor for the loadings measured during a severe drought condition.

CDM Response: While the summer of 1999 did have less rainfall than other years, we believe its effect on nutrient loadings is mitigated hydrology of the Agawam and Wankinco River systems. In terms of flow, we presented data in response to the previous comment that show that the Agawam and Wankinco Rivers had similar average flows in the periods (1) April 1999 through October 1999 and (2) April 1999 through March 2000. These data suggest that these rivers are not as affected by low flow periods so that while there may have been less river flow because of less rainfall (hence less runoff), the effect in the Agawam and Wankinco Rivers was likely not as great as in other river systems in the area.

We know of no study that measured nutrient delivery to a receiving water over a sufficiently long period of time to correlate nutrient loads with rainfall. We could speculate on many factors that would suggest scenarios from reduced nutrient delivery or similar nutrient delivery but have little basis for supporting one over another. We acknowledge that there could be interannual differences in nutrient loading based on rainfall and other factors. We point out, however, that having seven months of data is better than having no site-specific data, which is how the original permit limits were developed.

EPA Comment #7: The effluent total nitrogen data appears to correlate quite well with seasonal ground water levels. Lower concentrations occur during high groundwater periods and higher concentrations occur during low groundwater periods. The highest effluent concentration value measured occurred during a period when stream flows were the lowest as a result of the 1999 drought. This is not unexpected since it is well understood that the outfalls often contain significant quantities of groundwater in addition to effluent. Given this, it is inappropriate to use a long-term average outfall concentration with an average influent flow concentration to estimate treatment plant loads. It is unfortunate that actual outfall flows were not measured as part of the study. In the absence of outfall flow data, effluent loadings should be based on effluent concentrations during the extreme low flow periods when groundwater dilution of the effluent would be minimal.

CDM Response: While it is true that groundwater may dilute the effluent at the Wareham WPCF, CDM does not believe that annual variations in groundwater levels correlate well to total nitrogen effluent concentrations. CDM compared USGS groundwater levels (#MA-WFW 51) to total nitrogen effluent concentrations and found very little correlation. This USGS groundwater well is located in Wareham approximately four kilometers from the WPCF as illustrated in Figure 1. The data from this gauge (January 1994 to January 2001) are plotted versus the WPCF total nitrogen data in Figure 2. As illustrated, there is no correlation between the two data sets and furthermore when the groundwater is at is lowest (approximately 10 to 11 feet), the total effluent nitrogen concentrations vary the widest, ranging from 6.31 to 24.85 mg/l.

CDM believes that using a long-term average effluent concentration (15 mg/l) and long term influent flow rate (0.93 mgd) offers an accurate estimate of the nitrogen loading from the WPCF to the Wareham River Estuary. The variations in effluent concentration, as illustrated in Figure 3, suggest that a long-term average concentration will offer the most accurate estimate of how the WPCF is able to treat the wastewater. These variations do not correlate to seasonal trends in groundwater levels or influent flows.

Unfortunately the effluent flow rate is not measured at the WPCF and therefore the influent flow rate is used to estimate the effluent flow rate. This is a reasonable estimate because CDM does not believe that the groundwater infiltration comprises a significant portion of the flow exiting the effluent pipes.

EPA Comment #8: The original BBP land use based loadings estimate was based on an estimated number of housing units. CDM subsequently provided information indicating that the actual number of housing units was higher. The new CDM nitrogen loadings estimate for the subwatersheds contributing to the freshwater loads had to rely on the original BBP methodology since the actual number of housing units for each individual subwatershed is unknown. It is unclear however, if the new estimate is corrected for the under estimation of housing units made in the original BBP methodology.

CDM Response: As discussed in Section 4.2.3.1, the watershed nutrient load was segregated by specific subwatersheds. To accomplish this, CDM employed a land use based nutrient loading approach. The housing count analysis conducted in 1991 by CDM, was based on the 1990 Federal Census provided information, which was relative to the entire watershed. There wasn't sufficient data to segregate the housing count by subwatersheds, therefore the corrections made to the original BBP methodology had to be incorporated in a different manner.

These corrections were incorporated by basing the land use analysis on 2 data sets, Wareham parcel data and MassGIS land use data (with adjustments derived from the Wareham parcel data). The Wareham parcel data supplied land use data specific to every parcel of land (including housing count) within the section of the watershed contained within the Wareham Town limits. Nutrient loading rates were then developed for each of these land uses. The nutrient loads originating from the land outside the Town of Wareham were based on MassGIS land use. The nutrient loading rates for these land uses were based on the original BBP methodology, with

Figure 2
Groundwater Level (USGS Gage #MA-WFW 51)
vs
Wareham WPCF Effluent TN Concentration

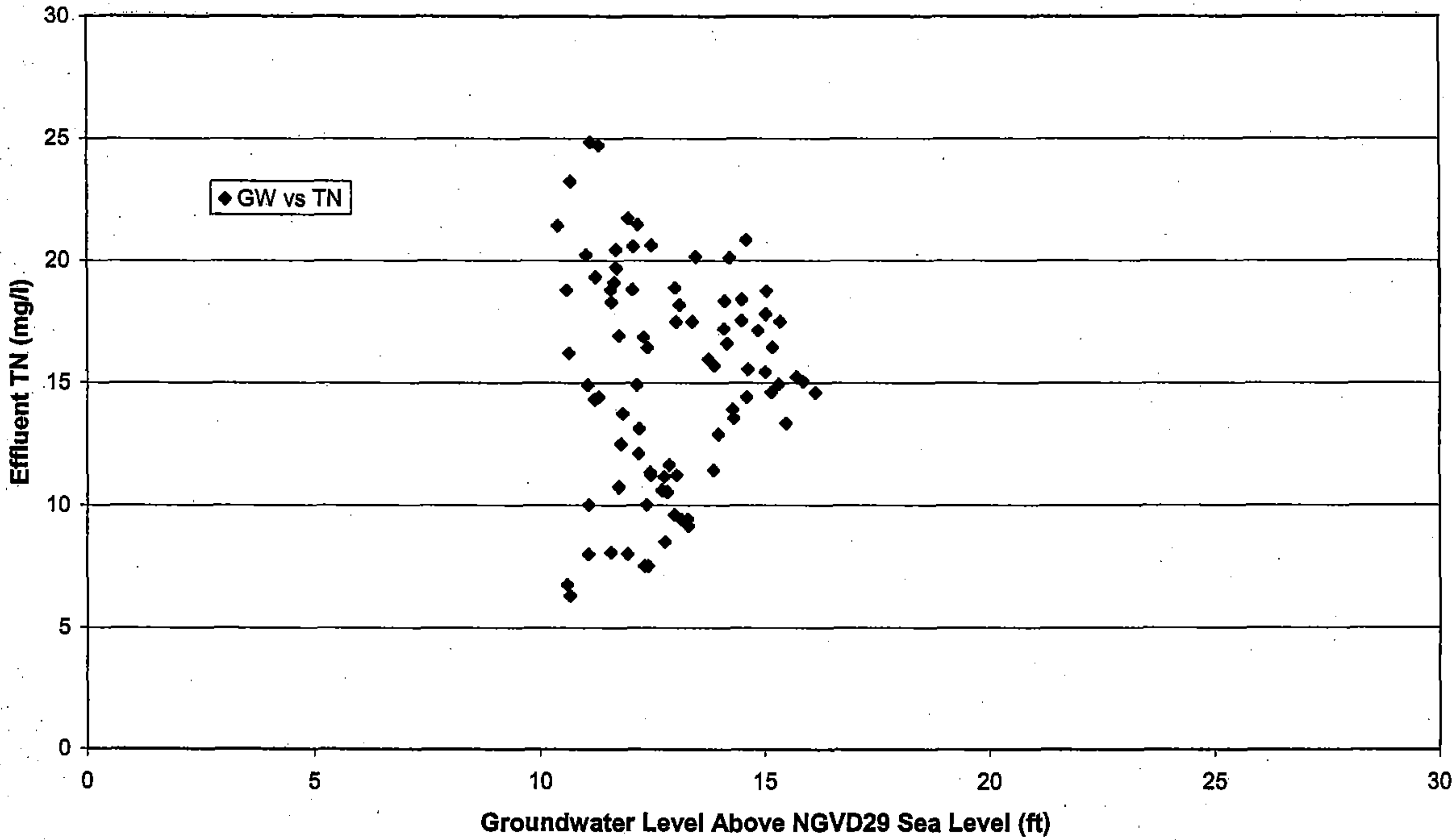
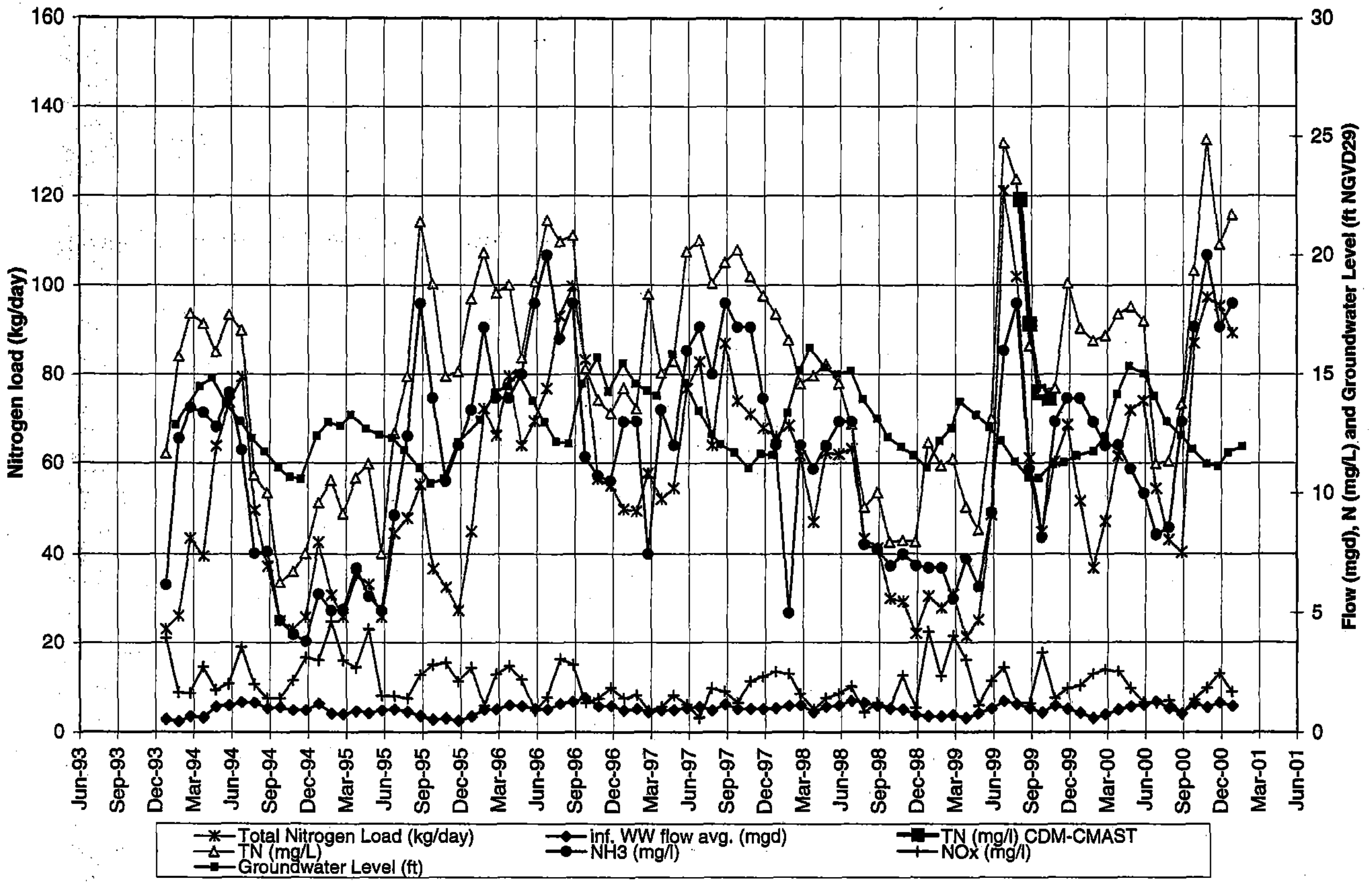


Figure 3
Monthly DMR Data For the Wareham Pollution Control Facility



adjustments derived from the Wareham parcel data set, *i.e.* typical lot sizes, as described in Section 4.2.3.2 of the report.

EPA Comment #9: The future sewer needs analysis estimates the change in nitrogen loading that is expected to result from sewering these areas. It is unclear however, what level of effluent flow is anticipated as a result of this sewering. Will sewering all of the needs areas result in effluent flows approaching the 1.6 MGD design flow?

and

DEP Specific Comment #1c: The report apparently only estimates existing loadings from the wastewater treatment facility and does not address either design flow loadings of the existing facility nor what estimated loadings are expected to be in the future and what their resultant impact would be on water quality conditions.

CDM Response: In the Wareham Report, CDM calculates a future WPCF load by estimating the additional load incorporated by sewering the 12 areas identified therein, given the present operating conditions of the WPCF. The nitrogen load taken from each of the "newly sewered" houses was added to the WWTP effluent load by a ratio of 15/33 (15 mg/l is the WWTP nitrogen effluent concentration and 33 mg/l is the typical septic system nitrogen effluent concentration). This analysis assumed that the future WWTP effluent concentration would remain the same at 15 mg/l and that the difference between the septic system effluent concentration (33 mg/l) and the WWTP effluent concentration (15 mg/l) was the nitrogen load eliminated from the watershed. This future load was estimated to be 22,415 kg-N/yr.

Currently the Wareham WPCF is undergoing an upgrade to its treatment processes and facilities. The future load from this new facility will depend on the effluent limits set forth in the Town's upcoming NPDES permit. The facility is designed to allow for reduction of nitrogen and phosphorus to technology-based limits.

As a part of the Wareham Wastewater Facilities Plan for the new facility, CDM has projected the average annual flow rate at the WPCF to increase to approximately 1.46 MGD in the year 2020. This increase in flow rate from existing conditions (average flow rate for 2000 was 0.98 MGD) is based on the completion of the following assumptions:

- Completing the sewering of the 12 areas identified in the Wareham Report.
- An extra allotted flow of 200,000 gallons per day for the Town of Bourne.
- Completing connection of some trailer parks to the Wareham WPCF collection system.

This estimate includes buildout for the 12 areas to be sewered, and includes an allowance for growth in existing sewered categories.

Other DEP Comments:

DEP General Comments: The Wareham report does not identify what loads are acceptable and therefore how much control is required from neither the treatment facility nor the watershed.

The report does not account for future watershed loadings from changes in land use (i.e. the AD Makepeace Company development).

CDM Response: These two tasks are outside the objectives set for this study.

DEP Specific Comment #1a: Attached aquatic plants are not mentioned, so presumably they were not encountered, but this should be verified.

CDM Response: Attached aquatic plants were observed in the far upper reaches of the Agawam River, in the freshwater portion just downstream of the dam and in the ponds located upstream of the dams on both the Agawam and Wankinco Rivers.

DEP Specific Comment #1b: See EPA Comment #5.

DEP Specific Comment #1c: See EPA Comment #9.

DEP Specific Comment #2: The total yearly volume nearly always influences annual loads. As such, data from any one year is likely to be very different from the long-term average. Thus, estimating attenuation factors using one year's worth of data is fraught with pitfalls. Also, the impact of travel time for N transported through groundwater further clouds the validity of any estimates for estimating an attenuation factor.

CDM Response: We agree there can be inter-annual variability in watershed attenuation. We point out, however, that having seven months of data is better than having no site-specific data, which is how the original permit limits were developed.

DEP Specific Comment #3: The estimate of flushing time varies widely. Even using the narrower range of 56 to 99 hours recommended in the report represents a factor of nearly 2. This range illustrates the inherent uncertainties that accompany any projections of water quality and suggests that control measures need to be accompanied by monitoring of the system to ascertain its actual response.

CDM Response: CDM agrees with DEP that the flushing time varies widely. The results of the flushing analysis indicate that the calculation of this value is not a simple calculation. If the regulatory agencies continue to pursue setting nitrogen limits that require a flushing rate as part of the calculations, then more effort should be put forward to its establishment. General calculations will only produce a range of values. It may be necessary for EPA/DEP to develop flushing rates for these embayments using a hydrodynamic model, set up and calibrated specific to each embayment.

DEP Specific Comment #4: See Response to EPA Comment 5.

DEP Specific Comment #5: The Agawam River is classified SB and the Wareham River is classified as SA. The dissolved oxygen criteria are 5mg/l, 60% saturation and 6mg/l, 80% saturation respectively. There is some confusion about this as exemplified on page 4-56, the last several lines.

CDM Response: There is a typo in the sentence referred to above. It should read, "...slightly below the Massachusetts standard of 5 mg/l and 60% saturation." In addition a similar typo was found at the top of page 3-40. The sentence should read, "... where they were just below the Massachusetts SB water quality standard of 5 mg/l and 60% saturation."

DEP Specific Comment #6: The first bullet on page 4-58 notes high (> 90 ug/l) chlorophyll a and supersaturated dissolved oxygen. Both are indicative of excessive nutrients. However, the low dissolved oxygen values are not noted. These too can be an indication of excessive productivity when they occur in combination with high or supersaturated concentrations of dissolved oxygen. While plots of dissolved oxygen are provided, the actual data should be included in the appendix.

CDM Response: CDM has attached a copy of dissolved oxygen data from both the river runs and the tidal flux studies.

DEP Specific Comment #7: C/N ratios of particulate matter are reported, but not discussed. There should be some discussion relative to the ratios significance in the report. In addition, the ratio of chlorophyll a to C is of interest for the samples analyzed and should be presented and discussed as well.

CDM Response: C/N ratios are shown in Appendix C. The C/N ratios for wastewater effluent are in the typical range. The C/N ratios in both the estuarine and river samples are similar to each other and suggest that the material is primarily phytoplankton. It is not possible to distinguish between freshwater and saltwater phytoplankton based on these C/N ratios. Further, the freshwater coming over the dam does not show the presence of organic matter from wetland and terrestrial plants, whose C/N ratios are typically >>10.

DEP Specific Comment #8: The report (page 4-18) discusses salinity and increased dilution resulting in tidal influence however there appears to be an assumption that no additional pollutant loading remains as a result of tidal action. DEP believes that some additional pollutant loading gets brought back into the estuary and the report should account for it in its calculation.

CDM Response: CDM believes that the numerical model used to estimate the 4-day average concentration (Section 4.1.3.3) incorporates the additional pollutant load that remains as a result of tidal action. First, the model is forced by both tidal and river mixing, resulting in both ebbing and flooding water motion. The load from the WPCF

Project: Wareham
Boat run: Dissolved Oxygen, CTD, and nutrients were taken same day.
Sampling Date: August 12, 1999

Station: 1 Flood
Time:

Depth (m)	DO mg/L	Temp (C)
0.25	8.35	22.8

Station: 1 EBB
Time: 10:16

Depth (m)	DO mg/L	Temp (C)
0	8.49	22.3
0.25	8.45	22.3
0.5	8.45	22.3
0.75	8.34	22.2

Station: 1 A EBB
Time:

Depth (m) **DO mg/L** **Temp (C)**
Unable to take, ran out of time before tide switch

Station: 1 A EBB
Time: 10:28

Depth (m)	DO mg/L	Temp (C)
0	6.64	22.5
0.25	6.74	22.4
0.5	6.55	22.4
0.75	6.21	22.5
1	4.69	22.3
1.25	5.01	22.4
1.5	5.38	22.5

Station: 2 FLOOD
Time: 17:32

Depth (m)	DO mg/L	Temp (C)
0	7.84	27

Station: 2 EBB
Time: 10:40

Depth (m)	DO mg/L	Temp (C)
0	6.51	22.9
0.25	6.72	22.8
0.5	7.49	22.8
0.75	6.68	22.7
1	6.01	22.7

Station: 2A FLOOD
Time: 17:46

Depth (m)	DO mg/L	Temp (C)
0	8.91	26.6
0.25	9.16	26.5

Station: 2A EBB
Time: 10:52

Depth (m)	DO mg/L	Temp (C)
0	7.02	22.9
0.25	6.92	22.9
0.5	6.96	22.8
0.75	6.71	22.8
1	6.65	22.7
1.25	5.82	22.7

Project: Wareham
Boat run: Dissolved Oxygen, CTD, and nutrients were taken same day.
Sampling Date: August 12, 1999

Station: 3 Flood
Time: 17.55

Depth (m)	DO mg/L	Temp (C)
0	9.45	26.2
0.25	9.32	26.2
0.5	9.54	26.2
0.75	9.90	26.1

Station: 3 EBB
Time: 11:00

Depth (m)	DO mg/L	Temp (C)
0	7.74	23.06
0.25	7.68	22.86
0.5	7.76	22.76
0.75	7.65	21.48
1	7.36	21.34
1.25	6.95	21.22

Station: 3A Flood
Time: 18:08

Depth (m)	DO mg/L	Temp (C)
0	14.05	26
0.25	13.95	26

Station: 3A EBB
Time: 11:14

Depth (m)	DO mg/L	Temp (C)
0	5.89	23.1
0.25	5.85	23.1
0.5	5.92	23
0.75	5.81	23
1	5.77	23
1.25	5.75	23

Station: 4 FLOOD
Time: 18:21

Depth (m)	DO mg/L	Temp (C)
0	10.30	25.1
0.25	10.45	25.2

Station: 4 EBB
Time: 11:29

Depth (m)	DO mg/L	Temp (C)
0	5.65	23.4
0.25	5.29	23.1
0.5	5.23	23.1
0.75	5.19	23.1

Station: 4A FLOOD
Time: 18:34

Depth (m)	DO mg/L	Temp (C)
0	9.76	25.1
0.25	9.91	25.2
0.5	7.08	24.6
0.75	7.08	24.6

Station: 4 A EBB
Time: 11:45

Depth (m)	DO mg/L	Temp (C)
0	5.98	20.32
0.25	5.88	20.14
0.5	5.88	20.14
0.75	5.85	20.14
1	5.81	19.77
1.25	5.72	19.77
1.5	5.47	19.76
1.75	5.7	19.75
2	5.65	19.62
2.25	5.61	19.75

Project: Wareham
Boat run: Dissolved Oxygen, CTD, and nutrients were taken same day.
Sampling Date: August 12, 1999

Station: 5 FLOOD
Time: 19:13

Depth (m)	DO mg/L	Temp (C)
0	7.53	24.7
0.25	7.57	24.7
0.5	7.39	24.6
0.75	7.46	24.6
1	7.33	24.6
1.25	7.37	24.6
1.5	7.30	24.6
1.75	7.31	24.6
2	7.30	24.6
2.25	7.20	24.6
2.5	7.20	24.6
2.75	7.09	24.6
3	6.75	24.6

Station: 5 EBB
Time: 12:30

Depth (m)	DO mg/L	Temp (C)
0	6.49	23.7
0.25	5.95	23.5
0.5	5.37	23.5
0.75	5.07	23.3
1	4.98	23.3
1.25	4.94	23.3
1.5	4.92	23.3
1.75	4.87	23.3
2	4.85	23.3
2.25	4.85	23.3
2.5	4.86	23.2
2.75	4.84	23.2
3	4.77	23.2
3.25	4.80	23.2
3.5	4.80	23.2
3.75	4.81	23.2
4	4.86	23.2
4.25	4.85	23.2
4.5	4.72	23.2

Station: 5A FLOOD
Time: 19:26

Depth (m)	DO mg/L	Temp (C)
0	7.95	24.7
2.5	6.36	24.2

Station: 5 A EBB
Time: 12:51

Depth (m)	DO mg/L	Temp (C)
0	5.30	23.5
0.25	5.16	23.4
0.5	5.17	23.4
1	5.15	23.4

Station: 6 flood
Time: 18:49

Depth (m)	DO mg/L	Temp (C)
0	8.51	24.8
0.25	7.71	24.8
0.5	7.56	24.8

Station: 6 EBB
Time: 12:07

Depth (m)	DO mg/L	Temp (C)
0	6.56	23.6
0.25	6.18	23.5
0.5	5.71	23.2
0.75	4.76	23.1

Station: 6A Flood
Time: 18:56

Depth (m)	DO mg/L	Temp (C)
0	7.94	24.6
0.25	7.21	24.6
0.5	7.25	24.6
0.75	7.31	24.6
1	7.29	24.6
1.25	7.28	24.6
1.5	7.25	24.6

Station: 6A EBB
Time: 12:19

Depth (m)	DO mg/L	Temp (C)
0	7.12	23.6
0.25	6.64	23.6
0.5	6.47	23.5
0.75	6.03	23.3
1	5.35	23.1
1.25	5.13	23
1.5	5.08	23
1.75	5.09	23
2	5.12	23.1

Project: Wareham
Boat run: Dissolved Oxygen, CTD, and nutrients were taken same day.
Sampling Date: August 12, 1999

Station: 7 FLOOD
Time: 19:50

Depth (m)	DO mg/L	Temp (C)
0	8.68	25.2
0.9	6.34	24.3

Station: 7 EBB
Time: 13:16

Depth (m)	DO mg/L	Temp (C)
0	5.98	24
0.25	6.29	23.7

Station: 7A FLOOD
Time: 19:46

Depth (m)	DO mg/L	Temp (C)
0	7.56	24.7
1.5	6.22	24.1

Station: 7A EBB
Time: 13:20

Depth (m)	DO mg/L	Temp (C)
0	6.70	23.7
0.5	6.62	23.5

Station: 8 FLOOD
Time: 19:42

Depth (m)	DO mg/L	Temp (C)
0	8.43	24.9
1.9	6.63	24

Station: 8 EBB
Time: 13:28

Depth (m)	DO mg/L	Temp (C)
0	5.57	24.2
0.8	5.63	23.6

Station: 8A FLOOD
Time: 19:38

Depth (m)	DO mg/L	Temp (C)
0	7.26	24.4
1.9	6.62	24

Station: 8A EBB
Time: 13:32

Depth (m)	DO mg/L	Temp (C)
0	6.17	23.8
0.5	5.97	23.6

Station: 9 FLOOD
Time: 19:34

Depth (m)	DO mg/L	Temp (C)
0	6.89	24.1
3.4	6.66	23.9

Station: 9 EBB
Time: 13:36

Depth (m)	DO mg/L	Temp (C)
0	5.38	23.7
1.5	5.43	23.5

Station: 9A Flood
Time:

Depth (m)	DO mg/L	Temp (C)
0	5.71	23.8
2.4	5.59	23.8

Station: 9A EBB
Time:

Depth (m)	DO mg/L	Temp (C)
0	5.85	24.1
3.5	5.28	23.1

Project: Wareham
Boat run: Dissolved Oxygen, CTD, and nutrients were taken same day.
Sampling Date: August 12, 1999

Station: 10 Flood
Time:

Depth (m)	DO mg/L	Temp (C)
0	5.53	23.8
1	5.33	23.8

Station: 10 EBB
Time:

Depth (m)	DO mg/L	Temp (C)
0	5.44	24.3
0.6	5.86	23.9

Station: 10A Flood
Time: 7:16

Depth (m)	DO mg/L	Temp (C)
0	5.65	23.8
2.9	5.67	23.7

Station: 10A EBB
Time:

Depth (m)	DO mg/L	Temp (C)
0	5.86	23.8
1.5	5.54	23.4

Station: 11 Flood
Time: 7:09

Depth (m)	DO mg/L	Temp (C)
0	5.41	23.7
2.4	5.32	23.7

Station: 11 EBB
Time: 14:09

Depth (m)	DO mg/L	Temp (C)
0	5.91	23.7
2.5	5.58	23.4

Station: 11A Flood
Time: 6:59

Depth (m)	DO mg/L	Temp (C)
0	5.97	23.6
4.9	5.40	32.5

Station: 11A EBB
Time: 14:38

Depth (m)	DO mg/L	Temp (C)
0	6.09	23.6
2.5	6.08	23.6

Station: 12 Flood
Time: 6:44

Depth (m)	DO mg/L	Temp (C)
0	5.92	23.5
2	5.62	23.6

Station: 12 EBB
Time: 14:56

Depth (m)	DO mg/L	Temp (C)
0	5.69	23.9
2.3	5.63	23.5

Station: 12A Flood
Time: 7:50

Depth (m)	DO mg/L	Temp (C)
0	5.73	23.4
2	5.41	23.4

Station: 12A Ebb
Time: 15:04

Depth (m)	DO mg/L	Temp (C)
0	5.71	23.9
1.8	6.45	23.6

Project: Wareham
Boat run: Dissolved Oxygen, CTD, and nutrients were taken same day.
Sampling Date: August 12, 1999

Station: 13 FLOOD
Time: 20:27

Depth (m)	DO mg/L	Temp (C)
0	6.45	22.9
4.4	6.16	22.8

Station: 13 EBB
Time: 14:38

Depth (m)	DO mg/L	Temp (C)
0	6.24	24
3.5	5.60	23.2

Station: 13A Flood
Time: 6:40

Depth (m)	DO mg/L	Temp (C)
0	5.86	23.5
2.4	5.53	23.1

Station: 13A Ebb
Time:

Depth (m)	DO mg/L	Temp (C)
0	5.94	24
2.4	5.34	23.5

Project: Wareham
Boat run: Dissolved Oxygen, CTD, and nutrients were taken same day.
Sampling Date: September 23, 1999

Station: 1 Flood
Time: 18:21

Depth (m)	DO mg/L	Temp (C)
0	8.82	18.6
0.25	8.68	18.6

Station: 1 EBB
Time: 9:56

Depth (m)	DO mg/L	Temp (C)
0	8.31	17.9
0.25	8.27	18
0.5	8.13	18

Station: 1A Flood
Time: 15:34

Depth (m)	DO mg/L	Temp (C)
0	8.47	21.2
0.25	8.42	21.2
0.5	8.45	21.2

Station: 1A EBB
Time: 10:28

Depth (m)	DO mg/L	Temp (C)
0	7.88	17.5
0.25	7.85	17.7
0.5	7.87	17.7
0.75	7.89	17.7

Station: 2 Flood
Time: 15:56

Depth (m)	DO mg/L	Temp (C)
0	8.49	20.6
0.25	8.5	20.6

Station: 2 EBB
Time: 10:47

Depth (m)	DO mg/L	Temp (C)
0	7.09	17
0.25	7.06	17

Station: 2A Flood
Time: 16:06

Depth (m)	DO mg/L	Temp (C)
0	8.54	20.4
0.25	8.64	20.4
0.5	8.66	20.3

Station: 2A EBB
Time: 11:00

Depth (m)	DO mg/L	Temp (C)
0	7.17	17.5
0.25	7.02	17.5
0.5	6.97	17.5

Project: Wareham
Boat run: Dissolved Oxygen, CTD, and nutrients were taken same day.
Sampling Date: September 23, 1999

Station: 3 Flood
Time: 16:14

Depth (m)	DO mg/L	Temp (C)
0	8.54	20.2
0.25	8.56	20.2
0.5	8.48	20.2
0.75	8.44	20.2
1	8.37	20.2

Station: 3 EBB
Time: 11:11

Depth (m)	DO mg/L	Temp (C)
0	7.82	17.6
0.25	7.65	17.6
0.5	7.55	17.7
0.75	7.39	17.7

Station: 3 A Flood
Time: 16:30

Depth (m)	DO mg/L	Temp (C)
0	8.16	20.1
0.25	8.05	20.1
0.5	7.95	20.1
0.75	7.74	20.1
1	7.58	20

Station: 3 A EBB
Time: 11:29

Depth (m)	DO mg/L	Temp (C)
0	6.59	17.4
0.25	6.65	17.4
0.5	6.63	17.4
0.75	6.57	17.4
1	6.58	17.4

Station: 4 Flood
Time: 16:47

Depth (m)	DO mg/L	Temp (C)
0	6.83	20.2
0.25	6.84	20.2
0.5	6.79	20.1
0.75	6.73	20.1
1	6.7	20.1
1.25	6.7	20

Station: 4 EBB
Time: 11:46

Depth (m)	DO mg/L	Temp (C)
0	6.62	17.9
0.25	6.71	17.9
0.5	6.56	18
0.75	5.87	18.3

Station: 4A Flood
Time: 17:07

Depth (m)	DO mg/L	Temp (C)
0	7.04	19.8
0.25	7.02	19.8
0.5	7.03	19.8
0.75	6.96	19.8
1	6.91	19.8

Station: 4A EBB
Time: 12:06

Depth (m)	DO mg/L	Temp (C)
0	6.26	18.5
0.25	6.26	18.5
0.5	6.22	18.5
0.75	6.12	18.5
1	6.14	18.5
1.25	6	18.5

Project: Wareham
Boat run: Dissolved Oxygen, CTD, and nutrients were taken same day.
Sampling Date: September 23, 1999

Station: 5 Flood
Time: 17:53

Depth (m)	DO mg/L	Temp (C)
0	6.9	19.7
0.25	6.9	19.7
0.5	6.88	19.7
0.75	6.89	19.7
1	6.9	19.7
1.25	6.89	19.7
1.5	6.92	19.7
1.75	6.84	19.7

Station: 5 EBB
Time: 12:30

Depth (m)	DO mg/L	Temp (C)
0	6.66	19.1
0.25	6.68	19.1
0.5	6.69	19.2

Station: 5 A Flood
Time: 18:08

Depth (m)	DO mg/L	Temp (C)
0	6.91	19.6
0.25	6.9	19.6
0.5	6.89	19.6
0.75	6.92	19.6
1	6.94	19.6
1.25	7.02	19.6
1.5	6.93	19.6
1.75	6.97	19.6
2	6.86	19.6
2.25	6.91	19.6
2.5	6.87	19.7

Station: 5 A EBB
Time: 13:08

Depth (m)	DO mg/L	Temp (C)
0	6.44	19.2
0.25	6.42	19.2
0.5	6.36	19.2
0.75	6.41	19.2
1	6.39	19.2
1.25	6.36	19.2
1.5	6.28	19.2

Station: 6 Flood
Time: 17:26

Depth (m)	DO mg/L	Temp (C)
0	7.22	19.6
0.25	7	19.7
0.5	7	19.7
0.75	6.98	19.7
1	6.94	19.7
1.25	6.94	19.7
1.5	6.9	19.7

Station: 6 EBB
Time: 12:28

Depth (m)	DO mg/L	Temp (C)
0	8.41	20.2
0.25	8.43	20.2
0.5	8.4	20.2
0.75	8.38	20.2

Project: Wareham
Boat run: Dissolved Oxygen, CTD, and nutrients were taken same day.
Sampling Date: September 23, 1999

Station: 6 A Flood
Time: 12:40

Depth (m)	DO mg/L	Temp (C)
0	6.91	19.7
0.25	6.93	19.7
0.5	6.98	19.7
0.75	6.95	19.7
1	6.97	19.7
1.25	6.93	19.7
1.5	6.93	19.7
1.75	6.91	19.7
2	6.93	19.8

Station: 6 A EBB
Time: 12:40

Depth (m)	DO mg/L	Temp (C)
0	7.78	19.6
0.25	6.91	20.1
0.5	8.73	20.3
0.75	8.46	20.1

Station: 7 Flood
Time: 14:46

Depth (m)	DO mg/L	Temp (C)
0	6.67	19.7
3.1	6.81	19.2

Station: 7 EBB
Time: 9:47

Depth (m)	DO mg/L	Temp (C)
0	5.75	18.6
3	5.71	18.7

Station: 7A Flood
Time: 15:02

Depth (m)	DO mg/L	Temp (C)
0	6.92	19.7
3.6	6.73	19.2

Station: 7A EBB
Time: 9:58

Depth (m)	DO mg/L	Temp (C)
0	5.88	18.7
4	5.86	18.7

Station: 8 Flood
Time: 15:09

Depth (m)	DO mg/L	Temp (C)
0	6.57	19.8
3.8	6.62	19.1

Station: 8 EBB
Time: 10:17

Depth (m)	DO mg/L	Temp (C)
0	5.89	18.7
5	5.82	18.7

Project: Wareham
Boat run: Dissolved Oxygen, CTD, and nutrients were taken same day.
Sampling Date: September 23, 1999

Station: 8A Flood
Time: 15:21

Depth (m)	DO mg/L	Temp (C)
0	6.83	19.7
3	6.44	19.2

Station: 8A EBB
Time: 10:32

Depth (m)	DO mg/L	Temp (C)
0	5.73	18.7
3.3	6.02	18.9

Station: 9 Flood
Time: 15:32

Depth (m)	DO mg/L	Temp (C)
0	6.56	19.7
1.5	6.70	19.6

Station: 9 EBB
Time: 10:41

Depth (m)	DO mg/L	Temp (C)
0	6.06	18.8
1.2	6.14	18.8

Station: 9A Flood
Time: 15:47

Depth (m)	DO mg/L	Temp (C)
0	7.31	20.4
1.2	7.14	19.4

Station: 9A EBB
Time: 10:56

Depth (m)	DO mg/L	Temp (C)
0	6.11	18.8
0.8	6.14	6.14

Station: 10 Flood
Time: 15:54

Depth (m)	DO mg/L	Temp (C)
0	7.05	19.8
2.75	7.3	19.3

Station: 10 EBB
Time: 11:04

Depth (m)	DO mg/L	Temp (C)
0	6.18	18.8
1.2	6.07	18.9

Station: 10A Flood
Time: 16:07

Depth (m)	DO mg/L	Temp (C)
0	7.63	19.4
4.2	7.39	19.4

Station: 10A EBB
Time: 11:17

Depth (m)	DO mg/L	Temp (C)
0	6.16	18.8
3.3	6.19	18.9

Project: Wareham
Boat run: Dissolved Oxygen, CTD, and nutrients were taken same day.
Sampling Date: September 23, 1999

Station: 11 Flood
Time: 16:16

Depth (m)	DO mg/L	Temp (C)
0	7.38	19.3
3.75	7.16	19.2

Station: 11 EBB
Time: 11:26

Depth (m)	DO mg/L	Temp (C)
0	6.30	18.9
3.75	6.68	18.6

Station: 11A Flood
Time: 16:27

Depth (m)	DO mg/L	Temp (C)
0	7.2	19.2
4.5	6.8	19

Station: 11A EBB
Time: 11:38

Depth (m)	DO mg/L	Temp (C)
0	7.13	18.6
3.75	7.11	18.5

Station: 12 Flood
Time: 16:36

Depth (m)	DO mg/L	Temp (C)
0	7.44	19.3
3	6.87	19

Station: 12 EBB
Time: 11:46

Depth (m)	DO mg/L	Temp (C)
0	6.66	18.8
1	6.5	18.8

Station: 12A Flood
Time: 16:50

Depth (m)	DO mg/L	Temp (C)
0	7.91	19.8
3.5	6.62	19

Station: 12A EBB
Time: 12:20

Depth (m)	DO mg/L	Temp (C)
0	6.8	18.9
2.25	7	18.8

Station: 13 Flood
Time: 17:15

Depth (m)	DO mg/L	Temp (C)
0	7.01	19.2
2.75	6.93	18.9

Station: 13 EBB
Time: 11:56

Depth (m)	DO mg/L	Temp (C)
0	6.82	18.8
2.75	6.57	18.6

Station: 13A Flood
Time: 17:00

Depth (m)	DO mg/L	Temp (C)
0	7.27	19.2
3.75	7.07	19

Station: 13A EBB
Time: 12:10

Depth (m)	DO mg/L	Temp (C)
0	6.88	18.9
1	6.89	18.7

Project: Wareham
Date: September 2, 1999
Bridge Tidal Flux
Depth profile: Temperature, Conductivity, and Dissolved Oxygen

Time Point: T1
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	18.8	4700	3.41
0.25	19.1	11500	3.41
0.5	19.3	13000	3.36
0.75	19.5	13000	3.30
1	19.5	13000	3.59
1.25	19.5	13000	3.76

Time Point: T1
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	20.9	31000	5.94
0.5	21.2	29500	5.82
1	21.3	30500	5.61
1.5	21.4	31000	5.82
2	21.5	31500	5.77
2.5	21.6	31500	5.76
3	21.6	31000	5.73
3.5	21.6	32200	5.73
4	21.6	32500	5.7
4.5	21.6	33000	5.51

Time Point: T2
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	19.3	12500	5.32
0.5	19.3	13000	5.21
1	19.4	12000	5.52
1.5	19.4	14000	5.72
2	19.4	14000	5.96

Time Point: T2
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	21.6	33700	6.81
0.5	21.7	34000	6.62
1	21.7	36000	6.47
1.5	21.7	36000	6.34
2	21.7	36400	6.28
2.5	21.7	36500	6.03
3	21.7	36500	5.84
3.5	21.8	37000	5.8
4	21.8	38000	5.65
4.5	21.8	37000	5.46

Time Point: T3
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	20	13000	4.12
0.5	19.8	13000	4.24
1	19.5	13500	3.77
1.5	19.5	14000	4.98
2	19.5	14000	5.05
2.5	19.5	14000	4.69

Time Point: T3
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	21.9	34000	7.22
0.5	21.8	35000	7.06
1	21.8	35000	6.92
1.5	21.8	35500	6.75
2	21.8	35000	6.87
2.5	21.8	36400	6.54
3	21.8	36000	6.10
3.5	21.8	36300	6.40
4	21.8	36500	6.42
4.5	21.9	36300	6.16

Time Point: T4 Note: Strong current
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	20.6	16100	11.12
0.5	20.6	17000	11.27
1	20.6	18000	11.44
1.5	20.6	18000	11.55
2	20.6	18000	11.69
2.5	20.6	18200	11.62

Time Point: T4 Note: Strong current
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	22.5	35000	8.14
0.5	22.3	35000	8.19
1	22.1	35500	8.1
1.5	22.1	35500	7.95
2	22	36000	7.55
2.5	21.9	36000	7.26
3	21.9	36500	7.25
3.5	21.9	36500	7.4
4	21.9	36500	7.35

Project: Wareham
Date: September 2, 1999
Bridge Tidal Flux
Depth profile: Temperature, Conductivity, and Dissolved Oxygen

Time Point: T5 Note: Strong current
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	21.7	21500	14.86
0.25	21.6	21500	14.69
0.5	21.6	21500	14.74
0.75	21.6	21500	14.87
1	21.6	21500	14.89
1.25	21.6	22000	14.88
1.5	21.7	22000	14.85
1.75	21.7	22000	14.86
2	21.7	22000	14.88
2.25	21.8	22500	14.93
2.5	21.8	22200	14.82
2.75	21.8	22500	14.85
3	21.8	22500	14.57

Time Point: T5 Note: Strong current
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	22.5	35500	8.61
0.5	22.3	35600	8.50
1	22.2	35500	8.35
1.5	22.1	36000	8.30
2	22	36000	7.80
2.5	22.1	36000	7.61
3	22	36100	7.81
4	22	36500	7.66
4.5	22	36500	7.63

Time Point: T6 Note: Strong current
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	22.3	25500	13.68
0.25	22.3	25500	13.17
0.5	22.3	26000	13.10
0.75	22.3	26000	12.98
1	22.3	26000	12.96
1.25	22.3	26000	12.77
1.5	22.3	26000	12.82
1.75	22.3	26000	13.08
2	22.3	26500	12.75
2.25	22.3	27000	12.67
2.5	22.3	26500	12.67
2.75	22.3	27000	12.31
3	22.3	27000	12.29
3.25	22.3	27000	12.23
3.5	22.3	27200	11.92

Time Point: T6 Note: Strong current
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	22.9	36000	9.19
0.5	23	36300	9.25
1	22.9	36000	9.11
1.5	22.6	36200	8.86
2	22.6	36200	8.67
2.5	22.5	36700	8.46
3	22.4	36800	8.51
3.5	22.2	36400	8.08
4	22.1	37300	7.76
4.5	22.1	37000	7.53
5	22	37200	7.47

Time Point: T7
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	22.6	27000	13.34
0.25	22.6	27000	13.30
0.5	22.6	27100	12.97
0.75	22.5	27500	12.90
1	22.5	27500	12.57
1.25	22.5	27500	12.66
1.5	22.5	27100	12.59
1.75	22.5	27100	12.36
2	22.5	27200	12.11
2.25	22.5	28000	12.07
2.5	22.5	28100	11.53
2.75	22.5	28500	11.32
3	22.5	28500	11.40
3.25	22.5	29000	11.11
3.5	22.5	29000	11.16

Time Point: T7
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	23	37100	9.13
0.5	23	37000	9.23
1	22.8	37200	8.92
1.5	22.6	37800	8.35
2	22.5	38000	8.09
2.5	22.5	38000	8.17
3	22.5	38000	8.1
3.5	22.4	38000	7.93
4	22.4	38000	7.82
4.5	22.4	38000	7.73
5	22.3	38000	7.66
5.5	22.3	38000	7.66

Project: Wareham
Date: September 2, 1999
Bridge Tidal Flux
Depth profile: Temperature, Conductivity, and Dissolved Oxygen

Time Point: T8
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	23.1	20000	17.54
0.25	23.6	20000	17.80
0.5	23.6	19500	17.55
0.75	23.6	21000	17.56
1	23.5	21000	17.68
1.25	23	21500	16.96
1.5	23.1	23000	16.70
1.75	23	23500	16.60
2	22.7	25000	15.11
2.25	22.6	26200	13.94
2.5	22.6	26500	13.62
2.75	22.6	26500	13.54
3	22.6	27000	13.55
3.25	22.6	27100	13.33
3.5	22.5	27000	12.84

Time Point: T8
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	22.7	37000	8.56
0.5	22.6	37300	8.42
1	22.6	37300	8.4
1.5	22.7	37300	8.34
2	22.6	37200	8.45
2.5	22.7	37200	8.61
3	22.7	37000	8.65
3.5	22.7	37300	8.55
4	22.8	37300	8.75
4.5	22.8	37300	8.76
5	22.8	37300	8.7
5.5	22.8	37300	8.69

Time Point: T9
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	23.4	18500	18.00
0.25	23.4	18000	18.29
0.5	23.4	18200	18.25
0.75	23.4	18500	18.14
1	23.4	19200	18.17
1.25	22.9	20500	17.84
1.5	22.9	20500	17.01
1.75	23	21000	16.86
2	23	20500	16.99
2.25	23	21000	16.82
2.5	23	20000	17.01
2.75	23.1	21000	16.60
3	23	20000	16.92
3.25	22.9	20500	16.89
3.5	22.8	21500	15.22

Time Point: T9
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	23.8	36000	10.77
0.5	23.2	37200	9.85
1	22.9	37400	8.46
1.5	22.9	37500	8.35
2	22.9	37500	8.34
2.5	22.9	37500	8.32
3	23	37500	8.25
3.5	23	37500	8.24
4	23	37500	8.16
4.5	23	37500	8.05
5	23	37500	7.98

Time Point: T10
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	23.4	15500	16.82
0.25	23.4	16500	17.03
0.5	23.3	17000	17.16
0.75	23.3	16500	17.38
1	23.2	16500	17.50
1.25	23.3	17000	17.55
1.5	23.2	18000	17.33
1.75	23.2	18500	17.26
2	23.2	18000	17.31
2.25	23.2	18000	17.06
2.5	23.1	18000	17.10
2.75	23.2	17500	17.27
3	23.2	18000	16.86

Time Point: T10
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	23.6	36900	11.32
0.5	23.7	36600	11.43
1	23.4	37000	9.8
1.5	23.3	37000	8.73
2	23.3	37000	8.6
2.5	23.3	37000	8.57
3	23.3	37000	8.57
3.5	23.3	37000	8.59
4	23.3	37000	8.45
4.5	23.3	37000	8.4
5	23.3	36800	8.13

Project: Wareham
Date: September 2, 1999
Bridge Tidal Flux
Depth profile: Temperature, Conductivity, and Dissolved Oxygen

Time Point: T11
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	23.4	14500	15.83
0.25	23.4	15000	15.94
0.5	23.4	15000	16.14
0.75	23.3	15000	16.33
1	23.3	15000	16.64
1.25	23.3	16100	16.65
1.5	23.3	16500	16.84
1.75	23.2	16500	16.81
2	23.2	16500	16.80
2.25	23.3	16000	16.84
2.5	23.3	17000	16.91

Time Point: T11
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	23.6	35100	10.39
0.5	23.7	35200	10.3
1	23.7	35200	10.57
1.5	23.6	35200	10.48
2	23.6	35200	10.81
2.5	23.6	35200	10.54
3	23.7	35300	11.12
3.5	23.6	35500	10.41
4	23.6	35600	10.76
4.5	23.6	35700	9.8

Time Point: T12
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	23	13200	14.71
0.25	23	14000	14.41
0.5	23	14000	14.48
0.75	23	14100	14.42
1	23	14800	14.58
1.25	23	14900	14.66
1.5	23	15000	14.59
1.75	23.1	15000	14.55
2	23.1	15000	14.72
2.25	23.1	15500	15.32

Time Point: T12
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	23.3	32800	11.73
0.5	23.5	33200	11.42
1	23.5	33200	11.32
1.5	23.5	33200	11.3
2	23.5	33500	11.2
2.5	23.6	34500	10.02
3	23.6	34600	10.21
3.5	23.7	35100	10.68
4	23.7	35200	10.5

Time Point: T13
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	22.6	11000	9.87
0.25	22.5	11500	9.89
0.5	22.5	11500	10.05
0.75	22.6	12000	10.06
1	22.6	12000	9.87
1.25	22.7	12200	9.94
1.5	22.7	12500	9.98
1.75	22.8	13000	10.23
2	22.8	13000	10.06
2.25	22.8	13000	10.14

Time Point: T13
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	23.3	32100	11.26
0.5	23.6	34000	10.38
1	23.6	34500	10.18
1.5	23.6	34500	9.75
2	23.6	34700	9.11
2.5	23.6	35000	8.54
3	23.5	35500	8.24
3.5	23.5	35000	8.18

Time Point: T14
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	22.6	13500	13.47
0.25	22.6	14000	13.35
0.5	22.6	14000	13.72
0.75	22.8	14000	13.75
1	22.7	14500	13.72
1.25	22.8	14500	13.64
1.5	22.8	15000	14.01
1.75	22.8	15000	14.23
2	22.8	15000	13.95
2.25	22.8	15000	13.10

Time Point: T14
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/c	DO (mg/L)
0	23.4	31500	10.57
0.5	23.5	33000	9.77
1	23.5	33400	9.36
1.5	23.6	34200	9.25
2	23.5	34200	8.82
2.5	23.5	36500	8.65
3	23.5	36900	8.44
3.5	23.5	36900	8.5
4	23.5	37000	8.22

Project: Wareham
Date: October 17, 1999
Bridge Tidal Flux
Depth profile: Temperature, Conductivity, and Dissolved Oxygen

Time Point: T1
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	14.4	6000	7.29
0.25	14.4	6500	7.34
0.5	14.4	6800	7.51
0.75	14.5	7000	7.45
1	14.5	7200	7.46
1.25	14.5	7200	7.37
1.5	14.5	7200	7.23
1.75	14.5	7500	6.95

Time Point: T1
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	14.8	24000	8.41
0.25	15	29000	7.99
0.5	15.1	33000	7.95
0.75	15.1	33500	8.35
1	15.1	34000	8.28
1.25	15.1	34200	8.12
1.5	15.1	35000	7.83
1.75	15.1	35000	8.42
2	15.1	35000	8.38

Time Point: T2
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	14.4	7000	7.24
0.25	14.5	6800	7.07
0.5	14.5	7000	7.14
0.75	14.5	7000	7.11
1	14.5	7000	7.13
1.25	14.5	7200	7.05
1.5	14.5	7500	6.96
1.75	14.5	7500	7.00
2	14.5	7800	7.03
2.25	14.5	8000	7.02
2.5	14.5	8000	6.85
2.75	14.5	8000	6.77

Time Point: T2
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	15.1	29000	8.28
0.25	15.1	31000	8.54
0.5	15.1	33000	8.76
0.75	15.1	32500	8.88
1	15.1	34000	8.81
1.25	15.1	34500	8.87
1.5	15.1	35000	8.93
1.75	15.1	34000	8.76
2	15.1	34000	8.81
2.25	15.1	34500	8.73

Time Point: T3
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	14.7	7500	7.21911
0.25	14.6	7800	7.22904
0.5	14.6	8000	7.40778
0.75	14.6	8000	6.96093
1	14.6	8200	7.00065
1.25	14.6	8500	7.00065
1.5	14.6	8500	7.06023
1.75	14.6	8800	7.10988
2	14.6	9000	7.1496
2.25	14.6	9000	7.11981
2.5	14.6	9000	7.11981
2.75	14.6	9200	7.06023

Time Point: T3
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	15.3	31000	8.74
0.25	15.1	31000	8.74
0.5	15.1	33000	9
0.75	15.1	33500	9
1	15.1	34000	9.02
1.25	15.1	34100	8.97
1.5	15.1	34200	8.94
1.75	15.1	34400	8.95
2	15.1	34300	8.94

Project: Wareham
Date: October 17, 1999
Bridge Tidal Flux
Depth profile: Temperature, Conductivity, and Dissolved Oxygen

Time Point: T4
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	14.8	8500	8.29
0.25	14.8	9000	8.16
0.5	14.8	9000	8.13
0.75	14.8	9000	8.11
1	14.8	9000	8.07
1.25	14.8	9500	8.05
1.5	14.8	9500	8.06
1.75	14.8	10000	8.00
2	14.8	10500	7.95
2.25	14.8	11000	7.86
2.5	14.8	11000	7.87
2.75	14.8	11000	7.78

Time Point: T4
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	15.8	30000	8.42
0.25	15.5	31000	8.57
0.5	15.3	33500	8.75
0.75	15.2	34000	8.67
1	15.2	34000	8.81
1.25	15.2	34000	8.87
1.5	15.1	34200	8.75
1.75	15.1	34500	8.68
2	15.1	34500	8.53

Time Point: T5
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	15.4	7500	7.66
0.25	15.4	8000	7.47
0.5	15.3	8000	7.65
0.75	15.1	8000	7.12
1	15.1	8200	6.97
1.25	15	8500	7.16
1.5	14.9	9000	7.28
1.75	14.9	10000	7.26
2	14.9	10500	7.24
2.25	14.9	11000	7.17
2.5	14.9	11500	6.82
2.75	14.9	11500	6.61

Time Point: T5
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	15.9	29900	9.02
0.25	15.8	29900	9.1
0.5	15.5	33000	9.17
0.75	15.3	33800	9.14
1	15.3	34000	9.12
1.25	15.2	34000	9.12
1.5	15.2	34000	9.2
1.75	15.2	34000	9.02
2	15.2	34000	9.06

Time Point: T6
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	15.7	9000	8.20
0.25	15.6	9500	8.15
0.5	15.5	9500	8.11
0.75	15.6	10000	8.05
1	15.5	10000	8.10
1.25	15.4	10500	8.00
1.5	15.3	11500	7.99
1.75	15.3	12000	7.85
2	15.2	13000	7.83
2.25	15.2	13500	7.76
2.5	15.2	13500	7.74
2.75	15.2	13500	7.70
3	15.2	14000	7.45

Time Point: T6
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	16	30900	9.35
0.5	16	30500	9.36
1	15.8	31300	9.27
1.5	15.6	32000	9.2
2	15.4	33500	9.1
2.5	15.3	34000	9.25
3	15.2	35000	9.32
3.5	15.2	35000	9.28
4	15.2	35000	9.39
4.5	15.2	35000	9.31

Project: Wareham
Date: October 17, 1999
Bridge Tidal Flux
Depth profile: Temperature, Conductivity, and Dissolved Oxygen

Time Point: T7
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	16.2	11000	8.08
0.25	16.3	12000	8.02
0.5	16.3	12500	7.87
0.75	15.8	12500	7.52
1	15.9	15000	6.82
1.25	15.8	15000	6.78
1.5	15.7	15500	7.12
1.75	15.7	15500	7.32
2	15.7	16000	7.65
2.25	15.7	16000	7.74

Time Point: T7
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	16.3	31500	9.09
0.5	16.1	31800	9.08
1	15.9	32100	9.11
1.5	15.8	32000	9.1
2	15.7	33500	9.16
2.5	15.5	33000	9.18
3	15.4	34200	9.26
3.5	15.3	35000	9.32
4	15.3	35000	9.35
4.5	15.2	35100	9.29
5	15.2	35100	9.16

Time Point: T8
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	16.6	17000	8.21
0.25	16.5	17500	8.17
0.5	16.4	18000	8.07
0.75	16.4	17000	7.89
1	16.4	17000	7.68
1.25	16.4	17000	7.81
1.5	16.5	18000	7.91
1.75	16.4	18000	8.01
2	16.4	18000	7.68
2.25	16.3	18000	7.83
2.5	16.3	18500	7.82
2.75	16.3	18500	7.82
3	16.3	18500	7.83
3.25	16.2	19000	7.93

Time Point: T8
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	16.5	32000	9.73
0.5	16.2	32000	9.75
1	16.1	32200	9.69
1.5	15.8	33000	9.62
2	15.8	33800	9.67
2.5	15.7	33000	9.63
3	15.6	34000	9.6
3.5	15.5	34000	9.6
4	15.5	34200	9.58
4.5	15.5	34500	9.52

Time Point: T9
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	17.3	9000	9.1
0.25	17.2	9000	9.07
0.5	17.1	9500	8.98
0.75	17.1	10000	8.95
1	17.1	10000	8.88
1.25	16.7	12000	8.73
1.5	16.6	14000	8.62
1.75	16.4	15000	8.6
2	16.4	15000	8.45
2.25	16.4	15000	8.43
2.5	16.4	15500	8.38
2.75	16.4	15500	8.4
3	16.4	16000	8.35
3.25	16.3	16000	8.07

Time Point: T9
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	16.2	33000	9.71
0.5	16.1	33000	9.73
1	15.9	33000	9.64
1.5	15.9	33200	9.61
2	15.9	33200	9.55
2.5	15.8	33200	9.53
3	15.8	33400	9.54
3.5	15.8	33300	9.52
4	15.8	33400	9.49
4.5	15.8	33500	9.49

Project: Wareham
Date: October 17, 1999
Bridge Tidal Flux
Depth profile: Temperature, Conductivity, and Dissolved Oxygen

Time Point: T10
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	17.4	7000	9.36
0.25	17.4	7500	9.34
0.5	17.3	8000	9.32
0.75	17.3	8500	9.26
1	17.3	8500	9.24
1.25	17.3	8500	9.24
1.5	17.1	9000	9.21
1.75	17.1	11000	9.15
2	17	11000	9.06
2.25	16.8	11500	8.92
2.5	16.5	14000	8.89
2.75	16.5	14000	8.84
3	16.5	15000	8.78

Time Point: T10
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	16.6	31200	9.71
0.5	16.4	32100	9.79
1	16.3	33000	9.74
1.5	16.2	33000	9.75
2	16.1	33100	9.67
2.5	16.1	33000	9.65
3	16	33000	9.61
3.5	16	33000	9.58
4	16	33000	9.52
4.5	15.9	33100	9.14
5	15.9	33200	9.09

Time Point: T11
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	16.9	8000	10.25
0.25	16.9	8000	10.24
0.5	16.9	8000	10.14
0.75	16.8	8000	10.10
1	16.7	9000	10.08
1.25	16.7	9000	10.01
1.5	16.7	9000	9.97
1.75	16.7	9000	10.01
2	16.8	9000	9.99
2.25	16.7	9000	9.94
2.5	16.6	10000	9.74
2.75	16.6	10500	9.30

Time Point: T11
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	16.8	26800	9.41
0.5	16.7	27500	9.29
1	16.5	29500	9.4
1.5	16.4	30500	9.44
2	16.3	30800	9.66
2.5	16.3	31100	9.62
3	16.3	31500	9.58
3.5	16.3	31500	9.56
4	16.3	31500	9.46
4.5	16.3	31800	9.26

Time Point: T12
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	16.8	6000	9.53
0.25	16.7	6000	9.45
0.5	16.7	7000	9.3
0.75	16.7	7000	9.26
1	16.7	8000	9.12
1.25	16.6	9000	9.09
1.5	16.6	9000	9.1
1.75	16.6	9000	9.07
2	16.6	9500	8.91
2.25	16.6	9500	8.51

Time Point: T12
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	16.5	26500	8.83
0.5	16.4	27100	8.75
1	16.4	28000	8.82
1.5	16.4	28900	9.01
2	16.4	29000	9.05
2.5	16.3	30000	9.1
3	16.3	31000	9.14
3.5	16.3	31200	9.43
4	16.3	31300	9.48
4.5	16.3	31300	9.1

Time Point: T13
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	16.5	6000	9.23
0.25	16.5	6500	9.21
0.5	16.5	7000	9.19
0.75	16.5	7000	9.07
1	16.5	7000	9.06
1.25	16.5	7000	9.01
1.5	16.5	7000	9.01
1.75	16.5	7500	9.04
2	16.5	8500	8.87

Time Point: T13
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	16.6	24100	9.18
0.5	16.5	24700	9.14
1	16.5	25100	9.08
1.5	16.5	26900	9.21
2	16.4	28500	9.12
2.5	16.4	29100	9.35
3	16.4	29900	9.48
3.5	16.4	30000	9.6
4	16.4	30100	9.64

Project: Wareham
Date: October 17, 1999
Bridge Tidal Flux
Depth profile: Temperature, Conductivity, and Dissolved Oxygen

Time Point: T14
Site: Agawam

Depth (m)	Temp (C)	Cond (uS/cm)	DO (mg/L)
0	16.6	6000	8.93
0.25	16.5	7000	9.07
0.5	16.5	7000	8.95
0.75	16.5	7000	9
1	16.5	7500	9.07
1.25	16.5	7500	9.07
1.5	16.5	7500	8.99
1.75	16.5	7500	8.72
2	16.5	8000	8.16
2.25	16.5	8000	8.38

Time Point: T14
Site: Tobey Railroad

Depth (m)	Temp (C)	Cond (uS/cm	DO (mg/L)
0	16.1	17000	8.4
0.5	16.3	17000	8.11
1	16.3	17500	7.76
1.5	16.4	17500	7.98
2	16.3	17500	7.32
2.5	16.1	17500	7.36
3	16	17500	8.03
3.5	16	17500	7.37
4	16	17500	7.63

is carried back and forth in the model, depending on the direction of the tide. Second, the boundary selected for the model is located 8 kilometers downstream of the WPCF. This boundary was selected so as to eliminate the boundary influence on the dilution calculation estimated at the WPCF.

DEP Specific Comments #9: DEP disagrees with the discussion relative to Table 4-13 (page 4-43). DEP does not believe that the data imply significant nitrogen removal in freshwater ponds (at least from this data set). We believe it is unreasonable to compare 1999 loading to the long-term average loading since 1999 was a dry year and the data were not collected during the entire year.

CDM Response: Dr. Brian Howes has collected additional data for the nutrient load from the Agawam and Wankinco Rivers that provide almost 17 months of data. We are still finalizing our analysis of these data. As discussed in response to EPA Comment 5, our preliminary look at the data (and the fluxes shown in draft Revised Figure 3-26) indicates that the estimates of annual nitrogen load were very close to measured values. We hope that these new data will give DEP information it needs to use our estimates of annual nitrogen loads. As for DEP's concern about 1999 being a dry year, we know of no data set that looks at variations in nutrient load with rainfall over the long term. See further the response to EPA Comment 6.

MCZM (Callaghan) Comments

CZM Comment 1: It appears to me that the 7Q10 for the Agawam River (10.8 cfs) calculated by EPA in the Fact Sheet of Wareham's Draft Permit is more accurate than the 7Q10 calculated by CDM (17.3 cfs; p. 4-18). The main difference in the calculation method seems to be that the EPA method takes into account the fact that the Agawam River watershed covers 2 basins; one with a flow factor of 1.0 cfs/sq. mile and one with a flow factor of 0.4 cfs/sq. mile.

If this is in fact the case, I would argue that the EPA method is more accurate because the CDM method assumes that all of the Agawam watershed has the same flow rate (1.0 cfs/sq. mile). This generalization happens to be in Wareham's favor since it in effect raises the dilution factor and loosens Wareham's pollutant limitations.

CDM Response: We disagree with this comment. We believe that the Agawam River has similar hydrologic behavior to the Eel River. See response to EPA Comment 5.

CZM Comment 2: I don't follow the logic involved in CDM's determination of the dilution ration (p. 4-19). I would agree with the EPA Fact Sheet that the dilution factor is 4.9 and not 12.5 as suggested by CDM (p. 4.19).

CDM Response: This comment is difficult to respond to because the commenter does not indicate which part of the analysis they have trouble following the logic of. In essence, our reasoning is that the EPA calculation only accounts for 7Q10 flow in the river. The Wareham treatment plant, however, discharges to a tidal portion of the river (estuary) and there is additional dilution over the course of 4 days (which is averaging period for the water quality criteria being used to establish average month permit limits) that should be accounted for in the dilution calculation. Our dilution estimate includes this additional mixing.

CZM Comment 3: It appears to me that CDM's land use data is more current than the BBP's data, that the CDM estimate for N loading due to residential, commercial, and cranberry bog uses is more accurate than the BBP's (p. 4-49). I also believe that the CDM study more accurately depicts the load contribution of the WPCF because the CDM estimate was based upon 6 years of DMR data (I'm assuming they used the most recent data), whereas the BBP study used an assumed flow rate and N discharge concentration.

CDM Response: No response necessary.

CZM Comment 4: It is interesting to note that CDM predicts that the total N load eliminated from the watershed due to sewering is approximately equal to the load added to the estuary through the WWTF from outside the watershed.

CDM Response: No response necessary.

CZM Comment 5: Other than the differences in land use, it appears that the major difference between the CDM study and the BBP study is the attenuation factor. CDM makes a reasonable claim that this difference is likely due to denitrification in the sediments of freshwater ponds and streams in the watershed. If it is in fact the case that 53-61% of all N loads from land use are attenuated by these waterbodies, couldn't degradation of these water bodies decrease their attenuating abilities? Is it possible that future uses to the lands bordering these water bodies would diminish the capacity to reduce N?

If this were a possibility, perhaps a more conservative estimate of attenuation, say something between 30% (BBP assumption) and 60% would be more reasonable for long-term planning purposes?

CDM Response: It is difficult to predict how the capacity for nitrogen removal in the linked ponds might behave in the future. Basically there are two mechanisms for removing nitrogen - burial and denitrification. If pond water quality degraded then there would like be more algae and plant growth in the pond increasing the burial rate. Degradation in pond water quality also likely means a decrease in any existing aerobic sediment layer (increasing the likelihood of denitrification) and the creation or enlargement of any existing anoxic bottom layer (also increasing the likelihood of sediment denitrification). In both cases, however, we do not know if the increased rate of burial or denitrification would keep up with increases in nutrient loading.

Buzzards Bay Project (BBP) Comments

Many of the BBP comments are incorporated in the EPA and DEP comments above. Below are CDM's responses to specific BBP comments not covered in the above comments.

Flushing Rate Analysis

- The flushing rate calculation error found in Table 4-4 of the Wareham report is acknowledged and the flushing rate calculated for the whole estuary (segment 1-21) for the second river run sampling event should be 7.87 days.
- CDM does not agree with the statement that the flushing rate of the upper 1/3 of the estuary should be longer than the flushing rate of the entire estuary. The flushing rate is defined as the average time that a particle remains inside an estuary. A particle located at the upper end of the estuary would leave the upper 1/3 in less time that it would take for that same particle to leave the entire estuary. Equivalently, it would take less time for the water of the upper 1/3 of the estuary to be replaced than it would take for all the water entire estuary to be replaced.
- The calculation of the flushing rate for the upper 1/3 of the estuary (based on the Ketchum fractional freshwater method) should use the salinity of segment 4 as the reference salinity. With this correction, the flushing rates for the upper 1/3 of the estuary (segments 5-21) for the two river run sampling events 1 and 2 are 3.00 and 3.52 respectively.
- The BBP questioned the validity of the reference salinity value used in the fraction of freshwater method. The reference salinity was calculated as an average of one or more profiles, incorporating a minimum of 20 measurement each (minimum number of measurement in a salinity profile). Furthermore, the absolute accuracy of these salinity values are not as important as the relative difference between the reference value and those values found in each "segment" of the estuary. Specifically if the reference salinity was off by 0.6 ppt, then the remaining values recorded would be off by the same value, resulting in the exactly the same flushing rate.
- The flushing rate analysis was conducted to show that a wide variety of flushing rates can be calculated for an estuary based on the analysis used. It is agreed that a more robust way of calculated flushing rates is needed (specific to each embayment) in future analyses (see DEP Specific Comments #3).

Estimates of Nitrogen Loading

See DEP and EPA comments

Application of Results to Nitrogen Loading Standards

- CDM acknowledges the error found in Figure 1-1 of the Wareham report. The entire analysis for the Wareham River Estuary was conducted with the boundary of the Wareham River Estuary concurrent with those defined for both the SWMM and WASP models. This boundary, defined as the line between Cromeset Point and the Wareham Town shoreline located just south of the end of Long Beach Road, was chosen based on the location of our tide gauge and the definition of the Wareham River Estuary watershed. This boundary offered a natural separation between the estuary and Buzzard's Bay. The boundary shown in Figure 1-1 is incorrect.

Figure 1

Legend:
● Groundwater Well

1 0 1 2 Kilometers

CDM Camp Dresser & McKee Inc.