Stearns & Wheler
Companies

January 31, 2001

Mr. Robert A. Durand, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street, 20th floor
Boston, Massachusetts 02202
Attn. MEPA Office and Richard Foster

Re: Town of Falmouth
Wastewater Facilities Planning Study
Wastewater Facilities Plan and Final Environmental Impact Report
EOEA Number 11857

Dear Secretary Durand:

On behalf of the Town of Falmouth, Stearns & Wheler is pleased to submit this Wastewater Facilities Plan and Final Environmental Impact Report (Report). This Report is submitted in accordance with the joint MEPA/Cape Cod Commission review process as outlined in the Certificate dated February 22, 1999 for this project. Based upon that Certificate and discussions with your office, we request MEPA to review this Report, and provide a decision of its adequacy. This Report is being distributed to the parties indicated on the attached distribution list.

Please feel free to call with any questions regarding this Report.

Very truly yours,
Stearns & Wheler, LLC

Wayne C. Perry NCW

Wayne C. Perry, P.E.
Associate

Nathan C. Weeks

Nathan C. Weeks, P.E.
Senior Project Manager

WCP:NCW/emc
Attachment

cc: Individuals and Organizations indicated on the attached Distribution List

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WASTEWATER FACILITIES PLANNING STUDY
TOWN OF FALMOUTH, MASSACHUSETTS

Wastewater Facilities Plan and Final Environmental Impact Report

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Attention: J. Barnes, Chairperson

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Town of Falmouth, Massachusetts

Wastewater Facilities Plan and Final Environmental Impact Report

for

Wastewater Facilities Planning Study

January , 2001

WASTEWATER FACILITIES PLAN AND
FINAL ENVIRONMENTAL IMPACT REPORT
TOWN OF FALMOUTH, MASSACHUSETTS

Prepared for
TOWN OF FALMOUTH, MASSACHUSETTS

Prepared by

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS
100 West Main Street, P.O. Box 975
Hyannis, Massachusetts 02601

January 2001

Project No. 80284

ACKNOWLEDGEMENTS

This Wastewater Facilities Plan and Final Environmental Impact Report was produced through the joint efforts of Stearns & Wheler and the Town of Falmouth. Stearns & Wheler appreciates the assistance and valuable contributions made by the staff of the Town of Falmouth Department of Public Works, Utilities Division, Engineering Division, Wastewater Treatment Facility, Planning Department, Health Department, Natural Resources Department and Data Processing Department. We would like to acknowledge the following individuals who contributed to this report and study.

> **Raymond Jack and Kenneth Ventura** of the Utilities Division who answered many questions and provided background on the Town's water and wastewater system.
>
> **George Calise** of the Engineering Division who provided insight and documents on previous engineering studies and groundwater monitoring.
>
> **William Owen** of the Department of Public Works who provided insight and construction costs for the existing wastewater facilities.
>
> **Robert White** of the Falmouth Wastewater Treatment Facilities who provided insight, operations data, previous reports, site visits to the wastewater facilities, and much operational information.
>
> **Brian Currie** of the Planning Department who provided GIS data and mapping, reports on previous planning efforts, insight into future conditions in the Town and the planning areas and planning strategies on controlling growth in Falmouth.
>
> **David Carignan and Robyn Hendricks** of the Health Department who provided data, background and insight on wastewater related health problems in the Town and in the planning areas, and information on controlling growth in new potential sewered areas.
>
> **Paul Montague** of the Natural Resources Department, who provided data, records and details on shellfish closures and water quality in the Town's harbors and embayments.
>
> **George Trudeau** of the Data Processing Department who created computerized data on the Town's properties, assessments, water consumption, land use, etc.

We would also like to acknowledge the following agencies that provided valuable data and insight for the Study.

Cape Cod Commission who provided GIS data and mapping, technical information on the West Falmouth Harbor Watershed and assistance on the overall review process.

University of Massachusetts at Dartmouth, CMAST who provided documents of previous research in Falmouth and gave details for on-going research in the West Falmouth Watershed.

United States Geologic Survey who supplied documents and maps of groundwater modeling and groundwater elevation measurements in western Cape Cod.

Massachusetts DEP who provided file documents on Falmouth and assistance on the overall review process.

Marine Biological Laboratory who provided research information on West Falmouth Harbor.

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WASTEWATER FACILITIES PLAN AND
FINAL ENVIRONMENTAL IMPACT REPORT
TOWN OF FALMOUTH, MASSACHUSETTS

INTRODUCTION

The Town of Falmouth (Town) has performed this Wastewater Facilities Planning Study (Study) to provide a comprehensive strategy for wastewater treatment and disposal issues for a 20-year planning period. The planning-period design year is 2023 which is approximately 20 years after improvements are expected to be complete at the Falmouth Wastewater Treatment Facility (WWTF).

This Wastewater Facilities Plan and Final Environmental Impact Report documents the fourth of four major phases of the Study. The first phase was the Needs Assessment which was documented in the May 1999 Needs Assessment Report, and identified wastewater needs at several Planning Areas in Town and at the Falmouth Wastewater Treatment Facility (WWTF). The second phase was the Identification and Screening of Alternative Solutions to meet the wastewater needs, and was documented in the October 1999 Alternatives Screening Analysis Report. The third phase was the Detailed Evaluation, Environmental Analysis, and Development of a Recommended Plan and was documented in the January 2000 Draft Wastewater Facilities Plan and Draft Environmental Impact Report (Draft Report). The fourth phase is the final revision to the Draft Report and is documented in this Wastewater Facilities Plan and Final Environmental Impact Report (Final Report).

The Study is proceeding with a joint regulatory review process with the Massachusetts Executive Office of Environmental Affairs MEPA Unit and the Cape Cod Commission.

An Environmental Notification Form and a Development of Regional Impact document were prepared and submitted to these two regulatory agencies for their review and comment. A public hearing was held at the Falmouth Town Hall on February 2, 1999 to review the scope of the Study and receive public comment. Also, the Needs Assessment Report, the Alternatives Screening Analysis Report, and the Draft Wastewater Facilities Plan and Draft Environmental Impact Report were submitted to the regulatory agencies for review. Public hearings were held to receive comments on these three reports. All written comments received during these reviews have been addressed with written responses. Study progress updates have been given to the Study advisory committee (the Working Group), the Town Board of Selectman, and to various civic organizations during the Study.

The Needs Assessment Report identified wastewater-related problems in the following Planning Areas.

- West Falmouth Harbor Watershed
- Falmouth High School
- Woods Hole
- Falmouth Beach
- Main Street
- Davis Straits/Inner Harbor which has been further divided into the following subareas (Service Areas).
    - Clinton Avenue
    - Scranton Avenue
    - North Davis Straits
- Falmouth Heights
- Maravista

The Alternatives Screening Analysis Report identified and screened alternative technologies and solutions in the following major categories.

- Decentralized treatment and disposal alternatives
- Centralized wastewater treatment and disposal alternatives
- Residuals management alternatives
- Collection system technologies
- Flow and loading reduction alternatives
- Non-Wastewater nitrogen mitigation alternatives

These alternative technologies and solutions were screened to select the most feasible solutions for detailed evaluation.

The Draft Wastewater Facilities Plan and Draft Environmental Impact Report (Draft Report) summarized the detailed evaluations and the environmental impact analysis, and presented a draft recommended plan for the wastewater facilities in the planning areas.

During environmental review of the Draft Report, a report by Dr. Brian Howes of the University of Massachusetts Center for Marine Science & Technology (CMAST Report) was released which presented a revised watershed delineation, a more stringent water quality standard for Snug Harbor and evidence of nitrogen attenuation in the Snug Harbor Watershed. Regulatory and public comments received as part of the Draft Report review requested that the Town address the information presented in the CMAST Report.

The purpose of the Wastewater Facilities Plan and Final Environmental Impact Report (Final Report) is to address the regulatory and public comments received from the review of the Draft Report and to present the final Recommended Plan and Environmental Impact Analysis.

SUMMARY OF DETAILED AND ENVIRONMENTAL IMPACT EVALUATIONS

Many detailed evaluations were performed on the feasible alternative solutions identified and developed in previous phases of the Study. The detailed evaluations included a cost effectiveness analysis, an analysis of non-monetary factors, and an assessment of technology performance. The following lists summarize the major categories of detailed evaluations that were performed and summarized in the Draft Report:

- Decentralized wastewater alternatives for the Planning Areas.
- Falmouth WWTF (centralized) treatment alternatives.
- Falmouth WWTF effluent discharge alternatives.
- Residuals management and disposal alternatives.
- Nitrogen loading evaluations for West Falmouth Harbor
- Additional evaluations and considerations including.
    - Water conservation
    - Infiltration and inflow reduction
    - Wastewater reuse and recycling
    - Managed septage pumping
    - Household hazardous waste collection
    - Land use and development regulations
    - Capital financing options
    - Additional groundwater investigations

The most cost-effective, manageable and environmentally beneficial alternatives were selected from the detailed evaluation and were integrated into the following five alternative wastewater facilities plans for additional cost effectiveness evaluations and environmental impact analysis.

- No Action Alternative which includes:
    - Continued wastewater treatment at the Falmouth WWTF with the aerated ponds
    - Approximate 15% flow increase from infilling and redevelopment in the existing sewered areas
    - Continued impacts to coastal areas
    - Upgrade of existing on-site systems as required by local and state regulations

- Alternative Plan No. 1 which includes:
    - Upgrade of the Falmouth WWTF to a design flow of 1.2 million gallons per day (mgd) and a 10 part per million (ppm) total nitrogen discharge limit
    - Connection of the following Planning Areas to the Falmouth WWTF
        - ❖ Existing sewered areas
        - ❖ Falmouth High School
        - ❖ Western portion of West Falmouth Harbor Watershed
        - ❖ North Davis Straits Service Area
    - Construction of a small WWTF for the Maravista Planning Area
    - Potential cluster system(s) for Falmouth Heights

- Alternative Plan No. 2 which includes:
    - Upgrade of the Falmouth WWTF to a design flow of 1.2 mgd and a 5 ppm total nitrogen discharge limit (3 ppm on average)
    - Other features listed for Alternative Plan No. 1

- Alternative Plan No. 3 which includes:
    - Upgrade of the Falmouth WWTF to a design flow of 1.4 mgd and a 10 ppm total nitrogen discharge limit

  - Connection of the Planning Areas identified in Alternative Plan No. 1 to the Falmouth WWTF plus the Maravista Planning Area
  - Potential cluster system(s) for Falmouth Heights

- Alternative Plan No. 4 which includes:
  - Upgrade of the Falmouth WWTF to a design flow of 1.4 mgd and a 5 ppm total nitrogen discharge limit (3 ppm on average)
  - Other features listed for Alternative Plan No. 3

Evaluation of these alternative plans indicated that Alternative Plan No. 4 was the highest rated Plan based on having the second lowest costs, and providing the most nitrogen removal and best environmental protection.

Several additional issues and the need for further study were identified in the detailed evaluations and were considered with the finding that Alternative Plan No. 4 is the highest rated Plan. These additional issues are listed below.

- A preliminary nitrogen assessment performed for Little Pond and its watershed indicated that nitrogen removal facilities are needed for the Maravista Planning Area. A more detailed nitrogen assessment of this Area is necessary to determine if other portions of the Little Pond Watershed need nitrogen removal facilities.

- Nitrogen loading assessments and wastewater treatment alternatives have recently been evaluated for the Great Pond, Green Pond, and Bournes Pond Watersheds east of the Little Pond Watershed as part of the Ashumet Plume Nitrogen Offset Program. Portions of the Maravista Planning Area are located within the Great Pond Watershed. Discussions with the consultants performing that evaluation indicate that sending wastewater to the Falmouth WWTF for treatment was not considered as a feasible alternative. This indication may change as the feasibility of remediating nitrogen impacts in this Area is developed further.

- Effluent discharge capacity at the Falmouth WWTF is limited due to low permeable soils in that portion of Falmouth. The use of well injection technology was identified as a low cost effluent discharge technology that has minimal environmental impact because it requires minimal land clearing and excavation. Also, it could more easily allow effluent disposal outside of the Snug Harbor Watershed. Well injection technology is new to Massachusetts and would need to be pilot tested before it is determined to be feasible and is approved by Massachusetts DEP.

All of the findings and additional issues were evaluated to develop a Draft Recommended Plan as presented in the Draft Report with the main items listed below:

- Upgrade of the Falmouth WWTF to an average annual flow of 1.2 million gallons per day (mgd) with nitrogen removal to produce an average effluent nitrogen concentration of 3 ppm.
- Connection of the Falmouth High School to the Falmouth WWTF.
- Sewering of portions of the West Falmouth Harbor Watershed west of Route 28.
- Sewering of North Davis Straits and Scranton Avenue Service Areas.
- Nitrogen removal septic systems for the West Falmouth Harbor Watershed east of Route 28.
- Allowance of 0.2 mgd treatment capacity as emergency reserve capacity to handle future connections that may occur in emergency situations and to provide operational flexibility.

It is noted that connection of the Maravista Planning Area to the WWTF was not recommended until additional studies on the Little Pond Watershed and effluent discharge facilities were completed.

ADDITIONAL EVALUTATIONS TO ADDRESS REGULATORY AND PUBLIC COMMENTS

As identified in the Introduction to this Executive Summary, a report by Dr. Brian Howes (CMAST Report) was released during the environmental review process of the Draft Report, and presented new information about Snug Harbor and its watershed. Regulatory and public comments received as part of the environmental review process requested that the Town address the information in the CMAST Report. The main findings of the CMAST Report are listed below:

- A revised Snug Harbor and Mashapaquit Creek watershed delineation was proposed.
- Nitrogen attenuation was observed in the Snug Harbor watershed as listed below:
    - 40% nitrogen attenuation of the groundwater that recharges from the Mashapaquit Creek watershed to Snug Harbor.
    - 65% nitrogen attenuation at the WWTF spray irrigation areas.
    - 8% nitrogen attenuation at the WWTF sand infiltration beds.
- The report suggests that a nitrogen concentration threshold of 0.35 to 0.37 mg/l in Snug Harbor would support a relatively high quality habitat for eelgrass and would support its reestablishment.

Several meetings have been held with the regulatory agencies to discuss the CMAST Report findings and the following regulatory direction was provided:

- A revised Snug Harbor watershed delineation should be created from the previous delineation with extension of the Mashapaquit Creek delineation further to the south.
- More conservative attenuation factors should be used to reassess nitrogen loading to Snug Harbor:
    - 20% nitrogen attenuation of the groundwater that recharges from the Mashapaquit Creek watershed to Snug Harbor.
    - 45% nitrogen attenuation at the WWTF spray irrigation area
    - 0% nitrogen attenuation at the WWTF sand infiltration beds.
- An alternatives analysis should be performed to investigate the cost to relocate a portion it the 1.2 mgd design flow from the WWTF site to locations outside the Snug Harbor watershed to meet the proposed 0.35 to 0.37 ppm total nitrogen limit in Snug Harbor.

A revised nitrogen evaluation for Snug Harbor and an alternatives evaluation to potentially relocate effluent discharge outside the Snug Harbor watershed were performed. These evaluations are detailed in this Final Report. The main findings are summarized below:

- Effluent discharge of 1.2 mgd in the Snug Harbor watershed (along with the other nitrogen loading sources projected in the watershed for the design condition) would result in a total nitrogen concentration of 0.38 mg/l in Snug Harbor using the more conservative attenuation factors directed by the regulatory agencies. The resulting concentration in Snug Harbor would be 0.36 mg/l total nitrogen using the attenuation factors identified in the CMAST Report. Theses findings indicate that the design flow of 1.2 mgd would meet the proposed nitrogen surface water standard of 0.35 to 0.37 mg/l for Snug Harbor when the attenuation factors identified in the CMAST Report are used, but not when the more conservative factors are used as directed by the regulatory agencies.

- Approximately 0.2 mgd of effluent flow would need to be relocated outside the Snug Harbor watershed to meet the 0.35 to 0.37 ppm limit in Snug Harbor when the more conservative attenuation factors are used. Relocation of that flow would cost $1.9 to $3.5 million to evaluate and construct new effluent discharge facilities outside the Snug Harbor watershed.
- Effluent discharge of 1.0 mgd in the Snug Harbor watershed at the design condition would therefore result in a 0.37 mg/l total nitrogen in Snug Harbor when the conservative attenuation factors are used. This same discharge flow would result in a 0.35 mg/l total nitrogen concentration in Snug Harbor when the attenuation factors from the CMAST Report are used.

Discussion with DEP indicate that they would limit the effluent discharge in the Snug Harbor watershed to 1.0 mgd based on the more conservative attenuation factors identified above. They will consider increasing the discharge flow to 1.2 mgd after review of the nitrogen removal performance that can be attained after the upgrade of the WWTF.

RECOMMENDED PLAN

The Recommended Plan is a slight modification of the draft Recommended Plan presented in the Draft Report. It has the following major components.

- Upgrade of the Falmouth WWTF to 1.2 millions gallons per day with nitrogen removal to meet a 5 ppm total nitrogen discharge limit and 3 ppm on average.
- WWTF expansion capability to at least 1.4 mgd to allow possible sewering and treatment of Maravista flows in the future.
- Effluent discharge of 1.0 mgd in the Snug Harbor Watershed with the potential to increase discharge to 1.2 mgd based on nitrogen removal performance of the WWTF upgrade, and the ability to find alternative discharge sites.

- Connection of the Falmouth High School to the Falmouth WWTF.
- Sewering of West Falmouth Harbor Watershed west of Route 28 with the Snug Harbor Watershed being the highest priority in the watershed.
- Sewering of North Davis Straits and Scranton Avenue Service Areas.
- Installation of nitrogen removal septic systems for the West Falmouth Harbor Watershed east of Route 28.
- Formation of a Wastewater and Nitrogen Management District to manage decentralized wastewater facilities and nitrogen loading in the West Falmouth Harbor Watershed.
- Evaluation of three potential sites outside the Snug Harbor watershed for new effluent discharge facilities as part of the Effluent Mitigation Project.

This Recommended Plan does not include sewering of the Maravista Planning Area until further nitrogen assessments are complete in the Little Pond Watershed, and the Effluent Mitigation Project is complete.

The facility will be designed for possible expansion to 1.4 mgd which could be implemented following the results of the Effluent Mitigation Project and the nitrogen assessment for Little Pond. The Recommended Plan provides nitrogen removal that will meet the 0.35 to 0.37 ppm concentration limit in Snug Harbor at the design (future) condition.

The 1.2 mgd design flow to the Falmouth WWTF is based upon the following projected flows:

- 0.47 mgd existing flow from existing sewered areas
- 0.09 mgd from infilling and redevelopment in existing sewered areas
- 0.01 mgd from Falmouth High School
- 0.23 mgd from the West Falmouth Harbor Watershed
- 0.2 mgd from the North Davis Straits and Scranton Avenue Service Areas

- 0.2 mgd as an emergency reserve

Given DEP's desire to limit the effluent discharge flow to 1.0 mgd; a portion of this 1.2 design flow will need to be put on hold until nitrogen removal performance is available from the WWTP upgrade or until additional discharge capacity is located outside the Snug Harbor watershed.

A Nitrogen Management Plan has been developed for the West Falmouth Harbor with the following major components:

- Upgrade of the Falmouth WWTF to advanced nitrogen removal and potential discharge of 1.2 mgd in the watershed contingent upon the performance of the WWTF upgrade and the ability to relocate 0.2 mgd outside the watershed.
- Sewering of the western portions of the Watershed (west of Route 28) to collect and treat the wastewater at the Falmouth WWTF to a cleaner level than is possible with on-site systems. Sewering of the Snug Harbor portion is the highest priority of the watershed.
- Requirement of nitrogen removal on-site systems in the eastern portion of the watershed to minimize nitrogen loading from these on-site systems. Also a minimum lot size of 80,000 ft^2 is recommended for the portions of this area that are not already zoned for this minimum lot size.
- Preparation of sewer-use and other local regulations for the Watershed as part of a Wastewater and Nitrogen Management District.
- Initiation of the Effluent Mitigation Project to further investigate alternative discharge sites.

This plan produces a projected watershed nitrogen loading to Snug Harbor that meets the 0.35 to 0.37 mg/l nitrogen standard.

The Recommended Plan has capital costs (construction costs plus engineering, fiscal, and legal costs) as listed below:

- $14,000,000 for upgrade of the Falmouth WWTF
- $1,000,000 for connection of the Falmouth High School
- $19,100,000 for the wastewater collection system in the western portion of the West Falmouth Harbor Watershed
- $2,800,000 for the wastewater collection system for the Davis Straits Service Area
- $400,000 for the Scranton Avenue collection system

The Wastewater Facilities Plan and Final Environmental Impact Report was submitted for MEPA review in late January 2001 to allow a decision by the Executive Office of Environmental Affairs Secretary by mid-March 2001. This timeline allows the Secretary's decision to be available for the Falmouth Annual Town Meeting in April 2001. Town Meeting appropriation for construction costs of the Falmouth WWTF upgrade will be requested at the April Town Meeting.

Town appropriation of WWTF construction costs at the April Town Meeting will allow the WWTF upgrade design to proceed. The design is expected to require six months for completion in late 2001. A low interest loan application will be submitted to the State Revolving Fund (SRF) program by the August 2001 deadline which is expected to provide low interest loans for construction in 2002. Upgrade of the WWTF would start in 2002 and be complete in early 2004.

The Recommended Plan provides future flexibility as the Town of Falmouth solves its wastewater needs while addressing water quality concerns in West Falmouth Harbor.

GLOSSARY OF COMMON ACRONYMS

ABF	Aerated Biological Fixtures
ACEC	Areas of Critical Environmental Concern
ANGB	Air National Guard Base
A-Zones	100 Year Floodway areas designated by FEMA
BBP	Buzzards Bay Project
BBP-ORW	This is the name of a nitrogen surface water quality standard developed by the Buzzards Bay Project based on the State's ORW surface water classification
BBP-SA	This is the name of a nitrogen surface water quality standard developed by the Buzzards Bay Project based on the State's SA surface water classification
BFP	Belt Filter Press
BOD	Biochemical Oxygen Demand
BOH	Board of Health
CCC	Cape Cod Commission
CDM	Camp Dresser & McKee
cf	cubic foot
CFR	Code of Federal Regulations
CMAST	Center for Marine Science and Technology
CMR	Code of Massachusetts Regulations
COD	Chemical Oxygen Demand
CPR	Coastal Pollution Remediation
CZM	Coastal Zone Management
DCPC	District of Critical Planning Concern
DEIR	Draft Environmental Impact Report
DEM	Department of Environmental Management
DEP	Department of Environmental Protection
DMF	Division of Marine Fisheries
DO	Dissolved Oxygen
DPW	Department of Public Works
DRI	Development of Regional Impact
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ENF	Environmental Notification Form
ENR	Engineering News Record
EOEA	Executive Office of Environmental Affairs
FAST	Fixed Activated Sludge Treatment

GLOSSARY OF COMMON ACRONYMS

FEIR	Final Environmental Impact Report
FEMA	Federal Emergency Management Agency
GBT	Gravity Belt Thickener
GIS	Geographic Information System
gpd	gallons per day
gpd/ft^2	gallons per day per square foot
gpm	gallons per minute
I/A	Innovative and Alternative
I/I	Infiltration and Inflow
JRP	Joint Review Process
kg/ha	killograms per hectares
kg/yr	killograms per year
kWh	Killowatt-hour
lb/d	pounds per day
LCP	Local Comprehensive Plan
MADEP	Massachusetts Department of Environmental Protection
MBE	Minority Business Enterprise
MBL	Marine Biological Laboratory
MCL	Maximum Contaminant Level
MCRT	Mean Cell Residence Times
MEPA Unit	Massachusetts Environmental Policy Act Unit
mg/l	milligram per liter
mg/m^3/Vr	Milligram per meter cubed per Vollenwieder flushing term
mgd	Million Gallons Day
MGL	Massachusetts General Law
MISER	Massachusetts Institute for Social and Economic Research
MLE	Modified Ludzack Ettinger
MLSS	Mixed Liquor Suspended Solids
MMR	Massachusetts Military Reservation
MSL	Mean Seal Level
NEPA	National Environmental Policy Act
NH_4-N	Ammonia Nitrogen
NLM	Nitrogen Loading Model
NO_3-N	Nitrate Nitrogen
O&M	Operation and Maintenance
POTW	Publicly-Owned Treatment Works
ppm	parts per million

GLOSSARY OF COMMON ACRONYMS

psi	pounds per square inch
PSTF	Privately-Owned Sewage Treatment Facility
RBC	Rotating Biological Contactor
ROW	Right of Way
RPP	Regional Policy Plan
S&W	Stearns and Wheler
SA-N	This is the name of a nitrogen surface quality standard developed by the CCC based on the State's SA surface water classification
SA-ORW	This is the name of a nitrogen surface quality standard developed by the CCC based on the State's ORW surface water classification
SBR	Sequencing Batch Reactors
SMCL	Secondary Maximum Contaminant Level
SRF	State Revolving Fund
STEG	Septic Tank Effluent Gravity
STEP	Septic Tank Effluent Pump
TDS	Total Dissolved Solids
THM	Trihalomethane
TKN	Total Kjeldahl Nitrogen
Total N	Total Nitrogen
TSS	Total Suspended Solids
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Survey
UV	Ultraviolet
VOC	Volatile Organic Compound
V-Zones	Velocity Zones designated by FEMA
WBE	Women's Business Enterprise
WEF-MOP	Water Environment Federation - Manual of Practice
WWTF	Wastewater Treatment Facility
ZOC	Zones of Contribution

CHAPTER 1

INTRODUCTION

1.1 REPORT AND PROJECT BACKGROUND

This Wastewater Facilities Plan and Final Environmental Impact Report is the fourth report produced for the Town of Falmouth (Town) Wastewater Facilities Planning Study (Study). The first of these reports was the Needs Assessment Report dated May 1999, which documented the Town's wastewater needs and related issues. The second report was the Alternatives Screening Analysis Report which identified and screened possible solutions to the Town's wastewater needs. The third report was the Draft Wastewater Facilities Plan and Draft Environmental Impact Report which provided a detailed evaluation of the alternative plans presented in the Alternatives Screening Analysis Report, and provided a draft recommended plan and environmental impact analysis of the recommended facilities and management structures.

The purpose of the Wastewater Facility Plan and Final Environmental Impact Report is to finalize the detailed evaluation and address issues raised during review of the Draft Wastewater Facilities Plan and Draft Environmental Impact Report.

The Wastewater Facilities Planning Study is being prepared to provide a comprehensive strategy for wastewater treatment and disposal issues in the Planning Areas during the next 20 years. The Study is meant to be consistent with the Town's Local Comprehensive Plan, which demonstrates a consistent goal that the Town protect its natural resources and provide a year-round economic base for its residents.

1.2 PROJECT LOCATION

The Project location is in the western portion of Falmouth at the southern end of Cape Cod. It is made up of the following eight planning areas as indicated on Figure 1-1.

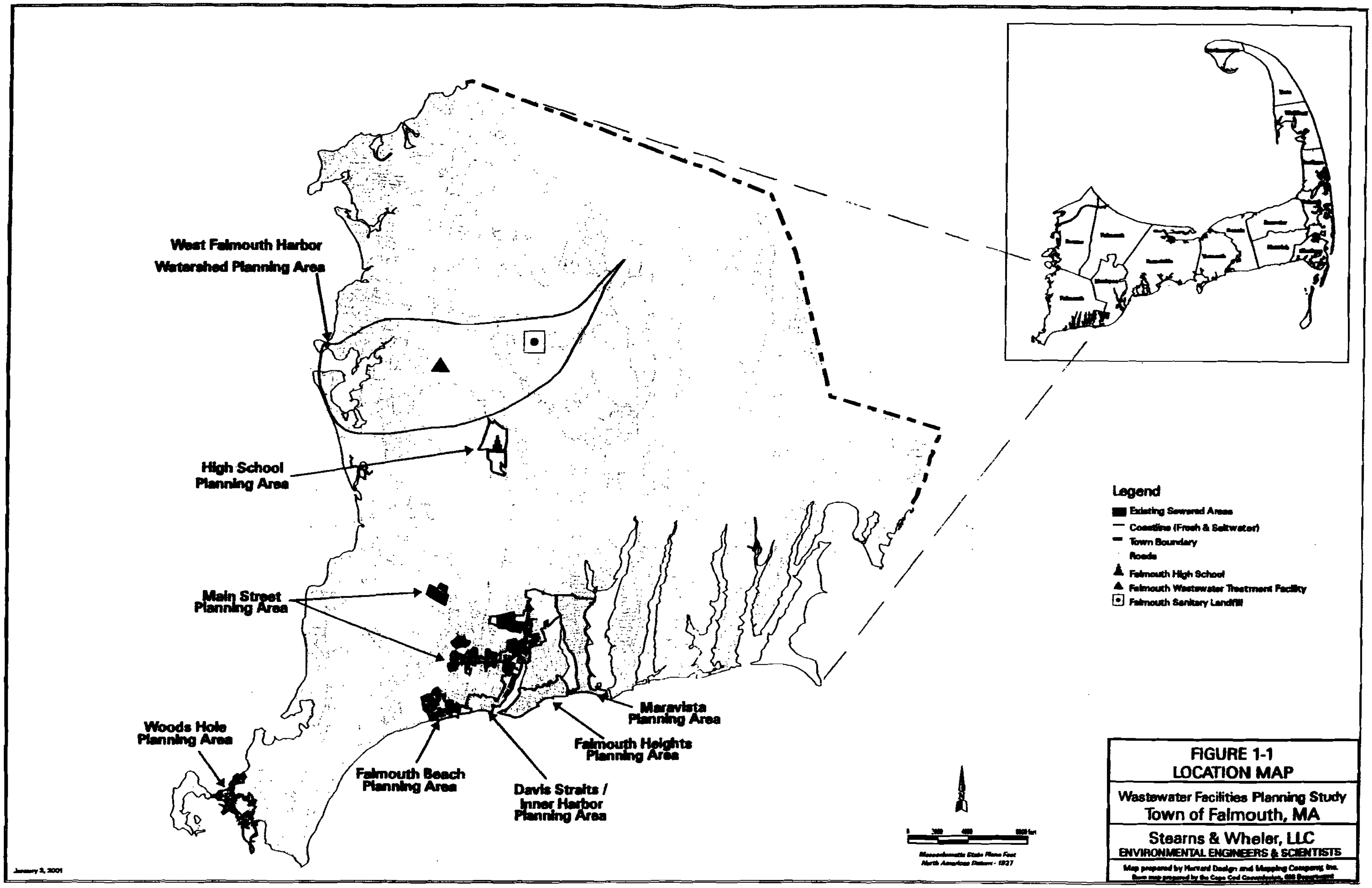

FIGURE 1-1
LOCATION MAP

Wastewater Facilities Planning Study
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Map prepared by Harvard Design and Mapping Company, Inc.
Base map prepared by the Cape Cod Commission, GIS Department

- Main Street Planning Area
- Woods Hole Planning Area
- Falmouth Beach Planning Area
- Davis Straits/Inner Harbor Planning Area
- Falmouth Heights Planning Area
- Maravista Planning Area
- Woods Hole Planning Area
- High School Planning Area
- West Falmouth Harbor Watershed Planning Area

These planning areas are described and illustrated in greater detail in Chapter Section 2.3 which is the Summary of the Needs Assessment Report.

A main focus of the Study has been the adequacy of the existing wastewater facilities and their ability to meet the wastewater needs of the Planning Areas. The existing wastewater facility locations are illustrated on Figure 1-2.

1.3 PROJECT SCOPE

The Falmouth Wastewater Facilities Planning Study has been divided into five phases. A brief listing of the tasks associated with the five phases of the Study follows:

- Phase 1: Establishment of Planning Area and Brief Assessment of Current Conditions.
  - Collect and review available data pertinent to the Project.
  - Identify the Planning Areas for the Project.
  - Prepare a summary Report of the findings.

- Phase 2: Project Scoping and Environmental Documents Preparation.
  - Collect and review data, and compile an inventory of the existing Wastewater Treatment Facilities (WWTF) and collection system.
  - Assess future conditions.

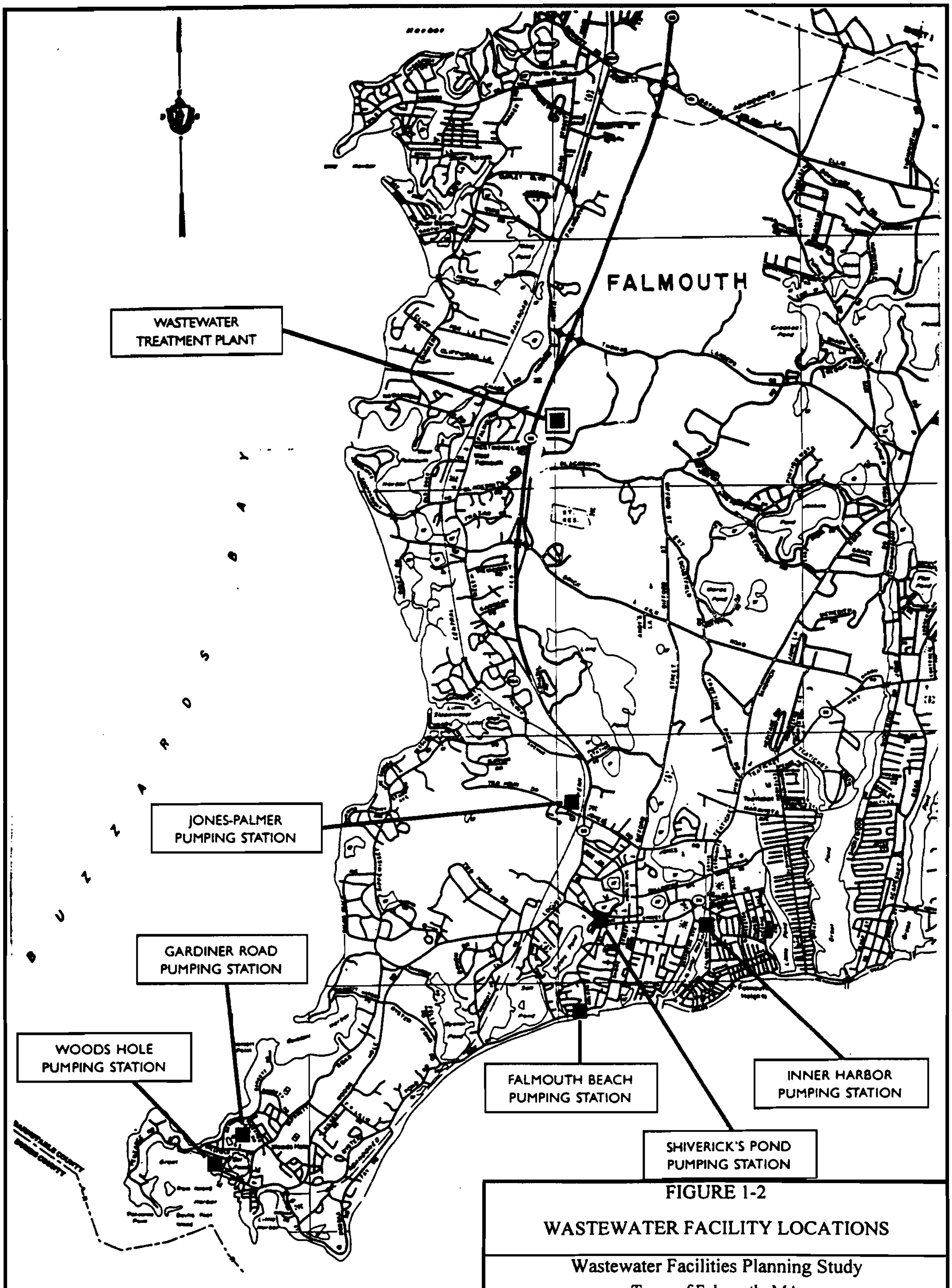

FIGURE 1-2

WASTEWATER FACILITY LOCATIONS

Wastewater Facilities Planning Study
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS AND SCIENTISTS

Source: Town of Falmouth WWTF O&M Manual

  - Develop a Detailed Scope of Work.
  - Prepare and file the Environmental Notification Form and the Development of Regional Impact document.

- Phase 3: Needs Assessment.
  - Review and evaluate the existing conditions in the Planning Areas including land uses, population growth patterns, wastewater collection and disposal practices, groundwater conditions, surface water conditions, geologic conditions and environmentally sensitive areas.
  - Develop future wastewater projections and needs for the Town including population, land use, water consumption and wastewater disposal.
  - Identify and prioritize service areas in need of corrective actions with respect to wastewater treatment and disposal.
  - Prepare a Needs Assessment Report, which includes the "No Action Alternative".

- Phase 4: Development and Screening of Alternatives.
  - Identify and develop decentralized treatment options.
  - Identify and develop centralized treatment options.
  - Identify and develop collection system alternatives.
  - Identify and develop flow and loading reduction alternatives.
  - Identify and develop alternative technologies (both conventional and innovative), solutions, and plans to meet the Town's wastewater needs.
  - Screen the alternative technologies, solutions, and plans to select the alternatives that provide the greatest environmental and cost benefit.
  - Prepare Screening Analysis Report.

- Phase 5: Detailed Evaluation of Alternatives.
  - Prepare a detailed evaluation of screened alternatives.
  - Develop additional considerations for evaluation of alternatives.
  - Develop a nitrogen management plan for West Falmouth Harbor.
  - Prepare a recommended plan and a schedule for its implementation.

- Summarize Phase 5 work in a Wastewater Facilities Plan, and Draft and Final Environmental Impact Reports.

The full Project Scope was included in the Environmental Notification Form and Development of Regional Impact document, which is available at the Town Library and at several Town department offices as identified on the distribution list of this Report.

The following documents have been prepared as part of the Project.

- **Phase 1 Report.** This Report was completed in December 1998, and provided a brief summary of the Phase 1 tasks. The findings of this report have since been expanded and included in the Needs Assessment Report.

- **Environmental Notification Form and Development of Regional Impact documents.** These documents have been prepared as described in Phase 2, and were submitted for environmental review on January 15, 1999.

- **Needs Assessment Report.** This report was prepared as described in Phase 3 and was submitted for environmental review on May 18, 1999.

- **Alternatives Screening Analysis Report.** This report was prepared as described in Phase 4 and submitted for environmental review on October 6, 1999.

- **Draft Wastewater Facilities Plan and Draft Environmental Impact Report (DEIR).** This report was prepared as described in Phase 5 and submitted for review on January 20, 2000. A public hearing was held on March 2, 2000 as part of the environmental review process, and written comments from the regulatory agencies and public were received. These comments have been addressed in a memo which is attached in Appendix 1-1 of this report.

- **Wastewater Facilities Plan and Final Environmental Impact Report (FEIR).** This report finalizes the recommended plan as described in Phase 5 and as part of the environmental review process.

The main findings of these documents are summarized in Chapter 2 of this report.

1.4 ENVIRONMENTAL REVIEW PROCESS

A joint review process with the Massachusetts Executive Office of Environmental Affairs Massachusetts Environmental Protection Act (MEPA) Unit and the Cape Cod Commission has been initiated for the Project.

An Environmental Notification Form and a Development of Regional Impact document have been prepared and submitted to these two regulatory agencies for their review and comment. A public hearing was held at the Falmouth Town Hall on February 2, 1999 to discuss the project and receive public comment on these two documents. This review resulted in the February 22, 1999 Certificate of the Secretary of Environmental Affairs, which accepted the project scope with few comments. The Secretary's Certificate was attached as Appendix A in the Needs Assessment Report.

A Needs Assessment Report dated May 1999 was prepared and submitted for regulatory review to the agencies indicated on the distribution list of this report. A public hearing was held on the Needs Assessment Report on June 10, 1999 to discuss the project and receive public comment on the Report. Several public and regulatory comments were received as included and addressed in Appendix A of the Alternatives Screening Analysis Report.

An Alternatives Screening Analysis Report dated October 1999 was prepared and submitted for regulatory review to the agencies indicated on the distribution list of this report. A public hearing was held on the Alternatives Screening Analysis Report on November 4, 1999 to discuss the project and receive public comment. Several public and regulatory comments were received as included in Appendix 1-1 of the Draft Wastewater Facilities Plan and Draft Environmental Impact Report.

A Draft Wastewater Facilities Plan and Draft Environmental Impact Report (DWWFP/DEIR) dated January 28, 2000 was prepared and submitted for regulatory review to the agencies indicated on the distribution list of this report. A public hearing was held on the DWWFP/DEIR on March 2, 2000 to discuss the project and receive public comments. These comments have been addressed in a memo attached in Appendix 1-1 of this report.

Two regulatory review meetings have been convened at the Cape Cod Commission offices to discuss the regulatory comments on the Draft Plan, and to clarify remaining issues. Meeting Notes from these meeting are attached in Appendix 1-2. DEP and CCC staff reviewed a preliminary version of the memo which is attached in Appendix 1-1. Comments dated December 22, 2000 on that memo and other wastewater planning issues were received from DEP and are also attached in Appendix 1-2. Also, DEP staff attended a Working Group (The Falmouth Citizens Advisory Committee) meeting on December 20, 2000 in which DEP and the Working Group agreed to several main issues. Meeting notes from that Working Group Meeting are also attached in Appendix 1-2.

Many members from CCC, DEP, CMAST, Buzzards Bay Project, the Town, and Stearns & Wheler have coordinated their efforts to come up with this Wastewater Facilities Plan and Final Environmental Impact Report.

1.5 PUBLIC PARTICIPATION PROCESS

An expanded public review and participation process has been established for this project.

An advisory committee called the "Working Group" has been established comprised of the following people and organizations:

- Eric McLaughlin of the Conservation Commission
- George Heufelder of the Board of Health
- Jim Vieira of the Finance Committee
- Alan Fleer of the Planning Board

- John Ross of the West Falmouth Harbor Boat Club

This group has provided valuable input and has met consistently throughout the Project; at least six times since submittal of the Draft Wastewater Facilities Plan and Draft Environmental Impact Report.

The environmental review process (as described in the previous section) is a part of the public participation process. It involves the preparation and public review of intermediate and final documents during the course of the Study.

Meetings with the Board of Selectman have been held to provide them with progress reports and public input on the Study. A meeting on March 27, 2000 presented the findings of the Draft Wastewater Facilities Plan and Draft Environmental Impact Report and the Secretary's (EOEA) Certificate on that report. The main findings of the report were accepted with one exception; the selectmen requested that treatment plant modifications should include 0.2 million gallons per day (mgd) of treatment capacity to treat wastewater potentially collected from the Maravista Planning Area. It was understood that the effluent resulting from the 0.2 mgd flow would be discharged outside the West Falmouth Harbor watershed to prevent water quality impacts.

Town staff have also attended meetings of the West Falmouth Civic Association to provide information on the Study and address concerns in the community.

Town staff and Stearns & Wheler have also met with Dr. Brian Howes and DEP to review Project findings, and to receive updates on Dr. Howes' work in West Falmouth Harbor.

1.6 UPDATES ON RELATED PROJECTS

A. Introduction. Several projects related to the Wastewater Facilities Planning Study have been proceeding. This Section briefly summarizes the progress of these related projects.

B. Improved Treatment Performance at the Falmouth WWTF. The WWTF staff has initiated nitrate recycling at the aerated pond system. The nitrate recycle involves pumping nitrified effluent from Pond No. 3 to the influent end of Pond No. 1. The nitrate mixes with the raw wastewater and is denitrified under anoxic conditions. The Draft Wastewater Facilities Plan reported that the total nitrogen in the WWTF effluent for July 1999 was 11.9 parts per million (ppm) compared with 23 ppm which was the average for 1998. The treatment plant staff continues to make slight modifications to the aeration system and overall plant operations to promote greater treatment performance.

C. Ashumet Plume Nitrogen Offset Program. As reported in the previous Study documents, the Ashumet Plume Nitrogen Offset Program has investigated nitrogen-loading problems in the Watersheds of Great, Green, and Bournes Ponds along the south coast of Falmouth. The Program Committee Report (dated October 27, 2000) identified and recommended the following items:

- Falmouth needs a comprehensive, long-term plan to solve nitrogen and other nutrient loading of ponds, town-wide. That plan should integrate the following elements:
    - sewers in densely-populated, N-sensitive areas, and small denitrifying units elsewhere
    - fertilizer management that limit fertilizer quantities and areas applied
    - constructed wetlands for N-removal from streams and rivers feeding coastal ponds.
- Each watershed should be considered an interdependent neighborhood naturally connected by nutrient sources, groundwater flows and resulting water quality. Nitrogen Management Districts should be created for these watersheds.
- A Fertilizer Reduction Program should be established to reduce nitrogen loadings from that nitrogen source.
- A Constructed Wetlands Demonstration Program should be established to test the feasibility of constructed wetlands to remove nitrogen where fresh water enters coastal ponds.
- Public Education is needed to disseminate information about the causes of pollution and potential remedies for the coastal ponds.

- A Town Meeting article (Article 70 of Fall 2000 Town Meeting) should be passed to continue the work of the project.

D. **CMAST Research and Evaluations in the West Falmouth Area.** As reported in previous Study documents, Dr. Brian Howes of the Center for Marine Science and Technology (CMAST) had ongoing academic research in the West Falmouth Harbor area. A draft report (no date) entitled "Evaluation of the Nutrient Related Health of West Falmouth Harbor" (CMAST Report) was released in February 2000 during environmental review of the Draft Wastewater Facilities Plan and Draft Environmental Impact Report to summarize this research. The CMAST Report presented findings that are summarized in Chapter Section 2.6.

E. **Falmouth High School Renovation.** Renovation of the Town High School is scheduled in the near future. The High School is located in the Long Pond Watershed Protection District and is one of the Study Planning Areas. Connection of this Wastewater Planning Area to the Falmouth Wastewater Treatment Facility with a sanitary sewer is recommended.

F. **Stormwater Mitigations at Old Dock Road Near Snug Harbor.** The Town recently was awarded grant monies for the construction of stormwater mitigation facilities that will collect stormwater along Route 28A and Old Dock Road and infiltrate it into the parking lot on the north side of Old Dock Road near the railroad right-of-way. Infiltration of this stormwater is expected to reduce fecal coliform loading to Snug Harbor during storm events.

G. **USGS Modeling of Western Cape Cod**. As reported in previous Study documents, the United States Geologic Survey (USGS) has performed several groundwater modeling efforts in the western Cape Cod area. Their most recent efforts have been to calculate tributary areas to several water supplies and to selected coastal embayments. A map and descriptive text of their efforts was published in early 2000.

H. **New Silver Beach Wastewater Plant SRF Funding**. The Town applied for low interest loans for construction of a new wastewater treatment facility for the New Silver Beach area, and the application was approved for the calendar year 2001 funding cycle. The loans are made available through the DEP State Revolving Fund (SRF) loan program.

I. **Effluent Mitigation Study**. The Town applied for SRF low-interest loans to further evaluate the feasibility of additional effluent discharge scenarios in Falmouth, and the application was approved for the calendar year 2001 funding cycle.

The Town had submitted a similar application to DEP in 1999 to further evaluate the feasibility of well injection as a potential effluent discharge technology at the Falmouth WWTF site. This application was approved for funding during calendar year 2000 but was released from the funding list due to preliminary findings from a similar evaluation in Barnstable, and the potential need to evaluate additional effluent technologies beyond the WWTF site.

J. **Revised Nitrogen Loading Methodology and Limits Proposed by Buzzards Bay Project.** In the early 1990's, the Buzzards Bay Project developed annual nitrogen loading limits which could be used by watershed managers and regulatory personnel to set critical nitrogen loading limits to coastal embayments. These limits were published in the 1991 Buzzards Bay Comprehensive Conservation and Management Plan (USEPA and EOEA 1991). The annual nitrogen loading limits have been adopted by the Cape Cod Commission and applied to many coastal embayments on Cape Cod including West Falmouth Harbor.

Revised annual nitrogen loading limits have recently been proposed by the Buzzards Bay Project. The September 24, 1999 draft report entitled "Managing Anthropogenic Nitrogen Impacts to Coastal Embayments: Technical Basis and Evaluation of a Management Strategy adopted for Buzzards Bay", (Costa et al) proposes the following changes to their nitrogen assessment methodology.

- Reduction of the SA annual nitrogen loading limit from 200 $mg/m^3/Vr$[1] to 150 $mg/m^3/Vr$
- Reduction of the ORW annual nitrogen loading limit from 100 $mg/m^3/Vr$ to 50 $mg/m^3/Vr$

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[1] Vr is the Vollenweider Flushing Period and is related to the local residence time of the embayment.

- A precipitation nitrogen loading term of 0.17 kg/ha should be used for undeveloped land uses.
- A 30 percent attenuation loss term should be used for "upper" watershed loadings to account for nitrogen removal in wetlands, streams, and ponds.
- Continued use of the Vollenweider Period in the calculation of critical nitrogen loading from nitrogen concentration increases.

The Report is in draft form until the final report is distributed. A technical memorandum is expected in early 2001.

1.7 ORGANIZATION OF THE WASTEWATER FACILITIES PLAN AND FINAL ENVIRONMENTAL IMPACT REPORT.

The Wastewater Facilities Plan and Final Environmental Impact Report is developed to present the final recommended Wastewater Facilities Plan and summarize the evaluation and recommendations requested after review of the Draft Wastewater Facilities Plan and Draft Environmental Impact Report. The report is divided into the following seven chapters. Chapter 1 presents the general introductory information about the Wastewater Facilities Planning Study (Study), and the Wastewater Facilities Plan and Final Environmental Impact Report. Chapter 2 summarizes the previous documents developed for the Study which are integral components of the Final Wastewater Facilities Plan and Environmental Impact Report. Chapter 3 describes the nitrogen evaluations for West Falmouth Harbor. Chapter 4 presents the evaluation of effluent discharge alternatives including potential discharge sites away from the WWTF. Chapter 5 presents additional evaluations on several issues. Chapter 6 presents the recommended plan and implementation schedule. Chapter 7 presents the environmental impact analysis.

CHAPTER 2

SUMMARY OF PREVIOUS DOCUMENTS PREPARED FOR THE WASTEWATER FACILITIES PLANNING STUDY

2.1 INTRODUCTION

Four main documents have been prepared as part of the environmental review process as discussed in Section 1.3. These documents are the Environmental Notification Form and Development of Regional Impact Document, the Needs Assessment Report, the Alternatives Screening Analysis Report, and the Draft Wastewater Facilities Plan and Draft Environmental Impact Report. These documents were submitted to the regulatory agencies in accordance with Massachusetts Environmental Policy Act (MEPA) and Cape Cod Commission policies. They also received public review through a public hearing process. These documents contain valuable information which was used as the basis of this report and are considered part of the Wastewater Facilities Plan and Final Environmental Impact Report.

Additional documents have been developed to assist in regulatory review and coordination. These include a report by CMAST, meeting minutes, and a comment summary.

The purpose of this Chapter is to summarize those documents and provide a summary of the detailed information and evaluations from those documents which are incorporated into this Report.

2.2 ENVIRONMENTAL NOTIFICATION FORM AND DEVELOPMENT OF REGIONAL IMPACT DOCUMENTS

The Environmental Notification Form (ENF) and Development of Regional Impact (DRI) documents are actually two separate documents to initiate the environmental review process for the Study. The ENF initiates the process for the Massachusetts Environmental Policy Act (MEPA) regulations, and the DRI initiates the process for the Cape Cod Commission regulations. The two review processes are combined into a joint review process as described in a "Memorandum of Understanding Between the Cape Cod Commission and of the Secretary of Environmental Affairs" which was attached in those documents.

The purpose of the ENF and DRI was to identify the Study and the Planning Areas, and present the Project Scope. The Project Scope is the detailed list of tasks that was performed during the Study to produce this Recommended Wastewater Facilities Plan and Final Environmental Impact Report. The Project Scope was presented at the beginning of the Study to request input from the regulatory community and the public; and therefore, minimize changes in later portions of the Study. The major components of the Project Scope were presented in Section 1.2. The full Project Scope is in the ENF and DRI which was distributed to the agencies listed on the distribution list for this Report.

2.3 NEEDS ASSESSMENT REPORT

A. **Introduction.** The Needs Assessment Report completed the first major phase of the Wastewater Facilities Planning Study. The Needs Assessment provided the framework and necessary background information to complete the next two phases of the Study.

The Needs Assessment Report utilized existing information and future estimations of land use, populations, and water usage to project future wastewater flows and loadings for the design year 2023. Wastewater issues and specific problem areas of the Town were identified and evaluated. Regulatory requirements and the Town's goals relating to wastewater management and growth management were incorporated into the Study.

B. **Wastewater Planning History.** A Wastewater Facilities Plan was last completed for Falmouth in August 1981. This plan focused on an aging wastewater collection and discharge system in Woods Hole, including the ocean outfall at Woods Hole, and the wastewater problems in densely developed portions of Falmouth Center, Falmouth Beach, Falmouth Heights, and the

Maravista area. Recommendations of the 1981 Wastewater Facilities Plan were approved by the Town, and the following centralized wastewater facilities were implemented.

- Construction of the Falmouth Wastewater Treatment Facility (WWTF), located off Blacksmith Shop Road in West Falmouth, to treat wastewater from sewered portions of Town and septage from the whole Town.
- Construction of the Jones Palmer Pumping Station to collect wastewater from several areas of Town and pump it to the Falmouth WWTF.
- Elimination of the Woods Hole ocean outfall and construction of the Woods Hole Pumping Station to pump the collected wastewater to the Jones Palmer Pumping Station and ultimately to the Falmouth WWTF.
- Expansion of the Woods Hole wastewater collection system to collect wastewater from portions of Gardner and Park Roads, and construction of the Gardner Road Pumping Station to pump the collected wastewater to the Woods Hole Pumping Station, and ultimately to the Falmouth WWTF.
- Repairs to the Woods Hole collection system to reduce groundwater infiltration to the system.
- Construction of sewers along Main Street and the Shivericks Pond Pumping Station to collect wastewater and discharge it to Jones Palmer Pumping Station, and ultimately to the Falmouth WWTF.
- Construction of sewers in the Falmouth Beach Area and the Falmouth Beach Pumping Station to collect wastewater and discharge it to Shivericks Pond Pumping Station, and ultimately to the Falmouth WWTF.
- Construction of sewers along East Main Street, Davis Straits Road, and Scranton Avenue, and construction of the Falmouth Inner Harbor Pumping Station.

The Town's collection system has been slightly extended in past years to collect additional wastewater flow since installation of these facilities.

The 1981 Wastewater Facilities Plan also recommended that portions of Falmouth Heights and Maravista be sewered approximately 10 years after Falmouth Center was sewered. These areas are densely developed. Portions of these two areas are in the 100-year flood zone and at low elevations where the groundwater is close to the surface. The Maravista area is adjacent to Little Pond and Great Pond. Both of these ponds have water quality problems that have been attributed to wastewater impacts.

C. **Falmouth Wastewater Treatment Facility (WWTF).** The Falmouth WWTF is located in West Falmouth, off Blacksmith Shop Road, east of Route 6. On average, it receives and treats 433,000 gallons per day (gpd) of wastewater from the centralized collection system and 28,000 gpd of septage from all of Falmouth. It utilizes an aerated pond treatment system, and effluent sand beds and spray irrigation fields for effluent disposal into the ground. The treatment system works well, and it has consistently met its effluent discharge permit from the Massachusetts Department of Environmental Protection (DEP). The treatment system was not designed to provide advanced nitrogen removal (treatment to less than 10 parts per million total nitrogen), which is typically required for all current treatment plants that have groundwater discharge permits.

The effluent discharge beds have performed poorly ever since they were built. The original five beds were designed at a hydraulic loading rate of 3 gallons per day per square foot (gpd/ft.^{2}). Several investigations since construction have indicated actual infiltration rates of 0.7 to 1.4 gpd/ft.^{2}. Three additional discharge beds were constructed in 1995. The total capacity of the discharge beds has been assessed at 0.41 mgd based on an average infiltration rate of 1.1 gpd/ft.^{2} as documented by the previous evaluations.

An average capacity of the spray irrigation area has been assessed at 0.5 mgd based on the design spray irrigation loading of 2 inches per acre per week.

The combined discharge capacity of the discharge beds and spray irrigation areas is 0.91 mgd. This capacity will need to be increased, especially in the winter when the spray irrigation system is not operated, if the Falmouth WWTF is expanded to treat additional flow from additional areas of Town.

D. Centralized Wastewater Collection System. The centralized wastewater collection system (collection system) is comprised of approximately seven miles of gravity collection pipe, six municipally operated pumping stations, and approximately 8.8 miles of force main, which is a pressurized sewer that delivers wastewater from a pumping station to the Falmouth WWTF or another point in the collection system. The collection system collects wastewater from the following areas:

- Woods Hole,
- Main Street,
- Falmouth Beach, and
- Davis Straits and Inner Harbor Area.

Most of the collection system was constructed in 1986 though the majority of Woods Hole was sewered in 1949.

The collection system operates well, and has sufficient capacity for the existing wastewater flows.

Analysis of water consumption in the sewered areas and analysis of the wastewater flows to the Falmouth WWTF indicates there is some extraneous flow in the collection system. This flow is groundwater infiltration into gravity collection pipes and manholes, and/or inflow to the gravity collection system from building sump pumps, catch basins, or roof leaders and is collectively called infiltration and inflow (I/I). It is suspected that most of this I/I is entering the system in Woods Hole through the older gravity collection pipes. It is noted that this quantity of I/I is not considered excessive by Massachusetts DEP criteria for a collection system of this size. Never the less, the Town should take efforts to inspect the sewers regularly and prevent I/I from occurring. Also, sewered users should be notified that basement sump pumps and roof leaders should not be connected to the sewer.

E. Wastewater Problems in Town Planning Areas. Several planning areas have been identified for this Study, and the wastewater problems have been prioritized for these areas.

These areas are identified on Figures 2-1, 2-2, 2-3, and 2-4 and described in the following paragraphs.

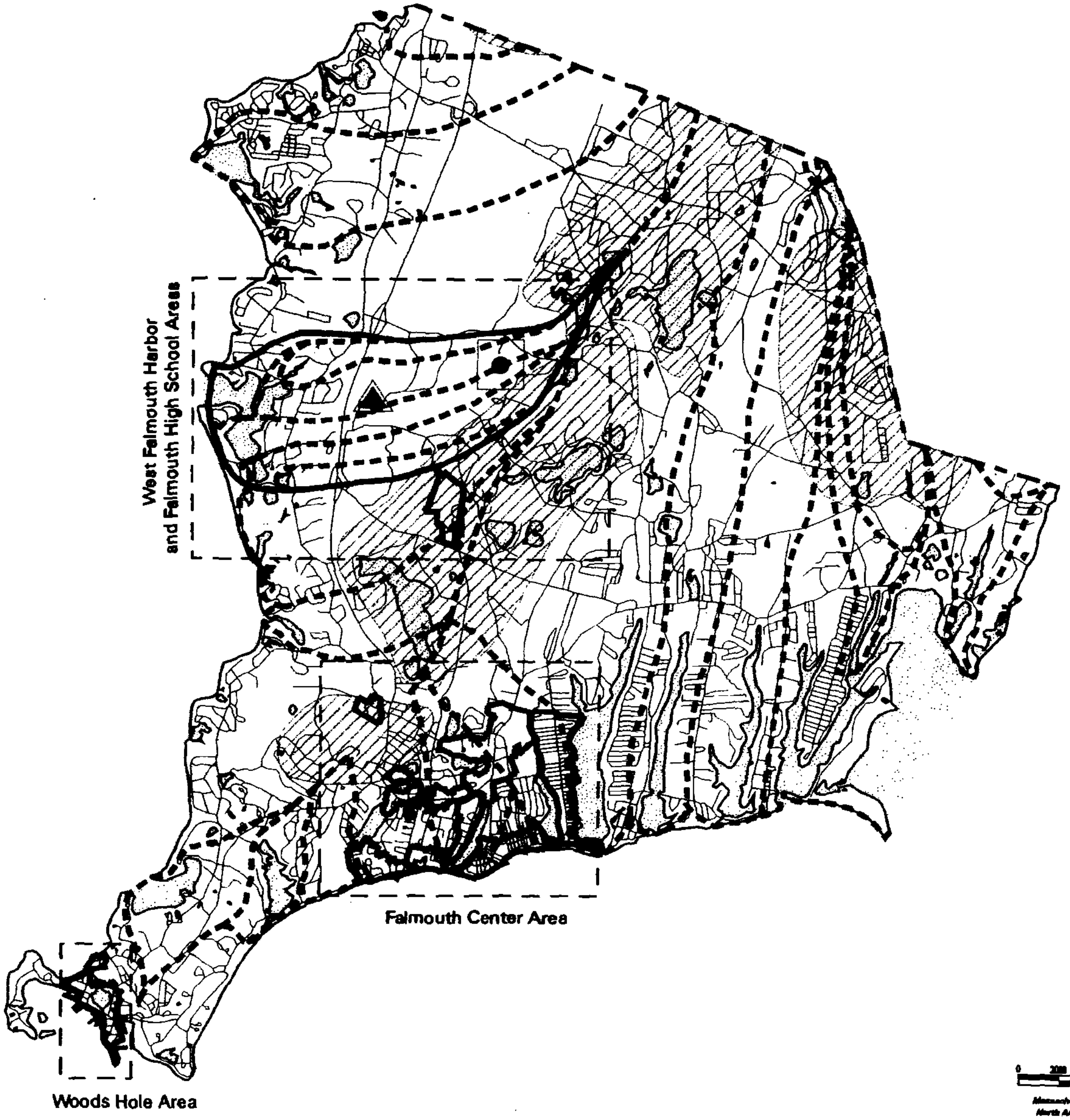
1. **Falmouth High School.** Falmouth High School was identified in this Wastewater Facilities Planning Study as a Planning Area because of its location in the Long Pond Watershed Protection District and its high wastewater design flow. It is located north of Brick Kiln Road and approximately one-half mile northeast of Long Pond.

The High School has a current Title 5 flow of 25,000 gpd based on a current student population of 1,250. This flow exceeds the Title 5 regulation limit of 10,000 gpd for septic systems designed after 1995 and 15,000 gpd for all other systems. Because this system exceeds this threshold and is located inside the Long Pond Watershed Protection District, DEP may require that the property apply for a groundwater discharge permit or connect to the Falmouth Wastewater Treatment Facility.

2. **West Falmouth Harbor Watershed Planning Area.** As the name implies, this Planning Area is the watershed area to West Falmouth Harbor that contributes groundwater into the Harbor. Nitrogen loading in the watershed from the Falmouth WWTF, Falmouth Landfill, old septage lagoons located at the landfill, individual septic systems, lawn fertilizer, and storm runoff have caused water quality impacts to Snug Harbor and Oyster Pond. Nitrogen removal and other remediation alternatives have been evaluated in subsequent phases of the Study to reduce nitrogen loading to these areas of West Falmouth Harbor.

3. **Woods Hole Planning Area.** The Woods Hole Planning Area is comprised of sewered properties. The main focus of evaluations in this area was a potential sewer extension to allow properties on Juniper Point to connect to a sewer. The collection system has capacity to handle existing wastewater flows in this area, and is working well.

4. **Main Street and Falmouth Beach Planning Areas.** These Planning Areas are comprised of mostly sewered properties. A few properties in each area are not connected but are expected to connect during the next 20 years. The collection system has sufficient capacity to



This map was developed by Stearns & Wheler, LLC, Environmental Engineers & Scientists for the purpose of studying Falmouth's wastewater management needs. Sewered parcels, and the Water Pollution Control Facility were digitized in 1990 for the Cape Cod Commission's Regional Policy Plan. Other base map features such as coastlines, water bodies, coastal embayment recharge areas, water supply protection areas and roads were automated by the Cape Cod Commission GIS department. Special technical assistance and data was provided by MassGIS of Boston, MA; and the Town of Falmouth.

The map has been developed as a planning tool to investigate problems related to wastewater treatment and disposal. Much Town-wide and regional information has been intergrated to produce this map. The source information comes from a variety of dates, as noted above, and therefore, may not reveal more recent changes. Also, the source information was digitized with a regional prespective, and this may show inherent inaccuracies pertaining to individual properties. This map does not intend to provide design information or regulatory enforcement for individual properties.

Legend

- ∴ Surface Water Bodies
- ⁄⁄ Water Suppy Protection Area
- — Coastline (Fresh & Saltwater)
- ▬ Town Boundary
- — Roads
- ▪▪ Perimeter of Costal Embayment Recharge Areas
- ▬ Planning Area Boundaries
- ▲ Falmouth Wastewater Treatment Facility
- ⊡ Falmouth Sanitary Landfill

Massachusetts State Plane Feet
North American Datum - 1927

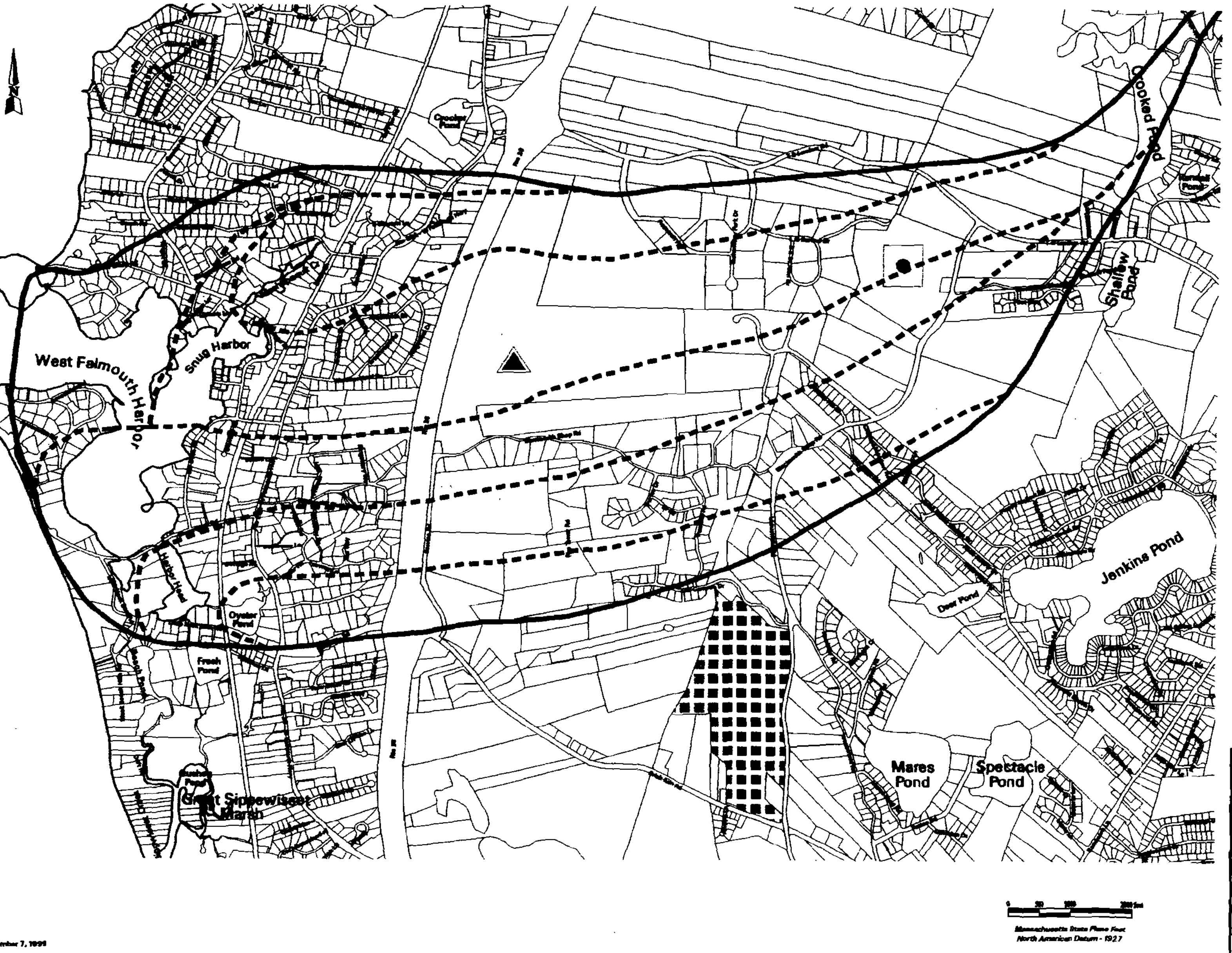
September 7, 1999

FIGURE 2-1
TOWN OF FALMOUTH PLANNING AREAS

Wastewater Facilities Planning Study
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Map prepared by Harvard Design and Mapping Company, Inc.
Base map prepared by the Cape Cod Commission, GIS Department



This map was developed by Stearns & Wheler, LLC, Environmental Engineers &Scientists for the purpose of studying Falmouth's wastewater management needs. Base map features such as coastlines, water bodies, roads and road names were automated by the Cape Cod Commission GIS department. Special technical assistance and data was provided by MassGIS of Boston, MA; and the Town of Falmouth.

Parcels were digitized by the Cap Cod Commission GIS Department for use by the Town of Falmouth from Falmouth 1994 Assessors Maps at the original scale of 1:1200 and 1:2400.

The map has been developed as a planning tool to investigate problems related to wastewater treatment and disposal. Much Town-wide and regional information has been intergrated to produce this map. The source information comes from a variety of dates, as noted above, and therefore, may not reveal more recent changes. Also, the source information was digitized with a regional prospective, and this may show inherent inaccuracies pertaining to individual properties. This map does not intend to provide design information or regulatory enforcement for individual properties.

Legend

- — Parcels
- — Coastline
- ▬ Town Boundaries
- ▬ West Falmouth Harbor Watershed Planning Area Boundaries
- ▪ ▪ Perimeter of Coastal Embayment Recharge Areas
- ▮▮ Falmouth High School
- ▲ Falmouth Wastewater Treatment Plant
- ⊡ Falmouth Sanitary Landfill

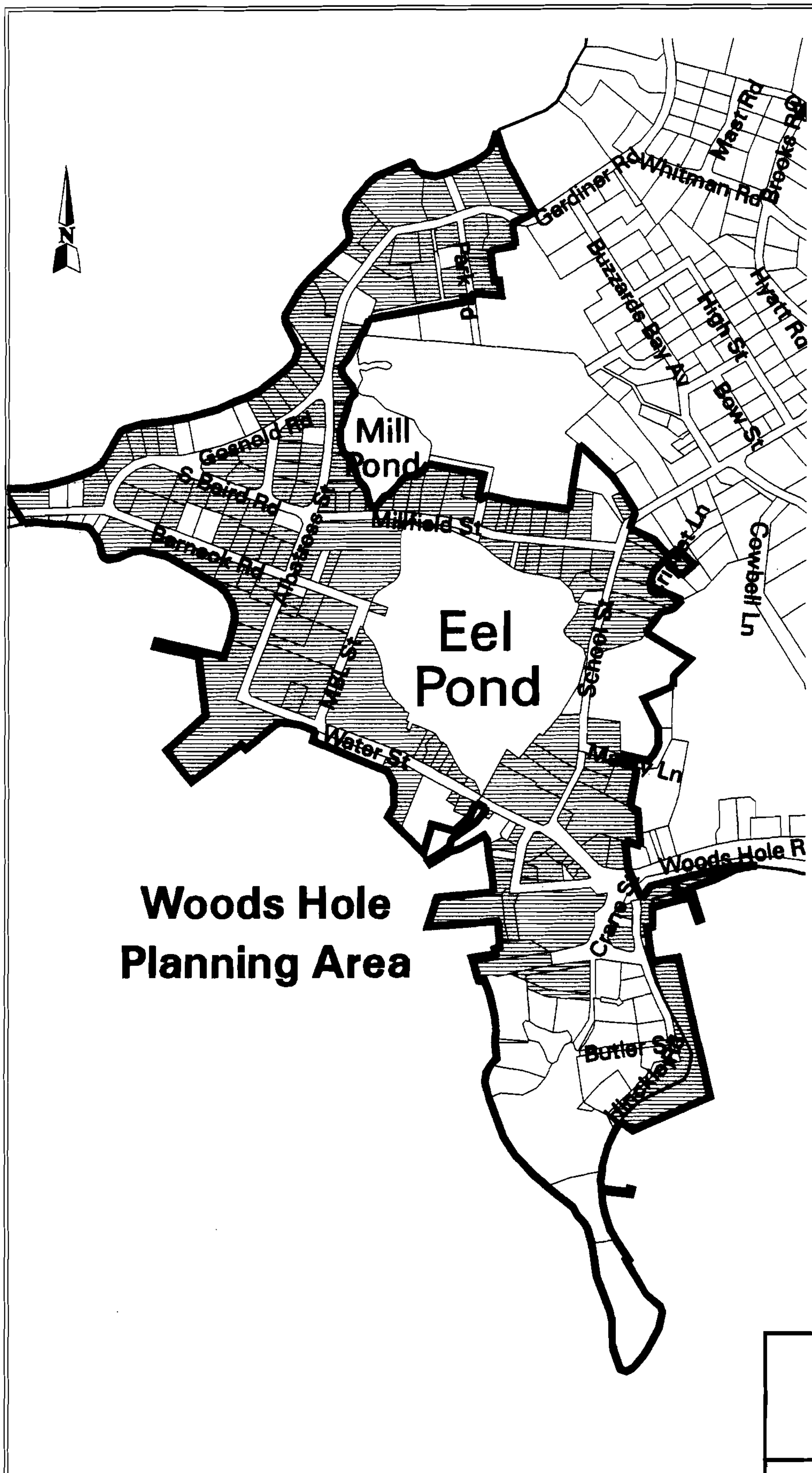
FIGURE 2-2
WEST FALMOUTH HARBOR & FALMOUTH HIGH SCHOOL PLANNING AREAS

Wastewater Facilities Planning Study
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Map prepared by Harvard Design and Mapping Company, Inc.

September 7, 1999



This map was developed by Stearns & Wheler, LLC, Environmental Engineers &Scientists for the purpose of studying Falmouth's wastewater management needs. Base map features such as coastlines, water bodies, roads and road names were automated by the Cape Cod Commission GIS department. Special technical assistance and data was provided by MassGIS of Boston, MA; and the Town of Falmouth.

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The map has been developed as a planning tool to investigate problems related to wastewater treatment and disposal. Much Town-wide and regional information has been intergrated to produce this map. The source information comes from a variety of dates, as noted above, and therefore, may not reveal more recent changes. Also, the source information was digitized with a regional prespective, and this may show inherent inaccouracies pertaining to individual properties. This map does not intend to provide design information or regulatory enforcement for individual properties.

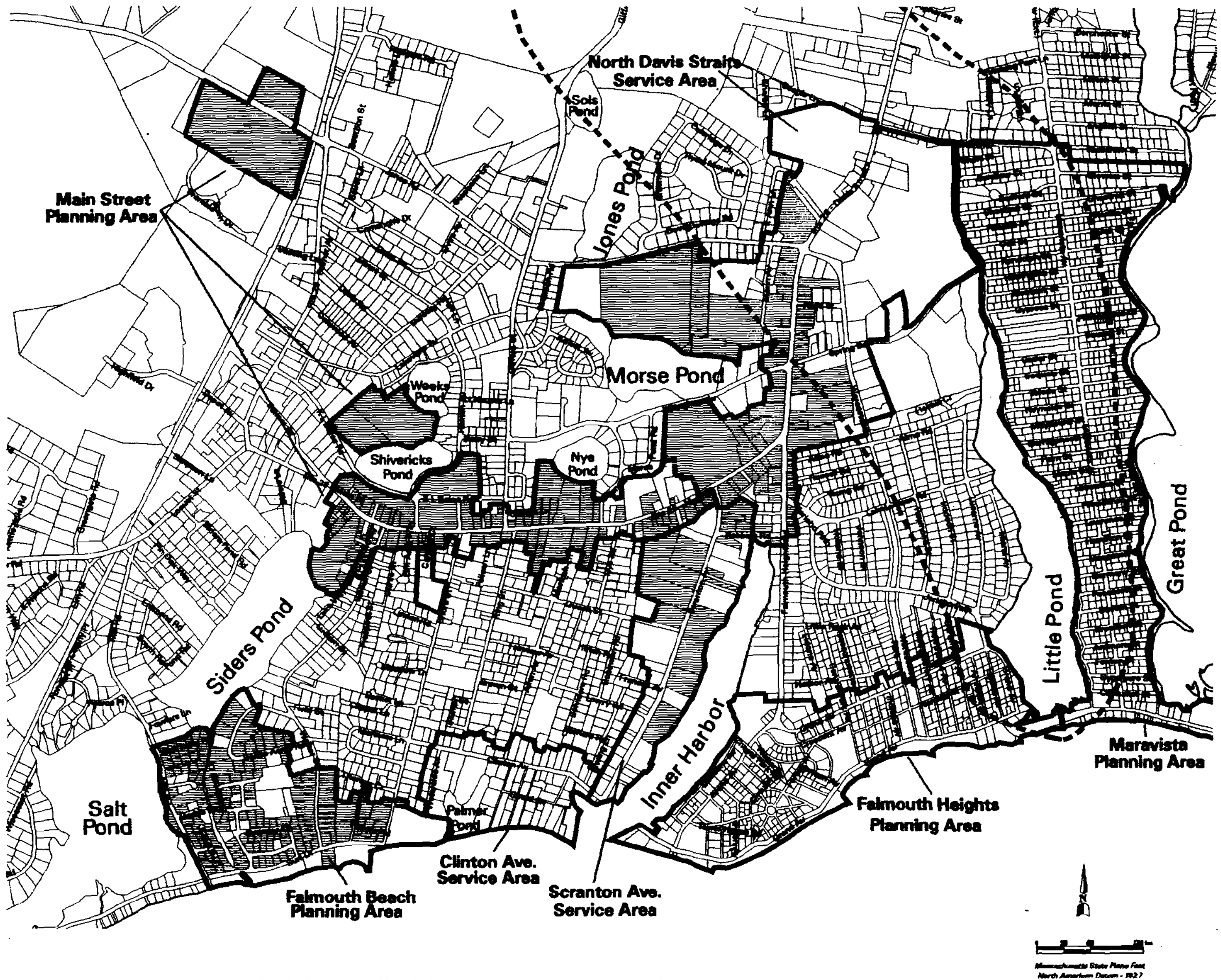
FIGURE 2-3
WOODS HOLE PLANNING AREA

Wastewater Facilities Planning Study
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Map prepared by Harvard Design and Mapping Company, Inc.

September 7, 1999



This map was developed by Stearns & Wheler, LLC, Environmental Engineers &Scientists for the purpose of studying Falmouth's wastewater management needs. Base map features such as coastlines, water bodies, roads and road names were automated by the Cape Cod Commission GIS department. Special technical assistance and data was provided by MassGIS of Boston, MA; and the Town of Falmouth.

Parcels were digitized by the Cap Cod Commission GIS Department for use by the Town of Falmouth from Falmouth 1994 Assessors Maps at the original scale of 1:1200 and 1:2400.

The map has been developed as a planning tool to investigate problems related to wastewater treatment and disposal. Much Town-wide and regional information has been integrated to produce this map. The source information comes from a variety of dates, as noted above, and therefore, may not reveal more recent changes. Also, the source information was digitized with a regional perspective, and this may show inherent inaccuracies pertaining to individual properties. This map does not intend to provide design information or regulatory enforcement for individual properties.

Legend
- Parcels
- Coastline
- Town Boundaries
- Planning Area Boundaries
- Perimeter of Coastal Embayment Recharge Areas
- Sewered Parcels

FIGURE 2-4
FALMOUTH CENTER PLANNING AREAS

Wastewater Facilities Planning Study
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Map prepared by Harvard Design and Mapping Company, Inc.

Note: Clinton Ave, Scranton Ave and North Davis Straits Service Areas are the 3 components of the Davis Straits / Inner Harbor Planning Area.

September 7, 1999

handle the existing wastewater flows and the future flows that will occur from connecting these unsewered properties.

5. **Davis Straits/Inner Harbor Planning Area.** This Planning Area extends from the intersection of Davis Straits and Maravista Avenue south to Clinton Avenue. It extends west along Jones Road to the Quality Inn and east to the commercially zoned properties of Worcester Court.

The non-sewered area along Davis Straits and Worcester Court (North Davis Straits Service Area) is included in the Planning Area because this area is zoned commercial and has a high concentration of commercial properties that have high wastewater flows. Also, based on Board of Health records, two properties, Tataket Square and Admiralty Inn have their septic systems frequently pumped and experience problems with their septic systems. The Admiralty Inn has expressed an interest to connect to the collection system, and may be forced by DEP to install its own advanced treatment system if it cannot connect. The Falmouth Mall is located in this area, and has expressed desire to be connected to the collection system. The Falmouth Housing Authority, James Conley Apartments, also have a high Title 5 design flow, and may need to connect to the collection system in the future. This area is where much of the Town's commercial activity occurs and is promoted through the existing zoning. Centralized collection facilities are needed to support this commercial activity.

The North Davis Straits Service Area extends west along Jones Road to include the Morse Pond School that was recently connected to the collection system. The next property to the west is the Quality Inn, which has a high water consumption and has its septic system pumped frequently. The property has significant wetland area, and groundwater is expected to be close to the ground surface.

Several of the commercial properties at the middle and southern end of Scranton Avenue (Scranton Avenue Service Area) have connected to the collection system via a gravity sewer extension, and with individual pumping stations connected to a force main in the road. A commercial property located at the east end of Clinton Avenue has investigated connection to the centralized collection system.

The properties along Clinton Avenue (Clinton Avenue Service Area) are large and generally have sufficient space to construct Title 5 systems, as their existing systems need to be upgraded. Only one property on this street is suspected of septic system problems, and this is a commercial property at the east end of the avenue that has minimal land for a Title 5 system.

6. **Falmouth Heights and Maravista Planning Areas.** These two Planning Areas are evaluated as part of the Study because they were designated as Phase 2 sewer areas in the 1981 Wastewater Facilities Plan. According to the 1981 Plan, these areas were scheduled for sewering approximately ten years after the Phase 1 sewering of Davis Straits, Inner Harbor, Main Street, Falmouth Beach and Woods Hole. These areas have not yet been sewered.

These areas are located a long distance from the existing collection system and sewering these areas would be expensive. They would also contribute a large wastewater flow to the Falmouth WWTF if they were sewered.. These areas have high water usage in the summer and minimal water usage in the winter.

Maravista Planning Area and portions of the Falmouth Heights Planning Area are in the Little Pond Watershed which contributes groundwater to Little Pond. Little Pond currently has water quality problems due to nitrogen from wastewater and other sources within the watershed. Nitrogen removal systems (individual, cluster, and centralized treatment) have been evaluated in the subsequent phases of this Study to reduce nitrogen loading to Little Pond.

7. **Prioritization of Planning Areas.** The following list prioritizes the Planning Areas (and subareas of Planning Areas) with respect to wastewater needs. The highest priority areas are listed first.

   a. Falmouth High School, which is located in the Long Pond Watershed Protection District, and has a high Title 5 design flow.

b. West Falmouth Harbor Watershed Planning Area and the Falmouth WWTF discharge, which are impacting water quality in Snug Harbor.

c. Unsewered portions of Davis Straits (North Davis Straits Service Area) where commercial properties have high wastewater flows and Town Zoning has been established to site commercial development.

d. Unsewered areas of Scranton Avenue (Scranton Avenue Service Area), which have commercial properties that need to connect to the collection system.

e. Unsewered areas of Woods Hole on Juniper Point.

f. Areas of Maravista and Falmouth Heights that are in Little Pond Watershed. [1]

g. Other areas in Falmouth Heights. [1]

h. Existing portions of the centralized collection system at Main Street, Davis Straits, and Inner Harbor that may need to convey additional wastewater to the Falmouth WWTF if the collection system is extended.

i. Falmouth Beach Planning Area, which may need an inspection for properties with sump pumps contributing to I/I.

j. Clinton Street Service Area, which is at low elevations but has large properties that can accommodate new Title 5 systems when their existing systems need to be updated.

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[1] These findings were revised slightly from the original findings presented in the Needs Assessment Report due to additional information from the preliminary nitrogen assessment for Little Pond developed in the Alternatives Screening Analysis Report.

F. No Action Alternative. The "No Action Alternative" was developed during the Needs Assessment to indicate what would occur in the Planning Areas if no changes were made to wastewater facilities as part of a new Wastewater Facilities Plan. Under the "No Action Alternative" future wastewater treatment and disposal would continue at the Falmouth WWTF with an approximate 15 to 20 percent flow increase due to unsewered properties connecting to the collection system (infilling) and increased land use in the sewered areas. Snug Harbor and Oyster Pond would continue to have impacted water quality due to high nitrogen loading in their respective watersheds.

Existing substandard on-site systems would be upgraded to the standards of Title 5 and local Board of Health regulations. The Falmouth High School and several commercial properties would need to obtain groundwater discharge permits because their wastewater flows exceed the flow limits specified in the Title 5 Regulations. This means that they would need to construct their own advanced treatment systems.

2.4 ALTERNATIVES SCREENING ANALYSIS REPORT

A. Introduction. The Alternatives Screening Analysis Report documented the second of the three major phases of the Study, and provided the identification and screening of alternative solutions to meet the wastewater needs that were identified in the Needs Assessment Report.

The less feasible technologies and solutions were eliminated (screened) from further evaluation, and the most feasible technologies and solutions were retained for detailed evaluation in the next phase of the Study. Alternatives were screened based on a uniform set of criteria which allowed a side-by-side comparison of the alternatives.

This Chapter Section summarizes all the alternative solutions that were identified and screened, and the ones that were retained for further evaluation.

B. Summary of All Alternative Technologies and Solutions Identified and Screened.

1. Technology and Solution Categories. Alternative technologies and solutions were identified and screened in the following major categories:

- Decentralized treatment and disposal alternatives
- Centralized wastewater treatment and disposal alternatives
- Residuals management alternatives
- Collection system technologies
- Flow and loading reduction alternatives
- Non-Wastewater nitrogen mitigation alternatives

2. Decentralized Treatment and Disposal Alternatives. The following list identifies the decentralized treatment and disposal alternatives that were identified and screened.

- Non-Nitrogen removal systems
    - Title 5 systems
    - Klargester Bio Disc
    - Peat system
- Non-Discharge systems
    - Tight tanks
    - Waterless toilets
- Nitrogen removal systems approved by DEP
    - Recirculating sand Filters
    - Ruck System
- Other nitrogen removal systems
    - Recirculating filters with DEP approval for provisional use (Bioclere, FAST, and Amphidrome)

  - Recirculating filters that are not currently approved by DEP for use in nitrogen sensitive areas (Waterloo Biofilter, Orenco Trickling Filter, Glendon Up-Flow Filter)
  - Constructed Wetlands
  - Solar Aquatics
- Small wastewater treatment facilities
  - Activated sludge/MLE process
  - Packaged biological treatment systems (Rotating Biological Contactors, Sequencing Batch Reactors, Amphidrome, Zenon, FAST, and Bioclere)
- Cluster systems
- Connection to the Falmouth WWTF

3. **Centralized Wastewater Treatment and Disposal Alternatives.** The following list presents the centralized wastewater treatment and disposal alternatives that were identified and screened in the Alternatives Screening Analysis Report. These are the technologies that could be utilized in upgrading the Falmouth WWTF.

- Secondary/advanced treatment technologies
  - Activated sludge/Modified Ludzack Ettinger (MLE) process
  - Rotating Biological Contactors (RBC)
  - Sequencing Batch Reactors (SBR)
  - Amphidrome
  - Zenon
  - Oxidation ditch modified for nitrogen removal with MLE process
  - Aerated biological filters
  - Denitrification filters for effluent polishing
  - Modifications to existing aerated ponds to create a rock filter for effluent polishing
  - Modifications to existing aerated ponds to create an extended aeration process, a constructed wetland, or a SBR
  - Solar Aquatics

  - Constructed Wetlands
- Disinfection technologies
  - Chlorination
  - Ozone
  - Ultraviolet radiation
- Effluent discharge technologies for use at the Falmouth WWTF
  - Sand infiltration beds
  - Spray irrigation
  - Subsurface leaching
  - Well injection
- Other potential effluent discharge technologies and locations
  - Ocean outfall
  - Potential discharge at the 16 sites evaluated for the 1981 Wastewater Facilities Plan and Environmental Impact Report including Otis Air National Guard (ANG) site, and Peterson Farm/Beebe Woods area
  - Spray irrigation at the Ballymeade Golf Course
  - Well injection at the Falmouth High School
  - Well injection in the Route 28 median strip north of the West Falmouth Harbor Watershed
- Residuals (sludge, septage and other byproducts of wastewater treatment) management alternatives
  - Sludge thickening and disposal at a regional facility
  - Sludge thickening, dewatering and disposal at a regional facility
  - Sludge thickening, dewatering and composting for public distribution
  - Sludge thickening and/or dewatering and land application
  - Septage treatment at the Falmouth WWTF or shipment to a regional facility
- Collection system technologies
  - Gravity sewers and lift stations
  - Pressure sewers with grinder pumps
  - Septic tank effluent sewers (STEP and STEG systems)
  - Vacuum sewers

4. **Flow and Loading Reduction Alternatives.** The following list presents the flow and loading reduction alternatives that were identified and screened in the Alternatives Screening Analysis Report.

- Reduction of infiltration and inflow (I/I) into the collection system
- Reduction of household water consumption
- Revised pricing policies for water and wastewater services
- Wastewater reuse and recycling
- Reduction of wastewater loadings
- Waterless toilets

5. **Non-Wastewater Nitrogen Mitigation Alternatives.** The following list presents the non-wastewater nitrogen mitigation alternatives that were identified and screened in the Alternatives Screening Analysis Report.

- Managed/regulated use of nitrogen fertilizers
- Stormwater management and treatment
- Improved flushing for West Falmouth Harbor
- Conversion of Oyster Pond to a fresh water system
- Modified land use and zoning

C. Summary of Alternative Technologies and Solutions Retained for Further Evaluation.

1. **Decentralized Treatment and Disposal Alternatives.** The following list presents the decentralized treatment and disposal alternatives that are the most feasible and were retained for detailed evaluation for the individual Planning Areas.

- West Falmouth Watershed Planning Area
    - Sewering and connection to the Falmouth WWTF

  - Individual nitrogen removal systems approved by DEP
- Falmouth High School Planning Area
  - Sewering and connection to the Falmouth WWTF
  - Small wastewater treatment facility
- Existing Sewered Planning Areas (Woods Hole, Main Street, and Falmouth Beach)
  - Sewering and connection to the Falmouth WWTF
- Clinton Street Service Area of the Davis Straits/Inner Harbor Planning Area
  - Title 5 Systems
- Scranton Avenue Service Area of the Davis Straits/Inner Harbor Planning Area
  - Sewering and connection to the Falmouth WWTF
  - Title 5 Systems
- North Davis Straits Service Area of the Davis Straits/Inner Harbor Planning Area
  - Sewering and connection to the Falmouth WWTF
  - Individual nitrogen removal systems
  - Small wastewater treatment facility
- Falmouth Heights
  - Individual or cluster Title 5 Systems for properties outside of nitrogen sensitive areas
  - Individual nitrogen removal systems for properties in nitrogen sensitive areas
- Maravista
  - Sewering and connection to the Falmouth WWTF
  - Small wastewater treatment facility
  - Individual nitrogen removal systems

2. **Centralized Treatment and Discharge Alternatives.** The following list presents the centralized wastewater treatment and discharge alternatives that are the most feasible and were retained for detailed evaluation.

- Wastewater treatment to 10 parts per million (ppm) total nitrogen limit
  - Oxidation Ditch with Modified Ludzack Ettinger process
  - Sequencing Batch Reactors

- Wastewater treatment to 5 ppm total nitrogen limit
    - Effluent polishing with denitrification filters
    - Effluent polishing with Rock Filters
- Effluent Disinfection with Ultraviolet (UV) radiation
- Effluent discharge at the WWTF site
    - Sand Infiltration Beds
    - Spray Irrigation
    - Injection Wells
- Effluent discharge at sites away from the WWTF site
    - Well injection in the Route 28 median strip north of the West Falmouth Harbor Watershed
    - Spray irrigation at the Ballymeade Country Club Golf Course
    - Well injection west of the Beebe Woods Water Supply Protection Area at the Beebe Woods/Peterson Farm area

3. **Residuals Management Alternatives.** The following residuals management alternatives were selected for detailed evaluation.

- Sludge thickening and disposal at a regional facility
- Sludge thickening, dewatering and disposal at a regional facility
- Sludge thickening, dewatering, composting and distribution to the public
- Septage treatment at the Falmouth WWTF or shipment to a regional facility

4. **Collection Systems Technologies.** The following collection system technologies were selected for collection system evaluations.

- Gravity sewers and lift stations
- Pressure sewers with grinder pumps
- Septic tank effluent sewers (STEP and STEG systems) only for Planning Areas outside of nitrogen sensitive areas

5. Flow and Loading Reduction Alternatives. The following flow and loading reduction alternatives were selected to be recommendations in the Wastewater Facilities Plan.

- Reduction of infiltration and inflow (I/I)
- Reduction of household water consumption
- Revised pricing policies for water and wastewater service
- Wastewater reuse as part of a spray irrigation program
- Reduction of wastewater loadings by discouraging use of garbage grinders that put shredded food wastes into the wastewater stream

6. Non-Wastewater Nitrogen Mitigation Alternatives. The following non-wastewater nitrogen mitigation alternatives were selected to be recommendations in the Wastewater Facilities Plan.

- Managed/regulated use of nitrogen fertilizers
- Stormwater management and treatment
- Modified land use zoning

D. Summary of Alternative Wastewater Plans Identified for Detailed Evaluation in the Draft Wastewater Facilities Plan and Draft Environmental Impact Report.

1. Introduction. The feasible alternatives listed above have been combined and grouped into four alternative plans. These four plans plus the No Action Alternative form the five alternatives requested for detailed evaluation in the Project Scope. The four alternative plans are described below and the No Action Alternative is described in Section 2.3.

2. Alternative Plan No. 1. Alternative Plan 1 involves the upgrade and expansion of the WWTF to treat a design flow of 1.2 mgd. The Facility would be designed to meet an effluent total nitrogen discharge limit of 10 parts per million (ppm).

The 1.2 mgd flow includes flow from the following Planning Areas:

- 0.01 mgd from the Falmouth High School.
- 0.47 mgd existing flow from the existing collection system.
- 0.09 mgd from redevelopment and infilling in the existing sewered area.
- 0.23 mgd from new sewers to be installed in the western portion of the West Falmouth Harbor Watershed Area. An allowance is provided for redevelopment and sewer infiltration in this currently non-sewered area.
- 0.2 mgd from North Davis Straits and Scranton Ave. An allowance is provided for redevelopment and sewer infiltration in the non-sewered portions of this area.
- 0.2 mgd emergency reserve capacity available for emergency connections, flexibility in operations, and buffer capacity needed when treatment plant flow becomes 80% of design flow and the plant must enter wastewater planning again. Potential emergency connections include:
    - connection of affordable housing projects to the centralized sewers.
    - flow from New Silver Beach if a treatment and discharge facility cannot be sited for that area.
    - flow from the Technology Park.
    - potential flow from existing properties on the west side of Siders Pond, the Ramada Inn on Main Street, and existing properties on the east side of the Inner Harbor.

  These potential flows could need to be added to the WWTF in the future to protect public health and the environment. The 0.2 emergency reserve capacity is created to address these potential needs.

The following wastewater treatment technologies were identified for evaluation as part of this alternative plan.

- Sequencing Batch Reactor (SBR)
- Oxidation Ditch with a Modified Ludzak Ettinger (MLE) nitrogen removal process

The following sludge treatment and disposal alternatives will be evaluated as part of this alternative plan.

- Sludge thickening and disposal at a regional facility
- Sludge thickening and dewatering; and disposal at a regional facility
- Sludge thickening, dewatering, and composting; and distribution of the compost to the public
- Septage treatment at the Falmouth WWTF or shipment to a regional facility

The following effluent discharge technologies were identified for evaluation at the WWTF site.

- Spray irrigation at existing and new sites
- Sand infiltration beds in the old aerated pond basins
- Well injection

The following additional effluent discharge scenarios were identified for evaluation for use away from the WWTF site.

- Spray Irrigation at the Ballymeade Country Club
- Well injection north of the West Falmouth Harbor Watershed in the Rte. 28 median strip
- Well injection at the Beebe Woods/Peterson Farm area

This alternative management plan also includes evaluation of the use of a small wastewater treatment facility to serve the Maravista Area. The treatment facility would be located on two properties south of Spring Bars Road at the north end of Little Pond. Effluent disposal would be at the following potential sites.

- Spray irrigation at the Woodbriar Golf Course
- Subsurface leaching at several properties on Maravista between Cypress and Cedar Streets

This alternative also includes evaluation of the use of individual on-site nitrogen removal systems for the Maravista Planning Area, eastern portions of the West Falmouth Harbor Watershed Planning Area, and eastern portions of the Falmouth Heights Planning Area.

Other Planning Areas are expected to be served by standard Title 5 systems and cluster systems.

The main concepts of Alternative Plan No. 1 are illustrated on Figure 2-5.

3. **Alternative Plan No. 2.** Alternative Plan No. 2 involves the upgrade and expansion of the Falmouth WWTF to treat a design flow of 1.2 mgd as identified in Alternative No. 1. The Facility would also be designed to meet an effluent total nitrogen discharge limit of 5 ppm.

The treatment technologies will be the same as for Alternative Plan No. 1 except that the effluent will be polished with one of the following technologies:

- Denitrification Filters
- Rock filter constructed in the bed of the aerated ponds

The sludge treatment and disposal alternatives, the additional effluent discharge scenarios and the evaluations for Maravista will be the same as identified in Alternative Plan No. 1.

The main concepts of Alternative Plan No. 2 are illustrated on Figure 2-5.

4. **Alternative Plan No. 3.** Alternative Plan No. 3 involves the upgrade and expansion of the Falmouth WWTF to treat a design flow of 1.4 mgd from the same sources identified in Alternative Plan Nos. 1 and 2 plus the flow from the Maravista Planning Area. The WWTF would be designed to meet an effluent total nitrogen discharge limit of 10 ppm.

The wastewater treatment technologies, the sludge treatment and disposal alternatives, and the additional effluent disposal alternatives will be the same as identified in Alternative Plan No. 1.

The main concepts of the Alternative Plan No. 3 are illustrated on Figure 2-6.

5. **Alternative Plan No. 4.** Alternative Plan No. 4 involves the upgrade and expansion of the Falmouth WWTF to treat a design flow of 1.4 mgd from the same sources as Alternative Plan No. 3. The WWTF would be designed to meet an effluent total nitrogen limit of 5 ppm.

The wastewater treatment technologies, the sludge treatment and disposal alternatives, and the additional effluent disposal alternatives will be the same as identified in Alternative No. 2.

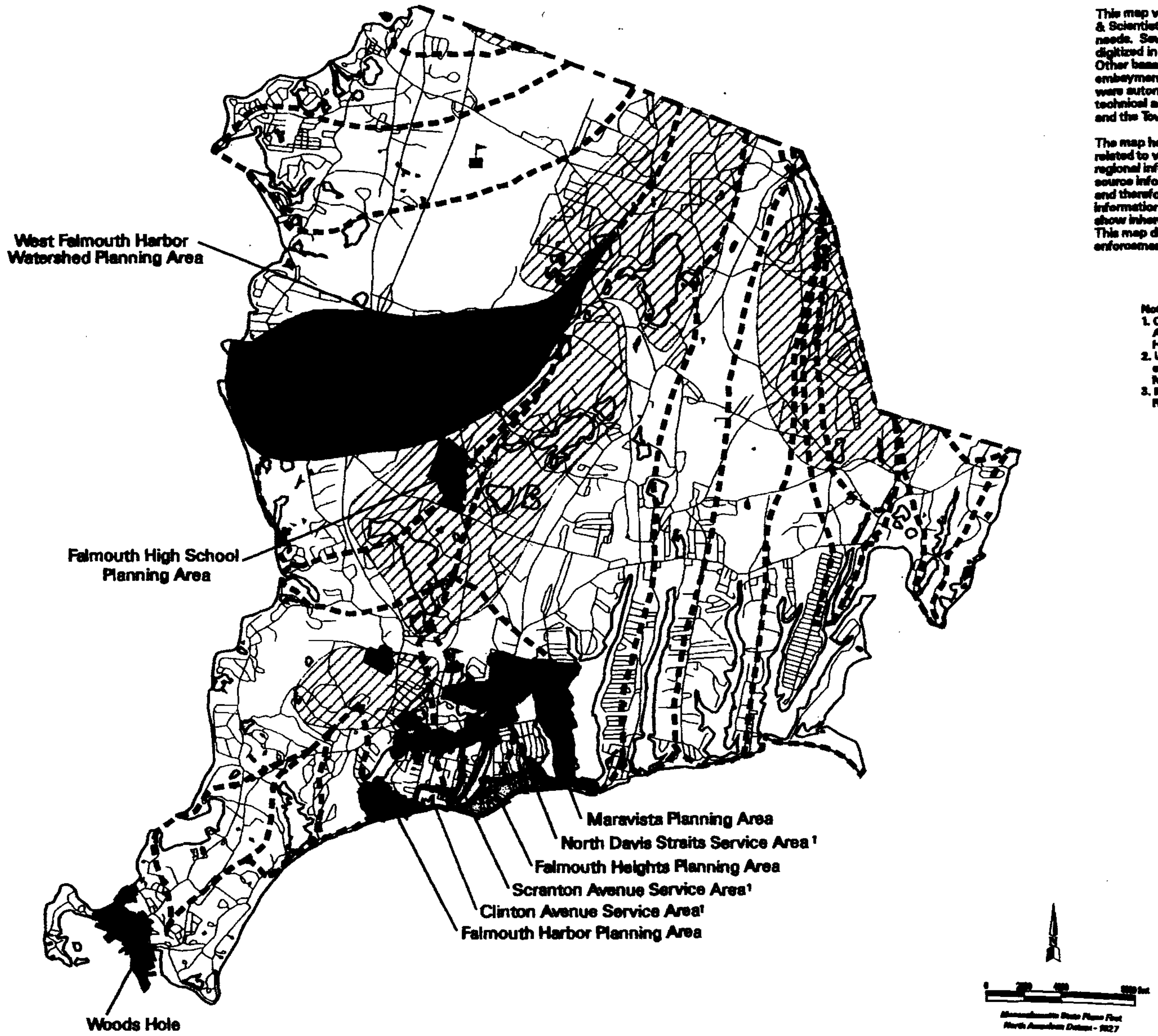
The main concepts of Alternative Plan No. 4 are illustrated on Figure 2-6.

E. Watershed Nitrogen Management Planning for West Falmouth Harbor

1. **Introduction.** The development of a Watershed Nitrogen Management Plan was identified for West Falmouth Harbor and its subembayments in the Alternatives Screening Analysis Report. It will provide recommended management strategies for the following nitrogen sources:

- Groundwater recharge from the WWTF
- Groundwater recharge from on-site systems
- Runoff from roofs and roads
- Groundwater recharge from lawns
- Groundwater recharge from the Landfill

The total nitrogen loadings from these sources will be compared to identified critical nitrogen loading values for the subembayments in the Draft Wastewater Facilities Plan.



This map was developed by Stearns & Wheler, LLC, Environmental Engineers & Scientists for the purpose of studying Falmouth's wastewater management needs. Sewered parcels, and the Water Pollution Control Facility were digitized in 1990 for the Cape Cod Commission's Regional Policy Plan. Other base map features such as coastlines, water bodies, coastal embayment recharge areas, water supply protection areas and roads were automated by the Cape Cod Commission GIS department. Special technical assistance and data was provided by MassGIS of Boston, MA; and the Town of Falmouth.

The map has been developed as a planning tool to investigate problems related to wastewater treatment and disposal. Much Town-wide and regional information has been intergrated to produce this map. The source information comes from a variety of dates, as noted above, and therefore, may not reveal more recent changes. Also, the source information was digitized with a regional prespective, and this may show inherent inaccuracies pertaining to individual properties. This map does not intend to provide design information or regulatory enforcement for individual properties.

Notes:

1. Clinton Ave, Scranton Ave and North Davis Straits Service Areas are the 3 components of the Davis Straits / Inner Harbor Planning Area.
2. Unsewered portions of North Davis Straits will also be evaluated for a Package Treatment System and Individual Nitrogen Removal Systems.
3. Maravista will also be evaluated for Individual Nitrogen Removal Systems.

Legend

- Surface Water Bodies
- ⁄⁄ Water Suppy Protection Area
- ▒ Cluster and On-Site System Area
- ■ Areas Served by Package Treatment Systems
- ■ Areas Served by Falmouth WWTF
- ▨ Individual Nitrogen Removal System Area
- ■ Golf Course Potentially Used for Effluent Disposal
- ▲ Falmouth Wastewater Treatment Facility
- ⊡ Falmouth Sanitary Landfill
- — Coastline (Fresh & Saltwater)
- — Town Boundary
- — Roads
- ▪▪ Perimeter of Costal Embayment Recharge Areas
- ▬ Planning Area Boundaries

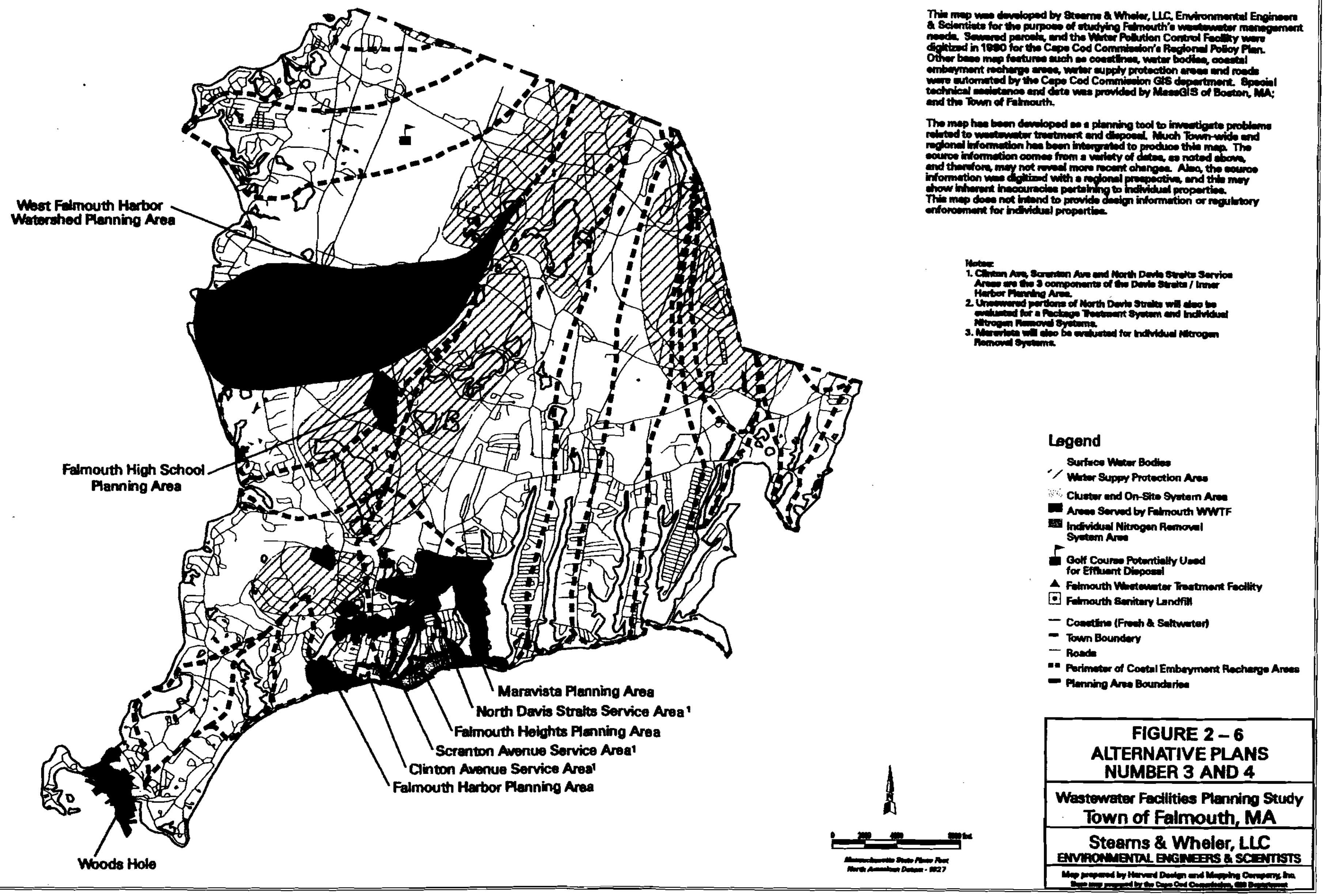
FIGURE 2 – 5
ALTERNATIVE PLANS NUMBER 1 AND 2

Wastewater Facilities Planning Study
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Map prepared by Harvard Design and Mapping Company, Inc.
Base map prepared by the Cape Cod Commission, GIS Department

October 5, 1998



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The map has been developed as a planning tool to investigate problems related to wastewater treatment and disposal. Much Town-wide and regional information has been intergrated to produce this map. The source information comes from a variety of dates, as noted above, and therefore, may not reveal more recent changes. Also, the source information was digitized with a regional prespective, and this may show inherent inaccuracies pertaining to individual properties. This map does not intend to provide design information or regulatory enforcement for individual properties.

Notes:

1. Clinton Ave, Scranton Ave and North Davis Straits Service Areas are the 3 components of the Davis Straits / Inner Harbor Planning Area.
2. Unsewered portions of North Davis Straits will also be evaluated for a Package Treatment System and Individual Nitrogen Removal Systems.
3. Maravista will also be evaluated for Individual Nitrogen Removal Systems.

FIGURE 2 – 6
ALTERNATIVE PLANS
NUMBER 3 AND 4

Wastewater Facilities Planning Study
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Map prepared by Harvard Design and Mapping Company, Inc.
Base map prepared by the Cape Cod Commission, GIS Department

October 5, 1999

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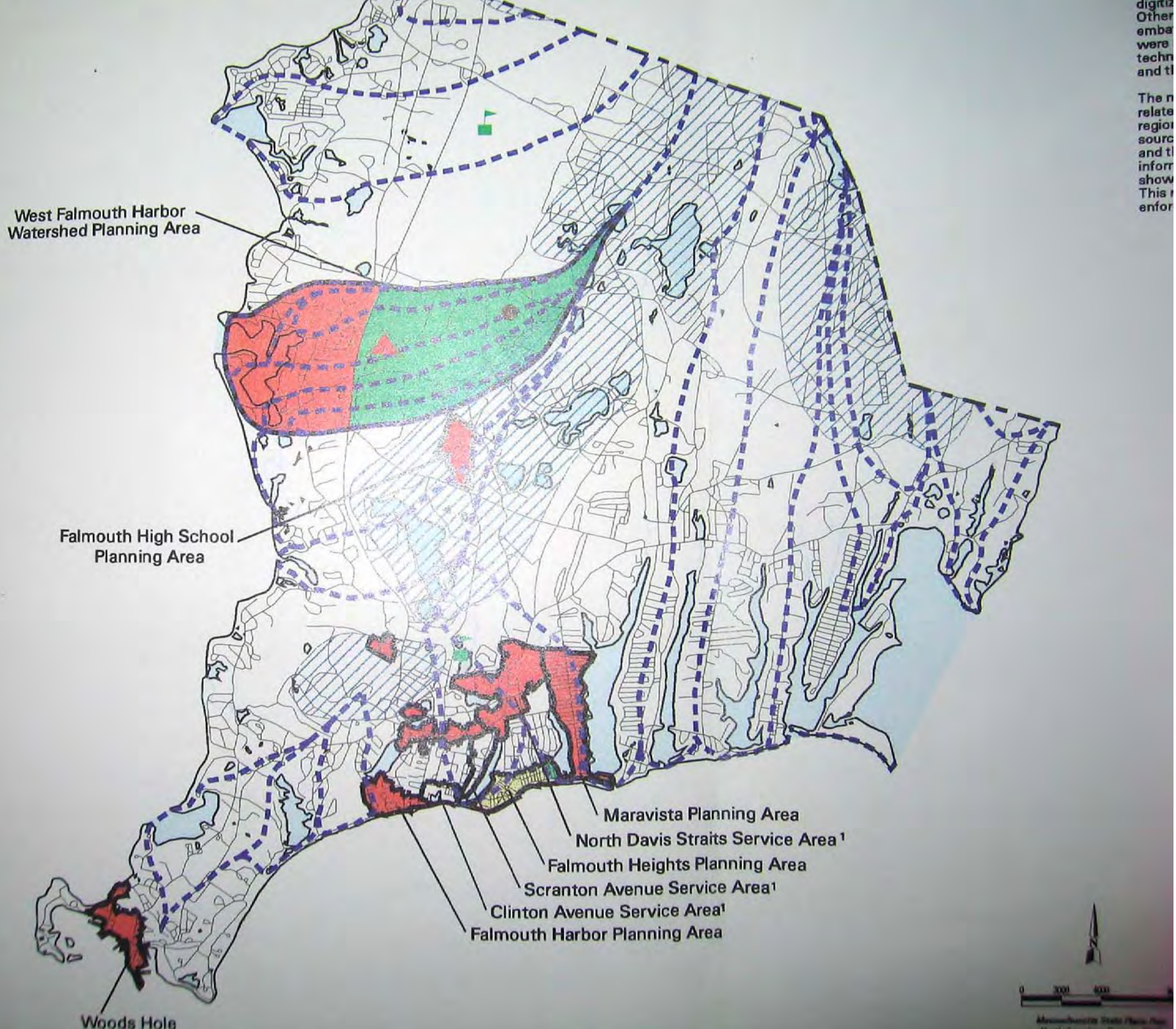


2.5 DRAFT WASTEWATER FACILITIES PLAN AND DRAFT ENVIRONMENTAL IMPACT REPORT

A. Introduction. The Draft Wastewater Facilities Plan and Draft Environmental Impact Report (DWWFP/DEIR) documented the detailed evaluations of alternative technologies and alternative plans listed in Section 2.4-B and C. These detailed evaluations were the basis of the Recommended Plan and Environmental Impact Analysis that was presented in draft form in this report.

The detailed evaluations indicated that Alternative Plan No. 4 (upgrade of the Falmouth WWTF to a design flow of 1.4 mgd; treatment to a 5 ppm total nitrogen discharge limit; and sewering of portion of West Falmouth Harbor, Falmouth High School, Davis Straits/Inner Harbor Area and Maravista) was the highest rated Plan based on having the second lowest costs, and providing the most nitrogen removal and best environmental protection. Also, several additional issues and the need for further study were identified as listed below.

- A preliminary nitrogen assessment performed for Little Pond and its watershed indicates that nitrogen removal facilities are needed for the Maravista Planning Area and 0.2 mgd of treatment capacity is included in the 1.4 mgd design flow. A more detailed nitrogen assessment of this Area is necessary to determine if other portions of the Little Pond Watershed need nitrogen removal facilities.

- Nitrogen loading assessments and wastewater treatment alternatives have been evaluated for the Great Pond, Green Pond, and Bournes Pond Watersheds east of the Little Pond Watershed as part of the Ashumet Plume Nitrogen Offset Program. Portions of the Maravista Planning Area are located within the Great Pond Watershed. Discussions with the consultants and committee members performing that evaluation indicate that sending wastewater to the Falmouth WWTF for treatment has not been considered as a feasible alternative. This indication may change as the feasibility of remediating nitrogen impacts in this Area is developed further as identified in Section 1.6C.

- Effluent discharge capacity at the Falmouth WWTF is limited due to low permeable soils in that portion of Falmouth. The use of well injection technology was identified as a low cost effluent discharge technology that has minimal environmental impact because it requires minimal land clearing and excavation. Also, it could more easily allow effluent disposal outside of the West Falmouth Harbor Watershed. Well injection technology is new to Massachusetts and would need to be pilot tested before it is determined to be feasible and is approved by Massachusetts DEP. Funding for effluent mitigation evaluation and possible pilot testing of the well injection technology in the form of zero percent loans has recently been made available by DEP. Findings of these evaluations (if needed) could indicate the most feasible and cost effective methods to discharge treated effluent with less environmental impact.

These findings and additional issues of the Detailed Evaluation and Environmental Impact Analysis came together to identify the Recommended Plan for wastewater facilities and management in Falmouth as submitted in the Draft Wastewater Facilities Plan and Draft Environmental Impact Report.

B. Draft Recommended Plan. The Draft Recommended Plan is a modification of Alternative Plan No. 4 and has the following major components.

- Upgrade of the Falmouth WWTF to an average annual flow of 1.2 million gallons per day (mgd) with nitrogen removal to meet a 5 parts per million (ppm) discharge limit on a daily basis, which is expected to produce an average effluent nitrogen concentration of 3 ppm.
- Connection of the Falmouth High School to the Falmouth WWTF.
- Sewering of portions of the West Falmouth Harbor Watershed west of Route 28.
- Sewering of North Davis Straits and Scranton Avenue Service Areas.
- Nitrogen removal septic systems for the West Falmouth Harbor Watershed east of Route 28.

This Draft Recommended Plan did not include sewering of the Maravista Planning Area until further nitrogen assessments are complete in the Little Pond Watershed, and the well injection pilot test and/or effluent mitigation evaluations are complete. The Draft Recommended Plan provided nitrogen removal that meets and is well below the SA-N surface water standard of Snug Harbor.

The 1.2 mgd design flow to the Falmouth WWTF was based upon the following projected flows:

- 0.47 mgd existing flow from existing sewered areas
- 0.09 mgd from infilling and redevelopment in existing sewered areas
- 0.01 mgd from Falmouth High School
- 0.23 mgd from the West Falmouth Harbor Watershed
- 0.2 mgd from the North Davis Straits and Scranton Avenue Service Areas
- 0.2 mgd as an emergency reserve

A Draft Nitrogen Management Plan was developed for the West Falmouth Harbor with the following basis and major components:

- Advanced nitrogen removal at the WWTF and WWTF nitrogen discharge reduction from 15,709 kg/yr in 1998 to 5,000 kg/yr at the design condition in 2023
- SA-N surface water standard as developed by the Buzzards Bay Project and Cape Cod Commission
- Snug Harbor nitrogen loading reductions from 21,083 kg/yr in 1998 to 7,860 kg/yr at the design condition in 2023
- Potential sewering of portions (west of Route 28) of the West Falmouth Harbor Watershed
- Nitrogen removal on-site systems for the eastern portion of the West Falmouth Harbor Watershed, and the establishment of a management district to manage and monitor the performance of these systems
- Regulations on nitrogen fertilizer use
- Increased tidal flushing for Oyster Pond

The Draft Recommended Plan had total capital costs (construction costs plus engineering, fiscal, and legal costs) as listed below:

- $12,800,000 for upgrade of the Falmouth WWTF
- $1,000,000 for connection of the Falmouth High School
- $18,500,000 for the wastewater collection system in the western portion of the West Falmouth Harbor Watershed
- $2,700,000 for the wastewater collection system for the Davis Straits Service Area
- $390,000 for the Scranton Avenue collection system

These costs are based on bidding in 2001.

The Draft Wastewater Facilities Plan and Draft Environmental Impact Report was submitted for MEPA review in late January 2000 to allow for a decision by the Executive Office of Environmental Affairs Secretary by mid-March 2000. This timeline allowed the Secretary's decision to be available for the Falmouth Annual and Special Town Meeting in April 2000. Also, a Phase I Waiver was requested from the Secretary to allow design of the Falmouth WWTF upgrade to proceed in April 2000, construction bidding to occur in early 2001, and construction to start in July 2001. The Phase I waiver was not approved due to issues expressed in a report by CMAST released in February 2000.

2.6 CMAST REPORT

As reported in previous Study documents, Dr. Brian Howes of the Center for Marine Science and Technology (CMAST) has ongoing academic research in the West Falmouth Harbor area. A draft report (no date) entitled "Evaluation of the Nutrient Related Health of West Falmouth Harbor" (CMAST Report) was released in February 2000 during environmental review of the Draft Wastewater Facilities Plan and Draft Environmental Impact Report to summarize this research. The main findings of the CMAST Report are summarized below:

- A revised Snug Harbor and Mashapaquit Creek watershed was proposed.
- The Mashapaquit marsh system provides approximately 40% nitrogen attenuation of the groundwater that recharges from the watershed into the creek.
- Effluent discharge facilities at the WWTF provide the following nitrogen attenuation:
    - 65% nitrogen attenuation at the spray irrigation areas
    - 8% nitrogen attenuation at the sand infiltration beds.
- The report suggests that a nitrogen concentration threshold of 0.35 to 0.37 would support a relatively high quality habitat for eelgrass and would support it's reestablishment.

Discussions with DEP and CCC (See Appendix 1-2) have requested the Wastewater Facilities Plan Study to incorporate several findings (as modified by regulatory considerations) of the report. These requested findings include:

- Revised Mashapaquit Creek and Snug Harbor watersheds should be based on the Cape Cod Commission delineation modified to expand the size of the Mashapaquit Creek watershed to incorporate the southern watershed portion indicated in the CMAST Report.
- The following attenuation factors should be used in subsequent nitrogen assessment for the Snug Harbor system:
    - 20% nitrogen attenuation as the groundwater from the Mashapaquit Creek watershed moves through the bordering marsh into the Mashapaquit Creek. This indicates a 100% safety factor on the reported attenuation factor.
    - 45% nitrogen attenuation at the spray irrigation areas instead of the 65% factor observed.
    - 0% nitrogen attenuation at the sand infiltration beds instead of the 8% factor observed.

These findings are used in the nitrogen assessment summarized in Chapter 3.

2.7 DRAFT SUMMARIES AND MEETING MINUTES TO ADDRESS REGULATORY AND PUBLIC COMMENTS

Several regulatory and public participation meetings have been held since submittal of the Draft Wastewater Facilities Plan and Draft Environmental Impact Report, and the CMAST Report as described in Chapter Section 1.4 and 1.5. Efforts have been made to address outstanding issues of the Study. Meeting notes and correspondence for several regulatory meeting are attached in Appendix 1-2.

Regulatory and public comments on the Draft Wastewater Facilities Plan and Draft Environmental Impact Report are addressed in a memo contained in Appendix 1-1. A preliminary copy (dated May 31, 2000) of the memo was submitted to CCC and DEP for their review and comments.

CHAPTER 3

REVISED NITROGEN LOADING EVALUATIONS FOR WEST FALMOUTH HARBOR

3.1 INTRODUCTION

Nitrogen loading evaluations are performed to assess the impact of land use and wastewater management within a watershed on coastal embayment water quality. Nitrogen is released into watersheds and embayments from the following major sources:

- On-site wastewater treatment systems.
- Run off from roads and roofs.
- Fertilizer application to lawns.
- Nitrogen release from undeveloped natural areas due to atmospheric precipitation and other mechanisms.
- Land application of treated wastewater effluent from wastewater treatment facilities.

Annual nitrogen loadings are typically calculated in kilograms per year (kg/yr) for each of these sources and then summed for each watershed. The sum is then compared to a critical nitrogen loading value (expressed in kilograms per year) which is based on a surface water standard to determine if excessive nitrogen loading is occurring in the watershed. Excessive nitrogen loading can over fertilize coastal waters causing an over production of algae which in turn results in poor water quality, reduced water clarity, loss of eelgrass coverage, and low dissolved oxygen levels when the algae settles to the bottom and decays.

The largest nitrogen sources in a watershed are typically wastewater related. These wastewater sources include on-site septic systems and effluent from wastewater treatment facilities. The nitrogen evaluations are performed in this Study to determine the most appropriate wastewater facilities to plan for the future to minimize nitrogen impacts to the coastal embayments of West Falmouth Harbor.

There are many detailed calculations (computer models) used to determine these nitrogen loadings. There are several opinions on the science and regulatory procedures to perform nitrogen evaluations. Great efforts have been made to incorporate established work and opinions from many different sources to produce an appropriate nitrogen evaluation which can be the basis for recommendations for improved wastewater facilities.

This Chapter summarizes the nitrogen evaluations performed in this Study and presented in the DWWFP/DEIR. It also discusses the regulatory comments on these evaluations and presents a revised nitrogen evaluation.

3.2 SUMMARY OF NITROGEN LOADING EVALUATION PRESENTED IN THE DWWFP/DEIR

Nitrogen loading evaluations were presented in detail on pages 5-8 through 5-28 of the DWWFP/DEIR. A Nitrogen Management Plan based on these evaluations was presented on pages 8-16 through 8-17 of that Draft Report. This Chapter Section provides a brief summary of those evaluations and the proposed management plan.

Table 3-1 presents a summary of the Existing, No-Action-Alternative, and Budgeted Nitrogen Loadings for the West Falmouth Harbor subembayments as presented in the DWWFP/DEIR. The Existing and No-Action-Alternative loadings were developed in the Needs Assessment based upon evaluations by the Cape Cod Commission that were reported in their Coastal Embayment Project Report (CCC, September 1998), and updates of that work based on a more

TABLE 3-1

SUMMARY OF NITROGEN LOADINGS TO WEST FALMOUTH HARBOR SUBEMBAYMENTS AS PRESENTED IN DRAFT WASTEWATER FACILITIES PLAN AND DRAFT ENVIRONMENTAL IMPACT REPORT

Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts

Loading Summary (kg/yr)												
Source	Snug Harbor			Oyster Pond/Harbor Head			Oyster Pond			Whole West Falmouth Harbor System		
	Existing	No Action Alternative[1]	Design[2]	Existing	No Action Alternative[1]	Design	Existing	No Action Alternative[1]	Design	Existing	No Action Alternative[1]	Design
Wastewater from on-site systems	2,509	6,301	1,300	2,230	3,775	1,730	481	970	540	6,644	14,244	3,721
Runoff from roofs and roads	712	909	910	491	530	530	176	188	190	1,620	1,965	1,965
Groundwater recharge from lawns	725	878	440[5]	320	633	317	49	148	74	1,490	2,091	1,46
Groundwater recharge from natural areas	211	211	210	129	129	131	45	45	45	927	927	927
Groundwater recharge from LF	1,217	0	0	0	0	0	0	0	0	2,434	0	0
Groundwater recharge from WWTF	11,300[3]	13,000[3]	5,000	0	0	0	0	0	0	11,300[3]	13,000[3]	5,000
Total N-Loading	16,674[3]	21,300[3]	7,860	3,170	5,067	2,710	751	1,351	849	24,415[3]	32,227[3]	12,660
SA-N Limit	11,675			3,675			478[4]			101,736		

Notes:

(1) These are the potential future nitrogen loadings that could result under the No Action Alternative. Future loadings from the WWTF represent a 15 percent increase. This source uses nitrogen attenuation factors for the WWTF effluent discharge facilities (no attenuation factor for groundwater travel through wetlands) as referenced in Note 3.

(2) Design nitrogen loading to meet a SA-N surface water standard. No nitrogen attenuation factors were used for the WWTF effluent facilities or for groundwater travel through wetlands.

(3) Existing and future values were calculated with nitrogen attenuation factors of 45% for effluent discharged at the spray irrigation area and 5% for effluent discharged at the sand infiltration beds (Needs Assessment Report).

(4) A larger culvert to Oyster Pond is recommended to increase the flushing to produce a critical nitrogen loading of a least 849 kg/yr to meet the design loading.

(5) A 50% reduction of the future lawn recharge (fertilizer) loading is due to a recommended ban on lawn fertilizers in the watershed.

detailed evaluation of Wastewater Treatment Facility (WWTF) discharges. The existing loadings represent loading that occurred in 1998 (The "Existing Condition" for the Study). The No-Action-Alternative loadings represent the loadings that would occur at buildout conditions in the watershed if no management steps are taken to mitigate this projected nitrogen loading. The design nitrogen loading is the calculated nitrogen loading that would occur in the design year (2023) based on the following Recommended Plan items that were presented in the DWWFP/DEIR:

- Upgrade of the Falmouth WWTF to advanced nitrogen removal and an average annual flow of 1.2 mgd.
- Sewering of western portions of the West Falmouth Harbor Watershed (area west of Route 28) to collect and treat the wastewater at the Falmouth WWTF to a higher level than is possible with the current on-site systems.
- Requirement of nitrogen removal on-site systems in the sparsely developed eastern portions of the watershed to minimize nitrogen loading from these on-site systems. Also a minimum lot size of 80,000 ft^2 is recommended for the portions of this area that are not already zoned for this minimum lot size.
- Public education and local regulations which would prohibit the use of nitrogen fertilizers in this watershed.
- Preparation of sewer-use and other local regulations to establish a wastewater management district and to control increased growth that could occur after a sewer is installed and the land use limitations of the State's Title 5 regulations are removed.
- Improved stormwater facilities to reduce fecal coliform loading to West Falmouth Harbor and the subsequent shellfish closures.

The Budgeted Nitrogen Loading values were developed to meet the SA-N surface water standard for West Falmouth Harbor as shown on the last line of Table 3-1. This standard is based on the State's SA classification of the embayments which states that SA surface waters are "suitable for shellfish harvesting without depuration; excellent habitat for fish, other aquatic life and wildlife and for primary and secondary contact recreation; and excellent aesthetic value". The Buzzards Bay Project utilized this classification when they performed evaluations (USEPA and EOEA, 1991) to modify this classification to a nitrogen standard. Additional updates have been developed by the Buzzards Bay Project as discussed in Chapter Section 1.6. The Cape Cod Commission has adopted the SA-N Standard for West Falmouth Harbor in their Regional Policy Plan.

Table 3-1 illustrates that the design loadings are significantly less than the SA-N Limit for all subembayments except Oyster Harbor. It also illustrates that existing and No-Action-Alternative loadings typically exceed the SA-N standards for nearly all of the subembayments. However, the SA-N standard is not exceeded when looking at the entire West Falmouth Harbor System.

The design loadings for Snug Harbor were based on no nitrogen attenuation at the effluent discharge facilities or in the watershed. This was a conservative assumption based on a history of the regulatory agencies being hesitant to accept attenuation in the watershed or at effluent discharge facilities.

3.3 REGULATORY DIRECTION FOR THE NITROGEN EVALUATION

Several regulatory and public comments were received during review of the DWWFP/DEIR as discussed in Chapter Sections 1.4 and 1.5 and attached in Appendix 1-1. Also a report was released by the University of Massachusetts Center for Marine Science and Technology (CMAST) as discussed in Chapter Sections 1.6D and 2.6. Several regulatory and Working Group Meetings have been held to discuss the comments and clarify the remaining issues. Meeting Notes for these meetings are contained Appendix 1-2.

The CMAST Report provided the following information:

- A slightly modified watershed delineation of the Mashapaquit Creek watershed based on modeling performed by USGS.
- A surface water standard of 0.35 to 0.37 mg/l total nitrogen in Snug Harbor with the goal to reestablish eelgrass.
- Nitrogen attenuation at the effluent discharge facilities and in the watershed:
    - 65% nitrogen attenuation at the spray irrigation area.
    - 8% nitrogen attenuation at the sand infiltration beds.
    - 40% nitrogen attenuation as groundwater flows from the Mashapaquit Creek Watershed into Snug Harbor.

Regulatory comments and meetings with DEP and CCC staff directed the Study to make the following revisions to the Nitrogen Evaluation:

- Revise the Mashapaquit Creek Watershed based on portions of the USGS delineations.
- Utilize the following nitrogen attenuation factors:
    - 45% nitrogen attenuation at the spray irrigation areas.
    - 0% nitrogen attenuation at the sand infiltration beds.
    - 20% nitrogen attenuation as groundwater flows from the Mashapaquit Creek in Snug Harbor.
- Investigate how much treated effluent at 3 ppm can be discharged at the WWTF site and still meet the 0.35 to 0.37 mg/l standard to reestablish eelgrass.
- Perform an alternative analysis to relocate a portion of the projected 1.2 mgd design flow from the WWTF site to one or more new sites outside the Snug Harbor Watershed.

Preliminary findings of the Nitrogen Evaluation were presented at a meeting of the Working Group on December 20, 2000 which was attended by DEP. These findings indicated that 0.2 mgd of the 1.2 mgd design flow would need to be relocated from Snug Harbor Watershed to meet the 0.37 mg/l standard. In addition 0.6 mgd would need to be relocated to meet the 0.35 mg/l standard. Both of these scenarios were based on treatment of 1.2 mgd at the WWTF, as recommended in the DEIR, use of the DEP suggested attenuation factors, and sewering of Snug Harbor Watershed west of Route 28. At that meeting DEP staff stated that they would be willing to accept a 1.0 mgd discharge in the Snug Harbor Watershed to meet the 0.37 mg/l standard if the Town tries to relocate 0.2 mgd outside the watershed. DEP staff also felt that the 0.2 mgd flow could be discharged in the Snug Harbor watershed in the future if actual treatment performance of the upgraded WWTF was better than the 3 ppm average performance currently expected.

3.4 REVISED WATERSHED DELINEATION

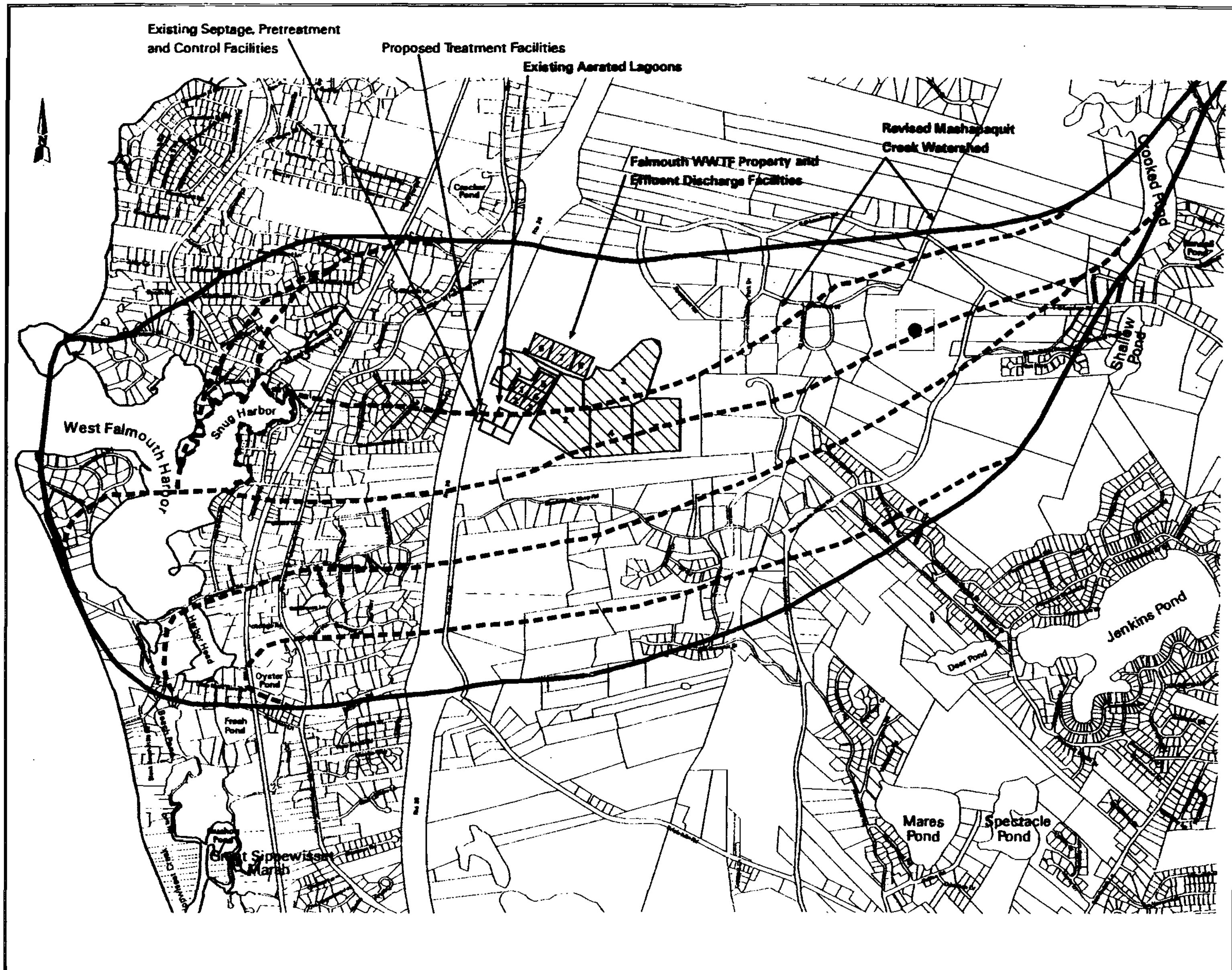
A revised delineation (as shown in Figure 3-1) was agreed for Snug Harbor and Mashapaquit Creek at the CCC technical meeting of November 13, 2000 (see meeting notes in Appendix 1-2) when this delineation is compared with the previous delineation shown in Figures 2-1 and 2-2, it is noted that the Mashapaquit Creek Watershed has been shifted to the south to include a larger portion of the WWTF site.

The portion of the Snug Harbor Watershed that does not flow into Mashapaquit Creek and recharges directly into Snug Harbor is identified in the following text as the "Snug Harbor Proper" Watershed.

The revised nitrogen evaluations are based on this revised delineation.

3.5 REVISED NITROGEN LOADING EVALUATIONS

A. Introduction. The main revisions were made for the Snug Harbor subembayments due to the revised watershed delineation in that area and the need to use attenuation factors. Additional evaluations were performed for the Oyster Pond subembayment as requested by the



January 3, 2001

This map was developed by Stearns & Wheler, LLC, Environmental Engineers & Scientists for the purpose of studying Falmouth's wastewater management needs. Base map features such as coastlines, water bodies, roads and road names were automated by the Cape Cod Commission GIS department. Special technical assistance and data was provided by MassGIS of Boston, MA; and the Town of Falmouth.

Parcels were digitized by the Cape Cod Commission GIS Department for use by the Town of Falmouth from Falmouth 1994 Assessors Maps at the original scale of 1:1200 and 1:2400.

The map has been developed as a planning tool to investigate problems related to wastewater treatment and disposal. Much Town-wide and regional information has been integrated to produce this map. The source information comes from a variety of dates, as noted above, and therefore, may not reveal more recent changes. Also, the source information was digitized with a regional perspective, and this may show inherent inaccuracies pertaining to individual properties. This map does not intend to provide design information or regulatory enforcement for individual properties.

Notes:

1. Facility locations and sizes are approximate.
2. Previous Mashapaquit Creek Watershed limits are illustrated on Figures 2-1 and 2-2.

Legend

—	Parcels
—	Coastline
▬	Town Boundaries
▬	West Falmouth Harbor Watershed Planning Area Boundaries
■ ■	Perimeter of Coastal Embayment Recharge Areas
⊡	Falmouth Sanitary Landfill
▨	Existing Spray Irrigation Areas
▨	Existing Infiltration Beds

FIGURE 3-1
REVISED MASHAPAQUIT CREEK WATERSHED

Wastewater Facilities Planning Study
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Map prepared by Harvard Design and Mapping Company, Inc.

CCC. Revised nitrogen evaluations for these two subembayments are presented below along with a summary for all the West Falmouth Harbor embayments.

B. Snug Harbor. This embayment was the focus of the CMAST Report and the subsequent regulatory meetings due to the WWTF being located this watershed. The main tasks of the nitrogen evaluation for Snug Harbor are listed below:

- Develop critical loading values (in kg/yr) based on the nitrogen limit of 0.35 to 0.37 mg/l total nitrogen concentration in the harbor.
- Evaluate the non-WWTF loadings based on the revised watershed delineation and a more detailed investigation.
- Allocate the Snug Harbor nitrogen loadings (for all sources) between the Mashapaquit Creek and Snug Harbor Proper watersheds so that an attenuation factor can be applied to the groundwater loading from the Mashapaquit Creek watershed.
- Apply the attenuation factors to the various nitrogen loadings as documented in the CMAST report and as directed by the regulatory agencies.
- Compare projected loadings to loading limits and calculate the effluent flows that may need to be relocated outside the Snug Harbor Watershed.

1. Nitrogen Limits and Critical Loading Values. Nitrogen limits of 0.35 to 0.37 mg/l have been recommended by the CMAST report for West Falmouth Harbor to reestablish eelgrass. These concentration limits convert to critical nitrogen loading values of 5,711 to 4,079 kg/yr using the mean embayment volume, local embayment residence time, a background nitrogen concentration of 0.3 mg/l in Buzzards Bay and the calculation method developed by Costa et al and presented in the "Comprehensive Conservation and Management Plan for Buzzards Bay" (USEPA and EOEA, 1991). Discussions with J. Costa of Buzzards Bay Project and E. Eichner of the Cape Cod Commission indicated that this calculation methodology is consistent with their guidelines and planned revisions as described in Chapter Section 1.6J, and should be used for the evaluations.

It is noted that surface water quality standards of 0.35 to 0.37 ppm are very stringent. The following Table provides a listing of total nitrogen concentrations in embayment surface water and a description of the associated water quality.

Nitrogen Concentration (ppm)	Description
<0.30	Dense eel grass, plentiful scallops and other shellfish, high oxygen levels for fish
0.30 to 0.39	Some eelgrass/scallops, high productivity of other shellfish; rare oxygen depletion
0.39 to 0.50	Little eelgrass/scallops, high productivity of other shellfish; occasional oxygen depletion; some phytoplankton blooms and macro-algae
0.50 to 0.70	No eelgrass/scallops, limited other shellfish; some large phytoplankton blooms, more frequent oxygen depletion, periodic fish kills, occasional macro-algae accumulation/odors
>0.70	Near-complete loss of other shellfish/benthic animals periodic near-complete loss of oxygen in bottom waters, lift-off algal mats, drift algae and increased frequence of odor problems
Source: Ashumet plume Citizens Committee Report dated October 27, 2000 and Dr. Howes of CMAST	

2. Reevaluation of Snug Harbor Nitrogen Loading For The Budgeted Condition. This Chapter Section summarizes the evaluations of the nitrogen loadings to Snug Harbor based on projected future flows of 1.2 mgd into the Snug Harbor Watershed which is the discharge proposed in the DWWFP/DEIR for the design conditions in 2023. This Section also summarizes projected nitrogen loadings at the design (Budgeted) conditions if 0.2 mgd is removed from the Snug Harbor Watershed

a. Non-WWTF Loading to Snug Harbor. The non-WWTF loading to the Snug Harbor Watershed is comprised of on-site system loading, loading from roofs and roads, loading from fertilized lawn areas, loadings from natural areas, and loadings from the capped landfill. The watershed loadings from roofs and roads as well as from natural areas has not changed from the budgeted values presented in Table 3-1.

The watershed loading from lawn fertilizers has changed from 440 kg/yr to 878 due to regulatory comments that they would not accept this reduction due to a fertilizer ban. It is noted that fertilizer loadings typically represent a large loading to the embayment; and they are based on many assumptions which may not be valid. There is much academic interest in developing more accurate calculation methods for this loading value. Those studies (and regulatory acceptance of the studies) will take years. In the mean time the public should be educated not to use lawn fertilizers, and organizations such as the Waquoit Bay National Estuaries Research Reserve (WBNERR) and University of Massachusetts Extension should develop recommendations on the use of lawn fertilizers. Also a ban on nitrogen fertilizers can be imposed as a component of a Nitrogen Management District. Education materials and regulatory restrictions would be made public by the district. Fines could be levied against blatant offenders. This type of ban is not unreasonable given the large amount of public and private expenditure for improved wastewater facilities in the watershed, and the length of time needed for academic institutions to develop more reasonable procedures to calculate this loading. The Town should consider imposing a ban on lawn fertilizers even though the regulatory agencies may not recognize the benefit to the embayments.

Watershed nitrogen loading from on-site systems in the eastern portion of the watershed have been recalculated based on a more detailed evaluation of land use in the area and the revised watershed delineations.

There are very few existing on-site septic systems in the watershed east of Route 28. The Tech Park has an existing water consumption of 900 gallons per day in 1999. There are three developed properties south of Thomas B. Landers Road with light industrial zoning and minimal water consumption. There are a few developed residential properties in upper reaches of the watershed next to Crooked Pond. The Geographic Information System (GIS) based on Assessor's data identifies a total of 18 bedrooms in this area. This existing land use equates to existing on-site septic system nitrogen loading of 112 kg/yr for this area (59 kg/yr for the Mashapaquit Creek portion and 53 kg/yr for the Snug Harbor Proper portion). Most of this part of the watershed is comprised of large undeveloped properties used (or planned) for gravel mining.

On-site septic system nitrogen loading at the budgeted conditions were developed based on the following basis:

- 8 times the existing wastewater flow for the Tech Park based on the remaining properties becoming developed and uncertainties on the exact water use of the new development.
- 20% increase to the existing light industrial water consumption.
- 40% increase to the existing residential water use in the upper reaches of the watershed adjacent to Crooked Pond and Deep Pond. It is noted that much of this nitrogen loading would flow through Crooked Pond where nitrogen attenuation would be expected. No nitrogen attenuation is assumed at this time, a specific surface and groundwater data is lacking for this area.
- Ultimate residential development of the gravel mine properties based on the construction of three-bedroom houses developed with two acre zoning. These houses would be constructed with individual nitrogen removal systems.

The budgeted on-site system loading for this area is calculated at 720 kg/yr (334 and 386 kg/yr respectively for Mashapaquit Creek and Snug Harbor Proper Watersheds respectively). This represents a 5 fold increase over the existing loadings and may be overly conservative.

The budgeted loading from the landfill is 0 kg/yr based on the landfill being capped and nitrogen in the groundwater system have migrated from the watershed.

b. Allocation of Nitrogen Loadings to the Two Snug Harbor Watersheds. On-site septic system loadings were allocated to the two watersheds (Mashapaquit Creek and Snug Harbor Proper) as discussed in the preceding Section.

Loadings from roofs, roads, and lawns were allocated to the two watersheds as a percentage of the land area of each watershed compared to the total Snug Harbor Watershed. The Mashapaquit Creek loading comprises approximately 52% of the total Snug Harbor loading; therefore, the Snug Harbor Proper loadings comprised approximately 48% of the total loadings.

Loadings from natural areas was allocated to the two watersheds similar to roofs, roads, and lawns except that the embayment area of Snug Harbor was added to the Snug Harbor Proper area. This calculation indicated that 51% of the total natural loading was in the Mashapaquit Creek Watershed while 49% of the natural loading was in the Snug Harbor Proper Watershed.

Loadings from the WWTF were allocated based on the location of the effluent discharge facilities illustrated on Figure 3-1 and the following considerations:

- The spray irrigation area is approximately split 50/50 between the two watersheds. These areas would receive 0.5 mgd during the summer or 0.25 mgd if the flow is annualized based on these areas being operated only six months per year. Accordingly each area would receive 0.125 mgd of annualized flow.

- The infiltration beds would receive the remaining flow based on their location and area. Infiltration basins 1-8 are located in the Mashapaquit Creek Watershed. Infiltration basins 9-13 are proposed for the aerated pond basins which are located in the Snug Harbor Proper Watershed.
- The average effluent concentration is expected to be 3 ppm.

c. Nitrogen Attenuation at the Effluent Discharge Facilities and in the Mashapaquit Creek Watersheds. The CMAST report documented nitrogen attenuation in the spray irrigation area, the sand infiltration beds, and at the interface between the Mashapaquit Creek Watershed and Snug Harbor. The regulatory agencies have directed the Study to utilize lower nitrogen attenuation rates as discussed in Section 3.3. These two groups of nitrogen attenuation factors have been used with the allocated watershed loadings to calculate projected nitrogen loadings to Snug Harbor. These calculations are summarized in Appendix 3-1 and result in a total loading of 6443 kg/yr based on the DEP suggested attenuation factors and 5,252 kg/yr based on the CMAST attenuation factors.

As summarized in Section 3.2, DEP would like to have 0.2 mgd of the 1.2 mgd flow removed from the Snug Harbor Watershed at design conditions to meet the 0.37 mg/l surface water standard. The 0.2 mgd flow equates to an average annual loading of 829 kg/yr of nitrogen. The following budgeted loadings result when the 0.2 mgd flow is removed from the watershed at design conditions:

- 5,614 kg/yr based on the DEP suggested attenuation factors
- 4,423 kg/yr based on the CMAST attenuation factors

A summary and assessment of these design and budgeted loadings, as well as existing and no action alternative conditions, for Snug Harbor is presented later in this Chapter.

3. Reevaluation of Snug Harbor Nitrogen Loadings For Existing and No Action Alternative Conditions. The Existing and No Action Alternative nitrogen loadings for Snug Harbor, as listed in Table 3-1, have been revised slightly due to nitrogen attenuation in the Mashapaquit Creek Watershed and slight modifications to the attenuation factors used for the WWTF discharge at the sand infiltration beds.

The non-WWTF loadings (groundwater recharge from on site systems, roofs, roads, lawns, and natural areas) were revised due to projected nitrogen attenuation in Mashapaquit Creek Watershed. The loading for each source was split between the Mashapaquit Creek Watershed and the Snug Harbor Proper Watershed as a percentage of the land area of each watershed compared to the total Snug Harbor Watershed area. The Mashapaquit Creek Watershed has approximately 52% of the total land area leaving approximately 48% of the total area for the Snug Harbor Proper Watershed. A 20% attenuation factor was applied to the nitrogen loading in the Mashapaquit Creek Watershed.

The landfill loading at the existing conditions has not changed.

The WWTF loadings were revised to reflect 0% nitrogen attenuation in the sand infiltration beds (as opposed to the 5% previously used), and the 20% attenuation for the effluent discharge in the Mashapaquit Creek Watershed.

These loadings are summarized in the following section.

4. Summary of Nitrogen Loadings For Snug Harbor. The following Table summarizes the nitrogen loadings for Snug Harbor as well as the resulting nitrogen concentrations in Snug Harbor.

Snug Harbor Nitrogen Loadings (kg/yr) and Resulting Concentrations (mg/l) (1)

Source	Existing Conditions	No Action Alternative	Design Conditions	Budgeted Conditions
Wastewater from on site systems	2,248	5,645	653	653
Runoff from roofs and roads	638	813	813	813
Groundwater recharge from lawns	650	785	785	785
Groundwater recharge from natural areas	189	189	189	189
Groundwater recharge from the landfill	1,217	0	0	0
Groundwater recharge from WWTF	9,807	11,278	4,003	3,174
Total N-Loading (kg/yr)	14,749	18,710	6,443	5,614
Resulting total Nitrogen concentration (mg/l) in Snug Harbor	0.49	0.53	0.38	0.37

(1) Based on the nitrogen attenuation factors suggested by DEP.

The following items are noted from the evaluations in this Section and this loading summary:

(1) Nitrogen loading to Snug Harbor in 1998 (which is the existing condition for this Study) is 14,749 kg/yr which equates to 0.49 mg/l total nitrogen concentration in Snug Harbor.

(2) The nitrogen loading to Snug Harbor for the no action alternative (which is the condition that will happen if no changes are made at the WWTF and no nitrogen management plan is implemented for the watershed) is 18,710 kg/yr which equates to 0.53 mg/l in Snug Harbor.

(3) A nitrogen loading of 7,432 kg/yr to Snug Harbor would occur if the watershed did not have the WWTF in it and no nitrogen management plan was implemented in the watershed. This loading is the No Action Alternative without the WWTF component. This situation would result in a 0.39 mg/l total nitrogen concentration in Snug Harbor.

(4) The design condition proposed in the DWWFP/DEIR (1.2 mgd discharge in Snug Harbor Watershed) would result in a nitrogen loading of 6,443 kg/yr and a resulting nitrogen concentration of 0.38 mg/l in Snug Harbor. If the attenuation factors documented in the CMAST Report are used to calculate this same design condition; the nitrogen loading would be 5,252 kg/yr and the nitrogen concentration in Snug Harbor would be 0.36 mg/l.

(5) The budgeted condition which is the design condition with 0.2 mgd of the 1.2 mgd design flow relocated outside the Snug Harbor Watershed would result in a nitrogen loading of 5,614 kg/yr and a nitrogen concentration of 0.37 mg/l. If the attenuation factors documented in the CMAST Report are use to calculate the same budgeted condition; the nitrogen loading would be 4,423 kg/yr and the nitrogen concentration in Snug Harbor would be 0.35 mg/l.

C. Oyster Pond

1. This embayment is a relatively deep kettle hole pond which is connected to Buzzards Bay through Harbor Head and West Falmouth Harbor. It is connected to Harbor Head with a shallow channel and a culvert under the railroad right of way (ROW). The pond and surrounding properties are illustrated in Figure 3-2.

Nitrogen loading evaluations of the DWWFP/DEIR as summarized in Table 3-1 indicate the following items:

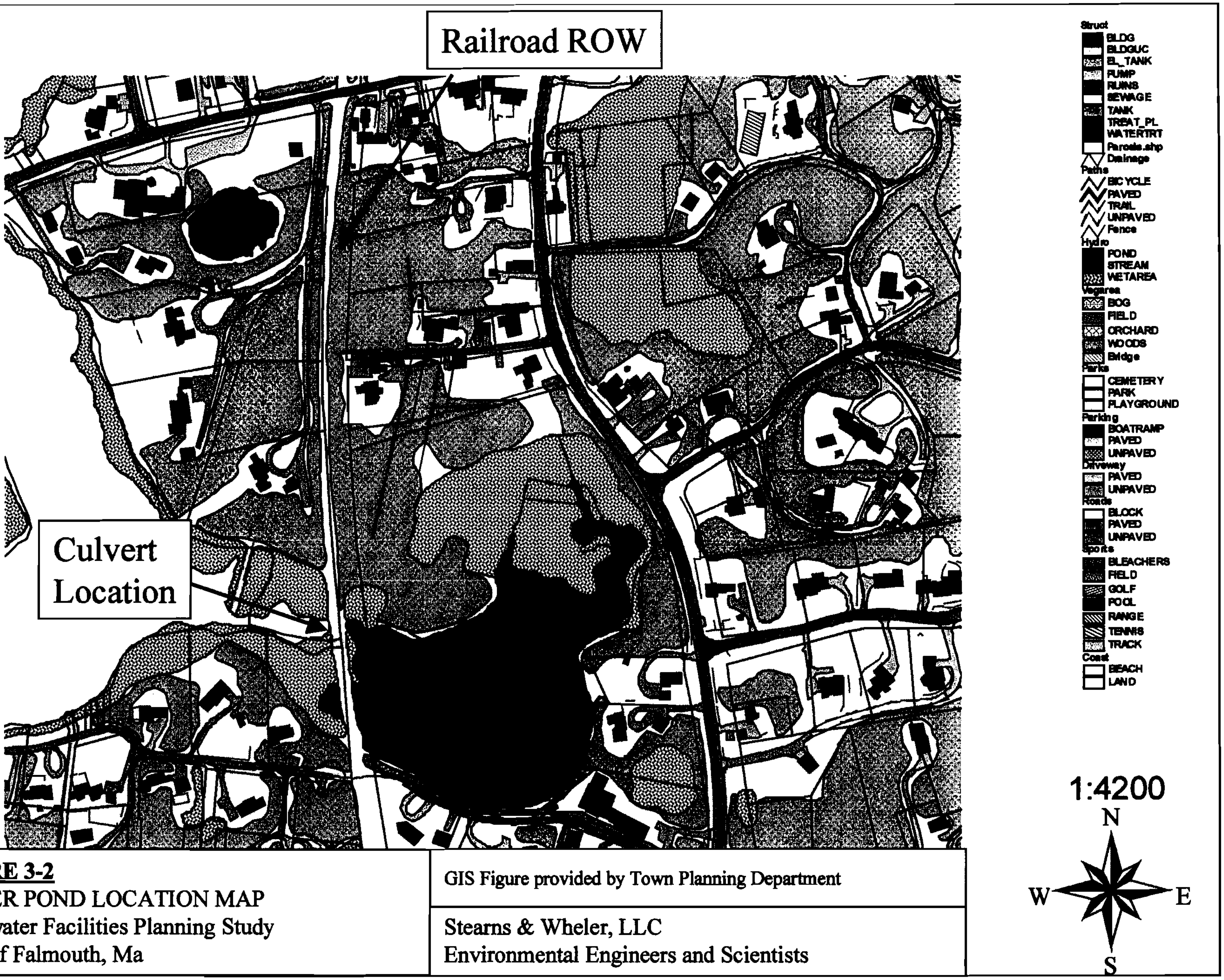


FIGURE 3-2
OYSTER POND LOCATION MAP
Wastewater Facilities Planning Study
Town of Falmouth, Ma

GIS Figure provided by Town Planning Department

Stearns & Wheler, LLC
Environmental Engineers and Scientists

- Design conditions of the DWWFP/DEIR cannot meet the SA-N standard proposed for Oyster Pond. These design conditions include:
    - Sewering the western portion of Oyster Pond Watershed (west of Route 28).
    - Individual nitrogen removal systems in the watershed east of Route 28.
    - Nitrogen management plan for the watershed to control growth and manage nitrogen loading.
- These same conditions will not be able to meet the more stringent 0.35 to 0.37 mg/l standard proposed by the CMAST Report.
- A larger culvert was recommended to increase flushing to the pond and thereby decrease the critical nitrogen loading for the pond.

The nitrogen loadings presented in Table 3-1 have minimal changes because the watershed delineation and nitrogen attenuation factors for this area have not changed from the ones used in the DWWFP/DEIR. One small change will be the doubling of the nitrogen loading from the lawn fertilizer source because the regulatory agencies are hesitant to recognize that a fertilizer ban could produce a 50% decrease.

2. **Additional Considerations On A Larger Oyster Pond Culvert.** A review comment from Cape Cod Commission on the DWWFP/DEIR requested details on the required sizing of the recommended culvert, its affect on tidal exchange, anticipated ecological effects of a new culvert, and potential costs to install the culvert. These details are the subject of a separate new project that would probably require its own Environmental Notification Form and possibly an Environmental Impact Report. This Chapter Section is written to provide preliminary information on these requested details.

The replacement of a culvert to increase tidal flushing typically requires a great level of effort for evaluations and permitting. The Town Engineering Department recently installed a new culvert to increase tidal flushing into Little Pond. This project took approximately four years, from

September 1991 to December 1995, when the construction was complete and final certifications were issued. Approvals were needed from the following agencies:

- The MEPA office of EOEA
- Massachusetts Coastal Zone Management
- US Army Corp of Engineers
- Town Conservation Commission

The March 1995, "Hydrodynamic and Water Quality Study of West Falmouth Harbor" by Aubrey Consulting, Inc. (Aubrey, 1995) provides the flushing information used for this analysis. Pages 13, 14, and 18 of that report (contained in Appendix 3-2) present tidal elevation measurements from July 12 through August 15, 1994 for Harbor Head and Oyster Pond. Page 18 of the report is a comparison of some of the tidal elevations for these two marine water bodies, and the data illustrates the following findings:

- Harbor Head had an average high tide elevation of 3 feet.[1]
- Oyster Pond had an average high tide elevation of 2.5 feet.[1]
- The low tide elevation in Oyster Pond is at 1.3 feet[1] due to a land shelf at the upgradient side of the culvert.
- Oyster Pond has an existing tide range of 1.2 feet and a potential tide range of 1.7 feet due to the fixed low tide elevation.

These elevations indicate that a larger culvert designed to minimize tidal dampening effects could increase the tide range from 1.2 feet to 1.7 feet for an approximate 40% increase. This indicates that the critical nitrogen loading for Oyster Pond could increase 40% from 478 kg/yr to 670 kg/yr for the SA-N standard shown in Table 3-1 due to the proportional relationship between tidal flushing and critical nitrogen loading.

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[1] Referenced to National Geodetic Vertical Datum (NGVD)

It is noted that some of the tide elevations from pages 13 and 14 of the Aubrey Report indicate conflicting information, and additional tide elevations will need to be recorded.

The diameter of the existing culvert is slightly greater than three feet. Given the slight oval cross sectional shape and the corrugated walls, a diameter of 36 inches is used in the evaluation.

Evaluations by Applied Science Associates (ASA) summarized in Appendix 3-3 indicate that doubling the existing effective area of the existing culvert would provide an expected high tide elevation of 2.9 feet[1]; and tripling it would provide an expected high tide elevation of 3.0 feet[1].

It is noted that this evaluation is simplistic because Oyster Pond is unlike the other shallow embayments of West Falmouth Harbor as it is relatively deep. It may not mix completely. It is also surrounded by wetlands that will enter into the nitrogen cycle with attenuation and release of nitrogen. The ecological effects of a larger culvert are difficult to predict with accuracy but the following items are noted:

- Increased flushing will increase the salinity in the pond and will tend to reduce the nitrogen concentration, thereby reducing the potential for algal blooms
- The surrounding wetlands would tend to change to more of a salt marsh. The existing extent of phragmites would be reduced. The increased flushing could decrease the fecal coliform counts in the pond and contribute to the reopening of this coastal pond to shell fishing.

Increasing the average high tide elevation would have some disadvantages for the developed properties around Oyster Pond. Groundwater elevations could be increased which could flood existing septic systems. This problem would be mitigated by the planned sewering of the area.

A larger culvert could also increase the storm surges or maximum high tides into Oyster Pond which could cause flooding of developed properties. This issue would need to be investigated as part of Massachusetts Coastal Zone Management (CZM) approvals and final culvert sizing. Costs for a new culvert will depend on the final sizing and CZM permit requirements. The most simplistic approach would be to install one or two additional 3-foot diameter culverts at an approximate construction cost of $8,000 to $16,000. More likely the CZM permitting process could indicate the need for a rectangular box culvert to replace the existing culvert while providing increased flow area. Installation of a box culvert could have an approximate construction cost of $40,000 to $60,000 based on the bid cost for the Little Pond culvert installation. Engineering and permitting cost are estimated at a range of $20,000 to $60,000 depending upon the permitting requirements and the proportion of this work to be completed by the Town's Engineering Division. In summary, the installation of a new culvert could be very expensive, but it could provide 40% greater flushing which would provide water quality benefits.

The budgeted nitrogen loadings for Oyster Pond are based on the following items that were described in the DWWFP/DEIR:

- Sewering the Oyster Pond Watershed west of Route 28.
- The potential for new residents in the eastern portion of the watershed with individual nitrogen removal systems as required and managed by the proposed Nitrogen Management District.
- Non-wastewater loadings from roofs, roads, ponds and natural areas as presented in previous documents. It is noted that the projected nitrogen loading from the lawn source will increase from the design value shown in Table 3-1 due to DEP's indication that a ban on lawn fertilizers is not expected to produce a 50% reduction.

These loadings are summarized at the end of this Chapter.

D. Other West Falmouth Harbor Subembayments. The nitrogen loadings for the other West Falmouth Harbor Subembayments have minimal changes from the loadings presented in the DWWFP/DEIR as summarized in Table 3-1. The only substantive change is the reduction to the "Whole West Falmouth Harbor" loadings due to the nitrogen attenuation in Snug Harbor. These loadings for these areas are based on the following items:

- Sewering of West Falmouth Harbor Watershed west Route 28.
- The potential for new residences and on-site septic systems in the eastern portion of the watershed with individual nitrogen removal systems as required and managed by the proposed Nitrogen Management District.
- Non-wastewater loadings from roofs, roads, lawns and natural area as presented in previous documents. It is noted that the nitrogen loadings from the lawn source will increase from the design value shown in Table 3-1 due to DEP's indication that a ban on lawn fertilizer would not provide a 50% reduction.

These loading are summarized in the following Section.

3.5 SUMMARY OF REVISED NITROGEN LOADINGS TO WEST FALMOUTH HARBOR

Table 3-2 presents a summary of the nitrogen loading evaluations presented in preceding Sections of this Chapter. The main changes to the loadings as presented in the DWWFP/DEIR and Table 3-1 are listed below:

- The budgeted nitrogen loadings from the lawn fertilizer source for all watershed has been increased due to DEP's indication that a 50% decrease of projected loadings cannot be expected after implementation of a ban of fertilizers.
- Snug Harbor loadings have changed due to the following factors:

TABLE 3-2

SUMMARY OF REVISED NITROGEN LOADING EVALUATION FOR WEST FALMOUTH HARBOR AND SUBAYMENTS
WASTEWATER FACILITIES PLAN AND FINAL ENVIRONMENTAL IMPACT REPORT
Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts

Loading Summary (kg/yr)													
Source	Snug Harbor[4]				Oyster Pond/Harbor Head			Oyster Pond			Whole West Falmouth Harbor System		
	Existing	No Action Alternative[1]	Design[5]	Budget[2]	Existing	No Action Alternative[1]	Budget	Existing	No Action Alternative[1]	Budget	Existing	No Action Alternative[1]	Budget
Wastewater from on-site systems	2,248	5,645	653	653	2,230	3,775	1,730	481	970	540	6,383	13,588	3,074
Runoff from roofs and roads	638	813	813	813	491	530	530	176	188	190	1,546	1,869	1,868
Groundwater recharge from lawns	650	785	785	785	320	633	633	49	148	148	1,415	1,998	1,998
Groundwater recharge from natural areas	189	189	189	189	129	129	131	45	45		905	905	906
Groundwater recharge from LF	1,217	0	0	0	0	0	0	0	0	0	2,434	0	0
Groundwater recharge from WWTF[3]	9,807	11,278	4,003	3,174	0	0	0	0	0		9,807	11,278	3,174
Total N-Loading	14,749[3]	18,710[3]	6,443	5,614	3,170	5,067	3,024	751	1,351	878	22,490[3]	29,638[3]	11,020
SA-N Limit	11,675				3,675			478			101,736		
0.37 ppm Limit	5,711				1,829			252			49,353		
0.35 ppm Limit	4,079				1,307			180			35,252		

Notes:
(1) These are the potential future nitrogen loadings that could result under the No Action Alternative. Future loadings from the WWTF represent a 15 percent increase over the existing loadings.
(2) Budgeted nitrogen loading to meet a 0.37 mg/l surface water standard. The WWTF loading is for a flow of 1.0 mgd indicating that 0.2 mgd of the 1.2 mgd design capacity has been relocated outside the watershed as agreed by DEP.
(3) Calculated values include nitrogen attenuation factors of 45% at the spray irrigation area, and 0% at the sand infiltration beds, as suggested by DEP.
(4) Calculated values include a 20% nitrogen attenuation factor for nitrogen attenuation in the Mashapaquit Creek Watershed as suggested by DEP.
(5) Design loading as proposed in the DWWFP/DEIR.

- Revised watershed delineation of the Mashapaquit Creek and Snug Harbor Watersheds.
- Nitrogen attenuation of 20% for nitrogen loadings in the Mashapaquit Creek Watershed as suggested by DEP.
- Nitrogen attenuation of 45% for the WWTF effluent discharge at the spray irrigation areas as suggested by DEP.
- Agreement to limit the effluent discharge into Snug Harbor to 1.0 mgd at the design condition until the nitrogen removal performance of the upgraded WWTF can be evaluated and shown to be better than 3 ppm.
- More detailed investigation of projected on-site system loading (east of Route 28).

Review of the loading presented in Table 3-2 indicate the following findings:

- Existing and No-Action-Alternative nitrogen loadings to Snug Harbor, Oyster Pond and the combined Oyster Pond/Harbor Head subembayments exceed the SA-N nitrogen standard required by the CCC Regional Policy Plan and the 0.37 ppm standard suggested by the CMAST Report to reestablish eelgrass in the harbor.
- Budgeted nitrogen loading from Snug Harbor will meet the 0.37 ppm nitrogen standard suggested by the CMAST Report to reestablish eelgrass in the harbor.
- Only the Whole West Falmouth Harbor System will meet the 0.35 ppm limit at the budgeted condition. This is due to the shallow and well-flushed nature of the main portion of West Falmouth Harbor.

CHAPTER 4

EFFLUENT DISCHARGE ALTERNATIVES

4.1 INTRODUCTION

A. Effluent Discharge Technologies Screened in the Alternative Screening Analysis Report. Several effluent discharge technologies were evaluated during the Alternative Screening Analysis Report (ASAR) and DWWFP/DEIR, and the following text is a summary of these technologies:

1. **Sand Infiltration Beds.** Sand infiltration beds are open basins designed to allow treated effluent to flow across the bottom of the basin and percolate through the sand bed to the groundwater. Bed maintenance is relatively easy because the bed is exposed at the surface and the sand bottom can be raked or replaced if the sand becomes plugged with effluent solids.

Effluent disposal in these sand infiltration beds has the following advantages:

- This is one of two methods currently used onsite.
- Bed construction is easy and relatively inexpensive.
- Operation and maintenance is simple and costs are low.
- Hydraulic loading rates are typically higher to sand infiltration beds which allows them to take up less areas than other disposal methods.

It has the following disadvantages:

- Construction of new beds requires the clearing of large areas of land which may provide a visual impact.

- Infiltration beds do not have secondary uses, such as parking lots and recreational areas (as subsurface leaching or spray irrigation facilities might have).
- Fouling of beds may reduce infiltration rates if not properly maintained.
- Poor soil conditions (and possibly poor effluent quality) have limited the infiltration rate at the existing beds.
- Extensive site work may be required for construction of new beds at new sites.

2. **Spray Irrigation**. Spray irrigation facilities for centralized wastewater treatment are typically comprised of effluent pumps, distribution piping, and a spraying system comprised of risers and spray nozzles. Effluent is pumped throughout the various distribution lines and discharged through spray nozzles to the surrounding area. The existing WWTF has five separate spray irrigation areas which cover a total of 65 acres. In other locations, these types of systems have also been used at golf courses.

Effluent disposal using spray irrigation has the following advantages.

- Currently is used in conjunction with sand infiltration beds at the WWTF.
- Allows for secondary use of land (i.e. golf courses)
- Provides inexpensive means of irrigation, reducing clean water demands.
- Provides nitrogen uptake by vegetative material and also reduced nitrogen application at golf courses.

It has the following disadvantages:

- Limited cold weather use due to potential freezing problems and/or no need for irrigation in the non-growing months.
- Disinfection may be required.
- Spray nozzles may be subject to clogging.
- Current facilities require a high level of maintenance.

- Laterals must be disassembled and vegetation cut each winter with the existing facilities.

3. **Subsurface Leaching.** Subsurface leaching facilities for centralized wastewater treatment are similar to leaching facilities for decentralized treatment. The effluent is piped (pressure dosed) to leaching facilities (trenches, beds, or galleries) where the effluent percolates to the groundwater. Maintenance of these systems is more difficult because the leaching area is not exposed to the surface and effluent solids cannot be easily removed. Subsurface leaching beds can have secondary uses such as parking lots, lawns, playing fields, and recreational areas.

Subsurface leaching facilities have the following advantages:

- Disinfection is typically not required prior to discharge.
- These facilities are contained underground and can have a secondary use such as parking lots and recreational areas.

They have the following disadvantages:

- Large land area requirements (larger than sand infiltration beds) due to lower hydraulic application rates for this technology.
- Typically require pumping for effluent distribution in large systems.
- Minimal uptake of nitrogen.
- Extensive site work may be required for construction at the WWTF site.

4. **Well Injection.**

a. General Information. Well injection involves the discharge of treated effluent to groundwater below the land surface. The discharge is accomplished by pumping the effluent through wells that extend into permeable, saturated geologic strata. This type of discharge can be compared to the reverse of extracting water from a well and has the following advantages:

- The land area required would be much less than the area required for infiltration beds, subsurface leaching, and spray irrigation. The effluent discharge would be occurring below the surface, and the surface would have minimal disruption.
- Discharge points (wells) could be spread over a large area to minimize groundwater mounding.

It has the following disadvantages:

- Effluent filtration is needed to minimize plugging in the wells.
- Relatively unproven technology in Massachusetts, though the technology is being pilot tested in Barnstable Massachusetts for the Hyannis Water Pollution Control Facility.
- Energy costs for pumping are higher.
- Limited performance data is available.
- Extensive pilot testing would typically be required.

b. Recent experience in the Town of Barnstable. The Hyannis Water Pollution Control Facility (WPCF) is currently evaluating injection wells as a means of disposing of treated wastewater at locations that are remote to the existing WPCF. Barnstable's main goals for using injection wells are: remote discharge, minimal groundwater quality and elevation impacts, cost effectiveness and ease of operation, and minimal aesthetic impacts and area requirements.

The Barnstable pilot testing involves the evaluation of the operational aspects of the system including: flow rate, injection pressure, water treatment, and plugging mechanisms. The objective of this pilot project was to examine the environmental impacts of well injection, including the hydraulic impacts of injection (mounding), and the transport of nutrients and other wastewater components, although that aspect of the test has not yet been completed.

The pilot testing was designed for a proposed 350 gpm flow rate using one well located at the WPCF site. The system initially discharged treated effluent from the advanced nitrogen removal process at the Hyannis WPCF. The effluent was disinfected using an UV system as required by DEP. The flow then passed through a series of 10 micron to 25 micron bag filters before entering the well. Groundwater quality monitoring was performed at the site for BOD, TSS, TS, nitrate, coliform, DO, ammonia-N, phosphorus, and water level measurements were also recorded.

After brief operation of the pilot test, the injection well was unable to discharge 350 gpm due to the plugging of the well and sand buildup in the bottom of the well. Possible plugging mechanisms include injection of solids, air entrainment, or biological activity. The well was rehabilitated with the use of chlorine suggesting that biological fouling was the primary plugging mechanism. The oxygen and nutrient rich effluent without residual disinfection apparently stimulated microbial growth around the well, clogging the screen and surrounding soil. The resulting increased injection pressure also was observed to disrupt the soils and surrounding sand pack, causing sand to collect and fill the bottom of the well.

In an effort to focus the pilot test on hydraulic effects and operational issues, injection resumed after the well was rehabilitated. This time potable water was used instead of treated effluent. The shift to potable water testing allowed for the assessment of individual performance variables (hydraulics and load). During the initial stages of the potable water tests, the start-up flow rate was 50 gpm. This flow rate was maintained for a four-week period. The flow was then increased gradually from 50 gpm to 150 gpm in 50 gpm increments. The ability of the well to accept water gradually declined as indicated by an increase in water level in the injection well. After one week of operation at 150 gpm, the injection rate was reduced to 100 gpm. At that point, resistance to injection remained stable and injection at 100 gpm was continued for two more weeks until the test was shut down.

The pilot test led to the conclusion that chlorination would be necessary to provide residual disinfection to prevent biological growth in the well and surrounding soil. Although injected water is disinfected by UV disinfection, a chlorine residual is required in the nearby geologic formation. Otherwise, the oxygen and nutrients in the effluent stimulate the growth of the indigenous microbes. A high level of effluent filtration is also necessary to reduce the solids loading to the well. Well injection pressures should remain low if discharging into unconsolidated, sandy soils to reduce disturbance around the well. The pilot test has so far demonstrated that well injection is a viable option for effluent disposal provided that chemical disinfection, and filtration are provided to reduce the biological activity and reduce solids loading to the well and soils. Additional testing is still needed.

c. **Preliminary Design.** A typical system would consist of two injection wells, six groundwater-monitoring wells, a force main from the pump gallery, transfer pumps, a filtration unit, and a building to house controls and equipment. The system would also be designed with a small infiltration basin to allow for the discharge of backwash water from the injection wells following routine cleaning. One injection well would be idle while the other well is in use. Each well would be typically sized for a capacity of 0.2 mgd, but the quantity of effluent that this system would be able to discharge would be a function of the results from pilot study.

The injection wells would each be approximately 150 feet deep with a 40 foot screened section.

5. Ocean Outfall.

a. Introduction. This alternative involves the siting, construction, and operation of an ocean outfall for effluent disposal into Buzzards Bay in front of West Falmouth Harbor

As discussed in previous Study reports the Massachusetts Ocean Sanctuaries Act prohibits the discharge of any municipal wastewater into an ocean sanctuary. The legislation is strictly imposed, and the filing and passing of Special Legislation would be required to amend the Massachusetts General Laws specifically for Falmouth. This would require action by several State departments and officials, and would involve a long political and legal process. Special Legislation would be passed only if it was shown that ocean disposal of treated wastewater effluent was the only feasible way to protect the public health.

This alternative would allow for all of the nitrogen currently generated at the WWTF to be discharged directly to Buzzards Bay minimizing the impacts to the near-shore environment and reducing the load to the Snug Harbor and West Falmouth Harbor embayments. This would result in a modeled nitrogen loading concentration in Snug Harbor of 0.33 mg/L which is below the 0.35 to 0.37 range identified by the CMAST report. An ocean outfall would require extensive study to evaluate the impacts associated with discharging treated effluent to Buzzards Bay. This would go beyond nitrogen impact, and include the impacts of freshwater discharges on the saltwater body, impacts to the ocean floor during the construction of such an outfall, studies on other nutrient impacts and other environmental impacts.

b. Preliminary Design and Costs. Capital costs for an outfall into Buzzards Bay would be approximately $8.3 million based on the following:

- Construction costs and design concepts used for the Seabrook New Hampshire WWTP outfall which was bid in 1995 and constructed in 1996 through 1997.
- A two-foot diameter outfall, approximately 2,500 feet into Buzzards Bay.
- Construction of an effluent forcemain between the WWTF and the outfall.
- An allowance of $1 million for environmental studies, permits, and legal support.

Operation and maintenance costs would include electrical costs to pump the effluent to the outfall and additional water quality monitoring that would be required by the National Pollution Discharge Elimination System (NPDES) permit, required for surface water discharges. Electrical costs would be minimal (as pumping would be down hill) and the monitoring costs would depend on the permit requirements.

Other information and study required per (301 CMR 20.99) would be as follows:

- definition of the tidal excursion for the proposed outfall location.
- definition of the dilution, of the effluent which can be expected given the volume of water passing the outfall under critical conditions.
- calculation of the maximum pollution parameter levels expected at the proposed outfall location, particularly total and fecal coliform bacteria, total nitrogen and total phosphorous, total organics, heavy metals, and toxic substances.

4.2 EFFLUENT DISCHARGE SCENARIOS AND SITES

Several discharge scenarios were evaluated as part of the DWWFP/DEIR. The current effluent disposal at the existing WWTF consists of eight sand infiltration beds and five spray irrigation areas for a total effluent disposal capacity of 0.91 mgd. These facilities and capacity evaluations are described in the Needs Assessment Report. The DWWFP/DEIR recommended construction of four new sand beds in the aerated pond basins to increase the effluent discharge capacity to 1.2 mgd. Additional capacity must be evaluated outside the Snug Harbor Watershed as requested by the regulatory agencies and to meet the more stringent water quality standard recommended by the CMAST Report. The following sections describe several discharge scenarios to achieve these design flows while minimizing the nitrogen impacts to West Falmouth Harbor.

A. Discharge at the Falmouth WWTF. Four of the five effluent discharge technologies identified above (sand infiltration beds, spray irrigation, subsurface leaching, and well injection) can be considered for use at the existing WWTF site. As identified previously in this report and the Needs Assessment Report the current site uses both spray irrigation and sand infiltration as a means of effluent disposal. These methods currently have a total discharge capacity of 0.91 mgd at the site.

Well injection at the WWTF is considered at a site on the property, near the main entrance to the facility, located outside of the Snug Harbor Sub-watershed. This location is identified as Site N. The injection wells would be approximately 1,300 feet from the existing control building. The system, depending on the flow, would consist of two to eight injection wells, six groundwater-monitoring wells, a force main from the pump gallery, transfer pumps, a filtration unit, and a building to house the controls and equipment. The system would also be designed with a small infiltration basin to allow for the discharge of backwash water from the injection wells following routine cleaning.

The injection wells would each be approximately 150 feet deep with a 40 foot screened section. The quantity of effluent that this system would be able to discharge would be a function of the results from a pilot study at this location.

B. Discharge Away From the Falmouth WWTF

1. Background. An evaluation of discharge alternatives away from the WWTF was previously evaluated as part of the Alternatives Screening Analysis Report. Additional sites are evaluated because the existing WWTF site is currently limited by

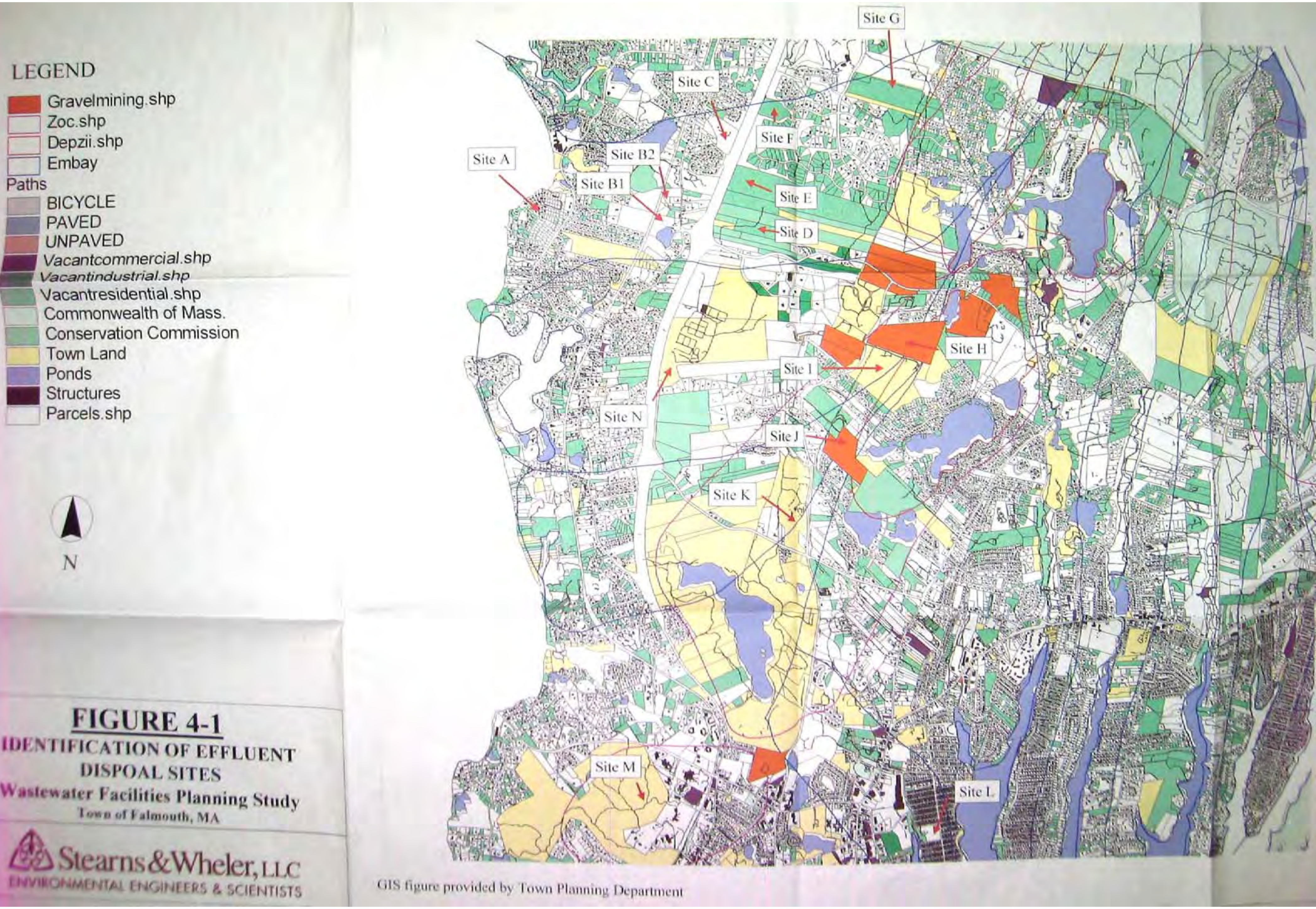


FIGURE 4-1

IDENTIFICATION OF EFFLUENT DISPOAL SITES

Wastewater Facilities Planning Study

Town of Falmouth, MA

Stearns&Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

GIS figure provided by Town Planning Department discharge capacity and the watershed is limited in the quantity of nitrogen that can be discharged.

Considerations for these sites take into account the distance from the existing WWTF site, the location with respect to sensitive embayments, watersheds and zones of contribution to public water supplies; as well as other evaluation criteria established for each technology.

2. Discharge Sites Evaluated in the Alternative Screening Analysis Report. The Alternatives Screening Analysis Report concluded that suitable effluent discharge sites in Falmouth are limited, as most of the Town is located inside coastal recharge areas or within contributing areas to a public water supply.

a. Sites Evaluated. The following sites identified as part of the 1981 Wastewater Facilities Plan were reviewed in the Alternatives Screening Analysis Report:

Site No.	Site Identification
1.	Otis Air National Guard (ANG) site
2.	Areas south of Hayway Road between Sandwich Road and Old Barnstable Road
3.	The Falmouth Landfill
3A.	The Industrial Park (this was the selected site and is the site of the current WWTF)
4.	The Falmouth Airport
5.	Areas east of Sandwich Road off Deepwood Road
6.	Areas north of Brick Kiln Road west of its intersection with Sandwich Road
7.	Areas south of Brick Kiln Road west of its intersection with Sandwich Road
8.	Teaticket west of Trotting Park Road

9. Beebe Woods
10. Peterson Farm
11. Fire Station site in Woods Hole
12. Fay Road site
13. Woods Hole playground near Mill Pond
14. Woods Hole east of School Street and north of Maury Lane and the site of the Woods Hole Pumping Station.

In addition to these sites the following sites were also evaluated as part of the Alternatives Screening Analysis Report.

- Effluent discharge at the Air National Guard (ANG) Wastewater Treatment Facility (WWTF).
- Effluent discharge at the Ballymeade Golf Course.
- Effluent discharge north of the West Falmouth Harbor Watershed in the Route 28 median strip.
- Well injection at Falmouth High School.
- Well injection at West Beebe Woods/Peterson Farm.

b. Sites Recommended for Future Evaluation. Based on the findings identified in the Alternatives Screening Analysis Report the following sites were considered for further evaluation for effluent disposal:

- The existing WWTF site (3A) for sand infiltration beds, spray irrigation and well injection.
- Spray irrigation at the Ballymeade Country Club.
- The area north of West Falmouth Harbor Watershed for well injection in the Route 28 median strip.
- The area west of Beebe Woods including Site 10 for well injection (only if there is not adequate capacity at the WWTF site and the site north of the West Falmouth Harbor Watershed).

3. **Additional Sites Evaluated Outside the Snug Harbor Watershed.** This Section includes identification of sites carried forward from the previous reports and additional sites that have been identified following the submittal of the DWWFP/DEIR. These sites are being considered specifically for effluent disposal using subsurface leaching facilities, which is a well accepted technology as discussed previously. Some sites may also be suited for other technologies such as well injection, sand infiltration beds, and seasonal spray irrigation. Because of the limiting considerations associated with well injection, sand infiltration beds, and spray irrigation; subsurface leaching was considered the most conservative and reliable technology for a side-by-side evaluation. Also, to aid in the evaluation, the sites are divided into two main groups:

- Sites with groundwater recharge directly to Buzzards Bay.
- Sites with groundwater recharge into (or near) the upper reaches of Long Pond ZOC.

The following is a summary of the 14 sites identified. Figure 4-1 shows the locations of these sites.

a. **Sites with recharge to Buzzards Bay.** The following sites are located in groundwater recharge areas (watersheds) that lead directly to Buzzards Bay and avoid recharge to nitrogen-sensitive coastal embayments previously identified by the Cape Cod Commission as well as public water supply contribution areas. These sites should have fewer environmental and permitting problems due to this location.

(1.) Site A: The Cliffs Residential Development

This site is privately owned, and provides open space for The Cliffs residential development. The site is located west of the developed properties and is approximately 18 acres in size. The site is wooded and is considered conservation land. The topography of the site varies between 20 to 60 feet above mean sea level. Based on the site's location west of the moraine, there is a higher potential for permeable soils on this property. Use of this property would require approval from both the owners in the residential development and the Town Conservation Commission.

(2) Site B: Salt Pond Bird Sanctuaries/Bourne Farm Site

This site is located west of Crocker Pond, and was the site of a former farm. The property deed restricts the future use of the property to open fields with the character of a farm. Based on the site's location relative to the moraine, there is a fair potential for permeable soils to be found here. The property is approximately 20 to 30 acres.

(3) Site B2: Arthur Handy Site

This is a privately owned property adjacent to a cranberry bog under the same ownership. The site currently has a paper subdivision. Due to its proximity to a working bog the site is likely to be mined for sand for use at the cranberry bog.

(4) Site C: Roscovitz Site

The Town is in the process of purchasing this site for open space. Route 28 borders the site to the east. The property also has access to Route 28A. The site is approximately 15 acres and is located up gradient of Wing Pond. Its location west of the moraine indicates a fair potential to find permeable soils at the site.

(5) Site D: DBI Site

This site is privately owned, and the current owners are proposing a land swap with the Town for a smaller property to the east of this Site. The Town Planning

Board is currently evaluating this land swap. The proposed site has the following characteristics:

- Located in the middle of the moraine.
- Very knobby, wooded.
- It is an isolated spot for effluent discharge and is nearly surrounded by conservation land.

Due to its location in the moraine, the site may contain few areas of permeable soil.

This site is considered as a replacement for the well injection site proposed during previous site identification for the Route 28 median strip north of Thomas Landers Road. This location is in a similar location, but would have fewer institutional constraints.

(6) Site E: Ballymeade Sale Site

This is a property that Ballymeade plans to transfer to the Town of Falmouth as part of an overall development project at Ballymeade, Wildwood Properties and a proposed new golf course. If purchased, the Town has plans to site a new Town public water supply well at the eastern end of the site. An estimated Zone II for this well would extend up to Crooked Pond. The western end of the site, adjacent to the Route 28 right-of-way, could potentially be used for effluent discharge. This property is located on the moraine and the most permeable soils are estimated to be located on the west end of the site.

This site is considered as a replacement for the well injection site proposed during previous site identification for the Route 28 median strip north of Thomas Landers Road. This location is in a similar location, but would have fewer institutional constraints.

(7) Site F: Barrows Property

This is a 14-acre property, and it is landlocked within the Ballymeade Development. It has the following characteristics:

- Upgradient of Wing Pond.
- Portions of the property are located within the Wild Harbor watershed.
- Site is located at the western side of the moraine and some permeable soils may be found.

(8) Site G: Falmouth Golf Site

This proposed site would be considered for seasonal spray irrigation on a proposed 18-hole golf course. Issues related to the proposed golf course and its possible use of treated effluent from the WWTF are summarized in a letter from the project's consultant contained in Appendix 4-1 and briefly listed below:

- The site is located over two groundwater plumes emanating from the MMR. These plumes will complicate the potential discharge, storage and use of effluent at the site.
- Expected average effluent demand will be 0.15 mgd during the months of June, July, and August.
- The project proponent would assist in the capital costs to bring the effluent to the site.
- There will be two ponds at the new golf course, one of which (2 acres) would be used for effluent/water storage.
- The proposed golf course would require effluent use on demand. Rainy weather and pond management would limit the ability to receive effluent from the WWTF all the time.

- Currently, there is a provision that if the plume contaminates the existing irrigation well, MMR will provide piped water for irrigation. In this case the site would not require treated effluent for irrigation purposes.

(9) Site M: Beebe Woods Site

The Beebe Woods Site was previously described in the Screening Analysis Report. This site was identified as Sites 9 and 10 in the 1981 Wastewater Facilities Plan. Site 9 (near Beebe Woods) was originally screened out due to poor soils underlying the property. The site is also close to an area identified as a potential future water supply source and public opposition may be great. Thus, the site was originally eliminated from further evaluation.

Site 10 (Petersen Farm adjacent to Beebe Woods) was originally screened out based on the limited buffer zone between it and abutters. The site was also thought to be in the watersheds of Salt, Flax, Oyster, and Miles Ponds. Based on existing watershed maps, this site is outside the coastal recharge areas for both Salt and Oyster Ponds. The area west of Beebe Woods including Site 10 will be considered only as a last resort due to the great distance from the WWTF. Effluent discharge at either of these sites may require meeting Massachusetts DEP Interim Guidelines on Reclaimed Water because of the properties status near a potential drinking water supply site.

b. Sites with recharge into (or near) upper reaches of Long Pond ZOC.

The following sites are located east and southeast of the WWTF and are in or near contributing areas to public water supply areas. These areas tend to be east of the moraine and have more permeable soils. These sites could be used with the goal of recharging water to the public water supply areas. The Great Sippewisset Marsh is over 1 ½ miles down gradient of many of these sites and may be cause for environmental concerns.

(1) Site H: Fish Farm Site

This site is located east of the landfill in the upper reaches of the West Falmouth Harbor watershed. This site is privately owned and has been used in the past as a fish farm and growing ornamental grasses and Christmas trees. This site has also been mined in the past, therefore the site is considered disturbed. The Town is currently negotiating to buy this property for open space purposes. If purchased, there may be conservation restrictions placed on it. The site has the following characteristics:

- A power line right-of-way crosses the western end of the site.
- Gravelly soils.
- Located within Long Pond ZOC.
- The western portion is located within West Falmouth Harbor watershed leading to Harbor Head.
- Portions of the site are located within the Zone II for the Mares Pond Well.

(2) Site I: Town Gravel Pit

This is a large Town owned property that is used by Town DPW as a source of gravel and sand for highway operations. A portion of the site has been mined and is currently used for the Town's Yard Waste Composting site. The property is immediately south of the Fish Farm property (Site H) and has the same power line right-of-way across it. It is similar to Site H with portions of the property being in the West Falmouth Harbor watershed, Long Pond ZOC, and Mares Pond Zone II. There is a small V-shaped portion that is outside of all of those contributing areas, but is within a contributing area to the Sippewisset Marsh area.

(3) Site J: Lawrence Lynch Property

This is a large site that is owned by the Lawrence Lynch Corporation. It is similar to Sites H & I. Portions of this site fall inside various Zone II's and other contributing areas. The eastern end has been mined, and therefore is already cleared and disturbed. The western end, bordering on Blacksmith Shop Road, has not been mined and is still forested. The property also narrows as it approaches Blacksmith Shop Road and this section of the property provides the main access to the site. Stearns & Wheler installed Well SWMW-2 on this site as part of the Study to aid in landfill plume delineation.

(4) Site K: High School Site

This site, previously identified in the Screening Analysis Report, is approximately 92 acres in size. The property includes school buildings, playing fields and wooded areas. There are a sufficient number of playing fields and cleared areas to support subsurface leaching facilities. The site is approximately ½ mile upgradient from Long Pond, and is located inside Long Pond's Watershed Protection District. The site has been recommended for connection to the WWTF to protect the Long Pond water supply from its current septic system discharge and because that solution is less expensive than construction of a small wastewater treatment system at the site.

c. Site with recharge into Vineyard Sound Watershed.

(1) Site L: Maravista Site

The Maravista site was described previously as part of the DWWFP/DEIR as part of the discussion on a package treatment facility for Maravista. The effluent discharge site is a group of vacant and developed residential properties located on the northwestern portion of the Maravista peninsula. The site would need to be cleared; and subsurface leaching facilities would be constructed to discharge the treated effluent from the treatment plant. The soils in this area are Enfield silt loam and Merrimack sandy loam soils as discussed in the Needs Assessment Report. They are well drained and the leaching facility capacity would be based on an application rate of 2.5 gpd/sf into leaching trenches. A maximum discharge capacity of 560,000 gpd has been estimated based on the overall size of the property and the application rate in the trenches. This capacity would need to be verified with subsurface investigations (test pits and possible soil borings) and groundwater modeling. Athletic fields, or other open space areas, could be constructed on top of the leaching facilities.

C. Site Screening Analysis. Each site has been evaluated on a qualitative basis and capital costs have been developed for the most favorable sites. Each of the 14 sites (Sites A through M) are described above and a summary of the screening analysis follows.

1. Methodology. Each site has been evaluated based on the following criteria: Available land area; owner type; availability of land; soil type; site access; abutting land use; distance to wetlands; distance from WWTF; whether it is located in a coastal embayment watershed or zone of contribution (ZOC); potential aesthetic impacts; and historic significance. Table 4-1 summarizes these findings.

A numeric value is assigned to each of the evaluation criteria. The higher the value assigned to the criteria, the more it weighs against the site. These values are then totaled to provide a ranking for each of the sites. The following text briefly describes the evaluation criteria and the numerical values assigned:

- Owner Type: This is a general description of the property owner, identified as either "Private" or "Town". Those identified as "Private" are assigned a value of "2" and those identified as "Town are assigned a value of "1".

- Availability of Land: This is a general description, similar to ownership, identifying property status. Five categories were identified from most favorable (value of "1") to the least favorable (value of "5"), and these categories are: Town Owned (non-conservation), planned Town Purchase, For Sale, Conservation Land, and Private.

- Soil Type: This is a general description of soil conditions relative to subsurface leaching systems based on information provided by the Town Planning and Health departments, a local engineer (Holmes and McGrath Inc.) which has much experience with the soils in West Falmouth, and soil survey information. Soil types were identified as: good, moderate or poor and valued from 1 to 3 accordingly.

- Site Access: This identifies if there is current access to the site or if the site is landlocked. Site Access was classified as either "Available" or "Limited". "Available" site access received a value of 1 and "Limited" a value of 2.

- Abutting Land Use: This general description was based on zoning and state class code maps which identified the abutting land use. These were then grouped accordingly as "Town", "Industrial / Residential / Town", "Residential / Town", "Residential /Agricultural", and "Residential" and assigned values from 1-5 respectively.

- Distance from wetlands: This is identified as a straight-line distance from the nearest wetland as identified on available GIS maps. The following is how values were assigned to various distances:

Distance	<100 ft	<500 ft	<1,000 ft	< 1,500 ft	< 2,000 ft	< 2,500 ft	< 3,000 ft	>3,000 ft
Value	8	7	6	5	4	3	2	1

- Distance from WWTF: This is the distance of force main necessary to carry effluent from the WWTF to the site. This distance is based on the most practical route expected for the force main – this is only an estimate and actual distances would be developed during the design phases of the project. The following table identifies how values were assigned to each length.

Distance	>20,000 ft	< 20,000 ft	< 15,000 ft	< 10,000 ft	< 8,000 ft	< 6,000 ft	< 5,000 ft
Value	7	6	5	4	3	2	1

- Watershed/ZOC: This generally identifies what, if any, sensitive watershed the site is located in. The following watersheds were identified in order of increasing value (from 0-4): None, Future Water Protection District or Long Pond, Great Sippewisset Marsh/Long Pond, Little Pond, West Falmouth Harbor/Long Pond.

- Potential aesthetic impacts: This generally identifies the expected visual, noise, and odor impacts associated with effluent disposal at each site. Each site was identified as having either "High", "Medium", or "Low" impacts, with "High" assigned a value of 3, "Medium" a 2, and "Low" a 1.

- Historic Significance: This generally identifies the potential for historic impacts with using the sites. Sites are either identified as having "potential" (value of 2) or "minimal" (value of 1) historic significance. Once a site is selected, the site will require review from the Massachusetts Historical Commission to identify any site-specific concerns. Sites were identified as "potential" if they were in close proximity to an existing or proposed historical district in the Town.

2. **Findings.** Tables 4-1 and 4-2 summarize these findings and rankings. The lower the total value the more favorable the ranking. Table 4-2 summarizes the top three sites identified and the associated cost of sending treated effluent to those sites.

Table 4-1

SITE IDENTIFICATION
Wastewater Facilities Planning Study
Town of Falmouth, MA

Site ID	Description	Map & Parcel	Approx. Land Area		Owner Type	Availability of land	Soil Type(2)	Site Access	Abutting Land Use	Distance to Sensitive Receptors (ft) (3)	Force Main Length (approx. distance from WWTF)	Watershed/Zone of Contribution	Potential aesthetic impacts (visual, noise, odors)	Historic Significance (5)	Potential Effluent Discharge Capacity
			Total (acres)	Available (acres)			Estimated			Wetland (4)			Low; Medium; High		gpd
A	The Cliffs Residential Development Open Space Site [1]	14-08,14-09,14-10	18.0	18.0	Private	Privately Owned	moderate	Available	Res.	500	18,300	none	High	minimal	940,000
B1	Salt Pond Bird Sanctuaries/Bourne Farm Site [1]	15-02-032-000	20.8	20.0	Private	Conservation Land	moderate	Available	Res/Agr	250	10,600	none	High	minimal	1,050,000
B2	Authur Handy Site [1]	15-02-004B000	4.9	4.9	Private	Privately Owned	moderate	Available	Res/Agr	500	8,300	none	Low	potential	260,000
C	Roscovitz Site	12-08-006A-000A	20.0	15.0	Private	Town Purchase Likely	moderate	Available	Res	1,500	9,000	none	Medium	potential	780,000
D	DBI Site	15-03-019-001	22.4	22.4	Private	For Sale	poor	limited	Town	2,000	6,000	none	Low	minimal	590,000
E	Ballymeade Sale Site				Private	Sale to Town Likely	poor	limited	Res/Town	2,500	7,500	none	Low	minimal	
F	Barrows Property	12-08-028-000	14.7	14.0	Private	Privately Owned	poor	limited	Res/Town	1,000	9,700	none	Low	minimal	370,000
G	Falmouth Golf Site [1]				Private	Privately Owned	moderate	Available	Res	3,500	16,000	none	Low	minimal	
H	Fish Farm Site	22-02-002-001	67.3	30.0	Private	Town Purchase Likely	moderate	Available	Ind/Res/Town	1,500	10,000	WFH/Long Pond	Medium	minimal	1,570,000
I	Town Gravel Pit	22-02-004-000	95.5	30.0	Town	Town owned	moderate	Available	Ind/Res/Town	2,500	9,300	WFH/Long Pond	Low	minimal	1,570,000
J	Lawrence Lynch Property	22-02-009-000	65.9	30.0	Private	Privately Owned	moderate	Available	Res/Town	1,000	8,700	GSM/Long Pond	Low	minimal	1,570,000
K	High School Site		92.4	25.0	Town	Town owned	good	Available	Res/Town	1,500	9,300	Long Pond	Medium	minimal	1,630,000
L	Maravista Site [1]		8.7	8.7	Private	Privately Owned	good	Available	Res	100	28,300	Little Pond	Medium	potential	570,000
M	Beebe Woods	38-01-001-000,48-07-013-000	475.0	20.0	Town	Conservation Land	moderate	Available	Res/Town	1,500	23,300	Future WPD	High	potential	1,050,000
N	WWTF Site with Well Injection Technology			2.0	Town	Town owned	poor	Available	Res/Town	3000	1,300	WFH	Low	minimal	-

Notes:

1) Multiple lots associated with these sites

2) Soil types: based on review of Barnstable County Soil Survey and discussions with Town officials and local engineers.

3) Shortest straight line distance between property line
and edge of zone

4) Includes Buffer Zone = 100 ft around wetland

5) Sites fall into one of three categories
- In Historic District
- Potential = May contain historical artifacts or significance
- Minimal = Not viewed as a historical site

6) Capacity is based on subsurface leaching facilities for all sites except Site N as described in Text

Table 4-2

SITE IDENTIFICATION
RANKING MATRIX
Wastewater Facilities Planning Study
Town of Falmouth, MA

Site ID	Description	Map & Parcel	Owner Type	Availability of land	Soil Type	Site Access	Abutting Land Use	Distance to Sensitive Receptors (ft)	FM Length (approx. distance from WWTF)	Watershed/ZOC	Potential aesthetic impacts (visual, noise, odors)	Historic Significance	Total	Total RANK
					Estimated			Wetland			Low; Medium; High			
N	WWTF Site with Well Injection Technology		1	1	3	1	3	2	1	3	1	1	17	1
D	DBI Site	15-03-019-001	2	3	3	2	1	3	2	0	1	1	18	2
E	Ballymeade Sale Site		2	2	3	2	3	3	3	0	1	1	20	3
I	Town Gravel Pit	22-02-004-000	1	1	2	1	2	3	4	4	1	1	20	3
K	High School Site		1	1	1	1	3	5	4	1	2	1	20	3
G	Falmouth Golf Site		2	5	2	1	5	1	6	0	1	1	24	6
C	Roscovitz Site	12-08-006A-000A	2	2	2	1	5	5	4	0	2	2	25	7
H	Fish Farm Site	22-02-002-001	2	2	2	1	2	5	4	4	2	1	25	7
F	Barrows Property	12-08-028-000	2	5	3	2	3	6	4	0	1	1	27	9
J	Lawrence Lynch Property	22-02-009-000	2	5	2	1	3	6	4	2	1	1	27	9
B2	Author Handy Site	15-02-004B000	2	5	2	1	4	7	4	0	1	2	28	11
B1	Salt Pond Bird Sanctuaries/Bourne Farm Site	15-02-032-000	2	4	2	1	4	7	5	0	3	1	29	12
M	Beebe Woods	38-01-001-000,48-07-013-000	1	4	2	1	3	5	7	1	3	2	29	12
A	The Cliffs Residential Development Open Space Site	14-08,14-09,14-10	2	5	2	1	5	7	6	0	3	1	32	14
L	Maravista Site		2	5	1	1	5	8	7	3	2	2	36	15

These top three sites based on the ranking system are the DBI Site, Ballymeade Sale Site, and the well injection site at the entrance to the WWTF site. Each site was evaluated for handling 0.2, 0.4, 0.6 and 0.8 mgd of treated effluent. The DBI site was unable to handle 0.8 mgd of treated effluent using subsurface leaching facilities. The other sites were able to handle these flows based on the information available.

3. **Costs.** Costs for discharging treated effluent at the three top sites are summarized on Table 4-3. Based on these costs, to handle flow ranging from 0.2 to 0.8 mgd of treated effluent, the WWTF site (Site N) is the least expensive, followed by the Ballymeade Sale Site (Site E) and the DBI Site (Site D). These costs were based on the following:

- Construction of subsurface leaching facilities at sites D and E, and well injection facilities at Site N.
- Construction of a force main and pumping station to carry the effluent to the site(s).
- Fiscal, legal, engineering and contingencies costs associated with this construction.
- Land purchase (Site D only).
- Effluent Mitigation Project Costs ($500,000 based on the proposed project to evaluate effluent disposal alternatives further).
- An allowance for additional Environmental Evaluation costs estimated at $150,000.

4.3 EFFLUENT DISCHARGE EVALUATION

A. Introduction. The goal of the effluent discharge evaluation is to develop additional effluent discharge capacity and reduce the nitrogen load to Snug Harbor by examining the cost and benefit of removing treated effluent from the Snug Harbor Watershed and discharging it elsewhere. Acceptable nitrogen concentrations for Snug

TABLE 4-3

COST SUMMARY OF
ALTERNATIVE EFFLUENT DISPOSAL FACILITIES
OUTSIDE THE SNUG HARBOR WATERSHED

Wastewater Facilities Planning Study
Falmouth, Massachusetts

Site	Description	Rank	Total Capital Cost for Development of Effluent Disposal Facilities			
			0.2 mgd	0.4 mgd	0.6 mgd	0.8 mgd
N	WWTF Site with Well Injection Technology	1	$ 1,900,000	$ 3,000,000	$ 4,200,000	$ 5,200,000
D	DBI Site [(1)]	2	$ 3,600,000	$ 5,000,000	$ 6,800,000	$ -
E	Ballymeade Sale Site	3	$ 3,700,000	$ 5,100,000	$ 6,800,000	$ 8,300,000

Notes:

1. Site D - the DBI Site is not large enough to handle 0.8 mgd of effluent using subsurface disposal methods.

Harbor have been suggested by the CMAST Report to reestablish eelgrass at 0.35 to 0.37 mg/L total nitrogen.

The evaluation is based on the projected nitrogen concentrations in Snug Harbor as evaluated in Chapter 3 and the capital costs associated with reaching that nitrogen concentration. Five different alternatives for evaluation are identified as discussed below:

- No Action Alternative
- Effluent Discharge as proposed in DWWFP/DEIR
- Discharge to meet the 0.37 mg/L limit in Snug Harbor requiring effluent relocation of 0.2 mgd
- Discharge to meet the 0.35 mg/L in Snug Harbor requiring effluent relocation of 0.6 mgd
- Ocean Outfall

These alternatives are described in detail in the following section.

B. Alternatives Identification.

1. **No Action Alternative.** The No Action Alternative was developed in previous reports and is summarized in Section 2.3 of this report. This alternative assumes that there is minimal change in the current wastewater treatment practices at the WWTF or with development patterns within the West Falmouth Harbor Watershed. Continuing with these practices, the No Action Alternative generates a nitrogen loading of 18,710 kg/yr which equates to a nitrogen concentration in Snug Harbor of 0.53 mg/L. This concentration greatly exceeds the 0.35 to 0.37 mg/L nitrogen standard. Continued nitrogen loading at this rate will result in nitrogen impacts of the Harbor. This alternative is not acceptable and therefore is not considered further during this evaluation.

2. **Discharge as Proposed in DWWFP/DEIR.** This alternative, as described in the DWWFP/DEIR, involves the discharge of 1.2 mgd at the existing WWTF site at the design condition (2023) following an upgrade of the wastewater treatment process. This results in a nitrogen load of 6,443 kg/yr and a nitrogen concentration in Snug Harbor of 0.38 mg/L. This is still greater than the 0.37 mg/L nitrogen concentration standard suggested by DEP. Costs for this alternative were developed as part of the DWWFP/DEIR. The total capital cost associated with the modifications to the WWTF adjusted for year 2002 costs is $14 million. These costs include the new advanced treatment process, sludge management facilities, aerated pond demolition, new sand infiltration basins, denitrification filters, fiscal and legal costs, engineering and contingencies.

This alternative is considered the baseline for comparison of all subsequent alternatives. Costs to implement the remaining three alternatives would be in addition to the $14 million upgrade cost.

3. **Discharge to Meet 0.37 mg/L Snug Harbor Standard.** This alternative includes the same components of the Recommended Plan as identified in the DWWFP/DEIR; however, it requires that 0.2 mgd (of the 1.2 mgd treated effluent flow) will need to be discharged outside of the Snug Harbor Watershed at one of the three sites identified on Table 4-3. With 0.2 mgd discharged outside of the Snug Harbor watershed, the nitrogen loading to Snug Harbor will be reduced to 5,614 kg/yr which will reduce the nitrogen concentration in Snug Harbor to slightly less than 0.37 mg/L, meeting water quality standard.

The additional capital cost associated with this alternative ranges from $1.9 million to $3.5 million dollars depending on the site and technology used. These costs are presented in greater detail in Appendix 4-2.

4. **Discharge to Meet 0.35 mg/L Snug Harbor Standard.** To meet the lower limit of the water quality standard, this alternative requires that 0.6 mgd (of the 1.2

mgd treated effluent flow) needs to be discharged outside the Snug Harbor Watershed. This would require effluent discharge at one of the three sites identified on Table 4-3.

The additional capital costs associated with this alternative range from $4.2 million to $6.8 million dollars depending on the site and technology used. These costs are presented in greater detail in Appendix 4-2.

5. **Ocean Outfall.** As described in the Alternatives Screening Analysis Report, an ocean outfall would be allowed only by Special Legislation passed by the State amending the provisions in the Ocean Sanctuaries Act specifically to aid the Town of Falmouth's needs. Obtaining that legislation would require a long permitting and environmental impact analysis process, along with a long legal and political process that could be very expensive. Capital costs for an outfall into Buzzards Bay would be approximately $8.3 million based on the following assumptions:

- Construction costs and design concepts used for the Seabrook New Hampshire WWTP outfall which was bid in 1995 and constructed in 1996 through 1997.
- A two-foot diameter outfall, approximately 2,500 feet into Buzzards Bay.
- Effluent forcemain between the WWTF and the outfall.
- An allowance of $1 million for environmental studies and permits, and legal support.

This preliminary design and cost could be used for the complete effluent discharge from the WWTF. It would reduce nitrogen loading to Snug Harbor to 2,440 kg/yr which would result in a calculated nitrogen concentration of 0.33 mg/l in Snug Harbor. It will also save some construction costs at the WWTF for conversion of the aerated pond basins to new sand infiltration beds. It would provide a similar nitrogen loading to Buzzards Bay as the land-based discharge to the Snug Harbor Watershed because the land based discharge eventually is transferred to Buzzards Bay with only a little attenuation.

C. Summary of Effluent Discharge Evaluation. Based on the cost and non-monetary evaluations performed in this Chapter, the following table summarizes the various alternatives.

Alternative	Snug Harbor Nitrogen Concentration (mg/L) [1]	Cost Range
DWWFP/DEIR Alternative	0.38	$0
Alternative to meet 0.37 mg/L	0.37	$1.9 million to $3.5 million
Alternative to meet 0.35 mg/L	0.35	$4.2 million to $6.8 million
Ocean Outfall Alternative	0.33	$8.3 million

(1) Conservative nitrogen attenuation factors were used to calculate these concentrations as requested by DEP. Lower concentrations are calculated when the attenuation factors documented in the CMAST Report are used as discussed in Chapter 3.

Based on the findings presented in this table, and the evaluations of this Chapter; plant discharge capacity will be limited to 1.0 mgd unless and until the WWTF upgrade produces a treated effluent consistently lower than 3 ppm total nitrogen, or 0.2 mgd of the 1.2 mgd design capacity is relocated outside the Snug Harbor Watershed.

CHAPTER 5

ADDITIONAL EVALUATIONS AND CONSIDERATIONS

5.1 INTRODUCTION

The purpose of this Chapter is to present additional evaluations and considerations for the planning and design of potential future water and wastewater management systems. The Chapter is divided into the following sections:

- Additional Groundwater Evaluations and Considerations
- Prioritized Sewering of West Falmouth Watershed
- Maravista Sewer System and 1.4 Treatment Capacity at WWTF.

5.2 ADDITIONAL GROUNDWATER CONSIDERATIONS

A. Introduction. The Draft Wastewater Facilities Plan and Draft Environmental Impact Report (DWWFP/DEIR) included a discussion of a number of hydrogeologic considerations related to the disposal of wastewater by discharge to groundwater. A significant portion of other sections of the Report address issues related to nitrogen migration toward the coast and the potential impacts on coastal waters. The separate hydrogeologic discussion (Section 5.8 of the DWFP/DEIR) focused primarily on:

- a general, regional hydrogeologic description of the area.
- a general summary of existing monitoring wells.
- a description of the Falmouth Landfill Plume and recent investigative efforts to better define potential impacts to Long Pond including the installation of two new wells and sampling.
- a discussion of safe yield from Long Pond.

- a proposed groundwater monitoring program related to the harbor and Long Pond.

In the various reviews of the DWFP/DEIR there was little comment on the subject matter covered in the groundwater discussion indicating that the information was sufficiently thorough and accurate in meeting the requirements of the report.

In comments provided by DEP and the Cape Cod Commission there were two primary outstanding issues identified that were related to the groundwater discussion. The two comments are summarized below:

- What are the potential impacts that increased groundwater recharge at the WWTF could have on groundwater flow directions near the Falmouth Landfill? Could these potential flow direction impacts affect the migration of landfill constituents toward Long Pond? In a related comment, the Cape Cod Commission sought a more detailed discussion of hydrogeologic and groundwater quality issues related to the landfill.

- DEP requested a more detailed description of a groundwater-monitoring program to safeguard water quality in Long Pond and to assess nitrogen migration toward West Falmouth Harbor. In addition to the monitoring, a mitigation plan to protect Long Pond was also requested.

B. Hydraulic Impacts of Recharge at WWTF. Numerous efforts have been undertaken to evaluate groundwater flow directions and watershed boundaries in the Falmouth Area in the past 15 years.

In 1985, USGS completed a study titled Direction of Ground-Water Flow and Ground-Water Quality Near a Landfill in Falmouth, Massachusetts. This report concluded that a portion of the water coming from beneath the landfill potentially reached the northern extremity of Long Pond.

In January 1987 Camp Dresser & McKee completed an investigation titled Summary of Groundwater Investigations In Support of Land Disposal of Treated Wastewater From The

Falmouth Wastewater Treatment Facility which provided groundwater modeling results for evaluations of effluent discharge at the WWTF and its impact on groundwater elevations. These results are contained in Appendix 3-1.

In July 1987 Camp Dresser & McKee completed an investigation titled Water Supply Investigation – Joint Zone of Contribution Study that investigated the areas of contribution to various water supplies in the Town including Long Pond. The study concluded that Long Pond is in a downgradient position from the Falmouth Landfill.

In 1996, Barnstable County and the Town of Falmouth completed a study that entailed contouring groundwater elevations between the landfill and Long Pond every two weeks over a five-month period ranging from June to October of that year. The resulting contour maps revealed that a portion of the groundwater flow out of the landfill area intercepts Long Pond, at least at the pond's northern extremity.

In 1998, the Cape Cod Commission completed the report titled Cape Cod Coastal Embayment Project that defined groundwater flow directions and watershed boundaries. In that mapping effort, the Falmouth Landfill was in a watershed that clearly discharged to Buzzards Bay. The flow component out of the landfill had a predominantly western component with a minimal southern component. The southern edge of the watershed boundary was approximately one mile north of Long Pond.

In 1998 The USGS completed a similar effort to define groundwater flow directions. In the USGS interpretation, groundwater flow is slightly more radial out of the central portion of the western cape. As a result, groundwater flow out of the landfill is more southerly than depicted in the Cape Cod Commission interpretation. As a result, in the USGS interpretation, Long Pond is in a downgradient position from the Falmouth Landfill.

All of the referenced studies have provided insights into the potential impacts of recharge at the WWTF on the landfill-Long Pond relationship. The first point is that even the most recent investigative efforts have resulted in slightly different interpretations. The significance of this is that despite having the best and most current data, the subsurface environment is sufficiently variable and unpredictable that conclusive results cannot be obtained through modeling. Although the modeling can be a useful tool in broad predictions, the very specific flow pattern between the landfill and Long Pond may not be able to be resolved, even through additional modeling. For that reason, additional modeling has not been completed as part of this submittal.

The second point that can be concluded from the existing studies is that a number of the investigations conclude that Long Pond is in a downgradient position from the Falmouth Landfill. An increase in the elevation of the water table of up to three feet at the WWTF resulting from a discharge of 1.2 mgd treated effluent from the WWTF, as modeled by Camp, Dresser & McKee (1987), is likely to have minimal impact on the watershed that includes the landfill and Long Pond. Any potential affect would be to shift the flow from the landfill slightly toward the south. Because most existing studies conclude that Long Pond is already in a downgradient position from the landfill, impacts are not suspected to increase. The existing impacts are discussed in greater detail below.

C. Landfill/Long Pond Hydrogeologic and Groundwater Quality Issues.

1. **Introduction.** As described above, Section 5.8 of the DWFP/DEIR presented a discussion of hydrogeologic considerations associated with discharge of treated effluent at the WWTF. The Cape Cod Commission requested further elaboration of some of the information in that discussion. That elaboration is provided below. All figures referenced are grouped in Appendix 5-1 of this report

2. **Area Hydrogeology.** A number of prior investigations have been completed that produced a considerable volume of stratigraphic information; upon which generalized geologic cross-sections can be created. One of the more detailed cross sections constructed for the Falmouth area was created by USGS in their numerical groundwater model (Open File Report 96-214), presented here as Figure 1. The north-south cross section shows the complicated stratigraphy sequence that underlies western Cape Cod, consisting of an assortment of sand, gravel, and silt deposits laid under various circumstances during periods of glacial retreat.

The primary water bearing zones are generally those with higher hydraulic conductivities. From the body of previous investigations, it is generally believed that hydraulic conductivities in the principal water bearing deposits can range anywhere from 100 feet per day to more than 350 feet per day. The porosity of these deposits on a regional scale can only be estimated, but considering the preponderance of sand coupled with the mixture of grain sizes present, it is unlikely that porosity in a regional "bulk" sense is substantially greater than 0.2 (20 percent).

The boring logs reviewed as part of Stearns & Wheler's investigation, and those produced by the installation of additional monitoring wells, generally reflect an assemblage of fine to coarse sand and varying amounts of gravel and silt, which is consistent with the stratigraphic model proposed by USGS and others.

3. **Groundwater Flow.** The groundwater flow system in the Falmouth area has been extensively studied, such that the groundwater flow direction around Long Pond is generally well understood. A recent USGS Report (Water Resources Investigations Report 98-4237) maps groundwater contours across western Cape Cod (Figure 2). Groundwater elevation measurements made by the Barnstable County Health Department in 1996 show the same general flow pattern (Figures 3 through 6). The regional gradient, calculated by the change in head over lateral distance along the groundwater flow path, is approximately 0.0014. The groundwater flow pattern represented in Figures 2 through 6 show that the prevailing groundwater flow direction in the area that includes the landfill, the WWTF, and Long Pond is generally from northeast to southwest. Locally, near the WWTF the flow direction becomes more directly to the east, as Buzzards Bay exerts greater influence as a regional groundwater discharge area. The groundwater flow system around the WWTF is therefore well defined, with groundwater from the WWTF traveling east less than 1 mile to its ultimate discharge at Snug Harbor. The groundwater flow direction under the landfill is more truly to the southwest, consistent with the regional pattern. As discussed above, Long Pond, located southwest of the landfill, therefore may potentially receive at least some groundwater that has passed below the landfill.

4. **Groundwater Quality – Long Pond Watershed.** There are numerous groundwater monitoring wells that have been installed over the years by various investigators, including municipalities, their private consultants, and USGS that collectively show that, despite the prevailing groundwater flow direction, the landfill has not produced a groundwater plume that affects Long Pond. Considering that the landfill has operated almost 50 years, there has been ample opportunity for a landfill plume to develop. It is conservatively estimated that groundwater travels at a rate of 0.5 feet per day [$v = Ki/n \rightarrow = (100 \text{ ft/d}) (0.0014)/0.2 \rightarrow = 0.5$ ft/d]. In 50 years groundwater impacts would reach approximately 9000 feet downgradient of the landfill, more than half the distance between the landfill and the pond. Based on chemical data collected as part of Stearns & Wheler's hydrogeologic investigation, there is little evidence to support that a plume of this size has developed between the landfill and the pond. Figures 7 through 11 present water quality data for the group of wells sampled as part of Stearns & Wheler's investigation. Because the wells sampled are screened at different depths, and hence monitoring different groundwater flow paths, the results are presented to indicate which particular wells are presumed to be screened along the flow path that originates from the landfill and continues to Long Pond. The flow path was presumed based on the following assumptions:

- The flow path originates in shallow groundwater at the landfill's downgradient edge (represented by well 558D).

- The flow path plunges according to a depression rate of approximately 1:100 (represented by wells SW A and SW B).

- The flow path converges upward towards Long Pond (represented by wells 560C and 561C).

Data from the above noted wells is highlighted to show the change in concentration of key landfill parameters with distance from the landfill. Data from the other wells is also included for comparison. Considering the data for chloride, alkalinity, TDS, hardness, and sodium, the relatively high levels near the landfill (well 558D) are not evident in groundwater near Long Pond (wells 560C and 561C). If the average concentration of each parameter is calculated from data from wells 560C and 561C, and then compared to the same data from well 558D, the decline in the concentration can be expressed as a percentage of the original amount (Figure 12). For example, chloride levels decline by approximately 80 percent between well 558D and Long Pond. TDS declines by more than 83 percent, while hardness declines by more than 90 percent. It is further apparent that this degree of decline has generally occurred by the time that the groundwater has reached the location of well SW-B, approximately mid-way between the Landfill and the Pond. This pattern of rapid attenuation of contaminant levels between the Landfill and the Pond, occurring over the first half of the flow path between the Landfill and the Pond, followed by fairly constant levels thereafter, indicates that parameter concentrations along the second half of the flow path are background levels. This finding is important in that it demonstrates that the groundwater that discharges into Long Pond is generally natural, and that the attenuation of landfill impacts occurs rapidly enough that background levels are reached well upgradient of the pond.

From the chemical evidence cited above, there are two possibilities to explain the absence of a plume between the Landfill and the Pond:

- The wells are installed off-center with respect to the center line of the plume;
- There is measurable natural attenuation of the plume.

Both of these scenarios are believed to hold true in this case, and the combined effect is that constituents of the landfill do not reach the pond. As shown earlier, the prevailing groundwater flow direction will convey groundwater originating from the landfill along a trajectory that passes primarily north of the pond. Regarding natural attenuation, it is noted that the decline in chloride levels (i.e. a conservative tracer) between the landfill and the pond is less than the apparent decline for other chemically reactive parameters. This in itself is evidence that chemical attenuation has the potential for reducing contaminant levels as groundwater migrates away from the landfill.

5. **Proposed Monitoring Program.** The Town of Falmouth currently conducts two monitoring programs, one associated with the WWTF and the second associated with the

landfill. Table 5-1 summarizes the wells and analyses performed as part of each of the analytical programs. To effectively monitor potential impacts migrating from the WWTF to West Falmouth Harbor and to effectively monitor potential impacts that the discharge at the WWTF might have on the landfill and Long Pond, modifications to the existing programs are proposed. Wells that do not provide useful data to this monitoring objective are eliminated from the program. These are wells on the eastern boundaries of the WWTF property. To better assess migration toward West Falmouth Harbor, it is suggested that an additional four wells be added to the program. These are existing wells 18, 18A, 18B and 19. Additionally, it is suggested that the two new wells installed by Stearns & Wheler in 1999 (SW-A and SW-B) be added to the monitoring program associated with the landfill. Finally, the Stearns & Wheler analytical program completed in 1999 indicated that TDS and sodium, two analytes not included in the existing program, would be useful indicators of landfill impact. It is therefore recommended that these two analytes be added to the landfill-monitoring program. Figure 13 illustrates the wells that are proposed for future monitoring of the Long Pond and Snug Harbor areas. Also indicated are the wells that are proposed for elimination from future monitoring. As indicated on the figure, the proposed wells for elimination hold no strategic importance for assessing the potential impacts to areas downgradient of the WWTF or the landfill. In all, the proposed monitoring array enhances the networks already in place for the landfill and the WWTF, providing expanded and more strategic coverage. Future monitoring for the WWTF and the landfill will actually be more aggressive than has occurred in the past, and more environmentally protective, since the wells included in those programs will monitor areas beyond the immediate perimeters of those two facilities.

To date there has been no comprehensive monitoring program for all of the proposed wells and there is only fragmented data available for the area, compiled from different sampling events that included only a few wells at a time. Following several rounds of data collection from the proposed network, a more informed evaluation can be completed regarding the adequacy of the proposed program, and the need for modification. In a previous submittal for this project, it was concluded that the lack of landfill impacts in the Long Pond area could be attributable to natural attenuation, the fact that groundwater flow may veer to the north and west of Long Pond, or both of these factors. DEP recently commented that this conclusion suggests a lack of certainty on the

TABLE 5-1
SUMMARY OF EXISTING AND PROPOSED MONITORING PROGRAMS
WASTEWATER FACILITIES PLANNING STUDY
TOWN OF FALMOUTH, MASSACHUSETTS

WWTF Monitoring Program Wells			**WWTF Analytical Program**	**Landfill Monitoring Program Wells**			**Landfill Analytical Program**
MW 1	C	E	pH	WC 1S			Ammonia
MW 1A	C	E	Spec. Cond	WC 1D	C	P	COD
MW 2	C	P	Sodium	WC 2			TKN
MW 2A	C	P	Iron	WC 3S			Arsenic
MW 3	C	E	Manganese	WC 3D			Barium
MW 4	C	E	Sulfate	WC 5S			Copper
MW 5	C	P	Chloride	WC 5D			Iron
MW 6	C	P	Ammonia - N	WC 6S	C	P	Lead
MW 7	C	P	Nitrate -N	WC 6D	C	P	Manganese
MW 8	C	P	TKN	WC 8D			Nitrates
MW 9	C	P	Phosphorus	WC 7S			Alkalinity
MW 9A	C	P	Copper	WC 7D			Chloride
MW 10	C	P	Surfactants	WC 9S	C	P	Sulfate
MW 11	C	P	VOCs	WC 9D	C	P	VOCs
MW 11A	C	P	Total Coliform	WC 10			
MW 12	C	P		FAL 1	C	P	**Supplemental Recommended Analytes**
MW 12A	C	P		MW 335A	C	P	
MW 13	C	P		BCH 13	C	P	
MW 14	C	P		MW 562A	C	P	
MW 14A	C	P		MW 562B	C	P	TDS
MW 15	C	E		MW 561C	C	P	Sodium
MW 16	C	E		FAL 3	C	P	
MW 17	C	E		FAL 4	C	P	
P 4	C	P		MW 570A	C	P	
P 10	C	P		MW 570B	C	P	
				FAL 2	C	P	
				MW 558C	C	P	
				MW 558D	C	P	
				P 8	C	P	

Supplementary Wells To Be Added to Proposed Monitoring Plan

MW 18		P		SW A		P
MW 18A		P		SW B		P
MW 18B		P				
MW 19		P				

NOTES:

Current monitoring program wells	C
Eliminated from proposed future monitoring plan	E
Included in proposed future monitoring plan	P

1/3/01
monitoring pln.xls

fate and migration of the landfill plume. As suggested above, the consistent and focused monitoring program recommended here, combined with routine water level measurements, will allow a more definitive characterization of the landfill plume and its potential impacts on Long Pond. It is recommended that decisions relating to possible expansion of the monitoring program, including the possible installation of new wells, be deferred until more information is available from the proposed network. This will help insure that additional monitoring points, if needed, are installed in appropriate locations, and that changes in the analytical program are likewise appropriate.

D. Impact Mitigation Plan. To date, there is not conclusive evidence that groundwater impacted by the Falmouth Landfill has impacted the water quality in Long Pond. As stated above, Long Pond is approximately 50 years away from the Landfill in terms of groundwater travel time. The potential exists that impacts could eventually reach Long Pond or, less likely, that recharge at the WWTF could hasten or exacerbate impacts. Because Long Pond is an important water supply resource to the Town, every effort should be made to identify and react to potential impacts that could occur to the pond. In recognition of this, the Town already regards the landfill-monitoring program as an “Early Warning System”. Although the current program serves as an early warning system and the proposed program will enhance that effort, response actions need to be considered. The groundwater discharge permit application that will be developed in association with the WWTF improvements will include a mitigation plan that will have the following components:

- Identification of specific “Early Warning Wells” in the monitoring program that will be a specific travel time away from the pond that will allow sufficient time to respond to “trigger concentrations”.
- The identification of “trigger concentrations”.
- Response actions: Response actions will be a function of what compounds are of concern and the concentrations of those compounds. Various responses may include:
  - More frequent monitoring.
  - Installation and sampling of additional strategically located monitoring wells.

- Completion of a risk assessment that would characterize the risk of the indicated impacts.
- Additional action based on the risk assessment.

5.3 SEWERING OF THE WEST FALMOUTH HARBOR WATERSHED

The Recommended Plan of the DWWP/DEIR recommended that a collection system be installed in the western portion of the West Falmouth Harbor Watershed (west of Route 28) to collect wastewater flows and treat it to a high level at the WWTF. A projected future flow of 0.23 mgd was budgeted in the WWTF capacity allocation for this.

Discussions with DEP (correspondence included in Appendix 1-2) indicate that the sewering of the Snug Harbor portion of the watershed is the highest priority because that sewering is part of the nitrogen-loading budget that was evaluated in Chapter 3. The Snug Harbor portion of the total area in the West Falmouth Harbor Watershed to be sewered represents approximately 50% of the total area as indicated in Figure 3-1.

Evaluations in Chapter 3 indicate that Oyster Pond and the combined Oyster Pond/Harbor Head embayments cannot meet the 0.37 standard even with sewers in the western portion of its watershed. A larger culvert is recommended for Oyster Pond to increase tidal flushing.

The Needs Assessment Report documented that there are many older homes in the West Falmouth Watershed that are served by older on-site-systems, many of which are cesspools. Many of these are built close to the embayment edge or in areas with high groundwater conditions. Upgrade of these systems to meet the Title 5 regulations would be costly. Cesspools also contribute a higher nitrogen loading and fecal coliform loading to the environment particularly when they are located next to surface water bodies. Sewering of these properties along West Falmouth Harbor should also be considered a priority.

As part of their comment letter on the DWWFP/DEIR, the CCC suggested that "consideration be given to the advisability and cost associated with sewering only the Snug Harbor and Oyster

Pond watershed portions west of Route 28". The nitrogen loading evaluations indicate that these are the two areas most impacted by nitrogen loading. As discussed above, the low elevation properties located close to the embayment are also a high priority. These areas could be the first area to be connected to the Treatment Plant. The Snug Harbor Watershed is the highest priority as requested by DEP.

will provide needed nitrogen loading reductions to West Falmouth Harbor. Also sewers are typically extended (as allowed by Massachusetts general law) to the properties that want to be connected as their individual septic systems fail, or as redevelopment occurs within a developed area. This extension is expected to occur unless sewer use regulations limit this expansion as part of a wastewater management district. Sewer use regulations are recommended in the DWWFP/DEIR (as contained in Appendix 5-1 of that Report) to limit that extension beyond the West Falmouth Harbor Watershed west of Route 28. This still appears to be a logical limit of the sewer system extension as discussed above and as a method to develop capacity at the WWTF for these potential flows.

If a smaller portion of the West Falmouth Harbor area was sewered, the reduced number of sewered properties would need to pay a higher betterment to cover the fixed costs for the pumping facilities and force main. Spreading these costs over a larger number of properties produces lower betterment costs for all.

The Town should design a collection system that is sized to handle wastewater flows from the whole West Falmouth Harbor area (west of Route 28) that is expected to connect in the next 20 years as budgeted in the WWTF capacity. The Snug Harbor portion of this area would be the highest priority to connect the WWTF. Properties at low elevations along the waters edge would be the second highest priority to connect. Properties in the eastern limits of the Oyster Pond Watershed proposed for sewering would be the third highest priority to connect. Remaining areas of the West Falmouth Harbor Watershed to be sewered would be the fourth highest priority to connect.

5.4 MARAVISTA EVALUATIONS AND 1.4 MGD TREATMENT CAPACITY AT THE WWTF

A. Introduction. As identified in the previous reports, Maravista is expected to contribute an average annual flow of 0.2 mgd of wastewater. The Draft WWFP/DEIR performed a detailed analysis of alternative wastewater facilities for the Maravista Planning Area which included the following alternatives:

- Individual nitrogen removal systems
- Connection to the Falmouth WWTF
- Small wastewater treatment facility

Based on the analysis performed as part of the Draft WWFP/DEIR, connection to the proposed upgraded WWTF was determined to be the most cost effective solution, and would provide the greatest environmental benefit to the Little Pond Watershed, by removing the nitrogen generated from wastewater from this watershed. This finding was not carried through to a recommendation due to the need for additional study of the Little Pond Watershed, and uncertainties on recommended wastewater management for the Great Pond, and Bourne Pond Watersheds as part of the Ashumet Plume Nitrogen Offset Program.

B. Summary of Draft WWFP/DEIR Detailed Analysis. Capital, O&M and Present Worth Costs are summarized below for the three alternatives investigated for the Maravista Planning Area.

Alternative	Total Capital Costs ($)	Annual O&M Costs ($/yr)	Total Present Worth Costs ($)
Individual Nitrogen Removal Systems	$18.3 million	$1.6 million	$35.9 million
Connection to the Falmouth WWTF	$14.3 million	$50,000	$14.8 million
Treatment and Discharge at a Small WWTF	$19 million	$200,000	$21.2 million

Connection to the Falmouth WWTF has the lowest Present Worth Cost. This alternative would also provide the greatest environmental benefit to the Little Pond Watershed as it would remove the most wastewater nitrogen from the Planning Area.

Treatment and discharge at a small wastewater treatment facility is the second lowest cost alternative, though it is significantly more expensive than connection to the Falmouth WWTF. It would require the purchase of two vacant industrial properties south of Spring Bar Road for the construction of a small wastewater treatment facility; and the purchase of several vacant and developed residential properties west of Maravista Avenue (between Cypress and Cedar Streets) for the construction of an effluent leaching facility.

As discussed in the Introduction, final recommendation to connect this area to the Falmouth WWTF was not made in the DWWFP/DEIR due to the need of additional study.

C. **1.4 mgd Treatment Capacity at the WWTF.** One of the largest issues associated with the sewering of the Maravista Planning Area and the upgrade of the existing WWTF to a 1.4 mgd facility is the effluent discharge that will be allowed at the existing site. Discussions with DEP indicate that a future groundwater discharge permit for the new WWTF will allow up to 1.0 mgd of flow to be discharged with a possible increase to 1.2 mgd based on nitrogen removal performance after WWTF upgrade. In conjunction with this, the Town is planning to proceed with the Effluent Mitigation Project to further evaluate additional discharge sites and technologies.

On March 27, 2000, the Falmouth Board of Selectmen voted that the new facility should be designed for 1.4 treatment capacity (to handle flows for the Maravista Planning Area) with discharge of 0.2 mgd outside the West Falmouth Harbor Watershed. Discussions with DEP indicate that a 1.4 mgd facility could be designed and constructed, but the discharge at the site will be limited 1.0 with a possible increase to 1.2 mgd based on the nitrogen performance of the upgraded treatment facilities. The Effluent Mitigation Project is planned to further evaluate three alternative discharge sites (as identified in Chapter 4) to potentially accept treated effluent to be discharge outside the Snug Harbor Watershed. This project will take over two years depending on the evaluation of the sites and technologies.

There is an approximate $3 million cost difference for a 1.4 mgd treatment facility versus a 1.2 mgd treatment facility as identified in Chapter 6 of the DWWFP/DEIR and in the comparison of WWTF modification costs for Alternative Plans No. 2 or No. 4 in Table 6-1 which follows pg. 6-5 of the DWWFP/DEIR.

Based on review of the issues listed above, the Town may prefer to design the capability to expand a 1.2 mgd facility to a 1.4 mgd facility in the future. This will save capital costs for treatment capacity that may not be usable for several years.

CHAPTER 6

RECOMMENDED PLAN AND IMPLEMENTATION

6.1 INTRODUCTION

This Chapter identifies and presents the Recommended Plan. This plan is a modification to the Recommended Plan identified in the DWWFP/DEIR, and includes the findings summarized in Chapters 3, 4, and 5 of this Report.

The Recommended Plan is made up of the following components:

- Wastewater treatment and discharge within the Planning Areas
- Modifications to the Falmouth WWTF and centralized collection system
- Recommended modifications to local regulations
- Nitrogen management plan for West Falmouth Harbor Area

This Chapter includes recommended design criteria for the new facilities and modifications to existing equipment.

Project cost estimates presented in this Chapter are based on 2002 dollars. If components of the Recommended Plan are not implemented during 2002, costs should be adjusted for inflation by the Engineering News Record Construction Cost Index.

6.2 REVIEW OF ALTERNATIVE PLANS AND REMAINING ISSUES

Four Alternative Wastewater Facilities Plans and the No Action Alternative were evaluated in the DWWFP/DEIR.

Based on those findings, Alternative Plan No. 4 was ranked the highest. Plan No. 4 provides a high level of nitrogen removal for the West Falmouth Watershed and the Little Pond Watershed. It is also the second lowest cost alternative plan. Also, it does not require the construction of a small wastewater treatment facility for the Maravista Planning Area which would be very costly, displace residents, and require the long-term Town operation of an additional wastewater treatment facility.

The main components of Alternative Plan No. 4 are listed below:

- Upgrade of the Falmouth WWTF to a design flow of 1.4 million gallons per day (mgd) with nitrogen removal to meet a 5 parts per million (ppm) total nitrogen discharge limit
- Connection of the Falmouth High School to the Falmouth WWTF
- Sewering of the West Falmouth Harbor Watershed west of Route 28
- Sewering of the North Davis Straits and Scranton Avenue Service Areas
- Sewering of the Maravista Planning Area
- Nitrogen removal septic systems for the West Falmouth Harbor Watershed east of Route 28.

However, there are several issues regarding Alternative Plan No. 4 that must be considered in the final selection of the Recommended Plan.

A preliminary nitrogen assessment was performed for Little Pond and its watershed that indicated that nitrogen removal facilities are needed for the Maravista Planning Area. A more detailed nitrogen assessment is needed for this area to determine if other portions of the Little Pond Watershed, such as densely developed residential areas west of Little Pond, need nitrogen removal facilities. That evaluation may indicate that additional areas of the Little Pond Watershed need to be sewered as well.

Nitrogen loading assessments and wastewater treatment alternatives have recently been completed for the Great Pond, Green Pond, and Bournes Pond Watersheds east of the Little Pond

Watershed as part of the Ashumet Plume Nitrogen Offset Program as discussed in Chapter Section 1.6C. Portions of the Maravista Planning Area are located within the Great Pond Watershed. Discussions with the consultants performing that evaluation indicated that sending wastewater to the Falmouth WWTF for treatment will not be considered as a feasible alternative. This indication may change as the feasibility of remediating nitrogen impacts in this Area is developed further.

Effluent discharge capacity at the Falmouth WWTF is limited due to low permeable soils in that portion of Falmouth. Renovation of the existing aerated pond basins to sand infiltration beds is proposed as part of all the alternative plans to increase the discharge capacity. The further evaluation of a well injection effluent discharge facility had been proposed as part of the Recommended Plan to determine the feasibility of this technology for this area of Falmouth, potentially to move a portion of the discharge outside the Snug Harbor Watershed, save capital costs, and increase the discharge capacity. Well injection technology is new to Massachusetts and would need to be pilot tested before it is found to be feasible and approved by Massachusetts DEP.

Regulatory comments on the DWWFP/DEIR requested that effluent discharge into the Snug Harbor Watershed be reevaluated and possibly limited to a flow that would reduce nitrogen concentrations in the Harbor to a level of 0.35 to 0.37 ppm total nitrogen. Those evaluations are summarized in Chapter 3. The findings of those evaluations and subsequent input from DEP indicate that effluent discharge to the Snug Harbor Watershed will be limited to 1.0 mgd to meet the 0.35 to 0.37 ppm range. This flow into the Snug Harbor Watershed could be increased to 1.2 mgd if the upgraded WWTF can produce an effluent with a total nitrogen concentration less than the expected 3 ppm level.

Regulatory comments on the DWWFP/DEIR also requested that alternative discharge sites be identified outside the Snug Harbor Watershed to allow portions of the treated effluent to be discharged outside the watershed. Those evaluations are summarized in Chapter 4. The findings of those evaluations identified the following three alternative sites:

- Well injection site at the WWTF entrance.
- Private undeveloped property (DBI Site) north of the WWTF site and north of Thomas Landers Road.
- The Ballymeade Sale Site which is a property that will transfer to the Town as part of development agreement with owners of the Ballymeade properties.

These properties are proposed for further evaluations, subsurface investigations, and pilot testing as part of the Effluent Mitigation Project.

An Effluent Mitigation Project is planned to evaluate the three alternative discharge sites evaluated in Chapter 4 and identified above. The Effluent Mitigation Project is designed to further evaluate the three sites and select one for possible pilot or hydraulic-load testing. The project has been listed on the States priority list for zero percent loans as part of the States Revolving Fund (SRF) loan program and has received Town Meeting support at the Fall 2000 Town Meeting.

6.3 IDENTIFICATION OF THE RECOMMENDED PLAN

The issues discussed in the previous section of this Chapter have been considered and a variation of Alternative Plan No. 4 is recommended. The Recommended Plan is made up of the following:

- Upgrade of the Falmouth WWTF to a design flow of 1.2 million gallons per day with nitrogen removal to meet a 5 ppm discharge limit and 3 ppm on average.
- Designed expansion capability to at least 1.4 mgd to allow possible sewering and treatment of Maravista flows in the future.
- Effluent discharge of 1.0 mgd in the Snug Harbor Watershed with the potential to increase discharge to 1.2 mgd based on results of the new WWTF upgrade.
- Connection of the Falmouth High School to the Falmouth WWTF.
- Sewering of the West Falmouth Harbor Watershed west of Route 28 with the Snug Harbor Watershed being the highest priority in the watershed.

- Sewering of North Davis Straits and Scranton Avenue Service Areas.
- Nitrogen removal septic systems for the West Falmouth Harbor Watershed east of Route 28.
- Formation of a Wastewater and Nitrogen Management District to manage decentralized wastewater facilities and nitrogen loading in the West Falmouth Harbor Watershed.

This Recommended Plan does not include sewering of the Maravista Planning Area until further nitrogen assessments are complete in the Little Pond Watershed and the Effluent Mitigation Project is complete.

The facility will be designed for possible expansion to 1.4 mgd which could be implemented following the results of the Effluent Mitigation Project and the nitrogen assessment for Little Pond. The Recommended Plan provides nitrogen removal that will meet the 0.37 mg/L concentration limit in Snug Harbor at the design (future) condition.

The Environmental Impact of the Recommended Plan and mitigation measures developed in accordance with the Massachusetts Environmental Policy Act (MEPA) regulations are discussed in Chapter 7.

A. Wastewater Treatment and Discharge within the Planning Areas. The existing and future wastewater needs for each Planning Area were developed in the Needs Assessment Report. The Alternatives Screening Analysis Report evaluated many alternatives to treat and discharge wastewater from these Planning Areas. The feasible alternatives were evaluated in detail in the Draft WWFP/DEIR.

The following table summarizes the Recommended Plan for the Planning Areas.

Planning or Service Area	Average Annual flow to WWTF (mgd)	Recommended Alternative
West Falmouth Watershed		
area west of Route 28	0.23	Connection to Falmouth WWTF
area east of Route 28	-	Nitrogen removal septic systems
Existing Sewered Areas	0.56	Connection to Falmouth WWTF
Falmouth High School	0.01	Connection Falmouth WWTF
Scranton Avenue and North Davis Straits	0.2	Connection to Falmouth WWTF
Clinton Street	-	Title 5 System Upgrade
Maravista	-	Wait until additional evaluations are complete
Falmouth Heights	-	Potential Cluster Systems after site-by-site analysis
Totals	1.0	Connection to Falmouth WWTF

B. Modifications to Falmouth WWTF.

1. Introduction. Recommended modifications to the Falmouth WWTF are based on an average annual design flow of 1.2 mgd from the following sources:

- 0.47 mgd from areas currently connected to the WWTF
- 0.09 mgd from infilling and Town growth along existing sewers
- 0.44 mgd from the Planning Areas recommended for connection as summarized in the preceding Chapter section
- 0.2 mgd as an emergency reserve capacity available for future unexpected growth and flexibility in operations.

Although the WWTF will be designed to treat 1.2 mgd, the Groundwater Discharge Permit, as issued by DEP, is expected to only allow a discharge of 1.0 mgd until sufficient performance data from the new treatment system can demonstrate that the WWTF can produce a nitrogen concentration less than 3 ppm; or when the Effluent Mitigation Project is complete and has demonstrated that additional flow can be discharged outside the Snug Harbor Watershed. The recommended modifications are also made based on expected effluent discharge limits which will be developed by Massachusetts DEP after review and approval of this FEIR. The effluent discharge limits are expected to be based on a maximum daily total nitrogen limit of 5 or 10 ppm total nitrogen and a total maximum annual loading (TMAL) of 4,145 kg/yr of nitrogen to the Snug Harbor Watershed (average flow of 1 mgd at 3 ppm total nitrogen concentration). This annual loading is based on the West Falmouth Harbor nitrogen loading assessment presented in Chapter 3 to meet the 0.35 to 0.37 mg/L nitrogen concentration limit set by DEP based on the CMAST report.

Recommended modifications to the WWTF are made to provide required future capacity, meet expected effluent limits, replace the aerated pond treatment process that cannot meet the nitrogen removal standards, and improve operational effectiveness and flexibility. Existing facilities will be reused when possible based upon their physical condition and design capacity.

2. **Capital Costs.** Capital costs estimated to implement the recommendations are summarized below.

Cost Summary of
Recommended Falmouth WWTF Modifications

Capital Cost Item	Cost ($) (1)
Sequencing Batch Reactor and Appurtenances	4,900,000
Sludge Management Facility	1,300,000
Aerated Pond Demolition	500,000
Renovation of Aerated Ponds to Sand Infiltration Beds 9-12	1,900,000
Sand Infiltration Bed Sand Replacement	700,000
Denitrification Filters	700,000
Total Construction Costs (2)	10,000,000
Contingency	1,500,000
Fiscal, Legal and Engineering	2,500,000
Total Capital Costs	14,000,000

Notes: (1) Costs are referenced to the year 2002 (ENR Cost Index of 6614)
(2) Disinfection facilities are not listed because they are not typically required for a groundwater discharge. If the facilities are required by DEP, they will cost approximately $200,000 for ultraviolet disinfection

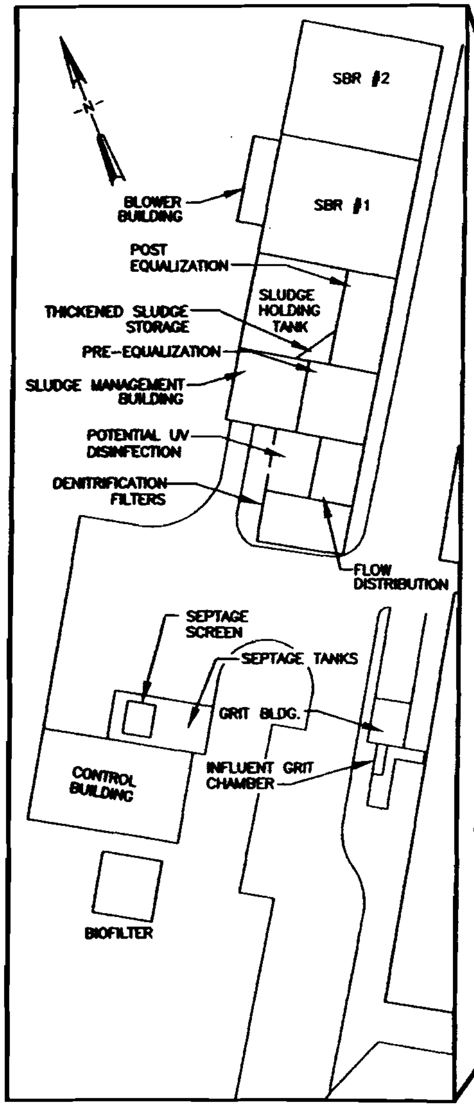
The proposed wastewater treatment and discharge facilities and sludge management facilities are described in the following sections. A more detailed listing of these facilities and processes is provided in Appendix 6-1 with the process design criteria.

The existing and proposed facilities are illustrated on Figure 6-1, Proposed Site Plan and Figure 6-2, Proposed Process Flow Schematic.

3. **Pretreatment Facilities.** The existing pretreatment facilities consist of an aerated grit chamber and grit screw. Currently the aerated grit chamber is only used for removing grit from the septage wastewater stream. The total maximum design flow for the grit chamber is 4.1 mgd with a detention time of 1.3 minutes. Modifications to the Falmouth WWTF have recently been completed to upgrade odor control facilities at the aerated grit chamber as well as other locations. The aerated grit chamber is expected to be used for sewered flows after the odor control modifications.

4. **Advanced Biological Treatment with Sequencing Batch Reactors and Denitrification Filters.** A Sequencing Batch Reactor (SBR) process followed by denitrification filters is recommended for the Falmouth WWTF. This will provide advanced biological treatment and nitrogen removal to meet an average annual total nitrogen concentration of 3 ppm.

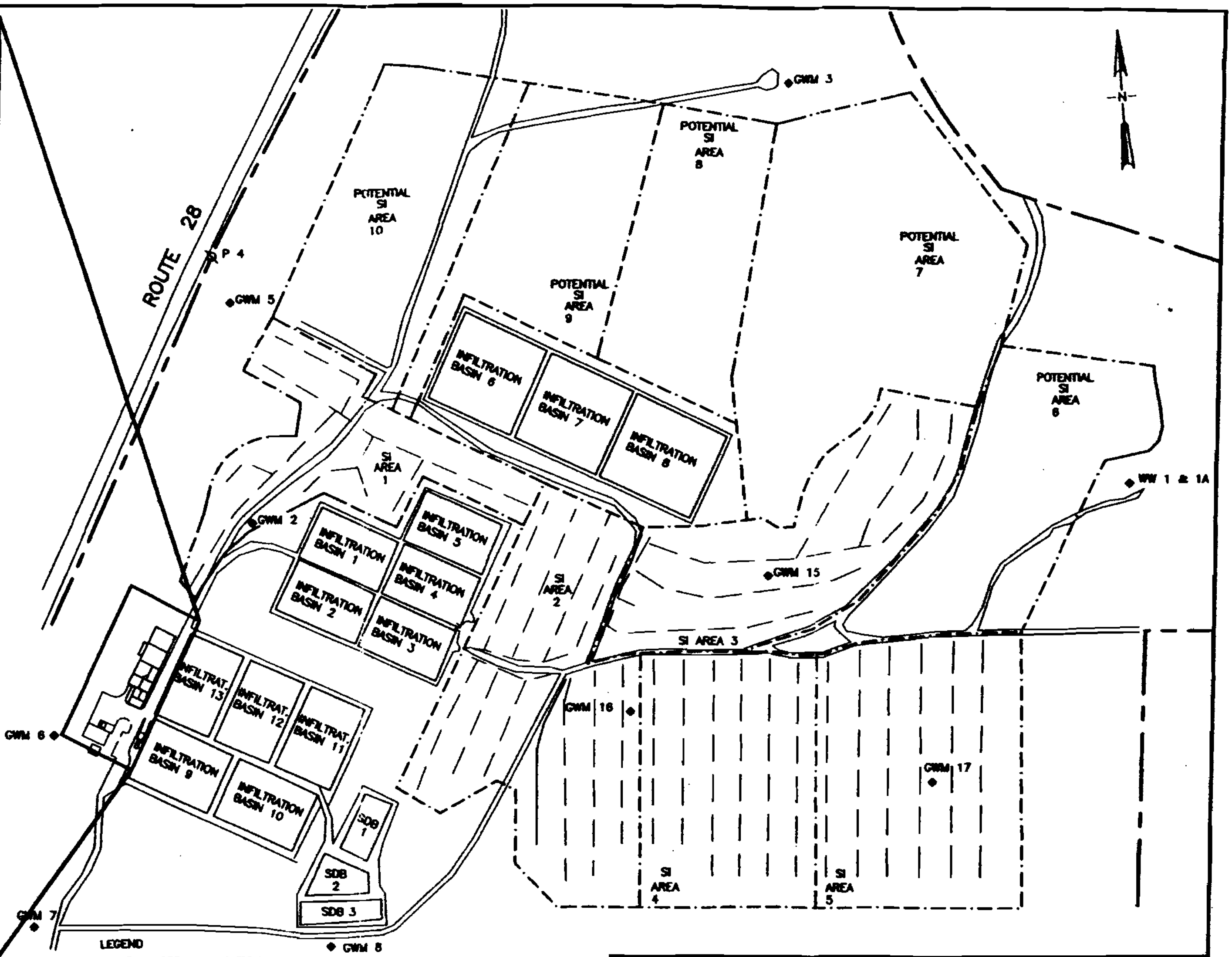
The first component of the treatment system is an equalization (pre-equalization) tank to equalize the diurnal flows of the collection system, and to allow one SBR to be taken off line for maintenance or during low flow periods. The pre-equalization tank will be aerated and mixed with diffused air injected at the tank bottom. Submersible pumps in this tank will pump the flow to the SBR tanks.



PARTIALLY ENLARGED

SITE PLAN

NOT TO SCALE



LEGEND

SI - SPRAY IRRIGATION
SDB - SLUDGE DRYING BED
GWM - GROUNDWATER MONITORING WELL
— — — PROPERTY LINE
— · — · — SPRAY IRRIGATION AREA PERIMETER
— — — SPRAY IRRIGATION PIPELINE

SITE PLAN

NOT TO SCALE

Stearns&Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE:11/99 JOB No.:8023415

WASTEWATER FACILITIES PLANNING STUDY
FALMOUTH, MASSACHUSETTS

FIGURE 6-1
PROPOSED SITE PLAN

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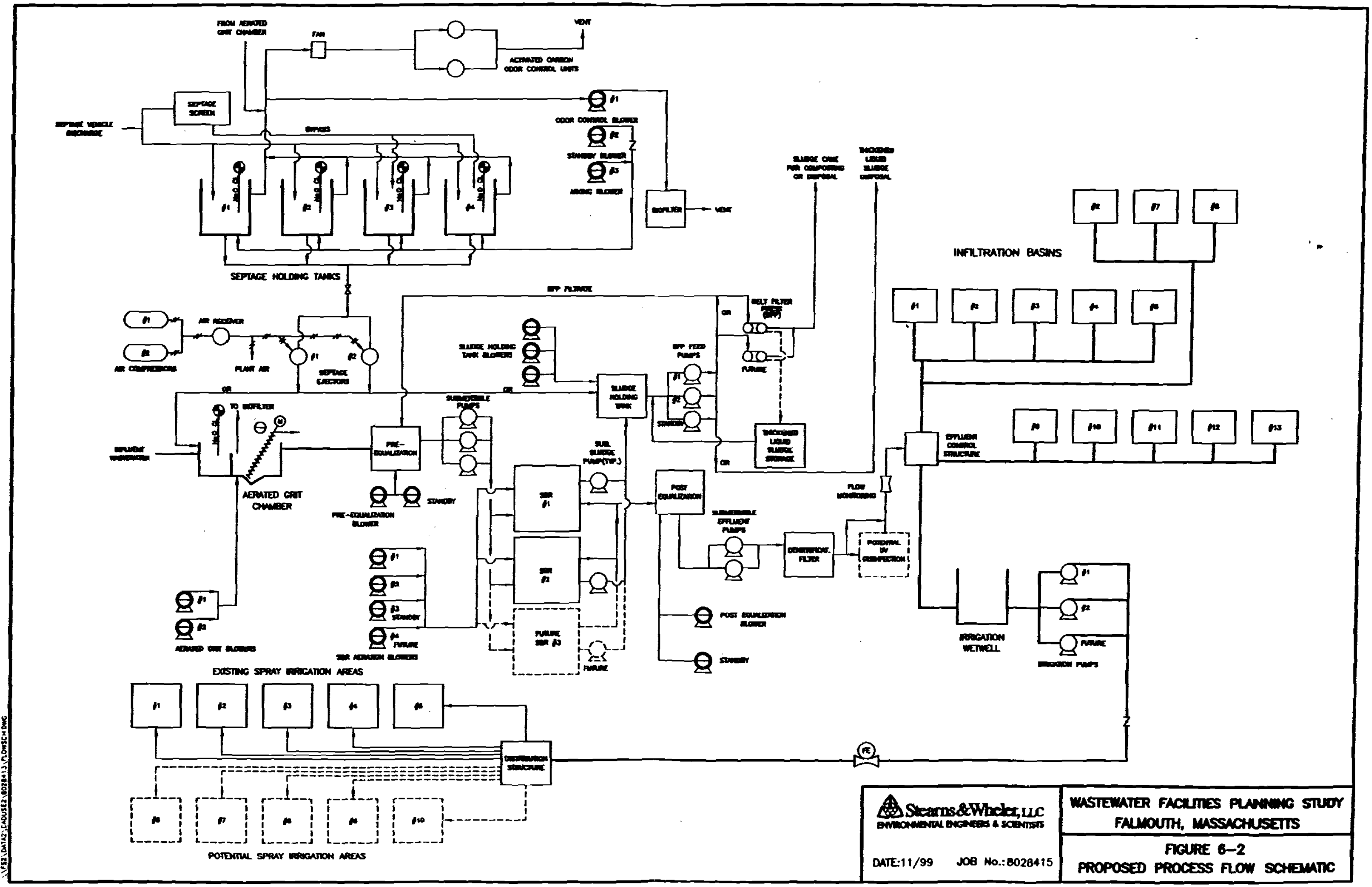

Stearns&Wheler,LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE:11/99 JOB No.:8028415

WASTEWATER FACILITIES PLANNING STUDY
FALMOUTH, MASSACHUSETTS

FIGURE 6–2
PROPOSED PROCESS FLOW SCHEMATIC

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The SBR tanks will provide the biological treatment by maintaining an active biomass for treatment of organic material and nitrogen to an average concentration of 8 ppm total nitrogen. Sequencing batch reactors are batch-type treatment processes. Aeration, anoxic reaction (for nitrogen removal), and settling are accomplished in a single basin, though parallel treatment paths are provided. The cycles of the SBR process include fill, react, settle, draw, and idle. Wastewater is added during the fill cycle. It is then aerated during the react cycle. Nitrogen removal will occur during the react and fill cycles. The next phase is settling of the biomass, followed by decanting of clarified effluent to the post-equalization tank in the draw cycle. Excess biomass (sludge) is collected and removed during the idle cycle. A process diagram of an SBR was included as Figure 5-5 in the Alternatives Screening Analysis Report.

The post-equalization tank is used to equalize the flow from the periodic decant cycles so that a continuous effluent flow can be provided to following processes such as denitrification filters, flow monitoring, and effluent discharge.

Denitrification filters will be used with methanol feed facilities to polish the effluent to an average annual total nitrogen concentration of 3 ppm.

The facilities will be sized to treat 1.2 mgd on an average annual basis in the design year 2023. The facilities will also be sized to treat the following seasonal and start-up flows:

Summary of Design Flow Variations

Flow Condition	Flow, mgd
Startup [1]	
Average Annual	0.46
Minimum Month	0.36
Maximum Month	0.60
Design Year (2023)	
Average Annual	1.20
Maximum Month	1.66

[1] Based on Existing Conditions in 1998

The facilities will also be designed to handle peak day and peak hour flows in accordance with the Design Guidelines for the Design of Wastewater Treatment Works as published by the New England Interstate Water Pollution Control Commission (TR-16). The facilities will be designed to handle these variable flows using multiple units, redundant facilities as required by TR-16 and variable fluid levels in the tanks to allow variable treatment and storage volumes.

5. **Effluent Discharge Facilities and Aerated Pond Renovation.** The existing sand infiltration beds (basins) and spray irrigation areas will continue to be used for effluent discharge to the groundwater system.

The aerated ponds will be renovated into new sand infiltration bed Nos. 9 – 12 as illustrated on Figure 6-1. This renovation will require the following components.

- Removal of accumulated sludge
- Removal of pond liners and aeration equipment
- Construction of a dividing wall in Pond No. 1 to separate sand infiltration beds No. 9 and 10
- Installation of sand in the basins
- Installation of distribution piping

Sand infiltration bed No. 13 would be constructed in the vacant area west of Pond No. 3 (proposed infiltration bed No. 12). This infiltration bed is not needed until the influent flows increase to the design condition.

The total discharge capacity of the existing and proposed effluent discharge facilities is 1.2 mgd based on hydraulic loading criteria for the spray irrigation areas and the observed infiltration rate for the existing sand infiltration beds as developed by previous evaluations, and discussed in the Needs Assessment Report (Chapter section 5-1.I).

The development of additional effluent discharge capacity should also be pursued as part of the Effluent Mitigation Project. Evaluations summarized in this Report and the Alternatives Screening Analysis Report indicated that well injection is a cost effective method to dispose treated effluent and has the least amount of land disturbance and resulting environmental impact. Well injection technology is relatively new in Massachusetts and pilot testing of the technology is needed before its feasibility can be proven.

The existing sand infiltration beds have never had their top layer of sand replaced which may be adding to their low infiltration rates. After the new treatment facilities come on line, the existing sand infiltration beds should have the top two feet of sand replaced with a layer of uniform coarse sand.

6. **Septage Pretreatment Facilities.** The existing Septage Pretreatment Facilities consist of the following components.

- Septage truck scale for weighing and measuring septage received at the WWTF.
- Septage Rotary Screen to remove solid material that can be screened from the septage.
- Septage holding tanks where the septage is aerated and managed to remove grit and potential toxic compounds.
- A biofilter to remove odors from the tanks constructed.

Continued use of these facilities is recommended. The pretreated septage can then be directed to the sewage pretreatment facilities (as currently practiced and described earlier in this Chapter Section) or directed to the proposed sludge holding tank. This operation flexibility is illustrated on Figure 6-2, Proposed Process Flow Schematic. Directing this flow to the sludge holding tank is the recommended mode of operation to reduce organic and nitrogen loading to the SBR. Experience indicates that addition of pre-treated septage to a sludge holding tank provides the most cost effective and efficient wastewater treatment and sludge treatment.

7. **Sludge Management Facilities**. Sludge management facilities are needed for a wastewater treatment facility that provides advanced wastewater treatment. Organic material and nitrogen is removed from the wastewater by biological treatment which produces excess biomass often called biosolids or sludge. The sludge will need to be processed and disposed in an economical and environmentally sound method. Evaluations identified in the Draft WWFP/DEIR indicate that sludge dewatering and disposal of the sludge cake at a regional disposal/reuse facility is the most cost effective and easily managed method.

The sludge management facilities are made up of the following components:

- Sludge holding tank
- Sludge dewatering equipment
- Thickened sludge storage
- Odor control system

Sludge produced in the SBR will periodically be pumped to the sludge holding tank and mixed with pretreated septage. The mixture will be aerated for several days and then allowed to settle, which will produce a thicker sludge, digest some of the organic solids, and denitrify the nitrogen in the pretreated septage.

The sludge will be pumped to a belt filter press which will dewater it by pressing it between fabric belts and produce a sludge cake that has an approximate solids concentration of 20 percent. The sludge cake will discharge to a dump trailer to be transported to a regional disposal or reuse facility. Several facilities will take this material, and the transportation and disposal is typically competitively bid to find the lowest cost transportation company and disposal/reuse location.

Sludge disposal redundancy should be provided by a back-up contract with another trucking and disposal/reuse company. Also, thickened sludge could be produced on the belt filter press or in the holding tank for disposal of thickened liquid sludge. The sludge holding tank will provide over 20 days of storage at average annual conditions to allow the belt filter press to be serviced or repaired.

Sludge cake disposal will be a new operations cost for the WWTF which must be budgeted and is detailed in Section 6.3-E.

Odor control at these facilities will be provided by a biofilter.

C. **Centralized Wastewater Collection System.** Sewer extensions and connections are recommended for the Falmouth High School, the West Falmouth Harbor Watershed (west of Route 28), and the Scranton Avenue/North Davis Straits Service Areas as indicated earlier in this Chapter and in the Draft WWFP/DEIR.

Connection of the Falmouth High School is recommended because the school exceeds the Title 5 design flow limit for an individual septic system, and it is currently discharging septic tank effluent into the Long Pond Water Resource District. Connection of the High School is also less expensive than construction of a small wastewater treatment facility at the High School site. A total capital cost of $1,000,000 is calculated for this sewer connection based on 9,300 LF of force main and a pumping station. This connection is expected to be completed as part of the planned renovations to the High School.

A wastewater collection system is recommended for the West Falmouth Harbor Watershed west of Route 28 to reduce nitrogen loading to the Harbor, and reduce potential health risks due to outdated septic systems that are too close to the groundwater table and too close to the Harbor. A total capital cost of $19,100,000 is calculated for this collection system based on 73,000 feet of sewer, one pumping station, 11,000 feet of force main, 900 building connections, unit costs presented in the Draft WWFP/DEIR, contingencies, and fiscal/legal/engineering costs. If this capital cost is distributed between the 900 properties that will be served; an average cost per household of $21,200 is calculated for a betterment for this collection system. The Snug Harbor Watershed is the highest priority area to sewer and should be done first.

Wastewater collection systems are recommended for the North Davis Straits and Scranton Avenue Service Areas to reduce nitrogen loading to Little Pond and to Inner Harbor and to provide sewer service to these predominately commercial areas. Several properties in these areas have failing septic systems and several others have large wastewater flows that may require individual groundwater discharge permits because the future flows can exceed Massachusetts DEP 10,000 gpd maximum flow limit for Title 5 systems.

A capital cost of $400,000 is calculated for the Scranton Avenue Service Area based on 1,300 feet of sewer, 30 home connections, and the other factors identified above for the West Falmouth Harbor Sewer Service Area. This capital cost would equate to a $13,300 average betterment for this collection system.

A capital cost of $2,800,000 is calculated for the North Davis Straits Service Area based on 4,700 feet of sewer, a new pump station located along Spring Bars Road, 4,000 feet of force main, 60 property connections and the other factors identified above for the West Falmouth Harbor Sewer Service Area. The estimated capital cost would result in a $46,700 average betterment for this collection system. This cost is significantly less than the cost that several of these properties may need to pay for their own small wastewater treatment facilities to meet possible state imposed groundwater discharge permits.

D. Potential Funding Sources. Federal and state grants are no longer available for new or modifications to existing wastewater facilities. Massachusetts has a State Revolving Fund (SRF) which was established in 1989 to provide low interest loans for publicly owned treatment facilities. This funding is available for construction of new collection, treatment, and discharge facilities. Typically zero percent loans are available.

Falmouth was recently identified for a SRF low interest loan for the effluent mitigation project. This project is expected to be a second phase of the Wastewater Facilities Planning Study to determine additional effluent disposal options for Falmouth.

Other funding sources focus primarily on low-income rural areas and would not be available to Falmouth.

Often industries or large commercial establishments that will benefit by the installation of a municipal sewer will be asked to pay a larger share of the sewer cost. This financial approach should be pursued in the North Davis Straits Service Area.

E. **Operation and Maintenance (O&M) Costs.** The Falmouth Utilities Department will be experiencing increased O&M costs due to the new wastewater treatment and collection facilities. Existing and projected (start-up) O&M costs are summarized in the following table and discussed in the following paragraphs.

Summary of Existing and proposed O&M Costs

O&M Item	2000	2004
Wastewater Administration Items		
Personnel	$307,000	$390,000
Purchased Services and Supplies	31,000	47,000
Staff Development	3,000	6,000
Pumping Stations and Collection System		
Repair and Maintenance	11,000	18,000
Electricity	39,000	59,000
Chemicals and Supplies	45,000	68,000
Wastewater Treatment Facility		
Electricity and Fuel Oil	101,000	246,000
Repairs and Maintenance	25,000	29,000
Communications	4,000	4,000
Chemicals and Supplies	34,000	67,000
Sludge Disposal	-	216,000
Total	$600,000	$1,150,000

The 2000 operating costs are based on the budget for 2000 as detailed in Appendix 6-2. Proposed costs in 2004 (start-up) are based on present day costs that have been increased approximately 3 percent per year due to inflation and other additional costs for the new facilities.

The Town currently has a staff of four trained operators to operate the existing treatment facilities and collection system. These duties include:

- Pump station operations, repair and maintenance
- WWTF operations, repair and maintenance
- Spray irrigation area maintenance
- Effluent-compliance and groundwater monitoring

One additional operator will be required at start-up to handle additional duties of process control, process monitoring, and sludge dewatering. Another operator may be needed in approximately three to five years to provide maintenance support for the additional treatment and collection facilities. The plant is expected to be upgraded to a Grade 6 wastewater treatment plant and additional staff development budget is required.

Pumping station and collection system O&M costs will increase due to inflation (approximately 3 percent per year) and by a 33 percent factor due to an increase in the number of major pumping stations. Also, $2,000/year is recommended for television inspections of selected portions (approximately 1.5 miles/year) of the collection system.

Electrical usage at the WWTF is expected to increase by approximately $140,000 due to additional aeration and other mechanical equipment.

Sludge disposal costs are expected to be $216,000 if all the sewers are installed by start-up and the WWTF is receiving a flow of 0.8 mgd. A sludge disposal cost of $130,000 is estimated if the WWTF is receiving a start-up flow of 0.5 mgd which is slightly above the existing flow of 0.46 mgd.

Supply and chemical costs will increase due to inflation and for the additional chemical needs of polymer ($17,000) for sludge dewatering and methanol ($15,000) for effluent polishing in the denitrification filters.

F. Sewer-Use Fees. Typically, sewer-use fees pay for the annual O&M costs of wastewater collection and treatment facilities. The O&M costs are projected to increase by approximately 90 percent as indicated previously in this Chapter. The water consumption which will be connected to the sewer at the start-up condition is projected to increase approximately 150 percent based on the existing water consumption in the sewered area of 0.27 mgd and the projected additional sewering of 0.39 mgd of water consumption. (The total 0.66 mgd water consumption is the projected design wastewater flow without I/I, the 20 percent growth factor and an allowance for lawn watering and other non-sanity water use. These estimates may change after the Town completes a review of water consumption in the sewered area.) This indicates that the increase in sewer-use billing is expected to exceed the increase in O&M costs; and sewer-use fees may not need to increase for the new facilities.

It is noted that the existing sewer-use fee of $2.31/100 cubic feet of water consumption does not provide 100 percent recovery of the existing O&M costs. If the projected O&M costs were to be paid completely by the sewer-use fees; a projected fee of $3.50/100 cubic feet of water consumption would be needed.

A sewer-use fee of $2.31/100 cf equates to $14/month for a typical three bedroom home and 50 gallons of water consumption per bedroom per day. A $3.5/100 cf fee equates to $21/month using the same flow values

Water consumption at properties that connect to the Falmouth WWTF (and need to pay a sewer-use fee) is expected to decline due to the increased cost for wastewater service. Additional water conservation (and reduction in sewered flow) may be possible by instituting an increasing block sewer-use and water-supply fee structure. This type of structure would bill a higher rate for water consumption and sewer use as more water is consumed at a property. It is recommended that the Town of Falmouth consider implementing this type of fee structure.

G. Nitrogen Management Plan for West Falmouth Harbor. Nitrogen loading evaluations for West Falmouth Harbor are summarized in Chapter 3. Findings of this evaluation indicate that the 0.37 mg/L nitrogen concentration for Snug Harbor to reestablish eelgrass can be met by a combination of recommended nitrogen mitigation efforts in the Watershed as summarized below:

- Sewering of the western portions of the Watershed (west of Route 28) to collect and treat the wastewater at the Falmouth WWTF to higher level than is possible with on-site systems. Sewering of the Snug Harbor portion is the highest priority.
- Upgrade of the Falmouth WWTF to advanced nitrogen removal and potential discharge of 1.2 mgd in the watershed contingent upon the performance of the WWTF upgrade and the ability to relocate 0.2 mgd outside the watershed.
- Requirement of nitrogen removal on-site systems in the eastern portion of the watershed to minimize nitrogen loading from these on-site systems. Also a minimum lot size of 80,000 ft^2 is recommended for the portions of this area that are not already zoned for this minimum lot size.
- Preparation of sewer-use and other local regulations for the Watershed.
- Initiation of the Effluent Mitigation Project to further investigate alternative discharge sites.

This plan produces a projected watershed nitrogen loading in the Snug Harbor Watershed that meets the 0.37 mg/L nitrogen standard.

Table 3-2 summarizes the Existing, No-Action-Alternative, and Budgeted Nitrogen Loadings for West Falmouth Harbor as evaluated and discussed in Chapter 3.

H. Recommended Modifications to Local Regulations and Policies. Potential Changes to wastewater facilities have been recommended that will require modifications to local regulations and policies. These modifications are discussed and identified below.

1. **Sewer Use Regulation**. The Town's existing Sewer Use Regulations were reviewed in Chapter 5 of the DWWFP and a copy of the New Silver Beach Service Area regulations are included in Appendix 5-1 of that report. Similar Sewer Use Regulations should be created for the planning areas identified for sewer installation in this Recommended Plan. The new regulations for the sewered planning areas would address the following issues:

- Definition of the properties within the sewer service areas.
- Requirements for connecting existing properties to the existing and proposed sewer system.
- Conditions which would allow properties outside the sewer service area to connect to the sewer.
- Limitations on the number of allowable bedrooms in existing and future properties.

This regulation would be designed to control growth in new sewered areas that would no longer have the growth limit of the Title 5 Regulations.

2. **Board of Health Regulations and Policies**. The following sections present recommended changes to Board of Health (BOH) regulations and policies.

a. Managed Septic System Pumping. The Town currently monitors the septic system pumping volume and frequency as discussed in the DWWFP/DEIR. The following modifications are proposed to the current monitoring practice:

- The Town should install a computer at the WWTF for accurate and timely recording of septage volumes and loads.
- The Health Department's current septage monitoring computer program (Septrac) should be upgraded to a revised version.
- A septage pumping program should be initiated that notifies homeowners to pump their septic system periodically. A Health Department official will need to be available to inspect septic systems and determine when they should be pumped.

b. Decentralized and Nitrogen Wastewater Management District Formation. On-site nitrogen removal systems have been recommended for the West Falmouth Watershed area east of Route 28 to reduce nitrogen loading to West Falmouth Harbor. As discussed in the DWWFP/DEIR; large-scale implementation of these systems does not lend itself to individual operation, maintenance and monitoring of these systems. A decentralized wastewater and nitrogen management district should be established for this area to perform the following functions.

- On-site system records storage
  - system pumping records
  - system design
  - monitoring and performance data
- System maintenance and repairs
- Regulatory enforcement
- Summary reporting on district (watershed) performance
- Monitoring on other district or watershed issues such as fertilizer usage or stormwater system operations

c. Needed Funding and Staffing. Costs for the Health Department staffing and operation are estimated in the O&M costs for the nitrogen removal systems as described in the DWWFP/DEIR. Inspection, monitoring, and maintenance costs would need to be paid to the Health Department by the individual property owners after development of regulations for the management district.

The Town should budget approximately $30,000 to $50,000 for Health Department staff and support infrastructure to set up a decentralized wastewater management district and the septic system-pumping program for the first year of operations. This annual cost will need to be adjusted after the first year.

3. **Zoning Regulations.** Nitrogen loading budgets have been developed for the West Falmouth Harbor Watershed based on buildout conditions, maximum lot sizes of 80,000 ft^2

and individual nitrogen removing on-site systems east of Route 28. Most of this area is zoned Agricultural AA and Light Industrial B with a minimum lot size of 80,000 ft^2. Small portions are zoned Agricultural A and Light Industrial B which have minimum lot sizes of 45,000 ft^2 and 40,000 ft^2 respectively. All of the West Falmouth Harbor Watershed east of Route 28 should be zoned with a minimum lot size of 80,000 ft^2 to represent the buildout conditions used for nitrogen budgeting.

4. **Potential Lawn Fertilizer Ban for West Falmouth Harbor Watershed.** As discussed in Chapter 3, lawn fertilizer loadings typically represent a large loading to the embayment; and they are based on many assumptions which may not be valid. There is much academic interest in developing more accurate calculation methods for this loading value. Those studies (and regulatory acceptance of the studies) will take years. In the mean time the public should be educated not to use lawn fertilizers and organizations such as the Waquoit Bay National Estuaries Research Reserve (WBNERR) and CMAST will develop recommendations on the use of lawn fertilizers. Also a ban on nitrogen fertilizers can be imposed as a component of a Nitrogen Management District. Education materials and regulatory restrictions would be made public by the district. Fines could be levied against blatant offenders. This type of ban is not unreasonable given the large amount of public and private expenditure for improved wastewater facilities in the watershed, and the length of time needed for academic and research institutions to develop more reasonable procedures to calculate this loading. The Town should consider developing a ban on lawn fertilizers as part of the Nitrogen Management District.

I. Recommended Groundwater Monitoring for Falmouth WWTF. Groundwater monitoring has been provided at the WWTF as required by the effluent discharge permit; at the Landfill as required by the Landfill closure documents; and in the Long Pond Watershed as needed to protect that public water supply. Evaluations summarized in the DWWFP/DEIR and in the FEIR indicate that future groundwater monitoring should be provided with a regional perspective to provide an early warning against undesirable consequences.

Monitoring wells 2, 2A, 5, 6, 7, 8, 9, 9A, 10, 11, 11A, 12, 12A, 13, 14, 14A, P4, and P10 should be sampled annually at the WWTF for the following parameters:

- Ammonia
- Surfactants
- Chloride
- Nitrate nitrogen
- Total nitrogen
- Total phosphorous
- Total coliform
- Copper
- Manganese
- Sodium
- Sulfates
- pH
- Specific conductance

Monitoring wells 18, 18A, 18B, and 19 in the West Falmouth Harbor area should be sampled annually for the following supplemental parameters:

- Total dissolved solids
- Chloride
- Sodium
- Ammonia
- Nitrate nitrogen
- COD
- Alkalinity
- Hardness

Monitoring wells MW-570, MW-562, MW-561, MW-560, SW-1, SW-2, and P-8 in the Long Pond Watershed area should be sampled annually for the eight parameters listed above.

Groundwater elevations should be recorded for these wells, and for wells 1, 1A, 3, 4, 15, 16, and 17 (at the WWTF) on a quarterly basis to verify groundwater mounding and groundwater flow direction. In the event that water level measurements indicate a change in the area groundwater flow pattern that might cause undesirable consequences, all of the wells listed above should be sampled within 90 days of the date of the last water level measurement, for the eight supplemental parameters. This contingency monitoring will ensure that desirable impacts relating to WWTF operation do not go undetected. If groundwater impacts are detected, response actions should be undertaken as part of a mitigation plan that are a function of the chemical compounds that are detected and the concentrations of these compounds. These responses may include:

- More frequent monitoring.
- Installation and sampling of additional strategically located monitoring wells.
- Completion of a risk assessment that would characterize the risk of the indicated impacts.
- Additional action based on the risk assessment.

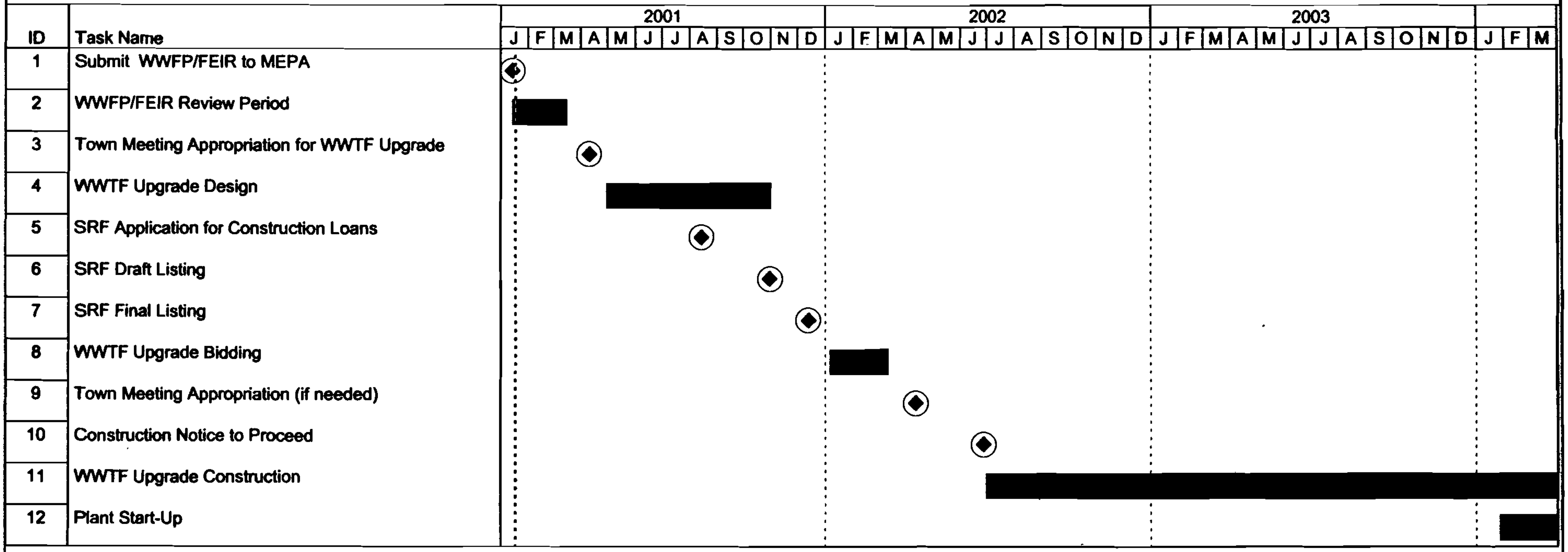
6.4 IMPLEMENTATION

The WWTF upgrade is recommended to be implemented by the year 2004 as illustrated in Figure 6-3. The major steps to complete the WWTF upgrade are listed below:

- Design the modifications to the Falmouth WWTF.
- Bid the construction.
- Construct the new facilities.

Implementation of the nitrogen management plan, modifications to local regulations and policies, and modifications to the groundwater-monitoring program should start after acceptance of the Wastewater Facilities Plan and Final Environmental Impact Report. These items should be established by 2004 when the WWTF upgrade is complete.

FIGURE 6-3
FALMOUTH WWTF UPGRADE IMPLEMENTATION SCHEDULE
Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts



ID	Task Name
1	Submit WWFP/FEIR to MEPA
2	WWFP/FEIR Review Period
3	Town Meeting Appropriation for WWTF Upgrade
4	WWTF Upgrade Design
5	SRF Application for Construction Loans
6	SRF Draft Listing
7	SRF Final Listing
8	WWTF Upgrade Bidding
9	Town Meeting Appropriation (if needed)
10	Construction Notice to Proceed
11	WWTF Upgrade Construction
12	Plant Start-Up

Project: feirfig6-3projsched
Date: Wed 1/17/01

Task ■ Milestone ◈

Implementations of the collection systems are proposed during the 20-year planning period. The timing of these projects will be dependant on available funding and Town priorities. It is noted that the Town is facing several large expenditures in the next few years for High School renovations and modifications to the Fire Station. Implementation of these projects is also dependant on homeowner and Town agreement of cost sharing details and property betterments. Collection system design will typically take six to eight months, and construction will require 12 to 18 months depending on the size of the area to be sewered at one time and the timing of the project. Sewer construction is typically not planned in the summer to minimize traffic impacts.

6.5 FUTURE PHASES OF WASTEWATER PLANNING

The Effluent Mitigation Project has been recommended as a future phase of wastewater planning in Falmouth. The primary purpose of the effluent mitigation project is to further evaluate the three sites identified in Chapter 4 of this report. The further evaluation would include subsurface investigations, soil evaluations, and possible pilot and hydraulic-load testing. This project is expected to take one to two years to complete depending on the evaluation of the sites and the technologies that are selected.

Evaluations and findings presented in this Chapter and the DWWFP/DEIR indicate that additional study is required in the Little Harbor Watershed to determine if additional properties should have nitrogen removal facilities. This additional study is expected to incorporate findings of the Ashumet Plume Nitrogen Offset Program which has investigated wastewater problems in the Great, Green, and Bournes Pond Watersheds.

Evaluations in the DWWFP/DEIR indicate that there are some properties on and around the Falmouth Heights Hill that cannot fit a fully compliant Title 5 system. These properties are not in a nitrogen-sensitive area as the properties are within a watershed that drains directly into Vineyard Sound. If desired by residents of these properties and the Town, these properties could be sewered with a cluster treatment and discharge system. This would be the lowest cost solution for this area but it would tend to limit future growth in this area. The future establishment of a cluster system would require a site-by-site analysis of the properties in this area, identification of the properties that should connect to a cluster system, and development of system costs.

Evaluations presented in Chapter 3 of this report indicate that a larger culvert will increase flushing to Oyster Pond and improve water quality in that subembayment. Additional evaluations would be needed for that potential project as identified in Chapter 3.

6.6 REQUIRED PERMITS

The following permits and approvals will be required during implementation of the Recommended Plan.

- Massachusetts EOEA approval of the Wastewater Facilities Plan and Final Environmental Impact Report.
- Cape Cod Commission approval of the Final Wastewater Facilities Plan and Final Environmental Impact Report as part of their Development of Regional Impact (DRI) approval process.
- Massachusetts Department of Environmental Protection sewer extension permitting (BRP WP 13, 17, or 18).
- Massachusetts Department of Environmental Protection Groundwater Discharge Permit (BRP WP 06) for sanitary sewage discharges in excess of 150,000 gpd or providing advanced treatment of sewage.
- Massachusetts Department of Environmental Protection Notice of Intent (WPA Form 3) for work with the 100 foot buffer to a wetland, per the wetlands regulations 310 CMR 10.00.

- Commonwealth of Massachusetts Department of Public Works permits for work within State Highway Layouts. These will be required for any work along Route 28 in the Planning Areas.

- Town of Falmouth building permits for the construction of structures as part of the Recommended Plan.

- Town of Falmouth Department of Public Works building sewers and connections permitting.

- Town of Falmouth Conservation Commission permits for work within the 100-foot buffer of a wetland.

CHAPTER 7

ENVIRONMENTAL IMPACT ANALYSIS

7.1 INTRODUCTION

In accordance with the MEPA review process, an Environmental Impact Report (EIR) is required as part of the Falmouth Wastewater Facilities Planning Study. The Code of Massachusetts Regulations (301 CMR 11.00) provides the outline for the information required for the EIR and this information is presented as part of the Facilities Planning Report. An EIR was prepared, as part of the DWWFP/DEIR and the purpose of this chapter is to summarize the findings of that EIR and provide additional analysis for any variations since the development of the DWWFP/DEIR. This chapter will also outline the mitigation measures necessary for any revised recommended plan.

As part of the DWWFP/DEIR Report, four Alternative Plans and the No Action Alternative were identified. The following is a brief description of these plans.

The No Action Alternative, as identified in the Needs Assessment Report, Screening Analysis Report, and the Draft WWFP/Draft EIR, is the consequence of doing nothing. Under this alternative the Town's wastewater treatment practices would remain the same. In addition, a 20 percent flow increase, due to unsewered properties connecting to the collection system and increased land use in sewered areas, could be expected.

Alternative Plan No. 1, as identified in the DWWFP/DEIR, is made up of the following components:

- Upgrade of the Falmouth WWTF to 1.2 mgd and nitrogen removal to meet a 10 ppm total nitrogen discharge limit.

- Construction of a 0.2 mgd small wastewater treatment facility to treat and discharge wastewater from the Maravista Planning Area.
- Connection of Falmouth High School to the WWTF.
- Sewering of the West Falmouth Harbor Watershed west of Route 28.
- Sewering of North Davis Straits and the remainder of Scranton Avenue.
- Nitrogen removal septic systems for the West Falmouth Harbor Watershed east of Route 28.
- Formation of a wastewater and nitrogen management district to manage decentralized wastewater facilities and nitrogen loading in the West Falmouth Harbor Watershed.

Alternative Plan No. 2, as identified in the DWWFP/DEIR, is made up of the following components:

- Upgrade of the Falmouth WWTF to 1.2 mgd and nitrogen removal to meet a 5 ppm total nitrogen discharge limit. This is expected to produce an average total nitrogen effluent of 3 ppm.
- Construction of a 0.2 mgd small wastewater treatment facility to service the Maravista Planning Area.
- Connection of Falmouth High School to the Falmouth WWTF.
- Sewering of West Falmouth Harbor Watershed west of Route 28.
- Sewering of North Davis Straits and the remainder of Scranton Avenue.
- Nitrogen removal septic systems for the West Falmouth Harbor Watershed east of Route 28.
- Formation of a wastewater and nitrogen management district to manage decentralized wastewater facilities and nitrogen loading in the West Falmouth Harbor Watershed.

The major difference between this alternative and Alternative No. 1 is the improved wastewater treatment to meet a 5 ppm total nitrogen effluent discharge limit. In order to meet the 5 ppm total nitrogen limit, the facility would also require the construction of a denitrification filter.

Alternative Plan No. 3, as identified in the DWWFP/DEIR, is made up of the following components:

- Upgrade of the Falmouth WWTF to 1.4 mgd and nitrogen removal to meet a 10 ppm total nitrogen discharge limit.
- Connection of Falmouth High School to the Falmouth WWTF.
- Sewering of West Falmouth Harbor Watershed west of Route 28.
- Sewering of North Davis Straits and the remainder of Scranton Avenue.
- Sewering of Maravista Planning Area.
- Nitrogen removal septic systems for the West Falmouth Harbor Watershed east of Route 28.
- Formation of a wastewater and nitrogen management district to manage decentralized wastewater facilities and nitrogen loading in the West Falmouth Harbor Watershed.

Alternative Plan No. 3 involves the upgrade of the Falmouth WWTF to treat a design wastewater flow of 1.4 mgd which is a 0.2 mgd increase over Alternative Plan Nos. 1 and 2. To meet this increased flow the addition of a well injection facility for effluent discharge would be necessary. The use of well injection will be dependent on the results of the well injection pilot (effluent mitigation) program, which was described in Chapter 4. The same Planning Areas would be served under this plan in addition to wastewater flow from the Maravista Planning Area; therefore a small wastewater treatment facility would not be necessary for that area.

Alternative Plan No. 4, as identified in the DWWFP/DEIR, is similar to Plan No. 3 except the upgrade and expansion of the WWTF would include denitrification filters to meet a total nitrogen effluent limit of 5 ppm.

7.2 SUMMARY OF THE DRAFT EIR RESULTS

Each of the five alternative plans were rated and ranked based on the criteria established in the Draft WWFP/DEIR. Table 7-1 summarizes the ranking analysis for the five alternatives, and greater detail of this analysis is included in the DWWFP/DEIR and in Appendix 7-1.

The results indicated that the slight variation in environmental impact between Alternative Nos. 1 through 4 was dependent on nine of the 16 categories examined. These categories included surface water quality, surface water hydrogeology, groundwater quality, groundwater hydrology, wildlife species and habitats, wetlands, coastal zones, land use, and scenic qualities open space and recreation. Three major components of the alternatives had the greatest impact on the determination of the alternative ratings. These three major components included future flows to the WWTF (1.2 or 1.4 mgd), the proposed nitrogen effluent limit (5 or 10 ppm), and the construction of a package treatment facility for Maravista.

Though treating more flow at the WWTF increased hydrological impacts, it actually decreased groundwater and surface water quality impacts because it provided greater treatment and a lower total nitrogen loading. These impacts (good and bad) are also reflected in the wetlands and coastal zone categories.

The change in the nitrogen limit from 10 ppm total nitrogen to 5 ppm provides a greater benefit to all areas. Wildlife species and habitats receive the greatest benefit of this improved treatment as some of these species and habitats are highly sensitive to slight changes in nutrient levels.

Scenic qualities, open space, recreation and Town land uses may experience larger impacts from the construction of a package treatment facility at Maravista. Construction of a package treatment facility with effluent disposal near Maravista would require land acquisitions and possible re-zoning of certain areas. The benefits of this would include

TABLE 7-1

ENVIRONMENTAL ASSESSMENT SUMMARY TABLE
FALMOUTH ALTERNATIVE PLANS
Falmouth Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts

Impacted Feature	No Action	Alternative #1	Alternative #2	Alternative #3	Alternative #4
Soil Disturbance					
Acquisition	0	0	0	0	0
Construction	-1	-1	-1	-1	-1
Operation	0	0	0	0	0
Surface Water Quality					
Acquisition	0	0	0	0	0
Construction	0	0	0	0	0
Operation	-1	1	2	1	2
Surface Water Hydrology					
Acquisition	0	0	0	0	0
Construction	0	0	0	0	0
Operation	0	-1	-1	-2	-2
Groundwater Quality					
Acquisition	0	0	0	0	0
Construction	0	0	0	0	0
Operation	-2	1	1	1	2
Groundwater Hydrology					
Acquisition	0	0	0	0	0
Construction	0	0	0	0	0
Operation	0	-1	-1	-2	-2
Air Quality					
Acquisition	0	0	0	0	0
Construction	-1	-1	-1	-1	-1
Operation	-1	0	0	0	0
Noise					
Acquisition	0	0	0	0	0
Construction	-1	-1	-1	-1	-1
Operation	0	0	0	0	0
Wildlife Species and Habitats					
Acquisition	-1	-1	-1	-1	-1
Construction	-2	-1	-1	0	0
Operation	0	1	2	1	2
Wetlands					
Acquisition	0	0	0	0	0
Construction	0	0	0	0	0
Operation	-1	1	2	1	2
Coastal Zones					
Acquisition	-1	0	0	0	0
Construction	-1	0	0	0	0
Operation	-1	2	2	1	2
Traffic					
Acquisition	0	0	0	0	0
Construction	-1	-2	-2	-2	-2
Operation	0	1	1	1	1

TABLE 7-1

ENVIRONMENTAL ASSESSMENT SUMMARY TABLE
FALMOUTH ALTERNATIVE PLANS
Falmouth Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts

Impacted Feature	No Action	Alternative #1	Alternative #2	Alternative #3	Alternative #4
Scenic Qualities, Open Space, and Recreation					
Acquisition	-2	-1	-1	0	0
Construction	-2	-1	-1	-1	-1
Operation	-1	2	2	1	1
Historic Resources					
Acquisition	-1	0	0	0	0
Construction	-1	0	0	0	0
Operation	-1	0	0	0	0
Land Use					
Acquisition	-1	-2	-1	-2	-1
Construction	-2	-1	-1	0	0
Operation	-2	2	2	2	2
Water Use					
Acquisition	0	0	0	0	0
Construction	0	-1	-1	-1	-1
Operation	-1	-2	-2	-2	-2
Public Health and Safety					
Acquisition	0	0	0	0	0
Construction	-1	-1	-1	-1	-1
Operation	-2	2	2	2	2
TOTAL	-32	-5	-1	-6	0
RANK	5	3	2	4	1

"urban renewal" at the old cement manufacturing plant site, and the possible construction of a recreational facility at the Maravista site.

Overall, the advantages and disadvantages tended to balance and the results for these alternatives were all close to zero (minimal impact). The summations of the ratings were all within +/- 6 points (not including the "No Action" Alternative), therefore they all are projected to have minimal environmental impacts and factors from the other analyses including cost and other non-monetary considerations will carry a greater weight in selection of a recommended plan.

Based on this ranking system, Alternatives No. 2 and 4 had the highest ranking with the smallest environmental impact. Alternative No.1 and Alternative No. 3 followed these alternatives. The "No Action Alternative" should not be considered a viable option based on its low ranking and current negative impacts to both West Falmouth Harbor and Little Pond.

The four alternatives had very close ratings following this evaluation. Factors of cost and other non-monetary issues developed in the Alternatives Screening Analysis Report and in the Draft WWFP/Draft EIR were used in combination with the findings of the EIR to select a Recommended Plan.

7.3 SUMMARY OF THE RECOMMENDED PLAN FROM THE DWWFP/DEIR

Additional issues were taken into account with the environmental impact analysis (as summarized above) when the recommended plan was developed for the DWWFP/DEIR. These additional considerations include:

- A preliminary nitrogen assessment was performed in the DWWFP/DEIR for Little Pond and its watershed that indicated that nitrogen removal facilities are needed for the Maravista Planning Area. A more detailed nitrogen assessment is needed for this area to determine if other portions of the Little Pond Watershed, such as densely developed residential areas west of Little Pond, need nitrogen removal facilities. That evaluation may indicate that additional areas of the Little Pond Watershed need to be sewered as well.

- Nitrogen loading assessments and wastewater treatment alternatives are currently being evaluated for the Great Pond, Green Pond, and Bournes Pond Watersheds east of the Little Pond Watershed as part of the Ashumet Plume Nitrogen Offset Program (discussed in Chapter section 1.6-C). Portions of the Maravista Planning Area are located within the Great Pond Watershed. Discussions with the consultants performing that evaluation indicated that sending wastewater to the Falmouth WWTF for treatment was considered as a feasible alternative. This indication may change as the feasibility of remediating nitrogen impacts in this Area is developed further.

- Effluent discharge capacity at the Falmouth WWTF is limited due to low permeable soils in that portion of Falmouth. Renovation of the existing aerated pond basins to sand infiltration beds is proposed as part of all the alternative plans to increase the discharge capacity to 1.2 mgd. The addition of a well injection effluent discharge facility is proposed as part of Alternative Plan No. 4 to move a portion of the discharge outside the Snug Harbor Watershed, save capital costs, and increase the discharge capacity. Well injection technology is new to Massachusetts and would need to be pilot tested before it is found to be feasible and approved by Massachusetts DEP.

Based on the environmental impact analysis and consideration of the additional issues, it was decided to modify the Alternative Plan No. 4 slightly to formulate the Recommended Plan.

The Recommended Plan included the upgrade of the existing Falmouth WWTF to 1.2 mgd and meet a max day effluent nitrogen concentration limit of 5 ppm. The upgrade is also expected to produce an average effluent concentration of 3 ppm total nitrogen. This facility will collect and treat wastewater from the existing collection system, Falmouth High School, the West Falmouth Harbor Watershed – west of Route 28, and expansion of the collection system in North Davis Straits and Scranton Avenue. The alternative does not involve the construction of a package treatment facility or collection system for the Maravista Planning Area.

The Recommended Plan was evaluated in detail based on the same criteria used in evaluating the four Alternative Plans (Nos. 1 through 4) and the No Action Alternative. This evaluation was taken further to assess the direct and indirect impacts of the project, their duration, either long-term or short-term, and the area impacted. Table 7-2 summarizes this evaluation.

7.4 IDENTIFICATION OF THE ENVIRONMENTAL IMPACT ANALYSIS BASED ON A REVISED RECOMMENDED PLAN.

The Recommended Plan has been revised slightly based on the desire to meet a more stringent surface water standard in Snug Harbor as described in Chapters 3 and 6 of this Wastewater Facilities Plan and Final Environmental Impact Report. The slight revisions include:

- Effluent discharge to the Snug Harbor Watershed will be limited to 1.0 mgd.
- This effluent flow discharge limitation is expected to be reconsidered by DEP after the modifications to the WWTF are complete and the performance of the new treatment facilities has been demonstrated. If the treatment facilities can produce an effluent with a nitrogen concentration less than 3 ppm, DEP will consider increasing the permitted effluent flow at the treatment plant site into the Snug Harbor watershed.
- An effluent mitigation project should be initiated as a follow-up to the Wastewater Facilities Planning Study to evaluate the three alternative discharge sites identified in Chapter 4 of this Report. As discussed in Chapter

TABLE 7-2

ENVIRONMENTAL ASSESSMENT OF THE RECOMMENDED PLAN

Falmouth Wastewater Facilities Planning Study

Town of Falmouth, Massachusetts

Parameter Impacted	Short or Long-term effect	Benefit /Detriment	Magnitude of Impact	Direct or Indirect Impact	Area Impacted
Soils disturbance					
Construction	Short	Detriment	Minor	Direct	Planning Areas
Surface Water Quality					
Construction	No Impact				
Effluent Discharge	Long	Benefit	Major	Indirect	WFH
Groundwater Quality					
Construction	Short	Detriment	Minor	Indirect	Local
Effluent Discharge	Long	Benefit	Major	Direct	WFH Watershed
Groundwater Hydrology					
Effluent Discharge	Long	Detriment	Minor	Direct	WFH Watershed
Air Quality					
Construction	Short	Detriment	Minor	Direct	Planning Areas
Treatment Plant Operation	Long	Detriment	Minor	Direct	Local
Noise					
Construction	Short	Detriment	Major	Direct	Planning Areas
Treatment Plant Operation	Long	Detriment	Minor	Direct	Local
Wildlife Species and Habitats					
Loss of Habitat	Short	Detriment	Minor	Direct	Local
Shellfish and Marine Life	Long	Benefit	Major	Indirect	WFH
Forests	Long	Detriment	Minor	Direct	Local
Rare and Endangered Species	Short	Detriment	Minor	Direct	Local
Wetlands					
Wetlands, Ponds & Bogs	Long	Benefit	Minor	Indirect	Local
Coastal Zones					
Coastal Zones	Long	Benefit	Minor	Indirect	WFH
Traffic					
Construction	Short	Detriment	Major	Direct	Town
Treatment Plant Operation	Long	Detriment	Minor	Direct	Local
Open Space					
Construction	No Impact				
Treatment Plant Operation	No Impact				
Recreation					
Construction	Short	Detriment	Minor	Direct	Local
Treatment Plant Operation	No Impact				
Scenic Qualities					
Construction	Short	Detriment	Minor	Direct	WFH
Treatment Plant Operation	Long	Benefit	Major	Direct	Town
Historic Resources					
Construction	Short	Detriment	Minor	Direct	Local
Treatment Plant Operation	Long	Benefit	Minor	Indirect	Planning Areas
Land Usage					
Zoning	Long	Detriment	Minor	Direct	Local
Acquisitions (treatment)	No Impact				
Acquisitions (discharge)	Long	Detriment	Minor	Direct	Local

1/5/01 10:59 AM
EIR-Table7-2.xls Recommended Plan,jjg

Section 1.6I, the Effluent Mitigation Project has been listed on SRF's priority list for zero-percent funding.

These modifications make no significant change to the environmental impact analysis of the DWWFP/DEIR. Environmental impact analysis of effluent discharge at the three alternative sites will be performed as part of the Effluent Mitigation Project or in a subsequent project.

The full Environmental Impact Analysis, which was presented in the DWWFP/DEIR, remains unchanged for the FEIR and is attached in Appendix 7-1.

7.5 MITIGATION MEASURES

As part of the EIR process outlined in 301 CMR 11.07, the following mitigation measures were identified in the DWWFP/DEIR. These measures were outlined and identified to limit negative environmental impacts and/or create positive environmental impacts during development and operation of this alternative.

1. **General Construction Measures.** During construction, the site shall be secured to prevent unauthorized entry to the construction site, and to protect existing and adjacent facilities and properties. Supplemental lighting, signs, railings, and construction barriers shall be used as necessary to provide safety to employees, construction workers, visitors and the general public during the construction process in accordance with OSHA and other applicable regulations.

Water used during the construction process, and that generated from runoff on the site, will be controlled by proper site grading, and by providing temporary berms, drains, and other means to prevent soil erosion. These means will also be used to reduce puddling and runoff on the site. Existing and new catch basins will be protected from siltation using hay bales and siltation fence. At no time will the pumping of silt-laden water be allowed in trenches, excavations, surface waters, stream corridors or wetlands. Pollution controls will also be provided to prevent the contamination of soils, water and the atmosphere from the discharge of noxious, toxic substances, and pollutants produced during the construction process.

Erosion control measures including hay bales, siltation fencing and erosion control fabric will be used to provide sedimentation barriers. Temporary seeding and mulching may also be used to minimize soil erosion and provide soil stabilization on slopes. Diversion trenches may also be used on the uphill side of disturbed areas to divert surface runoff. Land disturbances will be kept to a minimum to reduce impacts and erosion. All erosion control methods shall be in accordance with the State of Massachusetts and the Town of Falmouth.

The site will also be maintained free of waste materials, debris, and trash following each day of work. Waste and other debris will be collected and disposed of off-site periodically. At no time during construction will the dumping of spoil material, waste, trees, brush or other debris be allowed into any stream corridor, any wetland, any surface waters or any unspecified location. The permanent or unspecified alteration of stream flow lines is not allowed during construction.

Construction noise with heavy equipment will be limited to within normal operation hours of 8:00 am to 5:00 PM. Dust controls including the use of street sweepers and/or watering trucks will be used to minimize air-borne dust.

2. Collection System Construction. In addition to the measures identified in the general construction section. Police details and other traffic controls will be necessary to minimize traffic problems during construction of collection systems. Detours and trucking routes will need to be identified prior to construction and these routes will need to be designed to minimize impacts to surrounding residential areas not accustom to heavy construction and increased vehicle traffic. Construction of the collection system will have to allow for safe travel of both pedestrians and vehicle traffic.

Construction is to remain within the road right-of-ways as much as possible to minimize impacts to surrounding properties. Use of trench boxes, bracing and other shoring methods will be utilized to provide the necessary safety for workers and others at the construction site. Any property, including trees and vegetation, that is damage during construction is to be repaired or replaced by the contractor. Any collection system components and pump stations to be constructed outside of road right-of-ways will be reviewed with the Massachusetts Historical Commission.

3. **Wastewater Treatment Facility Site.** In addition to those mitigation measures identified previously, the following measures will be provided. The greatest mitigation measure is the operation of a new advanced wastewater treatment system designed for nitrogen removal, which will result in long-term improved water quality. The existing WWTF will remain in operation during the construction of the new facility and all permit requirements will continue to be met to the best of their ability during this construction.

This new wastewater treatment system will help reduce the amount of nitrogen entering the West Falmouth Harbor watershed, and will also provide a greater removal of suspended solids and BOD in the effluent. The downside to this process is an increase in the production of sludge, which will be disposed of at an approved off-site facility in accordance with DEP guidelines.

The facility will be designed with the proper odor controls, including tank covers, filters and other odor removal processes in addition to those currently being constructed. The new facility will also be designed to minimize noise during operation by insulating blower and pump galleries, and installing mufflers and silencers on equipment.

Df

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March 7, 2000

MAR - 9 2000
MEPA

Cape Cod Commission
3225 Main Street
P.O. Box 226
Barnstable, MA 02630

RE: Falmouth Wastewater Management Facilities Planning Study

Gentlemen:

Reference is made to the hearing held on March 2, 2000 concerning the on-going study and draft environmental impact report prepared by the Town of Falmouth and its consultants regarding the above project.

As you know, I have appeared at earlier hearings and previously commented in writing. I appeared at the hearing on Thursday, March 2nd, gave oral testimony and, therefore, will keep these written comments very brief. My comments are as follows:

1. On the eve of the hearing, you were in receipt of the report entitled *Evaluation of the Nutrient Related Health of West Falmouth Harbor* prepared by Brian L. Howes, Kirsten N. Smith and George R. Hampson. The findings and conclusions of the report are devastating. Nevertheless, at long-last, we know the nitrogen threshold that will support a recovery of eel grass and associated animal life and plant communities through West Falmouth Harbor. The answer is: 0.35 mg N L^{-1}.

I listened carefully to Mr. Nathan Weeks of Stearns & Wheler and, frankly, found his testimony confusing and inadequate on the issue of the critical nitrogen loading that the harbor can sustain. I am unfamiliar with the SA-N standard he was addressing as the design standard. It appears from his answer to one question that the SA-N standard would allow over 11,000 kilograms of nitrogen to emanate from the plant to the harbor. Another standard would only allow in the order of 3,000 kilograms to emanate from the plant. Why are we using kilograms? Why can we not get an answer to what percentage of nitrogen will result in the harbor from the design proposed by Stearns & Wheler with their recommended alternative 4? It appears it will be substantially higher than 0.35.

So that the record is clear, individually and on behalf of the West Falmouth Boat Club which contributed to the financing of the Evaluation prepared by Brian Howes, we object to the approval of any design that will result in nitrogen concentration in West Falmouth Harbor higher than 0.35. Bear in mind, the Town of Falmouth, in its wisdom when regulating other parties, set the standard at 0.32. To respond to Mr. Weeks, we are not insisting the water be as clear as it was when the Indians lived here, but we would like our harbor back in the condition it was in the early 1980's.

2. My second comment relates to the request to the Phase I waiver. I orally testified that I am truly conflicted on this issue. Speed in the remedy is important. I have sounded that clarion call for five years. Nevertheless, I have the distinct feeling there is a rush to start the process and spend money on a design that will not be adequate. I envision the Town later arguing that you must approve a less than adequate design because they have spent so much money by that time. We, therefore, oppose the Phase I waiver design unless and until it is made very clear by the proponents that the funds they intend to spend are not wasted when, and if, the approval is granted with conditions that the nitrogen loading to West Falmouth Harbor be no greater than 0.35.

I testified, and reiterate, that I am also conflicted on the pilot project for deep well injection. Given the glacial terrain of West Falmouth Harbor and its environs, there is no predictability or modeling able to answer the hydrological question of where the deep well-injected plume will surface. There may be a layer of clay 50 yards east of my dock in West Falmouth Harbor which will result in the entire surfacing of the plume in front of my house!

I fear that the unanswered questions to the deep well injection proposal will only further delay the process.

I am saddened that the proponents no longer seem to propose the sewering of West Falmouth which would be a significant mitigating factor.

Finally, with the results of the Howes' Evaluation in and the Town's urgent request for a Phase I waiver, it is a bit disingenuous to allow them to continue to truck into this overburdened watershed, septage which by some accounts is 30-50 percent as concentrated in nitrates as sewerage. Should not termination of septage be an immediate condition on any Phase I waiver? I believe so.

Thank you for your consideration of these comments.

Sincerely,

Robert E. McLaughlin, Sr.

REMSr./sjf

cc: Robert Durand, Secretary
<u>ATTENTION</u>: Mr. Richard Foster
Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

Lauren Liss, Commissioner
Commonwealth of Massachusetts
Department of Environmental Protection
One Winter Street
Boston, MA 02101

David DeLorenzo, Deputy Regional Director
Mr. Brian Dudley
Bureau of Resource Protection
Commonwealth of Massachusetts
Department of Environmental Protection
20 Riverside Drive
Lakeville, MA 02347

Troy Clarkson, Chairman
Board of Selectmen
Town of Falmouth
Falmouth Town Hall
59 Town Hall Square
Falmouth, MA 02540

John D. Ross, President
West Falmouth Boat Club, Inc.
12 Little Island Road
West Falmouth, MA 02574-0225

DF

P.O. Box 309
West Falmouth, MA 02574-0309
March 1, 2000

MEPA Unit, Secretary
Executive Office of Environmental Affair
20th floor,
100 Cambridge St.
Boston, MA 02202

#11957

MAR - 7 2000
MEPA

To Whom It May Concern:

As a long time resident on property ajacent to West Falmouth Harbor, comprised of marsh lands and upland, we are very concerned. The marsh portion of the property is currently receiving a high percentage of the Falmouth Waste Water Treatment Plant nitrogen (the highest in West Falmouth).

Once pristine waters of the Mashapaquit Creek and West Falmouth Harbor are now a cloudy brownish green and lack many former marine animals that previously inhabited these waters in the estuaries where sea animals breed.

We feel further loading of current Falmouth Waste Water Treatment Plant is not in the interest of Falmouth, West Falmouth and the residents thereof: long range will be lower property valuation when people leave due to contamination and smell of decaying marine life. It has already begun to happen. We do detect odors at times which is NOT natural marsh odor. We have lived here for fifty- five years and know the difference in this odors.

Please insist on a treatment plant that is engineered to standards of all available up-to-date technology so that we and others can continue to enjoy this lovely location. Most importantly to help to preserve the fragile marine sea creatures we have all grown to enjoy, especially in Massachusetts.

Thank you for your attention to this message.

Very truly yours,

Donald B. Cook

Donald B. Cook

Sally B. Cook

Sally B. Cook

07

#11867

THE COALITION FOR BUZZARDS BAY

Working to improve the health of Buzzards Bay through education, conservation, research and advocacy.

17 Hamilton Street
New Bedford, MA 02740
tel: (508) 999-6363
fax: (508) 984-7913
www.savebuzzardsbay.org

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MAR 14 2000
MEPA

March 8, 2000

Mr. James Wickersham, Director
MEPA Unit
MA Executive Office of Environmental Affairs
100 Cambridge Street, 20th floor
Boston, MA 02202

Re: Comments on Falmouth Wastewater Facilities Planning Study - #EIR 99001

Dear Mr. Wickersham:

The Coalition for Buzzards Bay offers the following comments regarding the Falmouth Wastewater Facilities Planning Study in Falmouth, Massachusetts. The Coalition for Buzzards Bay is a non profit, membership organization founded in 1987 and dedicated to the restoration, protection, and sustainable use and enjoyment of Buzzards Bay and its watershed.

The Coalition encourages the Town of Falmouth to continue to pursue the best environmental protection and restoration of West Falmouth Harbor throughout the Waste Water Treatment Facility planning and upgrade process. West Falmouth Harbor is a coastal estuary in decline. It is imperative that the town through its wastewater planning process and ultimate Plant upgrade implement a solution capable of reversing this decline and sustaining water quality and living resources in West Falmouth Harbor into the future.

Specifically, The Coalition for Buzzards Bay requests the following action by Secretary Durand and MEPA:

1. Deny the Town's request for a Phase I waiver.
2. Set a 3.5 ppm Total Nitrogen Discharge Limit for the plant – the only number capable of reversing the documented decline in the health of West Falmouth Harbor water quality and aquatic resources.

Background

West Falmouth Harbor is showing the initial stages of nutrient overloading. While residential and commercial development within the watershed provide significant inputs of nitrogen to the Harbor, the Falmouth Wastewater Treatment Facility accounts for more than two thirds of the nitrogen loading. The continually increasing nitrogen loading from sources outside of the West

Falmouth Harbor watershed through the WWTF continues to drives this estuary beyond its capacity to assimilate nitrogen without ecosystem decline.

The Harbor is important for recreational boating and supports an important habitat for quahogs, soft-shell clams, and oysters and to some extent scallops. In 1993 the Harbor supplied over 8% of Falmouth's commercial and recreational catch of clams, quahogs, and scallops, some 1200 bushels valued at about $90,000 (Town of Falmouth, 1993). In addition, the inner Harbor supports an "up-weller" for shellfish propagation, maintained by the Town Shellfish Department. The Department in 1997 used the Harbor for transfer of 1158 bushels of quahogs and 100,000 of seed. The MA Division of Marine Fisheries planted seed bay scallops in 1995 (1.5 million) followed by 75,000 seed by the Town in 1997.

Eelgrass beds which are important for some shellfish propagation are highly sensitive to nutrient overloading. Eelgrass beds within West Falmouth Harbor in the mid-1980's were found to cover ca. 28 acres. A current assessment providing a more detailed assessment of eelgrass health in the Harbor has been completed by scientists at the University of Massachusetts Center for Marine Science and Technology (CMAST). This study was prepared under contract with the MA DEP and has not been released to the public although it has been reported to identify some significant loss of eelgrass from inner Harbor areas. The presence of eelgrass is important to the use of West Falmouth Harbor as bay scallop habitat. It is clear from the seed/harvest programs in 1995 and 1997 that scallop production within this system is still possible, although potentially declining.

West Falmouth Harbor is notable for its diversity of nitrogen sources. Among these sources however, the Town's Waste Water Treatment Facility, is by far the largest and most rapidly expanding source. The average annual discharge of nitrogen to the spray irrigation and rapid sand infiltration beds in 1996-98 is more than 2x higher than in 1991-92 (K. Smith, M.A. Thesis, 1999). Since the WWTF represents more than two-thirds of the total watershed nitrogen loading, this translates into an increase in total nitrogen loading of more than one-third over six years. In addition, since the travel time for nitrogen from the WWTF through groundwater transport to the Harbor is about 6 years (effluent nitrogen entering the Harbor in 1998 was discharged in 1992), the Harbor will experience more than a 33% increase in total nitrogen load from present (1998) to 2004. This increase will occur even if the WWTF discharged ceased in 2000. Since Snug Harbor is currently showing the initial signs of nutrient overloading, this large input is cause for serious concern.

West Falmouth Harbor is currently in need of nitrogen management to protect its resources. Nitrogen management for this system will have to focus primarily upon reducing nitrogen inputs from wastewater due to discharge from the WWTF and from present (and future) residential housing within the watershed. The increase in nitrogen loading from the existing groundwater plume will take place with likely negative effects on inner Harbor systems during the coming years. For these reasons, nitrogen reduction should be a priority for the WWTF upgrade which will be performed over the next few years, for the future protection and restoration of this harbor system.

Harbor Monitoring Results

These findings continue to be supported by the water quality data collected in the Harbor over the past seven years by The Coalition for Buzzards Bay and published in the December 1999 Report, Baywatchers II: Nutrient Related Water Quality of Buzzards Bay Embayments. West Falmouth Harbor has been monitored by the Baywatchers and Falmouth Pond Watchers since 1992. Oxygen depletion of bottom waters is observed at all Harbor stations during summer. Oxygen depletion to 80% of air saturation is common throughout the inner regions and relatively infrequent in the outer Harbor. At present, within the inner regions periodic oxygen depletion to 60% saturation is relatively common. However, only in Snug Harbor do oxygen levels routinely reach ecologically stressful levels. There appears to be a trend in the oxygen data showing greater depletion in recent versus previous years in Snug Harbor and "outer Snug Harbor" (mid-region at Town Dock). The other stations although variable, do not show the same trend. Oxygen depletion to below 80% of air saturation occurred in Snug Harbor only about 15% of the time in the 1992-94 sampling compared to more than 60% in the 1995-98 sampling period with the mid-Harbor showing a similar but smaller trend, 20% versus 32% respectively. The Falmouth WWTF nitrogen plume began discharging to the Mashapaquit Creek/Snug Harbor sub-system in the mid 1990's (1994-95). Nitrogen levels are consistently higher within the inner Harbor than the outer Harbor waters throughout the monitoring period. This is common to most embayments as the watershed inputs are typically highest in the inner regions and this is where flushing is lowest. However, there appears to be a trend in the nitrogen concentrations similar to that observed for oxygen and which appears to coincide with entry of the WWTF plume. The Snug Harbor total nitrogen concentrations from 1995-1998 average 23% higher than in the years 1992-93 (plume entry was 1994-95). In contrast, both the mid and outer Harbor regions showed slightly lower levels (ca. 5%) in the later versus earlier years. Therefore, it appears that the trend in nitrogen is related to events in Snug Harbor rather than being a reflection of influences from the greater system.

In addition to a decline in water quality related parameters, the Coalition for Buzzards Bay Health Index suggests that changes may be resulting in a gradual decline in overall system quality. However, since this is only a screening technique, we support the town's efforts of acquire additional field measurements to confirm the level of decline in habitat quality associated with the observed increases in nitrogen and depletion in bottom water oxygen levels. While outer West Falmouth Harbor and Harbor Head are showing generally high water quality - above the median for the embayments to Buzzards Bay - Snug Harbor is currently showing only moderate to fair quality.

Conclusion

The Town's request to move forward with the plant's design through a Phase I waiver is premature and should be denied by Secretary Durand in the interest of designing a plant that will put a halt to the decline of water quality and resources in West Falmouth Harbor. Such an outcome can only be achieved with a firm nutrient removal target set for the plant's design.

We believe that the plant's upgrade should result in the establishment of a nitrogen limit of 3.5 ppm for the facility. Furthermore any corresponding physical improvements to the Plant in order to accommodate a projected increase in flow should have a target that will not increase nitrogen loading to the Harbor over the current existing conditions. This would include an offset from sources located within the West Falmouth watershed. Otherwise, the result will be the expenditure of $14 Million to create an embayment in which the ecological conditions are even more depleted than today. This number is supported by all best available science on the Harbor.

Thank you for the opportunity to comment on this important project.

Sincerely,

Mark Rasmussen

Mark Rasmussen
Executive Director

Attachment
Baywatchers II: Nutrient-related Water Quality of Buzzards Bay Embayments

cc: Cape Cod Commission
Falmouth Board of Selectmen
Falmouth Water & Sewer Commission
Falmouth Department of Public Works
West Falmouth Boat Club

214 Chapoquoit Road
PO Box 79
Falmouth Ma. 02574
Fax 617 227 7177
March 6, 2000

Seth Wilkinson
Caps Cod Commission
PO Box 226 Barnstable Ma. 02630
By Fax at 508 362 3136

Dear Mr. Wilkinson:

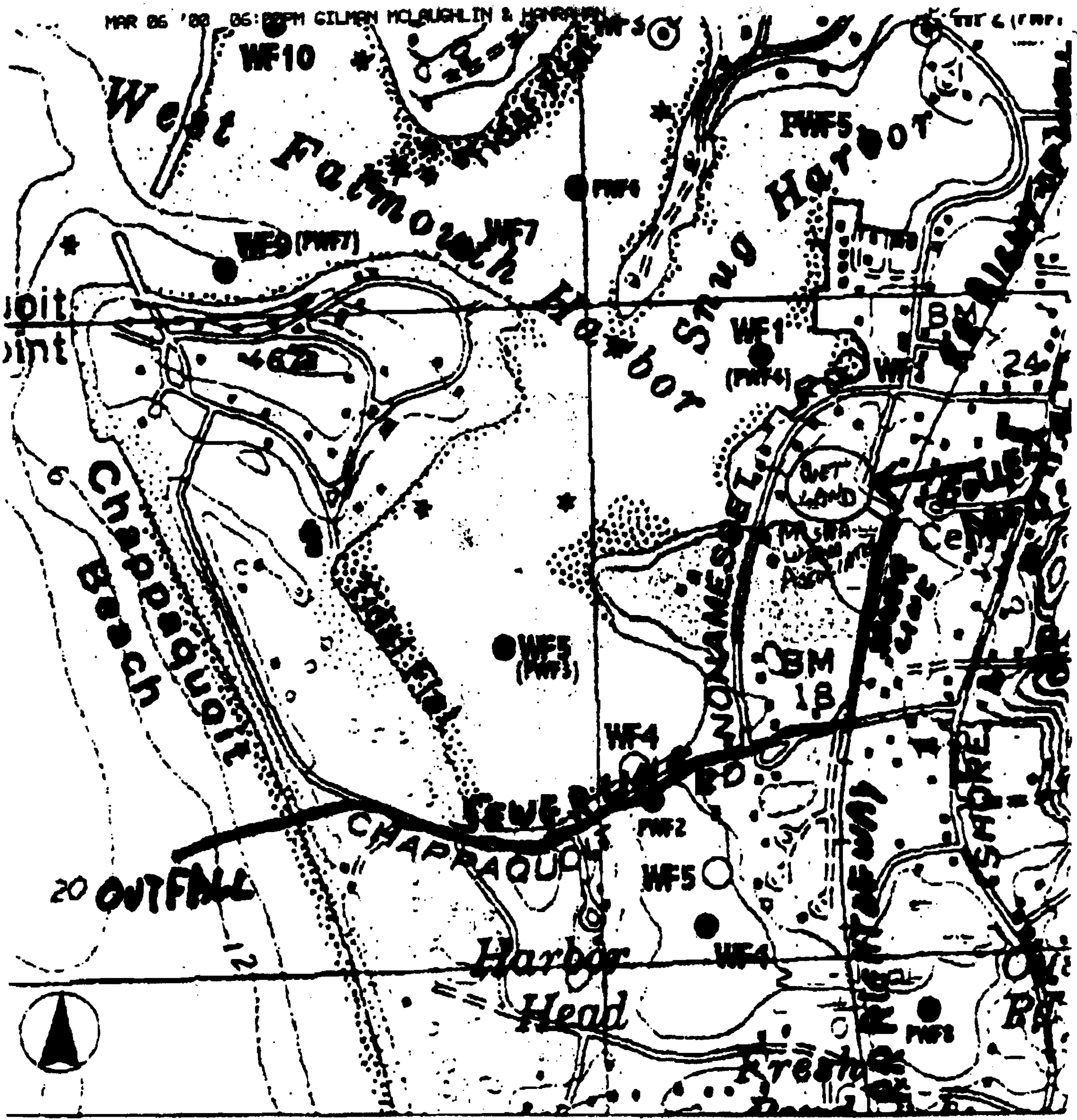
This is a comment on the Falmouth Wastewater Facilities Planning Study #EIR99001.

I am a property owner on West Falmouth and have studied the problems of nitrogen loading extensively. I have been concerned by the increasing effects of the nitrogen nutrient load from the WWTF on the harbor, particularly the latest assessment prepared by Brian Howes Kirsten Smith and George Hampson from the center for Marine Science & Technology-Univ of MA. Dartmouth.

From reading the literature, I draw the following conclusions about the present and future state of the harbor.

1 West Falmouth Harbor as a whole and particularly Snug Harbor has been increasingly stressed since the plume of the WWTF first arrived at the Harbor in 1994.
2 That stress in increasing because of the continuing introduction of an excessive load of nutrients into the harbor
3 No matter what steps are taken concerning the plant itself in the future there is already a seven year nutrient plume in the groundwater which has not been addressed by any of the remedial proposals.
4 The plume in the groundwater will bring increasing loads of nitrogen to the harbor in the next seven years because the load of nitrogen treated at the WWTF has steadily increased and because the effect of the infiltration basins installed in 1995 have not been felt by the Harbor.
5 The determination to continue to accept septage at the WWTF exacerbates the problem by adding an especially rich nitrogen supply which can easily be trucked to another facility.

There are four proposals presently on the table which will help the long range solution to the problem



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nbayment and Watershed Characteristics

st Falmouth Harbor, a coastal embayment opening into the

1 Improve the nitrogen removing capacity of the treatment plant so that it discharges less nitrogen into the groundwater
2 Sewer West Falmouth so that nitrogen presently going into the harbor will be removed from the watershed.
3 Discharge the effluent from the plant outside of the West Falmouth Harbor Watershed.
4 Stop taking septage.

However, none of these solutions with the possible exception of the sewering of West Falmouth Harbor will do anything to mitigate the effects of the seven year supply nitrogen presently in the water table between the WWTF and West Falmouth Harbor.

Before you go out and spend 32 million dollars for a solution which may take effect after the patient is dead, let me think outside the box and propose a piece of a solution which might make the plans, you already have, less expensive, and provide short term as well as long term relief to the harbor.

The groundwater heading toward West Falmouth Harbor from the WWTF is only dangerous to the environment because it contains excessive concentrations of nitrates which can cause severe damage to marine life in a small harbor which does not flush adequately. That groundwater is harmless in a much larger body of water such as Buzzards Bay because it does not significantly increase concentrations.

If we could find a way to cause the nitrogen rich groundwater to skip West Falmouth Harbor and discharge directly into Buzzards Bay it would be harmless and the Harbor would quickly recover. The deep injection system which is under exploration is designed to achieve that goal, but predicting the course of a deep injection plume is tricky and by the time it is built. it would not bring any relief for at least ten years.

There is another way to accomplish the goal of keeping the plume out of West Falmouth Harbor which involves thinking in ways that have not been evident in present attempts to solve the problem. The nitrogen rich groundwater can be intercepted before it reaches the harbor and discharged directly into Buzzards Bay.

Intercepting a plume is well within present technology. The cleanup of Otis Air base is accomplished by intercepting a plume and pumping it to the surface. There is abundant data in West Falmouth so show the location of the plume. It must be close to the surface as it approaches West Falmouth Harbor.

There is adequate public land available to intercept the plume where ever it is found. The railroad right of way is between the WWTF and the harbor. Wells can be drilled on that land. An easier solution might be to explore the nitrogen content of the standing water in the Wetland of the property of Nashawena Associates, the tennis club which sits between the railroad track and Snug Harbor. It might be possible to pump a large portion of the plume from that wetland. I am counsel for Nashawena Associates an organization of people deeply concerned with the harbor. I am sure I can get their cooperation.

Once the plume is captured it must be diverted so that it does not enter the watershed of the harbor. If it is captured under the railroad tracks or in their vicinity, it can be put in a pipe laid under the railroad right of way and pumped to the intersection of the railroad tracks and Chapoquoit road, approximately one half mile. From there another half mile of mile of pipe along Chapoquoit road and the public beach parking lot will take it to Buzzards Bay where it can be properly diffused with no effect on the environment into that much larger body of water. Since the entire project would only involve one pumping station and about one mile of sewer pipe, it could be accomplished within one year after it was permitted.

If this kind of plan works it could considerably cut the other costs of the solution. You would only need to sewer that part of West Falmouth east of the railroad track. The parameters of the plant design and use might be modified.

This is the only solution to the problem of the treatment plant which provides a remedy for the condition of West Falmouth Harbor during the next ten years and prevents the demise of the marine life which is what characterizes the Harbor as a high class body of water.

I realize that permits are not generally granted for piping groundwater into bodies of water such as Buzzards Bay. However, in this case the groundwater gets there eventually, and a large outfall pipe was placed in Massachusetts Bay from the Deer Island Facility. All we are really doing is preventing it from causing damage in West Falmouth Harbor before it reaches Buzzards Bay.

I believe that you should not grant any fast track authority to the Town until at least they consider this alternative.

I am attaching a plan to this letter showing where the groundwater could be collected, how it could be transported and where it could be discharged.

Thank you for your consideration. You can reach me in the office at 617 227 9999

Sincerely yours,

Walter H. Mclaughlin Jr.

Subject: Falmouth WWFPS #EIR99001
Date: Mon, 06 Mar 2000 12:25:23 -0500
From: Alan Fleer <afleer@whoi.edu>
To: Seth Wilkinson <planners@capecodcommission.org>

Alan P. Fleer
411 West Falmouth Highway
Falmouth, MA 02540
6 March 2000

Robert Randolph
Subcommittee Chair
Cape Cod Commission
P.O. Box 226
Barnstable, MA 02630

Re: Falmouth WWFPS #EIR99001

Dear Mr. Randolph,

This letter includes comments made at your hearing of March 2 reviewing the Draft WastewaterFacilities Plan and Draft Environmental Impct Report plus the draft report 'Evaluation of the Nutrient Related Health of West Falmouth Harbor: Determination of loading thresholds in support of wastewater facilities planning' by Brian Howes et. al. As the Falmouth Planning Board's representative on the working group, my greatest reservation about choosing Sterns & Wheler was that Dr. Howes was not part of their team. It is to the credit of Dr.Howes and the benefit of all that his report is avaliable for the present study. His study provides a performance standard for Nitrogen concentration in harbor waters that is directly linked with indicators of harbor health based on observations in the harbor itself, and is esentially seperate from the findings and arguments about attenuation of nitrogen in wetlands. I would urge acceptance of the 0.35 ppm standard. What this means is that even in the case of present and projected waste water flows and certainly for any increases in sewered areas, that a final outfall outside of West Falmouth Harbor will be necessary. It is for this reason that I an particularly critical of the proposed deep well injection pilot study site that could outfall in the outer snug harbor/south cove area. As in-flowing diluting Buzzards Bay waters pass through these areas, this outfall will effect the whole harbor especially the poorer flushed areas of Snug Harbor and Oyster Pond. I would suggest that alternative deep well injection pilot study sites include areas to the north ie Tech Park, Balleymeade etc. as this area is the only watershed in Falmouth that does not outfall into a coastal pond or harbor. Dr. Howes also recommends a more northerly site for infiltration to better utilize the denitrifing capacity of the Mashapaquit marsh. A more northerly site would reduce any potential impacts to the Long Pond source of municipal water supply. The fact that the proposed site is owned by the town and is proximal to the waste water facility is insufficient reason if the site were to become a permanent facility.

I accept the fact that the present location of the waste water treatment facility and the collection system will not change. These siting decisions were made in the past although not from a well enough informed basis, in hindsight. To find a new site and change the collection system already approaches the impossible: the expense and delays in implimentation would be unacceptable. The challenge is to upgrade the plant and remove its unacceptable impacts to the harbor. The choice of a recomendation that includes the best avaliable nitrogen reduction with a permitted maximum effluent concentration of 5 ppm should be allowed to proceed with a phase one waiver. This does not mean that all the other issues have been resolved and I would presume that the 'Final' EIR and Facilities plan would be a while in being completed. Whether the town meeting and subsequent voter approval will occur this spring or later, effects short term measures that might be necessary eg suspention of acceptance of septage. Dr. Howes denitrification results and a discussion of 'using' Mashapaquit marshes must be reviewed. Results of the deep well injection pilot must be reviewed. And avaliability of alternate infiltration/injection sites must be determined.

Other comments specific to the draft:

P 5-9 Oyster pond has no designation(this reference is to a pond on the Vineyard Sound side of Falmouth)

P 5-11 The choice of the SA-N standard has insufficient basis

P 5-12 The use of the 'Local' residence time is not protective of water quality in poorly flushed areas

P 5-18 The source of the 45% nitrogen attenuation by spraying is not indicated

P5-19 The on-site loading is not consistent with the table on 5-8. Is sewering and treatment at the plant presumed?

P5-12 The zoning by-law has never been applied to any Buzzards Bay watershed (in spite of my efforts)

P5-24 The original culvert into Oyster Pond (before repairs to RR tracks in '80s) was larger and 18" deeper

P 5-34 omission: west towards WEST falmouth harbor

Thankyou for considering my comments.

Sincerely,

Alan P. Fleer

Subject: internet email
Date: Thu, 09 Mar 2000 09:47:00 +0000
From: Cindy Reynolds <creynolds@capecodcommission.org>
Organization: Cape Cod Commission
To: Seth Wilkinson <swilkinson@capecodcommission.org>

Subject: Comments to Cape Cod Commission
Date: Wed, 8 Mar 2000 16:53:39 -0500
From: "John Drake Ross" <jdross@capecod.net>
To: "Seth Wilkinson" <frontdesk@capecodcommission.org>

Seth......I would like to make the following comments to the Commission about the meeting on March 2nd. I am sending them to your attention and appreciate your adding them to the other comments. I will, also Fax them to Richard Foster. The project number is 11857.

To the Cape Cod Commission:

Let me start by giving you some background on the West Falmouth Boat Club of which I am President. The club was founded thirty years ago to act as a liaison group between the town of Falmouth on matters relating to West Falmouth Harbor. We work closely with their Harbormaster, Shellfish Warden and other town committees. In addition, we run a nightly security patrol during the summer months to prevent thefts and vandalism. Five years ago, some of our members began to notice that changes were happening in regard to our harbor. We decided to use the club as a voice for the citizens who use and care about these waters and began to talk with the town about our concerns. This group well represents the people that are concerned about the future of West Falmouth Harbor, as we have over two hundred members.

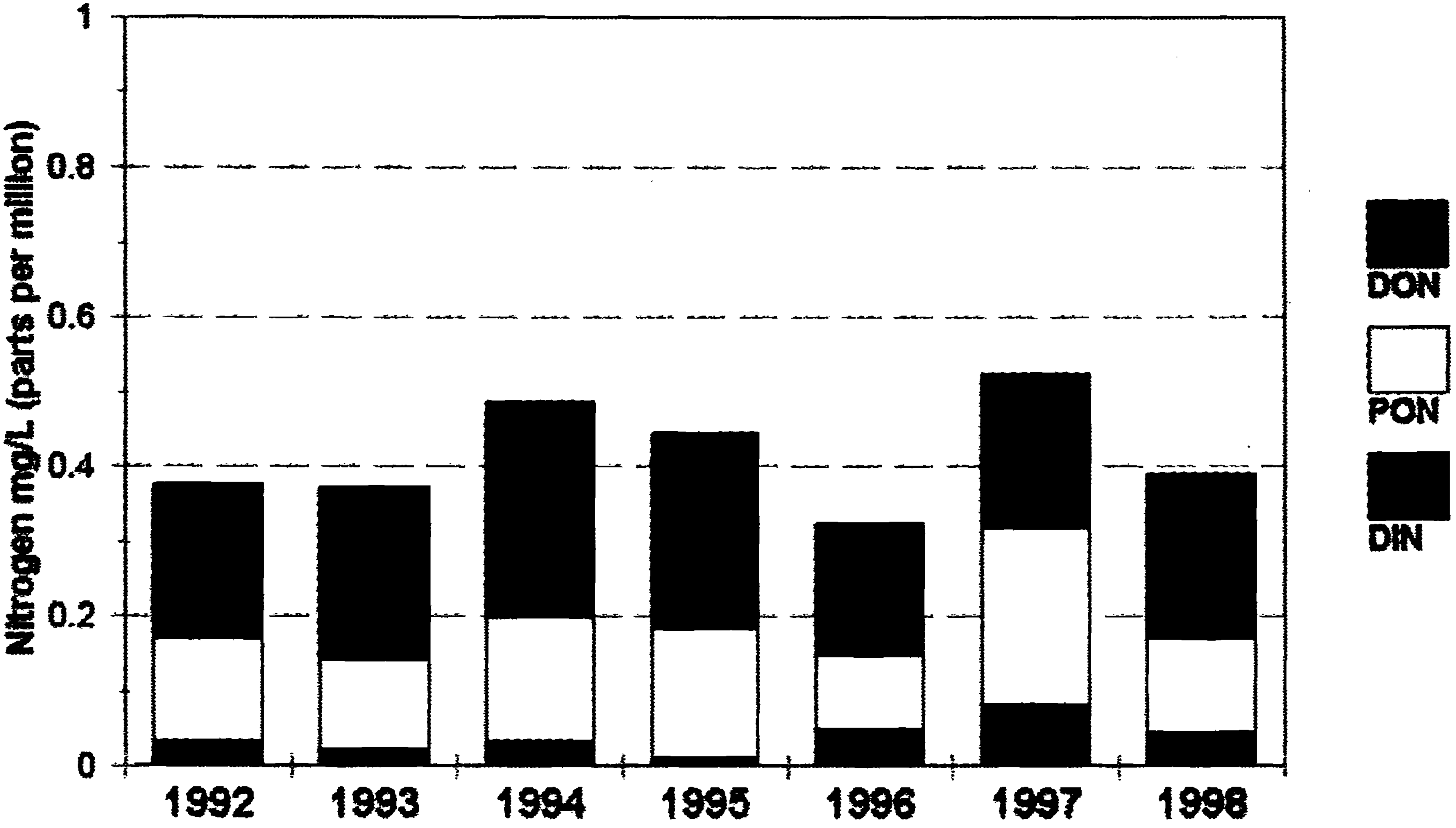
The presentation of two new studies by C-Mast and The Coalition For Buzzards Bay give us the latest information on how terribly distressed our harbor is. The C-Mast study, also, gives a target number of .35 milligrams per liter which must be met to give the harbor a chance to hopefully improve. We are still very concerned about the effects during the next six or seven years from what is already in the ground. Although we do not want to slow down the planning process, we feel strongly in light of the severity of the harbors water guilty condition and the situation that has been created, any plan must insure that West Falmouth Harbor does not die. We realize that our waters can never return to what they were hundreds of years ago, but would accept the condition they were in ten years back. We can let the harbor process nitrogen, but only up to the level that will not destroy it. Therefore, every attempt must be made to get down to the target number of .35 milligrams per liter.

These comments are from John D. Ross, 12 Little Island Rd., Box 225, W. Falmouth, MA 02174.

Surface Water Quality Data
West Falmouth Harbor

West Falmouth- Snug Harbor

Total Water Column Nitrogen



Source: "Baywatchers II, Nutrient related water quality of Buzzards Bay embayments: a synthesis of Baywatchers monitoring 1992-1998", December, 1999

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

MEMORANDUM

To: Raymond A. Jack
Falmouth Utilities Manager

From: WC Perry, P.E. WCP NCW
NC Weeks, P.E. NCW

Date: January 5, 2001

Re: **Town of Falmouth**
Wastewater Facilities Planning Study
Draft Wastewater Facilities Plan and
Draft Environmental Impact Report
Comments on Draft Report
Stearns & Wheler 80284.0

This memo is written to address comments received from the public and environmental review process for the Wastewater Facilities Planning Study (Study).

The Draft Wastewater Facilities Plan and Draft Environmental Impact Report (Draft Report) was submitted to many regulatory and citizens groups as part of the Study's review process. The Draft Report distribution list is attached to this memo. The Draft Report transmittal letter requested written comments from everyone on the Distribution List and the following written comments were received:

- Massachusetts Secretary of Environmental Affairs Certificate dated March 16, 2000
- Massachusetts DEP, SERO Memorandum dated March 9, 2000
- Massachusetts Historical Commission letter dated March 3, 2000
- Cape Cod Commission letter dated March 7, 2000
- Robert E. McLaughlin (of Gilman, McLauglin & Hanrahan LLP) letter dated March 7, 2000
- Donald B. and Sally B. Cook letter dated March 1, 2000
- The Coalition for Buzzards Bay letter dated march 8, 2000
- Walter H. Mclaughlin Jr. letter dated March 6, 2000
- Alan Fleer email dated March 6, 2000
- John D. Ross email dated March 8, 2000.

The written comments are attached at the end of this memo and are discussed in the memo. Excerpts from the comment letters are provided in italics and then addressed with numbered responses (A.1, A.2 etc.) in standard type.

A. Comments from the Massachusetts Secretary of Environmental Affairs dated March 16, 2000

As Secretary of Environmental Affairs, I hereby determine that the Draft Environmental Impact Report submitted on this project adequately and properly complies with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00).

This project involves the development of a wastewater facilities plan for the Town of Falmouth. The Town developed a Wastewater Facilities Plan in 1981 and implementation of that plan resulted in the current sewage collection and disposal system. The current plan includes an upgrade and expansion of the existing Falmouth Wastewater Treatment Plant and the extension of sewer service into several areas that have been determined to warrant such service in the Needs Analysis performed as part of the planning study.

The project also qualifies as a Development of Regional Impact subject to the Cape Cod Commission. In accordance with the Memorandum of Agreement between the Commission and my office, the Town requested a joint review process, and this document is being reviewed accordingly.

The Town has also requested a Phase I Waiver to allow the upgrade and expansion of the treatment facility to proceed prior to completion of the EIR process. I find that there are still outstanding issues associated with that effort and, consequently, I deny that request at this time.

One of the major issues responsible for the development of this new wastewater plan is the acknowledged degradation of water quality in West Falmouth Harbor that is attributable to the discharge plume from the existing wastewater plant. The DEIR indicates that the Town has adopted the CCC's loading standard of 0.45 parts per million (ppm) of total nitrogen for the upgraded plant. The Draft EIR, however, was filed before the results of an ongoing study by Dr. Brian Howes of the Center for Marine Science and Technology (CMAST) became available. This report, partially funded by EOEA, found that in order for the harbor to recover, a discharge limit of 0.35 to 0.37 ppm total nitrogen is recommended. The Final EIR should consider this recommendation and assess the effect of this reduced loading on the projected increase in flow to the plant.

A.1 The Howes Report was introduced quite late into the planning process. It suggests the use of a surface water standard of 0.35 to 0.37 ppm to reestablish eelgrass. Discussions with the Cape Cod Commission during the Study indicated the SA-N limit @ 0.45 ppm was the limit that would be used to review the DEIR.

The final EIR considers the CMAST recommendation and assesses the effect of this reduced loading on the projected increase in flow to the plant.

The CMAST report also defined a different watershed for Snug Harbor than that contained in the DEIR. The Final EIR should reconcile the difference in watershed boundary, since the boundary may influence the amount of sewering found to be necessary within the West Falmouth Harbor planning area.

A.2 The difference in the watershed delineations was discussed on pg. 6-20 of the Needs Assessment Report and 5-13 of the DEIR. As discussed in that text, Stearns & Wheler was advised by the CCC to use the delineation that was developed by CCC and subsequently used in the DEIR.

The watershed boundary was reconciled at the April 24 Technical Meeting with CCC and DEP, and the nitrogen assessment has been revised for the final EIR.

The proposed plan includes an increase in permitted flow to the treatment facility, from the currently permitted 0.88 million gallons per day (mgd) to 1.2 mgd.

A.3 The Falmouth Board of Selectmen (BOS) voted at their March 27, 2000 meeting to increase the capacity of the proposed WWTF modifications from 1.2 mgd to 1.4 mgd. This expansion would allow a 0.2 mgd projected flow from the Maravista area to be treated at the WWTF. The BOS vote also stipulated that the 0.2 mgd treated effluent from the Maravista connections would need to be discharged outside the West Falmouth Watershed. The final EIR reviews this recommendation and identifies how the recommendation can be incorporated in the Recommended Plan.

Of this increase, 0.2 mgd is reserved for possible future growth. Given the sensitive nature of the receiving waters, I expect the Town will reconsider this volume of reserve capacity which, if used, might further impact the nitrogen loading in West Falmouth Harbor.

A.4 This 0.2 flow is an emergency reserve as part of the Treatment Plant capacity.

Justification for the Emergency Reserve includes:

- Connection of Affordable Housing projects to the centralized sewer.
- Potential wastewater flow from the New Silver Beach area if that project does not proceed on its own.
- Potential wastewater flow from the Technology Park.
- Potential flow from existing properties on the west side of Siders Pond, the Ramada Inn on Main Street, and existing properties on the east side of the Inner Harbor.
- These potential flows may need to be added to the WWTF in the future to protect public health and the environment. The 0.2 mgd emergency reserve capacity is created to address these potential needs.

A letter from DEP on December 22, 2000 stated that allocation of 0.2 mgd for these purposes is warranted.

I received a number of thoughtful and detailed comments on this Draft EIR and I expect that the Final EIR will contain equally thoughtful and detailed responses to the issues raised in those comments.

A.5 Responses are provided for all comments.

B. Comments from Massachusetts Department of Environmental Protection, SERO dated March 9, 2000

DEP SERO's Cape Cod Watershed Team staff and Boston's Bureau of Municipal Facilities staff indicate that the Town has embarked on the comprehensive wastewater management planning process in response to concerns about the impact of the current Class III groundwater discharge on the upper reaches of West Falmouth Harbor. Building on the previous Needs Assessment and Screening Analysis, the DWFP/DEIR presents a recommended plan that includes upgrade of the current wastewater treatment plant to provide a high level of nitrogen reduction, increasing the discharge from the existing permitted 0.88 million gallons per day (MGD) to 1.2 MGD, additional sewering and installation of nitrogen reducing on-site systems for the West Falmouth Harbor area east of Route 28.

B.1 Please see response No. A.3 regarding the 1.2 mgd flow.

The major impetus for the facilities plan has been the observed degradation of water quality in the upper reaches of West Falmouth Harbor associated with the discharge plume from the existing wastewater treatment facility. In addressing this issue, the DWFP/DEIR, along with the Needs Assessment and Screening Analysis, has evaluated nitrogen loading in the West Falmouth Harbor watershed and recommended a loading consistent with the Cape Cod Commission's SA-N standard of 0.45 ppm total nitrogen. The report, however, acknowledged that an ongoing study by Dr. Brian Howes of the Center for Marine Science and Technology (CMAST) at the University of Massachusetts-Dartmouth is evaluating water quality data to develop a critical nitrogen loading value for the Snug Harbor and West Falmouth Harbor areas. The results of that study, funded by EOEA and the West Falmouth Boat Club, are now available as a "Draft Final" report; however, its results suggesting a 0.35-0.37 ppm total nitrogen load were not available at the time the DWFP/DEIR was being completed. Furthermore, this study suggests a different delineation of the subwatershed contributing to Snug Harbor than the one presented in the DWFP/DEIR. Dr. Howes's boundary suggests that the wastewater plume discharges to Mashapaquit Creek which may provide natural denitrification. The boundary presented in the DWFP/DEIR indicates discharge outside of Mashapaquit Creek with no natural denitrification.

The Department commends the Town of Falmouth for preparing a thorough report and, in general, is pleased with the recommendations contained therein. The need to upgrade the *existing treatment plant has been well documented as has the need to minimize overall nitrogen load to West Falmouth Harbor. However, there are some outstanding issues that need to be addressed as part of the final report, which are enumerated below.*

1. The Department will require that the Town re-evaluate its recommendations based on the 0.35-0.37 ppm total nitrogen loading developed in the CMAST report. Analyses shall include, but not necessarily be limited to, the impact of reduced loading on the projected increase in sewage flow and the impact of the proposed additional sewering if discharge remains within the watershed boundary.

B.2 These analyses are provided in the FEIR.

2. The Department will require evaluation and identification of alternative discharge sites outside the Snug Harbor and/or West Falmouth Harbor watershed boundary(ies). Depending upon the results of the loading analysis described in paragraph 1 above, the Town may have to consider discharging the treatment plant effluent outside the areas contributing to West Falmouth Harbor or Snug Harbor in order to reduce nitrogen input sufficiently to meet appropriate loading limitations.

B.3 The FEIR presents an identification and evaluation of alternative discharge sites outside the Snug Harbor and West Falmouth Harbor watersheds. Several sites have been identified for further evaluation as part of the Effluent Mitigation Project which is a subsequent project to follow the Facilities Planning Study.

The DWFP/DEIR also addresses the potential addition of an injection well or wells for effluent discharge outside of the Snug Harbor Watershed. As noted, this technology would require pilot testing and DEP approval prior to installation.

B.4 Pilot testing has been proposed and could be performed during the Effluent Mitigation Project.

3. The Town needs to reconcile the different watershed boundary for the Snug Harbor subwatershed delineations presented in the DWFP/DEIR and the CMAST report. The watershed boundary location is important, not only in determining whether Mashapaquit Creek provides any nitrogen removal, but may also influence proposed sewering within the West Falmouth Harbor planning area.

B.5 See response A.2.

4. The DWFP/DEIR does not propose to sewer Maravista or Falmouth Heights. It suggests that after further nitrogen loading assessments at Little Pond and well injection pilot tests are complete, the recommended plan could be modified to provide additional treatment capacity at the wastewater treatment facility. The Department is *concerned that this may not be feasible especially in light of the reduced nitrogen loading limits identified in the CMAST report.*

B.6 The Board of Selectmen modified this recommendation at their March 27, 2000 meeting (See response No. A.3). They felt that Alternative No. 4 was the most cost effective and would provide the least environmental impact to Little Pond. They also recognized that the treated effluent from this area should not be discharged into the West Falmouth Harbor Watershed to minimize impact to that surface water. This effluent will not be discharged in the West Falmouth Harbor Watershed.

5. The DWFP/DEIR proposes to increase the WWTF design flow from an existing 0.47 MGD (permitted maximum of 0.88 MGD) to 1.2 MGD.

B.7 See Response A.3 regarding the 1.2 mgd flow capacity.

It has been demonstrated through two groundwater models that a portion of the landfill plume is currently within the contributing area of the Long Pond water supply. As such, it must be further demonstrated whether the groundwater mounding from the existing wastewater treatment facility infiltration basins and spray irrigation areas will further change the groundwater flow direction of the landfill pollution plume toward Long Pond.

B.8 This is addressed in the FEIR.

The Drinking Water Program concurs with the DWFP/DEIR's proposed expanded monitoring of groundwater flow and water quality as it regards potential impacts to the Long Pond water supply. The plan for said monitoring should be submitted in conjunction with the application for groundwater discharge permit. The Department, through its groundwater discharge permit review, should evaluate the groundwater monitoring plan for potential to impact the Pond. Furthermore, the recommended plan should indicate the mitigation actions to be taken by the Falmouth WWTF should impacts to the Long Pond water supply be identified through the expanded monitoring program.

B.9 The FEIR identifies potential mitigation actions.

6. The tasks outlined in the original Scope of Work for the comprehensive wastewater management study included assessing the nutrient load from the landfill and plume delineation. The final report must provide more detail regarding the calculated load emanating form the residual landfill plume and delineation of the actual plume and projected discharge location in West Falmouth Harbor.

B.10 The Needs Assessment Report (pg. 6-21) presented the existing nitrogen loading to Snug Harbor based on work performed and summarized in the Cape Cod Commission (CCC)

Coastal Embayments Report (CCC, 1998). This loading was estimated at 1,217 kg/yr based on review of several reports, water analyses, and soil analyses; groundwater concentration of 15 ppm total nitrogen; and recharge from 20 acres of the landfill. The revised watershed delineation indicates that approximately ½ of the landfill site contributes groundwater to Snug Harbor and the other half contributes groundwater to the southern portion of West Falmouth Harbor.

Efforts to delineate the landfill plume are presented in the FEIR.

It is noted that the landfill capping was planned, evaluated and performed in accordance with the state regulations of 310CMR 19.00. The required reports were filed with DEP and several reviewed as part of the Study including:

- Initial Site Assessment
- Comprehensive Site Assessment and Risk Assessment
- Landfill Closure Plan
- Construction Certification

It is also noted that plume delineation in a terminal moraine is nearly impossible and would have much uncertainty. The proposed expanded monitoring program is the best method to manage the uncertainties of plume content and direction. Potential mitigation steps have been identified if monitoring identifies a problem.

7. *The DWFP/DEIR indicates that a portion of the increased design flow in the amount of 0.2 MGD will be held as emergency reserve available for future "unexpected growth". The Department believes that his reserve amount should be re-evaluated with respect to potential impacts on the nitrogen load to West Falmouth Harbor. Since 0.09 MGD has been allowed for infilling and growth along existing sewer lines, the 0.2 MGD reserve may be excessive and subject to reduction or elimination.*

B.11 The development of 0.2 mgd reserve capacity is desired by the Town because the Town recognizes that a 20-year plan cannot realistically account for all contingencies. The Town of Falmouth has several water quality problems that will need wastewater collection and treatment in the future. Design and construction of a 0.2 mgd reserve capacity is good sense because it will allow wastewater problems to be solved without entering a crisis situation. (See response A-4 for additional justification)

Discussions with DEP at an April 24, 2000 meeting suggested that a 0.2 mgd reserve capacity goes against Executive Order (E.O.) 385. Stearns & Wheler has reviewed this E.O. and discussed it with Mr. Kurt Gaertner, EOEA Director of Growth Planning and found no conflict; and has found that the E.O. tends to support this type of smart planning.

8. *The DFWP/DEIR requests a Phase One waiver in order to begin construction of the upgrades for the wastewater treatment facility. The Department believes that the*

proposed upgrade for the wastewater treatment facility is necessary and appropriate. The Department further believes that design parameters for the proposed upgrade will not change substantially relative to the Final Facilities Plan/Final Environmental Impact Report. For these reasons, the Department is of the opinion that the Town should proceed with funding the design of the upgrade; however, since there are still many unresolved issues regarding the ultimate nitrogen loading and its impact on expansion, sewering and discharge locations, the Department cannot support the Town's request for a Phase One waiver to allow construction prior to the acceptance of the Final Environmental Impact Report.

B.12 The Town plans to proceed with design based on Town Meeting approval. Construction will wait until effluent discharge issues are further resolved.

C. Comments from the Massachusetts Historical Commission dated March 3, 2000

Staff of the Massachusetts Historical Commission have reviewed the Draft Environmental Impact Report (DEIR) for the Wastewater Facilities Planning Study referenced above and have the following comments.

MHC understands that Alternative 4 has been selected as the preferred plan. This plan includes an upgrade of the existing Falmouth Wastewater Treatment Facility, a sewer connection to the Facility from Falmouth High School, and sewer installations in the western portion of the West Falmouth Harbor Watershed, the North Davis Straits Service Area, the Scranton Avenue Service Area Center, and the Maravista Planning Area.

MHC understands that the project proponent is requesting a Phase I Waiver in order to proceed with the proposed upgrade of the Falmouth Wastewater Treatment Facility. After review of MHC's files and the information in the DEIR, MHC staff have determined that the proposed upgrade of the existing Falmouth Wastewater Treatment Facility is unlikely to affect significant historic or archaeological resources. No further review by this office is required for Phase I of the proposed project.

Plans for the sewer connection between Falmouth High School and the Wastewater Treatment Facility, and the sewer installations the western portion of the West Falmouth Harbor Watershed, the North Davis Straits Service Area, the Scranton Avenue Service Center, and the Maravista Planning Area indicate that all proposed sewers will be located within existing roadways. MHC has determined that these installations are unlikely to affect significant historic or archaeological resources.

MHC requests the opportunity to review plans for pump stations when these become available, and to review any changes in proposed sewer installations that will involve construction of off-road sewer segments.

C.1 Pump station location and/or changes to sewer routing will be sent to MHC for review and comment during design and/or additional study.

D. Comments from the Cape Cod Commission dated March 7, 2000

The Draft Wastewater Facilities Plan/Draft Environmental Impact Report presents a recommended plan for wastewater treatment within the study areas identified during the previous Needs Assessment and Screening Analysis phases of the wastewater planning study. During the first phase, the Needs Assessment, the town's consultants identified seven areas for inclusion in the study: 1) Falmouth High School, 2) West Falmouth Harbor and its watershed, 3) sewered areas along Main St., 4) Falmouth beach, 5) Davis Straits/Inner Harbor (which has been subdivided into Clinton Ave., Scranton Ave. and North Davis Straits subareas), 6) Falmouth Heights, and 7) Maravista. In the second phase, the screening analysis, potential options for wastewater treatment in these areas were identified. The DEIR includes recommended options for addressing previously identified needs, preliminary cost estimates, and identifies other issues that may arise due tot he implementation of recommended options.

Subcommittee Coments:

Alternative #4 is the recommended alternative in the report. It includes treatment of 1.2 million gallons per day (MGD) at the town's existing wastewater treatment facility (WWTF) with a total nitrogen discharge concentration of 5 parts per million (ppm), and the use of denitrifying septic systems east of Rt. 28 within the West Falmouth Harbor watershed. The 1.2 MGD to be treated at the town WWTF includes 0.56 MGD for existing services and infilling in these areas, 0.01 MGD from Falmouth High School, 0.23 MGD from the portion of the West Falmouth Harbor watershed west of Rt. 28, 0.2 MGD from North Davis Straits and Scranton Ave., and 0.2 MGD as reserve capacity. The DEIR recommends an evaluation of effluent injection well technology. Sewering of Maravista is not recommended until further evaluation of Little Pond is completed. The estimated capital cost for the recommended wastewater alternative is $34.41 million.

The Town has requested a Phase One Waiver from the Secretary of the EOEA to proceed with construction of a new sequencing batch reactor with a design average annual flow of 1.2 MGD; new denitrification filters for a permitted treatment level of 5 ppm; sludge management facilities; and renovation of the aerated pond basins.

D.1 The following response is a clarification and update of the summary presented in the proceeding 2 paragraphs.

Alternative No. 4 (which includes treatment of 1.4 mgd at an upgraded WWTF) received the highest rating in the Detailed Evaluation and Environmental Impact Analysis (pg. 8-2 of the DEIR). A modification of Alternative No. 4 was recommended which included upgrade of the WWTF to only 1.2 mgd until further evaluations are complete in the Little Pond, Great Pond, Green Pond, and Bourne Pond watersheds (pg. 8-3 of the DEIR).

As discussed in response A.3, the BOS selected a different modification of Alternative No.4 which includes connection of the Maravista Planning Area to the WWTF, upgrade of the WWTF to 1.4 mgd and advanced nitrogen removal, and discharge of the treated effluent attributed to the Maravista Planning Area outside the West Falmouth Harbor Watershed. This will be discussed in the Final EIR.

Although Alternative #4 provides use of the best available technology to reduce nitrogen loading to West Falmouth Harbor and its more nitrogen sensitive tributary of Snug Harbor, the subcommittee are concerned that these actions may not provide the ultimate level of protection or restoration that this resource requires. Therefore, proceeding with a Phase One Waiver includes some risk of not accomplishing the protection and restoration goals sought by the Commission for West Falmouth Harbor.

The following section outlines the issue in more detail, identifies portions of the EIR scope that have not been completed and makes recommendations to review critical scientific assessment data that is near completion.

The existing treatment plant currently has a state DEP groundwater discharge permit to discharge up to 0.88 million gallons per day (MGD) of effluent with a nitrogen concentration of up to 50 parts per million (ppm) (the treatment plant began discharging effluent in October 1986). The WWTF averages approximately 0.46 MGD and had an average effluent nitrogen concentration of 23 ppm in 1998. Base on an average groundwater flow rate of one foot per day, it was estimated that the effluent would begin to reach West Falmouth Harbor in about 7 years, or January 1994. Water quality information collected by the Falmouth Pond Watchers measured an average total nitrogen concentration of 0.85 ppm during the summer of 1994, with concentrations of up to 1.3 ppm at the Nashawena Rd. Bridge in Snug Harbor.

D.2 These results differ from Falmouth Pond Watcher results (attached) presented in the Bay Watchers II Report (produced by the Coalition for Buzzards Bay in December 1999). Individual results are misleading and must be interpreted as part of a complete data set.

Average nitrogen concentrations in Buzzards Bay water just outside of the Harbor are approximately 0.3 ppm.

The Facilities Plan, as detailed in the scope of work (January, 1999 ENF), proposed to evaluate the sensitivity of West Falmouth Harbor and the impacts that the town WWTF discharge is having on the Harbor ecosystem. The following steps were proposed in Task 5.2 of the scope of work as part of the development of a nitrogen management plan for West Falmouth Harbor: 1) Evaluate the current "health" of the harbor and determine capacity or tolerance for future nitrogen loads, 2)prepare plume delineations for the WWTF and landfill, 3) perform sampling and analysis of all existing and new WWTF and landfill wells, 4) determine distribution of WWTF plume discharge by installation of hand-driven well points adjacent to the Harbor, 5) conduct a study to determine natural attenuation of nitrogen by *intercepting wetlands, and 6) adjust quality model as necessary based on data developed. The information to be developed in these steps is crucial for understanding the amount of nitrogen that should be going into the Harbor, which is directly related to the level of treatment and amount of flow that should go through the WWTF. This information is not contained in the DEIR. Rather, the DEIR relies upon satisfying a proposed SA-N nitrogen loading limit and providing the best available technology (treatment at less than 5 ppm).*

D.3 The following table presents the individual scope items of 5.2 and their status.

5.2.1 Identify flow and waste reduction measures.	This is complete.
5.2.2.a Review existing reports and documents – including flushing studies and monitoring well reports for both the WWTF and the landfill.	This is complete as reported in Chapter 2 and throughout the Report.
5.2.2.b Review existing watershed delineation and revise if necessary.	This was complete as reported on page 6-7. It was completed with much coordination with Ed Eichner of the Commission and also with USGS. Based on the CMAST report CCC has changed their views and the delineation has been revised.
5.2.2.c Conduct a land-use / nitrogen loading analysis – based on watershed delineation.	This is complete. The Commission's analysis for the 1998 Coastal Embayment Project Report was utilized with modifications to update the loadings from the WWTF. This was also coordinated with several groups
5.2.2.d Geophysically log all deep wells in the plume regions.	Boring logs have been compiled and reviewed. These logs provide more definitive interpretation than geophysical logs. Plume delineations using geophysical logging is highly subjective, therefore, new logging was not performed.
5.2.2.e Supplement existing WWTF monitoring well network – if necessary, install and sample up to five additional wells along the railroad adjacent to the northern end of West Falmouth Harbor (as guided by results of geophysical logs and particle tracking models). Total estimated vertical footage = 750 feet. Install multi-level samplers in the new well.	The purpose of these wells was to quantify the nitrogen in this cross-section of the Snug Harbor watershed. This might be appropriate in a uniform aquifer of porous media. It is not realistic in this area of terminal morraine. We believe that quantification of this groundwater nitrogen is impossible with even five wells. It is noted that the CMAST report presents information on nitrogen flux at the following

	locations: • discharge points • water table below the discharge points • edge of the salt marsh • in the surface water An intermediate sampling point at the Railroad ROW would be of limited value and would cost a large sum of money which has been better used for other efforts of this study.
5.2.2.f Supplement existing Landfill monitoring well network – if necessary, install and sample up to six additional monitoring wells for plume delineation and monitoring. Total estimated vertical footage = 900 feet.	Two new wells have been installed to delineate the landfall plume as described in Section 5.8 (pg. 5-30) of the DEIR. Additional information is provided in the FEIR.
5.2.2.g Perform sampling and analysis of all existing and new wells for the WWTF and Landfill monitoring well networks. This includes one sample from each existing well and six samples from each new well for vertical profiling.	Sampling of new and existing wells was performed on September 1 and 8, 1999; and the results are presented in the FEIR. Sampling and analysis of these wells was discussed in Chapter 5 (section 5.8 starting on pg. 5-30).
5.2.2.h Perform computer modeling of groundwater regime within watershed – to assess plume impacts (WWTF and Landfill) on Long Pond and West Falmouth Harbor and determine safe yield of Long Pond water supply.	The nitrogen loading assessment and computer modeling on West Falmouth Harbor was complete for the existing and projected conditions. This modeling has been refined based on the new watershed delineation and attenuation factors directed by DEP and CCC. Potential impacts to Long Pond have been completed and revised based on changed watershed delineation and the regulatory comments. Safe yield discussion is presented on pg. 5-36 through 5-39 of the DEIR
5.2.2.i Prepare vertical and horizontal plume delineation.	Additional information is provided in the FEIR.
5.2.2.j Determine distribution of plume	This work was completed by Dr. Valiela and

discharge by installation of hand-driven well points adjacent to the harbor	the MBL Water Quality program and Dr. Howes as part of the CMAST report. There was a desire not to duplicate (triplicate) efforts on this task. Now that Dr. Howes data and findings are available, it has been incorporated into the FEIR.
5.2.2.k Determine average groundwater fluxes and nitrogen loads in discharging plume waters and determine temporal variations in nitrogen discharge based on future plant loads.	This work was complete and has been revised based on the revised watershed delineation.
5.2.2.1 Conduct study to determine natural attenuation of nitrogen by intercepting wetlands.	This work was performed as discussed in the Needs Assessment Report (pg. 6-24). The CMAST presented more site-specific information in the salt marsh in the Snug Harbor Watershed as discussed on pg. 5-17 of the DEIR. DEP and CCC have interpreted this information to allow a 20% attenuation factor for the nitrogen flowing to this portion of the watershed. (Technical Meeting on April 24, 2000)
5.2.2.m Evaluate the current health of the harbor and determine capacity or tolerance for future nitrogen loads.	The health of the harbor was discussed on pg. 6-6 and 6-7 of the Needs Assessment Report as it relates to the water sampling program and shellfish closures. The harbor health and nitrogen assimilation capacity were discussed in Section 6-3.E on (pg. 6-12) of the Needs Assessment Report and Section 5.6 (pg. 5-8 through 5-11) of the DEIR. The CMAST report presents an analysis of data collected by the Coalition for Buzzards Bay which supports a standard for reestablishment of the eelgrass beds. Discussions with DEP and CCC (Technical Meeting on April 24, 2000) indicate that reestablishment of the eelgrass beds is the goal of their regulatory efforts even though the water body is classified as SA.

5.2.2.n Assess nutrient loads from WWTF and Landfill.	This work is reported in Section 6-3E (pg. 6-12) of the Needs Assessment Report, Section 5.6 (pg. 5-8 through 5-28) of the DEIR, and Section 8.3G (pg. 8-16 and 8-17) of the DEIR. This work has been revised based on the revised watershed delineation and regulatory comments.
5.2.2.o Adjust water quality model as necessary based on data developed.	This work has been performed as documented in the study and has been modified to adjust to revised watershed delineation and regulatory comments.

On a separate track, the DEIR recognizes that DEP and the Falmouth Boat Club have jointly funded Brian Howes of UMASS-Dartmouth, Center for Marine Science and Technology (CMAST) to complete an assessment of West Falmouth Harbor. Since the above steps in Task 5.2 have not been addressed within the DEIR, this evaluation is critical for appropriate consideration of the alternatives presented in the DEIR. The CMAST evaluation is to include consideration of watershed boundaries, location of discharge of the WWTF plume, potential nitrogen removal in the Snug Harbor marsh, ant the ecosystem impacts of the WWTF on Snug Harbor and the rest of West Falmouth Harbor. This study was just received by the Commission on February 25th. Until this information is reviewed and adequate discussion of the results and appropriate limits has occurred, it is suggested that complete and adequate review of the management options cannot occur.

Subcommittee Recommendation on Waiver Request:

It is essential that all components of the EIR scope be brought to a completion. These items include an evaluation of the nitrogen assessment being conducted by Dr. Howes and the piloting of injection well technology, especially if it is shown that the wastewater discharge or some portion must be moved out of the Snug Harbor watershed. However, even in the event that additional protective steps must be taken, it is unlikely at this time that a treatment facility could be engineered to achieve greater treatment levels (less than 5 ppm) or that another location to build a wastewater treatment facility could be found. Therefore, the subcommittee recommends the Phase One Waiver be granted contingent upon a commitment to complete the entire EIR scope and suggests that the funding for this work be included in the budget for the Phase One Waiver. In addition, the Phase One Waiver for an upgrade of the Treatment plant does not include sewering phases. The nitrogen loading issues of West Falmouth Harbor should be satisfactorily addressed prior to allowing increases in volume treated at the plant. It should also be noted the MBL Development of Regional Impact review will result in an escrow account of $43,350 that is targeted for and will be available for use towards the Wastewater Facility Plan to address West Falmouth Harbor.

D.4 No response needed.

DEIR Distribution List

WASTEWATER FACILITIES PLANNING STUDY
TOWN OF FALMOUTH, MASSACHUSETTS

Draft Wastewater Facilities Plan and Draft Environmental Impact Report

Distribution List

A copy of the Draft Wastewater Facilities Plan and Draft Environmental Impact Report has been sent to the following:

Secretary of Environmental Affairs
100 Cambridge Street - 20th floor
Boston, MA 02202
Attention: MEPA Unit and Richard Foster

Department of Environmental Protection
One Winter Street
Boston, MA 02108
Attention: R. Lyberger

DEP/Southeastern Regional Office
20 Riverside Drive
Lakeville, MA 02347
Attention: B. Dudley

Massachusetts Historical Commission
Achieve Building
220 Morrissey Blvd.
Boston, MA 02125

Cape Cod Commission (six copies)
3225 Main Street
Barnstable, MA 02630
Attention: S. Korjeff

Falmouth Utilities Department (seven copies)
59 Town Hall Square
Falmouth, MA 02540
Attention: R. Jack

Buzzards Bay Project
2870 Cranberry Highway
East Wareham, MA 02538
Attention: J. Costa

Coastal Management
100 Cambridge Street - 20th Floor
Boston, MA 02202

DEP/Southeastern Regional Office
20 Riverside Drive
Lakeville, MA 02347
Attention: MEPA Unit

USEPA, Region One
JFK Federal Building, CMA
Boston, MA 02203
Attention: B. Rosinoff

Division of Marine Fisheries
50A Portside Drive
Pocasset, MA 02559
Attention: J. Mendes

Dr. Brian Howes
Falmouth Pond Watchers and CMAST
70 Sommersea Road
Mashpee, MA 02649

Falmouth Planning Office
59 Town Hall Square
Falmouth, MA 02540
Attention: B. Currie

Falmouth Natural Resources Department
59 Town Hall Square
Falmouth, MA 02540

Falmouth Public Library
750 Main Street
Falmouth, MA 02540
Attention: Reference Department

Falmouth Administrators and Selectmen's Office
59 Town Hall Square
Falmouth, MA 02540
Attention: P. Boyer

Falmouth Health Department
59 Town Hall Square
Falmouth MA 02540
Attention: D. Carignan

Ashumet Plume Nitrogen Offset Program
P. O. Box 766
95 Indian Ridge Road
West Falmouth, MA 02574
Attention: J. Barnes, Chairperson

Comment Letters

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street, Boston, MA 02202

ARGEO PAUL CELLUCCI
GOVERNOR

JANE SWIFT
LIEUTENANT GOVERNOR

BOB DURAND
SECRETARY

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http://www.magnet.state.ma.us/envir

March 16, 2000

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	:	Wastewater Facilities Planning Study
PROJECT MUNICIPALITY	:	Falmouth
PROJECT WATERSHED	:	Cape Cod
EOEA NUMBER	:	11857
PROJECT PROPONENT	:	Town of Falmouth
DATE NOTICED IN MONITOR	:	February 8, 2000

As Secretary of Environmental Affairs, I hereby determine that the Draft Environmental Impact Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00).

This project involves the development of a wastewater facilities plan for the Town of Falmouth. The Town developed a Wastewater Facilities Plan in 1981 and implementation of that plan resulted in the current sewage collection and disposal system. The current plan includes an upgrade and expansion of the existing Falmouth Wastewater Treatment Plant and the extension of sewer service into several areas that have been determined to warrant such service in the Needs Analysis performed as part of the planning study.

The project also qualifies as a Development of Regional Impact subject to the Cape Cod Commission. In accordance with the Memorandum of Agreement between the Commission and my office, the Town requested a joint review process, and this document is being reviewed accordingly.

The Town has also requested a Phase I Waiver to allow the upgrade and expansion of the treatment facility to proceed prior to completion of the EIR process. I find that there are still outstanding issues associated with that effort and, consequently, I deny that request at this time.

One of the major issues responsible for the development of this new wastewater plan is the acknowledged degradation of water quality in West Falmouth Harbor that is attributable to the discharge plume from the existing wastewater plant. The DEIR indicates that the Town has adopted the CCC's loading standard of 0.45 parts per million (ppm) of total nitrogen for the upgraded plant. The Draft EIR, however, was filed before the results of an ongoing study by Dr. Brian Howes of the Center for Marine Science and Technology (CMAST) became available. This report, partially funded by EOEA, found that in order for the harbor to recover, a discharge limit of 0.35 to 0.37 ppm total nitrogen is recommended. The Final EIR should consider this recommendation and assess the effect of this reduced loading on the projected increase in flow to the plant.

The CMAST report also defined a different watershed for Snug Harbor than that contained in the DEIR. The Final EIR should reconcile the difference in watershed boundary, since the boundary may influence the amount of sewering found to be necessary within the West Falmouth Harbor planning area.

The proposed plan includes an increase in permitted flow to the treatment facility, from the currently permitted 0.88 million gallons per day (mgd) to 1.2 mgd. Of this increase, 0.2 mgd is reserved for possible future growth. Given the sensitive nature of the receiving waters, I expect the Town will reconsider this volume of reserve capacity which, if used, might further impact the nitrogen loading in West Falmouth Harbor.

I received a number of thoughtful and detailed comments on this Draft EIR and I expect that the Final EIR will contain equally thoughtful and detailed responses to the issues raised in those comments.

March 16, 2000
Date

Bob Durand

Comments received :

Department of Environmental Protection
Massachusetts Historical Commission
Cape Cod Commision
The Coalition for Buzzards Bay
Robert McLaughlin
Donald Cook

MEMORANDUM

TO: Richard Foster, Environmental Reviewer, MEPA Unit

THROUGH: Robert P. Fagan, Regional Engineer, BRP
David Johnston, Deputy Regional Director
David DeLorenzo, Deputy Regional Director
John Viola, Deputy Regional Director

CC: Elizabeth Kouloheras, Team Leader, Cape Cod Watershed
Jeffrey Gould, Chief, Water Pollution Control
Lawrence Dayian, Chief, Water Supply
Brian Dudley, SERO Wastewater Coordinator
Ronald Lyberger, Projects Manager, Bureau of Municipal Facilities, DEP/Boston
Patti Kellogg, EOEA Basin Team Leader, Cape and Islands Watershed
David Murphy, Commissioner's Office

FROM: Sharon Stone, SERO MEPA Coordinator

DATE: March 9, 2000

RE: DEIR EOEA #11857 – FALMOUTH – Falmouth Wastewater Facilities Planning Study

****

"For Use in Intra-Agency Policy Deliberations"

The Southeast Regional Office of the Department of Environmental Protection has reviewed the Draft Environmental Impact Report for the "Wastewater Facilities Planning Study" (DFWP/DEIR) for the Town of Falmouth, Massachusetts (EOEA #11857). The DEIR provides the following information for the project:

"This Draft Wastewater Facilities Plan and Draft Environmental Impact Report is submitted in accordance with the joint MEPA/Cape Cod Commission review process as outlined in the Secretary's Certificate dated February 22, 1999 for this project. The proponent also requests review of a Phase I Waiver for the Upgrade of the Falmouth WWTF as described in the DEIR. This third Phase of the project is the Detailed Evaluation, Environmental Analysis, and Development of a Recommended Plan and Draft EIR. A Final Wastewater Facilities Plan and Environmental Impact Report (FEIR) will be prepared to address remaining issues of the Study and the DEIR."

DEP SERO's Cape Cod Watershed Team staff and Boston's Bureau of Municipal Facilities staff indicate that the Town has embarked on the comprehensive wastewater management planning process in response to concerns about the impact of the current Class III groundwater discharge on the upper reaches of West Falmouth Harbor. Building on the previous Needs Assessment and

Screening Analysis, the DWFP/DEIR presents a recommended plan that includes upgrade of the current wastewater treatment plant to provide a high level of nitrogen reduction, increasing the discharge from the existing permitted 0.88 million gallons per day (MGD) to 1.2 MGD, additional sewering and installation of nitrogen reducing on-site systems for the West Falmouth Harbor area east of Route 28.

The major impetus for the facilities plan has been the observed degradation of water quality in the upper reaches of West Falmouth Harbor associated with the discharge plume from the existing wastewater treatment facility. In addressing this issue, the DWFP/DEIR, along with the Needs Assessment and Screening analysis, has evaluated nitrogen loading in the West Falmouth Harbor watershed and recommended a loading consistent with the Cape Cod Commission's SA-N standard of 0.45 ppm total nitrogen. The report, however, acknowledged that an ongoing study by Dr. Brian Howes of the Center for Marine Science and Technology (CMAST) at the University of Massachusetts-Dartmouth is evaluating water quality data to develop a critical nitrogen loading value for the Snug Harbor and West Falmouth Harbor areas. The results of that study, funded by EOEA and the West Falmouth Boat Club, are now available as a "Draft Final" report; however, its results suggesting a 0.35-0.37 ppm total nitrogen load were not available at the time the DWFP/DEIR was being completed. Furthermore, this study suggests a different delineation of the subwatershed contributing to Snug Harbor than the one presented in the DWFP/DEIR. Dr. Howes's boundary suggests that the wastewater plume discharges to Mashapaquit Creek which may provide natural denitrification. The boundary presented in the DWFP/DEIR indicates discharge outside of Mashapaquit Creek with no natural denitrification.

The Department commends the Town of Falmouth for preparing a thorough report and, in general, is pleased with the recommendations contained therein. The need to upgrade the existing treatment plant has been well documented as has the need to minimize overall nitrogen load to West Falmouth Harbor. However, there are some outstanding issues that need to be addressed as part of the final report, which are enumerated below.

1. The Department will require that the Town re-evaluate its recommendations based on the 0.35-0.37 ppm total nitrogen loading developed in the CMAST report. Analyses shall include, but not necessarily be limited to, the impact of reduced loading on the projected increase in sewage flow and the impact of the proposed additional sewering if discharge remains within the watershed boundary.

2. The Department will require evaluation and identification of alternative discharge sites outside the Snug Harbor and/or West Falmouth Harbor watershed boundary(ies). Depending upon the results of the loading analysis described in paragraph 1 above, the Town may have to consider discharging the treatment plant effluent outside the areas contributing to West Falmouth Harbor or Snug Harbor in order to reduce nitrogen input sufficiently to meet appropriate loading limitations.

The DWFP/DEIR also addresses the potential addition of an injection well or wells for effluent discharge outside of the Snug Harbor Watershed. As noted, this technology would require pilot testing and DEP approval prior to installation.

3. The Town needs to reconcile the different watershed boundary for the Snug Harbor subwatershed delineations presented in the DWFP/DEIR and the CMAST report. The watershed boundary location is important, not only in determining whether Mashapaquit Creek provides any nitrogen removal, but may also may influence proposed sewering within the West Falmouth Harbor planning area.

4. The DWFP/DEIR does not propose to sewer Maravista or Falmouth Heights. It suggests that after further nitrogen loading assessments at Little Pond and well injection pilot tests are complete, the recommended plan could be modified to provide additional treatment capacity at the wastewater treatment facility. The Department is concerned that this may not be feasible especially in light of the reduced nitrogen loading limits identified in the CMAST report.

5. The DWFP/DEIR proposes to increase the WWTF design flow from an existing 0.47 MGD (permitted maximum of 0.88 MGD) to 1.2 MGD. It has been demonstrated through two groundwater models that a portion of the landfill plume is currently within the contributing area of the Long Pond water supply. As such, it must be further demonstrated whether the groundwater mounding from the existing wastewater treatment facility infiltration basins and spray irrigation areas will further change the groundwater flow direction of the landfill pollution plume toward Long Pond.

   The Drinking Water Program concurs with the DWFP/DEIR's proposed expanded monitoring of groundwater flow and water quality as it regards potential impacts to the Long Pond water supply. The plan for said monitoring should be submitted in conjunction with the application for groundwater discharge permit. The Department, through it's groundwater discharge permit review, should evaluate the groundwater monitoring plan for potential to impact the Pond. The Plan should include provisions for preventing any impacts to the Pond. Furthermore, the recommended plan should indicate the mitigation actions to be taken by the Falmouth WWTF should impacts to the Long Pond water supply be identified through the expanded monitoring program.

6. The tasks outlined in the original Scope of Work for the comprehensive wastewater management study included assessing the nutrient load from the landfill and plume delineation. The final report must provide more detail regarding the calculated load emanating from the residual landfill plume and delineation of the actual plume and projected discharge location in West Falmouth Harbor.

7. The DWFP/DEIR indicates that a portion of the increased design flow in the amount

of 0.2 MGD will be held as emergency reserve available for future "unexpected growth." The Department believes that this reserve amount should be re-evaluated with respect to potential impacts on the nitrogen load to West Falmouth Harbor. Since 0.09 MGD has been allowed for infilling and growth along existing sewer lines, the 0.2 MGD reserve may be excessive and subject to reduction or elimination.

8. The DFWP/DEIR requests a Phase One waiver in order to begin construction of the upgrades for the wastewater treatment facility. The Department believes that the proposed upgrade for the wastewater treatment facility is necessary and appropriate. The Department further believes that design parameters for the proposed upgrade will not change substantially relative to the Final Facilities Plan/Final Environmental Impact Report. For these reasons, the Department is of the opinion that the Town should proceed with funding the design of the upgrade; however, since there are still many unresolved issues regarding the ultimate nitrogen loading and its impact on expansion, sewering and discharge locations, the Department cannot support the Town's request for a Phase One waiver to allow construction prior to the acceptance of the Final Environmental Impact Report.

The DEP Southeast Regional Office appreciates the opportunity to comment on this proposed project. If you have any questions regarding these comments, please contact Sharon Stone at (508) 946-2846.

YF

The Commonwealth of Massachusetts
William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

RECEIVED
MAR - 9 2000
MEPA

March 3, 2000

Secretary Bob Durand
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

ATTN: MEPA Unit

RE: Wastewater Facilities Planning Study, Falmouth, EOEA #11857, MHC #RC.23109

Dear Secretary Durand:

Staff of the Massachusetts Historical Commission have reviewed the Draft Environmental Impact Report (DEIR) for the Wastewater Facilities Planning Study referenced above and have the following comments.

MHC understands that Alternative 4 has been selected as the preferred plan. This plan includes an upgrade of the existing Falmouth Wastewater Treatment Facility, a sewer connection to the Facility from Falmouth High School, and sewer installations in the western portion of the West Falmouth Harbor Watershed, the North Davis Straits Service Area, the Scranton Avenue Service Center, and the Maravista Planning Area.

MHC understands that the project proponent is requesting a Phase I Waiver in order to proceed with the proposed upgrade of the Falmouth Wastewater Treatment Facility. After review of MHC's files and the information in the DEIR, MHC staff have determined that the proposed upgrade of the existing Falmouth Wastewater Treatment Facility is unlikely to affect significant historic or archaeological resources. No further review by this office is required for Phase I of the proposed project.

Plans for the sewer connection between Falmouth High School and the Wastewater Treatment Facility, and the sewer installations the western portion of the West Falmouth Harbor Watershed, the North Davis Straits Service Area, the Scranton Avenue Service Center, and the Maravista Planning Area indicate that all proposed sewers will be located within existing roadways. MHC has determined that these installations are unlikely to affect significant historic or archaeological resources.

MHC requests the opportunity to review plans for pump stations when these become available, and to review any changes in proposed sewer installations that will involve construction of off-road sewer segments.

These comments are offered in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800) Massachusetts General Laws, Chapter 9, Sections 26-27C (950 CMR

71), and MEPA. If you have any questions, please feel free to call Eric Johnson of my staff.

Sincerely,

Brona Simon

Brona Simon
State Archaeologist
Deputy State Historic Preservation Officer
Massachusetts Historical Commission

xc: Raymond A Jack, Falmouth Utilities Department
Nathan C. Weeks, Stearns and Wheeler
Cape Cod Commission
DEP, Southeast Regional Office
Ron Lyberger, BRP, DEP
Steve Hallem, BRP, DEP
Falmouth Historical Commission

DF

COUNTY OF BARNSTABLE MASSACHUSETTS

CAPE COD COMMISSION

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MAR 13 2000
MEPA

March 7, 2000

Mr. Robert A. Durand, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street, 20th floor
Boston, MA 02202

Attn: Richard Foster - MEPA Unit

RE: Town of Falmouth
Falmouth Wastewater Facilities Planning Study
Draft Environmental Impact Report Comment Letter
EOEA # 11857, CCC# EIR99001

Dear Secretary Durand:

The proposed project entitled, the Falmouth Wastewater Facilities Planning Study, is being reviewed by the Executive Office of Environmental Affairs MEPA Unit, as an Environmental Impact Report (EIR) pursuant to the Massachusetts Environmental Policy Act ("MEPA", G.L. c.30, secs. 61, 62-62H) and the Cape Cod Commission (CCC) as a Development of Regional Impact (DRI) pursuant to Section 12(i) and 13(b) of the Cape Cod Commission Act in accordance with the Memorandum of Understanding (MOU) between the CCC and MEPA.

Though the project is not designated as a "major and complicated project" the applicant agreed to submit interim reports for public comment and review during the course of the joint review process. The CCC subcommittee commented on August 10, 1999 regarding the Needs Assessment Report. The third of those interim reports, a Draft Environmental Impact Report (DEIR) was submitted to the CCC in February, 2000. A CCC subcommittee held a public hearing on Thursday, March 2, 2000 at 7:30 PM in the Gus Canty Recreation Center and subsequently met to discuss their concerns about the DEIR on March 6, 2000. Written public comments regarding this phase of the project were collected and forwarded to Richard Foster at the MEPA Unit, Raymond A. Jack, Falmouth Utilities Manager, and Nate Weeks at Stearns and Wheler.

Description of Study:

The Draft Wastewater Facilities Plan/Draft Environmental Impact Report presents a recommended plan for wastewater treatment within the study areas identified during the previous Needs Assessment and Screening Analysis phases of the wastewater planning study. During the first phase, the Needs Assessment, the town's consultants identified seven areas for inclusion in the study: 1) Falmouth High School, 2) West Falmouth Harbor and its watershed, 3) sewered areas along Main St., 4) Falmouth Beach, 5) Davis Straits/Inner Harbor (which has been subdivided into Clinton Ave., Scranton Ave. and North Davis Straits subareas), 6) Falmouth Heights, and 7) Maravista. In the second phase, the screening analysis, potential options for wastewater treatment in these areas were identified. The DEIR includes recommended options for addressing previously identified needs, preliminary cost estimates, and identifies other issues that may arise due to the implementation of recommended options.

Subcommittee Comments:

Alternative #4 is the recommended alternative in the report. It includes treatment of 1.2 million gallons per day (MGD) at the town's existing wastewater treatment facility (WWTF) with a total nitrogen discharge concentration of 5 parts per million (ppm), and the use of denitrifying septic systems east of Rt. 28 within the West Falmouth Harbor watershed. The 1.2 MGD to be treated at the town WWTF includes 0.56 MGD for existing services and infilling in these areas, 0.01 MGD from Falmouth High School, 0.23 MGD from the portion of the West Falmouth Harbor watershed west of Rt. 28, 0.2 MGD from North Davis Straits and Scranton Ave., and 0.2 MGD as reserve capacity. The DEIR recommends an evaluation of effluent injection well technology. Sewering of Maravista is not recommended until further evaluation of Little Pond is completed. The estimated capital cost for the recommended wastewater alternative is $34.41 million.

The Town has requested a Phase One Waiver from the Secretary of the EOEA to proceed with construction of a new sequencing batch reactor with a design average annual flow of 1.2 MGD; new denitrification filters for a permitted treatment level of 5 ppm; sludge management facilities; and renovation of the aerated pond basins. Although Alternative #4 provides use of the best available technology to reduce nitrogen loading to West Falmouth Harbor and its more nitrogen sensitive tributary of Snug Harbor, the subcommittee are concerned that these actions may not provide the ultimate level of protection or restoration that this resource requires. Therefore, proceeding with a Phase One Waiver includes some risk of not accomplishing the protection and restoration goals sought by the Commission for West Falmouth Harbor.

The following section outlines the issue in more detail, identifies portions of the EIR scope that have not been completed and makes recommendations to review critical scientific assessment data that is near completion.

The existing treatment plant currently has a state DEP groundwater discharge permit to discharge up to 0.88 million gallons per day (MGD) of effluent with a nitrogen concentration of up to 50 parts per million (ppm) (the treatment plant began discharging effluent in October 1986). The WWTF averages approximately 0.46 MGD and had an average effluent nitrogen concentration of 23 ppm in 1998. Based on an average groundwater flow rate of one foot per day, it was estimated that the effluent would begin to reach West Falmouth Harbor in about 7 years, or January 1994. Water quality information collected by the Falmouth Pond Watchers measured an average total nitrogen concentration of 0.85 ppm during the summer of 1994, with concentrations of up to 1.3 ppm at the Nashawena Rd. Bridge in Snug Harbor. Average nitrogen concentrations in Buzzards Bay water just outside of the Harbor are approximately 0.3 ppm.

The Facilities Plan, as detailed in the scope of work (January, 1999 ENF), proposed to evaluate the sensitivity of West Falmouth Harbor and the impacts that the town WWTF discharge is having on the Harbor ecosystem. The following steps were proposed in Task 5.2 of the scope of work as part of the development of a nitrogen management plan for West Falmouth Harbor: 1) Evaluate the current "health" of the harbor and determine capacity or tolerance for future nitrogen loads, 2) prepare plume delineations for the WWTF and landfill, 3) perform sampling and analysis of all existing and new WWTF and landfill wells, 4) determine distribution of WWTF plume discharge by installation of hand-driven well points adjacent to the Harbor, 5) conduct a study to determine natural attenuation of nitrogen by intercepting wetlands, and 6) adjust water quality model as necessary based on data developed. The information to be developed in these steps is crucial for understanding the amount of nitrogen that should be going into the Harbor, which is directly related to the level of treatment and amount of flow that should go through the WWTF. This information is not contained in the DEIR. Rather, the DEIR relies upon satisfying a proposed SA-N nitrogen loading limit and providing the best available technology (treatment at less than 5 ppm).

On a separate track, the DEIR recognizes that DEP and the Falmouth Boat Club have jointly funded Brian Howes of UMASS-Dartmouth, Center for Marine Science and Technology (CMAST) to complete an assessment of West Falmouth Harbor. Since the above steps in Task 5.2 have not been addressed within the DEIR, this evaluation is critical for appropriate consideration of the alternatives presented in the DEIR. The CMAST evaluation is to include consideration of watershed boundaries, location of discharge of the WWTF plume, potential nitrogen removal in the Snug Harbor marsh, and the ecosystem impacts of the WWTF on Snug Harbor and the rest of West Falmouth Harbor. This study was just received by the Commission on February 25th. Until this information is reviewed and adequate discussion of the results and appropriate limits has occurred, it is suggested that complete and adequate review of the management options cannot occur.

Subcommittee Recommendation on Waiver Request:

It is essential that all components of the EIR scope be brought to a completion. These items include an evaluation of the nitrogen assessment being conducted by Dr. Howes and the piloting of injection well technology, especially if it is shown that the wastewater discharge or some portion must be moved out of the Snug Harbor watershed. However, even in the event that additional protective steps must be taken, it is unlikely at this time that a treatment facility could be engineered to achieve greater treatment levels (less than 5 ppm) or that another location to build a wastewater treatment facility could be found. Therefore, the subcommittee recommends the Phase One Waiver be granted contingent upon a commitment to complete the entire EIR scope and suggests that the funding for this work be included in the budget for the Phase One Waiver. In addition, the Phase One Waiver for an upgrade of the Treatment plant does not include sewering phases. The nitrogen loading issues of West Falmouth Harbor should be satisfactorily addressed prior to allowing increases in volume treated at the plant. It should also be noted that the MBL Development of Regional Impact review will result in an escrow account of $43,350 that is targeted for and will be available for use towards the Wastewater Facility Plan to address West Falmouth Harbor.

Technical Issues:

While the merits of the preferred alternative will have to be reviewed in light of the further analysis afforded by the CMAST study; there are a number of technical issues that should be addressed in the EIR process:

1. The design capacity of the treatment plant is unclear. The alternatives analyses generally refer to flows of 1.2 or 1.4 MGD, yet the maximum month and peak day flows presented in Table 4.1 are between 25 and 55% higher. The Commission subcommittee questions the anticipated maximum peak day capacity and how peak flows will be accommodated through the general WWTF designs presented in the DEIR.
2. In assessing the impacts of the WWTF nitrogen loads, the DEIR stresses the difference between a permit concentration (5 or 10 ppm nitrogen) and an expected treatment concentration (3 or 7 ppm nitrogen). Since the WWTF upgrade is not complete and a history of performance has not been established, it is recommended that review of potential impacts use the permit concentrations. In addition, we suggest that use of total annual nitrogen load be considered as the groundwater discharge permit limitation.
3. Use of an injection well for effluent disposal is proposed for further evaluation in the DEIR. Although the town has received State Revolving Funds for a pilot test, additional site

exploration, design, and operating & maintenance costs are not included in any of the cost analyses. If further evaluation indicates that either a portion or all of the WWTF effluent should be discharged outside of the Harbor watershed, this effluent disposal option will increase in importance.

4. At this point in the assessment, there is a difference in the nitrogen sensitivity of the main portion of West Falmouth Harbor and the Snug Harbor or Oyster Pond sections. It is suggested that consideration be given to the advisability and costs associated with sewering only the Snug Harbor and Oyster Pond watershed portions west of Rt. 28.
5. As a portion of the proposed nitrogen management plan for West Falmouth Harbor, the DEIR proposes a 50% reduction in fertilizer application (~4% of the calculated nitrogen load to Snug Harbor). It is suggested that additional details of the efforts that will be undertaken to attain a 50% reduction be provided and an assessment of the likely success in attaining the reduction should be conducted.
6. Part of the recommended solution for Oyster Pond is an enlarging of the culvert connecting it to the rest of the West Falmouth Harbor system (p. 5-24). It is recommended that details regarding the required size of the culvert, its effect on tidal exchange, anticipated ecological effects, and costs should be provided.
7. As stated above, the scope of work was to include details on the assessment of the town landfill plume. The DEIR does not include sufficient detail of the work completed to support the conclusions regarding the potential impact on Long Pond. It is recommended that well maps, well logs, cross-sections, water table measurements, and monitoring results be provided in a technical memorandum to support the proposed changes in monitoring parameters and locations, as well as the conclusion that the landfill does not impact Long Pond.
8. Similarly, monitoring results and any additional water table measurements, especially between the WWTF and Snug Harbor, should be provided to support the proposed changes in the WWTF monitoring parameters and locations. We suggest investigation wells as called for in Task 5.2 proximal to West Falmouth Harbor to evaluate groundwater conditions prior to discharge into the West Falmouth Harbor system.
9. The costs assigned to the use of standard Title 5 ($8,100) and denitrifying septic systems ($19,700) seem to be rather high (Table 3-2) and the text further states that these costs are reduced in anticipation of management of these systems by a district. Full system installations depend on a number of design and permitting factors, but it is common to find conventional Title 5 septic system installations on Cape Cod costing between $4,000 and $6,000. While it is unclear whether these costs informed any of the decisions made regarding the recommended alternative, additional clarification of the source of these costs should be provided. In addition, details of the anticipated costs of an on-site management district (p. 8-20) should be provided.
10. It is recommended that details of the sewer use regulations and/or zoning changes (p. 5-6; Appendix 5-1) be resolved before additional areas are connected to the WWTF. The responses provided on the Commission's comment letter concerning the Alternatives Screening Analysis states that "more definitive proposed regulations will be recommended in the next phase" (Appendix 1-1). It is recommended that proposed regulations be provided for the proposed sewered and denitrifying septic system areas.
11. It is recommended that a plan to monitor and control septage be created and properly enforced to assure that septage from towns other than Falmouth are not being treated at the Falmouth Wastewater Treatment Facility.
12. In previous comments, the Commission suggested that consideration be given to reviewing the nitrogen sensitivity of Inner Harbor. This was suggested since Falmouth Heights, Scranton Ave. and North Davis Straits were study areas and wastewater solutions in these areas could improve water quality in the Harbor. However, the Commission subcommittee recognizes that it would not be possible to provide an assessment of the adequacy of these improvements without at least a rudimentary assessment of the tidal exchange in the system. The DEIR response to this comment lists a number of required activities to be undertaken to complete an adequacy assessment; the subcommittee suggests

that these activities are beyond the scope of this planning project. The Commission subcommittee would be willing to complete a modest assessment if the Town could provide water use and bedrooms by parcel and study area in the Inner Harbor watershed.

Summary:

1. The Commission subcommittee recommends the phase I waiver be granted by MEPA, contingent upon a commitment to complete the entire EIR scope, nitrogen loading issues of West Falmouth Harbor be satisfactorily addressed, and that the waiver not include sewering phases.

2. Commission staff remain available to assist the Town in resolving issues associated with the Facilities Planning process.

Sincerely,

Robert Randolph
Chair, EIR Review Subcommittee

cc: Raymond A. Jacks, Falmouth Utilities Manager
Nate Weeks, Stearns & Wheler Project Engineer
Brian Currie, Falmouth Town Planner
Peter Boyer, Falmouth Town Administer
Joseph Costa, Buzzards Bay Project
Alan Fleer
John W. Donohoe
Gary Hayward
Robert E. McLaughlin
Christiane Crasemann Collins

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REC'D MAY 04 2000

MINUTES
FALMOUTH WASTEWATER FACILITIES PLANNING STUDY TECHNICAL MEETING

Date: April 24, 2000
Project: Falmouth Wastewater Facilities Planning Study #EIR99001
Location: Cape Cod Commission
In attendance: Ron Lyberger, DEP; Brian Dudley, DEP; Brian Howes, UMASS-D,CMST; Raymond Jack, Falmouth Utilities Manager; Joe Costa, Buzzards Bay Project, Wayne Perry & Nate Weeks, Stearns & Wheler; Alan Fleer, George Heufelder, and John Ross, Falmouth WW Citizens Working Group; John Donohoe, Falmouth resident
Commission Staff: Ed Eichner, Tom Cambareri, Seth Wilkinson

Ed Eichner began the meeting at 9:10 AM. He started by reviewing the agenda for the meeting and the April 13 Memo from Stearns and Wheler (S&W) (see both attached). In response to the first item on the agenda and S&W's first questions, Mr. Eichner explained that the Commission would like to see the study target, as a goal, the level of water quality for Snug Harbor recommended by the DEP / Falmouth Boat Club study for the reestablishment of eelgrass (0.35 ppm total nitrogen).

Brian Dudley agreed with Mr. Eichner and stressed the importance of creating a situation where eelgrass could be reestablished. He also stressed that this goal should be used in the analyses to be completed in the study and that other targets could be discussed once the analyses are completed. Ron Lyberger offered his agreement and Nate Weeks acknowledged these answers.

Mr. Eichner initiated discussion regarding the differences between the Commission and USGS watershed delineations for the Mashapaquit Creek portion of Snug Harbor. He commented that these differences would only be important if some sort of nitrogen credit is given for attenuation through the marsh surrounding the creek and that the water quality measurements from the DEP/Boat Club study confirmed that a significant portion of the treatment facility's flow was arriving in the Creek. Further, the water balance information also supported the USGS delineation. He concluded that additional wells would help to clarify the situation, but if they were not installed the USGS watershed was appropriate.

The installation of observation wells to aid in estimating the attenuation of nitrogen by salt marshes was discussed further. The consensus was that without additional wells in the area between the facility and the creek marsh, conservative estimates would have to be used in the planning process. Mr. Dudley suggested that 45% attenuation in spray irrigation beds, 0% attenuation in sand infiltration beds, and 20% attenuation in marshes would be appropriate figures to be used given the uncertainty in the existing data and the need to establish reasonable but conservative estimates. Mr. Eichner and Brian Howes agreed that these would be appropriate assumptions unless additional data was collected. Dr. Howes also mentioned that the long term attenuation capacity of the marsh is not known. Ray Jack commented that it is not likely that additional wells will be installed because the available budget has been "expended".

There was discussion regarding the proposed nitrogen treatment levels at the facility and issues related to the likely permit for the plant. Mr. Dudley mentioned that the Groundwater Discharge Permit would likely include a mass loading limit and a "not-to-exceed" total nitrogen concentration. Mr. Eichner asked if this concentration was likely to be the 5 ppm that S&W has said the plant will attain and also asked how DEP was going to monitor permit compliance for the loading limit. Mr. Dudley responded that the likely mass loading monitoring would be based on a weekly total nitrogen concentration and daily flow monitoring, but that DEP is still discussing the policies related to these types of permits.

Mr. Weeks asked whether DEP has any concerns regarding the ability of the plant to attain the proposed 3 ppm total nitrogen treatment level. Mr. Dudley and Mr. Lyberger commented that DEP has some concerns and would like to review performance data for similar installations, as well as the details of the proposed design.

There was discussion regarding the proposed design flows at the treatment facility. Mr. Lyberger noted that the currently proposed plan has 200,000 gpd of flow that is not targeted for a particular use. He further noted that unaccounted flow would not meet Executive Order 385 regarding unplanned growth and would create approval difficulties for Falmouth Wastewater Facilities Planning Study (FWFPS) given the concerns about the total nitrogen loading to the harbor. Mr. Jack commented that the Selectman and Town Meeting vote approved the increase in design flow from 1.2 to 1.4 million gallons per day (MGD), including 0.2 MGD for the Maravista area and the 0.2 MGD of unaccounted flow, if injection effluent disposal became available. George Heufelder and Mr. Dudley stressed that the expected use of the "unaccounted" 0.2 MGD needs to be described. Mr. Eichner expressed concern that treatment of Maravista wastewater using a proposed treatment facility developed under the Ashumet Valley offset study had not be adequately reviewed as an alternative to importing more wastewater to the main treatment plant and increasing the nitrogen load to the harbor.

Mr. Weeks stated that the $500,000 made available by town meeting for the pilot injection test allowed the town to explore other types of effluent discharge as well. Mr. Lyberger commented that DEP had some concerns about injection wells given the current problems with the existing injection well test in Barnstable. Mr. Heufelder expressed some concern about how much flexibility was allowed by the town meeting vote.

Mr. Eichner initiated a discussion regarding wastewater management districts. Mr. Weeks stated that the proposed New Silver Beach sewer district regulations would be used as a model for the rest of the town. He stated, with assistance from Mr. Heufelder, that these regulations limit houses to three bedrooms and essentially lock in the number of bedrooms on houses with three or more existing bedrooms. Mr. Weeks also noted that they are recommending an increase in the minimum lot size, although questions were raised about how much of a difference this would make in the nitrogen loading.

There was discussion regarding limitations on lawn fertilizing. Mr. Eichner and Mr. Lyberger expressed considerable doubt that enforcement on the size of lawn or amount of fertilizers would be feasible and suggested that this provisions should be eliminated from the proposed nitrogen mitigation.

Discussion regarding the landfill plume was postponed to a time when George Calise of the Town of Falmouth could be present. Wayne Perry also noted that S&W are working on a response to previous Commission requests for study details: well maps, well logs, cross-sections, water table measurements, and monitoring results.

Agenda

West Falmouth Harbor/Falmouth Wastewater

Cape Cod Commission
April 24, 2000
9 AM to 12 NOON

1. Introductions
2. West Falmouth Harbor Nitrogen Limits
3. Watershed Delineation
4. WWTF and Landfill Plumes
5. Injection Well Status/Alternative Discharge Locations
6. Wastewater Management Activities
    a. management district
    b. zoning changes
    c. lawn limitations
7. Other Task 5.2.2 items
8. Next Steps

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

MEMORANDUM

RECEIVED
APR 1 4 2000
CAPE COD COMMISSION

To: Ed Eichner, Cape Cod Commission
Brian Dudley, Massachusetts DEP

From: Nathan Weeks, P.E. NWW
Wayne Perry, P.E. WCP

Date: April 13, 2000

Re: Town of Falmouth WWFP
Questions on Regulatory Framework

CC: Raymond Jack, Falmouth Utilities Manager

As we prepare for the April 24, 2000 meeting for the Falmouth Wastewater Facilities Planning (WWFP) Study, we have several questions on the regulatory framework governing the project. Several of these questions were identified at the March 13, 2000 meeting for the same project. We are listing the questions in this memo so that you can consult with members of your staff to provide the most complete answers possible.

The "Evaluation of the Nutrient Related Health of West Falmouth Harbor" (Draft Report) prepared by Howes et al presents several findings of an evaluation of Snug Harbor and its watershed. Several of these findings need regulatory interpretation and approval before we can proceed with the additional evaluations.

The Draft Report suggests a surface water nutrient threshold of 0.35 to 0.37 parts per million (ppm) total nitrogen to support a high quality habitat and to help restore eelgrass throughout West Falmouth Harbor.

- Is reestablishment of eelgrass the goal that will be the basis of DEP, CCC, and EOEA approval?
- Will DEP, CCC, and EOEA accept a different threshold if selected by the Town?

The Draft Report presents several findings on nitrogen attenuation in the watershed.

- Do DEP and CCC agree with the evaluation and its methods, watershed delineation, and findings?
- Will there be a review process for the Draft Report?

- Do the DEP and CCC agree with the following attenuation factors identified in the Draft Report?
  - 65% attenuation in spray irrigation areas
  - 8% attenuation at the sand infiltration beds
  - 40% attenuation in the Mashapaquit Creek Marsh
- If you do not, what attenuation factors should be used to develop a total annual loading limit?

The Cape Cod Commission has suggested that potential impacts to West Falmouth Harbor should be based on a permit concentration of 5 ppm not the expected average annual WWTF discharge concentration of 3 ppm.

- Does DEP agree with this approach for calculating average annual loadings?

A WWTF designed and operated for advanced nitrogen removal typically discharges 1 to 2 ppm soluble organic nitrogen which is relatively inert and cannot be removed in the treatment process. It is not expected to be available for plant uptake in the receiving water.

- Would the CCC and DEP consider removing this nitrogen component from the determination of a total annual loading limit?

We look forward to receiving your responses to these questions.

NCW/WCP/jsc

Stearns &Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

MEMORANDUM

To: Edward M. Eichner, Cape Cod Commission
Brian Dudley, Massachusetts DEP

From: Nathan C. Weeks, P.E. NCW
Wayne C. Perry, P.E. WCP NCW

Date: November 29, 2000

Re: Town of Falmouth
Wastewater Facilities Planning Study
Meeting Notes from November 13, 2000

Cc: Peter Boyer, Falmouth Town Administrator
Raymond Jack, Falmouth Utilities Manager
Jim Vieira, Wastewater Study Working Group

This memo is written to document the decisions made at the November 13, 2000 meeting at the Cape Cod Commission offices for the Town of Falmouth (Town) Wastewater Facilities Planning Study (Study). The following items were decided:

- The Study will use a West Falmouth Harbor watershed delineation based on the Cape Cod Commission delineation that has been slightly modified. The Mashapaquit Creek subwatershed will be extended further south to coincide with the southern limits of the Mashapaquit Creek subwatershed as delineated by USGS.
- The following attenuation factors should be used for the Study and the Final Environmental Impact Report:
  - 45% nitrogen attenuation at the spray irrigation fields.
  - 0% nitrogen attenuation at the sand infiltration beds
  - 20% nitrogen attenuation at the wetland interface between Mashapaquit Creek and its watershed.
- Watershed modeling will utilize an average concentration of 3 mg/l for the Falmouth WWTF effluent discharge.
- A possible reduction in the future fertilizer loading values should continue to be considered as part of a Nitrogen Management Plan for the watershed.
- Massachusetts DEP and Cape Cod Commission (CCC) will review the May 31, 2000 memo discussing the comments on the Draft Wastewater Facilities Plan and Draft Environmental Impact Report and send comments to Stearns & Wheler.
- Stearns & Wheler will contact Dick Foster of the MEPA Group to determine if the Study needs to be rescoped for the addendum scope.
- The Town and Stearns & Wheler will keep DEP and CCC informed as the Project proceeds.

Please review these items and call if you have any questions or comments.

NCW/emc

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REC'D DEC 27 2000

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
20 RIVERSIDE DRIVE, LAKEVILLE, MA 02347 508-946-2700

ARGEO PAUL CELLUCCI
Governor

JANE SWIFT
Lieutenant Governor

BOB DURAND
Secretary

LAUREN A. LISS
Commissioner

December 22, 2000

Mr. Nathan C. Weeks
Mr. Wayne C. Perry
Stearns and Wheler, LLC
100 West Main Street
P.O. Box 975
Hyannis, Massachusetts 02601

RE: FALMOUTH—Comprehensive
Wastewater Management Plan

Dear Messrs. Weeks and Perry:

As agreed at our November 13, 2000 meeting, the Department of Environmental Protection is providing written comments on your May 31, 2000 memorandum to Raymond Jack, Town of Falmouth Utilities Manager. This letter is intended to support the framework by which the remainder of the comprehensive wastewater management plan (CWMP) is to proceed and to reinforce agreements made at meetings subsequent to your memorandum.

The Department wishes to make its position very clear with respect to appropriate nitrogen loading limits to West Falmouth Harbor and the delineation of the Mashapaquit Creek subwatershed. Dr. Brian Howes of the Center for Marine Science and Technology (CMAST) of the University of Massachusetts, Dartmouth has completed a study concluding the reestablishment of eelgrass habitat to levels preceding the discharge of treated effluent from the current wastewater treatment facility (WWTF) requires an annual nitrogen loading corresponding to 0.35 to 0.37 ppm of total nitrogen in Snug Harbor. The Department believes that the Town of Falmouth must adopt this target as the goal of the CWMP in order to restore impacted waters to their "pre-discharge" condition. However, should this goal prove to be unattainable due to physical and/or technological constraints, economic factors or social acceptability based on a thorough environmental and cost/benefit analysis, the Department may consider less stringent loading requirements.

The delineation of the Mashapaquit Creek subwatershed was finalized at our November 13, 2000 meeting with the Cape Cod Commission (CCC) and representatives from the Town. As stated in your November 29, 2000 memorandum (to Eduard Eichner of the CCC and Brian Dudley of DEP), the West Falmouth Harbor (WFH) watershed will correspond to that determined by the CCC but with modifications to Mashapaquit Creek subwatershed. The southern boundary of this subwatershed will extend further south to coincide with the boundary determined by the United States Geological Survey (USGS).

The Draft Environmental Impact Report (DEIR) identified a design flow of 1.4 million gallons a day (mgd) for the upgraded WWTF. Of this, approximately 1.0 mgd accounts for existing flow, infilling, and planned expansions of the collection in the West Falmouth Harbor watershed area, North Davis Straits, Scranton Avenue and Falmouth High School. 0.2 mgd is slated for the Maravista planning area. The remaining 0.2 mgd was characterized in the DEIR as reserve capacity for emergencies and "unexpected growth and flexibility in operations".

Some issues with regard to the design capacity of the WWTF must be addressed as part of the final CWMP. First, the quantity of effluent discharged from the WWTF to WFH must be determined. As stated previously, the goal is to limit the volume of discharge so that the annual total nitrogen load will meet the 0.35 to 0.37 ppm total nitrogen limit in Snug Harbor. This flow limit has yet to be determined, and any flow from the WWTF above this limit must be discharged outside of the WFH watershed. This evaluation will be based on total nitrogen concentration in the WWTF effluent. Currently, the recommended treatment process anticipates an annual average total nitrogen concentration of 3 mg/l.

Secondly, the Department had expressed concern that 0.2 mgd was included for unexpected growth. Your memorandum clarifies that this capacity would accommodate existing developed areas, anticipated needs for affordable housing and provide appropriate reserves for flexible operation of the WWTF. Assuming that sufficient discharge capacity is available within the WFH watershed, or outside of it if necessary, the Department believes that the allocation of 0.2 mgd for the described purposes is warranted.

To summarize the Department's position with regard to design capacity, The WWTF can be designed for 1.4 mgd or designed to expand to 1.4 mgd with the understanding that discharge to the WFH watershed cannot exceed the flow limit determined to be protective of WFH. Any discharge above that flow limit must be discharged outside of the watershed.

Effluent discharge locations remain a concern. The existing infiltration beds and spray irrigation area all lie within watersheds ultimately discharging to Snug Harbor. As discussed previously, discharge from these disposal facilities will be limited and very likely will not be able to accommodate the ultimate design capacity of the WWTF and may not be able to accommodate the increase for the immediate remedies cited in the CWMP. It is imperative that the Town provide additional disposal capacity outside the WFH watershed. Your memorandum discusses the piloting of injection wells. Given the recent difficulties in Barnstable with pilot testing of injection wells and the uncertainty of success, the Town should actively pursue more traditional methods of effluent disposal. Screening and evaluation of potential disposal sites should begin as soon as possible in order to identify possible impacts and avoid unnecessary delay in completing the CWMP.

Your memorandum makes general references to attenuation factors which can be applied in nitrogen loading calculations. It has been agreed that the following attenuation factors can be applied:

45% nitrogen attenuation at the spray irrigation area
0% nitrogen attenuation at the infiltration beds
20% nitrogen attenuation at the Mashapaquit Creek interface.

The Department does not support the proposed 50% credit for fertilizer use reduction throughout the watershed.

Your memorandum included a document titled "Technical Memorandum Hydrogeologic Considerations of Falmouth Landfill Plume" dated May 10, 2000. Some of the conclusions drawn in that memorandum warrant further explanation. Chemical evidence is provided which purports to suggest that significant attenuation of a landfill plume toward Long Pond is occurring. However, the possibilities suggested are that there is "measurable natural attenuation" or that the monitoring wells were "installed off-center with respect to the centerline of the plume". It would seem that if there is doubt about the delineation of the plume, it is difficult to draw meaningful conclusions about its behavior. Similarly, in evaluating the plume coming from the WWTF and the groundwater quality at Snug Harbor, it is suggested that nitrate attenuation rates of 56% to 88% are possible. It is not clear if these attenuation values are based on marsh uptake or within non-wetland soils. In either case, these values exceed experimental observations at Mashapaquit Creek and need to be further substantiated or abandoned.

The Department appreciates the opportunity to review this information and looks forward to a successful conclusion to this project.

If you have any additional questions or require further information please contact Brian Dudley at (508)946-2753.

Very truly yours,

David A DeLorenzo

David A. DeLorenzo, Deputy Regional Director
Bureau of Resource Protection

D/BAD

cc: Peter Boyer, Town Administrator
Town of Falmouth
59 Town Hall Square
Falmouth, MA 02540

Raymond Jack, Utilities Manager
Town of Falmouth
59 Town Hall Square
Falmouth, MA 02540

Eduard Eichner
Cape Cod Commission
P.O. Box 226
Barnstable, MA 02630

DEP/Boston
Attn: Ronald Lyberger

TOWN OF FALMOUTH
59 TOWN HALL SQUARE
FALMOUTH, MA 02540
508-548-7611
FAX: 508-457-2511

January 24, 2001

Mr. David A. DeLorenzo, Deputy Regional Directory
Massachusetts Department of Environmental Protection
20 Riverside Drive
Lakeville, MA 02347

Re: Town of Falmouth
Comprehensive Wastewater Management Planning Study
Meeting Notes from December 20, 2000
Working Group Meeting

Dear Mr. DeLorenzo:

As requested, this letter is written to summarize the major points of discussion and agreement of the Working Group Meeting which was held on December 20, 2000, and was attended by you and Mr. Brian Dudley of your staff.

Stearns & Wheler presented the following information at the meeting:

- Revised watershed delineation for Snug Harbor.
- The following preliminary findings of nitrogen loading evaluations for Snug Harbor:
    - The design condition effluent discharge proposed in the DEIR would result in an approximate 0.36 mg/l total nitrogen concentration in Snug Harbor when calculated with the attenuation factors documented in the CMAST report.
    - This same design condition would result in an approximate 0.38 mg/l total nitrogen concentration in Snug Harbor when calculated with the attenuation factors directed by DEP.
    - Approximately 0.2 mgd of the 1.2 mgd design flow would need to be removed from the Snug Harbor Watershed to meet the 0.37 concentration threshold to reestablish eelgrass. This flow is based on the attenuation factors directed by DEP.
    - Approximately 0.6 mgd of the 1.2 mgd design condition flow would need to be removed from the Snug Harbor Watershed to meet the 0.35 concentration

  threshold. Again, this flow is based on the attenuation factors directed by DEP.
  - Buildout conditions in the Snug Harbor Watershed without contribution from the WWTF discharge would result in an approximate 0.40 mg/l total nitrogen concentration in Snug Harbor.
- Identification and description of 15 alternative discharge sites being evaluated for effluent relocation from the Snug Harbor Watershed.

Discussion of this information led to the following agreement on an acceptable effluent discharge to the Snug Harbor Watershed and how DEP might consider a future effluent discharge permit.

- An effluent discharge of 1.0 mgd to meet a projected 0.37 mg/l total nitrogen concentration in Snug Harbor (at the design condition) would be acceptable to DEP.
- DEP would consider allowing an effluent discharge of 1.2 mgd into the Snug Harbor Watershed if WWTF performance data demonstrated that the WWTF can produce an effluent with less than the currently projected 3 ppm total nitrogen concentration. This consideration would occur after an upgrade to the WWTF and demonstration of this performance.
- The implementation plan of the Wastewater Facilities Plan and FEIR will identify the timing of proposed sewering of the western portion of Snug Harbor.
- A final Wastewater Facilities Plan and Environmental Impact Report will be prepared for submittal to EOEA in late January to allow a Secretaries Certificate to be released by the April Town Meeting.

Please call if you have any questions or comments about these meeting notes.

Very truly yours,

Peter F. Boyer
Town Administrator

Cc: Nathan C. Weeks, P.E., Stearns & Wheler Engineers
Seth Wilkinson, Cape Cod Commission

APPENDIX 3-1

SNUG HARBOR
REVISED NITROGEN LOADING EVALUATION
WITH ATTENUATION FACTORS[1]

Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts

	CMAST Suggested Attenuation				DEP Suggested Attenuation			
	WWTF	Unattenuated	Atten. Loading (kg/year)		WWTF	Unattenuated	Atten. Loading (kg/year)	
	Flow (2)	Loading	To	To	Flow (2)	Loading	To	To
	(mgd)	(kg/year)	Groundwater	Creek[5]	(mgd)	(kg/year)	Groundwater	Creek[5]
Loading to Mashapaquit Creek								
Non WWTF Loading								
On-Site Systems		334	334	200		334	334	267
Roofs and Roads		482	482	289		482	482	386
Lawns		465	465	279		465	465	372
Natural Areas		108	108	65		108	108	86
Subtotal of non-WWTF Loading		1,389	1,389	833		1,389	1,389	1,111
WWTF Loading								
50% of Total Spray Irrigation[3]	0.125	518	181	109	0.125	518	285	228
Infiltration Beds 1-8[4]	0.54	2,238	2,059	1,236	0.54	2,238	2,238	1,791
Subtotal of WWTF Loading	0.665	2,756	2,241	1,344	0.665	2,756	2,523	2,019
Subtotal to Groundwater System			3,630				3,912	
Total to Creek[5]	0.665	4,145		2,178	0.665			3,130
Loading to Other Portions of Snug Harbor								
Non WWTF Loading								
On-Site Systems		386	386	386		386	386	386
Roofs and Roads		427	427	427		427	427	427
Lawns		413	413	413		413	413	413
Natural Areas		103	103	103		103	103	103
Subtotal of non-WWTF Loading		1,329	1,329	1,329		1,329	1,329	1,329
WWTF Loading								
50% of Total Spray Irrigation[3]	0.125	518	181	181	0.125	518	285	285
Infiltration Beds 9-14[4]	0.41	1,699	1,563	1,563	0.41	1,699	1,699	1,699
Subtotal of WWTF Loading		2,218	1,745	1,745			1,984	1,984
Subtotal to Groundwater System			3,074				3,313	
Total to Other Portions of Snug Harbor	0.535	3,547		3,074	0.535			3,313
Total Loading to Snug Harbor	1.2			5,252	1.2	-		6,443

Notes:

1. This table summarizes nitrogen loading to Snug Harhor for various nitrogen attenuation factors.
2. WWTF flows are annualized which takes into account the seasonal usage on the Spray Irrigation Areas.
3. CMAST observed nitrogen attenuation at the spray irrigation areas of 65%, therefore 35% of the nitrogen passes through. DEP suggested attenuation at the spray irrigation areas is 45%, therefore 55% of the nitrogen passes through.
4. CMAST observed nitrogen attenuation at the infiltration basins of 8%, therefore 92% of the nitrogen passes through. DEP suggested attenuation at the infiltration basins is 0%, therefore 100% of the nitrogen passes through.
5. CMAST observed attenuation at the Mashapaquit Creek Wetland of 40%, therefore 60% of the nitrogen passes through. DEP suggested attenuation at the Creek Wetland is 20%, therefore 80% of the nitrogen passes through.

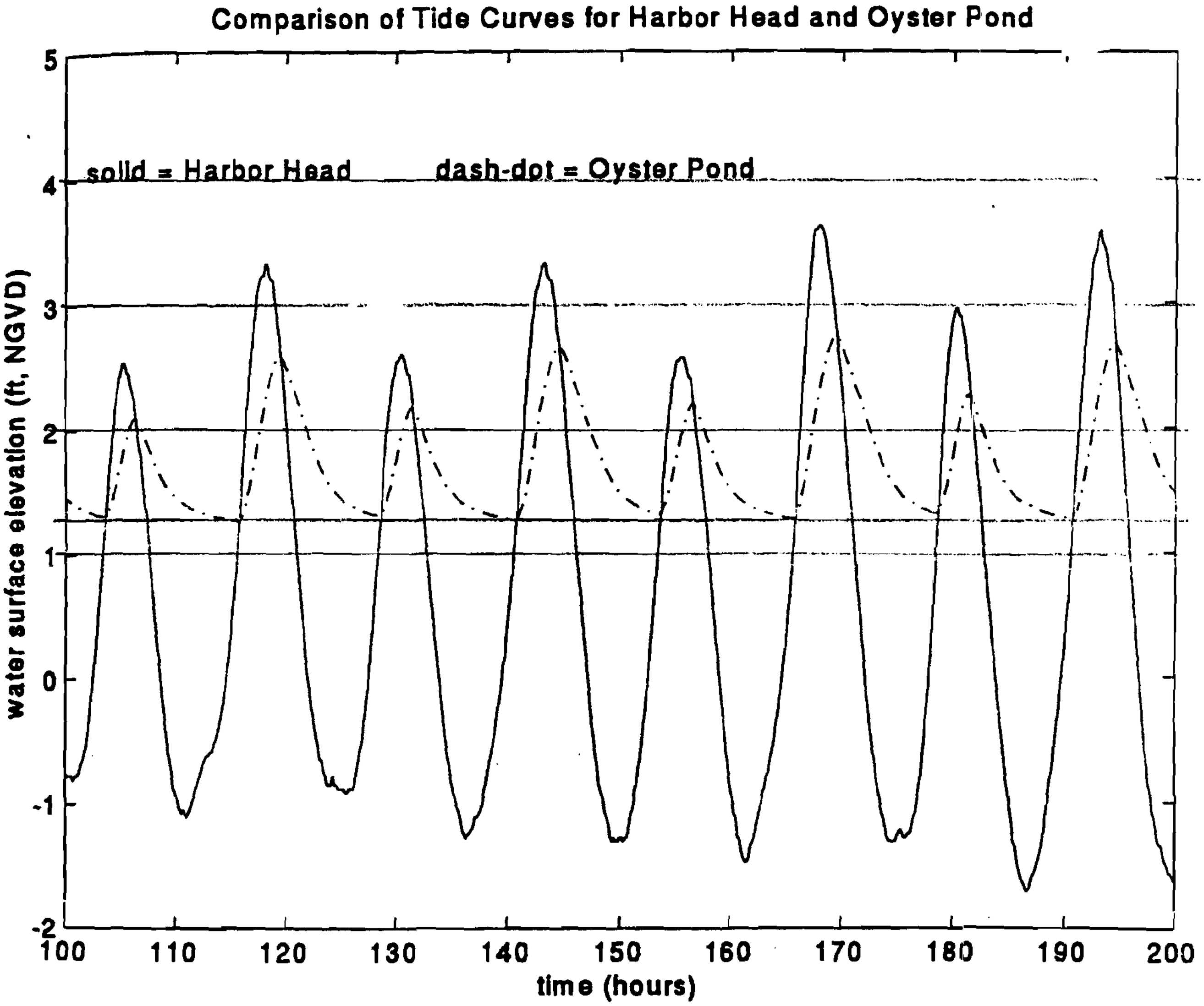
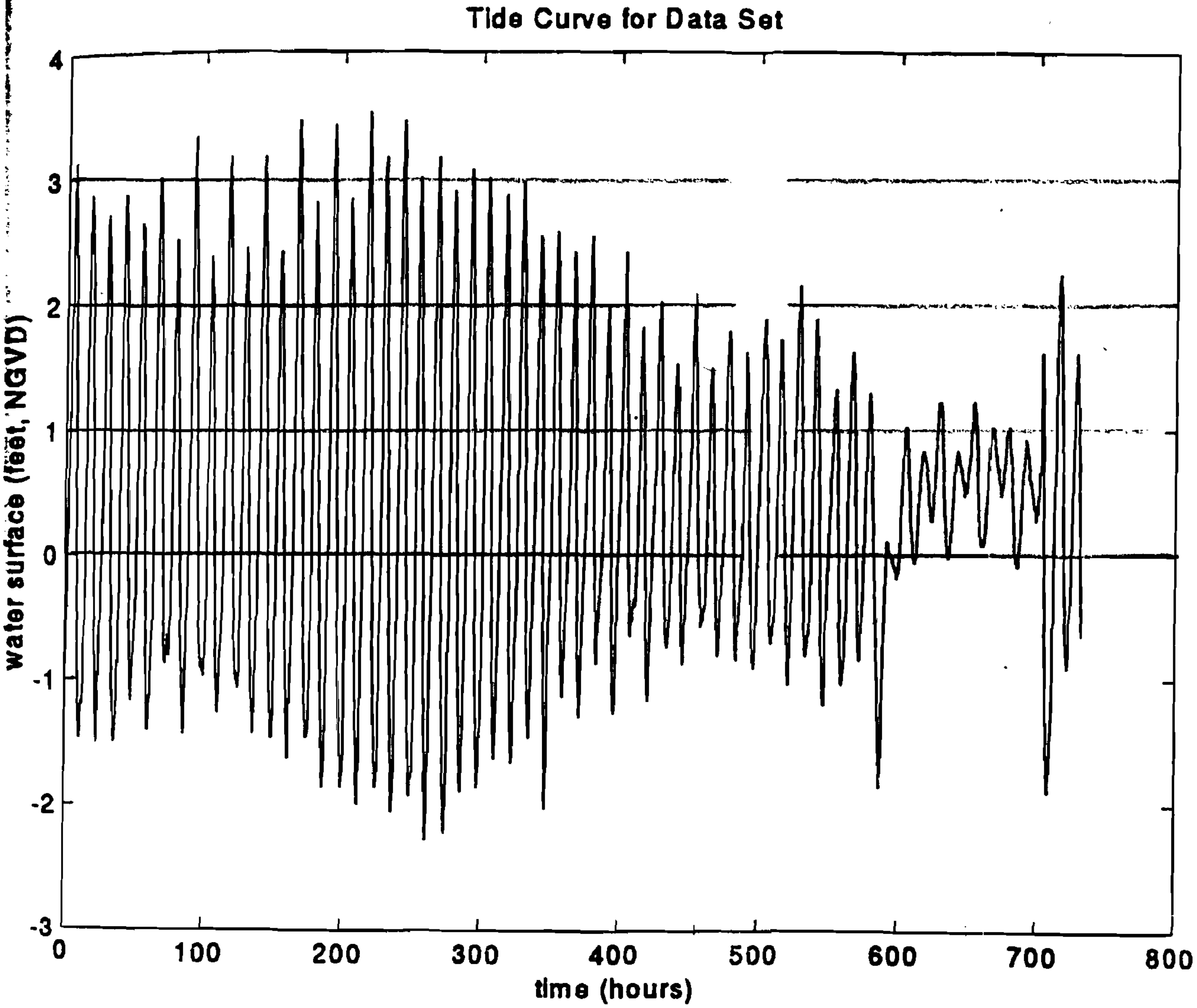
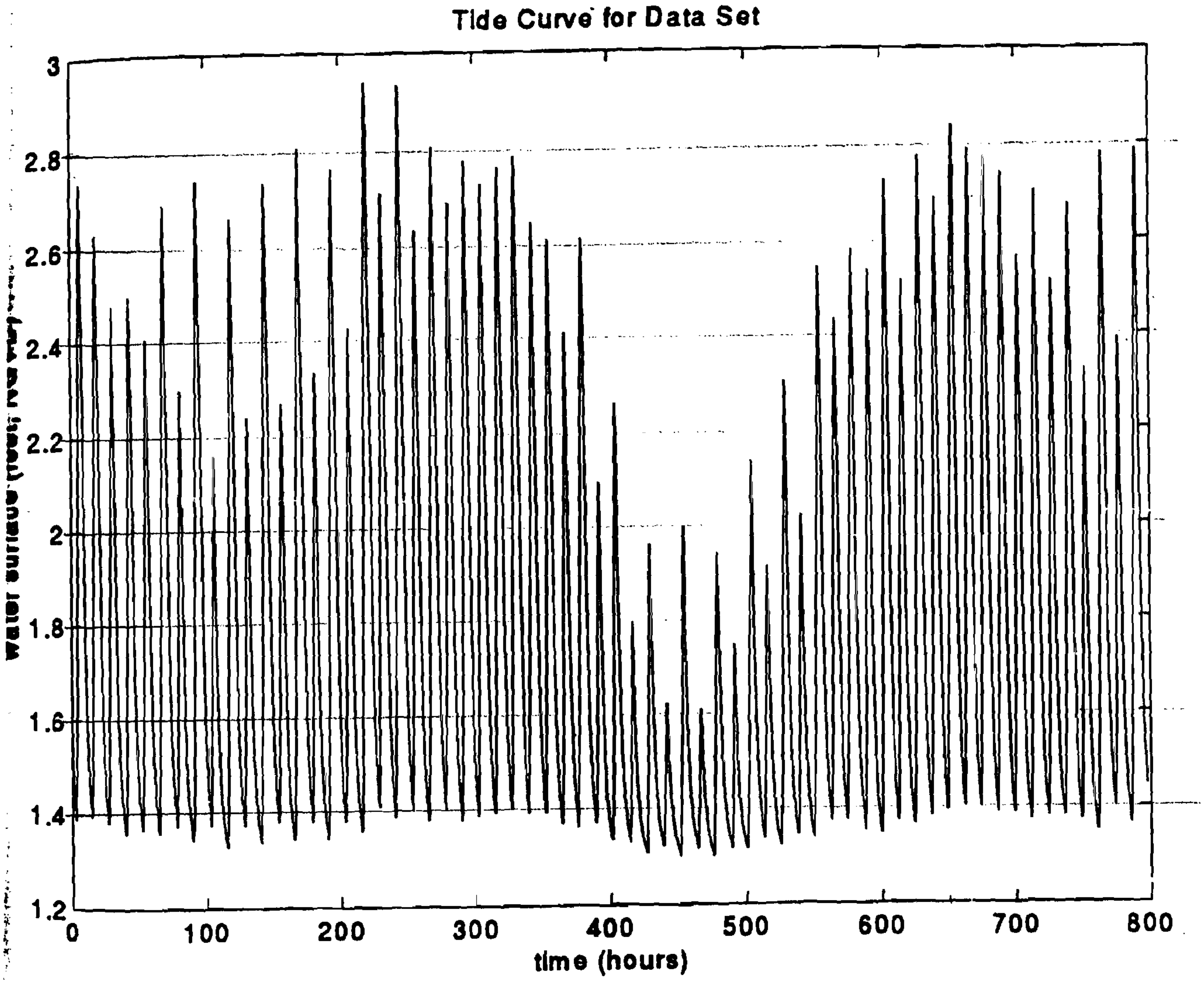


Figure II-9: Comparison of tidal records for Harbor Head and Oyster Pond showing non-linear distortion of tidal signal



(Harbor Head)

Figure II-6: Water surface elevation data from TDR 4 (12 July - 15 August, 1994)



(Oyster Pond)

Figure II-7: Water surface elevation data from TDR 5 (12 July - 15 August, 1994)

Applied Science Associates, Inc.

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asa@appsci.com

To: **Nate Weeks, Stearns & Wheler**

From: **Craig Swanson**

Date: **26 January 2001**

Re: **Culvert Cross Section Area Analysis for Oyster Pond, Falmouth, MA**

Introduction

An analysis of the culvert cross section area needed to increase the tidal range in Oyster Pond located in Falmouth, MA was performed. At present there is an approximate 3 ft diameter culvert connecting Oyster Pond to Harbor Head. Harbor Head is a small embayment at the south end of West Falmouth Harbor that in turn is connected to Buzzards Bay and the Atlantic Ocean. Measurements provided by Stearns & Wheler (Nate Weeks) indicate a mean tide range of 1.2 ft in Oyster Pond and a 4.2 ft tide range downstream of the culvert in Harbor Head. This reduction of tide range reduces the flushing action of the tide allowing for the potential of pollutant and nutrient buildup in the pond. The purpose of this analysis is to estimate the necessary cross section area of the culvert that will minimize the attenuation of the tide range in the pond.

Analysis

The actual connection between Harbor Head and Oyster Pond is complicated and somewhat difficult to analyze with standard techniques. The culvert is located above the mean tide elevation in the harbor so that it completely empties during the low tide portion of the tide cycle. Upstream of the culvert there is a shelf of mussels that becomes exposed and prevents the pond from draining during the low tide portion of the tidal cycle. Table 1 summarizes the vertical locations of these features of the harbor / pond system relative to the National Geodetic Vertical Datum (NGVD). This information was also supplied by Stearns & Wheler (Nate Weeks).

Table 1. Elevations relative to NGVD of the Harbor Head / Oyster Pond system including corresponding present culvert cross section areas.

Description	Elevation above NGVD (ft)	Culvert Cross Section Area (ft^2)
Mean low tide in Harbor	-1.2	na
Mean tide level in Harbor	0.9	na
Bottom of culvert	1.0	0.0
Mussel shelf	1.3	0.37
Mean high tide in pond	2.5	3.53
Average high tide in culvert	2.75	4.28
Mean high tide in Harbor	3.0	5.01
Top of culvert	4.0	7.07

Analyses of the tidal amplitude reduction in ponds, lagoons and embayments connected to a larger body of water by an inlet or culvert is based on well known hydraulic principles. Isaji and Spaulding (1981) present an approach for analyzing these types of problems, referring back to early work by Brown (1928). Spaulding (1994) generalized the problem using a non-dimensional approach based on the system geometry. For the analysis presented here, the linearized solution (Brown, 1928) to the one-dimensional momentum and continuity equations presented by Isaji and Spaulding (1981) is used. This approach was chosen because data existed for the present culvert configuration and could be used to estimate the total losses in the system thus calibrating this simple model. The model could then be used to estimate the culvert cross section area needed to increase the pond tidal amplitude.

The fact that the bottom of the culvert is 2.2 ft above the mean low tide elevation in the Harbor and that the mussel shelf is an additional 0.3 ft above the bottom of the culvert means that the frictional effects of the actual geometry will be greater than the theory assumes and flow through the system will be less. However, it is possible to derive a first order estimate of necessary cross sectional area using the method.

The ratio of the pond tidal amplitude to the harbor tidal amplitude is

$$\frac{a_b}{a_0} = \frac{K_r^2}{\sqrt{2}}\left[\left(1+\frac{4}{K_r^4}\right)^{1/2} - 1\right]^{1/2}$$

where K_r is the repletion coefficient defined as

$$K_r = \frac{A_c}{a_0 A_B \omega}\left(\frac{2ga_0}{F}\right)^{1/2}$$

Table 2 defines the variables used in these equations and provides the values used in the analysis for present conditions. The choice of friction factor, F, is explained below.

Table 2. System geometry description and values

Variable	Description	Present Value
a_0	Amplitude of harbor tide (high harbor tide – mean harbor tide)	2.1 ft
a_b	Amplitude of pond tide (high pond tide – mean harbor tide)	1.6 ft
A_c	Culvert cross section area	4.28 ft^2
A_b	Surface area of pond	305,000 ft^2 (7 ac)
F	Friction factor	0.053
g	Gravity	32.2 ft/s^2
ω	Principal (M_2) tidal frequency	0.000141 s^{-1}

Results

Figure 1 shows the relationship between pond high tide elevation and the high tide cross section area of the culvert. For small areas the culvert greatly attenuates the tidal amplitude in the pond and thus the high tide elevation. There is a near linear increase in elevation from 0.9 to 2.3 ft for the area range from 0 to 2 ft^2. Between 2 ft^2 and 6 ft^2 the elevation increases at a lower rate. Above 6 ft^2 the tidal amplitude asymptotically approaches the harbor high tide elevation of 3.0 ft.

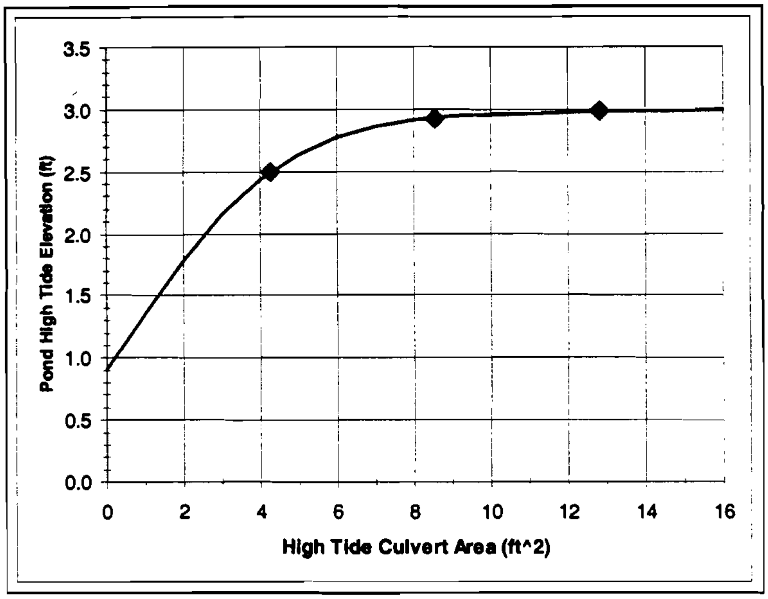

Figure 1 Relation between pond tidal amplitude and high tide culvert area.

The friction factor F was chosen so that the relation shown in Figure 1 would match the observed pond tidal amplitude and high tide culvert area. The large marker at 4.28 ft^2 represents the present conditions. Also shown are two additional markers at 8.56 ft^2 and 12.84 ft^2 that are equivalent to adding one or two identical culverts (of equal area), respectively. The high tide elevation in the pond is estimated to increase from 2.5 ft to 2.93 ft with one new culvert and to 2.98 ft with two new culverts. As shown, the addition of two new culverts is not appreciably different from adding one new culvert but will, in general, a factor of comfort to offset potential limitations in the analysis and to ensure that the culverts will eliminate any tidal attenuation.

It should be noted however that the mussel shelf also appears to be an impediment to flushing in the pond. Its elevation prevents draining of the pond over a substantial portion of the tidal cycle, more so than the elevation of the bottom of the culvert. The ideal situation, from a pond flushing perspective, would be removal of the mussel shelf and the installation of a deeper culvert so the pond tidal range could approximate the Harbor tidal range.

References

Brown, E. I., 1928. Inlets on sandy coasts. Proceedings of the American Society of Civil Engineers, Vol. LIV, pp. 505-553.

Isaji, T. and M. L. Spaulding, 1981. A simplified model for assessing the impact of breachway modifications on coastal pond circulation and flushing dynamics. Proceedings of OCEANS 81, 16-18 September 1981, Boston, MA.

Spaulding, M. L., 1994. Modeling the circulation and dispersion in coastal lagoons. In: Coastal Lagoon Processes, ed. by B. Kjerve. Elsevier Oceanography Series 60, Elsevier Science Publishers B. V., Amsterdam, pp. 103–130,

REC'D DEC 22 2000

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December 19, 2000

Nate Weeks
Stearns & Wheler, LLC
PO Box 975
Hyannis, MA 02601

RE: FALMOUTH, MA – The Golf Club at Cape Cod
Project No. 00-002

Dear Nate:

As we have been discussing by telephone, Falmouth Golf, the proponent for The Golf Club of Cape Cod, continues to be interested in exploring the potential for the beneficial reuse of treated wastewater at the site of the proposed 18-hole golf course located on the east side of Falmouth Woods Road in Falmouth.

A number of issues have been identified as the project has developed that have a direct impact on the feasibility of reusing wastewater at the site. It is Falmouth Golf's opinion that these issues must be considered as we both attempt to finalize the details surrounding the potential reuse of the treated effluent.

Two plumes emanating from the MMR site (FS 29 and CS 21) occur on the site. These plumes were previously identified and as of last week, AFCEE has started an additional subsurface investigation program on the site. This program includes the installation of 5 wells on the site of The Golf Club and additional wells at Ballymeade and on nearby residential properties. The wells have been sited to identify the leading edges of the two plumes and will further refine the understanding of the hydrogeology of the area. AFCEE intends to install a collection and treatment system near the leading edge of both plumes. The locations and details will be developed based on the results of their current study. Preliminary modeling indicates that the plumes are moving southwesterly and may impact most of the proposed golf course site. In the event that the proposed irrigation well is impacted, AFCEE has committed to provide treatment or an alternate source of irrigation water.

We have discussed the potential for wastewater reuse at the site with AFCEE representatives in the form of three scenarios. The first is the concept of injection. AFCEE believes that this should not occur in a manner that further complicates the intended remediation of the two plumes. Until they have completed the subsurface work, they cannot approve a location that is acceptable.

The second scenario is that of infiltration of treated effluent. Concerns have been expressed that the mound caused by the infiltration may have an effect similar to the injection well and therefore this should also not occur in the vicinity of the plumes. If we assume at this point that the modeling and plume locations will not change with further study, the most likely location for either injection or infiltration is on the existing Ballymeade Golf Course. The existing irrigation wells at Ballymeade are not located such that they could be used to collect water containing the treated effluent. The Ballymeade Golf Course is also located within the Wild Harbor Recharge District; an embayment for which the Cape Cod Commission has not calculated a nitrogen limit.

The third and final scenario is not impacted by the plumes. Under this scenario, 2/3 treated effluent will be mixed with 1/3 "clean" water from the irrigation well into the storage pond proposed at The Golf Club site. The use of treated effluent in a turfgrass system over time requires periodic flushing with 100% clean water and The Golf Club will need storage and distribution of both clean water and effluent. The proposed irrigation pond is approximately 2 acres in size and will be approximately 14 feet deep. In a year with average rainfall, the golf course will use an average of 225,000 gallons per day during the months of June, July and August. Two thirds of this is 150,000 gallons per day. The Golf Club could take only the effluent needed and would need the ability to take water or not take water based on the needs of the turf during and seasonal weather changes. Access to the pond is important for wildlife and habitat quality. In your opinion, will access to the pond containing some effluent be restricted? Ballymeade does not have a storage pond, so it is not possible to take effluent for the two golf courses.

Finally, you asked that Falmouth Golf comment on contributing to the cost of transporting the effluent. If access is possible to the pond and there is no penalty imposed on The Golf Club by the Cape Cod Commission due to additional nitrogen added to the Wild Harbor Watershed, Falmouth Golf will consider funding some portion of the costs associated with the use of the treated effluent. We anticipate that those costs will include additional water quality testing at The Golf Club and based on your allowance for pipes and installation of $70.00 per foot over a distance of approximately 3 miles, the cost for transport of the effluent of approximately 1.1 million dollars. As we discussed by phone, it is not possible for Falmouth Golf to contribute the total sum.

This identifies some of our concerns as we continue to pursue the reuse of the treated effluent for the golf course. The project will soon go before MEPA and the Cape Cod Commission and we anticipate that both bodies will have comments on the potential reuse. In addition, we are awaiting the results of testing of the wells on The Golf Club site to fully understand the impact on the project of the MMR plumes.

Please do not hesitate to contact me if you have any question regarding the project.

Sincerely,

Kelly Durfee Cardoza

Kelly Durfee Cardoza
Principal

cc: Rosario Lattuca, Falmouth Golf LLC

OFF-SITE EFFLUENT DISPOSAL
SITE D- COST SUMMARY
Falmouth Wastewater Facilities Planning Study
Falmouth, Massachusetts

	Off-Site Flows (mgd)		
	0.20	0.40	0.60
CAPITAL COSTS			
Effluent Disposal Costs			
Subsurface Leaching Area	$ 1,000,000	$ 2,000,000	$ 3,000,000
Force Main	$ 420,000	$ 420,000	$ 420,000
Pumping Station and Dosing Control	$ 400,000	$ 400,000	$ 600,000
Site Work	$ 57,000	$ 114,000	$ 171,000
Sub-total Construction Costs	$ 1,900,000	$ 2,900,000	$ 4,200,000
Contingency (15%)	$ 290,000	$ 440,000	$ 630,000
Fiscal, Legal and Engineering (25%)	$ 480,000	$ 730,000	$ 1,050,000
Total Construction Costs	$ 2,700,000	$ 4,100,000	$ 5,900,000
Land Purchase	$ 240,000	$ 240,000	$ 240,000
Effluent Mitigation Project Costs	$ 500,000	$ 500,000	$ 500,000
Additional Environmental Evaluation Costs (1)	$ 150,000	$ 150,000	$ 150,000
TOTAL CAPITAL COSTS	$ 3,600,000	$ 5,000,000	$ 6,800,000

Note:

1. Includes: Natural resource inventory, archaeological considerations, additional water quality modeling

OFF-SITE EFFLUENT DISPOSAL
SITE E - COST SUMMARY
Falmouth Wastewater Facilities Planning Study
Falmouth, Massachusetts

	Off-Site Flows (mgd)		
	0.20	0.40	0.60
CAPITAL COSTS			
Effluent Disposal Costs			
Subsurface Leaching Area	$ 1,000,000	$ 2,000,000	$ 3,000,000
Force Main	$ 530,000	$ 530,000	$ 530,000
Pumping Station and Dosing Control	$ 400,000	$ 400,000	$ 600,000
Site Work	$ 38,000	$ 76,000	$ 110,000
Sub-total Construction Costs	$ 2,000,000	$ 3,000,000	$ 4,200,000
Contingency (15%)	$ 300,000	$ 450,000	$ 630,000
Fiscal, Legal and Engineering (25%)	$ 500,000	$ 750,000	$ 1,050,000
Total Construction Costs	$ 2,800,000	$ 4,200,000	$ 5,900,000
Land Purchase	$ 240,000	$ 240,000	$ 240,000
Effluent Mitigation Project Costs	$ 500,000	$ 500,000	$ 500,000
Additional Environmental Evaluation Costs (1)	$ 150,000	$ 150,000	$ 150,000
TOTAL CAPITAL COSTS	$ 3,700,000	$ 5,100,000	$ 6,800,000

Notes:

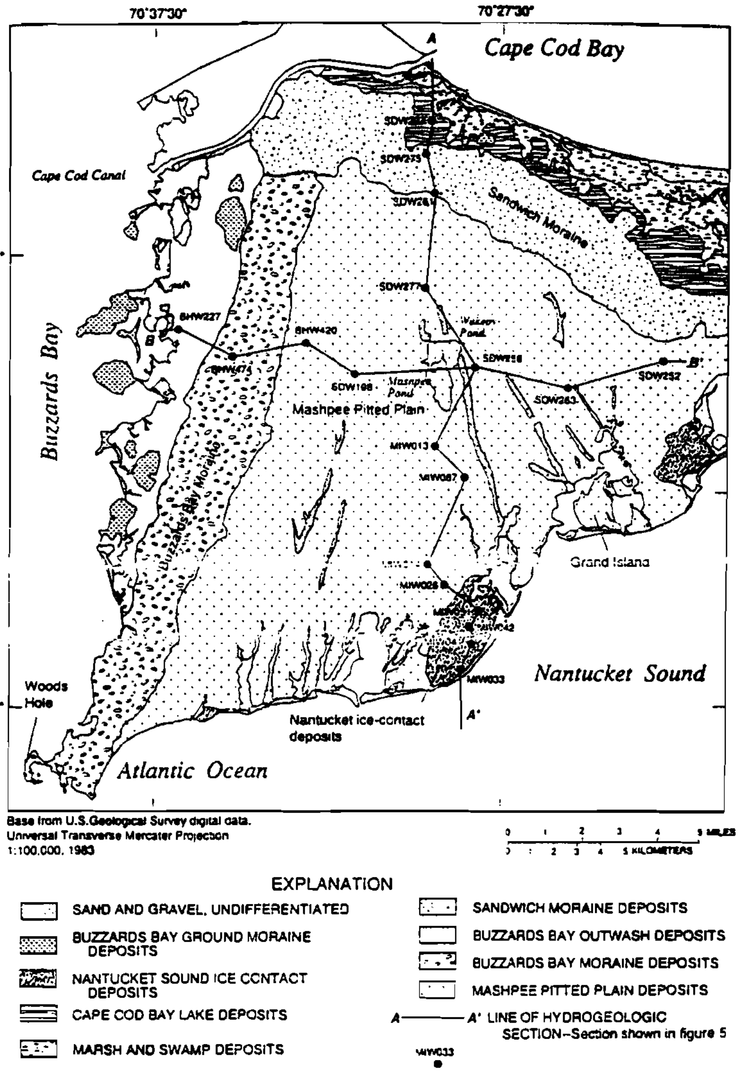
1. Includes: Natural resource inventory, archaeological considerations, additional water quality modeling

EFFLUENT DISPOSAL
SITE N - COST SUMMARY
WELL INJECTION TECHNOLOGY AT THE WWTF SITE
Falmouth Wastewater Facilities Planning Study
Falmouth, Massachusetts

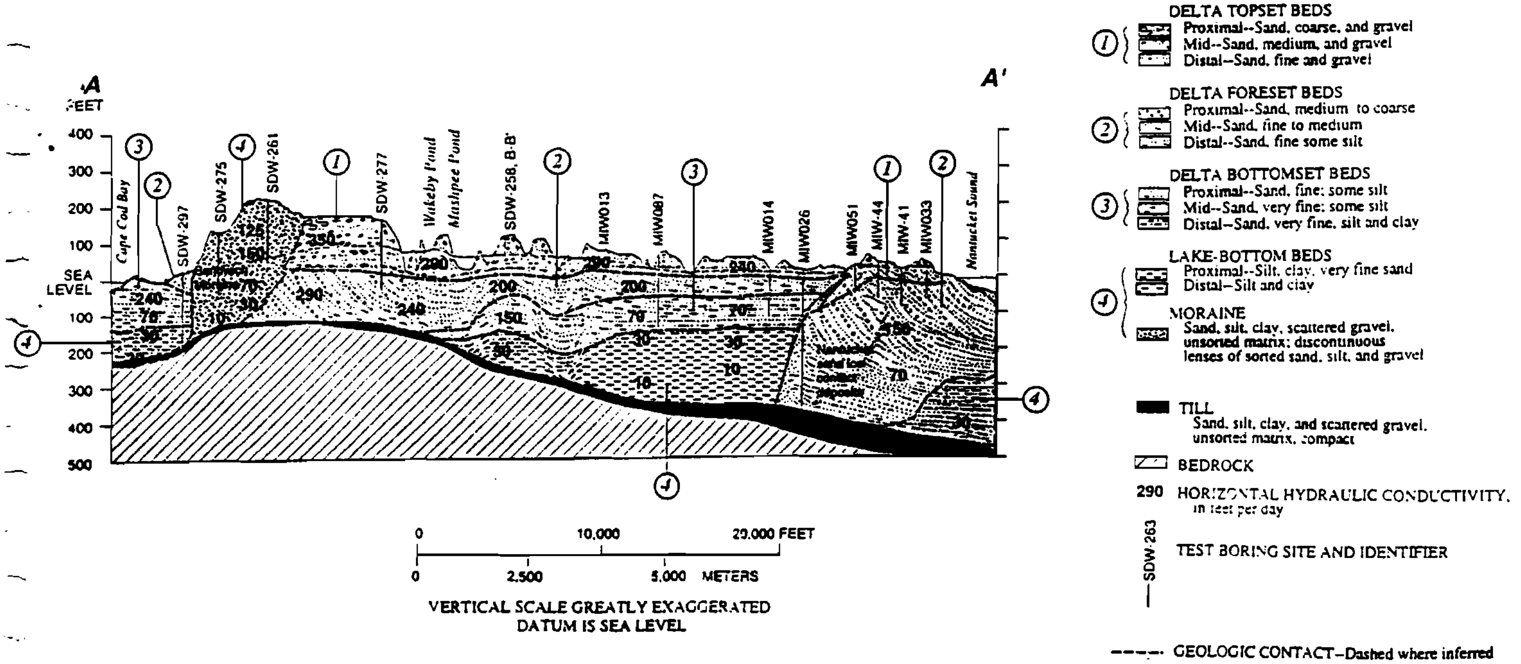
CAPITAL COST	Well Injection (On-site)		
	0.2 mgd	0.4 mgd (2)	0.6 mgd (2)
Well Injection Costs			
Two Injection Wells	$ 200,000	$ 400,000	$ 600,000
Six Monitoring Wells	$ 50,000	$ 100,000	$ 150,000
Equipment/Electrical	$ 80,000	$ 160,000	$ 240,000
Force Mains	$ 110,000	$ 220,000	$ 330,000
Filtration Unit	$ 180,000	$ 360,000	$ 540,000
Site Work	$ 130,000	$ 260,000	$ 390,000
Structures	$ 60,000	$ 120,000	$ 180,000
Finishes (1%)	$ 10,000	$ 20,000	$ 30,000
TOTAL CONSTRUCTION COSTS	$ 820,000	$ 1,640,000	$ 2,460,000
Contingency (15%)	$ 120,000	$ 250,000	$ 370,000
Fiscal, Legal and Engineering (25%)	$ 210,000	$ 410,000	$ 620,000
Total Construction Costs	$ 1,200,000	$ 2,300,000	$ 3,500,000
Land Purchase	$ -	$ -	$ -
Effluent Mitigation Project Costs	$ 500,000	$ 500,000	$ 500,000
Additional Environmental Evaluation Costs (1)	$ 150,000	$ 150,000	$ 150,000
TOTAL CAPITAL COSTS	$ 1,900,000	$ 3,000,000	$ 4,200,000

Notes:

1. Includes: Natural resource inventory, archaeological considerations, additional water quality modeling
2. Costs based on multiple 0.2 mgd installations as described in Chapter 4. If greater than 0.2 mgd could be discharged at Site N, the costs would be reduced as multiple facilities would not be needed. In this case the cost range could approach $2.3 million for 0.4 mgd and $3.2 million for 0.6 mgd facilities.



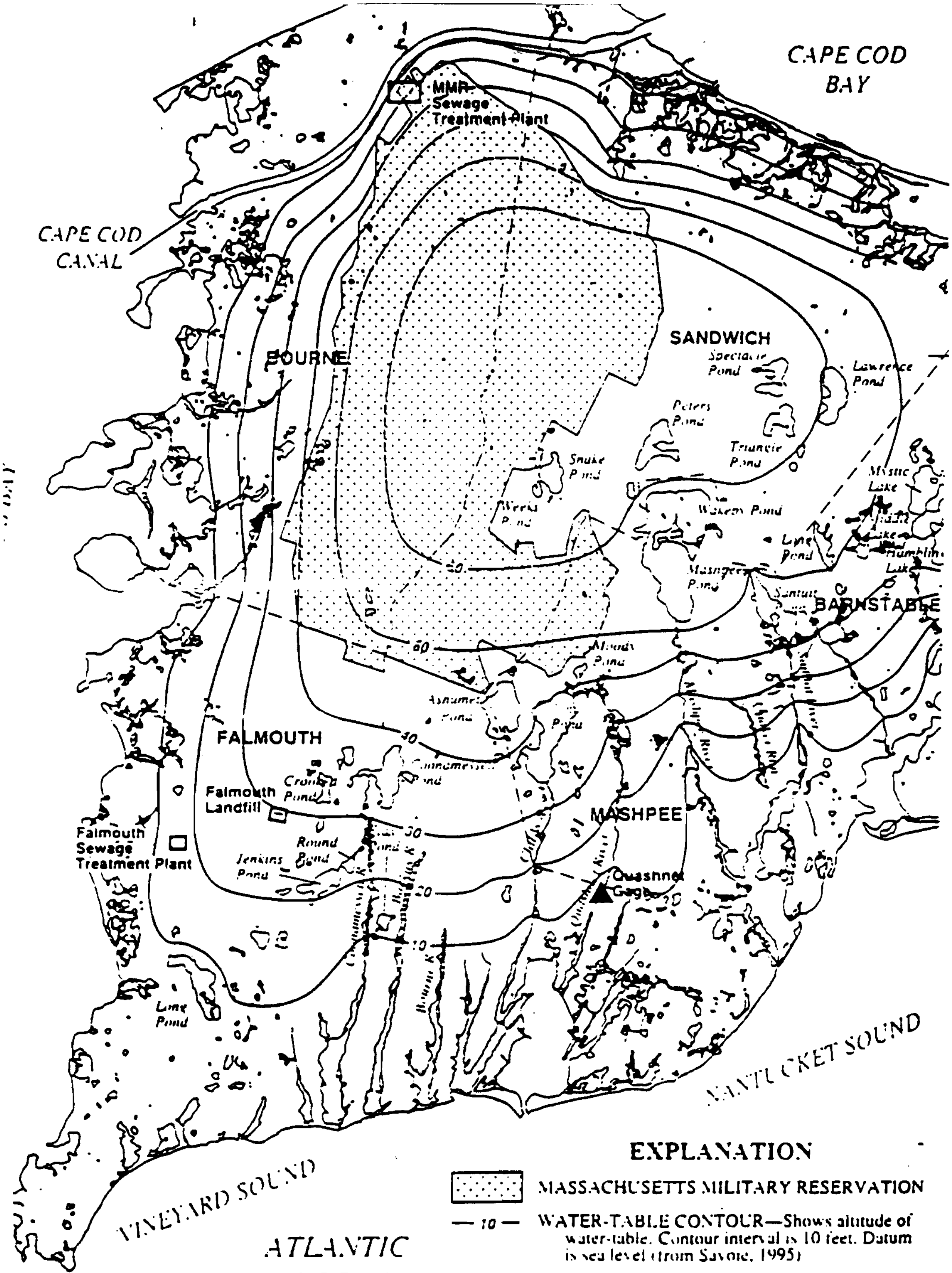
Base from U.S.Geological Survey digital data.
Universal Transverse Mercater Projection
1:100,000, 1983



Stearns&Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

FIGURE 1

Source: USGS Open-File Report 96-214



EXPLANATION

▨ MASSACHUSETTS MILITARY RESERVATION

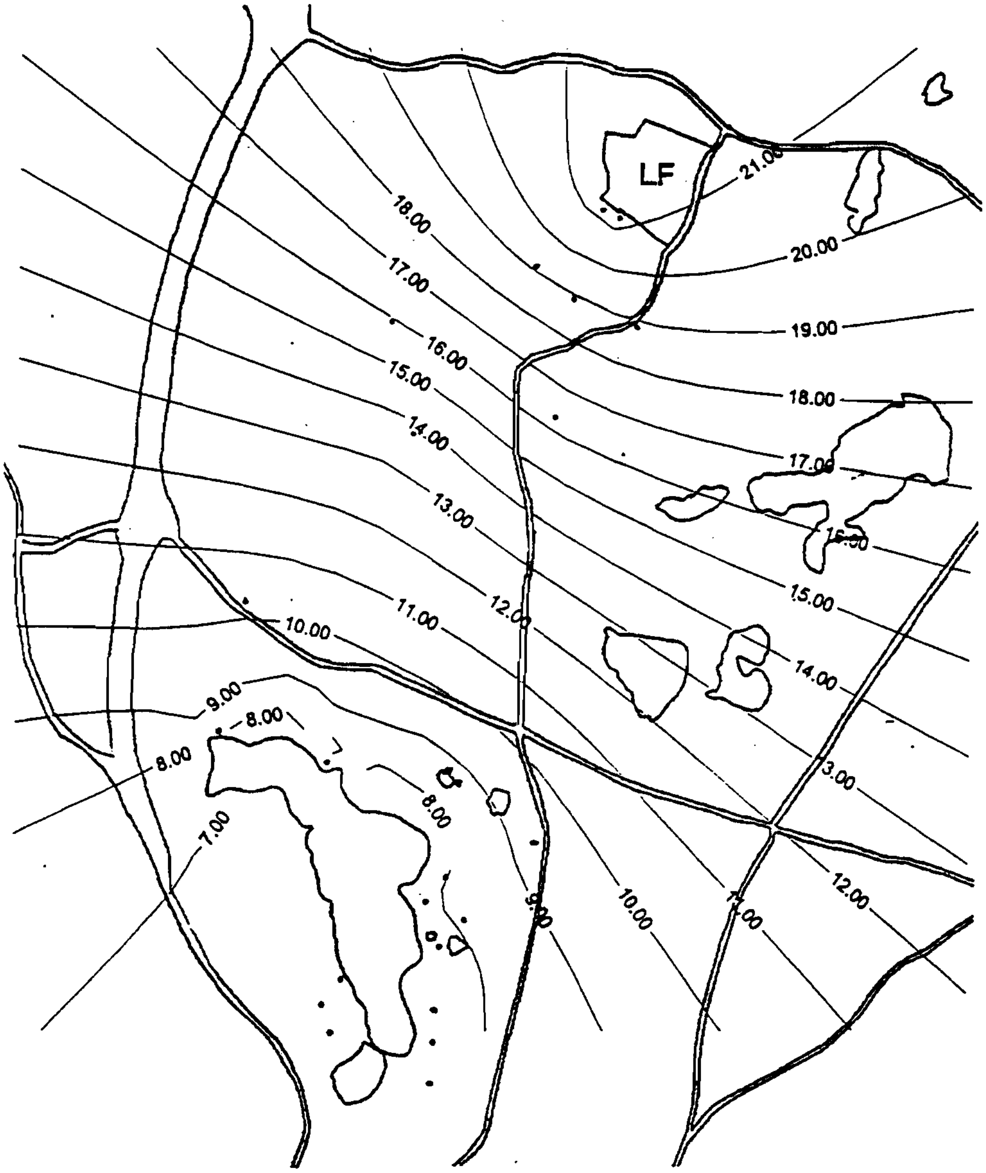
— 10 — WATER-TABLE CONTOUR—Shows altitude of water-table. Contour interval is 10 feet. Datum is sea level (from Savoie, 1995)

Stearns&Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

FIGURE 2

Source: USGS Open-File Report 96-214

Ground water countours derived from data collected at selected monitoring waters in surrounding areas of Long Pond for July 30,1996.



Source: Barnstable County Dept of Health & Environment; Town of Falmouth Div. of Engineering

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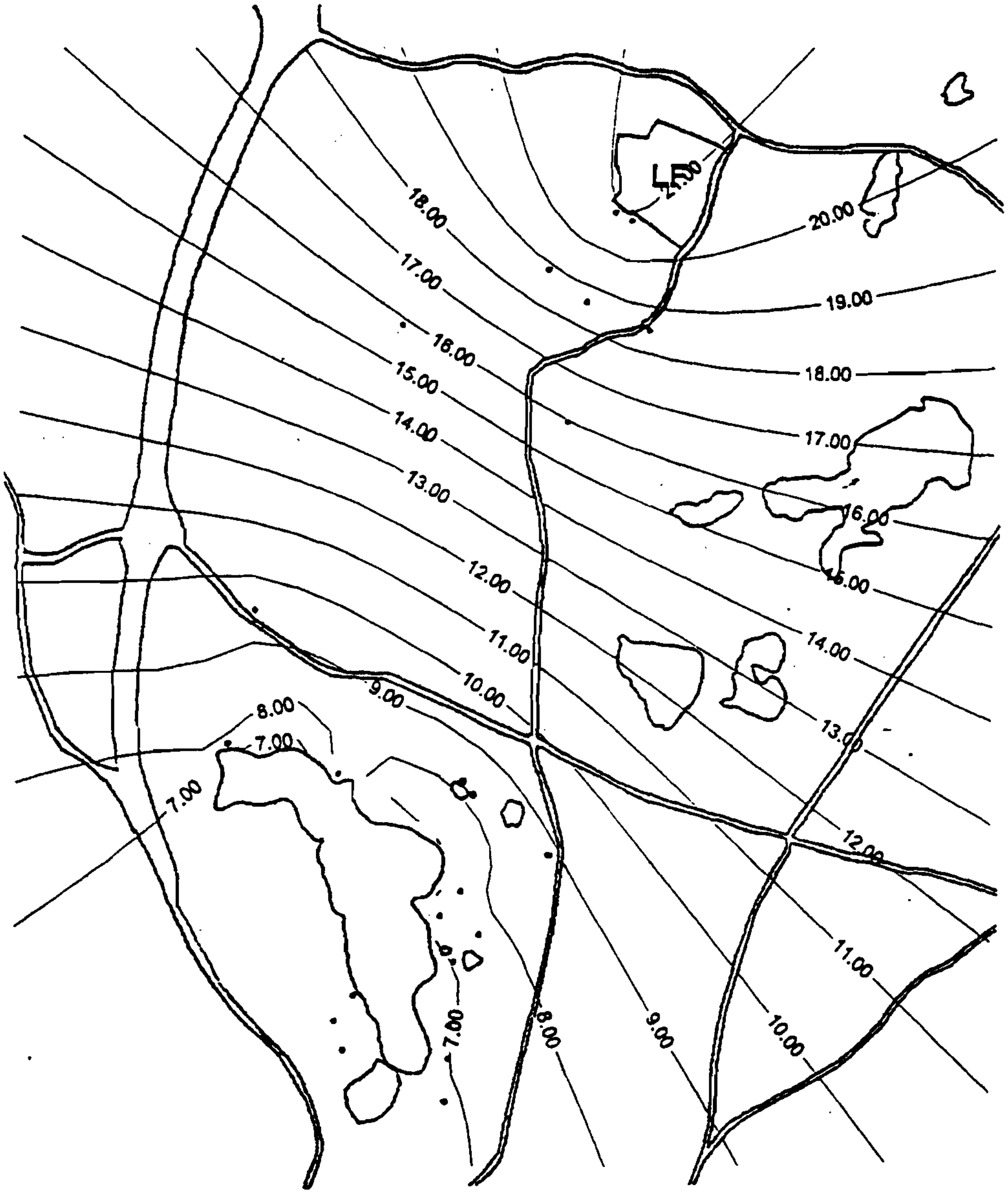
ENVIRONMENTAL ENGINEERS & SCIENTISTS

FIGURE 3

Ground water countours derived from data collected at selected monitoring v ¨ waters in surrounding areas of Long Pond forAug 27,1996.

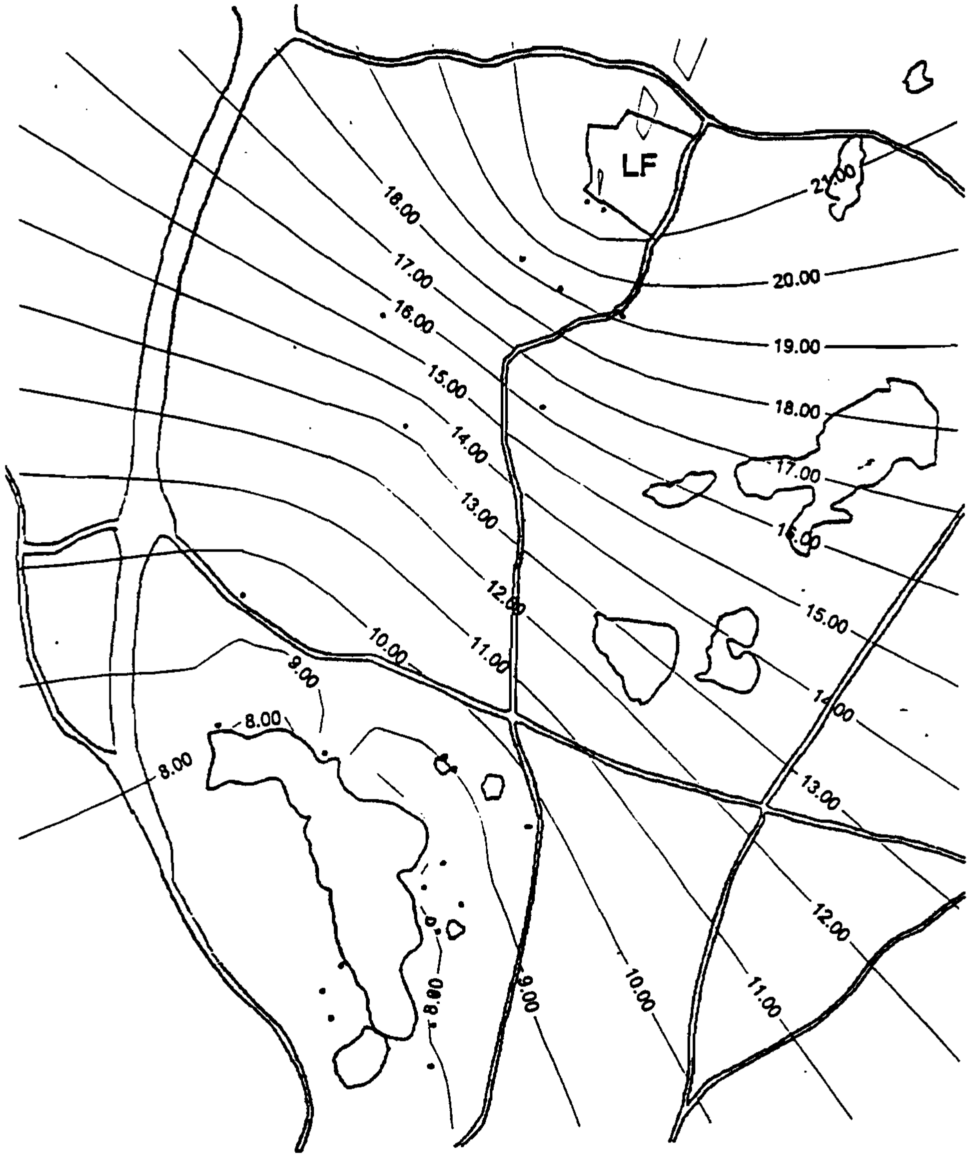


Source: Barnstable County Dept of Health & Environment; Town of Falmouth Div. of Engineering

FIGURE 4

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Ground water countours derived from data collected at selected monitoring ,ll waters in surrounding areas of Long Pond for Sept 24,1996.



Source: Barnstable County Dept of Health & Environment; Town of Falmouth Div. of Engineering

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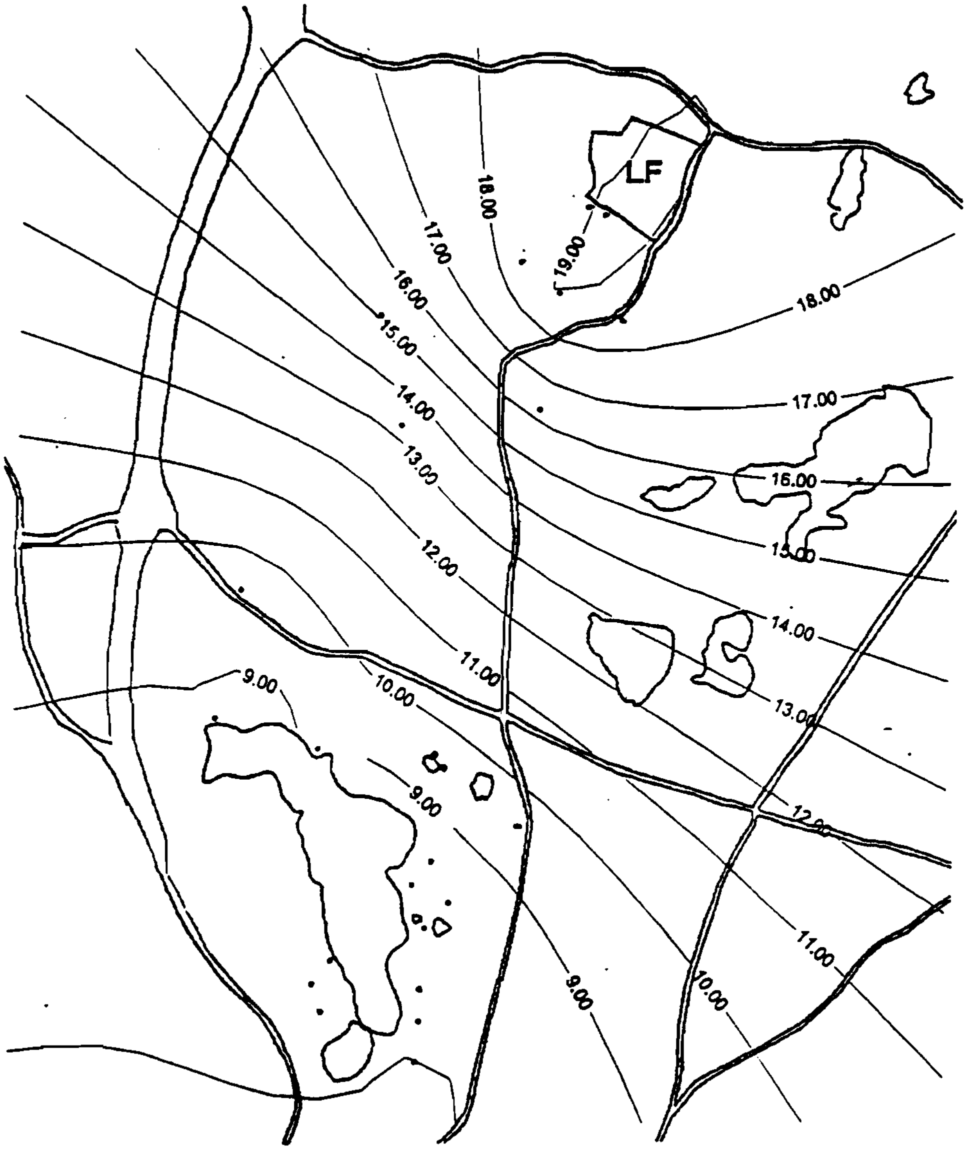
FIGURE 5

Ground water countours derived from data collected at selected monitoring well waters in surrounding areas of Long Pond for Oct 7,1996.



Source: Barnstable County Dept of Health & Environment; Town of Falmouth Div. of Engineering

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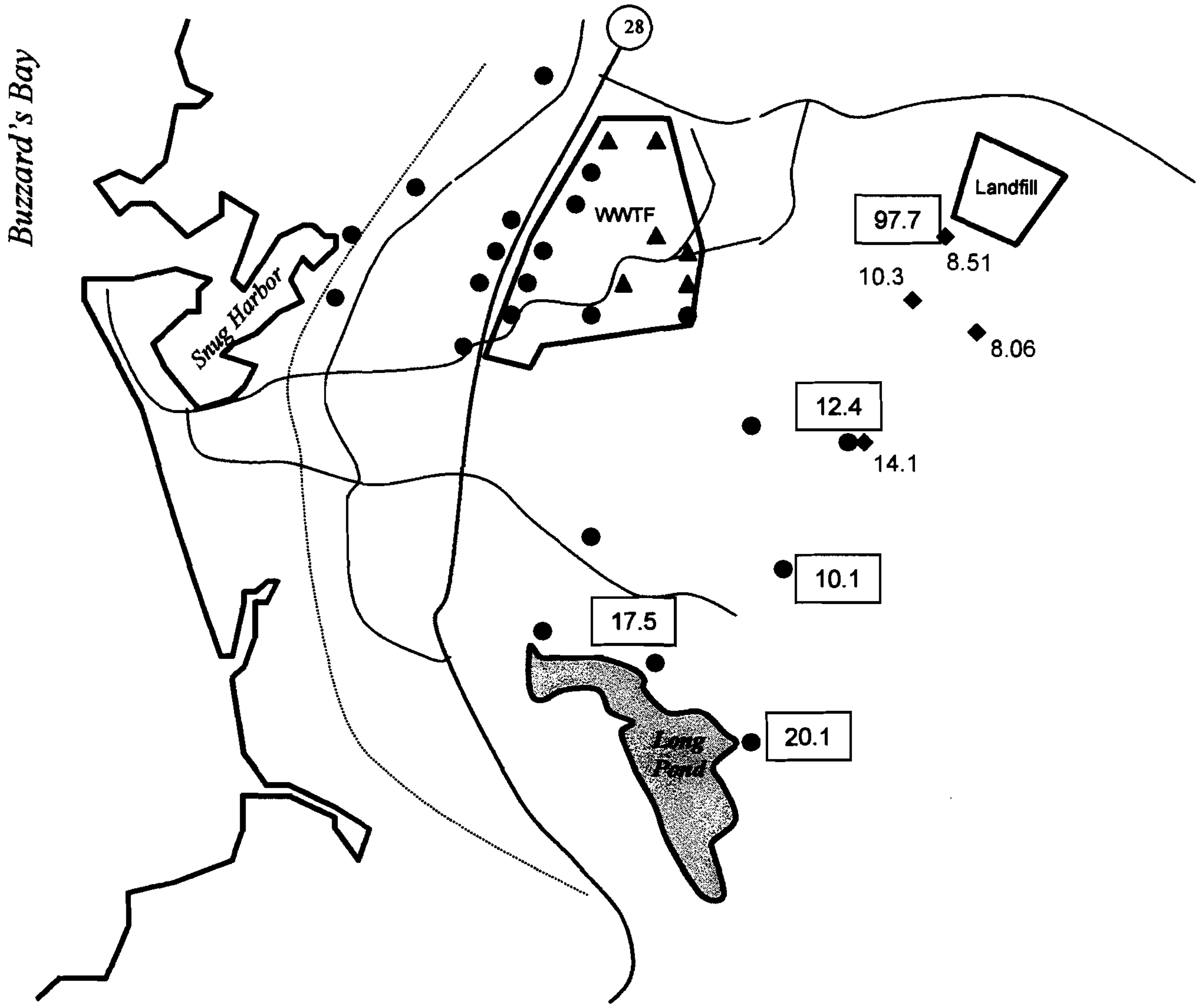
ENVIRONMENTAL ENGINEERS & SCIENTISTS

FIGURE 6

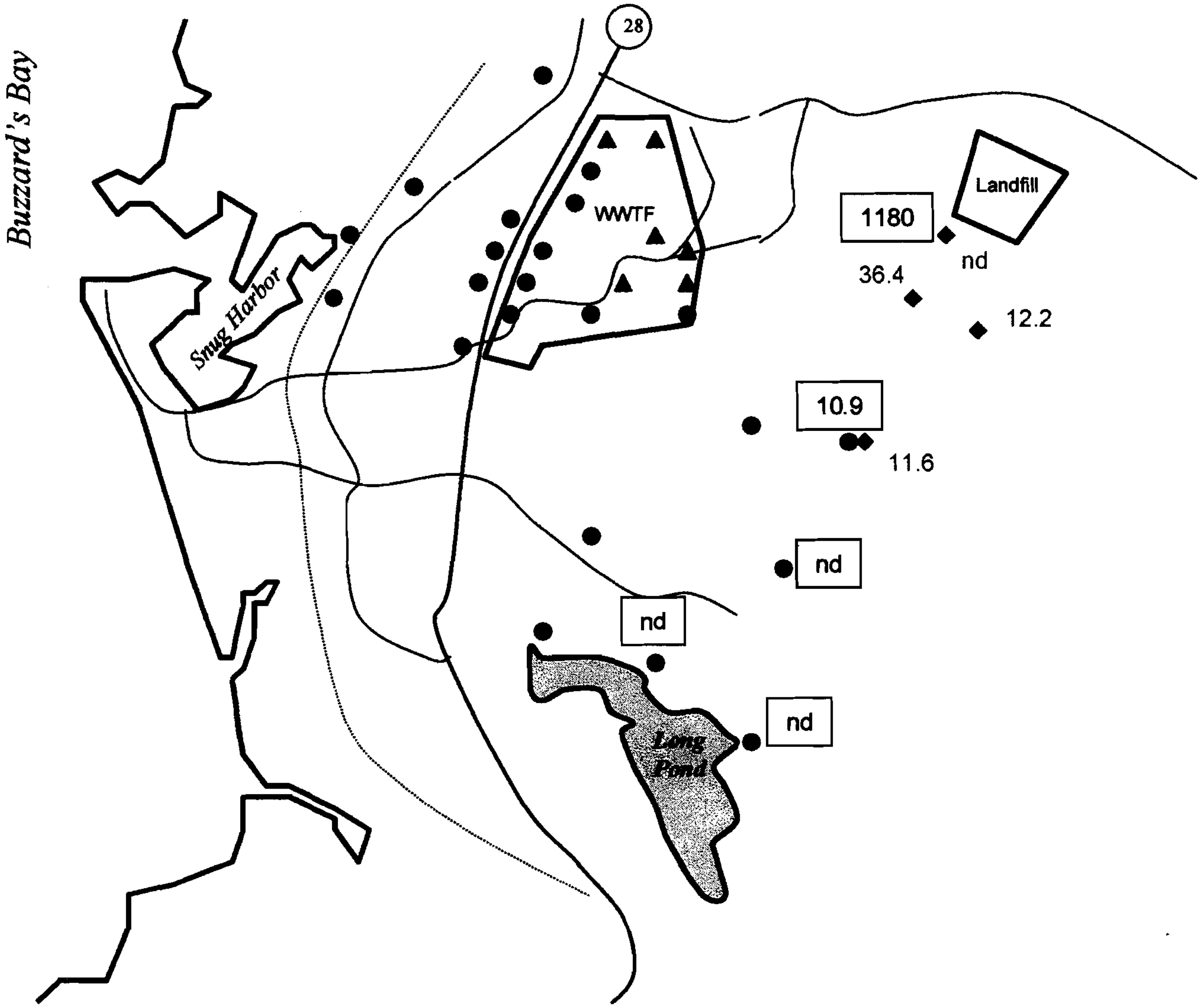


Chloride data, ppm

10.1	Data from well along inferred groundwater flow path	▲	Wells to be eliminated from future monitoring
		● ●	Wells to be included in future monitoring
10.3	Data from well presumed to be outside discrete flow path	◆ ●	Wells sampled as part of Stearns & Wheler study

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

FIGURE 7



Alkalinity data, ppm
nd = below detection limit

10.1	Data from well along inferred groundwater flow path	▲	Wells to be eliminated from future monitoring
		● ●	Wells to be included in future monitoring
10.3	Data from well presumed to be outside discrete flow path	◆ ●	Wells sampled as part of Stearns & Wheler study

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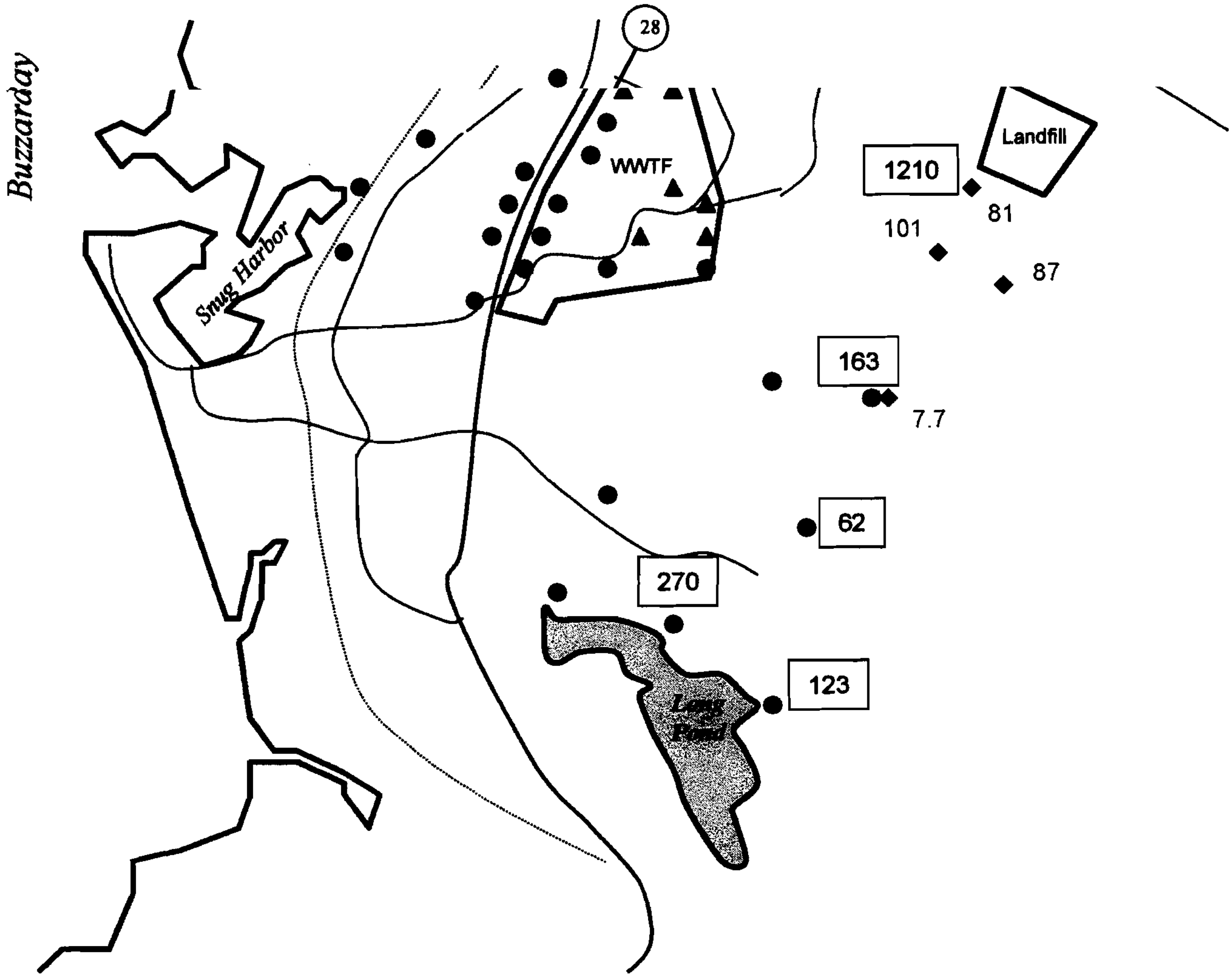
FIGURE 8

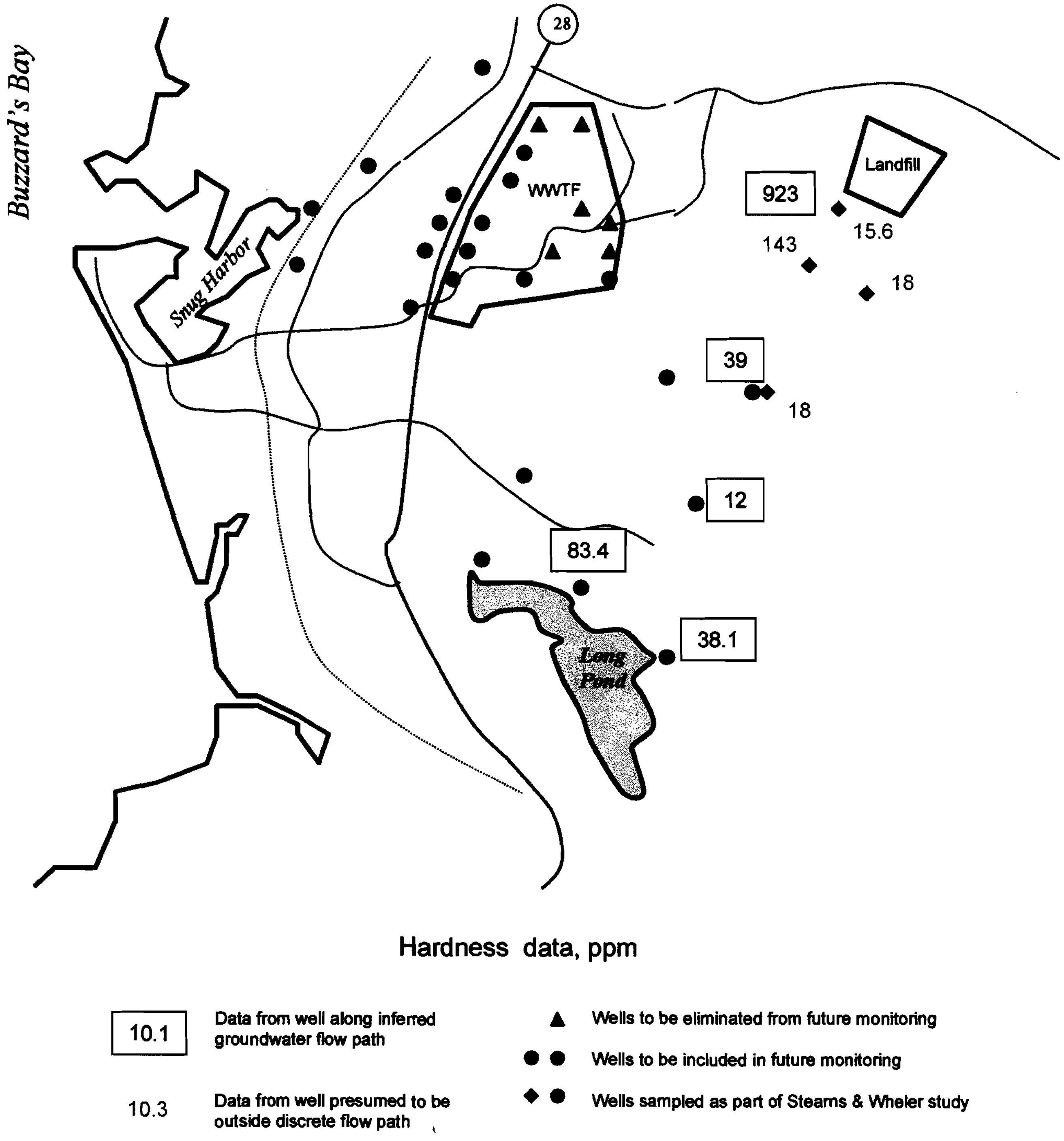


Total Dissolved Solids (TDS) data, ppm

10.1	Data from well along inferred groundwater flow path	▲	Wells to be eliminated from future monitoring
		● ●	Wells to be included in future monitoring
10.3	Data from well presumed to be outside discrete flow path	◆ ●	Wells sampled as part of Stearns & Wheler study

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

FIGURE 9



Hardness data, ppm

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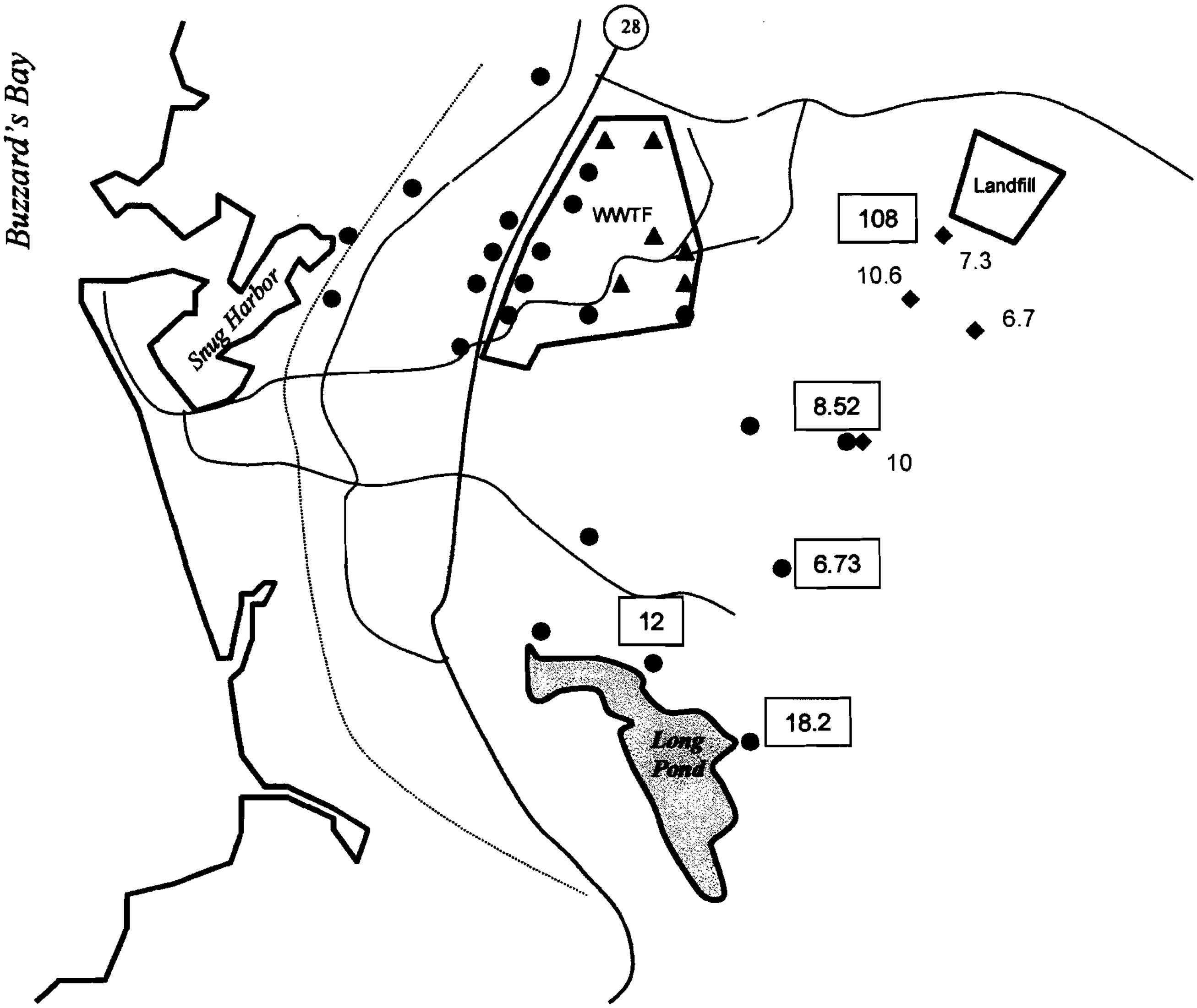
FIGURE 10



Sodium data, ppm

10.1	Data from well along inferred groundwater flow path
10.3	Data from well presumed to be outside discrete flow path
▲	Wells to be eliminated from future monitoring
● ●	Wells to be included in future monitoring
◆ ●	Wells sampled as part of Stearns & Wheler study

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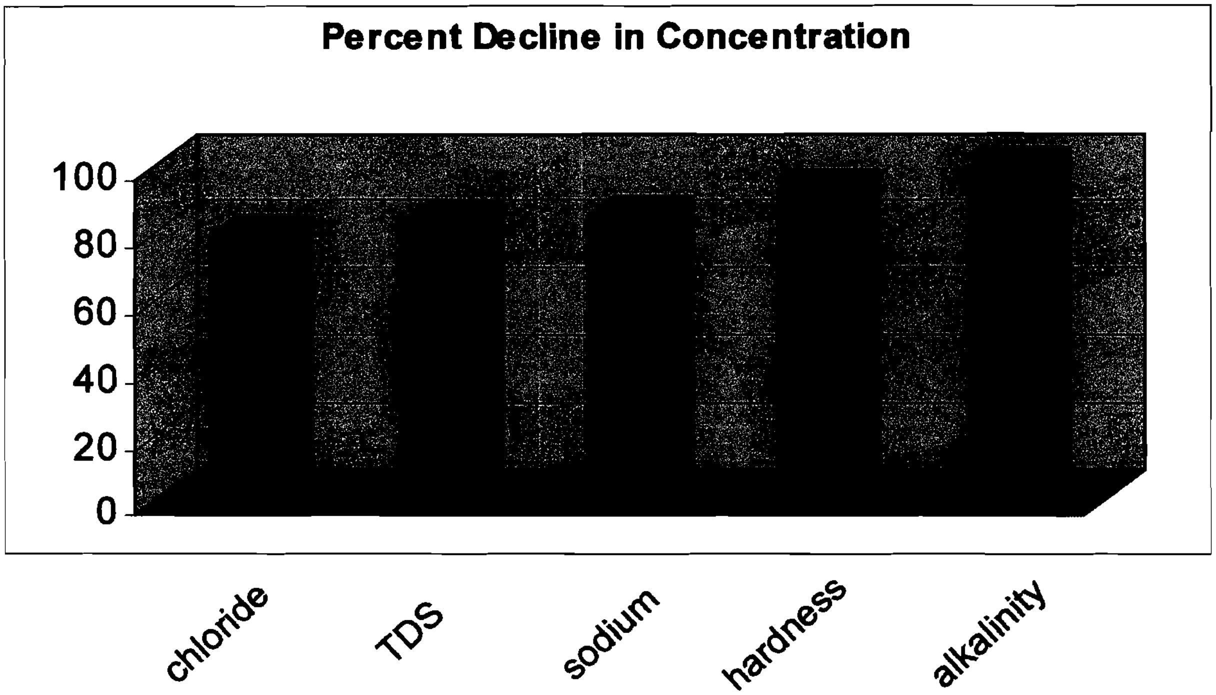
FIGURE 11



The decline in constituent concentrations between the landfill, based on data from well 558D, and Long Pond, based on data from wells 560C and 561C (computed average). The fact that chloride, a chemically conservative constituent, does not decline as much as other more reactive constituents supports that some degree of chemical attenuation is occurring.

FIGURE 12

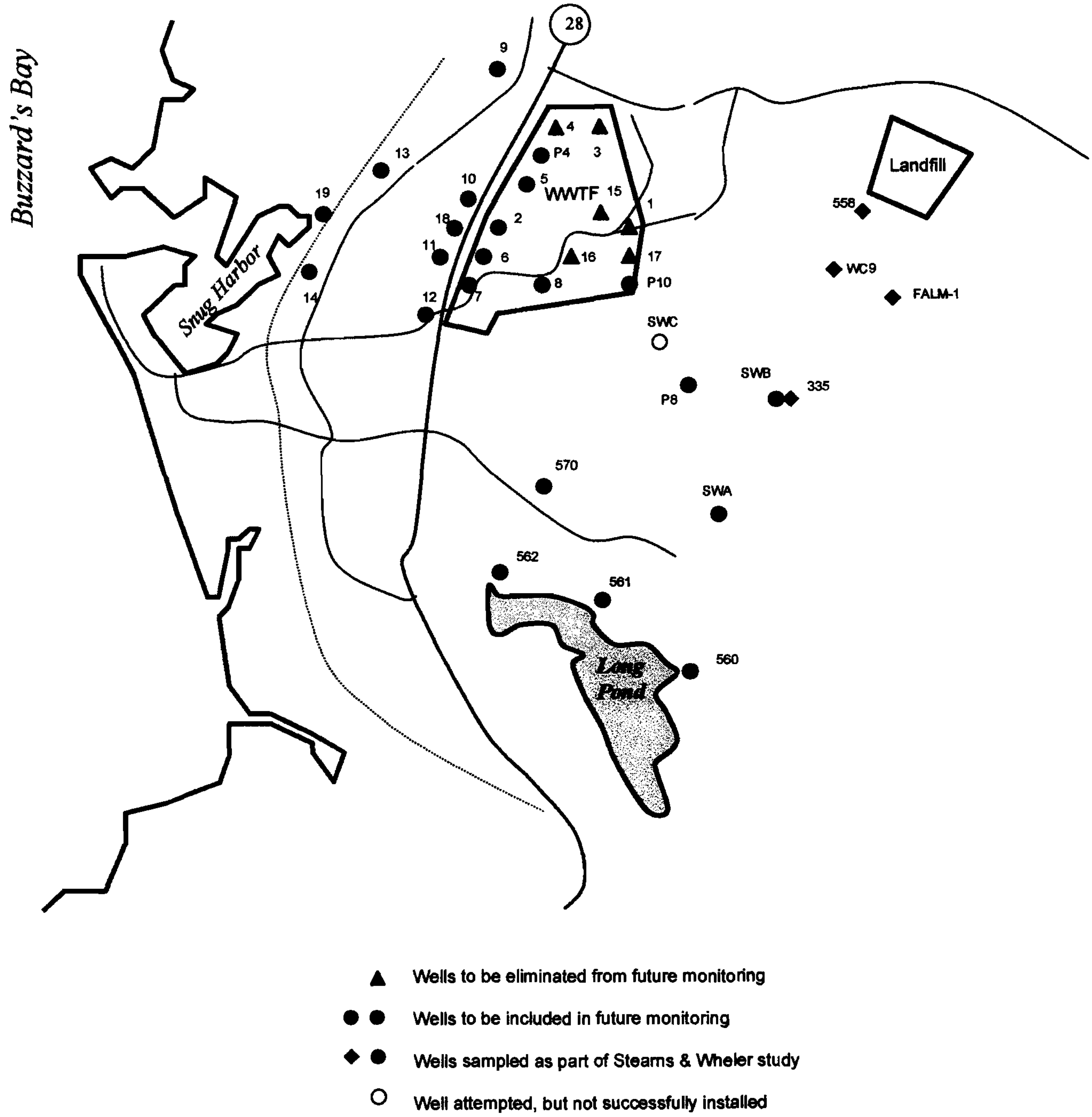


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FIGURE 13

Excerpts From Camp Dresser & McKee Draft Report
Summary of Groundwater Investigations In Support of Land Disposal of Treated Wastewater From The Falmouth Wastewater Treatment Facility

January 1987

4.4 ASSESSMENT OF SEASONAL VARIATIONS IN PLANT OPERATION

Phase I and Phase II steady state flow fields were also generated to investigate the sensitivity of results to expected plant peaking factors. Based on literature estimates for comparably sized facilities having similar service areas, plant peaking factors for maximum weekly and maximum daily summer flows are 1.3 and 2.3, respectively. These factors, applied to average summer flow estimates, are used to project the maximum flows which can be expected to occur, on average, once per year. For the purpose of this analysis, peak daily flow was conservatively assumed to occur on consecutive days over the entire month of July, when the Long Pond withdrawal rate is also at a maximum monthly value. Although it is unrealistic to expect peak daily flows to occur on consecutive days over a month, the simulation technique eliminates all ambiguity associated with worst case peak week or peak day analysis.

For Phase I, plant effluent was distributed as follows:

Months	Phase I Total Flow (MGD)	Applied Recharge Infiltration Basins (MGD)	Applied Recharge Irrigation Areas (MGD)
June	0.81	0.41	0.40
July	1.86	1.46	0.40
Aug, Sept	0.81	0.41	0.40
Oct, Nov	0.55	0.15	0.40
Dec, Jan, Feb, Mar	0.55	0.55	——
Apr, May	0.55	0.15	0.40

Under Phase II, plant effluent was areally distributed as follows:

Months	Phase I Total Flow (MGD)	Applied Recharge Infiltration Basins (MGD)	Applied Recharge Irrigation Areas (MGD)
June	1.29	0.59	0.70
July	2.97	2.27	0.70
Aug, Sept	1.29	0.59	0.70
Oct, Nov	0.92	0.22	0.70
Dec, Jan, Feb, Mar	0.92	0.92	----
Apr, May	0.92	0.22	0.70

To investigate the facilities operational flexibility, the full range of capacity in the use of the infiltration basins was evaluated. Simulations were conducted by maintaining discharge to the infiltration basins at design rates under Phase I and Phase II plant flows regardless of time of year. For Phase I, discharge to the infiltration basins was maintained at 0.55 mgd with only excess flow being diverted to the spray irrigation areas during the summer period. For Phase II, discharge to the infiltration basins was maintained at 0.92 mgd, with only excess summer flows diverted to the spray irrigation areas.

Simulation results are described in detail in Section 5.

5.0 PRESENTATION OF RESULTS

5.1 INTRODUCTION

Simulation results are presented in the following sections for additional groundwater modeling work performed in support of land disposal of treated effluent from the Falmouth Wastewater Treatment Facility. The results contained herein, in conjunction with a literature survey summarized in the report entitled "Water Quality Projections for Wastewater Treatment and Irrigation Land Treatment System," were developed to provide technical information for the Town of Falmouth to request a modification to its groundwater discharge permit.

5.2 SIMULATION RESULTS

Simulation results are presented graphically in Appendices A and B. Appendix A contains contour plots depicting simulated phreatic surface elevations across the site for seasonally varied hydraulic loading conditions. Appendix B contains concentration contour plots depicting projected aquifer nitrate concentrations following 30 years of plant operation. All contour plots were superimposed on a base map illustrating the location of the infiltration basins and spray irrigation areas relative to Routes 28 and 28A, the Penn Central Railroad, and Snug Harbor. Also shown are the current State Class III boundary and the Class III boundary adopted by the Town of Falmouth through a zoning bylaw.

The simulation results contained in Appendix A were developed based on the recalibrated local model described in Section 3.4.5 in conjunction with the applied recharge rates outlined in Section 4.2. As observed during recalibration, the simulated flow fields reflect a southerly shift from previous modeling results in the direction of groundwater flow. This southerly component was not apparent during earlier investigations, but observed in field data collected following installation and sampling of wells comprising the WWTP monitoring network. The observed southerly component appears to be related to a decrease in the hydraulic conductivity of formations north and west of the site.

Comparison of simulated phreatic surface contours shown in Appendix A with calibration results shown in Figures 3.4.3 and 3.4.4, further suggests the following:

- the general direction of groundwater flow down gradient of the site will remain in a predominantly westerly direction with ultimate discharge to Snug Harbor;
- groundwater mounding beneath the site, while greatest in close proximity to the infiltration basins, has minimal impact on the direction of groundwater flow beyond the plant boundary;
- localized mounding beneath the infiltration basins can be expected to range from 1.0 to 3.0 feet above existing average annual groundwater elevations under Phase II loading conditions; and
- groundwater mounding resulting from the use of the spray irrigation areas is expected to be significantly less than that associated with the infiltration basins.

APPENDIX A

SIMULATED PHREATIC SURFACE CONTOURS FOR SEASONALLY VARIED PHASE 1 AND PHASE II PLANT OPERATION

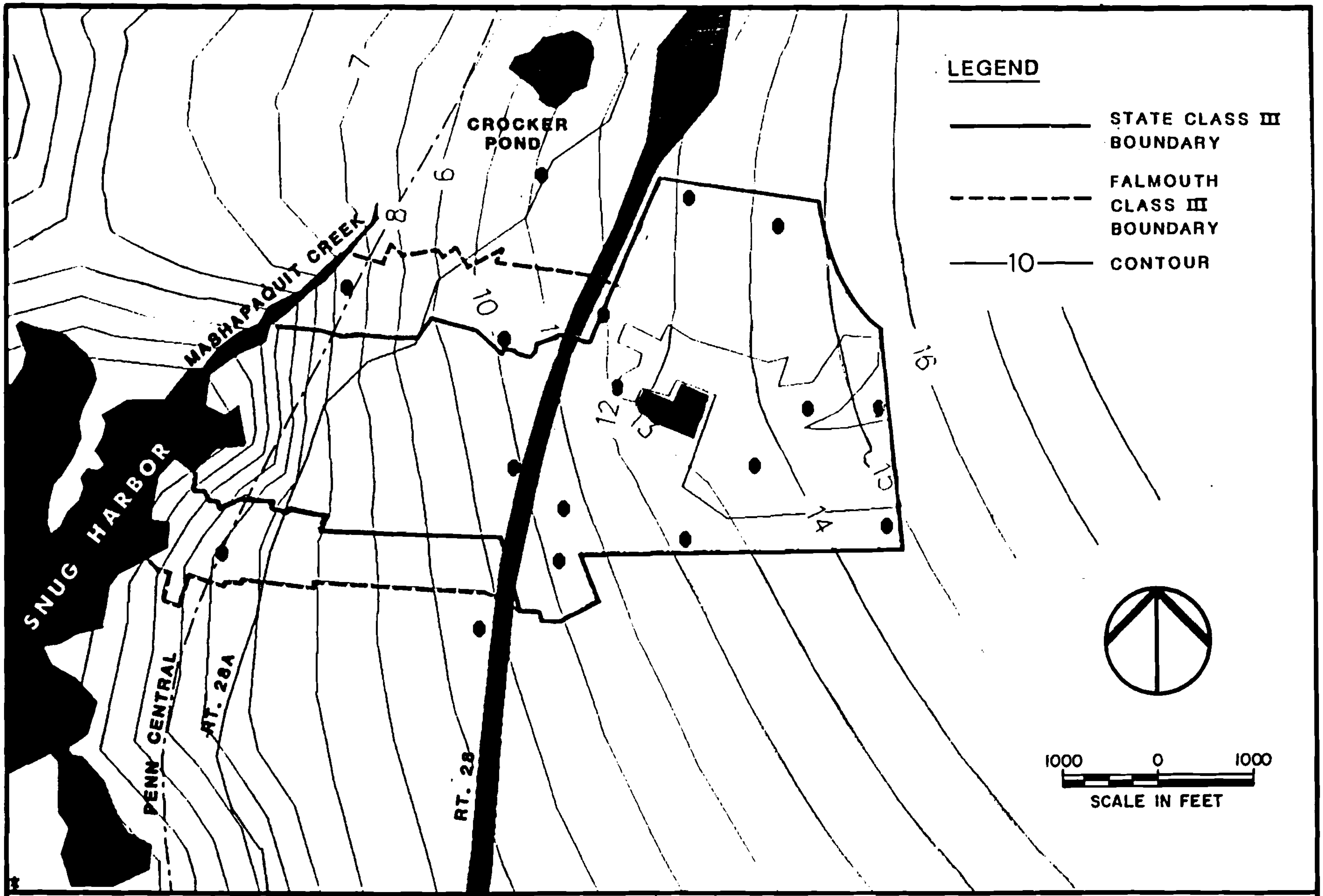

FIGURE A.1: PHASE I - SIMULATED PHREATIC SURFACE CONTOURS - WINTER Infiltration @ 0.55 MGD, Irrigation @ 0.0 MGD Long Pond @ 2.0 MGD

CDM

environmental engineers, scientists, planners, & management consultants

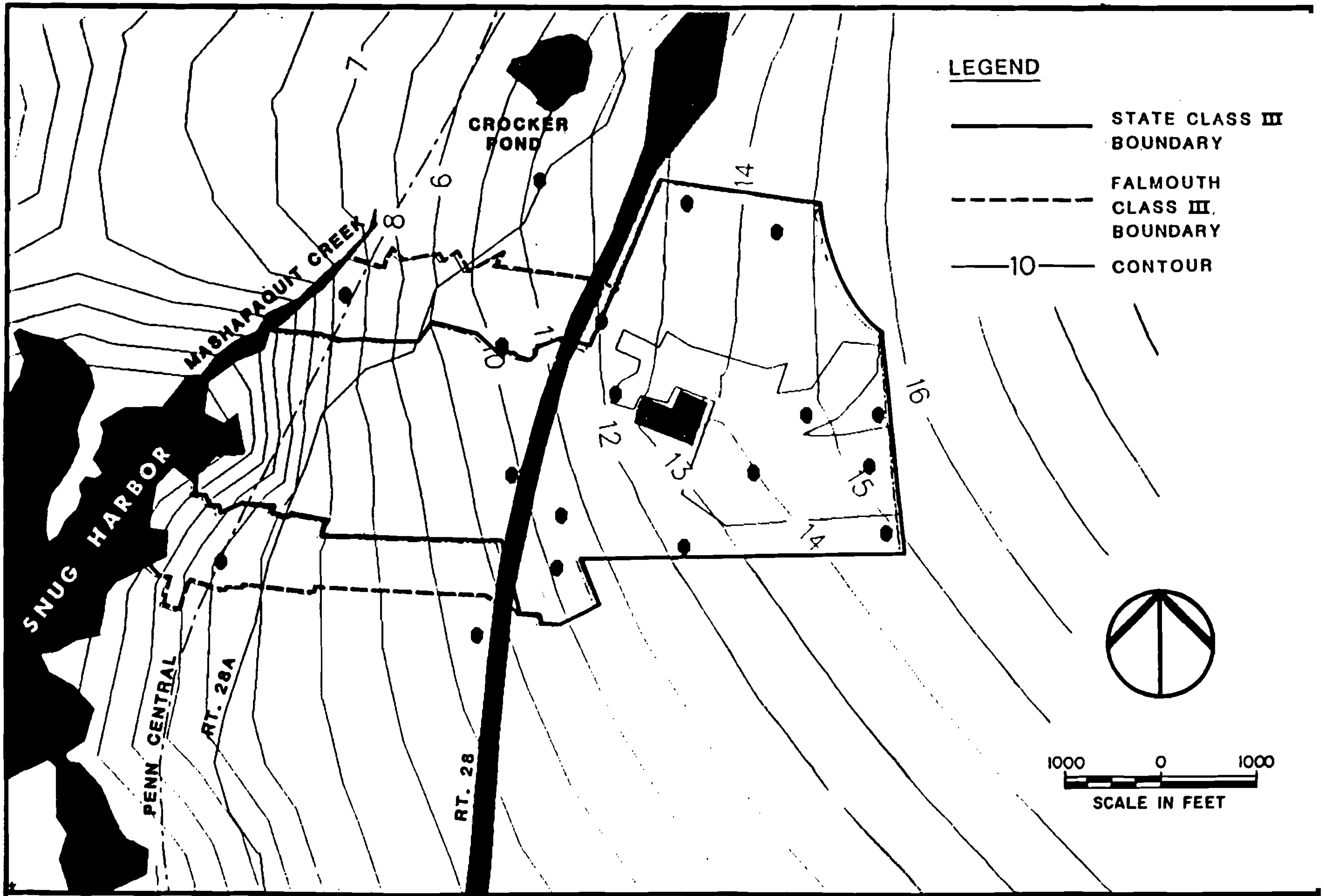

FIGURE A.3: PHASE I - SIMULATED PHREATIC SURFACE CONTOURS - SUMMER Infiltration @ 0.41 MGD, Irrigation @ 0.40 MGD Long Pond @ 4.0 MGD

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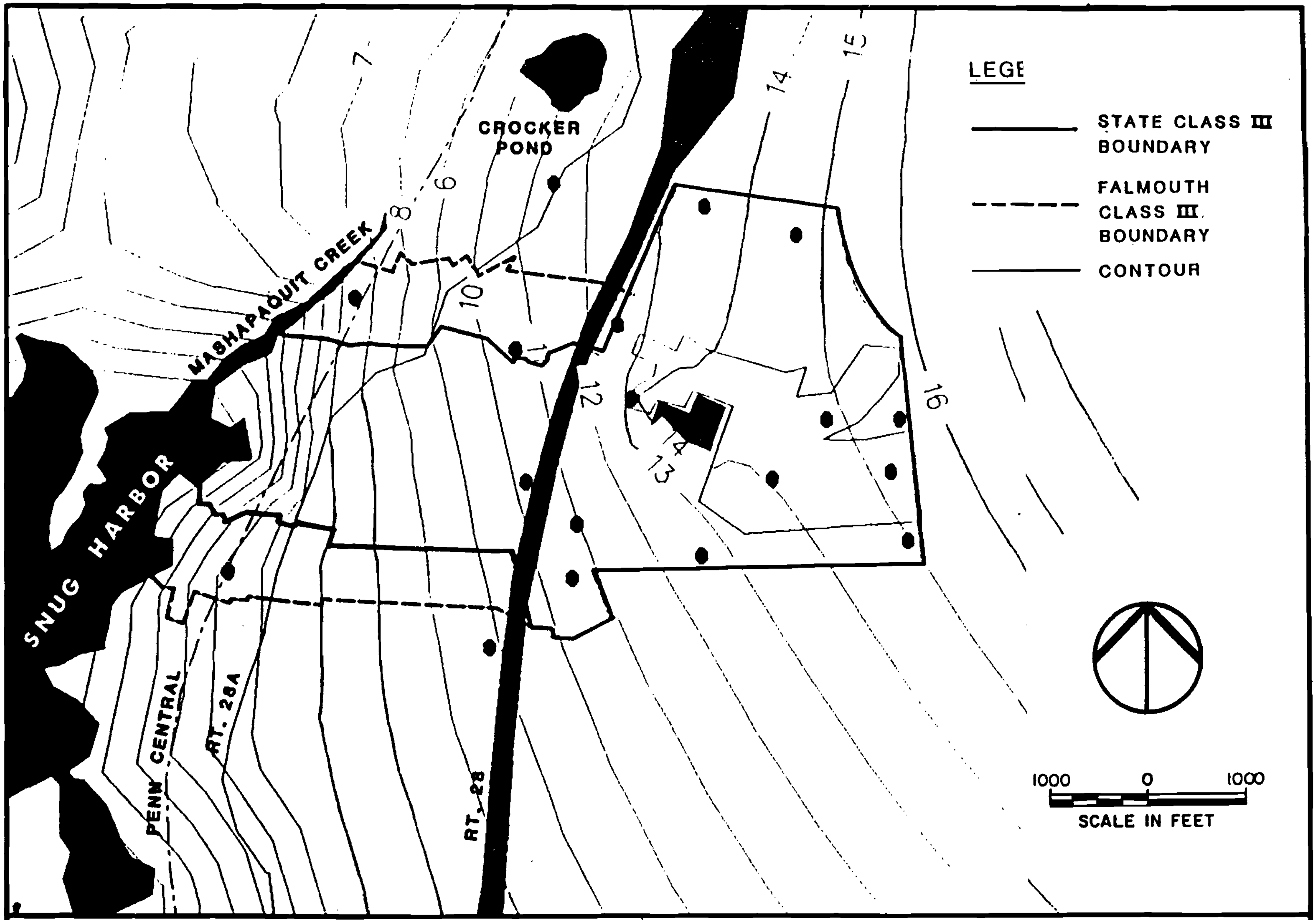

FIGURE A.4: PHASE II – SIMULATED PHREATIC SURFACE CONTOURS – WINTER Infiltration @ 0.92 MGD, Irrigation @ 0.0 MGD Long Pond @ 2.0 MGD

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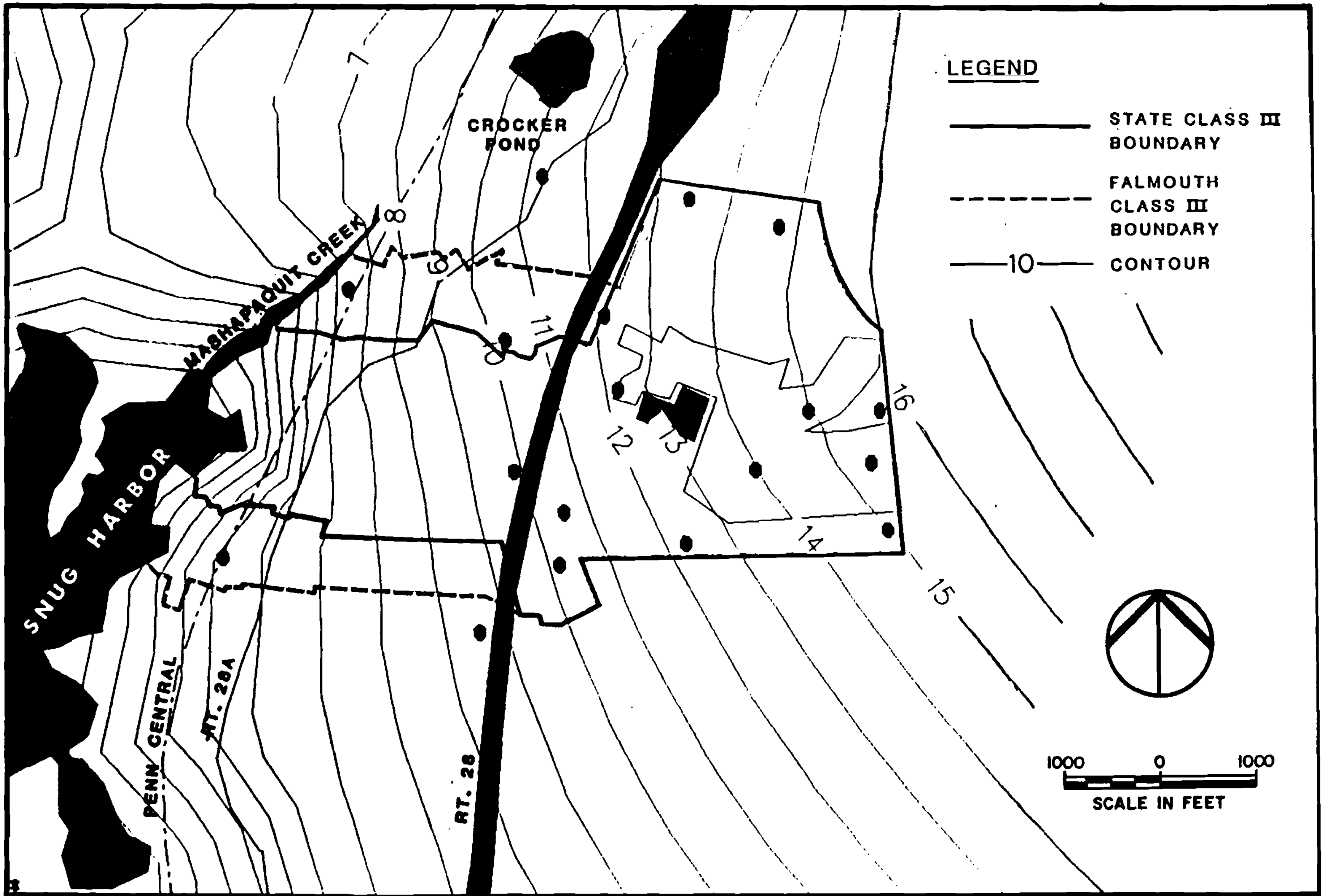

FIGURE A.5: PHASE II - SIMULATED PHREATIC SURFACE CONTOURS - SPRING/FALL
Infiltration @ 0.22 MGD, Irrigation @ 0.70 MGD Long Pond
@ 3.0 MGD

CDM
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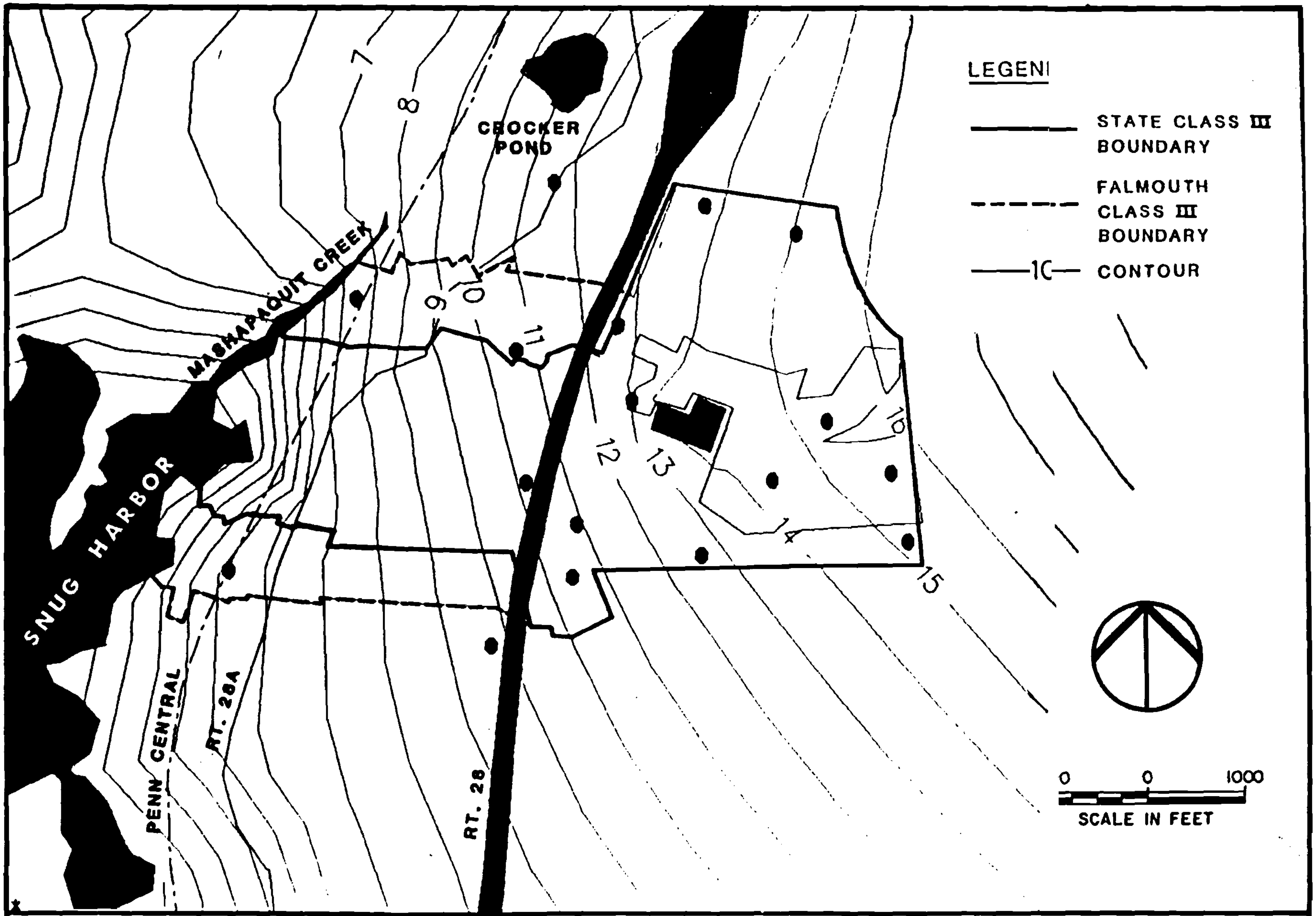

FIGURE A.6: PHASE II - SIMULATED PHREATIC SURFACE CONTOURS - SUMMER
Infiltration @ 0.59 MGD, Irrigation @ 0.70 MGD Long Pond
@ 4.0 MGD

CDM

nvironmental engineers, scientists,
nners, & management consultants

FALMOUTH WASTEWATER TREATMENT FACILITY
INVENTORY OF EXISTING AND PROPOSED FACILITIES AND PROCESS EQUIPMENT
Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts

Component	Existing	Proposed Design (Year 2023)
Pretreatment Facilities		
Aerated Grit Tank		Continue using existing equipment
Number	1	
Location	Headworks	
Total tank volume, cubic feet	900	
Shape	Triangular	
Tank dimensions, feet		
Length	24	
Width	6	
Sidewater Depth	13	
Aerated Grit Equipment		Continue using existing equipment
Type	Grit Screw	
Number	1	
Location	Grit building	
Manufacturer and model	RDP, 12-inch	
Year placed in service	1986	
Aerated Grit Blower		Continue using existing equipment
Type	Rotary Lobe Blower	
Number	2	
Horsepower	2	
Capacity (Range – scfm)	20	
Blower manufacturer and model	Roots: 820-184-320	
Year placed in service	1986	

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Town of Falmouth, Massachusetts

Component	**Existing**	**Proposed Design (Year 2023)**
Grit Sump Pumps		Continue using existing equipment
Type	Submersible	
Location	Grit building	
Number of units	2	
Drive, HP	1	
Manufacturer and model	Swaby Manufacturing Co.	
Year placed in service	1986	
Pretreatment Odor Control Type	Biofilter to be constructed in 2000	
Sequencing Batch Reactors and Appurtenances		
Pre-Equalization Tank and Equipment	Proposed new facility	
Number of tanks		1
Tank Retention time, hours		3.2
Pre-Equalization Aeration Equipment	Proposed new equipment	
Type		Coarse bubble, diffused air
Blower type		Positive displacement
Number		2 (1 standby)
Horsepower, each		50
Capacity (scfm)		600

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Town of Falmouth, Massachusetts

Component	**Existing**	**Proposed Design (Year 2023)**
Pre-Equalization Pumps		
Type		Submersible
Number		3
Horsepower, each		10
Sequencing Batch Reactors (SBR)	Proposed New Facility	
Number of Tanks		2
Tank Sidewater depth		21
Retention time, hours		30
SBR Aeration Equipment		
Type		Fine bubble diffused air
Blower type		Positive displacement
Number of blowers		3 (1 standby)
Blower horsepower		100
Blower capacity, scfm		2,678
SBR Mixers		
Number		2
Horsepower		40
SBR Decanters		
Type		Gravity
Number		2
SBR Sludge Pumps		
Type		Submersible
Horsepower		5

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Town of Falmouth, Massachusetts

Component	Existing	Proposed Design (Year 2023)
SBR Methanol Feed		
Storage tank capacity		4,000 gal
Number of feed pumps		3 (1 standby)
Post Equalization Aeration Equipment	Proposed new equipment	
Type		Coarse bubble, diffused air
Blower type		Rotary positive displacement
Number		2 (1 standby)
Horsepower, each		20
Capacity (scfm)		340
Post Equalization Pumps		
Type		Submersible
Number		2
Horsepower, each		7.5
Effluent Flow Monitoring		
Post-Equalization Discharge		
Flow Element		Flooded pipe velocity sensor
Location		Post-equalization discharge
Flow Range		0 to 3 mgd

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Town of Falmouth, Massachusetts

Component	Existing	Proposed Design (Year 2023)
Irrigation Pump Discharge		Continued use of existing equipment
Number	1	
Type	Doppler	
Manufacturer and model	Polysonics Doppler Flow #008312	
Location	Pump Room – Control Building	
Year placed in service	1988	
ExistingParshall Flume		Discontinue Use
Location	Infiltration bed – influent pipe	
Effluent Discharge Facilities		
Sand Infiltration Basins		
Beds 1-5		Continue using existing facilities
Surface Area (sf)	37,500	
Capacity (mgd)	0.205	
Beds 6-8		Continue using existing facilities
Surface Area (sf)	62,500	
Capacity (mgd)	0.205	
Beds 9-12	Proposed new facility	
Surface Area (sf)		58,000
Capacity (mgd)		0.255
Bed 13	Proposed new facility	
Surface Area (sf)		58,000
Capacity (mgd)		0.063

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Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts

Component	Existing	Proposed Design (Year 2023)
Spray Irrigation		Continue use of existing facilities
Number of application areas	5	
Total area, acres	65	
Hydraulic loading rate, in/ac/wk	2	
Capacity, mgd	0.5	
Wet well volume, gal	15,000	
Irrigation pumps		
Number of pumps	2	
Motor horsepower, each pump	25	
Design flow @ TDH	500 gpm @130 ft	
Pump manufacturer and model	Worthington D1011	
Location	Pump Room – Control Building	
Year placed in service	1988	
Septage Pretreatment Facilities		
Septage Rotary Screen		Continue using existing equipment
Number	1	
Capacity, gpm	425	
Location	Septage Receiving Area	
Manufacturer and model	Lakeside Septage Screen	
Year placed in service	1998	
Septage Manual Bar Screens		Continue using existing equipment
Type	Coarse – Hand cleaned	
Number	4	
Location	Septage Receiving Area	
Bar Separation, inches	1- 3/8	
Year Placed in service	1986	

FALMOUTH WASTEWATER TREATMENT FACILITY
INVENTORY OF EXISTING AND PROPOSED FACILITIES AND PROCESS EQUIPMENT
Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts

Component	**Existing**	**Proposed Design (Year 2023)**
Septage Receiving Tanks		Continue using existing equipment
Type	Aerated Storage Tanks	
Number	4	
Location	Adjacent to Control Building	
Total tank volume, cubic feet (each)	2,700	
Tank dimensions, feet		
Length	24	
Width	12	
Sidewater depth	10	
Septage Blowers		Continue using existing equipment
Type	Rotary Lobe Blower	
Number	3	
Horsepower	20	
Capacity (Range – scfm)	70-340	
Blower manufacturer and model	Roots: 409 RCS-V	
Year placed in service	1986	
Septage Pumps		Continue using existing equipment
Type	Ejector	
Number	2	
Capacity (gallons per cycle)	50	
Pump manufacturer and model	Carter, P/E 50 gal.	
Location	Process Room – Control Building	
Year placed in service	1986	

FALMOUTH WASTEWATER TREATMENT FACILITY
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Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts

Component	Existing	Proposed Design (Year 2023)
Air Compressors for Septage Pumps		Continue using existing equipment
Number	2	
Horsepower	25	
Capacity (Range – scfm)	180	
Blower manufacturer and model	Quincy Air Compressor – 5120	
Year placed in service	1986	
Septage Pretreatment Odor Control	Biofilter to be constructed in 2000	Continue using existing equipment
Sludge Management Facilities		
Sludge Holding Tank	Proposed new facility	
Volume, gallons		648,000
Retention time (average annual)		20 days @ 1.7% TS
Sludge Holding Tank Aeration Equipment	Proposed new equipment	
Type		Coarse bubble, diffused air
Blower type		Positive displacement
Number		3
Horsepower, each		75
Capacity (scfm)		1,624
Thickened Sludge Storage		
Volume, gallons		36,000
Retention time (average annual)		4 days @ 5% TS

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Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts

Component	Existing	Proposed Design (Year 2023)
Sludge Dewatering	Proposed new process	
Type		Belt Filter Press (3 belt)
Location		Sludge Management Building
Number of Units		1
Belt width, m		2
Feed pumps		
Type		Positive Displacement
Number		3 (1 standby) [2]
Odor Control Type		Biofilter
Sludge Drying Beds No. 1 – 3		Fill 2 of the beds. Connect the remaining bed to the plant influent to allow the bed to be used for dewatering of grit removed from pumping stations.
Surface Area each	20,000	
Additional Odor Control Facilities		Continue using existing equipment
Type	Sodium Hypochlorite	
Storage tank volume, gal.	2000	
Number of pumps	3	
Type	Diaphragm Metering Pump	
Motor horsepower, each pump	0.5	
Capacity, gph (each)	13	
Pump manufacturer and model	BIF Proportioneer 1731-28-9216	
Location	Pump Room – Control Building	
Year placed in service	1988	

---

[2] Feed pumps can also be used for tanker truck loading

			1997 Expended	1998 Expended	1999 Budget	2000 Request
	01440	**SEWER ADMINISTRATION**				
	51110	Salary & Wages - Permanent	229,883	238,476	296,468	284,900
1	51120	Salary & Wages - Temporary	0	0	0	0
	51130	Additional Gross Overtime	18,663	18,918	20,600	22,000
		Sub-Total, Personal Services	**248,546**	**257,394**	**317,068**	**306,900**
	52240	Repair/Maint - Office Equipment	940	121	1,000	1,000
	52291	Other Proprietary Svc - Well Monitoring	24,475	14,226	25,000	25,000
	52300	Prof/Tech - Professional Service	700	477	1,000	1,000
	52309	Prof/Tech - Engineers	0	0	500	500
2.	52340	Communication - Printing	379	850	1,000	1,000
	52342	Communication - Postage	999	29	1,000	1,000
		Sub-Total, Purchase of Services	**27,493**	**15,703**	**29,500**	**29,500**
	54420	Office Supplies	639	0	1,000	1,000
		Sub-Total, Supplies	**639**	**0**	**1,000**	**1,000**
	57710	In-State Travel	80	0	200	200
3	57730	Dues & Memberships	608	82	650	650
	57781	Staff Development*	999	243	1,500	1,500
		Sub-Total, Other Charges/Expenses	**1,687**	**325**	**2,350**	**2,350**
		ORG. TOTAL	**278,365**	**273,422**	**349,918**	**339,750**

	01449	SEWER TREATMENT PLANT	1997 Expended	1998 Expended	1999 Budget	2000 Request
7	52211	Energy - Fuel Oil*	0	1,317	800	800
	52212	Energy - Electricity*	86,344	82,926	100,000	138,500
	52241	Repair/Maint - Building	995	1,245	1,300	1,300
8	52242	Repair/Maint - Vehicle	3,159	4,150	3,200	3,200
	52243	Repair/Maint - Equipment	12,601	13,283	20,000	20,000
9	52341	Communication - Telephone	3,957	3,590	4,200	4,200
		Sub-Total, Purchase of Services	**107,056**	**106,511**	**129,500**	**168,000**
	54480	Vehicle Supply - Motor Oil	0	0	30	30
	54481	Gasoline*	1,121	938	1,600	1,600
	54482	Vehicle Supply - Diesel Fuel*	1,879	1,566	2,100	2,100
10	54484	Other Supply - Grease/Lubricant	111	271	400	400
	54485	Vehicle Supply - Tires	145	0	1,000	1,000
	54530	Public Works Supplies	1,770	1,813	2,500	2,500
	54533	Public Works Supplies - Tools	943	667	1,000	1,000
	54535	Public Works Supplies - Chemicals	7,377	8,875	18,000	18,000
	54536	Public Works Supplies - Fittings	921	2,635	3,000	3,000
		Sub-Total, Supplies	**14,267**	**16,765**	**29,630**	**29,630**
		ORG. TOTAL	**121,323**	**123,276**	**159,130**	**197,630**

$39,110 dgcted to P.S.

FALMOUTH WASTEWATER TREATMENT FACILITY
INVENTORY OF EXISTING AND PROPOSED FACILITIES AND PROCESS EQUIPMENT
Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts

Component	Existing	Proposed Design (Year 2023)
Pond Drainage Pump		Possible reuse with SBR
Number of pumps	1	
Motor horsepower, each pump	7.5	
Design flow @ TDH	800 gpm @ 23 ft	
Pump manufacturer and model	Worthington 6MFC-13	
Location	Pump Room – Control Building	
Year placed in service	1986	

CHAPTER 7

ENVIRONMENTAL IMPACT ANALYSIS

7.1 INTRODUCTION

In accordance with the MEPA review process, an Environmental Impact Report (EIR) is required as part of the Falmouth Wastewater Facilities Planning Study. The Code of Massachusetts Regulations (301 CMR 11.00) provides the outline for the information required for the EIR and this information is presented as part of the Facilities Planning Report. The purpose of this chapter is to outline the existing conditions of the Planning Areas in Falmouth, identify regulations and permit requirements, provide an analysis of effects for all alternative plans and the selected plans, and outline mitigation measures.

The existing conditions establish an environmental baseline to help assess the potential impacts of construction and operation of all alternative plans. Following the establishment of the impacts, a recommended plan is selected, and any impacts are identified. Mitigation measures are then identified to minimize these impacts to the proposed site(s), while allowing for full functionality of the proposed facilities.

There are eight Planning Areas used for the Wastewater Facilities Planning Study as illustrated in Figures 2-1, 2-2, 2-3, and 2-4. These areas were identified previously in the Needs Assessment and Alternatives Screening Analysis Reports and are summarized in Chapter 2 of this Report. These areas include:

- West Falmouth Watershed Area
- Falmouth High School
- Woods Hole
- Main Street

- Davis Straits/Inner Harbor
- Falmouth Beach
- Falmouth Heights
- Maravista

7.2 EXISTING ENVIRONMENT

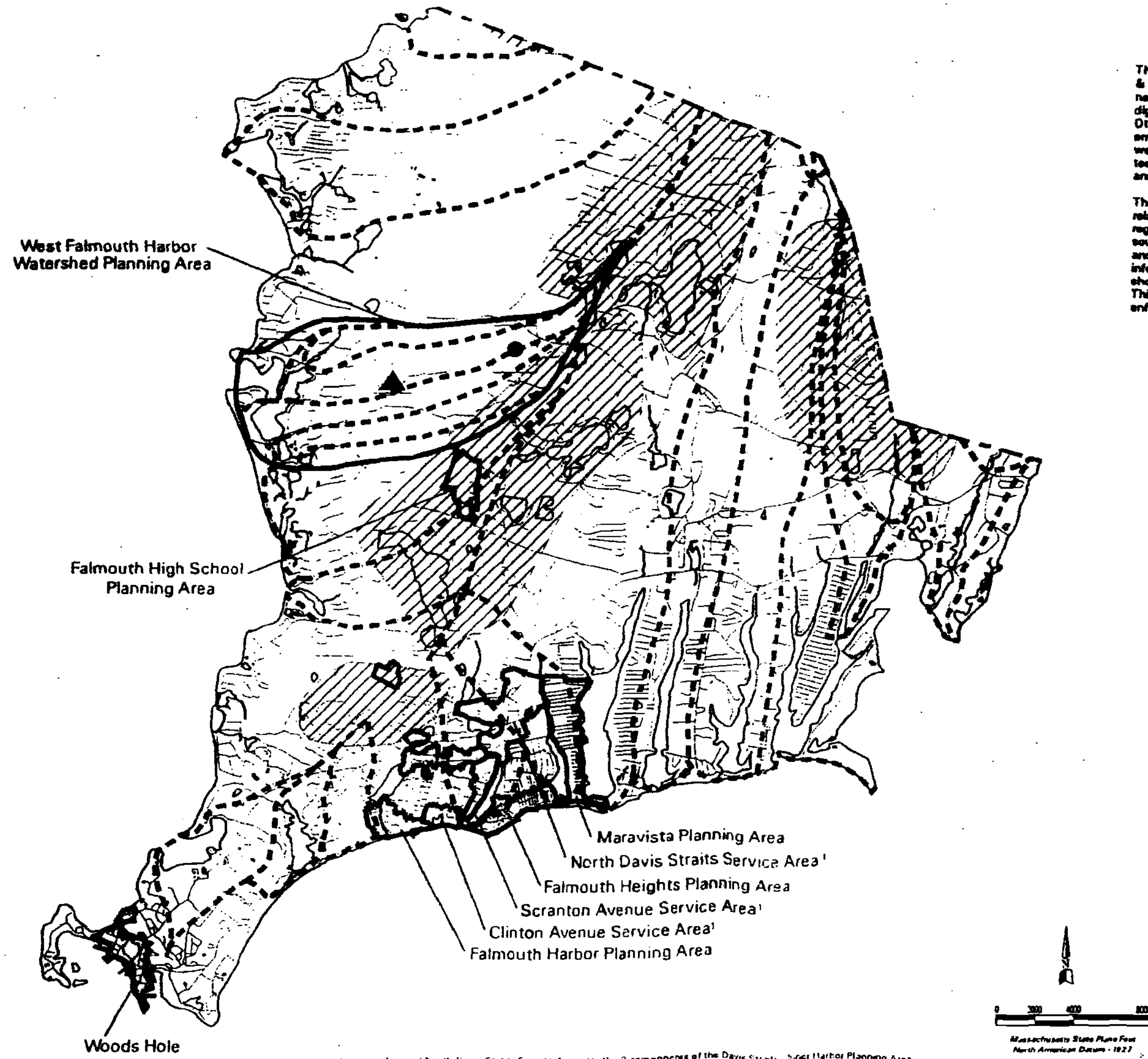
A. **Introduction.** To properly assess the potential site impacts, background information regarding the physical, biological, economic, and social conditions the Falmouth Planning Areas must be outlined. The majority of this information was previously compiled in the May 1999 Final Needs Assessment Report. The Needs Assessment Report described this information and the following sections summarize those findings. Information on the environment is developed in the EIR to aid in the assessment of alternatives by establishing the existing conditions in these Planning Areas.

The Figure 7-1 illustrates some existing conditions in Falmouth.

B. Topography, Geology, and Soils.

1. **General.** Falmouth's topography consists of hilly terrain along the western side of Town and transitions into glacial outwash plains to the east. The geologic formation along the western quarter of the town is identified as the Buzzards Bay Moraine, and consists of a loose glacial till created during the last ice age. The remainder of the Town is generally underlain by glacial outwash (as part of the Mashpee Outwash Plains), which typically consist of stratified and well-sorted sands and gravel.

In general, the Town soils have been classified in the 1993 Barnstable County Soil Survey, which is a report developed by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS). The sandy soils, which make up over 70 percent of the Town, generally are very deep and very well drained. The two most predominant soils found in town are identified as



This map was developed by Stearns & Wheler, LLC, Environmental Engineers & Scientists for the purpose of studying Falmouth's wastewater management needs. Sewered parcels, and the Water Pollution Control Facility were digitized in 1990 for the Cape Cod Commission's Regional Policy Plan. Other base map features such as coastlines, water bodies, coastal embayment recharge areas, water supply protection areas and roads were automated by the Cape Cod Commission GIS department. Special technical assistance and data was provided by MassGIS of Boston, MA; and the Town of Falmouth.

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Legend

- Surface Water Bodies
- ⁄ Water Suppy Protection Area
- — Coastline (Fresh & Saltwater)
- ▬ Town Boundary
- — Roads
- ■■ Perimeter of Costal Embayment Recharge Areas
- ▬ Planning Area Boundaries
- ▲ Falmouth Wastewater Treatment Facility
- ⊡ Falmouth Sanitary Landfill

FIGURE 7-1
TOWN OF FALMOUTH PLANNING AREAS

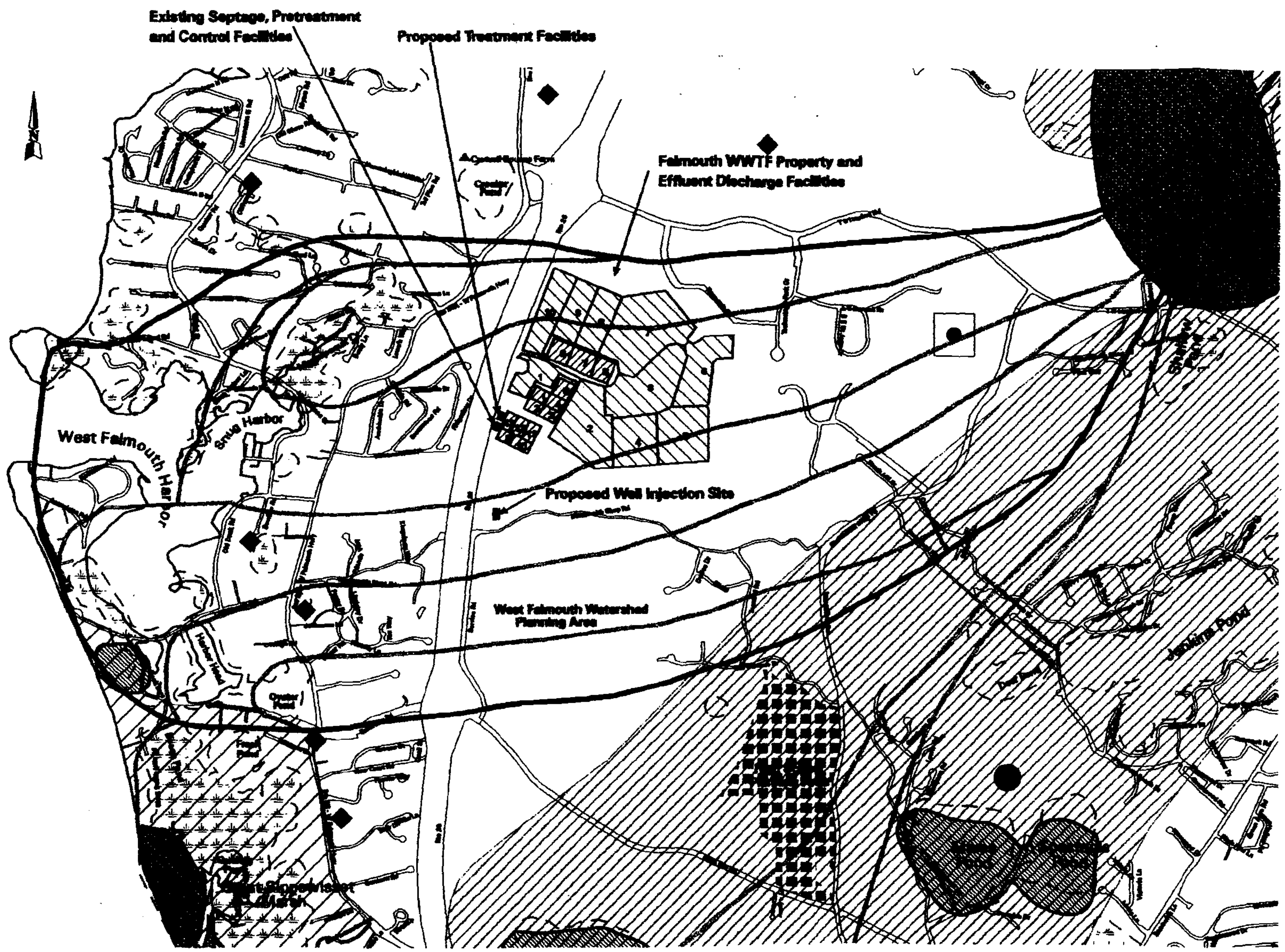
Wastewater Facilities Planning Study
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Map prepared by Harvard Design and Mapping Company, Inc.
Base map prepared by the Cape Cod Commission, GIS Department

December 10, 1999

Note: 1. Clinton Ave, Scranton Ave and North Davis Straits Service Areas are the 3 components of the Davis Straits / Inner Harbor Planning Area.



Notes:
1. Spray irrigation area 1-5 are existing.
2. Infiltration Beds 1-6 are existing.
3. Facility locations are approximate.

0 500 1000 2000 Feet

Massachusetts State Plane Feet
North American Datum - 1927
December 10, 1999

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Habitat Maps were provided by the Massachusetts Natural Heritage and Endangered Species Program 1999-2000. Wetlands were digitized by Cape Cod Commission GIS and augmented from 1990 MacConnell Aerial Photo Land Use and 1992 Mass DEP wetland restriction maps. Wetland restriction areas were provided by the Town of Falmouth, digitized by Cape Cod Commission.

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Legend

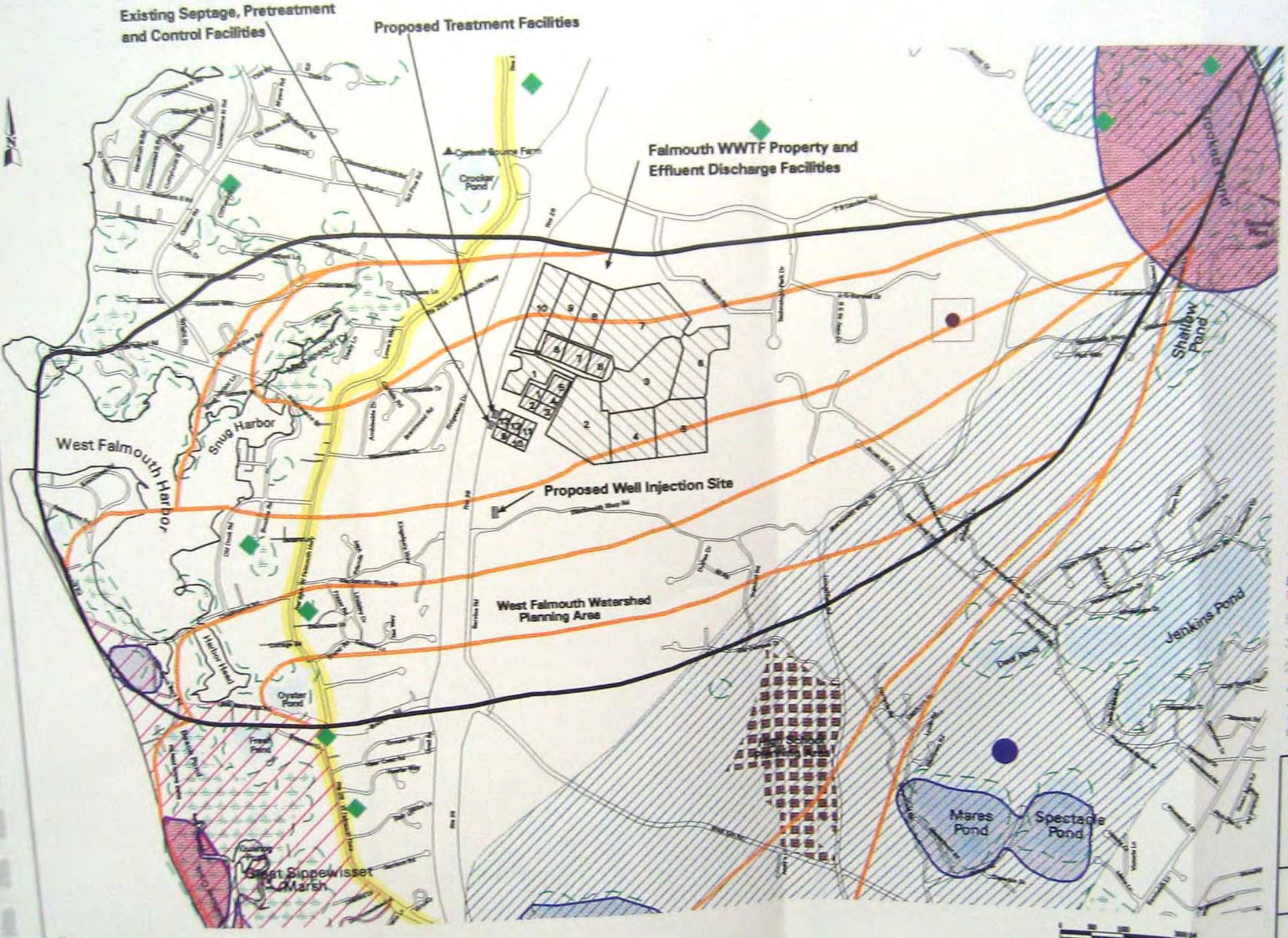
- Roads
- Coastline
- Town Boundaries
- Planning Areas
- Perimeter of Coastal Embayment Recharge Areas
- Wetland Restriction Area
- Wetlands
- Surface Water Bodies
- Water Supply Protection Areas
- Historic Districts
- Falmouth High School
- Estimated Habitats of Wildlife in Wetlands
- Estimated Habitats of State Protected Plants and Animals
- Existing and Proposed Spray Irrigation Areas (1)
- Existing and Proposed Infiltration Beds (2)
- ◆ Vernal Pools
- ▲ Historic Sites
- ● Existing Municipal Wells
- ⊡ Falmouth Sanitary Landfill

FIGURE 7-2
WEST FALMOUTH HARBOR & FALMOUTH HIGH SCHOOL
ESTIMATED HABITATS OF PRIORITY PLANTS AND ANIMALS

Wastewater Facilities Planning Study
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Map prepared by Harvard Design and Mapping Company, Inc.



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Notes:
1. Spray irrigation area 1-5 are existing.
2. Infiltration Beds 1-6 are existing.
3. Facility locations are approximate.

Massachusetts State Plane Feet
North American Datum - 1927
December 10, 1999

FIGURE 7-2

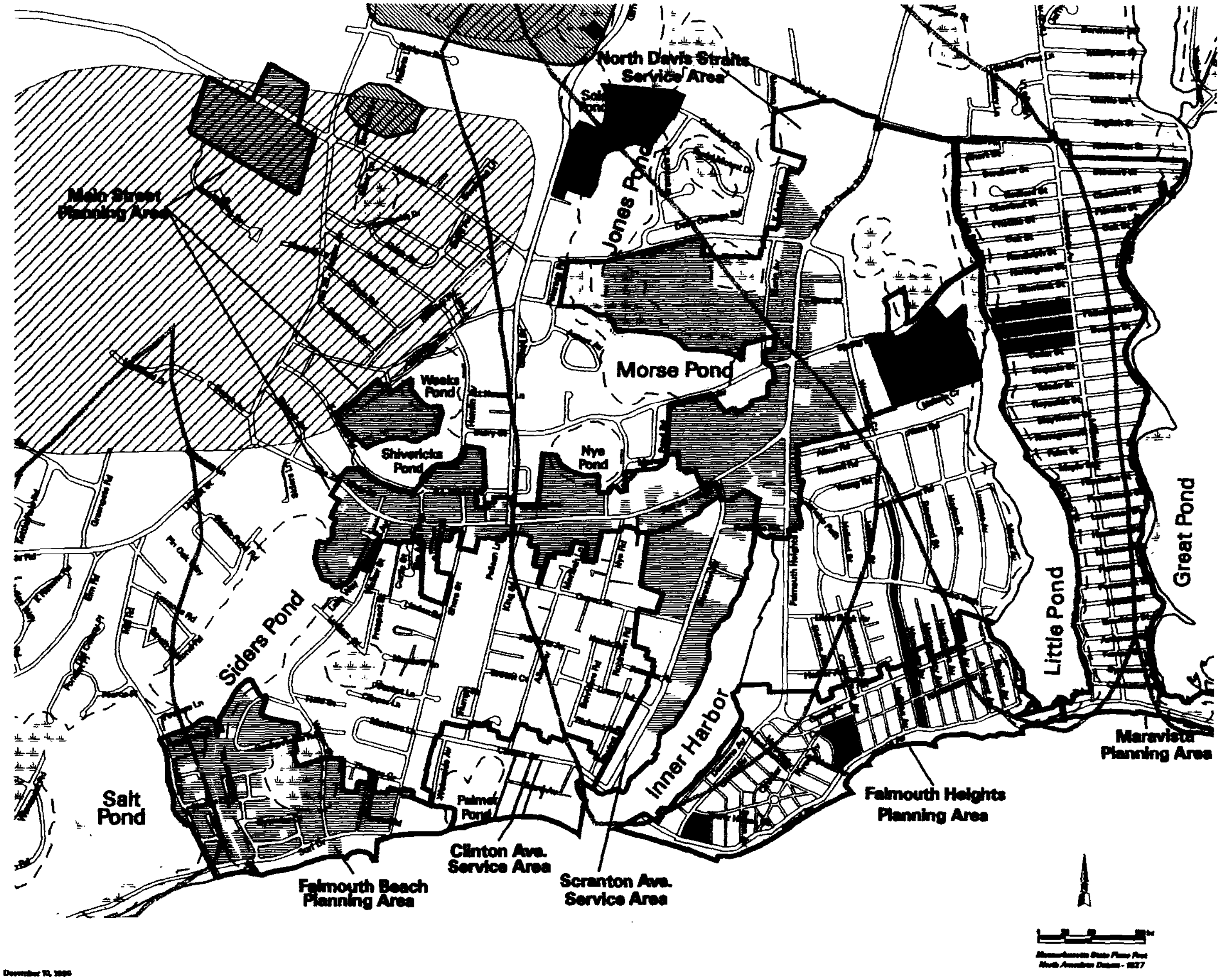
WEST FALMOUTH HARBOR &
FALMOUTH HIGH SCHOOL

ESTIMATED HABITATS OF
PRIORITY PLANTS AND ANIMALS

Wastewater Facilities Planning Study
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Map prepared by Harvard Design and Mapping Company, Inc.



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Legend

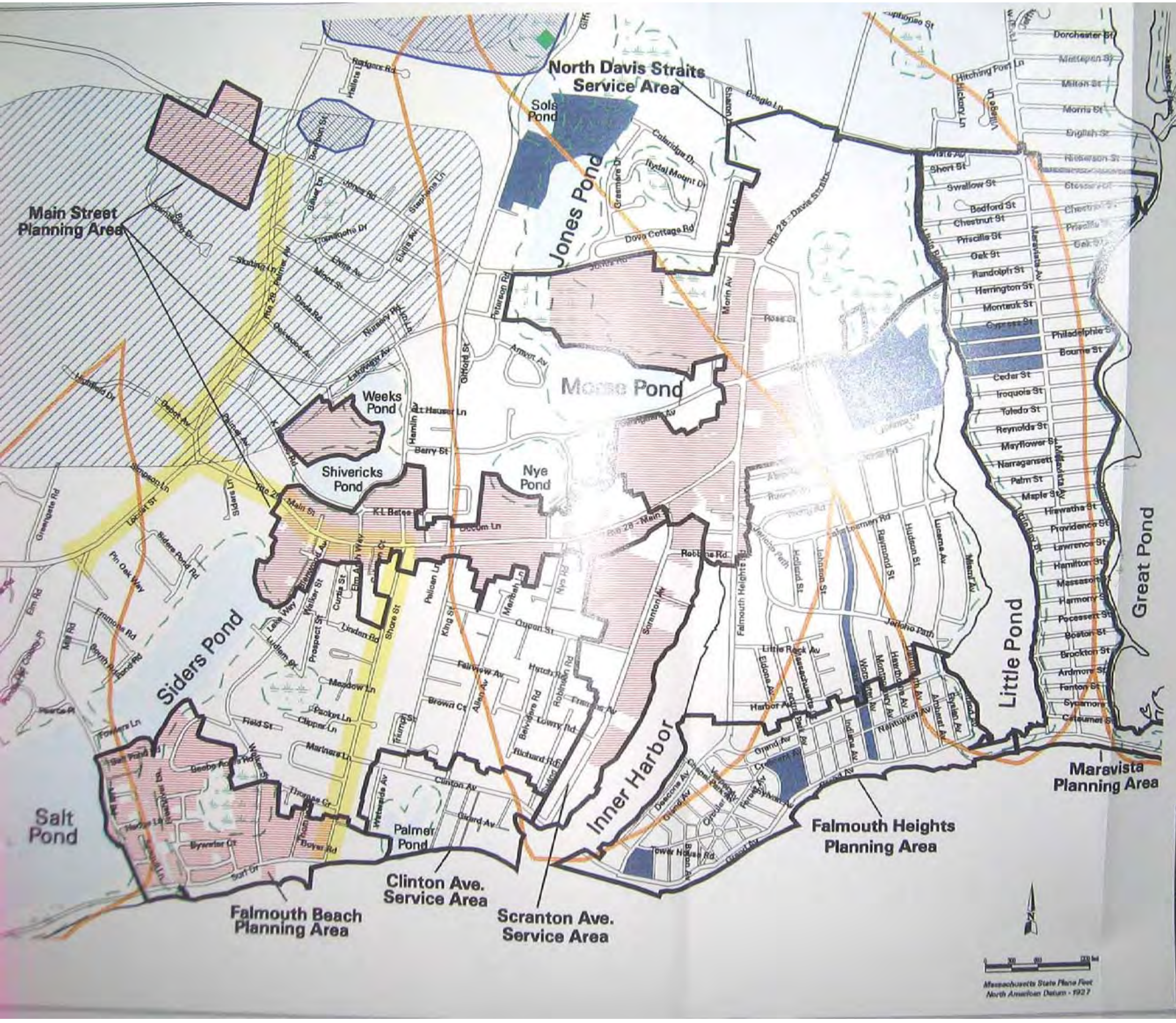
- Roads
- Coastline
- Town Boundaries
- Planning Areas
- Perimeter of Coastal Embayment Recharge Areas
- Wetland Restriction Area
- Wetlands
- Surface Water Bodies
- ▤ Sewered Parcels
- ■ Potential Sites for Cluster or Package Treatment Systems or Discharge Facilities
- Water Supply Protection Areas
- ▨ Estimated Habitats of State Protected Plants and Animals
- Historic Districts
- ▲ Historic Sites
- ◆ Vernal Pools

FIGURE 7-3
FALMOUTH CENTER
ESTIMATED HABITATS OF PRIORITY PLANTS AND ANIMALS

Wastewater Facilities Planning Study
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Map prepared by Harvard Design and Mapping Company Inc.



Legend

- Roads
- Coastline
- Town Boundaries
- Planning Areas
- Perimeter of Coastal Embayment Recharge Areas
- Wetland Restriction Area
- Wetlands
- Surface Water Bodies
- Sewered Parcels
- Potential Sites for Cluster or Package Treatment Systems or Discharge Facilities
- Water Supply Protection Areas
- Estimated Habitats of State Protected Plants and Animals
- Historic Districts
- Historic Sites
- Vernal Pools

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FIGURE 7-3
FALMOUTH CENTER
ESTIMATED HABITATS OF
PRIORITY PLANTS AND ANIMALS

Wastewater Facilities Planning Stu
Town of Falmouth, MA

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTIS

Map prepared by Harvard Design and Mapping Compan

Plymouth-Barnstable-Nantucket soils and Enfield-Merrimack-Carver soils, both are made up of sands and loamy soils from glacial outwash.

A review of soil evaluations performed to design on-site (Title 5) systems indicates that the Town's soils are a medium to coarse sand. Percolation tests have also been performed and the rates are generally less than two minutes per inch. This indicates that the disposal of wastewater is not generally a problem because the soils allow water to pass so quickly. At the same time, this high percolation rate does not promote treatment or polishing of septic tank effluent because it passes so quickly.

2. **West Falmouth Harbor.** Topography of the area varies from 0-40 feet above MSL along the coastline and west of Route 28A gradually increasing to more hilly terrain east of Route 28A and elevations up to 190 feet above MSL. The hilly terrain marks the location of the Buzzards Bay Moraine, created by glacial activity during the ice age. Further east, the West Falmouth Harbor Planning Area transitions into the Mashpee Outwash Plains (east of Locusfield Road), with rolling to flat terrain and a change in soil conditions to looser, sandier soils.

Soil Classifications for the study area were identified using the 1993 Barnstable County Soil Survey. The majority of the soil types in the West Falmouth Harbor watershed area are the PxC, PxD, and BeC (or the Plymouth-Barnstable, Barnstable-Plymouth complexes) soil types. These soils contain boulders and vary from rolling to hilly terrain. These soil types are located between Route 28A and the Falmouth Sanitary Landfill. The soils least suitable for on-site soil absorption systems are located north of West Falmouth Harbor, along the southern shore of the harbor, and near the north shore of Oyster Pond.

3. **Falmouth High School.** The Soil Survey identifies the majority of the property as udipsamments soils, which are defined as "nearly level soils in areas that have been excavated or filled during construction." Because the majority of this property is identified as Ud, on-site investigations would be necessary to identify more specific soil conditions on this site. The remaining soils are identified as providing poor filtering for on-site soil absorption systems.

4. **Woods Hole.** Because the majority of the Woods Hole Planning Area is already sewered, soil conditions are not as critical to the alternative plans. Juniper Point, located between Inner Harbor and Great Harbor, is the largest non-sewered part of the Planning Area. Soils in the non-sewered portions of the point are characterized as PxD, and BdC type soils. These soils are sandy loams having rapid permeability. These soils are limited in their ability to provide additional filtering of septic tank effluent.

5. **Main Street.** Topography of the area is flat, and ground surface elevations vary from 5 to 20 feet above MSL. Four different soil types were identified in the Main Street Planning Area by the Barnstable County Soil Survey. The four soil types are: Enfield silt loam 0-3 percent (EnA), Enfield silt loam 3-8 percent slopes (EnB), Upidsamments (Ud), and Urban (Ur). The majority of this area is sewered; therefore, soil conditions for sewered parcels are not as critical in assessing the alternative plans. In the areas not currently sewered, Enfield silt loam soils are the predominant soil type.

6. **Davis Straits / Inner Harbor.** Soils along the Clinton Avenue portions of the Planning Area are identified as Enfield silt loam, which generally drain well. Soils in the northern portions of the Planning Area are characterized as Eastchop loamy fine sands and Merrimack sandy loams. Both these soil types have moderate to rapid permeability, which provide good percolation rates for on-site systems but limited filtering. There is also some Freetown coarse sand, located near the Falmouth Mall property, and depth to groundwater in these areas can be less than 2 feet.

7. **Falmouth Beach.** Topography in Falmouth Heights ranges from 0 to 50 feet above MSL, with the highest elevations on the western end of the Planning Area. Velocity zones in this area exist only along the beaches and do not affect any of the properties located in this Planning Area. However, the eastern half of the Planning Area is located in a 100-year flood zone indicating properties in this area are situated at low elevations.

The Falmouth Beach Planning Area soils consist of three types: Freetown and Swanset mucks 0-1 percent slopes (Fs), Beaches (Bh) and Urban land (Ur). This Planning Area is completely sewered; so soil conditions are not a concern for wastewater disposal.

8. **Falmouth Heights.** The Barnstable County soil survey identified five soil types in the Falmouth Heights Planning Area, including: Beaches (Bh), Enfield silt loam 0-3 percent slopes (EnA), Enfield silt loam 3-8 percent slopes (EnB), Upidsamments (Ud), and Urban (Ur). The majority of this Planning Area is classified as Urban land or Upidsamment; these areas require on-site investigations in order to identify the specific soil conditions on any particular site. The remainder of the soils are characterized as capable of absorbing septic tank effluent, while providing limited filtering due to the fast percolation rates of these soils.

9. **Maravista.** Topography is flat, except along the eastern and western shorelines, and ranges in elevation from 0 to 25 feet above MSL. Five different soil types are identified in the 1993 Barnstable County Soil Survey for the Maravista Planning Area. These soil types include: Beaches (Bh), Enfield silt loam 0-3 percent slopes (EnA), Enfield silt loam 3-8 percent slopes (EnB), Merrimack sandy loam 0-3 percent slopes, and Carver coarse sand 15-35 percent slopes (CdD). The southern portions of Maravista are made up of the Enfield silt loams and the Beach soils. The Enfield soils are characterized by their rapid permeability and limited filtering abilities.

The Carver coarse sands and the Merrimack sandy loams exist in the northern portions of Maravista. These less loamy materials are also characterized by moderate to rapid permeability with limited ability to filter septic tank effluent discharges.

C. Surface and Groundwater Hydrology and Quality

1. **General.** There have been several studies and reports written on the Town of Falmouth's groundwater and surface water systems. Many of these studies have concentrated on impacts to West Falmouth Harbor from the Sanitary Landfill and WWTF.

The Town of Falmouth receives its drinking water from the Sagamore Lens of the Cape Cod Sole Source Aquifer and the Long Pond Reservoir. This section reviews aspects of the Sagamore Lens including its flow direction, elevation and impacts from the Massachusetts Military Reservation (MMR).

2. **Groundwater Flow Direction and Elevation.** Previous water supply and modeling studies in the West Falmouth Harbor area have characterized the groundwater system for that watershed. The United States Geologic Survey (USGS) has prepared regional groundwater contour maps and flow models for western Cape Cod, which covers Falmouth. Generally, the groundwater system (Sagamore Lens) is at its highest elevation north of Falmouth in the MMR and flows to Buzzards Bay and Vineyard Sound.

3. **Impacts from the MMR.** A large number of studies and reports have been produced to assess the impacts of the MMR on groundwater supplies. In 1986 as part of an Installation Restoration Program initiated for the MMR, a large number of these impacts were identified; in 1989, the MMR was declared a Super Fund Site by the USEPA. As of 1996, five large plumes have been identified, several of which impact Falmouth (Open Space, 1996). These impacts are well documented and currently there are studies and remediation efforts associated with these impacts.

4. **Identification and Watershed Delineation.** The Town of Falmouth is bordered to the south by Vineyard Sound and the west by Buzzards Bay. Many coastal embayments open into these two large water bodies from Falmouth. The watershed delineations for the coastal embayments were developed by the Cape Cod Commission and adopted for this Study. The watershed delineations are based on measured groundwater elevations and a review of available water supply data and environmental evaluations. There are uncertainties in delineating embayment watersheds as discussed in Section 5.6-B of this Report and in Chapter 6 (pg. 6-20) of the Needs Assessment Report. Discussion with the Cape Cod Commission have indicated that the Commission's delineation is the most appropriate to use for this Study.

The coastal embayment recharge areas have been developed due to concerns that nitrogen loading in these areas will surface in a coastal embayment. This nitrogen, acting as a fertilizer, can cause excessive plant growth, periodic changes in the dissolved oxygen content in the embayment, and create changes in the embayment ecosystem. This could affect shellfish and other marine animals. The over fertilization of a surface water (fresh or salt water) is called eutrophication. The two major watersheds of concern for this Study are the West Falmouth Harbor and Little Pond Watersheds.

5. **West Falmouth Harbor.** The water quality in West Falmouth Harbor has been monitored by the Falmouth Pond Watchers for several years, and their 1998 report states that the water quality remains good as evidenced by the presence of eel grass beds and benthic animal population. There is minimal evidence of water quality degradation. Water quality sampling and analysis indicates nitrogen and dissolved oxygen concentrations in the Harbor's outer portions is similar to water quality in Buzzards Bay and Vineyard Sound. However, water quality measurements at the Harbor's inner reaches indicate elevated nitrogen levels and lower dissolved oxygen levels. This reduced water quality is attributed to the nitrogen loading from the Falmouth WWTF and other nitrogen sources in the watershed (Howes and Goehringer, 1998).

Nitrogen loading assimilation, and monitoring studies performed by the Cape Cod Commission, Buzzards Bay Project, Falmouth Pond Watchers, and Aubrey Consulting, Inc. indicate that the WFH is beginning to see the impacts of this nitrogen loading. Recent studies indicate that the assimilative capacity (critical nitrogen loading) for the Snug Harbor and Harbor Head/Oyster Pond subembayments is being exceeded, although the entire harbor remains below these critical nitrogen loads.

West Falmouth Harbor is classified as SA according to the state classification system in 314 CMR 4, which means that the harbor has the following characteristics.

- "Suitable for shellfish harvesting without depuration"
- "Excellent habitat for fish, other aquatic life and wildlife, and for primary and

- secondary contact recreation"
- "Excellent aesthetic value".

An additional set of nitrogen loading standards has been developed by the Town and has been adopted as Article XXI of the Zoning Bylaws. It is commonly called the Nitrogen Zoning Bylaw. It limits the nitrogen concentration of West Falmouth Harbor extending to Chappaquoit Road, and Snug Harbor extending to Nashawena Road to a nitrogen limit of 0.32 ppm. These areas are considered High Quality Areas. Harbor Head and Oyster Pond are not specifically classified in this bylaw but are believed to be Stabilization Areas, which have a nitrogen limit of 0.52 ppm.

6. **Maravista and Falmouth Heights.** A large portion of the Maravista Planning Area is in the recharge area to Little Pond. This means that nitrogen loading from these properties (from septic systems and other land use activities) drains into Little Pond, which has water quality problems as documented by the Falmouth Pond Watchers (Howes and Goehringer, 1998). Little Pond also receives nitrogen loading from land areas that extend nearly to Long Pond, and include portions of North Davis Straits and Falmouth Heights Planning Areas.

The Alternatives Screening Analysis Report presented a preliminary nitrogen assessment for Little Pond and its watershed. Findings of that assessment indicated that the embayment exceeds the current and projected future nitrogen loading into the watershed; and properties in the Maravista Planning Area needed to be served by nitrogen removal wastewater systems. These findings were reviewed in Chapter 3. A more detailed nitrogen assessment is needed as a future evaluation and is beyond the scope of this Study.

D. **Air Quality**. Falmouth has a limited number of industries located inside its boundaries, and no major sources of air pollution. Automobile traffic in Falmouth is probably the largest major non-point source of air pollution. Carbon monoxide pollution is a result of the incomplete combustion fossil fuels used in automobiles. No major studies on air quality in Falmouth have been identified.

Increased growth in Falmouth may lead to an increase in car traffic and the potential for a decrease in air quality.

The Falmouth WWTF and pump stations generate limited odors, most of which are generated at the septage receiving facilities. They pose minimal impact on the Town environment and as a result of the large buffer area around the facility. The Town is also in the process of constructing additional odor control facilities at the WWTF and are scheduled for completion by the year 2001. The Jones Palmer Pumping Station was recently evaluated for odor problems, and revised operations and chemical addition have been implemented to control these odors.

E. **Noise.** Motor vehicles, the Steamship Authority, the Otis Air National Guard Station and the US Coast Guard Station are some of the Town's major sources of noise. The operation of the Falmouth sanitary landfill and solid waste transfer station also use heavy equipment and thus generate a limited amount of noise. The Main Street and Woods Hole areas also experience increased noise in association with high traffic volume and a high visitor population in these densely developed areas during the summer season.

Aircraft taking off and landing from Otis Air National Guard generate additional noise, but this is limited to FAA regulated levels and the Otis Air National Guard Station is well buffered from the Town. The Steamship Authority also generates noise from docking ships, and vehicle traffic generated by Island travelers.

F. Plant and Animal Species and Habitat.

1. **General.** In 1993, the Falmouth Wetlands Action Committee performed a wetland survey to account for unidentified wetland areas and this information was then incorporated into the Falmouth Comprehensive Plan (Open Space, 1996). Also as part of the Town's wetland regulations, a 100-foot buffer was defined; surrounding each identified wetland area.

The Open Space and Recreation plan has identified 50 freshwater ponds, 20 of which are classified as "Great Ponds" (those exceeding 10 acres in size) by the Commonwealth of Massachusetts. There are also 15 known white cedar swamps, 23 Certified Vernal Pools, and 39 additional vernal pools identified by the Falmouth Wetlands Action Committee (Open Space, 1993).

Falmouth also has numerous saltwater wetlands; one of the largest is Great Sippewisset Marsh. Great Sippewisset Marsh is approximately 100 to 150 acres and is located just south of West Falmouth Harbor along Buzzards Bay.

The Massachusetts Natural Heritage & Endangered Species Program has also identified several wildlife species which are endangered or of special concern in the Town of Falmouth. These species include the Grasshopper Sparrow (Ammodramus Savannarum), Comet Darner (Anax longipes), Spiny Oakworm, Gerhard's Underwing Moth (Catocala Herodias Gerhardi), Piping Plover (Charadius Melodus), Spotted Turtle (Clemmys Guttata), Wright's Panic-Grass (Dichanthelium Wrightianum), New England Bluet (Enallagma Laterale), Barrens Bluet (Enallagma Recurvatum), Bushy Rockrose (Helianthemum Dumosum), Saltpond Pennywort (Hydrocotyle Verticillata), Redroot (Lachnanthes Caroliana), Saltpond Grass (Leptochloa Fascicularis Var Maritima), Tidewater Mucket (Leptodea Ochracea), New England Blazing Star (Liatris Scariosa Var Novae-Angliae), Sandplain Flax (Linum Intercursum), Water-willow Stem Borer (Papaipema Sulphurata), Pondshore Knotweed (Polygonum Puritanorum), Short-Beaked Bald-Sedge (Rhynchospora Nitens), Long-Beaked Bald-Sedge (Rhynchospora Scirpoides), Plymouth Gentian (Sabatia Kennedyana), Terete Arrowhead (Sagittaria Teres), Bristly Foxtail (Setaria Geniculata), Least Tern (Sterna Antillarum), Eastern Box Turtle (Terrapene Carolina), and Fibrous Bladderwort (Utricularia Fibrosa).

2. **West Falmouth Harbor.** This Planning Area contains large areas of wetlands west of Route 28A, along the coastline of West Falmouth Harbor. A small section of this Planning Area, south and west of the Little Neck Barn Road, is part of the Great Sippewisset Marsh District of Critical Planning Concern (DCPC). There are also two vernal pools located west of Route 28 near

the harbor. One priority habitat was also identified, just south of the harbor and west of Harbor Head. Figure 7-2 provides the estimated locations of these habitats.

3. **Falmouth High School.** The site contains no wetlands, and is not located in an Area of Critical Environmental Concern (ACEC) or part of a District of Critical Planning Concern (DCPC). No vernal pools or priority habitats were identified in this Planning Area.

4. **Woods Hole.** Natural resources identified in the Planning Area include wetlands, fresh and salt-water ponds, and flood zones. There is one large wetland located between Gardiner Road and Milfield Street, which is also the location of the Gardiner Road Pumping Station, and one small wetland restriction area is located on Juniper Point. The FEMA Flood Insurance Rate Maps show the southern portions of Juniper Point in a velocity zone, and the northern and western portions of the point within the 100-year flood zone (or A-Zone). The Woods Hole Planning area does not include any ACECs or DCPCs. No vernal pools or priority habitats were identified in this Planning Area.

5. **Main Street.** Natural resources identified in the Planning Area include: wetlands, coastal embayment recharge areas, coastal embayments, fresh and salt-water ponds, and flood zones. There are no ACECs or DCPCs identified in the Main Street Planning Area. According to GIS mapping, several of the sewered parcels are located inside the wetland restriction areas north of Siders Pond, and south of Shivericks and Nye Ponds. There is also a portion of this Planning Area, west of Shore Street, that is located in the Inner Harbor coastal embayment recharge area. No vernal pools or priority habitats were identified in this Planning Area as shown in Figure 7-3.

6. **Davis Straits / Inner Harbor**. Wetlands in this Planning Area are located north of Inner Harbor around Morse Pond and the Falmouth Mall property and east of Morton Avenue (see Figure 7-3). Also, a large portion of this Planning Area, between Clinton Avenue and Spring Bars Road, is located in the Inner Harbor coastal embayment recharge area. No vernal pools or priority habitats were identified in this Planning Area.

7. **Falmouth Beach.** The southern most portions of the area are in a velocity zone and the remainder of the Planning Area is located inside the 100-year flood zone. There is a large wetland in the center of the Planning Area and there are wetland restriction areas that parallel the Salt Pond shoreline and a small stream, which extends south from Siders Pond (see Figure 7-3). No vernal pools or priority habitats were identified in this Planning Area.

8. **Falmouth Heights.** Limited areas of wetland restrictions exist along the western shore of Little Pond. Coastal embayment recharge areas exist along the eastern and western most portions of this Planning Area for Little Pond and Inner Harbor respectively (see Figure 7-3). No vernal pools or priority habitats were identified in this Planning Area.

9. **Maravista.** The Maravista Planning Area is situated between Little Pond and Great Pond and includes properties located between Nickerson Street and the Vineyard Sound. Limited areas of wetland restrictions exist along the shores of Little and Great Ponds. The Planning Area is divided by the coastal embayment recharge areas for these ponds. Approximately two-thirds of the area is within the Little Pond recharge area and one-third in the Great Pond recharge area (see Figure 7-3). No vernal pools or priority habitats were identified in this Planning Area.

G. **Traffic.** Falmouth experiences a large tourist population in the summer which creates high traffic volume through the center of Town and along Woods Hole Road. This increased traffic is compounded by the Town's narrow streets in these two areas and the dense commercial development located along Route 28. As a result, the Town's traffic can be very congested. Route 28, which extends through the center of Falmouth, is very busy with large numbers of shops, restaurants, hotels, and municipal buildings. Woods Hole has similar problems with even narrower roads, and a large tourist population which can be partially attributed to the Steam Ship Authority's ferry service to the Islands, and the scenic, historic and educational resources of Woods Hole.

The scenic beauty along the Vineyard Sound and Buzzards Bay has also contributed to the traffic volume in Falmouth. As a result, heaviest traffic is often seen during the summer, but this traffic does drop off outside the summer months of June, July, and August. In the future, as the Cape becomes a more year-round destination, traffic volume and associated concerns will continue to grow.

H. **Scenic Qualities, Open Space, and Recreational Resources.** The Town of Falmouth Conservation Commission oversees approximately 1,500 acres or 5% of the Town's total area. These areas include but are not limited to: Beebe Woods, the Coonamessett Reservation, and Spectacle Pond Reservation. The Commonwealth of Massachusetts also has approximately 2,100 acres in perpetuity, including the Frances A. Crane Wildlife Management Area, Washburn Island State Park, the State Forest, and the Waquoit Bay National Estuarine Research Reserve (Open Space, 1996). The majority of these areas are located outside of the Planning Areas for this project.

There are also several privately protected areas in Falmouth. Groups including the Conservation Trust, Audubon Society, Salt Pond Area Bird Sanctuaries Inc., and the 300 Committee own and protect approximately 400 acres of Falmouth's lands (Open Space, 1996). These conservation lands, both public and private, are used as open space and recreation areas, and account for approximately 4,300 acres or 14% of the Town (Open Space, 1996).

The Falmouth Local Comprehensive Plan also identifies approximately 50 scenic roads, 59 scenic vistas and 42 culturally significant landscapes within Falmouth.

I. **Historic Structures or Districts.** Several areas in Falmouth have been identified as historic resources. Currently there are five sites and one district identified on the National Register of Historic Places and they include: Nobska Lighthouse - Woods Hole, Woods Hole School – Woods Hole, Bourne Farm – West Falmouth, Cleveland Light – Buzzards Bay, The Josiah Tobey House – East Falmouth, and the Falmouth Village Green District – West end of Main Street. There are also several other locations in Town that have been nominated for the National Register (Falmouth LCP).

The Town has also identified seven Historic Districts in North Falmouth, West Falmouth, Woods Hole, Falmouth Village, Davisville, Waquoit, and Quissett. There are also an additional 550 other sites and structures which range in date from 1686 to 1926, half of which are located within these historic districts (Falmouth, LCP).

Two studies in 1980 and 1996 identified archaeological sites in Falmouth, 36 prehistoric sites, and nine historic sites were recorded by the Massachusetts Historical Commission (MHC). There has also been six archaeological surveys conducted since 1981.

1. **West Falmouth Harbor.** Sections of Route 28A in this Planning Area have been identified as a historic district by the Town

2. **Falmouth High School.** This site has not been identified as a historic site.

3. **Woods Hole.** The southeastern portions of this Planning Area are in the Woods Hole Historic District. This District extends from Church Street to the Nobska Lighthouse, along Water Street to Eel Pond Bridge, and also includes Woods Hole Road, School Street, and Luscombe Avenue. Also included in the Planning Area is Woods Hole School, which is listed in the National Register of Historic Places.

4. **Main Street.** The western end of this Planning Area, up to Shore Street, is part of the Falmouth Village Green District. This is a Nationally Registered Historic District, which includes 79 buildings, and the Old Burying Grounds.

5. **Falmouth Beach.** The historic district, which runs along Shore Street, intersects this Planning Area along the eastern end of this area.

6. **Falmouth Heights.** There are no historic districts in this Planning Area, although the western half of Falmouth Heights has been proposed as a Town Historic District.

7. **Maravista.** No historic districts or historic sites have been identified in this Planning Area.

J. Built Environment and Demographics

1. **General.** As part of the Local Comprehensive Plan, the Town of Falmouth developed town-wide land use statistics. Falmouth is 29,447 acres in size, with 32-percent (or 9,364 acres) of that land used for residential properties, 90 percent of which are single family residences. Commercial properties account for less than 2-percent of the Town, and industrial properties make up less than 1.5 percent of the properties in Town.

The Town owns over 3,300 acres, the Commonwealth owns 2,200 acres and the Federal government owns 47 acres. These publicly owned properties account for approximately 19 percent of the Town.

About 2,000 acres of Town are used for agricultural purposes including cranberry bogs, orchards, pasture lands, croplands, and open areas not yet cultivated.

- **Land Use.** The land use for each Planning Area has been identified in detail in the 1999 Needs Assessment Report, using 1998 tax assessor data for the Town, and is grouped into the following categories: single family residential; multi-family residential; office and retail trade; motel and restaurant; commercial and industrial; auto related business; storage, warehouse and distribution; public utility; vacant land; agricultural land; recreational and open space; and institutional.

  Five general land use groups were developed to further summarize these land uses. These groups include residential, commercial and industrial, institutional, agricultural and undevelopable properties as defined in the Needs Assessment Report.

- **Town Zoning.** The Town of Falmouth is divided into eight major zoning districts: Single Residence, General Residence, Public Use, Agricultural, Marine, Business, Light Industrial, and Buffer Space. The Single and General Residence, Agricultural, Business, and Light Industrial are subdivided to account for more specific classifications.

- **Population.** US Census data for the Town was last collected in 1990. Based on this information the Town of Falmouth was estimated to have a year round population of approximately 28,000 people. The Census data also estimated that there were approximately 2.4 people per household year round. The Town of Falmouth Planning Department estimates the peak summer population to be approximately 2 times the annualized year round population. For Falmouth, using the previously projected 1998 year-round population of 33,000, an estimate of the 1998 summer populations would be 69,000.

The following sections provide a brief description of land use in the Planning Areas.

2. **West Falmouth Harbor.** None of the properties in the West Falmouth Harbor Watershed are connected to the public sewer, and they all rely on individual septic systems for wastewater treatment and disposal. Eighty percent of this Planning Area is residential, 8 percent undevelopable, 7 percent institutional, and 4 percent commercial/industrial.

3. **Falmouth High School.** The Falmouth High School was originally constructed in 1974, and since then no additions have been constructed. The student population is approximately 1,250 students with a school staff of approximately 100 people. Based on discussions with the school business office, no expansion of the school is projected in the next five years. The school population is reported as stable and has actually declined from 1,500 students due to the opening of the Mashpee High School and the relocation of Mashpee students to that facility.

4. **Woods Hole.** There are 233 parcels in the Woods Hole Planning Area, 141 (60 percent) are residential, 21 (9 percent) are commercial, 52 (22 percent) are institutional, and 18 (8 percent) are undevelopable.

The original Woods Hole collection system was constructed in 1949, servicing the area of Woods Hole surrounding Eel Pond. This collection system was extended and modified in 1986 as a result of the 1981 Wastewater Facilities Plan for the Town. Currently 70 percent (160 of 233 parcels) in the Woods Hole Planning Area is sewered and the largest concern for this system is I/I. Some rehabilitation was performed during the 1986 modifications.

5. **Main Street.** The majority of the Main Street Planning Area is classified as Commercial (87 parcels), making up 64 percent of the total number of parcels in this Planning Area. The remaining area is delineated as follows: 18 percent residential, 14 percent institutional and 3 percent industrial. The majority of properties in this Planning Area are sewered.

6. **Davis Straits/Inner Harbor.** Currently about half of this Planning Area is sewered. Residential and commercial properties each make up 45 percent of the area.

7. **Falmouth Beach.** Falmouth Beach Planning Area is nearly 90 percent residential properties. The Falmouth Beach Planning area consists mainly of seasonal and year-round residences, and is located outside any major commercial areas, as indicated by the percentage of residential properties. Nearly 100 percent of this Planning Area is sewered.

8. **Falmouth Heights**. Similar to the Falmouth Beach Planning Area, Falmouth Heights is highly residential (80 percent), but there is a larger number of multi-family residential properties in this Planning Area, unlike the single-family homes of Falmouth Beach. Falmouth Heights also has a larger number of commercial properties, mostly motels and restaurants located along the shoreline that are active in the summer but closed in the winter. Falmouth Heights has very seasonal use as a summer vacation area. Currently there are no sewers in this Planning Area.

9. **Maravista**. Maravista is almost entirely residential, with one lone commercial property located at the inlet to Great Pond. Maravista is similar to Falmouth Beach, with the majority of residential land use consisting of single family residences. Residential properties in this area are a mix of densely developed seasonal and year-round properties. The seasonal properties are located in the southern sections of Maravista, and more year-round properties in the northern sections, closer to the commercial center of Falmouth. Maravista is also not currently sewered.

K. **Rare or Unique Features of the Site and Environs.** The Town of Falmouth has one ACEC, designated in 1983, which is centered around the Waquoit Bay Area and includes: Waquoit Bay, Childs River, Moonakis River, Bourne Pond, and Quashnet River. This ACEC also extends into the Town of Mashpee. Regulations regarding stormwater discharges, flood control, and shell fishing have been instituted to help protect this area. A Town by-law regarding this ACEC also established a 50-foot buffer to protect against clear cutting and construction in this area (Falmouth LCP, 1997). This ACEC is not part of any of the Planning Areas defined for this project.

The Town of Falmouth has established a DCPC to protect the Black Beach/Great Sippewissett Marsh area of Falmouth. The DCPC is located south of West Falmouth Harbor and west of Route 28A. The DCPC was developed to help protect this area from flooding, minimize erosion, protect wildlife and vegetative habitats and the sensitive coastal ecosystem. No zoning regulations regarding the DCPC were implemented (Falmouth LCP, 1997).

7.3 REGULATION STANDARDS AND PERMIT REQUIREMENTS

A. **General.** A detailed outline of the Regulatory Issues associated with the Falmouth Wastewater Facilities Planning Study was discussed in Chapter 3 of the Final Needs Assessment Report developed for this project in 1999. This Chapter summarizes the major regulatory and permitting issues associated with this phase of the Facilities Planning Study.

Federal regulations are contained in the Code of Federal Regulations (CFR) and are enforced by the United States Environmental Protection Agency (USEPA). Massachusetts regulations are contained in the Code of Massachusetts Regulations (CMR) and Massachusetts General Law (M.G.L.) and are enforced by the Massachusetts Department of Environmental Protection (DEP). There are also regional and local regulations which may be enforced by the Cape Cod Commission, the Falmouth Zoning Board, Falmouth Board of Health, or other Falmouth Town Departments.

B. **Federal.** The National Environmental Policy Act of 1970 (NEPA) provides the basis for the protection of the environment. The NEPA process is designed to aid public officials in the decision making process regarding the use of federal property and provide an understanding of the environmental consequences of that use. The NEPA process would require the filing of an Environmental Impact Statement (EIS) with regards to any proposed site usage on or adjacent to federal property which could potentially impact that property.

C. **State.** Similar to the NEPA process of the federal government, the Commonwealth of Massachusetts developed the Massachusetts Environmental Policy Act Unit (MEPA) process, identified in 301 CMR 11.00. This process establishes thresholds, procedures, and timetables for a two-level review process. Falmouth is anticipating requesting State funding, through the Massachusetts DEP State Revolving Fund (SRF) Loan Program, for any construction pursuant to the recommendations of the Wastewater Facilities Planning Study. As a result, an Environmental Notification Form (ENF) was filed with the Secretary of Environmental Affairs (Secretary) regarding this Project. Following the 30-day review period for the Wastewater Facilities Plan's ENF, it was determined by the Secretary that an Environmental Impact Report (EIR) would be required for this project. The ENF was filed on January 15, 1999 and the certificate dated February 22, 1999 stated that an EIR is required. In this case, the EIR is being developed in conjunction with the Draft Wastewater Facilities Plan for Falmouth and will be reviewed by state, local and regional agencies, and the public for comment.

The environmental review process for this Study is discussed in Chapter 1.

There are several more specific State regulations which apply to the Falmouth's Wastewater Facilities Planning Study. These include: the 310 CMR 15.00 (Title 5) regulations regarding individual on-site treatment and disposal systems; the Wetlands Protection Act (M.G.L. ch. 131, s. 40); the Massachusetts Ocean Sanctuaries Act (M.G.L. c132A); the Massachusetts Groundwater Discharge Permit Program (314 CMR 5.00); the Massachusetts Groundwater Quality Standards (314 CMR 6.00); the Massachusetts Surface Water Discharge Permit Program (314 CMR 3.00); the Massachusetts Surface Water Quality Standards (314 CMR 4.00); DEP's Interim Guidelines on Reclaimed Water; and the Massachusetts Natural Heritage & Endangered Species Program.

As a result of the Massachusetts Ocean Sanctuaries Act, the Outstanding Resource Water designation of Buzzards Bay, and the designation of all Falmouth's fresh and saltwater ponds, treated effluent from the existing WWTF or proposed package treatment plant would be limited to subsurface discharge or spray irrigation methods. This would require the Town of Falmouth to renew the Groundwater Discharge Permit with the State to account for any increases in flow.

D. **Regional.** Falmouth also consists of several sensitive habitats for rare and endangered wildlife and vegetation and thus must comply with the regulations set forth by the Wetlands Protection Act and the Massachusetts Natural Heritage & Endangered Species Program. The Cape Cod Commission (CCC) has set minimum performance standards with respect to these sensitive habitats along with other natural resources including: water resources, coastal resources, open space, air quality. The CCC also established "Goals, Policies, and Implementation" regarding economic development, transportation, solid and hazardous waste management, capital facilities and infrastructure, energy, affordable housing, and heritage preservation/community character. Notice of intents and other permits may be required for any work within the 100-foot buffers to wetlands.

E. **Local.** Falmouth has also developed its own Local Comprehensive Plan to address issues of Land Use/Growth Management; Water Resources/Coastal Resources; Wetlands, Wildlife and Plant Habitat; Historic Preservation and Community Character; and Economic Development. The Town has also developed what is often referred to as the Nitrogen Loading Bylaw for Coastal Embayments.

7.4 ANALYSIS OF EFFECTS

A. **General.** An analysis of effects is performed to assess the environmental impacts of the several proposed alternatives developed and presented in the 1999 Alternatives Screening Analysis Report for Falmouth. The analysis of effect is used to evaluate the various environmental impacts of the alternatives and select, by a ranking system, the alternative which is the most beneficial to the Town. This information, in combination with a cost benefit analysis and the previously discussed screening information will then be used to select the best alternative for Falmouth and will recommend it as part of the Draft Facilities Plan for the Town.

The five alternatives examined include: the "No Action" alternative, Alternative Plan No. 1, Alternative Plan No. 2, Alternative Plan No. 3 and Alternative Plan No. 4 as described in Chapters 2 and 6. Several criteria, based on the 301 CMR 11.07 requirements for developing an EIR, are used in developing the comparison. Analysis of the "No Action" alternative identifies what impacts would be seen if no other alternative plan is implemented.

A rating system was developed to aid in analyzing the various alternatives and their impacts on the existing conditions in the Planning Areas. The rating system examines the impact on each parameter discussed previously in this Chapter and assigns it a numerical value of -2, -1, 0, 1, or 2. Negative values represent the magnitudes of the negative impacts of the parameter on the environment, and the positive represent positive impacts. A rating of zero indicates that there is either no impact or it is negligible. Each of the parameters is described briefly in the following section of this chapter.

The ratings are summed for each alternative to develop a total value and the final ranking of the alternative.

B. Description of Environmental Features for All Alternatives

1. **Soil Disturbance.** Construction of an on-site system or a treatment plant requires soil excavation for building foundations, tanks and other structures. The actual amount of soil disturbance for a site is a function of the size of the facility, and the topography of the individual sites involved.

Construction and/or repair of an on-site system disturbs a much smaller area than construction of a centralized treatment facility based on the relative size of the treatment system, but repairs to a large number of these systems in a Planning Area can translate into a large overall soil disturbance.

Conversely, modifications to the existing WWTF and/or construction of a new package treatment plant requires large excavations in a localized area, but drastically reduces the number of sites impacted. Centralized treatment does require additional construction and expansion of the existing collection system, but the soil beneath the roadway is already considered disturbed and thus is not considered a major impact.

2. **Surface Water Quality and Hydrology.** The Town of Falmouth has numerous fresh and saltwater ponds, but no major rivers within its borders. With proper erosion control and site protection measures in place, surface water quality impacts due to construction will be negligible.

Wetlands, bogs, ponds and the ocean represent the major surface water bodies potentially impacted by effluent discharge from the existing or any proposed new facility. Since the Town is not directly discharging to any of these aforementioned surface waters, the impacts on the water quality is a function of infiltration from the groundwater.

The greatest concern, associated with increased wastewater flow to the existing WWTF, is the generation of a larger plume which could impact both the Long Pond Watershed and the West Falmouth Harbor Watershed.

Modifications to the existing WWTF will produce a higher quality effluent than achievable with on-site septic systems and will improve the water quality by reducing the nitrogen discharged to the watershed. This could reduce the number of shellfish bed closures, and provide an improved surface water quality in West Falmouth Harbor.

Effluent discharge at sites other than at the current WWTF may cause localized flooding in low areas adjacent to wetlands and some ponds. Well injection (shallow) and sand bed infiltration create the greatest potential impacts on surface waters due to localized mounding of the groundwater table, which result from large volumes of effluent wastewater being discharged to the subsurface at a centralized location. This impact can be reduced by constructing these facilities with sufficient setbacks from potentially impacted surface water bodies.

3. **Groundwater Quality and Hydrology.** Groundwater hydrology could be impacted by any of the proposed plans since all require groundwater discharges.

Groundwater hydrology is affected the greatest in areas where effluent discharge occurs at a centralized location. Well injection and sand bed infiltration create the greatest disruption in natural groundwater flow by mounding the groundwater table. Groundwater mounding at the WWTF generated by increased flow could alter the groundwater flow path of the existing landfill plume or the general groundwater flow path, potentially impacting the Long Pond Reservoir.

Subsurface leaching systems will affect groundwater flow, but as the flow is distributed over larger areas the overall impact on the groundwater's flow direction is reduced.

Currently the Town of Falmouth draws its drinking water from the Sagamore Lens and the Long Pond Reservoir. Falmouth's groundwater has already been impacted by the Massachusetts Military Reservation, and is beginning to show signs of impact from nitrogen discharges from on-site septic systems and the existing WWTF.

Although on-site systems (especially the ones designed for nitrogen removal) reduce the amount of nutrients and contaminants that enter the groundwater, these reductions can not compare to those produced by a centralized wastewater treatment and discharge facility designed for nitrogen removal. A centralized wastewater treatment facility provides a higher level of treatment, reducing nitrogen and providing improved BOD and TSS removal.

Any advanced treatment helps improve the groundwater quality, especially in areas of dense populations, because the groundwater is no longer being impacted by the nutrients from on-site septic systems, cesspools and failed on-site treatment systems.

4. **Air Quality.** During any construction, dust is often generated on site. Emissions generated by construction equipment also has negative impacts on air quality. To reduce these impacts, proper pollution control measures are necessary to limit these effects and provide a positive means to prevent airborne dust and reduce vehicle emissions.

Odors generated during operations at the WWTF and pumping stations can be limited by designing centralized treatment facilities with odor control units and tank covers. Currently there is a project under way to improve odor control at the existing WWTF. On-site systems typically only generate odors during pumpouts, repairs, or system failures.

5. **Noise.** The majority of noise impacts are generated during the construction phase of any project. The larger the extent of construction, the more noise associated with that work. In Falmouth, noise impacts from collection system construction will be greatest in the Planning Areas with narrow streets and where buildings are in close proximity to both the road and each other. Noise will also be a problem during any on-site system construction, but for a shorter duration.

Modification to the existing WWTF will generate minimal noise impacts on neighboring properties. The existing property is remotely located and has an adequate buffer from these properties. Modifications to the wastewater treatment facilities are also designed to minimize noise from pumps and blowers by designing the buildings accordingly.

6. **Wildlife Species and Habitat.** The impacts on ecosystems vary based on the size of the area being disturbed during construction. Construction at any site considered pristine, would pose the largest impacts to natural habitats in those areas.

Increased effluent quality, resulting from an improved wastewater treatment process, provides a more positive impact on the surrounding environment. With improved wastewater treatment, shellfish beds and wetland areas will receive less nutrients and contaminants, and as a result these areas will experience improved water quality through reductions in nutrient loadings. It has been identified by the Regional Policy Plan that some of these habitats may be extremely sensitive to slight nutrient and water level changes from nearby effluent discharge, thus, any of the proposed alternatives could impact these ponds and wetlands.

7. **Wetlands.** The majority of construction for any of the proposed alternatives is located outside of the 100-foot buffer zone to any existing wetlands. Construction of the collection system should avoid wetlands, as these systems are projected to be installed in the right-of-way of existing roads. Any construction within the 100-foot buffer to the wetlands shall be performed following the proper protocols to protect the wetlands. The construction of a package treatment plant at the Spring Bars Road site will also have to provide adequate protection to the wetlands in the center of that site. Construction will be performed outside the 100-foot buffer for this facility but precautions will still be necessary to protect the wetlands.

As previously discussed, improving effluent quality helps improve Town wide water quality which has positive effects on the health of the wetlands. Greater flow distribution through spray irrigation or individual on-site systems using subsurface discharge systems will reduce the potential for localized flooding.

8. **Coastal Zones.** Impacts to coastal zones could result from the repairing and replacing of existing on-site systems or collection system construction along the coastline, or in flood zones. These impacts can be reduced through proper implementation of erosion control and other mitigation measures.

Construction and operation of the any of the alternatives Nos. 1 through 4, will improve effluent quality and reduce future negative impacts on West Falmouth Harbor and Little Pond. This improved treatment will further protect shellfish beds and sea life from nutrients and contaminants, which are suspected to have caused the shellfish bed closures and increased eutrophication in these water bodies. This improved water quality ensures safer public recreation in these areas and eliminates the need for on-site wastewater treatment systems in some beach areas.

9. **Traffic.** Falmouth's infrastructure varies depending on location. Some areas like Woods Hole and Main Street, and West Falmouth Harbor consists of many narrow roads. Any construction on these narrow roads will create traffic problems. Repair, replacement or expansion of existing collection system in these areas will also create some traffic problems in these Planning Areas especially during the summer.

The collection and distribution systems necessary for Alternative Nos. 1 through 4 require construction within road right-of-ways, which is more disruptive than the construction of on-site septic systems. Alternative routes and designated trucking and equipment routes will help alleviate these problems. Construction during the off-season will also be necessary to minimize traffic delays.

The existing WWTF is located in a remote area of Town with easy access to Route 28, and construction and operation in this area will create minimal traffic impacts.

10. **Scenic Qualities, Open Space, and Recreation.** Limited impacts on scenic qualities, open space and recreational facilities may occur during construction, especially during the installation of collection systems. These impacts are to be kept to a minimum during the construction process. Operation of facilities with advanced nitrogen removal will help improve water quality in West Falmouth Harbor improving the Scenic Quality in that area and improving the water quality for recreational use in these areas. Construction of package wastewater treatment and discharge facilities may require the taking of lands necessary to site these facilities. Impacts to open space, scenic quality and recreation will be kept to a minimum through design, architecture and landscaping.

11. **Historic Resources.** Falmouth is a vastly historic town and any construction on or near properties in the Historic District of Town has the potential of negatively impacting historic sites or archaeological sites both known and unknown. Because collection systems are located under roadways they are presumed to have minimal impacts on the land within the road right-of-way (ROW). Because streets are narrow, there is always the chance of disturbing existing structures

adjacent to roadways during construction, and these impacts would have to be minimized. Any new structures located inside the Historic District could also be architecturally designed to remain consistent with the character of the Town.

As part of this Wastewater Facilities Planning Study, none of these sites is to be adversely impacted as a result of the implementation of any of the alternative plans. As part of the MEPA process, the MHC will be providing comments and recommendations on any proposed sites which may have historical or archaeological significance.

12. **Land Usage.** Land usage for the EIR alternative analysis examines a property's current usage, and potential future usage and what impacts construction and operation of a treatment facility or on-site system has on an individual site. Improved wastewater treatment can improve land use and provide increased flexibility in the types of use allowable for various sites. The Town may be required to acquire land or establish utility right-of-ways in order to expand the existing collection system, which would be considered negative impacts to the current owners of those properties.

Growth is always a concern when working in the towns on Cape Cod, but growth in Falmouth has continued over the years without centralized wastewater treatment facilities and if this trend continues, it could have a large negative impact on the Town and its resources.

13. **Water Usage.** Water usage is not expected to increase drastically during the construction of any new facilities. Construction will require some increased water use during plant testing and startup and for dust control at the site.

Falmouth already has high water demands in the summer months due to the tourist populations, but may see a slight increase in year-round water use following installation of additional collection systems. This can be curbed by implementing a water and sewer billing program that encourages water conservation.

14. **Public Health.** Construction will not impact public health in Falmouth. The improved wastewater treatment will have a positive impact on the Town's surrounding ecosystems, thus reducing public health risks through contact or exposure. This is accomplished by reducing the number of failed on-site systems or those, which produce a lower effluent quality, and higher effluent quality at the existing WWTF.

7.5 ALTERNATIVE RANKING AND SUMMARY OF EVALUATIONS

Each of the five alternative plans were rated and ranked based on the criteria established in Section 7.4 of this Chapter. Table 7-1 summarizes the ranking analysis for the five alternatives. The slight variation of the results for Alternative Nos. 1 through 4 was dependent on nine of the 16 categories examined. These categories included surface water quality, surface water hydrogeology, groundwater quality, groundwater hydrology, wildlife species and habitats, wetlands, coastal zones, land use, and scenic qualities open space and recreation. Three major components of the alternatives had the greatest impact on the determination of the alternative ratings. These three major components included future flows to the WWTF (1.2 or 1.4 mgd), the proposed nitrogen effluent limit (5 or 10 ppm), and the construction of a package treatment facility for Maravista.

Though treating greater flow at the WWTF increased hydrological impacts, it actually decreased groundwater and surface water quality impacts because it provided greater treatment and a lower total nitrogen loading. This loading comparison was illustrated in Chapter 5. These impacts (good and bad) are also reflected in the wetlands and coastal zone categories.

The change in the nitrogen limit from 10 ppm total nitrogen to 5 ppm provides a greater benefit to all areas. Wildlife species and habitats receive the greatest benefit of this improved treatment as some of these species and habitats are highly sensitive to slight changes in nutrient levels.

Scenic qualities, open space, recreation and Town land uses may experience larger impacts from the construction of a package treatment facility at Maravista. Construction of a package treatment facility with effluent disposal near Maravista would require land acquisitions and possible re-zoning

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Scenic qualities, open space, recreation and Town land uses may experience larger impacts from the construction of a package treatment facility at Maravista. Construction of a package treatment facility with effluent disposal near Maravista would require land acquisitions and possible re-zoning

TABLE 7-1

ENVIRONMENTAL ASSESSMENT SUMMARY TABLE
FALMOUTH ALTERNATIVE PLANS
Falmouth Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts

Impacted Feature	No Action	Alternative #1	Alternative #2	Alternative #3	Alternative #4
Soil Disturbance					
Acquisition	0	0	0	0	0
Construction	-1	-1	-1	-1	-1
Operation	0	0	0	0	0
Surface Water Quality					
Acquisition	0	0	0	0	0
Construction	0	0	0	0	0
Operation	-1	1	2	1	2
Surface Water Hydrology					
Acquisition	0	0	0	0	0
Construction	0	0	0	0	0
Operation	0	-1	-1	-2	-2
Groundwater Quality					
Acquisition	0	0	0	0	0
Construction	0	0	0	0	0
Operation	-2	1	1	1	2
Groundwater Hydrology					
Acquisition	0	0	0	0	0
Construction	0	0	0	0	0
Operation	0	-1	-1	-2	-2
Air Quality					
Acquisition	0	0	0	0	0
Construction	-1	-1	-1	-1	-1
Operation	-1	0	0	0	0
Noise					
Acquisition	0	0	0	0	0
Construction	-1	-1	-1	-1	-1
Operation	0	0	0	0	0
Wildlife Species and Habitats					
Acquisition	-1	-1	-1	-1	-1
Construction	-2	-1	-1	0	0
Operation	0	1	2	1	2
Wetlands					
Acquisition	0	0	0	0	0
Construction	0	0	0	0	0
Operation	-1	1	2	1	2
Coastal Zones					
Acquisition	-1	0	0	0	0
Construction	-1	0	0	0	0
Operation	-1	2	2	1	2
Traffic					
Acquisition	0	0	0	0	0
Construction	-1	-2	-2	-2	-2
Operation	0	1	1	1	1
Scenic Qualities, Open Space, and Recreation					
Acquisition	-2	-1	-1	0	0

of certain areas. The benefits of this would include "urban renewal" at the old cement manufacturing plant site, and the possible construction of a recreational facility at the Maravista site.

Overall, the advantages and disadvantages tended to balance and the results for these alternatives were all close to zero (minimal impact). The summations of the ratings were all within +/- 6 points (not including the "No Action" Alternative), therefore they all are projected to have minimal environmental impacts and factors from the other analyses including cost and other non-monetary considerations will carry a greater weight in selection of a recommended plan.

Based on this ranking system, Alternatives No. 2 and 4 had the highest ranking with the smallest environmental impact. These alternatives were followed by Alternative No.1 and Alternative No. 3. The "No Action Alternative" should not be considered a viable option based on its low ranking and current negative impacts to both West Falmouth Harbor and Little Pond.

The four alternatives had very close ratings following this evaluation. Factors of cost and other non-monetary issues developed in the Alternatives Screening Analysis Report and in previous chapters of this report must be used in combination with the Environmental Impact Analysis ranking.

TABLE 7-1

ENVIRONMENTAL ASSESSMENT SUMMARY TABLE
FALMOUTH ALTERNATIVE PLANS

Falmouth Wastewater Facilities Planning Study
Town of Falmouth, Massachusetts

Impacted Feature	No Action	Alternative #1	Alternative #2	Alternative #3	Alternative #4
Construction	-2	-1	-1	-1	-1
Operation	-1	2	2	1	1
Historic Resources					
Acquisition	-1	0	0	0	0
Construction	-1	0	0	0	0
Operation	-1	0	0	0	0
Land Use					
Acquisition	-1	-2	-1	-2	-1
Construction	-2	-1	-1	0	0
Operation	-2	2	2	2	2
Water Use					
Acquisition	0	0	0	0	0
Construction	0	-1	-1	-1	-1
Operation	-1	-2	-2	-2	-2
Public Health and Safety					
Acquisition	0	0	0	0	0
Construction	-1	-1	-1	-1	-1
Operation	-2	2	2	2	2
TOTAL	-32	-5	-1	-6	0
RANK	5	3	2	4	1