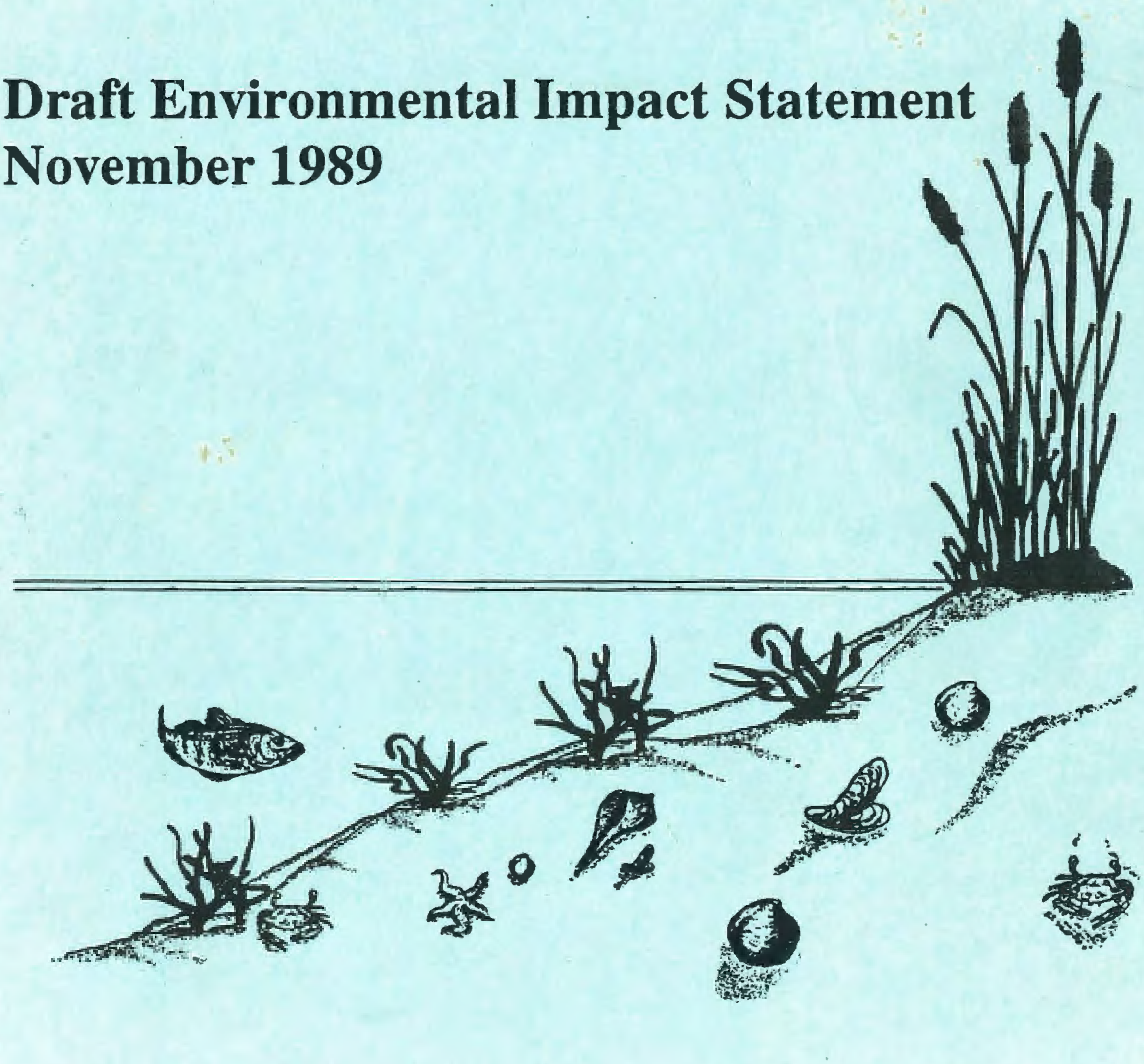
EPA

United States
Environmental Protection
Agency

Region 1
JFK Federal Building
Boston, MA 02203

# Wastewater Treatment Facilities for the City of New Bedford, MA

## Draft Environmental Impact Statement
November 1989



# Draft Environmental Impact Statement November 1989

## Wastewater Treatment Facilities for the City of New Bedford, MA

**Prepared By:**

**United States**
**Environmental Protection Agency**
**Region 1**
**JFK Federal Building**
**Boston, Mass. 02203**

**Technical Assistance by:**

**C. E. Environmental, Inc.**

Paul Keough    Nov. 30, 1989

**Paul G. Keough**    **Date**
**Acting Regional Administer**
**U.S. EPA Region I**

# DRAFT ENVIRONMENTAL IMPACT STATEMENT

| | |
|---|---|
| PROPOSED ACTION: | SITING AND EVALUATION OF NEW BEDFORD WASTEWATER TREATMENT PLANT |
| LOCATION: | New Bedford, MA |
| DATE: | December 15, 1989 |
| SUMMARY OF ACTION: | The Draft EIS considers the environmental acceptability of alternative locations and technologies for the new wastewater treatment facilities for New Bedford |
| LEAD AGENCY: | U.S. EPA, Region I<br>JFK Federal Building<br>WQE-1900C<br>Boston, MA 02203 |
| COOPERATING AGENCY: | U.S. Army Corps of Engineers<br>U.S. Fish & Wildlife Service |
| TECHNICAL CONSULTANT: | C.E. Environmental, Inc. |
| FOR FURTHER INFORMATION: | Ann Rodney<br>Water Management Division<br>U.S. EPA, Region I<br>JFK Federal Building<br>Boston, MA 02203<br>617-565-4424 |
| FINAL DATE BY WHICH COMMENTS MUST BE RECEIVED: | February 12, 1989 |

# NOTICE TO READERS

This Draft Environmental Impact Statement (EIS) identifies and evaluates alternatives for the locations and technologies for the new wastewater treatment facilities for New Bedford

This Draft EIS is organized to promote comparison among the alternatives by describing consecutively the screening method used to identify alternatives for detailed evaluation (Chapter 2, 3, and 4), the existing environment around each alternative site (Chapter 5), and the projected impacts for each alternative (Chapter 6). Chapter 7 presents the environmentally acceptable alternatives and the recommended plan. Chapter 8 describes the public participation program conducted in conjunction with this project. Chapter 9 provides a list of preparers. Because of the level of detail in the table of contents, there is no index for this document. A Glossary is located at the end of the document.

This report is a "piggyback" document in that it builds upon the Draft Facilities Plan/Environmental Impact Report (FP/EIR) developed by the City of New Bedford. While this Draft EIS is based on scientific and technological data generated during the FP/EIR process, it is an independent report in that it provides a separate evaluation of the potential project impacts. Due to the piggyback nature of this Draft EIS, much of the supporting information developed by the City is referenced throughout this document to avoid unnecessary duplication.

# DRAFT ENVIRONMENTAL IMPACT STATEMENT

FOR THE

CITY OF NEW BEDFORD
WASTEWATER TREATMENT PLANT, SOLIDS DISPOSAL, AND
EFFLUENT OUTFALL

November 1989

Prepared By
C-E Environmental, Inc.
Wakefield, MA

for

U.S. Environmental Protection Agency, Region I
Boston, MA

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# CHAPTER ONE

# INTRODUCTION

This Draft Environmental Impact Statement (EIS) considers the selection of suitable locations and appropriate technologies for the construction and operation of a secondary wastewater treatment facility for the City of New Bedford, Massachusetts. The Draft EIS presents the information needed to evaluate these alternatives for the facility. Based upon environmental, technical, institutional, and economic considerations for each alternative, the Draft EIS recommends locations for a wastewater treatment plant, solids disposal site, and an outfall site. In addition, the Draft EIS examines technologies for liquid wastewater treatment, solids handling and disposal processes, and construction of an outfall.

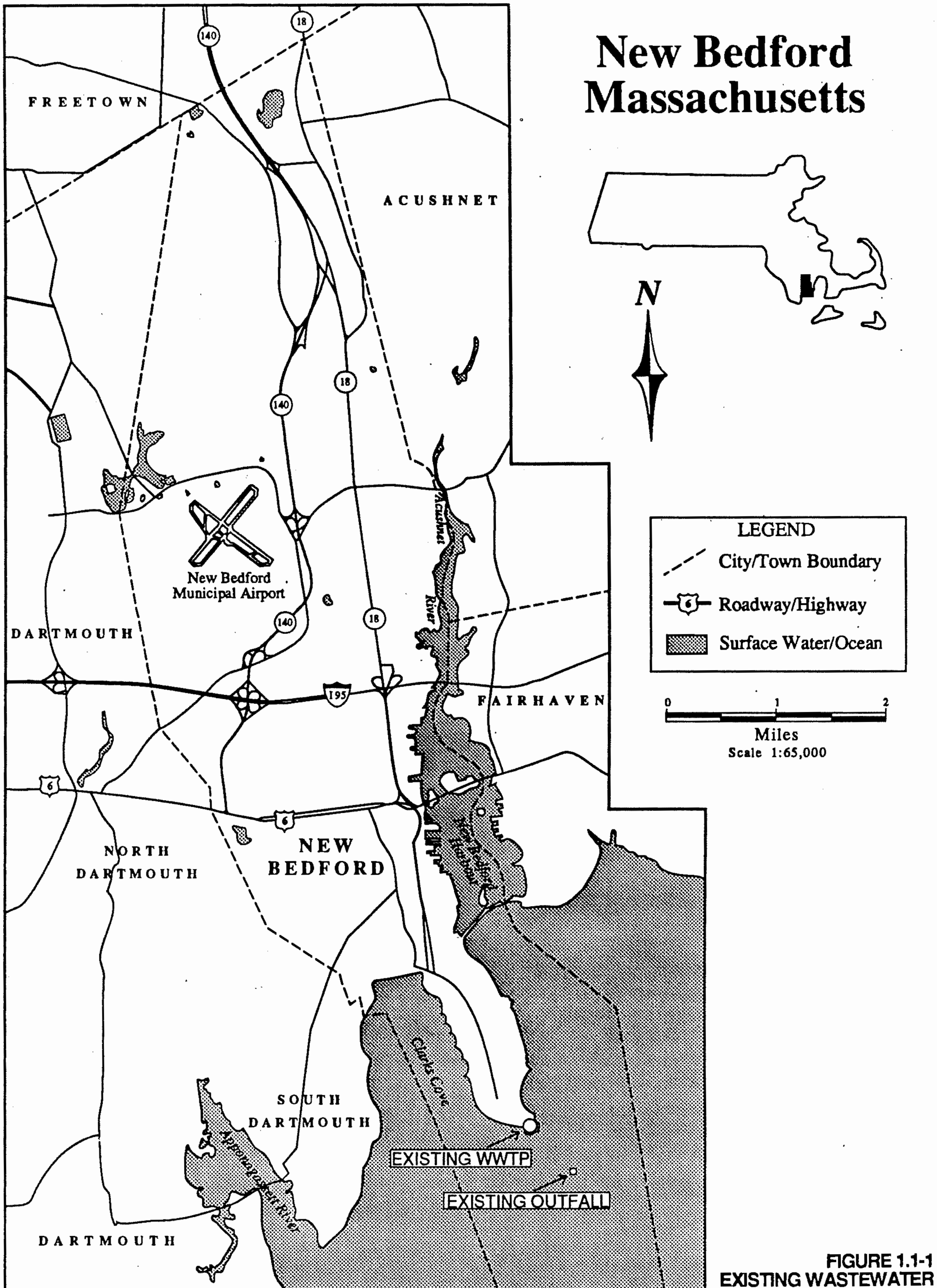
## 1.1 PROJECT HISTORY AND BACKGROUND

### 1.1.1 Project History

The New Bedford wastewater collection system was originally constructed in the 1800s. The existing primary wastewater treatment facility was built and began operation in the early 1970s. By 1977, after amendments to the Clean Water Act set forth requirements for secondary wastewater treatment, the City's existing primary treatment system was no longer in compliance with the federal treatment standards. However, Section 301(h) of the CWA allowed for a waiver of these secondary treatment standards, provided that less than secondary treatment would not result in adverse affects on the water quality, or the local environment. In 1979, the City applied for a "301(h) waiver", but in 1982 the request was denied by the EPA Administrator. Although the City revised its application in 1983 in an effort to correct the deficiencies, the waiver was again denied.

### 1.1.2 Existing Conditions

The existing wastewater collection facility in New Bedford consists of over 200 miles of sewers combining wastewater and stormwater (combined sewers) in the south and central parts of the city and in portions of the Towns of Dartmouth and Acushnet. The combined wastewater is conveyed by an eleven-mile main interceptor to the Fort Rodman primary treatment plant (Figure 1.1-1). As originally constructed, the plant was designed to treat an average daily flow of 30 million gallons per day (mgd). Currently, effluent from the plant is discharged through an outfall into Buzzards Bay (Figure 1.1-1) (CDM, Volume I, 1989).




Adapted from CDM, 1989

**FIGURE 1.1-1**
**EXISTING WASTEWATER TREATMENT PLANT AND OUTFALL LOCATION**

### 1.1.3 Enforcement

In 1987, the United States, the Commonwealth of Massacusetts, and the Conservation Law Foundation sued the City of New Bedford for violations of federal and state water pollution laws. That lawsuit was settled when the City of New Bedford signed a consent decree that contains, among other provisions, a federal court-enforceable schedule for the City to make interim improvements to its existing primary treatment facility and to construct a secondary treatment facility to bring the City into compliance with applicable state and federal wastewater treatment requirements. Some changes to the original consent decree schedule were negotiated in 1989. Under the most recent proposed schedule (see Table 1.4-1), the new secondary treatment facilities are to be built and in full operation by November of 1995.

### 1.1.4 Other Related Issues

**1.1.4.1 CSOs.** To determine the required capacity for the secondary wastewater treatment facilities, it is necessary to consider the need for combined sewer overflow (CSO) control. Combined sewer overflows occur when combined stormwater runoff and wastewater flow volumes exceed the capacity of the sewer system and the excess flow is discharged to the surrounding marine waters.

In New Bedford, combined sewers direct runoff from an area of about 3,440 acres. At present, one fourth of the excess runoff volume generated by wet-weather flow is routed to the treatment plant. The remaining runoff volume is discharged as CSO to the Acushnet River and Clarks Cove (CDM, Volume I, 1989). Because of the need to make substantial improvements to the treatment system in New Bedford, the City's consultant, Camp Dresser and McKee, Inc., is preparing a separate facilities plan for the Combined Sewer System. Although independent, this facilities plan is coordinated with the wastewater treatment facilities plan. Specifically, the location and capacity of the new secondary treatment plant must be considered along with the volumes, loads, and frequencies of overflows.

The CSO facilities planning is being completed in three phases. Phase I was completed in December 1983 and included investigations to evaluate the characteristics of existing facilities, a wet-weather CSO/storm drainage sampling program, and some computer modeling. The second phase of the CSO facilities planning process included an expansion and verification of the SWMM model (a model used to assess the magnitude of CSO pollutant loads relative to other pollutant sources). The final phase of the CSO Facilities Plan, currently in progress, will build upon previous and ongoing studies to recommend the level of CSO control necessary for New Bedford.

**1.1.4.2 PCBs.** From the 1940s to the late 1970s, electronics manufacturing firms in the New Bedford area have discharged wastewaters containing PCBs (polychlorinated biphenyls) to the Acushnet River and New Bedford Harbor, seriously contaminating the water and local biota. Between 1974 and 1982, several studies were conducted to assess the magnitude of PCB contamination in the Harbor. Elevated concentrations of PCBs were first reported in sediments from New Bedford in 1976 (EPA, 1976). Additional investigations revealed that PCBs had been discharged into the surface waters of the harbor causing elevated concentrations in the sediments, surface water, fish, and shellfish. Since New Bedford was added to the National Priority List (EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response), efforts have been underway to develop and implement remedial actions for protection of this environment under the Superfund Program. Hence, the preparation of this Draft EIS considers the PCB problem in New Bedford, including reviewing the status of PCB remediation efforts and coordination with the Superfund Program.

## 1.2 PROPOSED ACTION

The proposed action is the final construction and operation of secondary wastewater treatment facilities for the City of New Bedford and includes the following elements:

- construction and operation of a secondary wastewater treatment plant;
- construction and operation of solids treatment and disposal facilities; and
- construction of an outfall for effluent from the wastewater treatment plant.

Each of these elements involves both site selection and technologies assessment.

## 1.3 PURPOSE AND NEED

The existing New Bedford wastewater facility has a long history of inadequate performance which has resulted in pollution of the surrounding waters. The purpose of this Draft EIS, in compliance with the National Environmental Policy Act (NEPA), is to:

- provide essential information regarding the potential environmental impacts of a reasonable range of alternatives for wastewater treatment and solids and effluent disposal;
- compare the impacts among the alternatives;
- identify a preferred alternative; and
- provide the basis for any necessary mitigation measures.

This Draft EIS is prepared in a "piggy-back" style, in that it draws heavily on the technical and scientific studies conducted for the Draft Facilities Plan/Environmental Impact Report (FP/EIR) prepared by the City of New Bedford pursuant to the Massachusetts Environmental Policy Act (MEPA). However, this Draft EIS is an independent document from the Draft FP/EIR, and supplements the information in the Draft FP/EIR where necessary to ensure that NEPA requirements are met for the consideration of feasible alternatives and evaluation of potential impacts. Further, this Draft EIS is prepared pursuant to the Council on Environmental Quality (CEQ) procedures implementing NEPA (40 CFR 1502.14), which specifically require the consideration of a reasonable range of alternatives.

## 1.4 EIS PROCESS

### 1.4.1 Scoping

The scoping process for this project was conducted jointly by the Massachusetts Executive Office of Environmental Affairs (for the EIR pursuant to MEPA), the City of New Bedford, and EPA. An initial meeting was held on March 23, 1988 to provide the public with information about the project and solicit comments on the scope of studies to be performed for the state and federal environmental reviews. This meeting served as the scoping meeting for the Draft EIS pursuant to NEPA requirements. The issues raised at the meeting are listed in Chapter 8 of this Draft EIS.

On April 6, 1988 a Notice of Intent to prepare the EIS was published in the Federal Register, followed by a 30-day comment period during which EPA accepted written comments on the scope of alternatives and impacts that should be considered. The final scope of this Draft EIS (EPA, May 1988a) includes a complete review of a reasonable range of feasible alternatives being considered for wastewater treatment/disposal sites and technologies, solids treatment/disposal sites and technologies, and outfall locations and construction technologies. The Draft

EIS identifies and evaluates the beneficial and adverse impacts of the various project alternatives and recommends appropriate mitigation. Some of the subject areas that the Draft EIS addresses include issues related to construction, water resources, wetland/biological resources, air quality, community plans, and economic issues.

Other elements of the scoping process and continued project review are the Citizens Advisory Committee (CAC) and the Technical Advisory Group (TAG). Details on the activities of these groups and associated public participation activities are provided in Chapter 8.

### 1.4.2 Agency Coordination

The scoping process solicited both community and regulatory agency involvement to provide a forum for comment prior to the preparation of the Draft EIS. In addition to the general coordination associated with any Draft EIS, consideration of project-related decisions which may be made by governments or agencies other than EPA must be considered. For example, any decisions made regarding wastewater management may interact with decisions made by the Commonwealth of Massachusetts, the City of New Bedford, or federal agencies other than EPA. A list of coordinating agencies is presented in Chapter 8.

### 1.4.3 Schedule

EPA began the EIS process for this project with its Notice of Intent on April 6, 1988. Based on current planning, and under the Consent Decree described briefly above (Section 1.1.3), the schedule for the project is shown in Table 1.4-1.

After a 60-day public review and comment period on this Draft EIS, EPA will publish a Final EIS in April of 1990, responding to and incorporating comments received. After another review period for the Final EIS, EPA will issue its final Record of Decision documenting the final recommended plan and any required mitigation measures.

## 1.5 NO-ACTION ALTERNATIVE

In addition to analyzing a range of alternatives, the NEPA regulations (40 CFR 1502.14) require that the alternative of no action be considered. In the case of New Bedford, no action theoretically consists of continued unacceptable wastewater and solids treatment and discharge of effluent through the existing outfall. This practice is not in compliance with the federal Clean Water Act, and has led to the continued degradation of water quality in Buzzards Bay. Neither the legal consequences associated with violating the Clean Water Act or the adverse environmental consequences of such continuing violations are considered to be acceptable. Therefore, the no-action alternative was screened out and was not subject to detailed evaluation in this Draft EIS.

**TABLE 1.4-1 PROJECT SCHEDULE**

| | |
|---|---|
| New Bedford to submit Draft FP/EIR | August 16, 1989 |
| EPA to issue Draft EIS | November 1989 |
| New Bedford to submit Final FP/EIR | January 17, 1990 |
| New Bedford to commence preparation of plans and specifications for facilities design and construction | March 1, 1990 |
| EPA to issue Final EIS | April 1990 |
| EPA to issue Record of Decision (approximate) | July 1990 |
| New Bedford to complete construction | May 1, 1995 |
| New Bedford to achieve full operation of of new facilities | November 1, 1995 |

# CHAPTER TWO

# IDENTIFICATION OF WASTEWATER TREATMENT PLANT ALTERNATIVES

The evaluation and selection of wastewater treatment plant alternatives involved the following steps:

- determination of the wastewater treatment plant influent quantity and quality;
- development of the liquid wastewater treatment process configuration; and
- determination of the location for the proposed wastewater treatment plant.

Determining the influent quantity and quality required detailed analysis of the existing and future population serviced by the plant, sources of the wastewater, and existing and future levels of constituents in the wastewater. Section 2.1 contains the wastewater treatment plant (WWTP) influent quantity and quality evaluation.

Development of the liquid wastewater treatment process configuration is addressed in Section 2.2. This evaluation involved two screening analyses of the available wastewater treatment technologies. A detailed analysis of the technologies was then conducted based on technical, environmental, institutional and cost criteria. This evaluation resulted in a recommended treatment process configuration for the proposed WWTP.

The location of the proposed WWTP involved the identification of potential sites within the City of New Bedford. An initial candidate list of 47 sites was screened down in several steps, with each step making use of a set of criteria and specific categories of information. The process used to identify WWTP sites is described in Section 2.3.

## 2.1 INFLUENT CHARACTERIZATION (FLOWS AND LOADS)

The existing New Bedford Wastewater Treatment Plant receives wastewater and its associated pollutants from residential, commercial, and industrial business activities of the region. Water also enters the facility through infiltration (water which enters pipes through leaks and cracks in the sewer pipe) and inflow (water from illegal connections to the sewer system), and combined sewage flow that results from the mixing of sewage and urban stormwater runoff during periods of rain or snow melt. In melt. In addition, the plant receives septage from septic systems in the unsewered areas of New Bedford, Acushnet, Dartmouth, Fairhaven, and Mattapoisett.

This section characterizes these components of wastewater separately in terms of flows (volumes expressed in millions of gallons per day) and loads (quantities of pollutants expressed in pounds per day) to the WWTP. Estimates are presented for both existing and future conditions during the 20-year period of evaluation.

A 20-year planning period for the wastewater treatment facility was used for this evaluation, as required by EPA regulations, and will begin at the end of 1994. The facility, however, must be in operation by the end of 1995, in conformance with the revised Consent Decree (see Section 1.1.3 Enforcement).

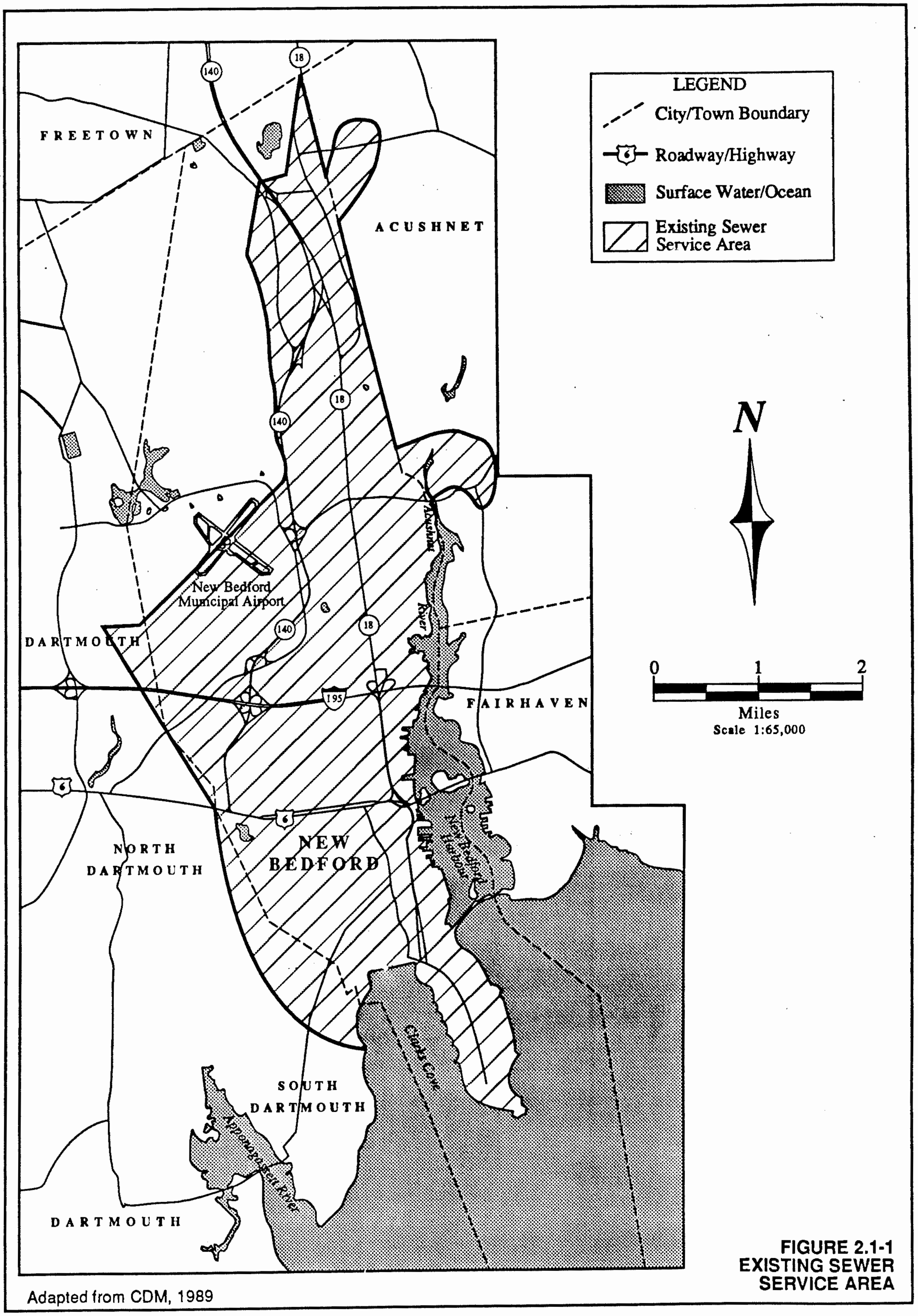
The volume of wastewater produced in the service area is related to three factors:

- population size and water volume used by residents which is returned to the sewer system;
- economic activity and wastewaters discharged as a result of manufacturing and employee usage; and
- rainfall in the service area (from infiltration and inflow, and direct stormwater runoff).

### 2.1.1 Service Area and Population Projections.

The WWTP provides treatment for the City of New Bedford's wastewaters as well as for small sections of the towns of Dartmouth and Acushnet. The service area encompasses approximately 11.5 square miles, with a contributing population of approximately 95,713 (see Figure 2.1-1). Table 2.1-1 presents 1985 census figures as well as projections of the total and sewered populations of the City of New Bedford and the towns of Dartmouth and Acushnet for the years 1994 and 2014. The sewered population estimates include sufficient allowance for the septage volumes from unsewered areas of New Bedford, Acushnet, and Freetown.

Population projections used for this evaluation were made by the Massachusetts Institute for Social and Economic Research (MISER) in 1986. MISER projections are the only area-wide population forecasts developed in recent years and are accepted for planning purposes statewide (CDM, Volume III, 1989). However, in 1988, MISER revised their projections based on slower population growth than previously anticipated. Using the 1988 figures, MISER projected a population of 96,566 for 1990 and 97,461 for 1995.




Adapted from CDM, 1989

**FIGURE 2.1-1**
**EXISTING SEWER SERVICE AREA**

**TABLE 2.1-1**
**POPULATIONS OF SERVICE AREA COMMUNITIES**

| Total Populations | 1985 | 1994 | 2014 |
|---|---|---|---|
| New Bedford | 96,553 | 102,598 | 111,355 |
| Dartmouth | 24,843 | 26,833 | 30,100 |
| Acushnet | 8,772 | 9,447 | 10,700 |
| TOTAL: | 130,168 | 138,878 | 152,155 |

| SEWER SERVICE AREA Populations* | 1985 | 1994 | 2014 |
|---|---|---|---|
| New Bedford | 93,233 | 99,519 | 110,355 |
| Dartmouth | 2,280 | 2,300 | 2,300 |
| Acushnet | 200 | 2,743 | 5,232 |
| TOTAL: | 95,713 | 104,562 | 117,887 |

*1994 and 2014 populations include projected extensions of the sewer system.

Adapted from: CDM, Volume III, 1989.

Comparing the 1988 MISER projections to the 1985 State Census (96,552) and the 1987 City of New Bedford Census (100,060) indicated additional uncertainty in predicting the future populations. To supplement the MISER number, an analysis was conducted of the yearly increase in the number of housing units and persons per unit over the last decade. This analysis resulted in an average housing unit increase per year (0.5 percent) and an average number of persons per housing unit (2.4). Using the City of New Bedford 1987 census and existing number of housing units as the base, population projections were estimated for the years 1994 and 2014, as shown in Table 2.1-1 (CDM, Volume III, 1989).

The 1986 MISER population projections for the towns of Dartmouth and Acushnet were also revised in 1988; however, the increases were found to be less than two percent and were considered insignificant (CDM, Volume III, 1989).

### 2.1.2 Flow Estimates

Flow estimates were prepared to determine the required treatment capacity of the proposed WWTP. These estimates were based on projected residential and non-residential flows (industrial, commercial, institutional, infiltration, inflow and tidal inflow).

**2.1.2.1 Residential Wastewater Flows.** The City of New Bedford's average residential water consumption, as estimated using metered water consumption data from 1983 to 1987, was 64 gallons per capita per day (gpcd). This rate is also approximately the same for the towns of Dartmouth and Acushnet. New Bedford is an urban area with limited open spaces, which results in less water being used for nonconsumptive purposes such as watering lawns. Therefore, it is assumed that approximately 90 percent of residential water usage will be returned to the sewer system as domestic wastewater (CDM, Volume III, 1989). Consequently, assuming a residential water consumption rate of 64 gpcd, approximately 58 gpcd (64 gpcd x 0.90) is discharged to the system as domestic wastewater. Domestic wastewater flow is therefore estimated at approximately 5.4 mgd for the years 1983 to 1987, using the population estimate of 93,233 from Table 2.1-1. New Bedford's future domestic wastewater flows from residential sources (estimated by applying past per capita wastewater contributions to the forecasted future sewered populations presented in Table 2.1-1) is approximately 5.8 mgd for the year 1994 and 6.4 mgd for the year 2014.

The domestic wastewater contribution from the towns of Acushnet and Dartmouth can be estimated using the 1982 facilities plan report for the sewer construction program completed by CDM. Current domestic flow contributed by the Town of Acushnet is

0.01 mgd. The second phase of the sewer construction program estimated the contribution of 0.14 mgd of domestic wastewater in 1994. In 2014, the sewer construction program should be finished, with an estimated domestic wastewater flow of 0.26 mgd contributed by the Town of Acushnet. Domestic flow from Dartmouth has been estimated at 0.13 mgd, based on average flows from 1983 to 1985. This flow is assumed to remain constant through the year 2014 because there are no plans to further expand New Bedford's sewer system in Dartmouth, regardless of the projected population increase.

In summary, the total domestic flow from residential sources entering the New Bedford WWTP from New Bedford, Acushnet, and Dartmouth are projected to be 6.0 mgd for 1994 and 6.8 mgd for 2014 (CDM, Volume III, 1989).

**2.1.2.2 Non-Residential Flows.** Sources of wastewater flow other than residential include industrial, commercial, and institutional discharges, infiltration and inflow (I/I), and tidal inflow.

Currently, an estimated flow of 5.7 mgd is generated from New Bedford's 930 acres of developed industrial land, representing a discharge rate of approximately 6,000 gpd per acre (gpad). Typical industrial water usage is 5,000 gpad, therefore, this discharge rate is indicative of moderate to heavy industrial water usage. New Bedford's future industrial growth is not expected to involve major water-consuming industries due to the limited reserve capacity of potable water and the limitations inherent within the City's water distribution and sewerage infrastructure. In addition, higher rates for sewer use associated with the upgraded WWTP would discourage industries that require large amounts of water from moving into the area or encourage them to implement water conservation or reuse programs. Therefore, future industrial flows from existing undeveloped land in New Bedford are expected to emanate from industries which typically generate 2,000 gpad, such as warehousing, trucking, garment, electronics, and plastics manufacturing. It is also expected that by the year 2014 all existing undeveloped land zoned for industrial use will be developed. Based on these assumptions, future industrial flows from the City of New Bedford are projected to be approximately 6.0 mgd for 1994 and 7.5 mgd for 2014 (CDM, Volume III, 1989).

The Town of Dartmouth currently has no industries connected to the New Bedford sewer system. However, due to the planned development of the existing New Bedford/Dartmouth Industrial Park and the opening of the Crapo Hill Regional Sanitary Landfill (leachate discharge), it is anticipated that industrial wastewater discharged to the system will increase to approximately 0.3 mgd in 1994 and 1.0 mgd in 2014.

The Town of Acushnet currently contributes an industrial flow of approximately 0.09 mgd, which is generated solely by the Acushnet Company. It is expected that this flow may increase to 0.10 mgd by 1994, and an additional industry with an estimated flow of 6,000 gpd will contribute to the expanding sewer system in 2014. Therefore, estimated industrial flows from Acushnet for 1994 and 2014 are 0.1 mgd and 0.11 mgd, respectively. In summary, industrial flows entering the New Bedford WWTP are projected to be approximately 6.4 mgd for 1994 and 8.6 mgd for 2014.

Wastewater flow from commercial sources in the City of New Bedford was estimated from metered water consumption. It was assumed that 96 percent of commercial users are sewered and that 90 percent of water usage is returned to the sewer, as with residential flows. Given these two assumptions, the amount of commercial wastewater currently generated in New Bedford is approximately 1.97 mgd. Accounting for expansion of the sewer system, projections of commercial wastewater flow for 1994 are 2.02 mgd and 2.06 mgd for 2014.

The Town of Dartmouth's current commercial wastewater contribution is estimated at 0.02 mgd, and is not expected increase before the year 2014. The Town of Acushnet has no commercial establishments connected into the New Bedford sewer system; however, approximately 20 existing commercial establishments will be connected at the completion of the town's proposed sewer extension by 1994. Because Acushnet's protective bylaws prohibit any new commercial development, the current commercial flow contribution of approximately 6,300 gpd is expected to remain constant through the year 2014. Therefore, commercial flows currently entering the New Bedford WWTP were estimated at 2.00 mgd, with projected increases to 2.04 mgd and 2.09 mgd for the years 1994 and 2014, respectively.

Institutional discharges to the New Bedford sewer system originate from government properties such as schools and small hospitals. Presently, all institutional discharges are generated within the City of New Bedford. Based on water use data from 1983 to 1987, the present institutional flow is estimated at 0.34 mgd. This flow is expected to increase to approximately 0.40 mgd by 1994 and remain at that level through 2014 (CDM, Volume III, 1989).

Infiltration and inflow (I/I) is the water that enters the sewer system through leaks and cracks in sewer pipes and house connections, and from drainage device connections from yard drains, roof leaders, catch basins, and sump pumps. In order to develop estimates of the I/I contribution to the New Bedford sewer system, wastewater flows were measured during periods of high and low groundwater, using both continuous and instantaneous flow measurement equipment. Measurements taken during low flow periods (between 12 am and 6 am) were used to estimate average annual infiltration. The annual average I/I was estimated at 15.20 mgd, of which 13.95 mgd is attributed to infiltration sources, and 1.28 mgd is attributed to inflow resulting from wet weather (e.g., high groundwater) (CDM, Volume III, 1989). The amount of infiltration/inflow is estimated to be reduced by 20 percent through sewer rehabilitation projects, resulting in 11.4 mgd for 1994 and 2014.

Tidal inflow from leaking tide gate structures currently accounts for about 1.30 mgd of seawater flow into the sewer system, and is limited to New Bedford. During high tide the tide gate structure is intended to prevent inflow of seawater, while permitting discharges of overflows resulting from rainfall. Recommended improvements should reduce tidal inflow by 50 percent (CDM, 1983a). Despite continuous inspection and maintenance efforts, tidal inflow cannot be completely eliminated. Assuming improvements will be implemented by 1994, tidal inflow to the sewer system would be approximately 0.65 mgd and remain constant through 2014 (CDM, Volume III, 1989).

Dry weather overflows from the sewer system currently occur because of insufficient sewer capacity and poor system maintenance. The most recent report indicates a total dry weather overflow volume of 2.84 mgd at the existing New Bedford WWTP. With the installation of recommended improvements, dry weather overflows should be eliminated by 1994 (CDM, 1983; CDM, Volume II, 1989).

Records from the existing WWTP indicate that flows can be influenced by direct and indirect sources of inflow within 24 hours of a rain event. Table 2.1-2 summarizes average dry weather (no rainfall in the last 24 hours) flow for the various components of each community, covering the years 1983 through 1987, 1994, and 2014. Total dry weather flows for the years 1994 and 2014 are estimated at 26.9 mgd and 30.0 mgd, respectively.

**2.1.2.3 Peaking Factors.** Peak wastewater flows must be estimated to properly size the wastewater treatment facility. Peaking factors are defined as the ratio of the peak flow (during periods of high usage) to the average flow. Peaking factors are usually developed for each wastewater component (e.g., industrial, commercial). Presently, there are no data from which peaking factors for residential, commercial, and institutional flows can be determined. The only historical information available on New Bedford peaking factors applies to total flow to the WWTP. Estimated peak-to-average dry weather flow ratios, combining domestic, commercial, and industrial flows in New Bedford, range from 2.6 to 2.7; this estimate is based on Merrimack curves generated using historical data from similar wastewater systems.

**TABLE 2.1-2**
**SUMMARY OF AVERAGE DRY WEATHER WASTEWATER FLOWS (mgd)**

| Flow Component | Current Estimate | 1994 | 2014 |
|---|---|---|---|
| RESIDENTIAL | | | |
| New Bedford | 5.4 | 5.8 | 6.4 |
| Dartmouth | 0.1 | 0.1 | 0.1 |
| Acushnet | 0.0 | 0.1 | 0.3 |
| Subtotal | 5.5 | 6.0 | 6.8 |
| INDUSTRIAL | | | |
| New Bedford | 5.7 | 6.0 | 7.5 |
| Dartmouth | 0.0 | 0.3 | 1.0 |
| Acushnet | 0.1 | 0.1 | 0.1 |
| Subtotal | 5.8 | 6.4 | 8.6 |
| COMMERCIAL | | | |
| New Bedford | 2.0 | 2.0 | 2.1 |
| INSTITUTIONAL | | | |
| New Bedford | 0.3 | 0.4 | 0.4 |
| INFILTRATION | | | |
| New Bedford | 13.6 | 11.0 | 11.0 |
| Dartmouth | 0.4 | 0.3 | 0.3 |
| Acushnet | 0.0 | 0.1 | 0.1 |
| Subtotal | 14.0 | 11.4 | 11.4 |
| TIDAL INFLOW | | | |
| New Bedford | 1.3 | 0.7 | 0.7 |
| DRY WEATHER OVERFLOW | | | |
| New Bedford | -2.8 | 0.0 | 0.0 |
| TOTAL DRY WEATHER FLOW TO WWTP | 26.1 | 26.9 | 30.0 |

Notes: "Dry Weather" indicates no rainfall within previous 24 hour period. Dry weather overflows will be eliminated prior to 1994. All current and projected flows are rounded to the nearest 0.1 mgd.

Adapted from: CDM, Volume III, 1989.

Industrial operations were reviewed with respect to the number of shifts per day, operating schedule, and rate of batch discharges. This established a comprehensive industrial peaking factor of approximately 3.0. A peaking factor of 1.7 for infiltration represents the ratio between the estimated infiltration rate during high groundwater conditions and the estimated annual average daily infiltration rate (CDM, Volume III, 1989). Tidal inflow and dry weather overflow are reasonably uniform flow components, resulting in a peaking factor of 1.0 for each. Table 2.1-3 summarizes estimated peak flows for current and design-year conditions.

**2.1.2.4 Design Flows.** The average and peak daily dry weather flows presented in Table 2.1-3 have been adopted as the design flows for the proposed WWTP. These flow rates will be used throughout the alternatives analyses in this Draft EIS. Additional flow from wet weather events will be addressed in the CSO facilities plan.

### 2.1.3 Conventional Pollutant Loadings

Wastewater treatment plants remove oxygen-demanding substances and suspended matter from the waste stream. These "conventional pollutants" are measured as five-day biochemical oxygen demand (BOD) and total suspended solids (TSS), respectively, and are typically expressed as a concentration in milligrams per liter (mg/l) or as a loading in pounds per day (lb/day). The BOD of wastewater can be described as the quantity of oxygen that the wastewater must consume to degrade its organic matter (the higher the organic concentration of the wastewater, the higher the BOD). The BOD of the wastewater is significant because its increase will decrease the amount of oxygen available to the indigenous animals and aquatic plants of the receiving water body. TSS is the total amount of organic and inorganic solids that are present in the wastewater. TSS increases the turbidity and sediment layer of a receiving water.

Loadings of BOD and TSS in wastewater entering the WWTP can be categorized according to their sources. Residential, commercial, institutional, and industrial flows, and septage components all contribute to the loads of conventional pollutants in the wastewater. Septage, in particular, represents a very concentrated organic loading source. Tables 2.1-4 and 2.1-5 contain the concentrations in wastewater (mg/l) and average loadings (lbs/day), respectively, of the conventional pollutants in the various flow components.

**2.1.3.1 Residential Loadings.** Residential loadings were estimated using an average per capita load factor and the community's sewered population. Future loadings have been estimated in a similar way (see Tables 2.1-4 and 2.1-5).

TABLE 2.1-3
SUMMARY OF AVERAGE AND PEAK DRY WEATHER WASTEWATER FLOWS (mgd)

| FLOW COMPONENTS | Average Flow | | | Peaking Factor | | | Peak Flow[1] | | |
|---|---|---|---|---|---|---|---|---|---|
| | Current | 1994 | 2014 | Current | 1994 | 2014 | Current | 1994 | 2014 |
| Residential Commercial & Institutional | 7.8 | 8.4 | 9.3 | 2.7 | 2.6 | 2.6 | 21.1 | 21.8 | 24.2 |
| Industrial | 5.8 | 6.4 | 8.6 | 3.0 | 3.0 | 3.0 | 17.4 | 19.2 | 25.8 |
| Infiltration | 14.0 | 11.4 | 11.4 | 1.7 | 1.7 | 1.7 | 23.8 | 19.4 | 19.4 |
| Tidal Inflow | 1.3 | 0.7 | 0.7 | 1.0 | 1.0 | 1.0 | 1.3 | 0.7 | 0.7 |
| Dry Weather Overflow | -2.8 | 0.0 | 0.0 | 1.0 | 1.0 | 1.0 | -2.8 | 0.0 | 0.0 |
| Total Dry Weather Flow to WWTP | 26.1 | 26.9 | 30.0 | | | | 60.8 | 61.1 | 70.1 |

[1]Peak Flow = Average Flow x Peaking Factor

Adapted from: CDM, Volume III, 1989.

**TABLE 2.1-4**
**SUMMARY OF CONVENTIONAL POLLUTANT AVERAGE CONCENTRATIONS**

| | BOD | | | TSS | | |
|---|---|---|---|---|---|---|
| Flow Component | Current Average | 1994 | 2014 | Current Average | 1994 | 2014 |
| Residential (lb/capita/day) | 0.17 | 0.18 | 0.19 | 0.18 | 0.19 | 0.22 |
| Commercial (mg/l) | 200 | 200 | 200 | 200 | 225 | 225 |
| Institutional (mg/l) | 200 | 200 | 200 | 200 | 225 | 225 |
| Industrial (mg/l) | 260 | 275 | 275 | 260 | 275 | 320 |
| Septage (mg/l) | 5,000 | 5,000 | 5,000 | 15,000 | 15,000 | 15,000 |

Adapted from: CDM, Volume III, 1989.

**TABLE 2.1-5**
**SUMMARY OF CONVENTIONAL POLLUTANT AVERAGE LOADINGS (lbs/day)**

| | BOD | | | TSS | | |
|---|---|---|---|---|---|---|
| Flow Component | Current Average | 1994 | 2014 | Current Average | 1994 | 2014 |
| Residential | 16,200 | 18,800 | 22,400 | 17,200 | 19,850 | 25,900 |
| Commercial | 3,300 | 3,400 | 3,400 | 3,300 | 3,800 | 3,900 |
| Institutional | 500 | 650 | 650 | 500 | 750 | 750 |
| Industrial | 12,100 | 14,700 | 19,700 | 12,100 | 14,700 | 22,950 |
| Total Influent | 32,100 | 37,550 | 46,150 | 33,100 | 39,100 | 53,500 |
| Septage | 900 | 900 | 900 | 2,600 | 2,600 | 2,600 |
| TOTAL: | 33,000 | 38,450 | 47,050 | 35,700 | 41,700 | 56,100 |

Adapted From: CDM, Volume III, 1989

**2.1.3.2 Non-Residential Loadings.** Commercial loadings entering the WWTP have been estimated using assumed concentrations of BOD and TSS and estimated commercial flows (CDM, Volume III, 1989). The BOD and TSS concentrations for institutional flows are assumed to be the same as those of commercial users. The industrial load was determined by subtracting contributions from all the other sources to the total influent load. The concentrations of the industrial load are assumed to increase based on the expectation that industries will reduce their wastewater discharges through water conservation and reuse programs, thereby concentrating the waste into a smaller volume of water. Concentrations and loadings for these components are summarized in Tables 2.1-4 and 2.1-5.

**2.1.3.3 Septage Loadings.** The New Bedford WWTP currently receives septage from New Bedford, Acushnet, Dartmouth, Freetown, Fairhaven, and Mattapoisett. Total septage from these sources exceeds 5 million gallons per year. The current septage is assumed to be the maximum load because only New Bedford, Acushnet, and Freetown will continue to dispose of their septage in New Bedford. The other three towns will be serviced by their own treatment plants or dispose their septage at other municipal plants. Also, expected future growth in New Bedford and Acushnet will be offset by the expansion of the sewered tributary in these communities. Septage BOD and TSS concentrations were derived from published sources (NEIWPCC; CDM, Volume III, 1989) and are presented in Tables 2.1-4 and 2.1-5. Projected septage contributions by community for the year 2014 are presented in Table 2.1-6.

**TABLE 2.1-6**

**CITY OF NEW BEDFORD PROJECTED SEPTAGE VOLUMES FOR DESIGN YEAR 2014**

| | Average Septage Volumes | |
|---|---|---|
| Community | Millions Gallon/Year | Gallons/Day* |
| New Bedford | 0.5 | 1,900 |
| Acushnet | 1.8 | 6,900 |
| Freetown | 2.2 | 8,400 |
| TOTAL | 4.5 | 17,200 |

* Based upon operation of septic tank pumpers 5 day/week.
Adapted from: CDM, Volume III, 1989.

**2.1.3.4 Adjusted Average Loadings.** Operating records for the existing WWTP were used to estimate the current conventional pollutant loadings for the dry weather flow (CDM, Volume III, 1989). The average loads are 27,650 lbs/day for BOD and 28,200 lbs/day for TSS. These estimates do not, however, include loads associated with dry weather overflows or septage. To account for dry weather overflows, the average loading estimates have been increased by the ratio of total dry weather flow in the sewerage system (28.5 mgd) to dry weather flow reaching the WWTP (24.5 mgd) for the recorded period. This resulted in estimates of 32,100 lbs/day for BOD and 33,100 lbs/day for TSS. The addition of septage loads to these values results in a final BOD loading of 33,000 lbs/day and a TSS loading of 35,700 lbs/day.

**2.1.3.5 Peaking Factors.** The peaking factor for the conventional pollutants loads is defined as the ratio of the maximum daily loading in each month to the average daily loading. Typically, an accepted value used in designing a major wastewater treatment plant is 1.5. The loading values for the monthly, yearly, and 5-year averages were evaluated for the total wet weather flows (including I/I, tidal, etc.) and compared to the dry weather flow. For the New Bedford WWTP, the highest monthly averages for each year were compared to the annual average and the maximum month's average was compared to the 5-year average, for total wet weather and dry weather flow. The maximum month to annual average ratio for BOD loadings was determined to be 1.5. The representative maximum month to annual average ratios for TSS loadings varied from 1.57 to 1.61. A value of 1.6 was selected as the peaking factor because the peaking factor should be higher than 1.5, based on historical values and because a value of 1.6 is more representative of high monthly averages (CDM, Volume III, 1989).

**2.1.3.6 Design Loadings (Conventional Pollutants).** The average and maximum dry weather BOD and TSS loadings are presented in Table 2.1-7.

### 2.1.4 Nonconventional Pollutant Loadings

Nonconventional pollutants are those constituents of the wastewater which can be harmful when found in excessive concentrations. These pollutants include heavy metals, volatile organics, semivolatile organics (also referred to as acid/base neutral compounds or ABNs), pesticides, and polychlorinated biphenyls (PCBs).

Sampling of the wastewater and analyses for chemicals on the Priority Pollutant List (PPL) and Hazardous Substance List (HSL) were conducted to characterize the wastewater influent to the WWTP. The PPL is a list of chemicals used to monitor industrial wastewater as part of the National Pollutant Discharge

TABLE 2.1-7
DESIGN LOADINGS FOR CONVENTIONAL POLLUTANTS (lbs/day)

| | BOD | | | TSS | | |
|---|---|---|---|---|---|---|
| | Current Average | 1994 | 2014 | Current Average | 1994 | 2014 |
| Average Loading | 33,000 | 38,450 | 47,100 | 35,700 | 41,700 | 56,100 |
| Peaking Factor (1) | 1.5 | 1.5 | 1.5 | 1.75 | 1.6 | 1.6 |
| Peak Loading (2) | 49,500 | 57,700 | 70,700 | 62,500 | 66,700 | 89,800 |

(1) The peaking factor is the approximate ratio of maximum monthly average loading to average monthly loading.

(2) Peak Loading = Average Loading x Peaking Factor

Adapted from: CDM, Volume III, 1989.

Elimination System (NPDES) permits, authorized under the Clean Water Act. The HSL, now often referred to as the Target Compound List, is a list of chemicals EPA uses to screen sites regulated under the Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response Compensation and Liability Act/Superfund Amendment and Reauthorization Act (CERCLA/SARA).

Sampling of the raw wastewater at the headworks was conducted in the spring and summer of 1987 and was supplemented by data from monthly sampling and analysis reports for the existing WWTP. A summary of the results of both sampling programs can be found in CDM, Volume III, 1989.

Future influent loadings of the nonconventional pollutants were estimated from these sampling programs. Increases in total loadings from future flows were calculated, and loadings expected from complete capture of combined sewer overflows (CSOs) were estimated.

The dry weather average loading of an individual pollutant was calculated from the concentration of the pollutant in each sample and the flow readings recorded on the day of sampling (dry weather). In cases where the concentrations reported were below the detection limit of the test method, the following methodologies were used:

- If a pollutant was detected at least once above the detection limit, then half the detection limit was used as the concentration.
- If a pollutant was not detected at least once above the detection limit, then no loadings were presented.

It was assumed that the concentration of wasteloads of nonconventional pollutant loads will not change in the future. Therefore, loadings of nonconventional pollutants are assumed to increase in direct proportion to projected increases in wastewater volume generated from those pollutant sources (other than I/I). Because wastewater flow from domestic, industrial, commercial, and institutional sources is projected to increase by 29 percent, so are the projected nonconventional pollutant loadings.

The City of New Bedford's Industrial Pretreatment Program (initiated in the fall of 1987) is expected to decrease the industrial loadings of nonconventional pollutants; however, it has been conservatively assumed for the purposes of this study, that the pretreatment program will have minimal to no effect on future nonconventional pollutant loadings.

Estimates of present and future wet weather non-conventional pollutant loadings were developed using concentration data for runoff from EPA's Nationwide Urban Runoff Program (NURP). These estimates assume 100 percent capture of the CSO volume, which has been estimated to be 1.5 billion gallons per year or 4.2 mgd (CDM, 1983a). In cases where the NURP has not estimated a concentration for a nonconventional pollutant, the existing dry weather concentration has been assumed in calculating the urban runoff mass loading figure. Characteristics of the existing urban environment are assumed to remain unchanged for the duration of the planning period, therefore, present and future runoff mass loadings are projected to be the same. Tables 2.1-8 through 2.1-11 present the estimated loads for metals, VOCs, ABNs, pesticides and PCBs.

**2.1.4.1 Nutrient Loadings.** Excess concentrations of nitrogen and phosphorus can stimulate blooms of algae and other phytoplankton in the receiving water. When phytoplankton cells die, decomposition leads to a high oxygen demand, and a subsequent decrease in water quality of the receiving water. Excess ammonia, which is a byproduct of nitrogen metabolism, also causes an increase in oxygen demand of the receiving water.

Samples of raw sewage were collected weekly at the existing WWTP headworks and analyzed for nitrogen, ammonia, and phosphorous. The future nutrient loading was estimated based on the ratio of future to existing BOD concentrations and the existing nutrient concentrations. The current influent concentrations of ammonia and nitrogen were determined to be 8.2. mg/l and 18.7 mg/l respectively (1987). Loadings of ammonia and nitrogen in the design year (2014) were estimated to be 3,100 and 7,050 lbs/day respectively. The average influent concentration of total phosphorus was estimated to be 5.5 mg/l (1987). The design year (2014) influent loading of total phosphorus was estimated to be 2,100 lbs/day.

### 2.1.5 Wet Weather Flows and Loads

When the combined volumes of runoff and wastewater flows exceed the transmission capacity of the sewer system, the excess flow is discharged to the surrounding marine waters through a system of flow regulators and outfall pipes, known as CSOs. In 1982 and 1983, a study was performed to characterize the CSO flows from the New Bedford sewer system. This study used a model to simulate thirty years of wet weather precipitation data and resulted in an estimate of 1.5 billion gallons per year of CSO. A second phase of the study is currently being conducted to further quantify the CSO problem so that a cost-effective and comprehensive management plan can be prepared. The WWTP was designed to treat a total flow of 75 mgd and meet the effluent

**TABLE 2.1-8**
**AVERAGE METAL LOADINGS (lbs/day)**

| Constituent | Existing Dry Weather Average Mass Loadings | Projected Dry Weather Average Mass Loadings | Projected Average Runoff Loadings | Projected Total Average Mass Loadings |
|---|---|---|---|---|
| Antimony | 1.17 | 1.51 | 0.81 | 2.32 |
| Arsenic | 0.53 | 0.68 | 0.15 | 0.83 |
| Beryllium | 1.86* | 2.40 | 1.72 | 4.12 |
| Boron | 62.02 | 79.87 | 18.74 | 98.61 |
| Cadmium | 0.42 | 0.54 | 0.06 | 0.60 |
| Chromium | 21.18 | 27.27 | 0.30 | 27.57 |
| Copper | 32.03 | 41.25 | 0.68 | 41.93 |
| Cyanide | 1.98 | 2.55 | 0.70 | 3.25 |
| Lead | 6.95 | 8.95 | 2.55 | 11.50 |
| Mercury | 0.10 | 0.13 | 0.04 | 0.17 |
| Molybdenum | 4.55* | 5.86 | 1.37 | 7.23 |
| Nickel | 16.83 | 21.67 | 0.67 | 22.34 |
| Selenium | 0.95 | 1.22 | 2.70 | 3.92 |
| Silver | 1.99 | 2.56 | 0.03 | 2.59 |
| Thallium | 0.93* | 1.20 | 0.49 | 1.69 |
| Zinc | 47.39 | 61.03 | 3.64 | 64.67 |

*Estimated from one-half the detection limit.

Adapted from: CDM, Volume III, 1989.

**TABLE 2.1-9**
**AVERAGE VOC LOADINGS (lbs/day)**

| Constituent | Existing Dry Weather Average Mass Loading | Projected Dry Weather Average Mass Loadings | Projected Average Run Off Loadings | Projected Total Average Mass Loadings |
|---|---|---|---|---|
| Methylene Chloride | 1.21 | 1.56 | 0.00 | 1.56 |
| 1,2-Dichloro-ethene | 1.15 | 1.48 | 0.11 | 1.59 |
| Chloroform | 2.28 | 2.94 | 0.42 | 3.36 |
| 1,2-Dichlo-roethane | 1.15 | 1.48 | 0.14 | 1.62 |
| 1,1,1-Tri-chloroethane | 2.40 | 3.09 | 0.35 | 3.44 |
| Trichloro-ethylene | 2.85 | 3.67 | 0.42 | 4.09 |
| Tetrachlo-roethylene | 1.87 | 2.41 | 1.51 | 3.92 |
| Tetrachlo-roethane | 1.27 | 1.64 | 0.11 | 1.75 |
| Toluene | 9.09 | 11.71 | 0.32 | 12.03 |
| Ethylbenzene | 2.09 | 2.69 | 0.07 | 2.76 |
| Total Xylenes | 10.19 | 13.12 | 3.08 | 16.20 |
| 2-Butanone | 7.07 | 9.10 | 2.14 | 11.24 |
| Acetone | 32.12 | 41.36 | 9.71 | 51.07 |
| Benzene | 0.97 | 1.25 | 0.46 | 1.71 |
| 4 Methyl-2-Pentatone | 1.58 | 2.03 | 0.48 | 2.51 |

Adapted From: CDM, Volume III, 1989

**TABLE 2.1-10**
**AVERAGE ABN LOADINGS (lbs/day)**

| Constituent | Existing Dry Weather Average Mass Loadings | Projected Dry Weather Average Mass Loadings | Projected Average Runoff Loadings | Projected Total Average Mass Loadings |
|---|---|---|---|---|
| Phenol | 2.92 | 3.76 | 0.46 | 4.22 |
| Benzyl Alcohol | 1.72 | 2.21 | 0.52 | 2.73 |
| 2-Methylphenol | 1.49 | 1.92 | 0.45 | 2.37 |
| 4-Methylphenol | 7.68 | 9.89 | 2.32 | 12.21 |
| Benzoic Acid | 10.94 | 14.09 | 3.31 | 17.40 |
| 4-Chloro-3-Methylphenol | 1.47 | 1.89 | 0.05 | 1.94 |
| Isophorone | 1.52 | 1.96 | 0.35 | 2.31 |
| 1,2,4-Trichlorobenzene | 1.54 | 1.98 | 0.00 | 1.98 |
| 2-Methyl-napththalene | 1.53 | 1.97 | 0.46 | 2.43 |
| N-Nitroso-diphenylamine | 1.96 | 2.52 | 0.59 | 3.11 |
| Di-n-Butyl Phthalate | 1.60 | 2.06 | 0.39 | 2.45 |
| Butylbenzyl Phthalate | 1.50 | 1.93 | 0.35 | 2.28 |
| Bis(2-ethylhexyl) Phthalate | 14.42 | 18.57 | 0.07 | 18.64 |
| Di-n-octyl Phthalate | 1.54 | 1.98 | 0.07 | 2.05 |
| Naphthalene | 2.08 | 2.68 | 0.08 | 2.76 |
| Diethyl phthalate | 1.66 | 2.14 | 0.35 | 2.49 |

Adapted From: CDM, Volume III, 1989.

**TABLE 2.1-11**

**AVERAGE PCB LOADINGS (lbs/day)**

| | Existing Dry Weather Average Mass Loadings | Projected Dry Weather Average Mass Loadings | Projected Average Runoff Loadings | Projected Total Average Mass Loadings |
|---|---|---|---|---|
| gamma-BHC | 0.02 | 0.03 | 0.00 | 0.03 |
| PCB-1242 | 0.06 | 0.08 | 0.00 | 0.08 |
| PCB-1254 | 0.08 | 0.10 | 0.00 | 0.10 |

Adapted From: CDM, Volume III, 1989.

limitations detailed in the plant's discharge permit. The final CSO management plan proposes to store the overflow volume at existing CSO locations until the WWTP is operating below the 75 mgd limit. The overflow volume will then be pumped to the WWTP for treatment (see Chapter 4).

Wet weather flows can significantly increase the amount of wastewater entering the treatment facility and can therefore be a major contributor to the wastewater flow. An estimate of the wet weather inflow was made by comparing the mean of a data base for the average daily flow rates (five year period from 1983 to 1987) to the mean of an edited version of the same data base. The edited data base was created by deleting the daily flow rates affected by precipitation from the original data base. The affected flow rates included days for which precipitation was reported and for days immediately following a day on which precipitation was reported. The difference between the two means is 2.0 mgd. This estimate of wet weather inflow rate was added into the projected design flows as peak flow condition. Therefore, the peak dry weather flow estimate was increased by 2.0 mgd for inclusion in the summary of projected flows and loads. The annual quantity of wet weather flow represented by this inflow rate was not part of the 1.5 billion gallons per year of CSO flow noted in the beginning of Section 2.1.5.

The mean concentration of BOD and TSS in the combined runoff and wastewater was 115 mg/l and 117 mg/l, respectively. The annual loading for conventional pollutants, based on the estimated annual volume of CSO, is presented in Table 2.1-12. The instantaneous design loads during a wet weather event at the proposed treatment facility are also presented in Table 2.1-12.

TABLE 2.1-12

SUMMARY OF DESIGN YEAR (2014) FLOWS AND LOADS

| Dry Weather | Annual Average Condition | Seasonal Low Groundwater Conditions | Seasonal High Groundwater Conditions |
|---|---|---|---|
| Flow (mgd) | | | |
| Daily Average | 30.0 | 27.2 | 38.5 |
| Daily Peak | 72.6* | 63.7 | 72.6* |
| BOD (lbs/day) | | | |
| Annual Daily Average | 47,100 | 47,100 | 47,100 |
| Peak Loading | 70,700 | 70,700 | 70,700 |
| TSS (lbs/day) | | | |
| Annual Daily Average | 56,100 | 56,100 | 56,100 |
| Peak Loading | 89,800 | 89,800 | 89,800 |
| Wet Weather | | | |
| Flow (mgd) | 120 | | |
| BOD (lbs/day) | 115,100 | | |
| TSS (lbs/day) | 117,100 | | |

* Daily peak flow rounded up to 75 mgd for WWTP design purposes
Adapted From: CDM, Volume III, 1989.

## 2.2 LIQUID WASTEWATER TREATMENT PROCESS ALTERNATIVES

Several technologies for preliminary treatment, primary treatment, secondary treatment, and disinfection were considered for liquid wastewater treatment at the proposed facilities. To limit the number of alternatives to be considered, and to make the evaluation of alternatives more manageable, two screening analyses were conducted as part of the facilities planning process. The criteria used and the results of each screening step are described below. The screening process is described in more detail in the City of New Bedford's Phase II Facilities Plan/EIR (CDM, Volume III, 1989).

### 2.2.1 Phase I Screening

Each technology was evaluated for surface area and volume requirements using a daily average wastewater flow of 30 mgd. In addition, information for historical and operational success of each process at other facilities of similar size was reviewed. This review was based on 15 non-monetary criteria listed in Table 2.2-1.

TABLE 2.2-1
NON-MONETARY PHASE I SCREENING CRITERIA FOR LIQUID WASTEWATER TREATMENT ALTERNATIVES

| Criteria | Description | Rating |
| --- | --- | --- |
| Reliability | The level of assurance that the unit process will consistently achieve and the required degree of treatment under an expected range of operating conditions, including consideration of the track record of the unit process at other large municipal wastewater treatment facilities. | low, average, high |
| Flexibility | The ability of a unit process to operate under atypical conditions or to adapt to major changes in flows or loadings. | low, average, high |
| Constructability | Consideration of several aspects of construction including the complexity of construction, duration, and scheduling. | difficult, normal |
| Safety | The level of precautions needed to reduce risks to plant personnel and the surrounding community, including those required for operation under both normal and special circumstances. | special, normal |
| Operators Required | A measure of the relative number of operators and maintenance personnel required to successfully operate and maintain the unit processes as compared to the reference unit process. | greater, average, fewer |
| Operational Complexity | The degree of difficulty in the maintenance and control of a unit process. | high, average, low |
| Power Efficiency | The amount of power necessary to achieve the desired level of treatment. | low, average, high |

TABLE 2.2-1 (CONTINUED)
NON-MONETARY PHASE I SCREENING CRITERIA FOR LIQUID WASTEWATER TREATMENT ALTERNATIVES

| Criteria | Description | Rating |
|---|---|---|
| Auxiliary Needs | Any additional needs (e.g., chemical feed facilities) required for a unit process. | (no auxiliary need or specific need) |
| Residuals Aspects | Consideration of the quality and quantity of the residuals generated by a particular unit process regarding the difficulty of collection, processing and disposal of residuals. | difficult, average, good |
| Spoils Disposal | The amount of soils excavation and the difficulty in the disposal of such material when compared to the reference unit process. | difficult, average, simple |
| Air Emissions Control | The potential for generating air emissions and therefore the level of control necessary to limit air emissions from a unit process. | low, average, high |
| Odor | The potential for generating and emitting odor-causing compounds to the environment. | high, average, low |
| Noise Control | The ease of controlling the noise generated during operation of a specific unit process. | high, average, low |
| Aesthetics | The relative visual impact of a unit process on the surrounding communities and adjacent marine users. | average, good |
| Effluent Quality | The relative impact of a unit process on downstream unit processes or receiving wate. | low, average, high |

Adapted from: CDM, Volume III, 1989

Each unit process was evaluated and compared to a reference unit process that performs well against the non-monetary criteria. The reference unit processes are as follows:

| Treatment | Reference Unit Process |
|---|---|
| Preliminary | Aerated Grit and Catenary Screens |
| Primary | Standard Rectangular Clarifiers |
| Secondary | Air Activated Sludge and Rectangular Secondary Clarifiers |
| Disinfection | Sodium Hypochlorite |

Wastewater treatment processes considered in Phase I are shown in a flow diagram, Figure 2.2-1.

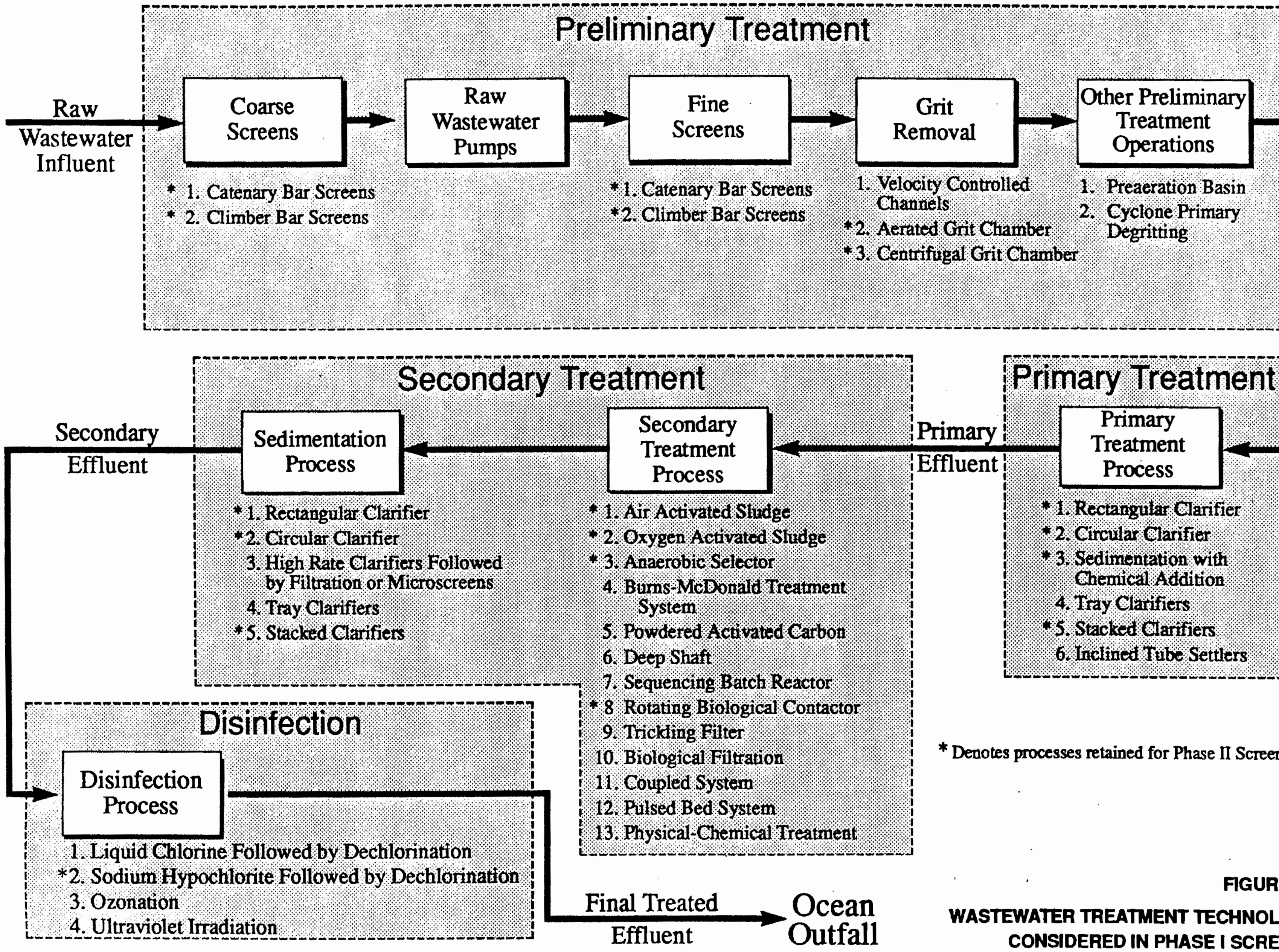
**2.2.1.1 Preliminary Treatment.** Preliminary treatment is provided to optimize the operation and performance of subsequent wastewater treatment processes. The screening process removes rags, trash, and other large size solids that may interfere with the operation of equipment. Grit removal processes remove sand, gravel, and other minute minerals and organics (e.g., shells and coffee grounds). Other preliminary treatment operations considered improve the operation of preliminary treatment by freshening the wastewater and dewatering the grit. The technologies considered for preliminary treatment are shown in Figure 2.2-1.

Following the Phase I screening, three options were excluded from further consideration: the velocity controlled grit channel, preaeration basin, and cyclone primary degritting. Reasons for elimination can be found in Appendix Table A-1. The remaining options considered for further analysis are labeled in Figure 2.2-1 with an asterisk.

**2.2.1.2 Primary Treatment.** The purpose of primary treatment is to physically remove readily settleable solids and floating material, thereby reducing the suspended solids content of the wastewater and the BOD associated with it. Six technologies listed in Figure 2.2-1 were evaluated as options for primary treatment.

Based on the Phase I screening, the tray clarifiers and the inclined tube settlers were excluded from further consideration. Reasons for their elimination can be found in Appendix Table A-1.

**2.2.1.3 Secondary Treatment.** Secondary treatment extracts the remaining organic matter not removed in primary treatment, using a biological process. The secondary treatment portion of the plant was sized to treat up to the peak dry weather flow of




* Denotes processes retained for Phase II Screening.

**FIGURE 2.2-1**

**WASTEWATER TREATMENT TECHNOLOGIES CONSIDERED IN PHASE I SCREENING**

75 mgd. The technologies considered as secondary treatment options are listed in Figure 2.2-1. The options eliminated from further consideration as a result of Phase I screening are listed in Appendix Table A-1, along with the reasons for their elimination.

**2.2.1.4 Disinfection.** Disinfection of the treated wastewater is required to reduce the level of bacteria and pathogens present in the final treated effluent. The disinfection options considered are listed in Figure 2.2-1.

Liquid chlorine, ozonation, and ultraviolet irradiation were dropped from further consideration as treatment options. Reasons for their elimination can be found in Appendix Table A-1.

### 2.2.2 Phase II Screening

Phase II screening consisted of a detailed evaluation of the treatment alternatives retained after Phase I screening, as denoted in Figure 2.2-1. Phase II screening was based on technical, environmental, institutional criteria shown in Table 2.2-1 as well as cost criteria.

The design criteria for evaluating the liquid treatment alternatives were developed based on an assumed peak dry weather flow of 75 mgd and loading conditions detailed in Table 2.1-12. The treatment technologies retained after the Phase II screening for further analysis in the Draft EIS are shown in Figure 2.2-2.

**2.2.2.1 Preliminary Treatment.** Two screening processes were evaluated in the Phase II screening: the climber bar screen and the catenary bar screen. Both racks have been used and are operating in facilities of comparable size to the proposed facility. The catenary bar screen has a slight advantage because it can be cleaned more frequently than the climber bar screen, thereby minimizing problems such as excessive buildup on the screen. However, based on the application of the screening criteria, the alternatives would most likely provide the same level of treatment (Appendix Table A-2). In addition, the capital and operation and maintenance (O&M) costs are similar for both processes. Therefore, both alternatives will be evaluated further in this Draft EIS.

For grit removal, aerated and centrifugal systems were evaluated in the Phase II analysis. The results of the screening analysis (Appendix Table A-3) revealed that both grit removal alternatives will effectively remove grit and keep organic matter in suspension over the range of expected flows and loads. In addition, neither alternative will present any construction difficulties or safety problems. The cost of the centrifugal system is approximately 25 percent less than that for the aerated

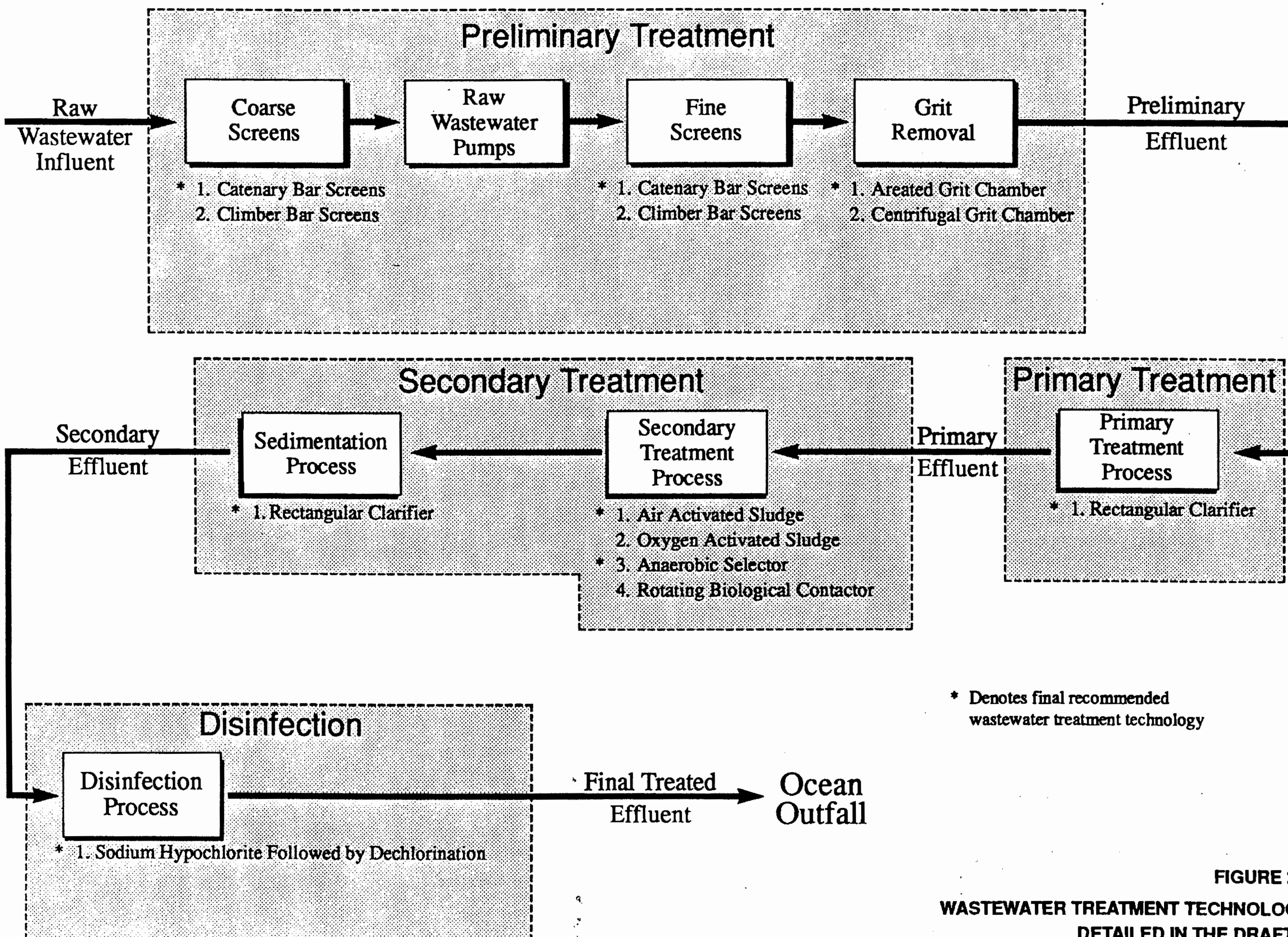



**FIGURE 2.2-2**
**WASTEWATER TREATMENT TECHNOLOGIES DETAILED IN THE DRAFT EIS**

system, however, the O&M costs are slightly higher. Both grit removal alternatives will be retained for further analysis.

**2.2.2.2 Primary Treatment.** Phase II evaluation of the primary treatment technologies (see Figure 2.2-1) resulted in the elimination of sedimentation with chemical addition and stacked clarifiers. The addition of chemicals in the primary treatment process (sedimentation with chemical addition) enhances suspended solids removal and aids in the removal of phosphorous. The disadvantages of this unit process are that it is slightly more complex and required more operation and maintenance than the other alternatives. Another reason for the elimination of the process alternative was New Bedford has no effluent discharge limitations on phosphorous warranting the need for chemical addition. Stacked clarifiers were eliminated because there was sufficient land available for standard clarifiers. The use of stacked clarifiers will be re-evaluated if necessary (i.e., if land area becomes constrained due to the need for advanced treatment).

Based on the screening criteria circular clarifiers were eliminated as a potential primary treatment process. Even though the circular and rectangular clarifiers would provide equal degrees of treatment, the circular clarifier required extra land area, a substantially larger ventilation and air emission control system, and had a higher overall cost, as shown in Appendix Table A-4. Based on these criteria, the rectangular clarifier was retained for the Draft EIS.

**2.2.2.3 Secondary Treatment.** Four types of biological treatment process were evaluated in the Phase II screening (see Figure 2.2-1). This evaluation indicated that the cost of rotating biological contactors (RBC) greatly exceeded the present worth costs of the other three options (Appendix Table A-5). Therefore, the RBC was eliminated for further evaluation in this Draft EIS.

Evaluation of the three clarifiers (rectangular, circular and stacked), for secondary sedimentation had the same results as in primary treatment evaluation. The stacked clarifier was eliminated because sufficient land area was available for standard clarifiers, avoiding the higher construction cost of the stacked units. The circular clarifier requires extensive ventilation and air emission control systems and has a higher overall cost than the rectangular clarifier (see Appendix Table A-6). Based on this evaluation the rectangular clarifier was retained for the Draft EIS.

**2.2.2.4 Disinfection.** Sodium hypochlorite was selected as the preferred disinfectant in the Phase I screening. If dechlorination is necessary to remove residual chlorine, two chemicals were identified for analysis, sulfur dioxide and sodium bisulfite. Both chemicals present hazards to workers but are commonly used in wastewater treatment facilities. They may also require additional instrumentation for monitoring. The sodium bisulfite process is simpler to operate, and was selected as the preferred alternative for this Draft EIS (CDM, Volume III, 1989).

### 2.2.3 Description of the Alternatives

The alternatives given detailed consideration in this Draft EIS are shown in Figure 2.2-2.

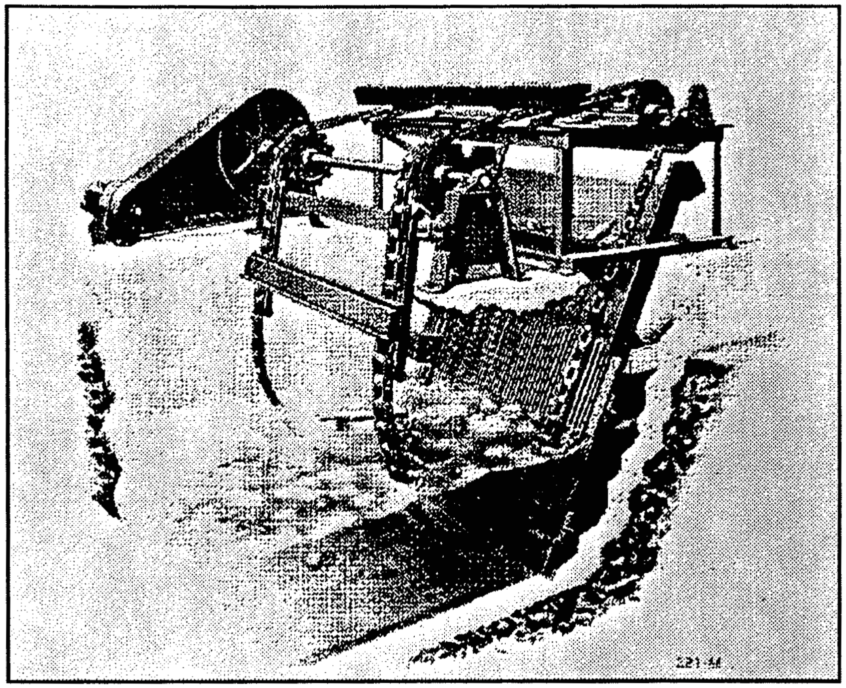
**2.2.3.1 Preliminary Treatment.** Catenary bar screens (see Figure 2.2-3) use a series of weighted toothed rakes mounted between two parallel chains which are driven by a motor-driven sprocket. The front cleaning rake moves down in front of the bar screen, guided by a curved guide frame located above the water surface. The rake is pulled up along the bar screen rack to remove captured screenings. The screenings are then deposited onto a conveyor for handling and disposal.

Climber bar screens (see Figure 2.2-3) use a single screen rake, which moves vertically and is driven by a motor attached to a rack and pinion gear frame. As the rake reaches the bottom of the bar screen, the rake teeth engage the bar rack. At this point, the rake is retracted up along the screen to collect the screening. Screenings are then deposited onto a conveyor for handling and disposal.

The aerated grit system (see Figure 2.2-4) consists of two tanks designed so each tank will handle half of the plant's peak design flow and remove 95 percent of the grit material greater than 0.3 mm in size. The tanks contain influent and effluent weirs on opposites sides and have diffused air pumped up from the bottom. The diffused air keeps the organics in suspension while the grit settles to the bottom of the tank and is pumped away for further solids treatment. Odors are minimized by enclosing the tanks and treating the off-gases. Aerated grit systems emit higher concentrations of VOCs than the centrifugal system described below.

Centrifugal grit removal systems consist of three grit tanks that use a low rpm (rotation per minute) paddle mixer to separate and suspend the organic particles, and direct the settled grit particles to the center of the unit. A sump is used to remove the collected grit from the tank. The centrifugal system is enclosed to control VOC emissions, noise, and odors.

**2.2.3.2 Primary Treatment.** Rectangular clarifiers (see Figure 2.2-5) are in widespread use at municipal wastewater treatment facilities. They are used for primary clarification as either



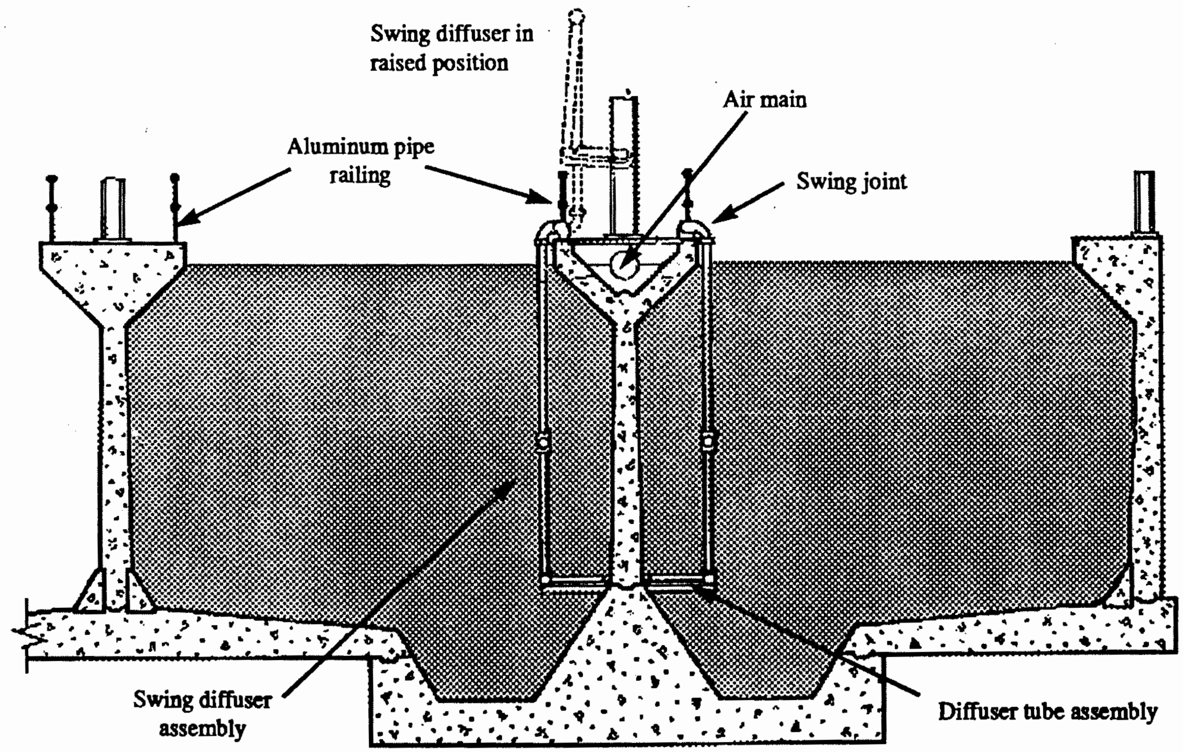
**Typical Catenary Bar Screen[1]**

**Typical Climber Bar Screen[2]**

Source: 1. MOP/11, *Operations of Wastewater Treatment*, WPCF, 1976
2. *Water Supply and Pollution Control*, Clark, Viesmann, and Hammer, 1977

Not to Scale

**FIGURE 2.2-3**
**TYPICAL BAR SCREENS**

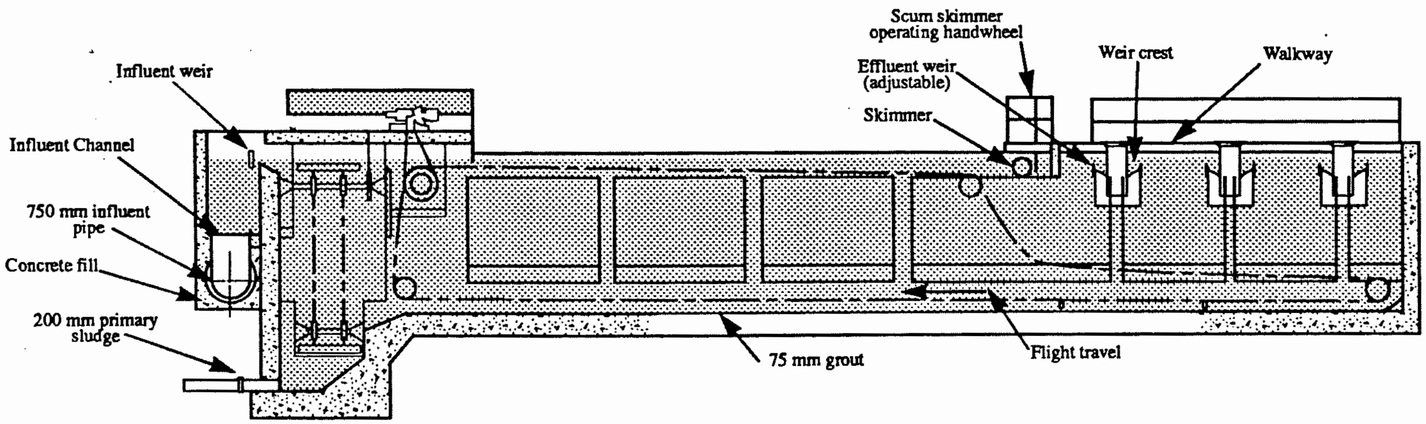



**Typical Aerated Grit Tank**

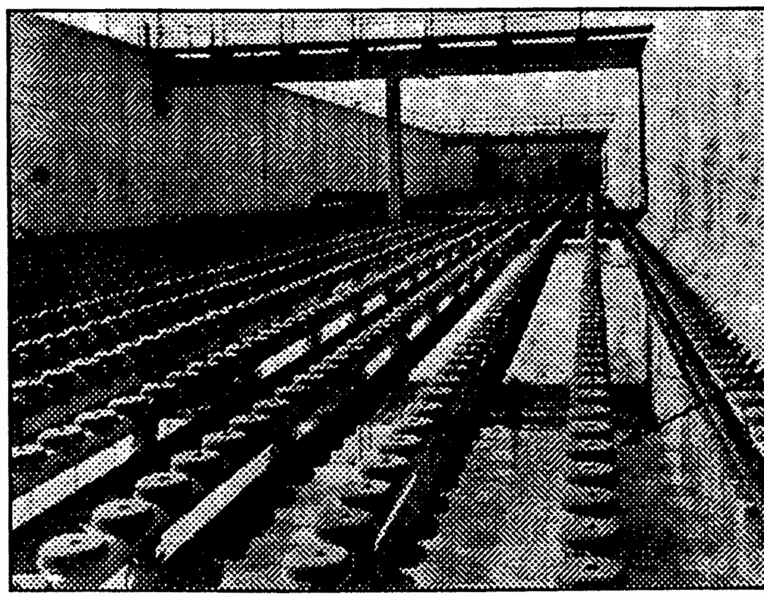
Source: *Wastewater Engineering*, Metcalf & Eddy, 1979

Not to Scale

**FIGURE 2.2-4**
**TYPICAL AERATED GRIT TANK**




**Typical Rectangular Clarifier**




**Typical Air or Oxygen Activated Sludge Tank**

**FIGURE 2.2-5**
**TYPICAL RECTANGULAR CLARIFIER AND ACTIVATED SLUDGE TANKS**

Source: *Wastewater Engineering*, Metcalf & Eddy, 1979

Not to Scale

individual units or multiple units with common wall construction. The settled solids are removed by chains and flights or mechanical bridges. In primary clarifiers, the sludge hopper is usually at the influent end of the tank with the sludge-pumping facilities located near the sludge hoppers. Scum is moved by the flight and/or water sprays to collection equipment at the effluent end and is then removed mechanically or hydraulically.

**2.2.3.3 Secondary Treatment.** In the activated sludge process (see Figure 2.2-5), microorganisms metabolize and biologically flocculate the organics in wastewater. The organics serve as food for the microorganisms and are converted into cell tissue and oxidized to end products (mostly $CO_2$). The air activated sludge system uses air that is introduced to the system via diffused aerators, mechanical surface aerators, or submerged turbine aerators. In contrast, the oxygen activated sludge process uses pure oxygen instead of air to produce the same reaction.

Anaerobic selectors are a modification of the activated sludge process. They were developed to eliminate poor solids separation, which is commonly caused by an excess of filamentous organisms. Filamentous growth is usually found in aeration systems that have uniformly low, soluble levels of carbonaceous BOD or low dissolved oxygen levels. The anaerobic selector would be located prior to the activated sludge process and would mix return activated sludge (RAS) with the primary effluent, thereby increasing the levels of BOD and dissolved oxygen.

Secondary clarifiers (see Figure 2.2-5) are settling tanks which follow secondary aerobic treatment units. The sludge settles in the tank and is either returned to the aeration tank or disposed of. The treated liquid then proceeds to disinfection.

**2.2.3.4 Disinfection.** Wastewater is disinfected to destroy the pathogenic (disease causing) organisms which may be present in the waste stream. Sodium hypochlorite, a chemical agent used for disinfection, is an aqueous solution typically containing 15 percent sodium hypochlorite. This solution is injected into the effluent. After a specified contact period, the effluent is discharged through the ocean outfall. The residual chlorine level in the final effluent is measured as a means of evaluating disinfection efficiency.

A dechlorination process may be required if the primary effluent from the CSO facilities is combined with the secondary treatment effluent. This combination will require a stronger loading of sodium hypochlorite in the initial disinfection process to destroy the pathogenic organisms. Once destroyed, a high concentration of chlorine remains in the effluent, thereby requiring dechlorination. This is accomplished by the use of sodium bisulfite. The chemical reaction dechlorinating the combined final treatment effluent occurs prior to discharge through the ocean outfall. The necessity for dechlorination will be determined in the CSO facilities plan.

### 2.2.4 Description of the Liquid Treatment Technologies for Detailed Evaluation.

The following comparisons of the remaining liquid wastewater treatment processes, were conducted to determine the recommended process configuration for the proposed WWTP. The recommended process options are denoted in Figure 2.2-2 by an asterisk. After the process configuration was determined the system was designed and evaluated for redundancy, which ensures a reliable and efficient WWTP operation capable of handling the projected peak design flow of 75 mgd.

**2.2.4.1 Preliminary Treatment.** The preliminary treatment system incorporates coarse and fine screening and grit removal from the raw wastewater influent. The remaining screening processes are the catenary and climber bar screens. These two options have nearly identical environmental impacts and technical requirements (see Appendix Table A-2); however, the catenary screen is rated higher according to the operation and cost criteria. The catenary bar screen was therefore selected for the coarse and fine screening process. Design of the system can be found in Appendix Table A-7.

The remaining grit removal options include aerated and centrifugal grit chambers. The environmental impacts of the two chambers were determined to be almost identical, however the centrifugal chambers rated slightly better on a cost basis. Due to the relative comparability of the two processes, the final recommendation was based on non-monetary factors (see Appendix Table A-3). The aerated grit chamber was selected because it has a more flexible wastewater flow range, and is capable of stripping VOCs in an emissions control system of limited size and cost. Design of the aerated grit chamber is detailed in Appendix Table A-7.

**2.2.4.2 Primary Treatment.** The purpose of the primary treatment process is to remove settleable solids and floating material, thus reducing the TSS and BOD concentrations of the wastewater. The recommended process alternative for the proposed WWTP was the rectangular clarifier, based on the Phase II analysis. The process design is detailed in Appendix Table A-7.

**2.2.4.3 Secondary Treatment.** The secondary treatment processes remove the remaining amount of BOD and TSS from the primary effluent and consist of two stages, secondary treatment and sedimentation.

Three secondary treatment processes remain (air and oxygen activated sludge, and anaerobic selectors for detailed evaluation.

The anaerobic selector is a modification of the activated sludge process and can provide process stability, control of bulking and the ability to stabilize performance during shock loads. However, this process option in more expensive than the other two and the majority of the performance data is from pilot plants with limited experience. Based on this evaluation, the anaerobic selector was retained for the design phase of the WWTP, to be used in conjunction with the recommended alternative. At that time the quantitative advantages of the anaerobic selector can be compared to its actual cost to determine if the process should be utilized.

The remaining secondary treatment alternatives were an air or oxygen activated process. The detailed evaluation determined that the air process was more energy efficient, required no special safety precautions and was less complex to operate than the oxygen process. The oxygen process required a less costly VOC emission and odor control system. Based on this analysis the air activated treatment process was selected as the recommended alternative (CDM, Volume III, 1989).

**2.2.4.4 Disinfection.** Disinfection of the plant's effluent is required to reduce the level of bacteria and pathogens. Sodium hypochlorite was chosen as the recommended disinfectant after the Phase I screening analysis. The question then remained as to whether dechlorination of the effluent was required to remove the total combined chlorine residual remaining after disinfection. Based on EPA ambient receiving water quality criteria and the toxicity test performed on the existing plants effluent, dechlorination may be necessary (CDM, Volume III, 1989).

Dechlorination can be accomplished by the addition of sodium bisulfite, requiring a contact time of only one minute. Design of the system is shown in Appendix Table A-7.

**2.2.4.5 Process Equipment Redundancy.** The recommended process configuration, detailed in Appendix Table A-7, was designed to incorporate redundant mechanical equipment and tankage. The redundancy will provide the WWTP with the capability to treat the peak design wastewater flow under various conditions of equipment failure or routine maintenance outages. The design of the process configuration met U.S. EPA requirements of redundancy as outlined in their document entitled "Technical Bulletin: Design Criteria for Mechanical, Electric, and Fluid System and Components Reliability". EPA requires a minimum of one spare unit for all mechanical equipment that perform the same function.

Spare tankage and storage can be met within the design number of tanks; should a primary clarifier be pulled out of service for repair or maintenance the remaining clarifiers are capable of treating the design peak flow and meeting water quality criteria. Table 2.2-2 lists the number of tanks and equipment for the proposed WWTP and the percent redundancy designed into the process configuration. Continued reliability of the equipment requires expeditious repair or maintenance of a standby unit to be able to place it back in available service. If long periods elapse between repairs or if recommended routine maintenance is not provided the availability of units is reduced and the reliability of the system could decrease.

## 2.3 WASTEWATER TREATMENT FACILITY SITING ALTERNATIVES

This section describes alternative sites for locating the New Bedford Wastewater Treatment Plant. Forty-six candidate sites were initially identified. Many of these sites were subsequently eliminated in successive screening processes as described below. The screening process is described in more detail in the City of New Bedford's Phase II Facilities Plan/EIR (CDM, Volume III, 1989).

### 2.3.1 Phase I Screening

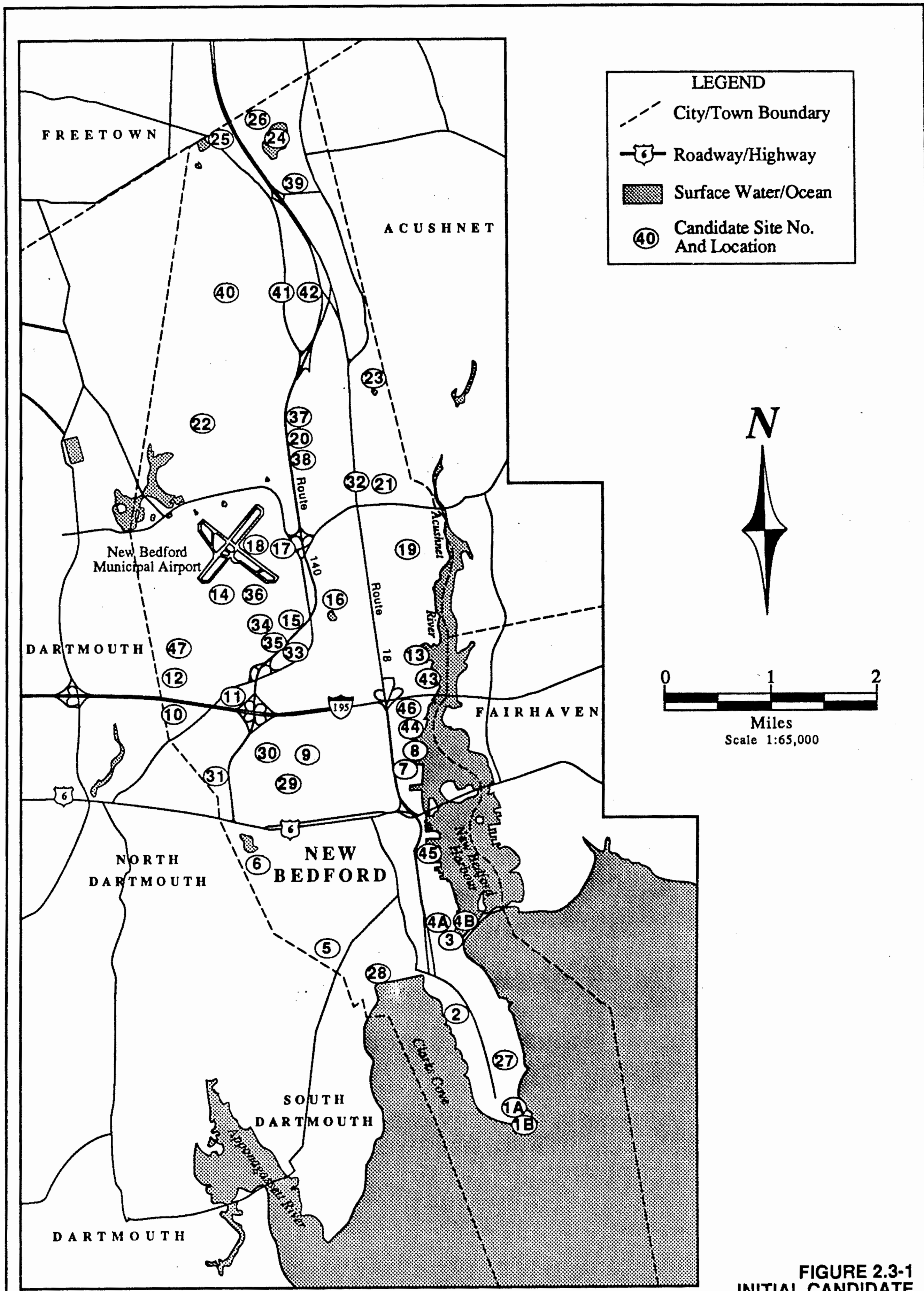
During Phase I of facilities planning (CDM, Volume I, 1989), 46 potential WWTP sites were identified by the City of New Bedford. All of the sites are within the city's boundaries and at least 10 acres in size. In addition, each of the 46 sites could be categorized by at least one of the following types: public (city, state, federal); quasi-public (institutions, educational facilities); industrially zoned property; land previously identified for large-scale industrial or commercial activities; land owned by the Department of Public Works; private under-utilized land suitable for development; or land proposed for development (e.g., large subdivisions). The initial 46 sites are presented in Figure 2.3-1 and Table 2.3-1.

The Phase I screening process consisted of two steps. In the first step, "Screen 1", 14 sites were eliminated using the criteria and screening elements listed in Table 2.3-2 (CDM, Volume I, 1989). Of the remaining 32 sites (see Appendix Table A-8), several could only accommodate a split facility (either a primary or secondary wastewater treatment facility, but not both). Some of the smaller adjacent sites were combined to make them suitable for a consolidated primary and secondary facility. Other sites that had at least 25 acres available to allow for a

**TABLE 2.2-2**
**SUMMARY OF LIQUID WASTEWATER TREATMENT PROCESS REDUNDANCY**

| Treatment Unit | Total No. of Units | No. on Standby | Standby Redundancy (%) |
|---|---|---|---|
| <u>Preliminary Treatment</u> | | | |
| Coarse Screens | 3 | 1 | 50 |
| Raw Sewage Purpose | 4 | 1 | 33 |
| Fine Screens | 3 | 1 | 50 |
| Aerated Grit Tanks | 2 | - | - |
| Grit Tank Blowers | 2 | 1 | 100 |
| <u>Preliminary Treatment</u> | | | |
| Primary Clarifiers | 6 | - | - |
| <u>Secondary Treatment</u> | | | |
| Aeration Tanks | 4 | - | - |
| Aeration Air Blowers | 3 | 1 | 50 |
| Final Clarifier Aeration Blowers | 2 | 1 | 100 |
| Final Clarifiers | 6 | - | - |
| Return Activated Sludge Pumps | 5 | 1 | 25 |
| Waste Activated Sludge (WAS) Pumps | 4 | 1 | 33 |
| <u>Disinfection</u> | | | |
| Chlorine Contact Tanks | 2 | - | - |
| Hypochlorite Metering Pumps | 4 | 1 | 33 |
| <u>Effluent Pumping</u> | | | |
| Effluent Pumps | 4 | 1 | 33 |

Adapted from: CDM, Volume V, 1989




Adapted from CDM, 1989

**FIGURE 2.3-1**
**INITIAL CANDIDATE SITES FOR THE WWTP**

TABLE 2.3-1

INITIAL CANDIDATE SITE LIST

| Site No. | Site Description |
|---|---|
| 1a | Army land and existing WWTP |
| 1b | Existing WWTP and filling into Buzzards Bay |
| 2 | Hazelwood Park (west of Brock Avenue) |
| 3 | Berkshire-Hathaway Mill Complex (south of Gifford) |
| 4a | Standard-Times Field (north of Gifford) |
| 4b | Filling into Acushnet River from Standard-Times Field |
| 5 | Rural Cemetery (east of Rockdale) |
| 6 | Buttonwood Park (west of Rockdale) |
| 7 | Railroad Property (west of Herman Melville Blvd.) |
| 8 | Property north of North Terminal (east of Herman Melville Blvd.) |
| 9 | Oak Grove Cemetery (east of Hathaway Blvd.) |
| 10 | Property north of Hathaway Road |
| 11 | Sullivan's Ledge (south of Hathaway Road) |
| 12 | Whaling City Golf Course (north of Rte. 195) |
| 13 | Property east of Belleville Ave. between Sawyer St. and Coffin Ave. |
| 14 | Water Department/Solid Waste Landfill (west of Shawmut Avenue) |
| 15 | Sacred Heart Cemetery (west of Mt. Pleasant) |
| 16 | Property behind Chamberlain Manufacturing (east of Rte. 140) |
| 17 | Foreign Trade Zone/Air Industrial Park (west of Aviation Way) |
| 18 | New Bedford Municipal Airport |
| 19 | Brooklawn Park (south of Brooklawn) |
| 20 | Property west of Church Street, east of Rte. 140 |
| 21 | Pine Grove Cemetery (east of Ashley Blvd.) |
| 22 | Great Cedar Swamp (west of railroad tracks) |
| 23 | Property north of Arnoff Street |
| 24 | Sassaquin Pond (east of Bessette Memorial Highway) |
| 25 | Property east of Braley Road, south of the Freetown line |
| 26 | Property north of Sassaquin Pond |
| 27 | Victory Park (north or Portland) |
| 28 | Property opposite Goodyear (east of Orchard) |

TABLE 2.3-1 (CONTINUED)

INITIAL CANDIDATE SITE LIST

| Site No. | Site Description |
|---|---|
| 29 | Sargent Field/City Yard (north of Mayfield) |
| 30 | Vacant land opposite high school (south of Durfee) |
| 31 | St. Mary's Cemetery (north of Kempton; on Dartmouth line) |
| 32 | Vacant portion next to vocational school (west of Ashley Blvd.) |
| 33 | Building 19 and adjacent area (east of Shawmut Avenue) |
| 34 | NYNEX Garage (north of Nash Road) |
| 35 | Salvage yard adjacent to Rte. 140 (south of Nash Road) |
| 36 | Salvage yd and vacant portion of airport (north end of Shawmut Ave.) |
| 37 | Vacant area west of Church Street |
| 38 | Undeveloped area adjacent to railway spur (east of Rte. 140) |
| 39 | Polaski School and Park (north of Braley Road) |
| 40 | Industrial Park (west of Duchaine Blvd.) |
| 41 | Polaroid site (west of Phillips Road) |
| 42 | Cemetery between Rte 140 and Phillips Road |
| 43 | Atlantic Mill Buildings (north of Rte. 195) |
| 44 | Revere and Wamsetta (east of Herman Melville Blvd, south of Kilburn) |
| 45 | Commonwealth Electric Company site (east of JFK Memorial Drive) |
| 46 | Acushnet/Ashley Blvd. |
| *47 | Undeveloped area adjacent to New Bedford Airport (north of Rte. 195) |

* Added to site evaluation in Phase I/Level 2 screening

Adapted from: CDM, Volume I, 1989.

TABLE 2.3-2
PHASE I/SCREEN 1 SCREENING CRITERIA AND ELEMENTS

| Criteria | Screening Elements |
|---|---|
| Minimize Size | Consolidated facility - minimum of 25 acres<br>Split facility - minimum of 10 acres |
| Dedicated Public Land | Parks<br>Cemeteries |
| Public & Private | Schools |
| Developed Institutional Properties | Private cemeteries<br>Churches |
| Open Water Bodies | Open water without contiguous developable land |
| Unworkable Site Configuration | Consolidated facility - minimum dimensions 700 x 1550 feet<br>Split facility - minimum dimensions 500 x 870 feet<br>Awkward site arrangement |

Adapted from: CDM, Volume I, 1989.

**TABLE 2.3-3**
**PHASE I/SCREEN 2 SUITABILITY FACTORS**

| Criteria | Description |
|---|---|
| Environmental Factors | Relationship of site to wetlands, relationship of site to flood hazard areas, and surface water at site |
| Engineering Factors | Effluent pipeline length, energy consumption, compatibility with existing system |
| Compatibility (with site and surrounding areas) | Site land use and zoning, surrounding land use and zoning, and community disruption |
| Vehicle Access | Proximity of site to truck routes, and direct access to site |
| Implementation | Land acquisition (multiple ownership) |
| Historical Features | Presence and significance on-site |

Adapted from: CDM, Volume I, 1989.

consolidated facility (e.g. sites 1 and 4) were split into subsites to more specifically define the area being considered.

The objective of the second screening step, "Screen 2", was to determine the suitability of each of the 32 remaining sites for the construction of a wastewater treatment plant. Suitability was determined by evaluating the sites with respect to several environmental and engineering considerations, listed in Table 2.3-3. Each site was analyzed for its suitability relative to the other sites, and rated as most suitable, less suitable, or least suitable for each factor. Sites that had a conflict with land use and zoning (i.e., in an industrial area with residential zoning) were reviewed in greater detail. From this evaluation, five sites were determined to be the most suitable for further analysis: 1A, 4A, 7/8, 14/36, and 16 (CDM, Volume I, 1989).

These five sites were then evaluated against each other, with respect to another more detailed set of environmental criteria and screening elements listed in Table 2.3-4 (CDM, Volume I, 1989). As a result, major advantages and disadvantages for each of the five sites were identified. These are presented in Table 2.3-5 (CDM, Volume I, 1989). Based on this evaluation, Site 16 was eliminated from the list of alternatives because there were more disadvantages than advantages in constructing a facility at this site. The other four sites were retained for evaluation in the Phase II screening.

### 2.3.2 Phase II Screening

The four sites identified from the Phase I screening (Sites 1A, 4A, 7/8, 14/36) plus one more site not previously considered in Phase I (Site 47), were reviewed in a more detailed screening process in Phase II. Site 47 was not initially considered as a candidate WWTP site in Phase I because the suitability factor of surrounding land use and zoning was misapplied with regard to Site 47. Site 47, which should have been rated "most suitable" for a WWTP (as it was for a solids disposal facility) was mistakenly rated "least suitable". When this error came to the attention of the regulatory agencies and the City, Site 47 was added to the list of alternatives for further consideration.

Phase II screening was conducted using a process called constraint mapping. This screening evaluated the potential for development of a site using maps to identify physical/environmental, regulatory, and legal constraints (see Table 2.3-6). From this information, it was possible to determine whether a site had suitable land to accommodate a secondary wastewater treatment plant (CDM, Volume II, 1989). In addition, this constraint mapping identified physical and environmental features that would limit the construction and operation of the plant.

Features that could not feasibly be relocated, such as flood hazard zones, surface water bodies, and wetlands, were identified at each of the five sites in order to determine any constraints they might cause. Land parcel boundaries, ownership, topography and existing structures were also identified and mapped. Constraint areas were then excluded from the total usable acreage of each site, and a diagram of the optimum WWTP layout was compared to the remaining area on the map.

As a result of the constraint mapping exercise, two sites, 7/8 and 14/36, were eliminated because the physical facility layouts would not function well for both construction and operation/ maintenance. At Site 7/8, the facility would have impinged on the railroad easement through the site, coastal wetlands and existing property uses. Site 14/36 would have impinged

**TABLE 2.3-4**
**CRITERIA AND SCREENING ELEMENTS APPLIED TO THE FIVE "MOST SUITABLE" SITES[1] IN PHASE I/SCREEN 2**

<u>Geology, Soils & Topography</u>
- Geologic features
- Depth to bedrock
- Soil/subsurface conditions
- Slope constraints and erosion potential

<u>Drainage</u>

<u>Flooding</u>

<u>Groundwater Hydrology</u>
- Potential impact to groundwater quality/quantity
- Depth to water table

<u>Surface Water</u>
- Proximity to surface water bodies
- Water quantity classification

<u>Land Use</u>
- Onsite land use
- Adjacent land use
- Generalized (surrounding) land use

<u>Zoning</u>
- Site zoning
- Surrounding zoning

<u>Regulatory Requirements</u>

<u>Noise</u>
- Distance to sensitive receptors
- Existing noise levels
- Noise mitigation potential

<u>Odors</u>

<u>Wetlands</u>

<u>Terrestrial Habitat</u>

<u>Marine Habitat</u>

<u>Historic Sites and Districts/Archaeological Areas</u>

<u>Aesthetics</u>

<u>Traffic</u>
- Routes through residential neighborhoods
- Increase in traffic and delays caused by trucks
- Site accessibility

<u>Engineering Feasibility</u>
- Hydraulic compatibility
- Effluent pipe length
- Energy consumption
- Expansion/buffer potential

<u>Incineration</u>
- Air quality impacts
- FAA restrictions

<u>Hazardous Waste</u>

1. Sites 1A, 4A, 7/8, 14/36 and 16.

Adapted from: CDM, Volume I, 1989.

**TABLE 2.3-5**
**EVALUATION OF PHASE I/SCREEN 2 SITES**

| Site | Major Advantages | Major Disadvantages |
|---|---|---|
| 1A | Includes existing WWTP site; most compatible with existing wastewater collection system<br><br>Surrounded on 3 sides by water<br><br>Potential for using additional portions of Fort Rodman area for buffering or additional treatment, flexibility | Contains Fort Taber Historic District<br><br>Deed restrictions on adjacent education land<br><br>Potential impacts to adjacent residential areas, depending treatment, flexibility upon final site layout and configuration within Fort Rodman area. |
| 4A | Large vacant area, industrially zoned<br><br>Compatible with existing waste-water collection system<br><br>Potential for use of adjacent mill buildings as additional buffer from residential areas<br><br>Flexibility for WWTP layout: some administrative uses, storage, or maintenance uses, could be accommodated by mill buildings located to the south of the site<br><br>Very good access<br><br>Preservation of adjacent harbor area for marine industrial use | Site abuts a few houses and small businesses<br><br>Potential impacts to residential areas, even though separated from site by JFK Highway<br><br>Occupies some land currently used for recreational activities<br><br>Radio tower on site |
| 7/8 | Large area industrially zoned<br><br>Very good access | Would dislocate existing marine-related businesses<br><br>Would disrupt lease arrangements with Harbor Development Commission |

**TABLE 2.3-5 (CONTINUED)**
**EVALUATION OF PHASE I/SCREEN 2 SITES**

| Site | Major Advantages | Major Disadvantages |
|---|---|---|
| | Compatible with existing waste-water collection system | Existing active rail lines through the site would require settlement with railroad |
| 14/36 | Largely undeveloped and most compatible with surrounding land uses compared to other sites | Incompatible with existing wastewater collection system |
| | Potential for using adjacent areas for buffering and/or additional treatment, flexibility | Need for wetland filling |
| | | Displacement of salvage yard on Site 36 |
| | More opportunity for wetland replication than Site 16 | If both parcels used, site would be split by Shawmut Avenue |
| 16 | Vacant and industrially zoned | Need for wetland filling |
| | Buffered from adjacent residential areas to east and west by abutting commercial/industrial establishments and highway | Access road required |
| | | Little opportunity for securing vacant land for buffering or additional treatment, minimal flexibility |
| | | More residential land uses within 1/2 mile than the other sites, but buffered by commercial/industrial uses |
| | | Incompatible with existing wastewater collection system |
| | | Access to site is off heavily used Nash Road and requires construction through wetland |

Adapted from: CDM, Volume I, 1989.

**TABLE 2.3-6**
**CONSTRAINT FACTORS MAPPED IN PHASE II SCREENING**

| | |
|---|---|
| Property Boundaries | - Determined from the City assessor's plat and lot maps and records |
| Deed Restrictions | - Related to educational, Army, railroad and industrial uses |
| Easements | - Water, sewer, power line and conservation |
| Zoning Requirements | - District, setbacks, height and coverage |
| Floodplains | - A-Zone (100-year floodplain based on storm surge evaluation) |
| | - V-Zone (coastal high hazard area subject to the 100-year flood and having additional hazards due to wave action) |
| Wetlands | - Coastal or vegetative wetlands, not including areas subject to flooding, in order to avoid overlap of floodplains and wetlands |
| Surface Water Resources | - Rivers, streams and ponds |
| Existing Land Use | - Residential, commercial, industrial, recreational, municipal or vacant |
| Sensitive Features | - Unique features that affect each particular site, such as historic resources, recreation facilities, and railway lines |

Adapted from: CDM, Volume II, 1989.

extensively on 12 acres of vegetated wetlands, the floodplain and existing commercial uses. The three remaining sites to be evaluated are 1A, 4A, and 47.

At this point, the decision was made to no longer consider split facilities as alternatives for evaluation in the Phase II screening. Two separate plants would not be cost effective because they would require the duplication of personnel and equipment. The three remaining candidate sites are large enough to accommodate a consolidated facility.

### 2.3.3 Elimination of Site 47

Locating a WWTP at Site 47 would require extensive construction of a complex conveyance system, not required for Sites 1A and 4A. The conveyance system would include new influent and effluent pipe lines and special connection structures and pumping facilities which would decrease the site's overall reliability and cause serious disruption to the community during construction. It was also determined that the environmental impacts associated with the conveyance system and access to the site would have significant impacts on the surrounding area. Excessive costs, estimated to be nearly $100 million (CDM, Volume II, 1989) higher than the other sites, would also be incurred by using Site 47 for the WWTP.

After a re-evaluation of the Phase II Screening analysis, EPA concluded that Site 47 should be eliminated from further analysis in this Draft EIS as a potential site for locating the WWTP. This conclusion was based on engineering, environmental, and cost considerations. Initially, EPA was hesitant to eliminate Site 47 due to public concern over preserving New Bedford's waterfront and the apparent desire to carry an inland site. Once the siting studies were completed, however, it became clear that Site 47 was not a "reasonable" alternative (NEPA Section 1502.14) for the City of New Bedford, either technically or economically.

### 2.3.4 Description of Alternative Sites

This section describes the two alternative sites, Sites 1A and 4A, (Figure 2.3-2), considered suitable for constructing the wastewater treatment plant.

**2.3.4.1 Site 1A.** Site 1A (Figure 2.3-3) is an area of approximately 80 acres, bounded by South Rodney French Boulevard to the north and Clarks Point to the south. The existing WWTP occupies approximately ten percent of this site. The northern section of the site is occupied by the U.S. Army including a truck storage area, ancillary storage buildings, and U.S. Army administrative buildings. Some of the site is City-owned recreational land that currently serves as a buffer between the

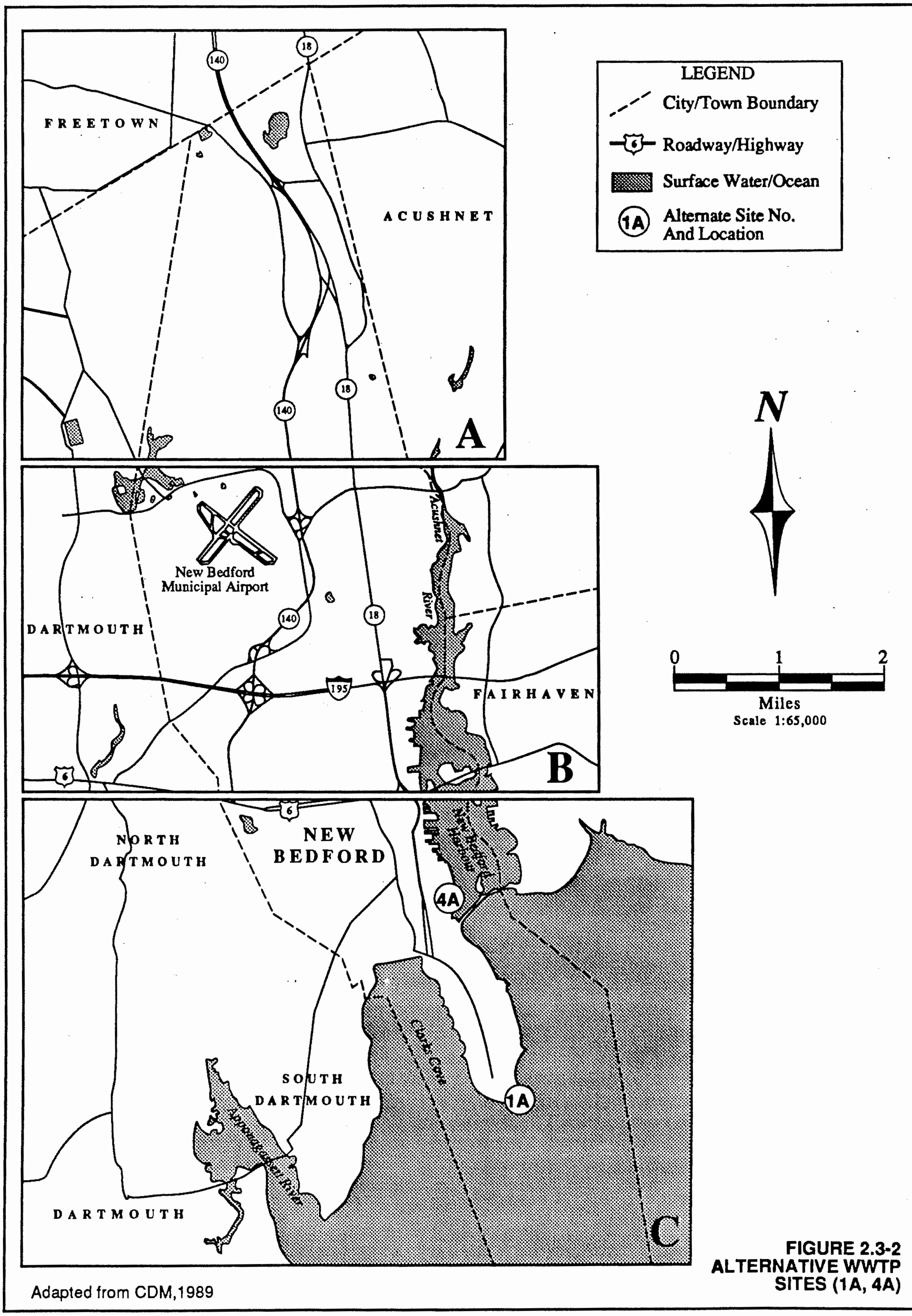



**FIGURE 2.3-2**
**ALTERNATIVE WWTP SITES (1A, 4A)**

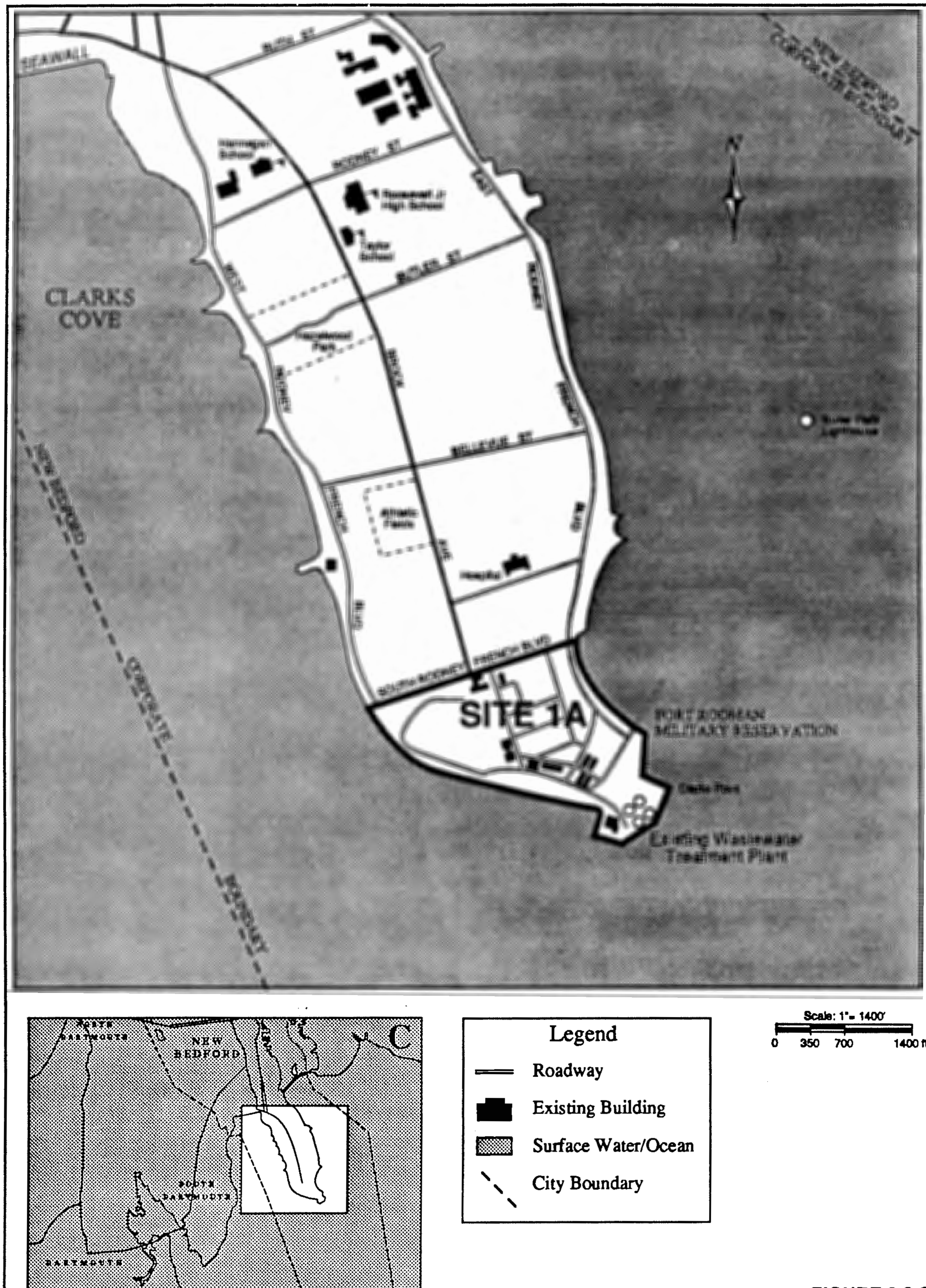
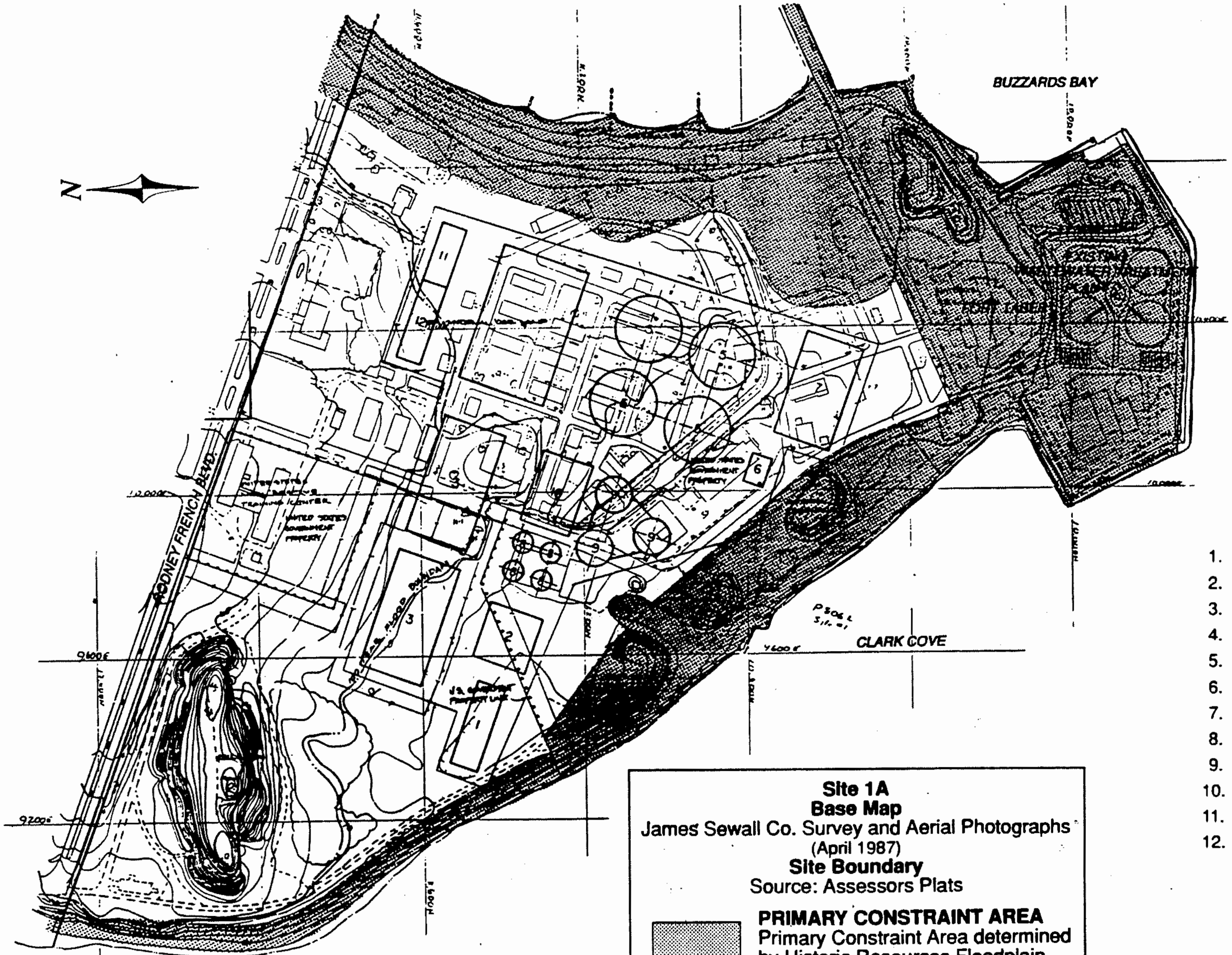



**FIGURE 2.3-3**
**LOCATION OF**
**ALTERNATIVE SITE 1A**

Adapted from CDM, 1989

existing primary WWTP and the residential area to the north. The land immediately adjacent to Site 1A is occupied by three vacant houses, a yacht club, and four Sea Lab buildings to the north, a soccer field to the northwest, and Fort Taber Historic District to the southeast and southwest. The "footprint" of the proposed WWTP on Site 1A is shown on Figure 2.3-4.

**2.3.4.2 Site 4A.** Site 4A occupies an area of approximately 39 acres (Figures 2.3-5 and 2.3-6) bounded by the Acushnet River on the east, with a fish processing company to the north, Gifford Street to the south, and Front Street (not including the existing buildings on Front Street) to the west. Approximately half of the site is vacant, while the rest is occupied by the Standard-Times Field, consisting of recreational fields, and an area used by dirt bikes, and the New Bedford Radio Inc. (a small building and radio transmitter/antenna in the northwest corner). Adjacent to the site on the south are a parking lot and several commercial businesses. The area to the north is used for fish processing and other industrial purposes, with an athletic club, some residences, the United Social Club, and more small businesses located to the west. The "footprint" of the proposed WWTP on Site 4A is shown on Figure 2.3-6.




**Site 1A**
**Base Map**
James Sewall Co. Survey and Aerial Photographs
(April 1987)
**Site Boundary**
Source: Assessors Plats

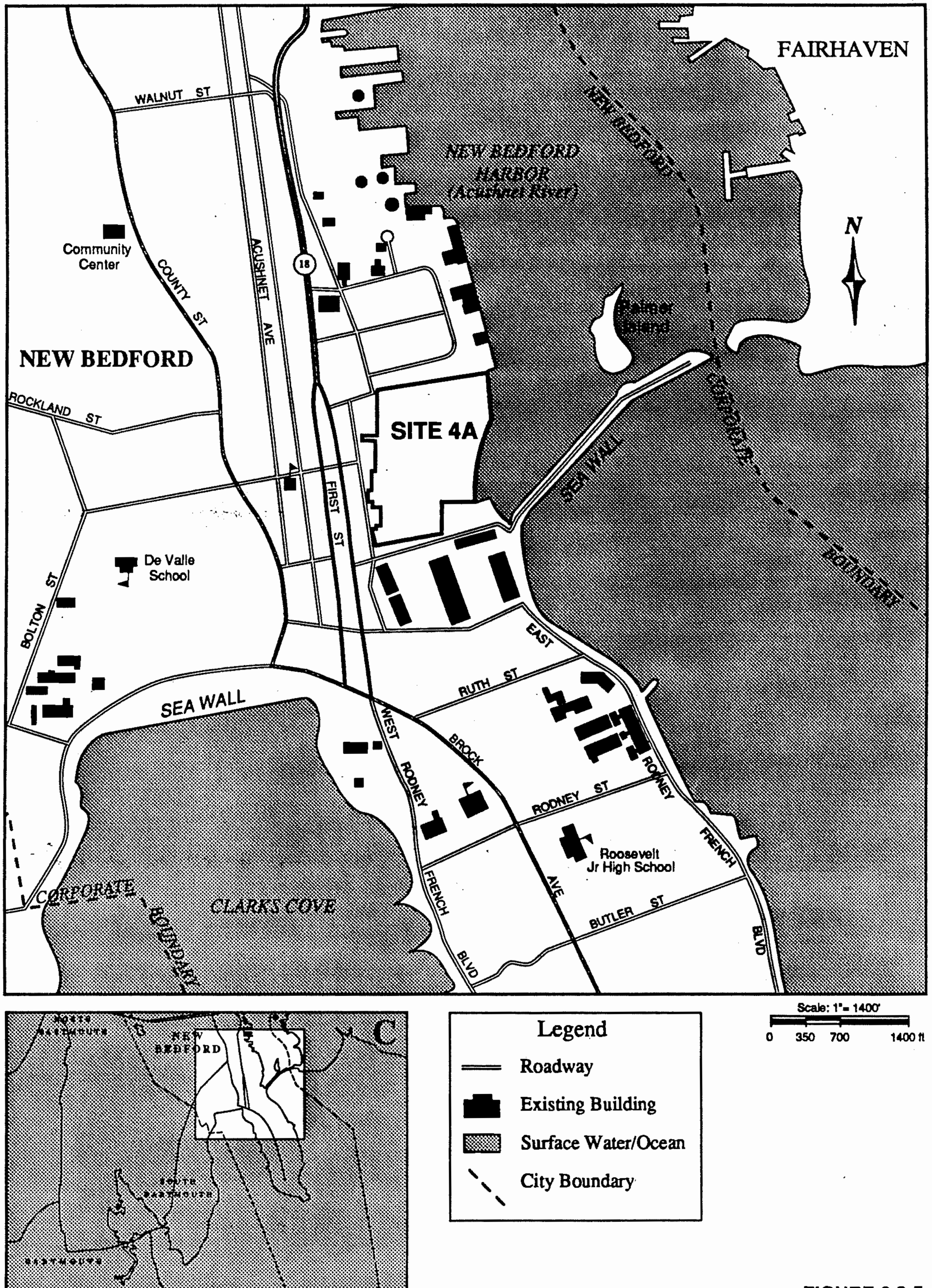
**PRIMARY CONSTRAINT AREA**
Primary Constraint Area determined by Historic Resources Floodplain (V-Zone), Wetlands

**KEY**

1. HEADWORKS BUILDING
2. GRIT REMOVAL
3. PRIMARY SEDIMENTATION
4. AERATION TANKS
5. SECONDARY CLARIFIER
6. SODIUM HYPOCHLORITE BUILDING
7. CHLORINE CONTACT TANKS
8. GRAVITY THICKENER
9. ANAEROBIC DIGESTER
10. SLUDGE PROCESSING BUILDING
11. ADMINISTRATION BUILDING
12. MAINTENANCE BUILDING

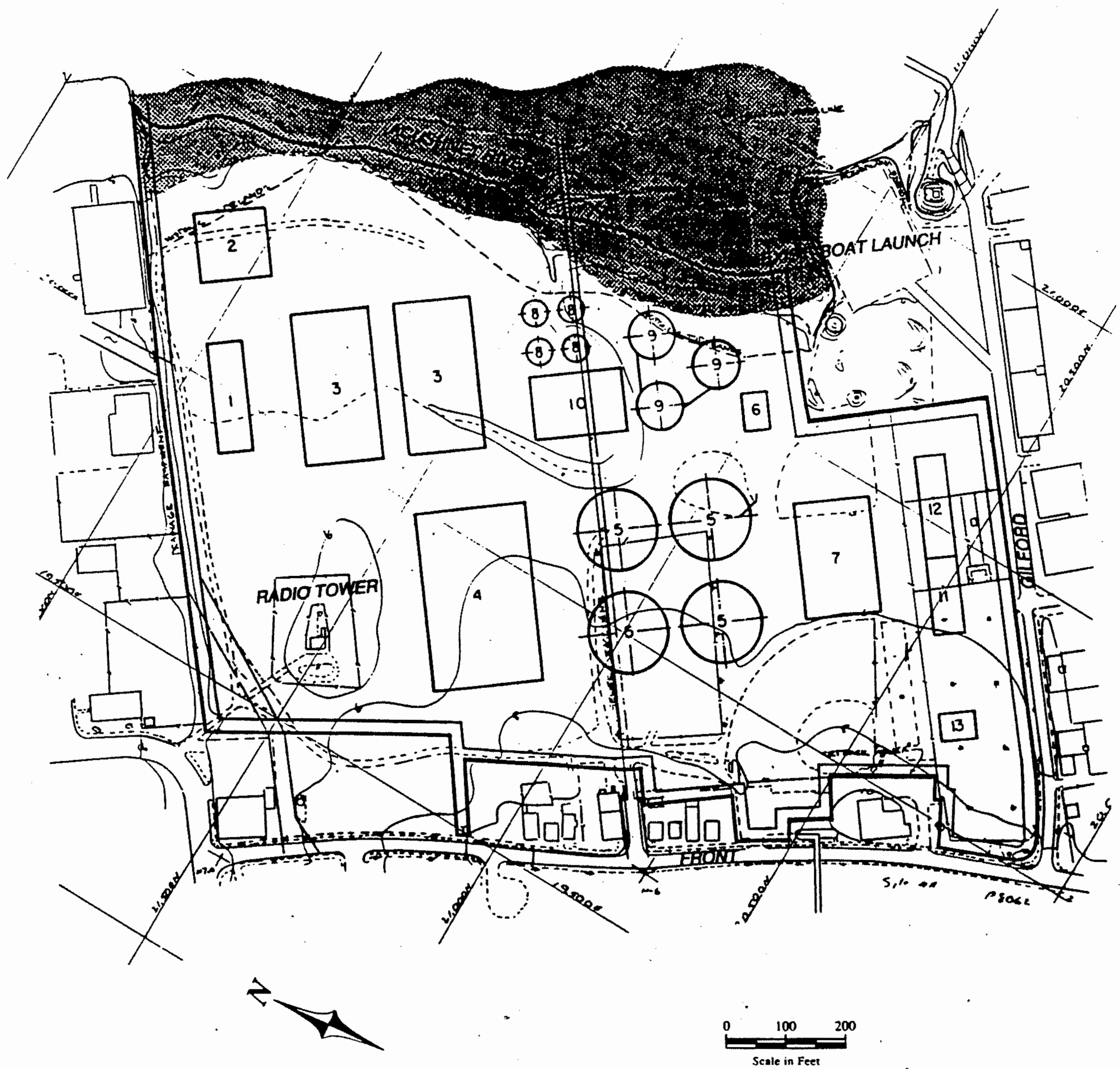
**FIGURE 2.3-4**
**PROPOSED WWTP FOOTPRINT FOR ALTERNATIVE SITE 1A**

Adapted from CDM, 1989




Adapted from CDM, 1989

**FIGURE 2.3-5**
**LOCATION OF**
**ALTERNATIVE SITE 4A**




**KEY**

1. HEADWORKS BUILDING
2. GRIT REMOVAL
3. PRIMARY SEDIMENTATION
4. AERATION TANKS
5. SECONDARY CLARIFIER
6. SODIUM HYPOCHLORITE BUILDING
7. CHLORINE CONTACT TANKS
8. GRAVITY THICKENER
9. ANAEROBIC DIGESTER
10. SLUDGE PROCESSING BUILDING
11. ADMINISTRATION BUILDING
12. MAINTENANCE BUILDING
13. EFFLUENT PUMPING STATION

**Site 4A**
**Base Map**
James Sewall Co. Survey
**Site Boundary**
Source: Assessors Plats

**PRIMARY CONSTRAINT AREA**
Primary Constraint Area determined by Wetlands (Coastal Bank, Coastal Beach areas)

**FIGURE 2.3-6**
**PROPOSED WWTP FOOTPRINT FOR ALTERNATIVE SITE 4A**

Adapted from CDM, 1989

# CHAPTER THREE

# IDENTIFICATION OF SLUDGE PROCESSING AND DISPOSAL ALTERNATIVES

The evaluation and selection of sludge processing and disposal alternatives involved the following steps:

- o determination of the sludge quantity and quality;
- o development of the sludge process configuration; and
- o determination of the disposal site for the sludge or sludge product.

The evaluation of the quantity and quality of sludge to be produced by the proposed WWTP required a detailed analysis of the existing and projected solids removed by the WWTP as described in Section 3.1.

Development of the sludge process configuration is addressed in Section 3.2. This evaluation involved two screening analyses of the available treatment and disposal technologies. The remaining processes were then arranged into potential sludge process configurations and evaluated on a cost-effectiveness basis.

The location of the proposed sludge disposal site involved the identification of existing and proposed landfills and incinerators in and around New Bedford, and potential sites within the City boundary. These sites were investigated and evaluated in two screening analyses, as described in Section 3.3.

## 3.1 SLUDGE CHARACTERIZATION

The purpose of this section is to characterize the quantity and quality of the primary and secondary or Waste Activated Sludge (WAS) that will be produced at the new WWTP in New Bedford.

### 3.1.1 Sludge Quantity

Wastewater treatment plant residuals include grit, scum and skimmings, primary sludge, and secondary sludge. Estimates of the average day and maximum month residuals quantities for 1994 and 2014 are presented in Table 3.1-1. Only those residuals generated under dry and wet weather conditions up to 75 mgd are considered in this section. A separate facilities plan will address residuals from potential CSO control facilities.

The existing wastewater treatment facility currently removes approximately 5.5 cubic feet (cf) of grit per million gallons of influent wastewater during dry and wet weather conditions.

TABLE 3.1-1
ESTIMATED RESIDUALS QUANTITIES

| | INITIAL YEAR 1994 | DESIGN YEAR 2014 |
|---|---|---|
| WWTP Influent Flow (mgd) | | |
| Average | 26.9 | 30.0 |
| Maximum Month | 35.4 | 38.5 |
| Grit (cf/day) | | |
| Average Day | 149 | 167 |
| Maximum Month | 196 | 214 |
| Screenings (cf/day) | | |
| Average | 135 | 150 |
| Maximum Month | 177 | 193 |
| Skimmings (lb/day)[1] | 1,620 | 1,800 |
| Primary Sludge (lb/day)[1,2] | | |
| Dry Weather | | |
| Average | 27,600 | 37,100 |
| Maximum Month | 44,100 | 59,300 |
| Maximum 3-Day | 62,100 | 83,500 |
| Wet Weather | 32,900 | 32,900 |
| Secondary Sludge (lb/day)[1,2] | | |
| Dry Weather | | |
| Average | 16,400 | 21,000 |
| Maximum Month | 29,400 | 37,250 |
| Maximum 3-Day | 36,900 | 47,250 |
| Wet Weather | 28,800 | 28,800 |
| Total (Sludge and Skimmings, lb/day)[1,2] | | |
| Dry Weather | | |
| Average | 45,620 | 59,900 |
| Maximum Month | 75,120 | 98,350 |
| Maximum 3-Day | 100,620 | 132,550 |
| Wet Weather | 61,700 | 61,700 |

[1] Pounds of dry solids per day.
[2] Includes 10% allowance for side stream loadings.

Note: Wet weather sludge quantities are estimated based on the plant's maximum influent capacity of 75 mgd.

Adapted from: CDM, Volume III, 1989.

number is not expected to increase. Screenings are currently removed at about 0.1 to 0.5 cf per million gallons of influent wastewater, during both dry and wet weather conditions. The new facility is expected to be more efficient, removing about 4 to 5 cf of screenings per million gallons of wastewater (CDM, Volume III, 1989). The combined sludge will then be treated and disposed of, as described in Section 3.2. Scum and skimmings will be pumped to sludge storage tanks and combined with the primary sludge for solids processing. The amount of scum and skimmings expected at the new WWTP is insignificant when compared to the total amount of primary and secondary sludge being processed.

Estimates of primary sludge quantities for average and maximum month wastewater influent loadings were made based on current conditions at the existing WWTP. Average and maximum month estimates of secondary sludge quantities were made based on current influent characteristics and the difference between the diffused air activated sludge process and the projected quality of the secondary effluent (CDM, Volume III, 1989). Maximum 3-day sludge quantities were also calculated.

### 3.1.2 Sludge Quality

The quality of residuals is important because it may put restrictions on the ultimate method of reuse or disposal of WWTP solids. The Massachusetts Department of Environmental Protection (DEP) classifies sludges as Type I, II, or III, depending on the concentrations of heavy metals and other constituents. Type I sludges can be used as a low grade fertilizer or soil conditioner without special permitting. However, there are restrictions on the land application of Type II and III sludges which limit reuse options.

Several sources were used to estimate the projected sludge quality of the combined primary and secondary sludge. These included an Industrial Pretreatment Program study, sludge sample analyses, Phase I primary sludge and wastewater sampling analyses, Phase II primary sludge sampling and PCB pilot plant analyses, and typical removal efficiencies for metals and other chemicals (CDM, Volume III, 1989).

Historical data, collected from the existing plant in the fall of 1982 as part of the Industrial Pretreatment Program (IPP) study, indicated that the sludge would have been considered Type III by today's standards. The sludge was rated as Type III because of the high concentrations of copper, nickel, and cadmium. However, the existing primary clarifiers do not always meet design standards; therefore, the concentrations of metals in the sludge may not be representative of future sludge quality. A study on the effect of the pretreatment program on nonconventional pollutants has shown some apparent reduction in chromium, copper and zinc over the last year and a half; however, the full impact of the program cannot be estimated with any certainty at this time (CDM, Volume III, 1989).

The analyses completed as part of Phase I facilities planning in 1987 also indicated that primary sludge would be classified as Type III due to the high concentrations of the metals copper, chromium, nickel, and molybdenum. In addition, detectable, and sometimes high, concentrations of antimony, cadmium, selenium, and molybdenum were consistently reported in the sludge, but not in the influent wastewater (CDM, Volume III, 1989).

Results of the Phase II primary sludge sampling round indicated that primary sludge exceeds Type II criteria for copper, molybdenum, nickel, and PCBs. The PCB pilot plant study also revealed that WAS exceeds Type II criteria for copper and nickel (barium, boron, cyanide, and molybdenum were not included in the pilot plant sludge analysis). An EP toxicity test was also performed during this phase in order to determine if the primary sludge was a hazardous waste. During this test, sludge was prepared in the laboratory and kept in an acidic environment (pH 5), mimicking typical landfill conditions. Concentrations of various metals which leach out of the prepared sludge solution were then measured to determine the toxicity of the sludge. EP toxicity tests revealed that the primary sludge is not a hazardous waste (CDM, Volume III, 1989). Nutrient testing has shown that the nutrient content of primary sludge is within the qualification range of a low grade fertilizer.

Because the existing primary treatment plant in New Bedford has consistently experienced operation and maintenance problems, the sludge sampling results are not considered to be representative of future sludge quality. The influent wastewater sampling data was considered to be the most reliable basis for estimating the sludge quality of the proposed secondary treatment facility. The predicted sludge qualities were based on estimated removals of nonconventional pollutants reported in published literature and are presented in Tables 3.1-2 and 3.1-3 for the initial year (1994) and the design year (2014), respectively. The quality was based on dry weather flow because wet weather flow concentrations would be lower due to dilution. Estimates of sludge quality for both years showed concentrations of molybdenum exceeding Type II limits (CDM, Volume III, 1989). Further, wastewater entering the proposed facility will include wastewater discharged by local industries. Based on the uncertainty of the industrial pretreatment program effectiveness and the above sludge quality analysis results, solids processing and disposal siting evaluations will conservatively assume that the sludge could have a Type III classification.

**TABLE 3.1-2**
**INITIAL YEAR (1994) SLUDGE QUALITY AT DRY WEATHER AVERAGE LOAD**

| Constituent | Infl. Load (lb/day) | Primary Removal % | Primary Sludge Metals (lb/day) | Primary Sludge Metals Conc. (mg/kg) | Combined Sludge Pri.& Sec. Removal % | Pri.& Sec. Sludge Metals Conc. (mg/kg) | Type II Sludge Metals Conc. (mg/kg) |
|---|---|---|---|---|---|---|---|
| Antimony | 1.17 | 30 | 0.35 | 12.72 | 60 | 15.95 | -- |
| Arsenic | 0.53 | 25 | 0.13 | 4.80 | 50 | 6.02 | -- |
| Beryllium | 1.86 | NA | -- | -- | 50 | 21.14 | -- |
| Boron | 62.02 | 2 | 1.24 | 44.94 | 5 | 70.48 | 300 |
| Cadmium | 0.42 | 15 | 0.06 | 2.28 | 50 | 4.77 | 25 |
| Chromium | 21.18 | 40 | 8.47 | 306.96 | 76 | 365.84 | 1000 |
| Copper | 32.03 | 35 | 11.21 | 406.18 | 82 | 596.92 | 1000 |
| Cyanide | 1.98 | 10 | 0.20 | 7.17 | 60 | 27.00 | -- |

| | |
|---|---|
| Primary Sludge | 27,600 lb/day |
| Second Sludge | 16,400 lb/day |
| Total Sludge | 44,000 lb/day |

** - Exceeds Type II criteria.

**TABLE 3.1-2 (CONTINUED)**
**INITIAL YEAR (1994) SLUDGE QUALITY AT DRY WEATHER AVERAGE LOAD**

| Constituent | Infl. Load (lb/day) | Primary Removal % | Primary Sludge Metals (lb/day) | Primary Sludge Metals Conc. (mg/kg) | Combined Sludge Pri.& Sec. Removal % | Pri.& Sec. Sludge Metals Conc. (mg/kg) | Type II Sludge Metals Conc. (mg/kg) |
|---|---|---|---|---|---|---|---|
| Lead | 6.95 | 46 | 3.20 | 115.83 | 57 | 90.03 | 1000 |
| Mercury | 0.10 | 22 | 0.02 | 0.80 | 75 | 1.70 | 10 |
| Molybdenum | 4.55 | 10 | 0.46 | 16.49** | 50 | 51.70** | 10 |
| Nickel | 16.83 | 15 | 2.52 | 91.47 | 32 | 122.40 | 200 |
| Selenium | 0.95 | 10 | 0.10 | 3.44 | 50 | 10.80 | -- |
| Silver | 1.99 | 30 | 0.60 | 21.63 | 90 | 40.70 | -- |
| Thallium | 0.93 | NA | -- | -- | 67 | 14.16 | -- |
| Zinc | 47.39 | 40 | 18.96 | 686.81 | 76 | 818.55 | 2500 |
| PCB's | 0.14 | 50 | 0.07 | 2.54 | 90 | 2.86 | 10 |

Primary Sludge 27,600 lb/day
Second Sludge 16,400 lb/day
Total Sludge 44,000 lb/day

** - Exceeds Type II criteria.

Adapted from: CDM, Volume III, 1989.

## TABLE 3.1-3
## DESIGN YEAR (2014) SLUDGE QUALITY AT DRY WEATHER AVERAGE LOAD

| Constituent | Infl. Load (lb/day) | Primary Removal % | Primary Sludge Metals (lb/day) | Primary Sludge Metals Conc. (mg/kg) | Combined Pri.& Sec. Removal % | Combined Pri.& Sec. Sludge Metals Conc. (mg/kg) | Type II Sludge Metals Conc. (mg/kg) |
|---|---|---|---|---|---|---|---|
| Antimony | 1.51 | 30 | 0.45 | 12.21 | 60 | 15.59 | -- |
| Arsenic | 0.68 | 25 | 0.17 | 4.58 | 50 | 5.85 | -- |
| Beryllium | 2.40 | NA | -- | -- | 50 | 20.65 | -- |
| Boron | 79.87 | 2 | 1.60 | 43.06 | 5 | 68.73 | 300 |
| Cadmium | 0.54 | 15 | 0.08 | 2.18 | 50 | 4.65 | 25 |
| Chromium | 27.27 | 40 | 10.91 | 294.02 | 76 | 356.72 | 1000 |
| Copper | 41.25 | 35 | 14.44 | 389.15 | 82 | 582.19 | 1000 |
| Cyanide | 2.55 | 10 | 0.26 | 6.87 | 60 | 26.33 | -- |

Primary Sludge 37,100 lb/day
Second Sludge 21,000 lb/day
Total Sludge 58,100 lb/day

** - Exceeds Type II criteria.

**TABLE 3.1-3 (CONTINUED)**
**DESIGN YEAR (2014) SLUDGE QUALITY AT DRY WEATHER AVERAGE LOAD**

| Constituent | Infl. Load (lb/day) | Primary Removal % | Primary Sludge Metals (lb/day) | Primary Sludge Metals Conc. (mg/kg) | Combined Pri.& Sec. Removal % | Combined Pri.& Sec. Sludge Metals Conc. (mg/kg) | Type II Sludge Metals Conc. (mg/kg) |
|---|---|---|---|---|---|---|---|
| Lead | 8.95 | 46 | 4.12 | 110.97 | 57 | 87.81 | 1000 |
| Mercury | 0.13 | 22 | 0.03 | 0.77 | 75 | 1.68 | 10 |
| Molybdenum | 5.86 | 10 | 0.59 | 15.80** | 50 | 50.43** | 10 |
| Nickel | 21.67 | 15 | 3.25 | 87.61 | 32 | 119.35 | 200 |
| Selenium | 1.22 | 10 | 0.12 | 3.29 | 50 | 10.50 | -- |
| Silver | 2.56 | 30 | 0.77 | 20.70 | 90 | 39.66 | -- |
| Thallium | 1.20 | NA | -- | -- | 67 | 13.84 | -- |
| Zinc | 61.03 | 40 | 24.41 | 658.01 | 76 | 798.33 | 2500 |
| PCB's | 0.18 | 50 | 0.09 | 2.43 | 90 | 2.79 | 10 |

Primary Sludge 37,100 lb/day
Second Sludge 21,000 lb/day
Total Sludge 58,100 lb/day

** - Exceeds Type II criteria.

Adapted from: CDM, Volume III, 1989.

## 3.2 SLUDGE PROCESSING AND DISPOSAL ALTERNATIVES

This section presents the technologies considered for the processing and disposal of primary and waste-activated sludges (WAS) produced by the New Bedford WWTP. The relatively small amount of scum and skimmings produced by the facility will be mixed with the primary sludge prior to the thickening process. The solids processing techniques evaluated are a function of the size and location of the wastewater treatment plant, the technologies used to treat the wastewater, and the ultimate method of disposal selected. The evaluation of alternatives was conducted using three successive screening steps as described below.

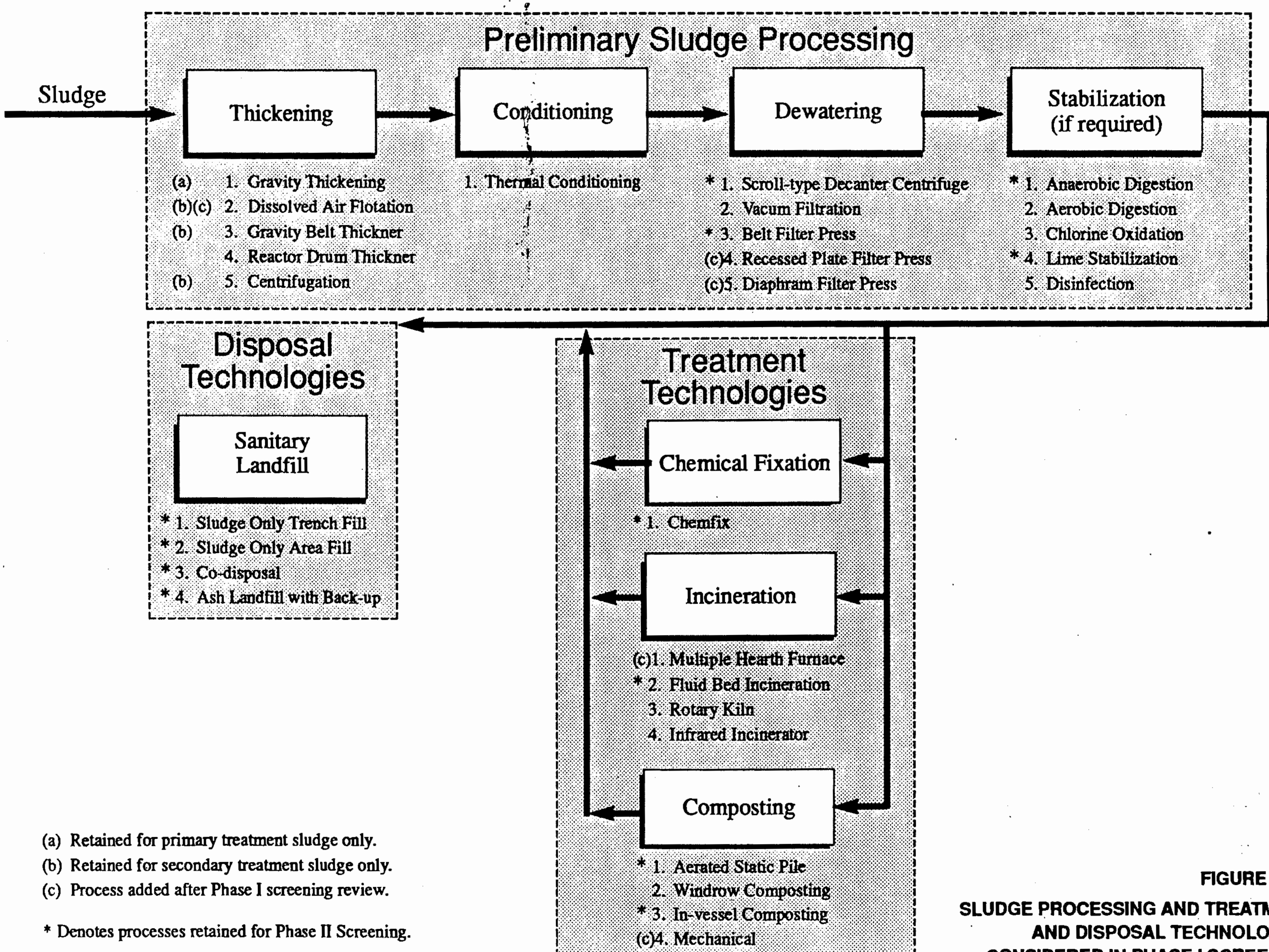
### 3.2.1 Phase I Screening

The intent of the Phase I screening was to identify potential solids processing technologies and disposal alternatives for New Bedford, and to eliminate those technologies and disposal methods that were clearly not compatible with the proposed WWTP. The technological alternatives considered in Phase I are shown in Figure 3.2-1.

The categories of Phase I screening criteria included: sludge characteristics, equipment space requirements, and an advantages/disadvantages comparison. With the exception of incineration technologies, the screening process did not include cost comparisons. The intent was only to eliminate the processes and disposal methods that were clearly unsuitable for a new secondary WWTP (CDM, Volume III, 1989). The screening criteria of solids treatment technologies and disposal options are described in Appendix Table B-1.

**3.2.1.1 Preliminary Processing Technologies** The purpose of processing sludge is to extract water from the solids and possibly alter its characteristics, thereby making the sludge more manageable for subsequent treatment or disposal. Combinations of physical, chemical, and biological processes are employed in handling sludges. The preliminary processing of sludge involves four steps: thickening, conditioning, dewatering, and stabilization.

Sludge thickening reduces the volume of sludge to be further processed; conditioning enhances dewatering, minimizes odors, and disinfects wastewater solids through biological, chemical, and/or physical treatment; dewatering removes water from the sludge to achieve a volume reduction greater than that achieved by thickening; and sludge stabilization reduces the volatile solids (those that evaporate easily) and odors in the sludge, thus reducing the number of organisms (pathogens) in the sludge that are capable of producing disease. Often no stabilization




(a) Retained for primary treatment sludge only.
(b) Retained for secondary treatment sludge only.
(c) Process added after Phase I screening review.

* Denotes processes retained for Phase II Screening.

**FIGURE 3.2-1**
**SLUDGE PROCESSING AND TREATMENT AND DISPOSAL TECHNOLOGIES CONSIDERED IN PHASE I SCREENING**

procedure is employed if, for example, a sludge is to be incinerated.

The processes retained for Phase II screening are noted by an asterisk on Figure 3.2-1. The gravity thickening process was retained for primary treatment sludge only, while the other three thickening processes retained apply only to secondary treatment sludge. The processes eliminated during Phase I screening and the reasons for their elimination are presented in Appendix Table B-2.

**3.2.1.2 Solids Treatment and Disposal Technologies.** Potential solids treatment technologies, which can reduce the volume or stabilize the sludge prior to disposal, include chemical fixation, incineration, and composting.

The chemical fixation process mixes dewatered sludge with chemicals to produce a mixture that behaves more like a solid and is less likely to leach when landfilled. In addition, the sludge is stabilized so that it will not decompose. The Phase I screening involved an investigation of the patented CHEMFIX process developed by Chem-Fix Technologies, Inc. This treatment is currently employed by the South Essex Sewerage District (SESD) for treating dewatered primary sludge cake prior to disposal.

Incineration involves the combustion of dried sewage sludge to produce ash, thereby reducing the ultimate landfill capacity required for disposal. Four incinerator technologies were evaluated during the Phase I screening analysis (Figure 3.2-1), of which only fluidized bed incineration was retained for the Phase II screening.

The composting of sewage sludge results in biological degradation of sludge into a stable humus-like material producing a good soil conditioner. Three composting technologies were considered for New Bedford: aerated static pile, windrows, and in-vessel composting (Figure 3.2-1).

Three methods of landfilling sludge and one method of landfilling ash were considered in Phase I (Figure 3.2-1). Sludge-only landfilling involves the disposal of dewatered sludge into a trench which is immediately covered with excavated soil. Area filling, in contrast, requires mixing sludge with soil. The soil serves as a bulking agent and increases the load-bearing capacity of the sludge, allowing heavy equipment travel during subsequent operations. Co-disposal refers to the landfilling of sludge with refuse. During co-disposal, a layer of sludge is spread over a compacted layer of refuse and allowed to dry for approximately one hour, then it is covered with another layer of refuse. Ash landfilling involves the land disposal of incinerated solids; it requires the ash to be mixed with either a bonding agent or soil, to reduce dust and odor problems.

To fully evaluate the alternatives for sludge disposal, estimates of land requirements for the following options were developed for use as screening criteria in Phase I:

- o landfill with 20-year life
- o back-up landfill with a 2 to 5 year life
- o ash landfill for sludge resulting from incineration

As stated earlier, additional criteria was used to evaluate the disposal options, as detailed in Appendix Table B-1.

The technologies retained for Phase II screening are denoted in Figure 3.2-1; the technologies eliminated and their reasons for elimination are presented in Appendix Table B-2.

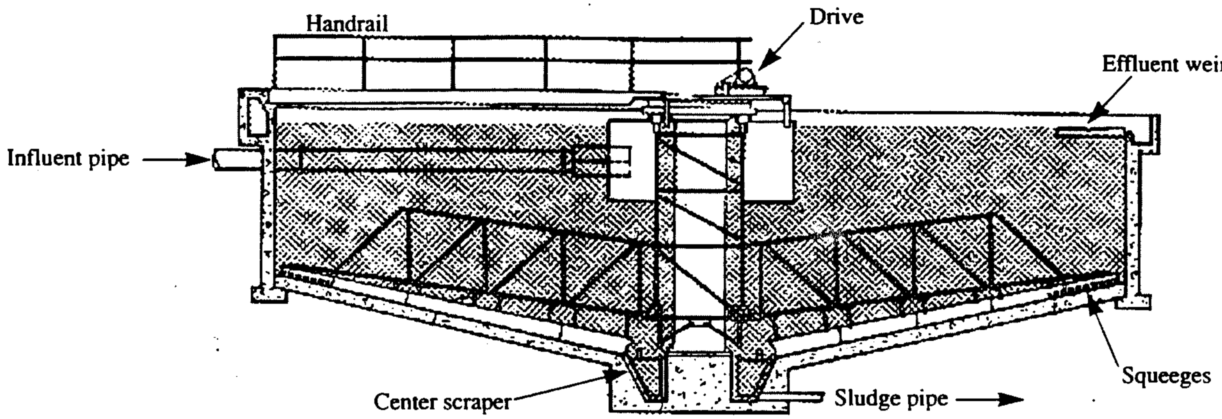
### 3.2.2 Phase II Screening

Phase II screening consisted of a detailed evaluation of the technologies which were retained after Phase I screening. In the Phase II screening, technologies were evaluated in greater detail than Phase I using technical, environmental, institutional criteria (see Appendix Table B-1), and cost criteria.

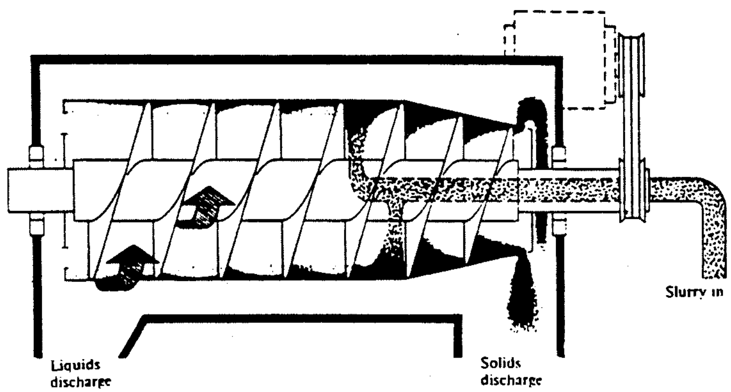
**3.2.2.1 Preliminary Processing Technologies** There are two types of sludge to be thickened: primary sludge, which constitutes the heavier solids in the sludge matrix, and secondary or waste activated sludge (WAS) which constitutes the lighter solids. The only primary sludge thickening process evaluated under Phase II was gravity thickening. Secondary sludge thickening processes evaluated under Phase II included gravity belt, centrifuge, and dissolved air flotation (see Figure 3.2-2).

Gravity thickening of primary sludge is used in many wastewater treatment facilities and has proven to be reliable, effective, and simple. Because secondary sludges do not settle well by gravity, separate thickening processes for primary and secondary sludges were preferable to combined thickening. Therefore, gravity thickening of primary sludge will be further evaluated in the process trains for this Draft EIS. The process trains refer to the sludge processing and disposal technologies retained after the Phase II screening being arranged into a series of progressive and inter-dependent steps.

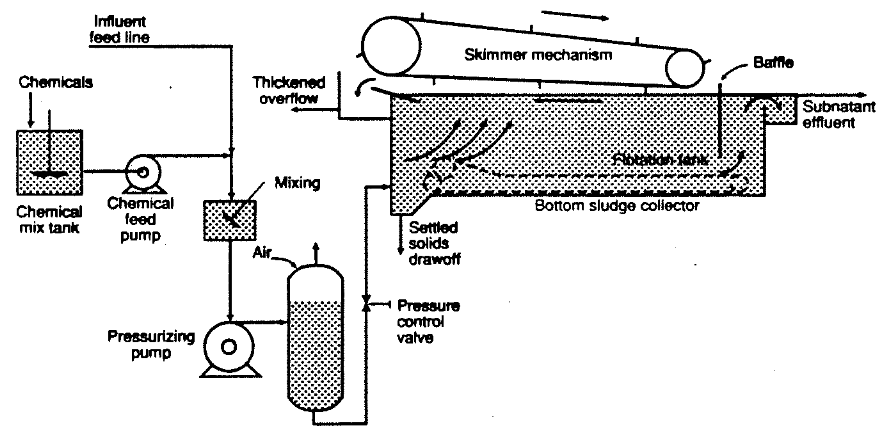
The three processes evaluated for thickening secondary sludge (WAS) were all determined to consistently thicken the sludge to 4-6 percent solids. The rating and cost-effectiveness analysis results (Appendix Table B-3) determined that the gravity belt thickeners would be retained for further evaluation in the




**Typical Gravity Thickner (Primary Sludge)** [1]




**Typical Centrifuge** [2]




**Typical Dissolved Air Flotation** [1]

Source: 1. *Wastewater Engineering*, Metcalf & Eddy, 1979
2. *Water Supply and Pollution Control*, Clark, Viesmann, and Hammer, 1977

Not to Scale

**FIGURE 3.2-2**
**TYPICAL GRAVITY THICKNER,CENTRIFUGE, AND DISSOLVED AIR FLOTATION**

process trains for this Draft EIS based on energy requirements, simplicity of operation and maintenance, and cost criteria.

Dewatering of thickened sludge can be performed to produce a sludge with low solids content (20-22 percent) or high solids content (30-40 percent). The costs of achieving a high solids sludge are greater than those of a low solids sludge due to the operating costs of the dewatering equipment. However, overall operating costs may be less with high solids sludge because there is a smaller volume of sludge to undergo further processing or disposal. Both low solids and high solids dewatering technologies are evaluated in this Draft EIS (see Figure 3.2-3).

The belt filter press, the only technology which produces a low solids sludge, will be evaluated in this Draft EIS. Evaluation of the high solids dewatering alternatives (centrifuges, the recessed plate and frame filter press, and the diaphragm filter press) indicated that, on the basis of cost effectiveness, flexibility, simple Operation and Maintenance (O & M), and odor control requirements, centrifuges are the preferred technology for high solids dewatering (Appendix Table B-4).

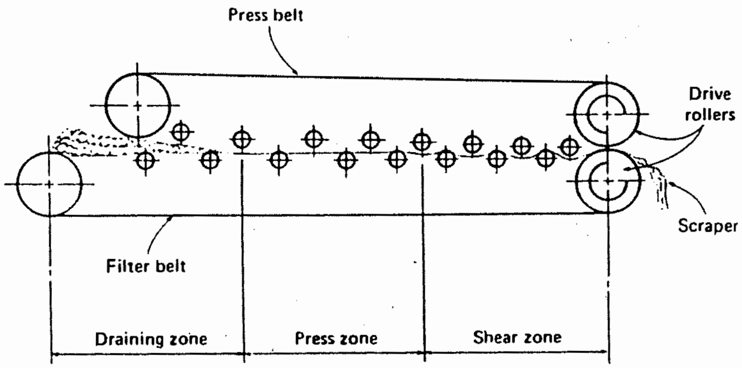
The two alternatives for sludge stabilization retained from the Phase I screening, anaerobic digestion (Figure 3.2-3) and lime stabilization, each result in significantly different volumes of sludge. This affects the cost of further treatment disposal. Therefore, both were retained for detailed evaluation of the process trains.

**3.2.2.2 Solids Treatment and Disposal Technologies.** The sludge processing and disposal technologies evaluated during the Phase II screening included chemical fixation, incineration, composting, and landfilling (as denoted in Figure 3.2-1).

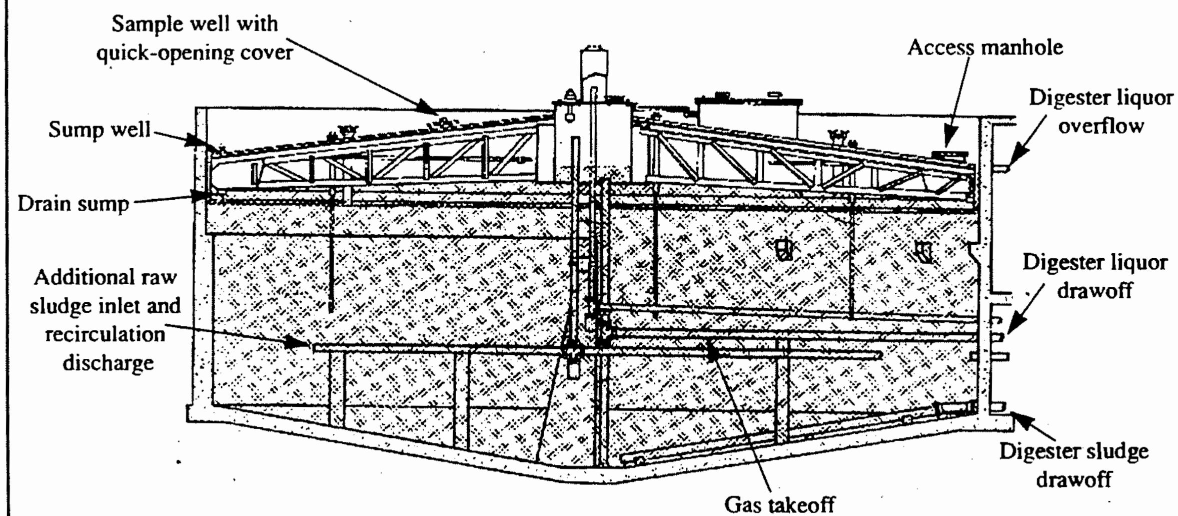
The process of chemical fixation, CHEMFIX, was retained for detailed evaluation of the process trains, as the volume of sludge will directly affect the disposal costs.

Multiple hearth furnaces (added after Phase I) and fluidized bed incinerators were the two incineration technologies evaluated in the Phase II screening (see Figure 3.2-4). Multiple hearth incineration is expensive, requires a lot of power, and is not reliable or flexible. In contrast, fluidized bed incineration is inexpensive, fuel efficient, and simple to operate (see Appendix Table B-5). Therefore, fluidized bed was chosen to be evaluated in the process train for the Draft EIS.

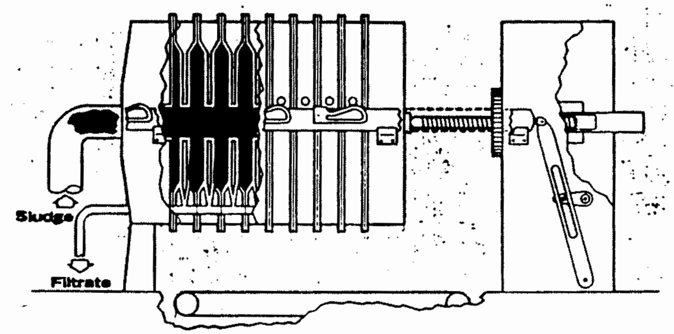
The three composting alternatives evaluated in Phase II were aerated static pile, in-vessel, and mechanical composting; mechanical composting was added during the Phase II screening evaluation. Results of the Phase II screening analysis are presented in Appendix Table B-6. Because in-vessel composting



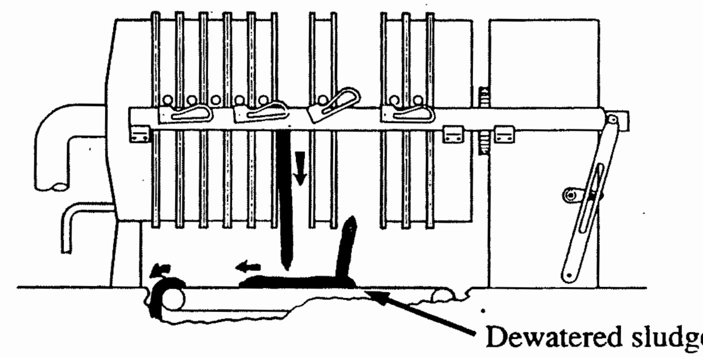

**Typical Belt Filter Press** [1]




**Typical Anaerobic Digester** [1]




Step 1. Thickened sludge pumped into filter press.



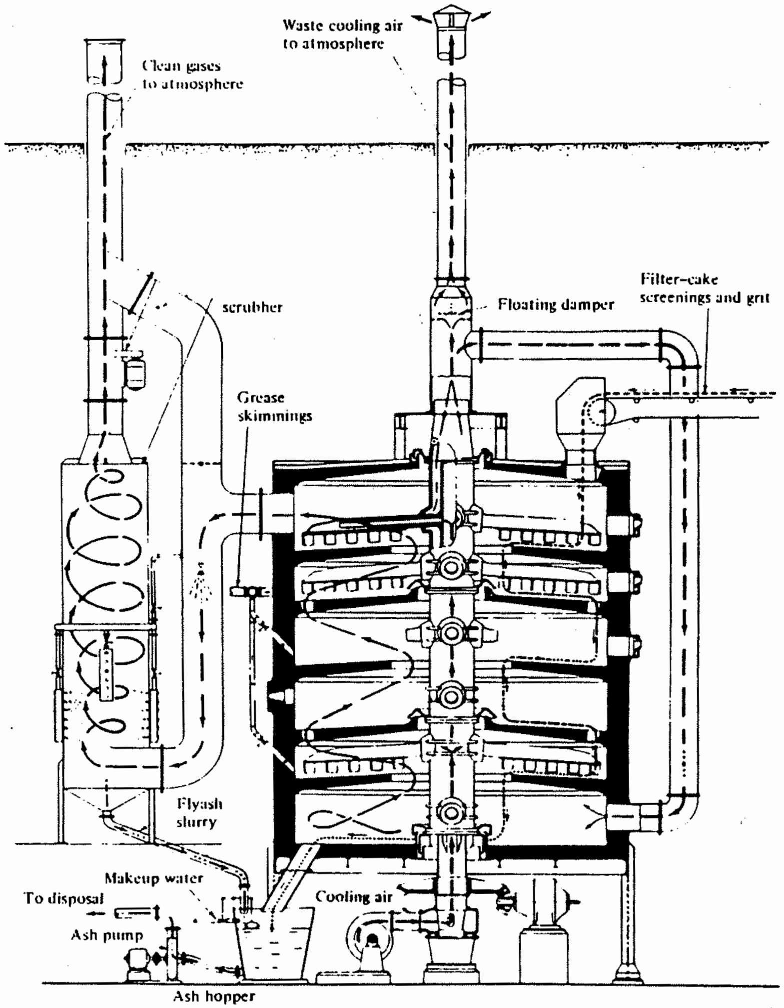

Step 2. Plates separated to dispose of dewatered sludge.

**Typical Recessed Plate and Frame Filter Press** [2]

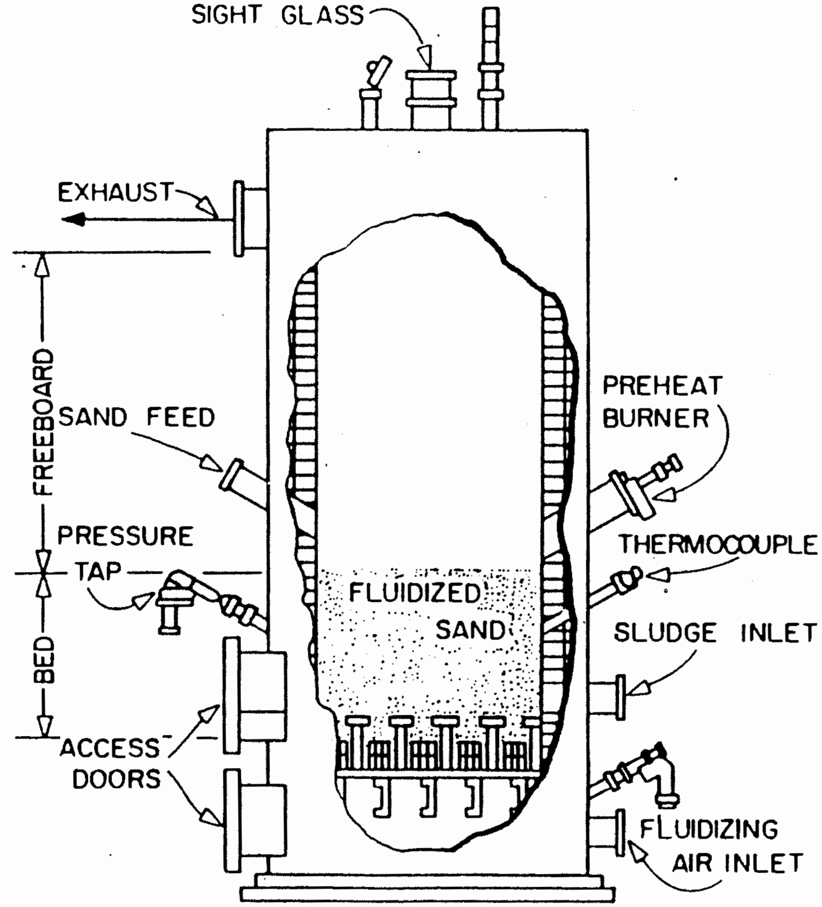
Source: 1. *Wastewater Engineering*, Metcalf & Eddy, 1979
2. MOP/11, *Operations of Wastewater Treatment*, WPCF, 1976

Not to Scale

**FIGURE 3.2-3**
**BELT FILTER PRESS, RECESSED PLATE AND FRAME FILTER PRESS, AND ANAEROBIC DIGESTER**




**Typical Multiple Hearth Furnace**




**Typical Fluidized Bed Incinerator**

Source: *Water Supply and Pollution Control,* Clark, Viesmann, and Hammer, 1977

Not to Scale

**FIGURE 3.2-4**
**MULTIPLE HEARTH FURNACE AND FLUIDIZED BED INCINERATOR**

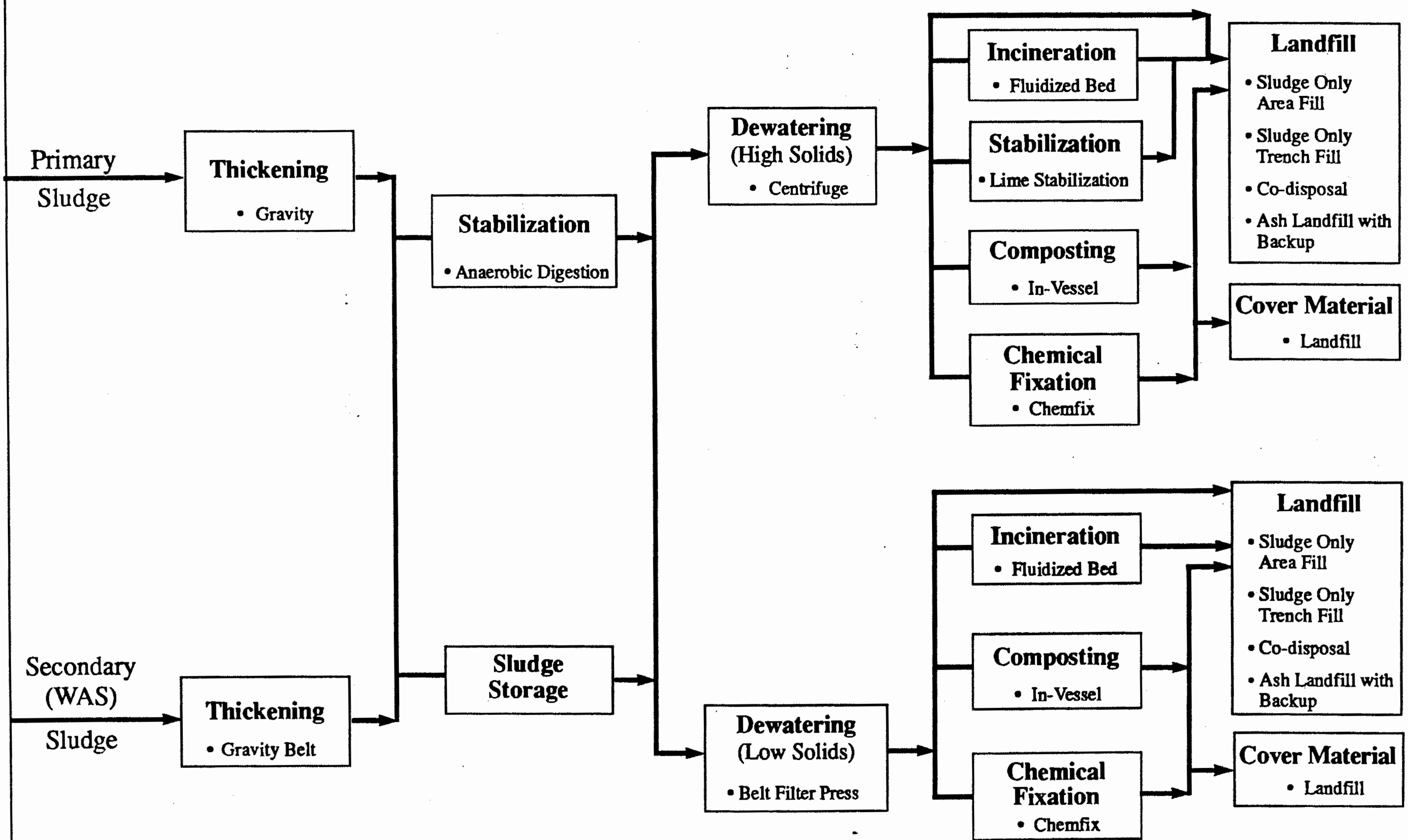
occupies less space, provides better process and odor control, and uses enclosed equipment (protecting it from the weather), it was chosen as the alternative to be evaluated in this Draft EIS.

Landfilling options evaluated under Phase II are also denoted in Figure 3.2-1. Each of four alternatives, i.e., the two sludge-only landfilling options, co-disposal, and ash landfilling, will be further evaluated in the Draft EIS as possible disposal options.

**3.2.2.3 Process Train Evaluation** The sludge processing and disposal technologies remaining after Phase II screening have been arranged into a series of progressive and interdependent steps beginning with the sludge thickening options, and continuing through dewatering, stabilization or solids treatment, and finally sludge disposal. These progressive steps are referred to as a process train, as shown in Figure 3.2-5. Numerous process trains are available, starting with the treatment and disposal of thickened primary sludge separately or combined with thickened WAS sludge. Whether independent or combined, the thickened sludge can be stabilized by an anaerobic digester or stored. The trains continue into a dewatering process resulting in sludge with either high or low solids content. Once dewatered, the sludge can be disposed of or treated a final time prior to disposal. The process trains were evaluated to determine the most appropriate configuration for the proposed WWTP.

There is only one process train utilizing lime stabilization. This is because its use with a low solids dewatering process produces an excessive volume of sludge. This volume exceeds the sum of the disposal capacities of the net developable areas at all three solids disposal sites under consideration in New Bedford. Therefore, a process train with lime stabilization and a low solids dewatering process was eliminated. All of the remaining treatment technologies were evaluated to determine whether the reduction of sludge volume achieved by the more expensive high solids dewatering process resulted in sufficient overall savings to justify the cost.

The evaluations of the process trains were based on cost-effectiveness analyses. These analyses were conducted for each potential process train combination and do not include primary sludge or WAS thickening, as these components are of approximately equal cost (CDM, Volume III, 1989). Each process train assumes that all sludge processing will be completed at the wastewater treatment plant site, that primary sludge will be thickened by gravity to 6 percent solids, and WAS will be thickened by gravity belt to 4 percent solids. Based on average sludge quantities, five days of sludge storage is also assumed. This storage accounts for peak flows in the system and ensures that weekend disposal is not required. Sludge disposal




Adapted from CDM, 1989

**FIGURE 3.2-5**
**SLUDGE PROCESS TRAINS**
**DETAILED IN THE DRAFT EIS**

transportation costs assume an average 21-mile round trip (CDM, Volume III, 1989).

The cost-effectiveness analyses were conducted in two stages (see Tables 3.2-1 and 3.2-2). The first assumed no sludge reuse and consisted of nine potential process trains. The second assumed reuse of chemically fixed or composted sludge and consisted of a reuse-alternative for four of the nine potential process trains. The reusable product could be used as landfill cover material at the proposed Crapo Hill Landfill in Dartmouth or at another municipal landfill in the area.

The first stage was conducted because of the uncertainty of the actual sludge quality produced by the new WWTP and the possibility that the proposed Crapo Hill Landfill will not be in operation in time. These conditions require a complete reliance on sludge disposal in a sludge-only landfill. The cost-effectiveness analyses determined that composting with either high or low solids dewatering would not be cost-effective with the non-reuse option. The total present worth cost to build, operate, and maintain a compost non-reuse system greatly exceeded the cost of the other seven options. Further, low solids with incineration, anaerobic digestion, or chemical fixation was not cost-effective because the landfill cost exceeded the equipment and O&M savings.

The most cost-effective alternatives involve the use of high solids dewatering with chemical fixation, incineration, or lime stabilization of anaerobically digested sludge. Chemical fixation was the least costly and lime stabilization the most costly of the four high solids alternatives (CDM, Volume III, 1989), although the difference among them was relatively small.

The results of the reuse evaluation indicated that unless compost (high and low solids) had a high market value, it would not be a cost-effective alternative. A detailed marketing study would have to be conducted after the plant began operation to accurately determine the compost's quality, value, and demand.

The two stage cost-effectiveness analyses identified five equally effective process trains of similar cost. These are as follows:

- chemical fixation with high solids dewatering - non-reuse;
- lime stabilization with high solids dewatering - non-reuse;
- incineration with high solids dewatering - non-reuse;
- anaerobic digestion and lime stabilization with high solids - non-reuse; and
- chemical fixation with high solids - reuse.

TABLE 3.2-1

COST EFFECTIVENESS ANALYSIS OF PROCESS TRAINS
(W/O REUSE OPTIONS)

| | Capital Cost | Present Worth Replace. Cost (15 yrs) | Present Worth Salvage Value (20 yrs) | Annual O&M Cost | Total Present Worth |
|---|---|---|---|---|---|
| 1. Chemical Fixation w/High Solids Dewatering | | | | | |
| Sludge Storage | $706,000 | $88,466 | $38,997 | $24,100 | |
| Dewatering | $8,752,000 | $1,736,644 | $765,545 | $226,900 | |
| Chemical Fixation | $1,338,000 | $210,216 | $88,700 | $1,380,000 | |
| Hauling | $240,000 | | | $65,300 | |
| Landfill (20 yrs) | $10,739,000 | | | $189,300 | |
| TOTAL | $21,775,000 | $2,035,326 | $893,242 | $1,885,600 | $40,600,241 |
| 2. Digestion w/High Solids Dewatering | | | | | |
| Digestion | $5,808,000 | $1,210,519 | $533,619 | $148,000 | |
| Lime Addition | $1,338,000 | $201,216 | $88,700 | $0 | |
| Dewatering | $8,752,000 | $1,736,644 | $765,545 | $262,700 | |
| Hauling | $160,000 | | | $40,800 | |
| Landfill (18 yr + 2 yr) | $15,452,000 | | | $439,800 | |
| TOTAL | $31,510,000 | $3,148,379 | $1,387,864 | $891,300 | $41,629,126 |
| 3. Incineration w/High Solids Dewatering | | | | | |
| Sludge Storage | $668,000 | $88,466 | $38,997 | $24,100 | |
| Dewatering | $5,804,000 | $1,137,911 | $501,612 | $337,000 | |
| Incineration | $15,085,000 | $3,307,921 | $1,458,193 | $481,500 | |
| Lime Addition | $1,338,000 | $201,216 | $88,700 | $0 | |
| Hauling | $160,000 | | | $16,300 | |
| Landfill (15 yr + 5 yr) | $7,448,000 | | | $52,300 | |
| TOTAL | $30,503,000 | $4,735,514 | $2,087,502 | $911,200 | $41,696,246 |

TABLE 3.2-1 (CONTINUED)

COST EFFECTIVENESS ANALYSIS OF PROCESS TRAINS
(W/O REUSE OPTIONS)

| | Capital Cost | Present Worth Replace. Cost (15 yrs) | Present Worth Salvage Value (20 yrs) | Annual O&M Cost | Total Present Worth |
|---|---|---|---|---|---|
| 4. Post Lime Stabilization w/High Solids Dewatering | | | | | |
| Sludge Storage | $706,000 | $88,466 | $38,997 | $24,100 | |
| Dewatering | $8,752,000 | $1,736,644 | $765,545 | $226,900 | |
| Lime Addition | $1,338,000 | $201,216 | $88,700 | $254,100 | |
| Hauling | $240,000 | | | $57,100 | |
| Landfill (20 yrs) | $20,173,000 | | | $564,600 | |
| TOTAL | $31,209,000 | $2,026,326 | $893,242 | $1,126,800 | $42,909,214 |
| 5. Incineration w/Low Solids Dewatering | | | | | |
| Sludge Storage | $668,000 | $88,466 | $38,997 | $24,100 | |
| Dewatering | $4,950,000 | $720,446 | $317,586 | $372,800 | |
| Incineration | $15,085,000 | $3,307,921 | $1,458,193 | $481,500 | |
| Lime Addition | $1,338,000 | $201,216 | $88,700 | $0 | |
| Hauling | $160,000 | | | $16,300 | |
| Landfill (15 yr + 5 yr) | $12,740,000 | | | $52,300 | |
| TOTAL | $34,941,000 | $4,318,049 | $1,903,476 | $947,000 | $46,236,539 |
| 6. Chemical Fixation w/Low Solids Dewatering | | | | | |
| Sludge Storage | $706,000 | $88,466 | $38,997 | $24,100 | |
| Dewatering | $6,007,000 | $749,356 | $330,330 | $316,000 | |
| Chemical Fixation | $1,338,000 | $201,216 | $88,700 | $2,069,500 | |
| Hauling | $400,000 | | | $114,200 | |
| Landfill (20 yrs) | $16,593,000 | | | $294,100 | |
| TOTAL | $25,044,000 | $1,039,038 | $458,027 | $2,817,900 | $52,051,277 |

TABLE 3.2-1 (CONTINUED)
COST EFFECTIVENESS ANALYSIS OF PROCESS TRAINS
(W/O REUSE OPTIONS)

| | Capital Cost | Present Worth Replace. Cost (15 yrs) | Present Worth Salvage Value (20 yrs) | Annual O&M Cost | Total Present Worth |
|---|---|---|---|---|---|
| 7. Digestion w/Low Solids Dewatering | | | | | |
| Digestion | $5,808,000 | $1,210,519 | $533,619 | $148,000 | |
| Lime Addition | $1,138,000 | $201,216 | $88,700 | $0 | |
| Dewatering | $6,007,000 | $749,356 | $330,330 | $269,700 | |
| Hauling | $240,000 | | | $65,300 | |
| Landfill (18 yr + 2 yr) | $25,982,000 | | | $751,900 | |
| TOTAL | $39,175,000 | $2,161,091 | $952,649 | $1,234,900 | $51,964,334 |
| 8. Composting w/High Solids Dewatering | | | | | |
| Sludge Storage | $706,000 | $88,466 | $38,997 | $24,100 | |
| Dewatering | $8,752,000 | $1,736,644 | $765,545 | $226,900 | |
| Composting | $16,081,000 | $2,265,992 | $998,891 | $960,800 | |
| Hauling | $240,000 | | | $65,300 | |
| Landfill (18 yr + 2 yr) | $19,392,000 | | | $539,000 | |
| TOTAL | $45,171,000 | $4,091,102 | $1,803,433 | $1,816,100 | $64,490,055 |
| 9. Composting w/Low Solids Dewatering | | | | | |
| Sludge Storage | $706,000 | $88,466 | $38,997 | $24,100 | |
| Dewatering | $6,007,000 | $749,356 | $330,330 | $316,000 | |
| Composting | $18,562,000 | $2,583,428 | $1,138,823 | $1,111,000 | |
| Hauling | $320,000 | | | $81,600 | |
| Landfill (18 yr + 2 yr) | $25,737,000 | | | $681,800 | |
| TOTAL | $51,332,000 | $3,421,250 | $1,508,150 | $2,214,500 | $74,012,681 |

Source: CDM, Volume III, 1989.

TABLE 3.2-2

COST EFFECTIVENESS ANALYSIS OF PROCESS TRAINS
(W/REUSE OPTIONS)

| | Capital Cost | Present Worth Replace. Cost (15 yrs) | Present Worth Salvage Value (20 yrs) | Annual O&M Cost | Total Present Worth |
|---|---|---|---|---|---|
| 1. Chemical Fixation w/High Solids Dewatering | | | | | |
| Sludge Storage | $706,000 | $88,466 | $38,997 | $24,100 | |
| Dewatering | $8,752,000 | $1,736,644 | $765,545 | $226,900 | |
| Chemical Fixation | $1,338,000 | $201,216 | $88,700 | $1,380,000 | |
| Hauling | $240,000 | | | $78,300 | |
| Landfill (5 yrs) | $3,493,000 | | | $0 | |
| TOTAL | $14,529,000 | $2,026,326 | $893,242 | $1,709,300 | $31,691,899 |
| 2. Chemical Fixation w/Low Solids Dewatering | | | | | |
| Sludge Storage | $706,000 | $88,466 | $38,997 | $24,100 | |
| Dewatering | $6,007,000 | $749,356 | $330,330 | $316,000 | |
| Chemical Fixation | $1,338,000 | $201,216 | $88,700 | $2,069,500 | |
| Hauling | $400,000 | | | $137,000 | |
| Landfill (5 yrs) | $5,110,000 | | | $0 | |
| TOTAL | $13,561,000 | $1,039,038 | $458,027 | $2,546,600 | $38,024,026 |
| 3. Composting w/High Solids Dewatering | | | | | |
| Sludge Storage | $706,000 | $88,466 | $38,997 | $24,100 | |
| Dewatering | $8,752,000 | $1,736,644 | $765,545 | $226,900 | |
| Composting | $16,081,000 | $2,265,992 | $998,891 | $960,800 | |
| Hauling | $240,000 | | | $75,000 | |
| Landfill (Surplus + 5 yrs) | $10,644,000 | | | $202,200 | |
| TOTAL | $36,423,000 | $4,091,102 | $1,803,433 | $1,489,000 | $52,674,511 |

TABLE 3.2-2 (CONTINUED)

COST EFFECTIVENESS ANALYSIS OF PROCESS TRAINS
(W/REUSE OPTIONS)

| | Capital Cost | Present Worth Replace. Cost (15 yrs) | Present Worth Salvage Value (20 yrs) | Annual O&M Cost | Total Present Worth |
|---|---|---|---|---|---|
| 4. Composting w/Low Solids Dewatering | | | | | |
| Sludge Storage | $706,000 | $88,466 | $38,997 | $24,100 | |
| Dewatering | $6,007,000 | $749,356 | $330,330 | $316,000 | |
| Composting | $18,562,000 | $2,583,428 | $1,138,823 | $1,111,000 | |
| Hauling | $320,000 | | | $113,000 | |
| Landfill (Surplus + 5 yrs) | $19,482,000 | | | $345,000 | |
| TOTAL | $45,077,000 | $3,421,250 | $1,508,150 | $1,909,100 | $64,893,640 |

Adapted from: CDM, Volume III, 1989.

The first three non-reuse options listed utilized sludge storage instead of anaerobic digestion in their process train.

Given that the five process trains have similar present worth costs, a non-economic evaluation was subsequently conducted to assess the relative advantages and disadvantages of each surviving alternative (see Table 3.2-3). This final analysis resulted in the elimination of anaerobic digestion with lime stabilization and incineration, for the reasons detailed in Table 3.2-4, and the selection of chemical fixation and with back-up lime stabilization system as the recommended process train, detailed on Figure 3.2-6. All of the components will be located at the treatment facility site.

### 3.2.3 Recommended Solids Treatment Alternative

The recommendation of the solids treatment process shown on Figure 3.2-6 has significant advantages over the other options. The design of the process train will further provide redundancy within the system to ensure a reliable and efficient WWTP operation capable of handling the projected peak design load.

**3.2.3.1 Solids Treatment Process Train.** Chemically fixed sludge (with high solids dewatering) was the recommended process train, along with a back-up lime stabilization system. The advantages of the recommended option were that without reuse, chemical fixation was the most cost-effective process train; should reuse become available, the cost-effectiveness would be further improved. Chemical fixation also required the least landfill capacity of all the non-combustion alternatives.

The installation of the back-up lime stabilization system could be incorporated at a minimal cost, as most of the same equipment is used for chemical fixation. The back-up system would be available should any problems occur with the chemical fixation process. Design of the recommended process train and back-up system can be found in Appendix Tables B-7 through B-9.

**3.2.3.2 Redundancy.** The recommended process train and backup system were designed to provide an adequate level of redundancy. This redundancy will ensure a reliable and efficient plant operation capable of handling the peak design load under various conditions of equipment failure or routine maintenance outages. The design of the solids treatment process met the U.S. EPA redundancy requirements detailed in Section 2.2.4.5 of this Draft EIS. A spare unit was supplied for all mechanical equipment that perform the same function. In addition, spare tankage can be met within the design number of tanks; should a tank be pulled out of service the remaining tanks performing the same function (e.g., sludge storage tank) are capable of treating the design peak load when operation adjustments are made. Table 3.2-5 lists the number of tanks and equipment for the recommended solids

## TABLE 3.2-3
## EVALUATION MATRIX FOR HIGH SOLIDS PROCESS TRAINS

| | Chemical Fixation | Anaerobic Digestion | Incineration | Lime Stabilization |
|---|---|---|---|---|
| Reliability | High | Average | Low | High |
| Flexibility | High | Average | Low | High |
| Constructibility | Normal | Difficult | Difficult | Normal |
| Safety | Normal | Special | Special | Normal |
| Opeartors Required | Average | Average | Greater | Average |
| Operational Complexity | Simple | Difficult | Difficult | Simple |
| Power Efficiency | Average | High | Low | Average |
| Auxiliary Needs[1] | Yes | Yes | Yes | Yes |
| Residuals Disposal | Good | Average | Good | Average |
| Air Emissions Control | Average | Average | Difficult | Average |
| Noise Control | Average | Average | Difficult | Average |
| Aesthetics | Good | Average | Difficult | Good |

[1] See individual process matrices.

Note: All process trains include high solids centrifugal dewatering.

Adapted from: CDM, Volume III, 1989.

**TABLE 3.2-4**
**REASONS FOR ELIMINATING INCINERATION AND ANAEROBIC DIGESTION FROM FURTHER CONSIDERATION**

Incineration

- Not economically advantageous.

- Combustion and air emissions control equipment require highly skilled operators, and must be run 24 hours a day, resulting in noise affecting considerations to the surrounding community.

- The air emissions control equipment has limited operational experience with respect to metals removal, therefore, incinerator design must allow for additional air emissions control equipment, should greater removal efficiencies be required.

- Regulations governing combustion processes are in a state of flux. There is no guarantee that the combustion process train assumed for this analysis will be permittable.

- The height of the exhaust stacks (125 feet) may be aesthetically undesirable.

Anaerobic Digestion

- Digested sludge cannot be re-used without further treatment, therefore, anaerobic digestion offers no economic advantages relative to the re-use potential of chemical fixation.

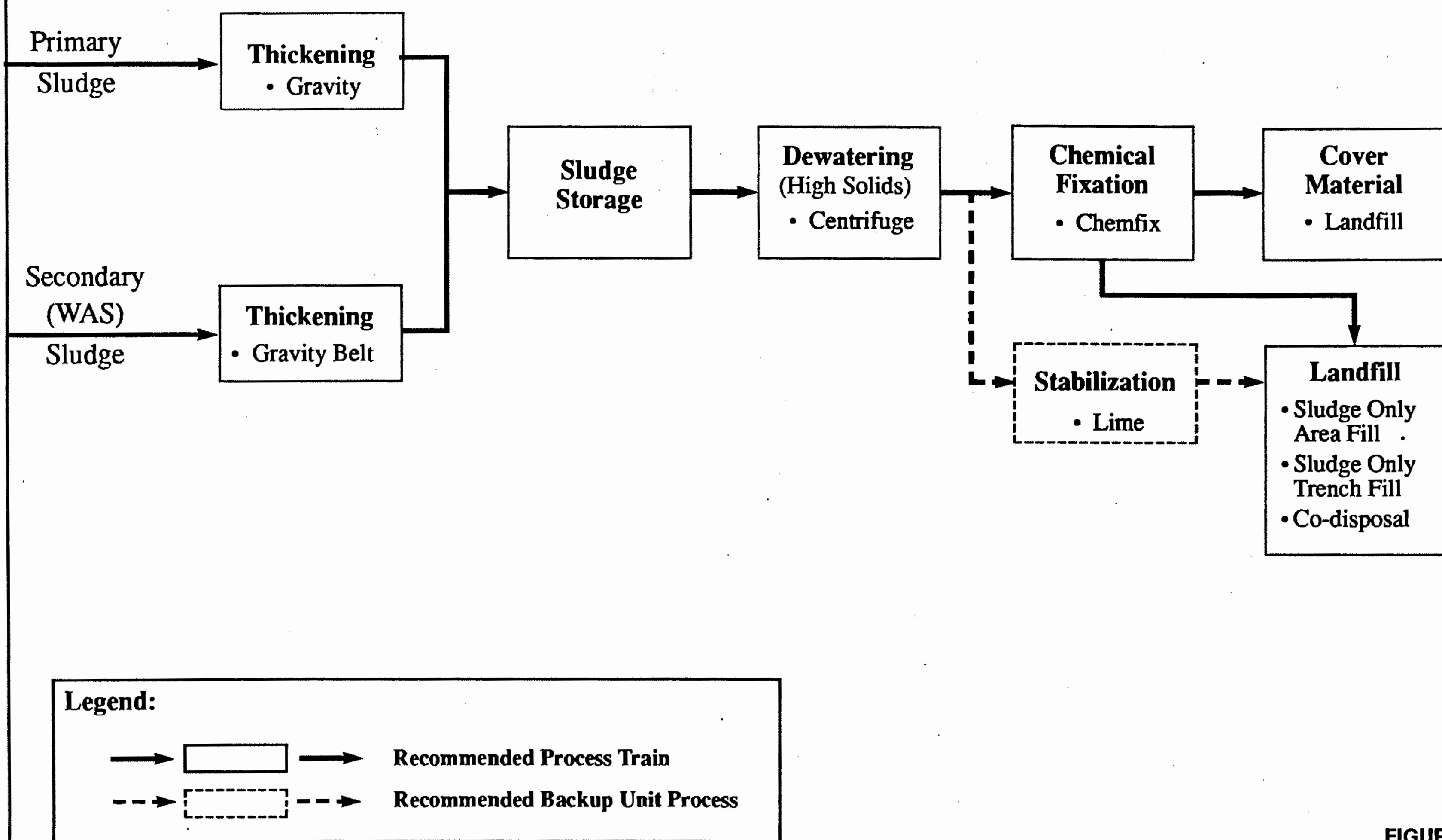
- Digestion is a complex process requiring skilled operators and continuous monitoring.

- Methane gas is produced during digestion, which presents a safety hazard not present in chemical fixation.

- Toxics present in the sludge may interfere with the digestion process.

- A liquid sidestream is produced during the digestion process increasing the amount of nutrient and organic wastes. This increase could impact the quality of the receiving water.

- More land area is required for the construction of the digestion process than for chemical fixation.




Adapted from CDM, 1989

**FIGURE 3.2-6**

**RECOMMENDED SLUDGE TREATMENT PROCESS TRAIN**

treatment process train and the percent redundancy in the process. Continued reliability of the solids treatment process requires expeditious repair or maintenance of the standby unit to place it back in available status. If long periods elapse between repairs or if recommended routine maintenance is not provided the availability of units is reduced and the process reliability could decrease.

**TABLE 3.2-5**
**SUMMARY OF SOLIDS TREATMENT PROCESS REDUNDANCY**

| Treatment Unit | Total No. of Units | No. on Standby | Standby Redundancy(%) |
|---|---|---|---|
| Sludge Processing | | | |
| Primary Sludge Thickeners | 4 | 1 | 33 |
| WAS Thickeners | 8 | 1 | 14 |
| Sludge Storage Tanks | 6 | - | - |
| Sludge Dewatering Units | 5 | 1 | 25 |
| Odor Control | | | |
| Odor Control Scrubber | | | |
| Liquid Pumps | 2 | 1 | 100 |

Adapted from: CDM, Volume V, 1989

In addition to the process equipment, the power supply to operate the WWTP has been designed to include backup systems. Two separate electrical lines will be provided to the proposed WWTP. Each line will be able to operate the entire plant and will originate from a separate location of the power gird system. The lines will be installed in separate trenches underground ensuring complete secondary treatment of the wastewater if an electrical line is damaged or under repair. In addition, a natural gas generator will be on site with the available power to operate the preliminary and primary liquid treatment processes, disinfection, collector mechanisms, sludge pumps, and effluent pumps. The gas generator will be available if the utility company is unable to supply the necessary power.

## 3.3 SOLIDS DISPOSAL SITING ALTERNATIVES

This section describes alternative sites for locating a solids disposal site for the City of New Bedford. The 46 candidate sites that were initially identified for a WWTP were also considered for solids disposal. Many of these sites were subsequently eliminated in successive screening processes as described below and in the Draft EIR (CDM, Volume III, 1989).

### 3.3.1 Phase I Screening

The objective of Phase I screening was to identify potential sites for the disposal of solids, such as composted or chemically-fixed sludge or ash. The Phase I screening consisted of two parts: the identification of existing landfills and incinerators within a reasonable distance of New Bedford, and the analysis of identified candidate sites within the City.

**3.3.1.1 Existing and Planned Solids Disposal Facilities.** The first part of the siting analysis, identified existing disposal facilities (landfills and incinerators) within a reasonable distance of the City of New Bedford. These sites were reviewed for their possible use as a solids disposal facility. This review included an analysis of costs and an evaluation of sludge acceptance policies and capacities of the sites (CDM, Volume I, 1989).

**Existing Landfill Sites.** For the Phase I screening analysis, the Department of Environmental Protection (DEP) compiled a list of landfills that were permitted for disposal of municipal sludge and that were located within a radius of 45 miles from the City of New Bedford (this radius was chosen as the maximum distance within which trucking costs would remain reasonable). Fifteen landfills met these requirements and were investigated further.

Of the 15 landfills investigated (see Appendix Table B-10), only two, Browning-Ferris Industries (BFI) landfill in Fall River and Shawmut Avenue Landfill in New Bedford, have the necessary capacity and will accept sludge or sludge ash. Only the BFI landfill has agreed to accept New Bedford sludge at 20 percent solids. Existing landfills in the Towns of Marshfield and Rockland will not accept municipal sludge or sludge ash; however, they remain as potential landfills for composted or chemically-fixed sludge. Therefore, the landfills in Marshfield and Rockland, and the BFI Fall River landfill were carried into the Phase II analysis.

**Planned Landfill Site.** The proposed Crapo Hill landfill in Dartmouth has not yet been constructed, but was considered as a potential site for solids disposal for New Bedford. The current plans of the Greater New Bedford Regional Refuse Management District (who own about 150 acres of land at Crapo Hill) are not clear, and community concerns about the landfill must still be addressed. However, this alternative does have potential as a sludge disposal site and was retained for detailed analysis in Phase II of the siting analysis.

**Existing Incinerator Sites.** A list of existing sewage sludge incinerators in the New Bedford area was reviewed for potential disposal of solids from the WWTP. The sludge incinerator in Fall River was found to be the only one of moderate size and situated within a 45-mile radius of New Bedford. However, the capacity of the Fall River incinerator (18 dry tons/day) was not sufficient for the quantity of sludge expected to be generated by the proposed New Bedford facility (35 tons/day) (CDM, Volume I, 1989). Therefore, the use of the Fall River sludge incinerator was eliminated as a viable alternative for solids disposal.

Co-incineration of sludge with solid waste at a solid-waste burning facility was also considered during the Phase I siting process. The Fall River incinerator and the SEMASS resource recovery facility (under construction) were considered as potential alternatives, but were eliminated because of inadequate capacity. Also, the SEMASS facility cannot adequately reduce sludge moisture content to 10 percent so that it can be incinerated with solid waste.

**3.3.1.2 New Solids Disposal Sites.** The 46 sites identified in the Phase I Screening for the WWTP site (Figure 2.3-1 and Table 2.3-1) were also considered as candidates for the disposal of solids. The criteria used to develop the list of candidate sites are presented Section 2.3.1.

**3.3.1.3 Phase I Screening Evaluation Process.** A four-level evaluation process was applied to the 46 candidate sites. This process determined which sites were most feasible for each of the solids disposal options considered in the Phase I screening of technologies (Section 3.2.1). The first level of the evaluation eliminated public parks, cemeteries, schools, and open bodies of water from the candidate list. The sites retained for further analysis in level two can be found in Appendix Table B-11. Potential combinations of retained sites were examined at the second level of analysis in order to increase the available acreage. Sites were combined if they abutted each other or were separated by only a road, local highway or railroad. (Appendix Table B-12).

The second level of analysis evaluated sites with respect to the presence of sensitive features. These sensitive features (i.e., wetlands, floodplains, and surface water bodies) were mapped and eliminated from the total acreage to determine the net developable area (see Appendix Table B-13). At the beginning of this analysis level Site 47 was determined to be a potential disposal site and was added into the level two evaluation.

The third level of evaluation compared the remaining usable area for each candidate site to the minimum size requirements for solids disposal technologies (see Table 3.3-1). Sites that did not have enough net contiguous land to meet the minimum size requirements after screening out the sensitive areas, were eliminated.

**TABLE 3.3-1**
**SOLIDS DISPOSAL OPTIONS AND ACREAGE REQUIREMENTS**

| | |
|---|---|
| 2-Year Back-Up Sludge Landfill (with 100-ft buffer) | 14 acres |
| 5-Year Back-Up Sludge Landfill (with 100-ft buffer) | 40 acres |
| 20-Year Ash Landfill (with 100-ft buffer) | 18 acres |
| Compost Facility (with 100-ft buffer) | 20 acres |
| 20-Year Sludge-Only Landfill (with 100-ft buffer) | 1 site - 140 acres<br>2 sites - 80 acres each<br>3 sites - 55 acres each |

Adapted from: CDM, Volume I, 1989.

The fourth level of evaluation applied a feasibility rating based on land use and potential for additional buffering on and adjacent to the remaining candidate sites (see Table 3.3-2). As shown in this table, only Site 40 was considered suitable for all options, including the largest solids volume requirement, a 20-year sludge landfill. Sites 20 and 47 were also considered feasible for some solids disposal options. These three sites were carried into the Phase II screening.

### 3.3.2 Phase II Screening

The objective of Phase II screening was to evaluate the four existing landfill sites (BFI, Crapo Hill, Rockland and

TABLE 3.3-2
RESULTS OF PHASE I/LEVEL 4 SCREENING OF SOLIDS DISPOSAL SITES

| Feasibility | Disposal Options | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2-Year Back-Up (14 acres) | Ash Landfill (18 acres) | Compositing (20 acres) | 5-Year Back-Up (40 acres) | 20-Year Landfill (1-140 acres) | (2-80 acres) | (3-55 acres) |
| Most Feasible | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| Sites | 47 | 47 | 47 | 47 | | | |
| | 20 | 20 | 20 | | | | |
| Less Feasible | 10 | 10 | 10 | | | | |
| Sites | 26 | 26 | 26 | | | | |
| | 37 | 41/42 | 41/42 | | | | |
| | 38 | 20/38 | 20/38 | | | | |
| | 20/38 | 20/37 | 20/37 | | | | |
| | 20/37 | 34/35 | 34/35 | | | | |
| | 41/42 | | | | | | |
| | 34/35 | | | | | | |
| Least Feasible | 3 | 3 | 3 | 22 | | | 22 |
| | 4a | 4a | 4a | 7/44 | | | 7/44 |
| | 7 | 7 | 7 | | | | |
| | 11 | 17 | 17 | | | | |
| | 17 | 22 | 22 | | | | |
| | 22 | 29 | 29 | | | | |
| | 23 | 33 | 33 | | | | |
| | 25 | 37 | 37 | | | | |
| | 28 | 38 | 44 | | | | |
| | 29 | | 45 | | | | |
| | 30 | 45 | 46 | | | | |
| | 33 | 46 | 7/44 | | | | |
| | 42 | 7/44 | 13/43 | | | | |
| | 43 | 13/43 | 33/35 | | | | |
| | 44 | 33/35 | 17/18 | | | | |
| | 45 | 17/18 | | | | | |
| | 46 | | | | | | |
| | 7/44 | | | | | | |
| | 13/43 | | | | | | |
| | 33/35 | | | | | | |
| | 17/18 | | | | | | |

Adapted from: CDM, Volume I, 1989.

Marshfield) and the three potential sites (40, 20 and 47) carried from Phase I. This evaluation determined the presence of any physical, regulatory, or legal constraints on their development as solids disposal sites. As stated earlier, Site 47 was also considered an alternative for the WWTP thereby affecting the estimated acreage available for the disposal of solids.

Because of the limited number of existing solids disposal facilities within the 45-mile radius of New Bedford that were willing to accept sludge from the WWTP, additional existing facilities outside the 45- mile radius were reviewed. This review determined that no public or private landfill owners in southeastern Massachusetts were willing to accept sludge, as it would decrease their landfill capacity for refuse (CDM, Volume III, 1989). However, cover material (e.g., compost) is generally needed for most landfills and remains as a remote disposal option. At this time, however, landfills outside the 45-mile radius will not be retained for Phase II screening analysis.

**3.3.2.1 Existing and Planned Solids Disposal Facilities.** Four feasible locations for solids disposal outside the City of New Bedford were identified in Phase I: the Browning-Ferris Industries (BFI) landfill in Fall River, the proposed Crapo Hill landfill in Dartmouth and the existing municipal landfills located in Rockland and Marshfield.

**BFI Landfill.** The BFI landfill would not agree to accept sludge from the City of New Bedford, as it would decrease the landfill capacity for refuse. However, chemically fixed or composted sludge could be accepted as landfill cover material.

**Crapo Hill Landfill.** This proposed landfill has not yet been built, but is expected to be in operation by the end of 1992. It falls under the jurisdiction of the Greater New Bedford Regional Refuse Management District, and preliminary discussions with District representatives of the landfill indicated at this stage that the landfill would accept certain waste products such as grit, screenings, chemically fixed sludge and composted sludge as daily landfill cover. The representatives did indicate, however, that they would not allow the disposal of lime-stabilized or anaerobically digested sludge, nor would they accept incinerator ash, as these waste options would deplete the landfill capacity for solid waste.

**Rockland Municipal Landfill.** The existing municipal landfill was a possible disposal site for composted or chemically fixed sludge as cover material. The Town of Rockland will not formally approve the solids disposal until the proposed WWTP is further along in the design and permit approval process. Based on the delayed approval this site was eliminated from further evaluation, but could be pursued if the recommended alternative(s) runs into difficulty.

**Marshfield Municipal Landfill.** The town landfill restricted the solids disposal to composted or chemically fixed sludge and also delayed disposal approval for the City of New Bedford WWTP. For this reason the site was eliminated from further evaluation, but could be pursued based on the outcome of the recommended alternative(s).

**3.3.2.2 New Solids Disposal Sites.** Three potential disposal sites for new solids disposal facilities within the City of New Bedford were carried over from Phase I screening (Sites 20, 40, and 47). In Phase I, many sites were eliminated because of existing primary constraints at the sites, such as wetlands and floodplains. In Phase II, primary constraints were evaluated in greater detail (e.g., the evaluation of groundwater yield), and secondary constraints (features or site characteristics that could be modified or relocated using appropriate regulatory or legal procedures) were identified. Features such as land use and access to the site are examples of secondary constraints.

The Phase II analysis also looked in detail at the landfill design considerations, identified in Phase I, for each of the three sites (see Table 3.3-3). Landfill design plays an important role because it influences the acreage needed and available capacity at each candidate site. Each solids processing option produces a different quantity of sludge, and will consequently have different landfill volume requirements. From these options, the approximate area and capacity requirements of the different solids disposal options were determined. They are shown in Appendix Table B-14. Based on the landfill volume requirements for the solids disposal options, preliminary landfill designs were prepared for each candidate site to determine site capacity. These designs were based on parameters such as desired buffer area, landfill configuration, and earthen dike configuration (see Table 3.3-3). Using these parameters, the estimated landfill capacity for each site, without impacting primary constraints (such as wetlands or high and medium yield groundwater areas), is as follows:

| Site | Capacity, in million cubic yards |
|---|---|
| 20 | 0.41 |
| 40 | 1.89 |
| 47 (without WWTP) | 1.55 |
| 47 (with WWTP) | 0.68 |

The approximate capacity of each candidate site was then compared to the volume of each solids disposal option to determine the compatibility of the site with the treatment options (see Appendix Table B-14 and B-15). This resulted in the determination that Site 40 is compatible with most of the treatment options, whereas Site 20 and Site 47 (with a WWTP) are

**TABLE 3.3-3**
**SLUDGE LANDFILL DESIGN PARAMETERS**

| | |
|---|---|
| **Buffer Area Design Preferences** | |
| 2640 ft. | Upgradient of surface drinking water supply |
| 500 ft. | Downgradient of surface drinking water supply |
| 500 ft. | From private water supply |
| 500 ft. | From nearest residence |
| 250 ft. | Upgradient of all water supply tributaries |
| 100 ft. | From wetland or 100 year floodplain |
| 50 ft. | From property line |
| 4 ft. | Separation from lowest liner to the maximum groundwater table |
| **Landfill Configuration** | |
| 30 ft. | Maximum height from bottom of landfilling surface to top of final cover |
| 2.5 ft. | Final cover depth, consisting of 12 inches impermeable clay, 6 inches of sand and 12 inches of loam to support a vegetative cover |
| 3:1 | Maximum side slope |
| **Earthen Dike Configuration** | |
| 15 ft | Maximum height |
| 5 ft | Top width |
| 2:1 ft | Side slopes |

1 All of the buffers are measured from the inside of the primary liner to the point of concern, except for the wetland, floodplain, groundwater and property line distances, which are measured from the outside of the bottom of the toe of the dike.

Adapted from: CDM, Volume I, 1989.

not compatible with any treatment options. Site 47 without a WWTP is compatible with some of the options.

### 3.3.3 Elimination of the BFI Landfill Alternative

The BFI landfill, located in the Town of Fall River, is currently operating and is permitted to accept sludge and sludge ash. However, Fall River is not willing to allow disposal of sludge generated outside the Town at this landfill. Therefore, the BFI landfill was eliminated from further consideration.

### 3.3.4 Description of Solids Disposal Sites for Detailed Evaluation

**3.3.4.1 Crapo Hill Landfill.** The proposed Crapo Hill Landfill (see Figure 3.3-1) will cover an area of approximately 100 acres in the City of Dartmouth. It has not been built, but is expected to be in operation by the end of 1992. The proposed landfill has an expected life of approximately 43 years assuming receipt of 500 tons per day of refuse only (from normal household and commercial waste). With the addition of an estimated 240 tpd from the New Bedford facility, the life of the landfill would be reduced to approximately 35 years (CDM, Volume III, 1989).

**3.3.4.2 Site 47.** Site 47 was briefly described in Section 2.3.3. This site (see Figures 3.3-2 and 3.3-3) is bordered on the south by a rail line and the municipal golf course, and along the rest of the site by the Paskamanset River and wetlands. It totals approximately 122 acres. Most of the site (114 acres, or 93 percent) is vacant, while the remaining area is reserved for municipal use associated with portions of the adjacent City landfill. Much of the site is in a 100 yr floodplain and is comprised of wetlands. The initial site investigation determined that approximately 72 acres (60 percent) of the site was developable (see Section 5.5 for further discussion of wetlands constraints at this site).

Site 47 is bisected by a water main which runs northwest across the site from the golf course. The landfill would be constructed in phases, beginning with the area east of the water main (see Figure 3.3-3). This initial phase area, 47a, has enough area to account for approximately five years of chemically fixed or lime stabilized sludge production.

**3.3.4.3 Site 40.** Site 40 is one complete parcel comprising approximately 383.5 acres in total area. The site is bordered by two easements, a railroad to the east and a power line to the north. The remainder of the site is bordered by State Reservation land. Although all of the site is vacant, about half of the site is undevelopable due to primary constraints, leaving a net developable area of about 225 acres. The site is divided into sections by these constraints, so that the largest

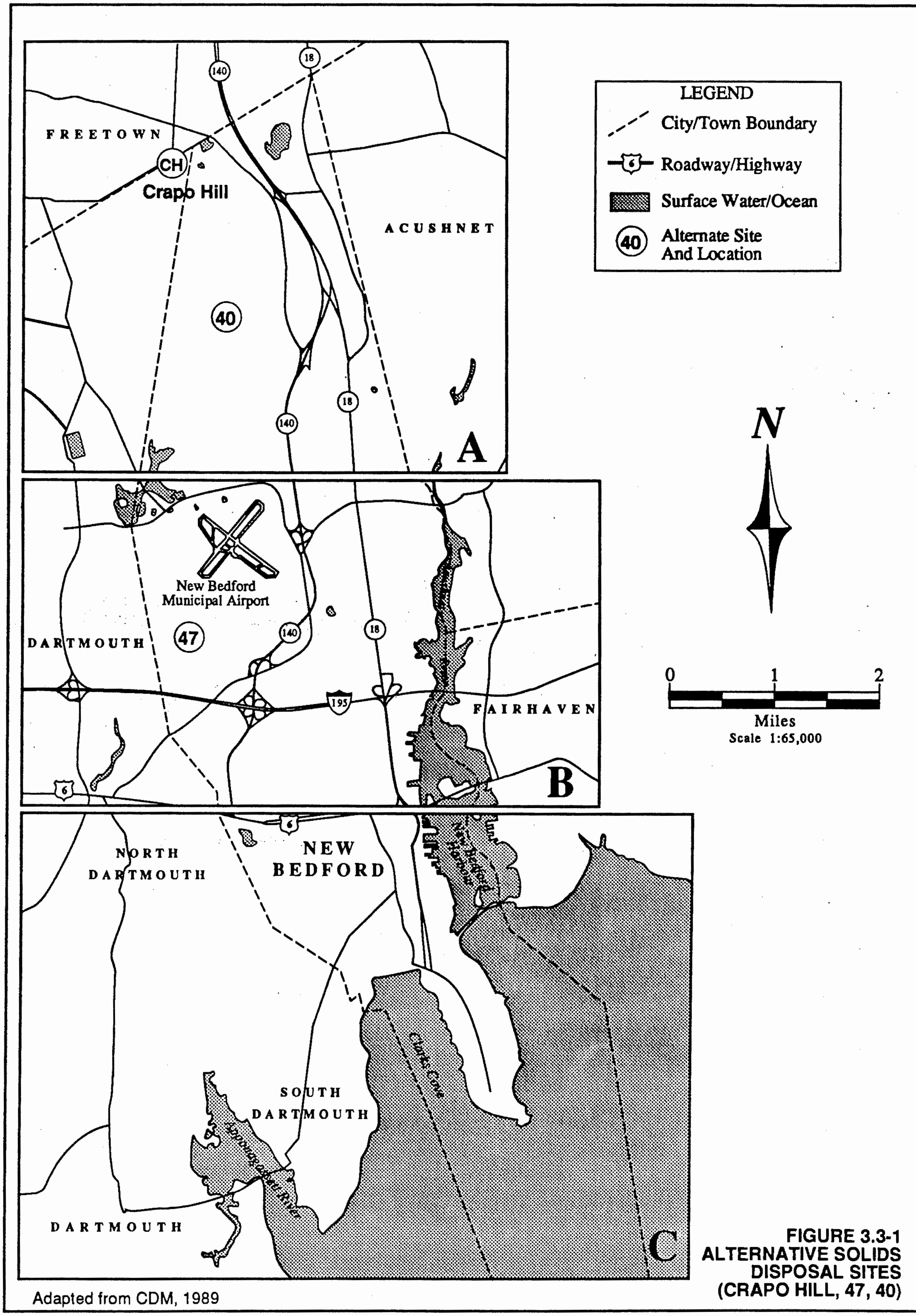
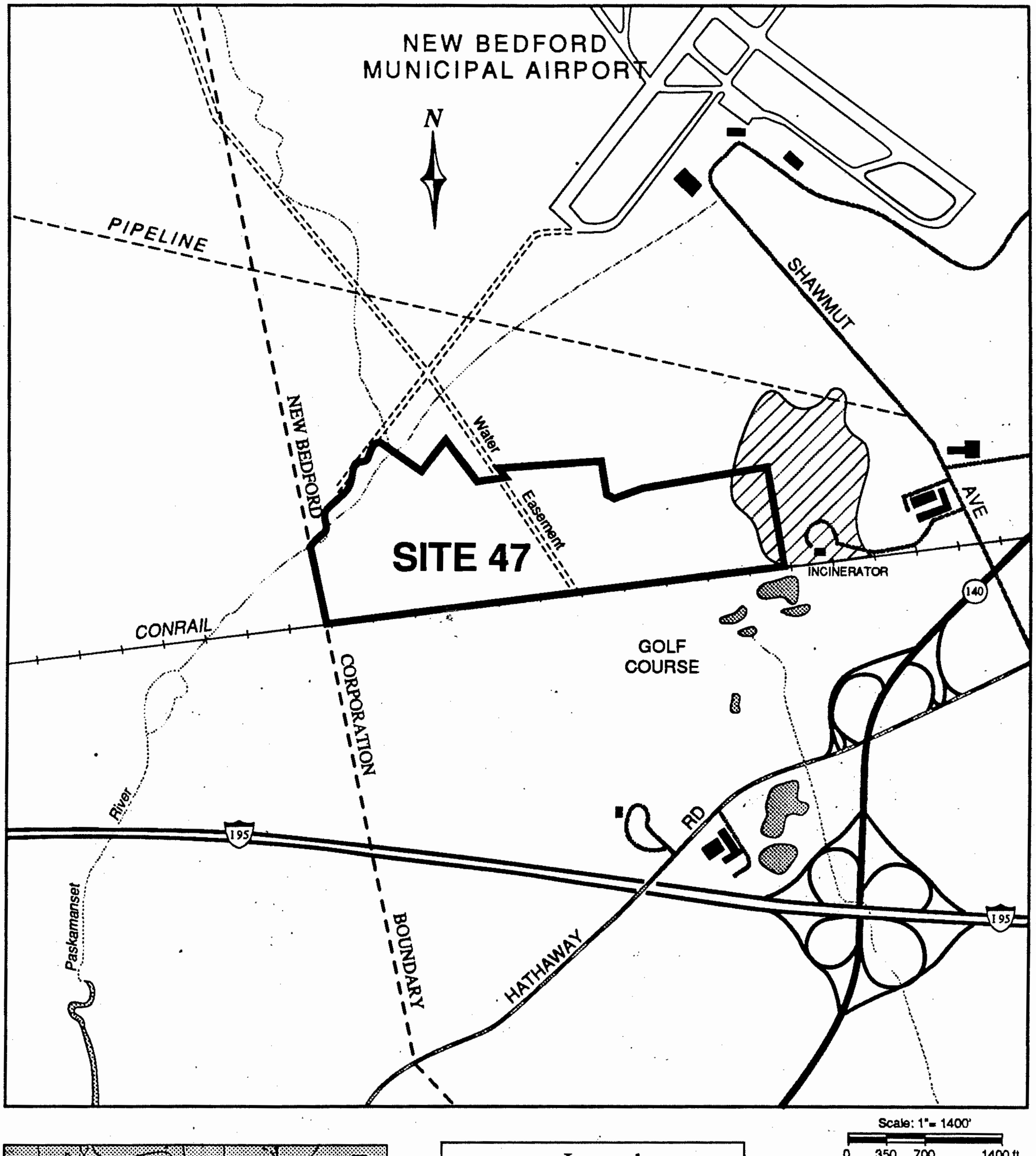
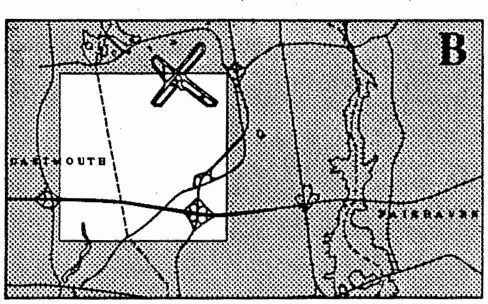
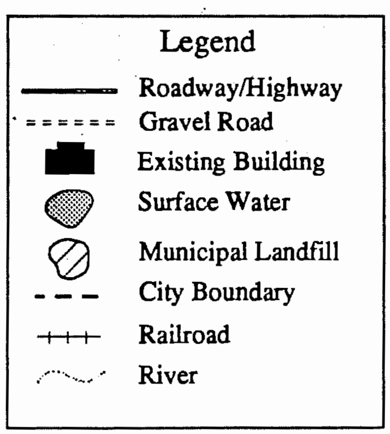



**FIGURE 3.3-1**
**ALTERNATIVE SOLIDS DISPOSAL SITES**
**(CRAPO HILL, 47, 40)**

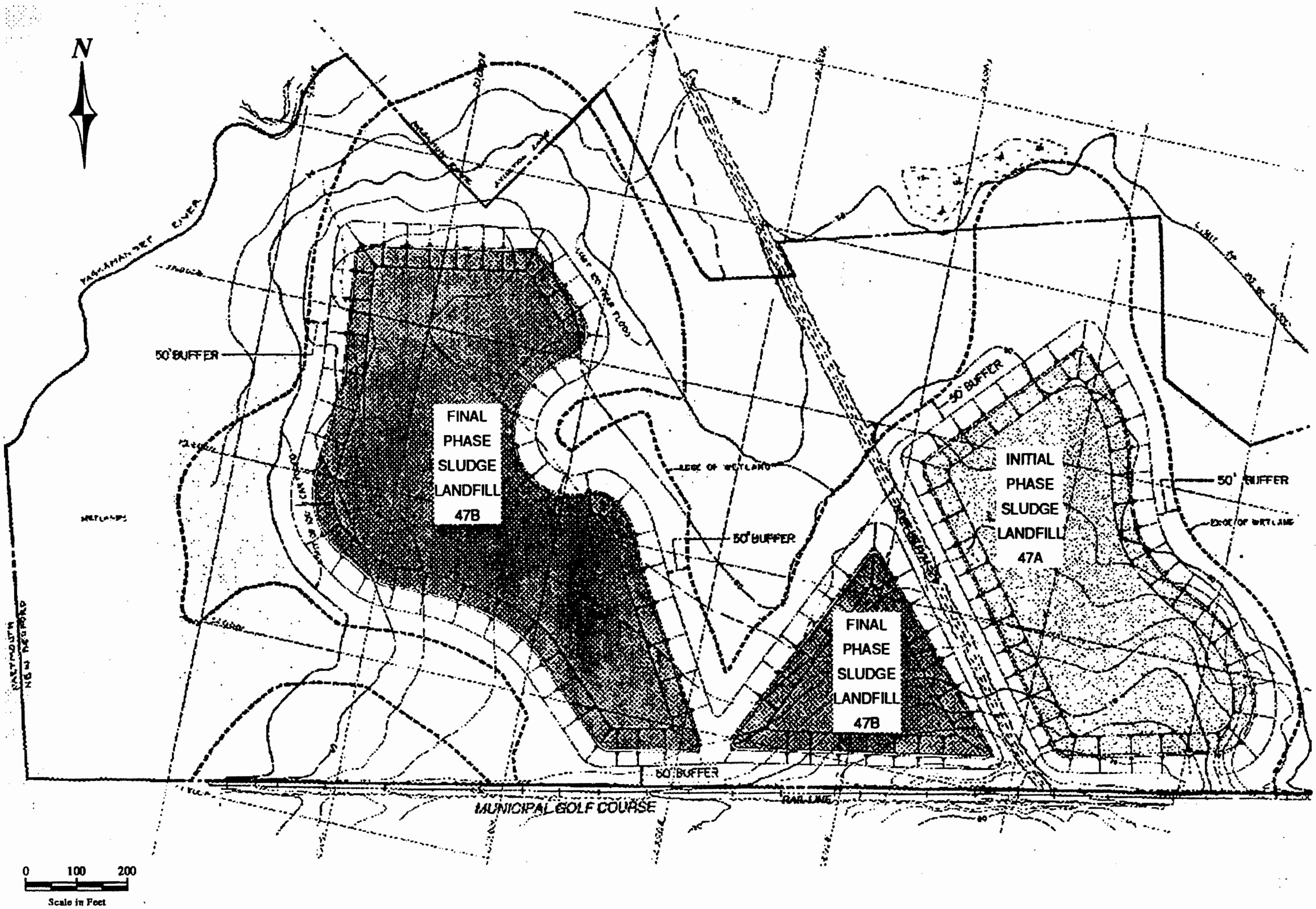



Adapted from CDM, 1989

**FIGURE 3.3-2**
**LOCATION OF**
**ALTERNATIVE SITE 47**




Adapted from CDM, 1989

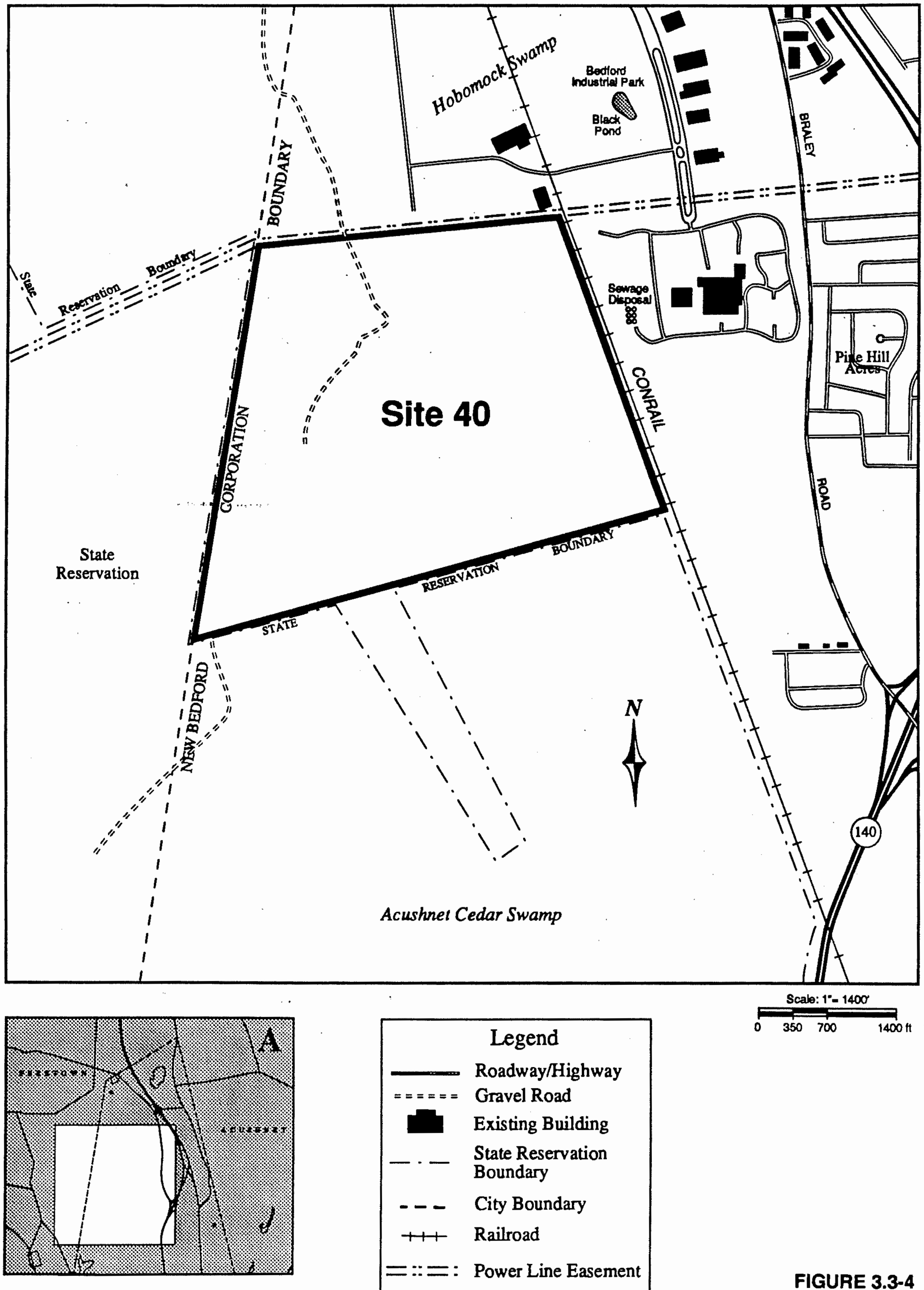
**FIGURE 3.3-3**
**PROPOSED LANDFILL LAYOUT**
**FOR ALTERNATIVE SITE 47**

developable portion of the site is an area of approximately 70 acres (see Figure 3.3-4 and 3.3-5).

## 3.4 DESCRIPTION OF SOLIDS MANAGEMENT ALTERNATIVES

The solids treatment technologies and disposal sites retained for detailed evaluation as described in Section 3.2.3 and 3.3.4, respectively, can be combined in a number of ways to make up an overall solids management scheme for the City of New Bedford. In particular, this Draft EIS considers using the Crapo Hill Landfill for reuse of chemically fixed sludge as daily cover along with a landfill with five years of available capacity for disposal of either chemically fixed or lime stabilized sludge as backup. Both Site 47 and Site 40 have enough area available for this backup.

Site 40 and 47 will also be evaluated for development of a landfill that could accommodate disposal of chemically fixed sludge for the full planning period (through the year 2015). For these alternatives, the backup plan would be landfilling of lime stabilized sludge at the same site. It is also possible that a combination of the two sites could be considered, if necessary, to provide sufficient landfill capacity to serve the full planning period.




Adapted from CDM, 1989

**FIGURE 3.3-4**
**LOCATION OF**
**ALTERNATIVE SITE 40**


Adapted from CDM, 1989

**FIGURE 3.3-5**
**PROPOSED LANDFILL LAYOUT FOR ALTERNATIVE SITE 40**

## CHAPTER FOUR

## IDENTIFICATION OF OUTFALL ALTERNATIVES

The selection process for the outfall alternatives involved three steps:

- o determination of the quality and quantity of effluent to be discharged by the new treatment plant;

- o development of the best mechanism (i.e. technology) through which to discharge the effluent; and

- o selection of the best discharge location.

The latter two steps were carried out simultaneously, although the outcome of both was ultimately dependent upon effluent quality and quantity. Furthermore, choices made for technology and location alternatives were also interdependent. The selection process is outlined in this chapter according to the three steps listed above.

### 4.1 OUTFALL EFFLUENT CHARACTERIZATION

This section describes the predicted effluent quality and quantity used to predict potential impacts for each outfall alternative. Both parameters are required to assess the ability of the discharge to meet both EPA and Massachusetts Water Quality Criteria and Standards.

Each outfall alternative was modeled using 30 mgd and 75 mgd of secondary effluent as average and worst-case conditions, respectively. The 30 mgd is annual average dry weather flow, while 75 mgd is the peak dry weather flow. Of the 1500 mgy of storm effluent entering the system, approximately 1230 mgy (80 %) will receive secondary treatment, while the remianing volume will enter the Inner Harbor as CSOs. The additional storm flow entering the treatment plant represents 3.4 mgd, resulting in a total plant annual average flow of 33.4 mgd. Given that all effluent to be discharged through the outfall will receive secondary treatment, there is not a significant difference between average dry weather flow and total average annual flow, especially in comparison to the 75 mgd assumed for peak dry weather flow. Therefore, the outfall alternatives were not additionally modeled under the 33.4 mgd total annual flow rate.

#### 4.1.1 Projected Conventional Pollutant Loads

Assuming that only secondary treatment effluent is discharged at an outfall site, BOD (biochemical oxygen demand) loads are expected to range from 15 mg/l at a discharge rate of 30 mgd (average annual dry weather flow) to 30 mg/l at a discharge rate of 75 mgd (CDM, Volume IV, 1989). Total suspended solids (TSS) will similarly range from 15 mg/l to 40 mg/l for flows of 30 and 75 mgd.

#### 4.1.2 Projected Non-Conventional Pollutant Loads

Non-conventional pollutants include volatile and semivolatile organic compounds, metals, and pesticides. Pollutants of concern were identified through a tiered screening procedure, outlined in Figure 4.1-1. Of 137 constituents initially listed (those constituents of greatest environmental concern), 22 were determined to have the potential to impact the marine environment (Table 4.1-1). Projections of non-conventional pollutant loads (entering the treatment plant) were made in order to estimate concentrations in the effluent. These projections were based on the mass loading rates of the 22 compounds identified in the screening procedure, assuming that the loading rate remains constant with changes in flow (CDM, Volume IV, 1989).

Projected effluent pollutant loads were determined as a function of projected influent loads and expected removal efficiencies during secondary treatment (CDM, Volume IV, 1989). The resulting loading projections made for the secondary effluent are summarized in Table 4.1-1.

#### 4.1.3 Partitioning of Toxic Chemicals Between Water Column and Effluent Solids

The loading rates given in Table 4.1-1 represent the total amount of a contaminant contained in the whole effluent. In the aquatic environment, some contaminants will remain dissolved in the water column while others will sorb (bind) to settleable solids and eventually accumulate in the sediments near the outfall. Some bound constituents, and nearly all dissolved constituents, will be transported out of the area before settling. The unique partitioning behavior of each contaminant is an important factor in predicting pollutant concentrations in both the water column and in the sediments.

A detailed analysis of the tendency of those contaminants listed in Table 4.1-1 to bind with particles was undertaken in the EIR, and is described in Section 5.5, Volume IV, of that document. This analysis is summarized below.

**4.1.3.1 Partitioning of Organic Compounds.** The projected partitioning of organic compounds between the atmosphere, the water column, and the sediments during secondary treatment is summarized in Table 4.1-2. The majority of compounds exhibit a tendency to remain in the water column, and thus have a greater potential to move away from the immediate vicinity of the outfall

**Step 1**

137 wastewater constituents of the greatest environmental concern identified; influent sampling program implemented to determine presence of these compounds

↓

**Step 2**

Remove constituents with no water quality criteria (33 out of 137 removed)

↓

**Step 3**

Remove chemicals with influent loadings which meet all criteria (17 removed)

↓

**Step 4**

Remove chemicals that were never detected whose detection limits after dilution* are below criteria (39 removed)

↓

48 constituents of concern of which 22 were detected in influent

* Based on expected minimum dilution factor of 20

Adapted from: CDM, 1989

**FIGURE 4.1-1**
**SUMMARY FLOWCHART OF CONSTITUENT SELECTION PROCESS**

## TABLE 4.1-1
## LOADING PROJECTIONS FOR CHEMICALS OF CONCERN

| Constituent | Projected Influent Load (lb/day) | Projected Influent Std. Deviation (lb/day) | Removal Efficiencies Secondary Treatment(1) | Secondary Effluent Average Load (lb/day) | Secondary Effluent Std. Deviation (lb/day) |
|---|---|---|---|---|---|
| bis(2-ethylhexyl) phthalate | 18.64 | 48.10 | 90% | 1.864 | 4.81 |
| butylbenzyl phthalate | 2.28 | 0.99 | 95% | 0.11 | 0.05 |
| chloroform | 3.36 | 1.19 | 90% | 0.34 | 0.12 |
| di-n-butyl phthalate | 2.45 | 1.33 | 90% | 0.25 | 0.13 |
| diethyl phthalate | 2.49 | 0.81 | 90% | 0.25 | 0.08 |
| di-n-octyl phthalate | 2.05 | 0.80 | 90% | 0.21 | 0.08 |
| n-nitrosodiphenylamine | 3.11 | 2.56 | 69% | 0.97 | 0.79 |
| 1,1,2,2-tetrachloroethane | 1.75 | 1.59 | 90% | 0.18 | 0.16 |
| tetrachloroethylene | 3.92 | 4.93 | 90% | 0.39 | 0.49 |
| arsenic | 0.83 | 0.61 | 50% | 0.42 | 0.31 |
| beryllium | 4.12 | -- | 50% | 2.06 | -- |
| chromium | 27.57 | 20.94 | 76% | 6.62 | 5.03 |
| copper | 41.93 | 18.79 | 82% | 7.55 | 3.38 |
| lead | 11.50 | 26.64 | 57% | 4.95 | 11.46 |
| mercury | 0.17 | 0.05 | 75% | 0.04 | 0.01 |
| nickel | 22.34 | 13.06 | 32% | 15.19 | 8.88 |
| silver | 2.59 | 1.51 | 90% | 0.26 | 0.15 |
| zinc | 64.67 | 31.06 | 76% | 15.52 | 7.45 |
| cyanide | 3.25 | 5.35 | 60% | 1.30 | 2.14 |
| 4,4'-DDT | 0.01 | -- | 90% | 0.001 | -- |
| gamma-BHC | 0.03 | 0.03 | 90% | 0.003 | 0.003 |
| PCBs(total) | 0.18 | 0.12 | 90% | 0.018 | 0.012 |

(1) Secondary treatment removals include primary treatment removals.
Adapted from: CDM, Volume IV, 1989.

**TABLE 4.1-2**
**PARTITIONING OF ORGANIC CHEMICALS**

| Chemical | Secondary Effluent (Peak Flow, 75mgd) | | |
|---|---|---|---|
| | % in water | % in solids | % in air |
| bis(2-ethylhexyl) phthalate | 73 | 27 | 0 |
| butylbenzyl phthalate | 77 | 23 | 0 |
| chloroform | 87 | 0 | 13 |
| di-n-butyl phthalate | 86 | 14 | 0 |
| diethyl phthalate | 99 | 1 | 0 |
| di-n-octyl phthalate | 61 | 39 | 0 |
| 4,4'-DDT | 17 | 83 | 0 |
| gamma-BHC | 96 | 4 | 0 |
| n-nitrosodiphenylamine | 96 | 4 | 0 |
| PCBs(aroclor mixtures) | 6 | 94 | 0 |
| 1,1,2,2-tetrachloroethane | 98 | 0 | 2 |
| tetrachloroethylene | 52 | 0 | 48 |

Adapted from: CDM, Volume IV, 1989

through current and wave action. PCBs and 4,4'-DDT are exceptions to this pattern, tending to partition to the solid fraction of the effluent.

Estimates of organic contaminant concentrations in the effluent suspended solids were calculated from partitioning coefficients (CDM, Volume IV, 1989). The concentrations of a constituent in the solids is a function of the load of the constituent in the effluent (see Table 4.1-1), the percent of the constituent expected to associate with solids (see Table 4.1-2), and the load of settleable solids in the effluent. Predicted concentrations of organic chemicals under average and peak discharge of secondary effluent are listed in Table 4.1-3.

**4.1.3.2 Partitioning of Inorganic Compounds.** The extent that metals bind to sewage particles varies not only from metal to metal, but also between treatment plants (Table 4.1-4) (CDM, Volume IV, 1989).

Unlike organic compounds, metals are nonvolatile and therefore partitioning to the atmosphere is not considered (CDM, Volume IV, 1989). Estimates of the sorption of metals to effluent particles are summarized in Table 4.1-5 and are based on information about binding characteristics of each metal and on sorption data found in the literature.

The procedure used to estimate metals concentrations in the effluent suspended solids is similar to that described above for organics (CDM, Volume IV, 1989). The resulting estimates of metals concentrations in effluent suspended solids under average and peak secondary flow are summarized in Table 4.1-6.

**TABLE 4.1-3**

**CONCENTRATION (PPM) OF ORGANIC CHEMICALS IN PROJECTED EFFLUENT SUSPENDED SOLIDS**

| Constituent | Average Annual Secondary Effluent (34 mgd) | Peak Flow Secondary Effluent (75 mgd) |
|---|---|---|
| bis(2-ethylhexyl)phthalate | 53.9 | 20.28 |
| butylbenzyl phthalate | 2.7 | 1.3 |
| chloroform | 0.018 | 0.008 |
| di-n-butyl phthalate | 3.5 | 1.4 |
| diethyl phthalate | 0.20 | 0.089 |
| di-n-octyl phthalate | 9.5 | 3.3 |
| 4,4'-DDT | 0.15 | 0.033 |
| gamma-BHC | 0.01 | 0.005 |
| n-nitrosodiphenylamine | 1.03 | 0.46 |
| PCBs (aroclor mixtures) | 9.05 | 1.69 |
| 1,1,2,2-tetrachloroethane | 0.052 | 0.023 |
| tetrachloroethylene | 0.019 | 0.009 |

Adapted from: CDM, Volume IV, 1989.

**TABLE 4.1-4**

**EXAMPLES OF ASSOCIATION OF METALS WITH PARTICLES IN EFFLUENTS FROM SEWAGE TREATMENT PLANTS**

| | Laxen & Harrison 1981 | Chen et al. 1974 | Rossin et al. 1982 | Lawson et al. 1984 |
|---|---|---|---|---|
| Effluent TSS (mg/l): | 23 | 8 | 10 | 57 |
| Filter Size: | >12 um | >0.008 um | >0.22 um | >0.2 um |
| Type of Treatment or Effluent: | Final Eff. from Final Sed. Tank | Secondary Effluent | Secondary Effluent From AS (1) | Secondary Effluent From AS (1) |
| Metal | Percent (%) associated with Particles in Effluent | | | |
| arsenic | ND | ND | ND | ND |
| beryllium | ND | ND | ND | ND |
| cadmium | 20 | 13 | 60 | 52 |
| chromium | 22 | 94 | ND(2) | ND |
| copper | 32 | 15 | 24 | 72 |
| lead | 52 | 5 | 84 | ND |
| mercury | ND | 21 | ND | ND |
| nickel | ND | 2 | 9 | 54 |
| selenium | ND | ND | ND | ND |
| silver | ND | ND | ND | ND |
| zinc | ND | 12 | 93 | ND |

Note: (1) AS = activated sludge
(2) ND = no data available

Adapted from: CDM, Volume IV, 1989.

**TABLE 4.1-5**

**ESTIMATES OF METAL SORPTION TO SEWAGE PARTICLES IN SECONDARY TREATMENT EFFLUENT**

| Metal | Percent Associated with Effluent Particles: Measured Range (N)[1] | Percent Associated with Effluent Particles: Recommended for Model[2] |
|---|---|---|
| arsenic | - | (10) |
| beryllium | - | (35) |
| cadmium | 13-60 (5) | 34 |
| chromium | 22-94 (3) | 54 |
| copper | 15-72 (5) | 35 |
| lead | 5-84 (3) | 47 |
| mercury | 21 (1) | (30) |
| nickel | 2-54 (4) | 17 |
| selenium | - | (10) |
| silver | - | (35) |
| zinc | 12-93 (3) | 40 |

NOTES: (1) N = number of data points for range (data from Table 4.1-4.

(2) Based on measured range for chemical, data for similar chemicals and, where no measured range available, on expected speciation of metal in effluent. Parenthesis indicate a high degree of uncertainty.

Source: CDM, Volume IV, 1989.

**TABLE 4.1-6**
**CONCENTRATION OF METALS IN**
**PROJECTED EFFLUENT SUSPENDED SOLIDS**

| Constituent | Average Annual Secondary Effluent (34 mgd) | Peak Flow Secondary Effluent (75 mgd) |
|---|---|---|
| arsenic | 10 | 1 |
| beryllium | 169 | 18 |
| chromium | 840 | 89 |
| copper | 621 | 66 |
| lead | 547 | 58 |
| mercury | 3 | 0.3 |
| nickel | 607 | 64 |
| silver | 21 | 2 |
| zinc | 1459 | 155 |

Adapted from: CDM, Volume IV, 1989.

### 4.1.4 Summary

Twelve organic compounds and ten metals were identified from a list of 137 priority compounds as contaminants of concern for the modeling section (Section 5, Volume IV, 1989) of the Draft EIR. Concentrations of each contaminant in the secondary treatment effluent were determined for average and peak discharge of secondary treatment effluent. This information will be used in Section 6.2 of this Draft EIS to make predictions about the ability of the effluent to meet applicable water quality criteria and standards in the mixing zone for each candidate outfall alternatives.

## 4.2 OUTFALL TECHNOLOGY ALTERNATIVES

The purpose of this section is to describe the technological differences between outfall alternatives, and to describe the screening process for these alternatives.

#### 4.2.1 Phase II Screening

Seven alternatives for the New Bedford outfall were identified in the initial screening process. Each alternative involves pipe construction or rehabilitation, with or without addition of a diffuser. The Phase II Screening process began with a preliminary review of the engineering feasibility of each option to eliminate those options that did not present clear advantages.

Several factors were evaluated in this preliminary screening, including engineering constructability, and cost criteria. As a result, four of the seven alternatives were eliminated for reasons outlined in Table 4.2-1. The following alternatives were retained for additional review:

- o rehabilitation of the existing 60" pipe at the Existing Site;
- o construction of a buried pipe to the Existing Site, with a seabed diffuser at its terminus; and
- o construction of a tunnel boring to the 301(h) Site, with a seabed diffuser at its terminus.

The nearfield and farfield dilution potential for each alternative was subsequently compared using a series of computer models; the modeling phase of the analysis is described in Chapter 6 of this document.

**4.2.1.1 Minimum Design Criteria.** To adequately transport and discharge the effluent, each chosen alternative must meet several minimum design criteria. These operational criteria are designed to ensure that the system functions properly under a broad range of discharge and environmental conditions.

**Design Ocean Levels.** The effluent outfall system must be designed to discharge a relatively large range of flows against a variety of tide levels (CDM, Volume IV, 1989). Changes in tides can alter the system head (difference in pressure exerted on the effluent between the treatment plant and the outfall) that is required to drive the outfall system. Each alternative must be able to maintain sufficient head under all expected ocean levels.

**Dynamic Heads.** Dynamic heads are a measure of the energy required to push the effluent through the outfall pipe and diffuser (if present)(CDM, Volume IV, 1989). Losses in dynamic head are caused by friction between the effluent and the pipe material. The magnitude of the head required to drive the effluent depends on pipe size and material, diffuser configuration (if present), and the magnitude of the flow.

**Surge Protection.** If plant failure occurs, there is a potential for the outfall pipe to partially empty, allowing air to enter

TABLE 4.2-1 NEW BEDFORD OUTFALL ALTERNATIVES ELIMINATED FROM ANALYIS

| Alternative | Reason for Rejection |
|---|---|
| Add a diffuser to the Exiting 60" pipe | The joints and walls of the existing pipe are not expected to withstand the internal pressures associated with discharging the effluent against a 100-year ocean level without further modification. |
| Rehabilitate Existing pipe with HDPE liner and install | Entails additional construction for diffuser, that will disrupt contaminated sediments; rehabiliatation only option preferred, because the additional dilution provided by diffuser is outweighed by the additional costs. |
| Extend existing 72" pipe and diffuser | Extending the 72-inch pipe requires adding substantial outfall improvements or additions to existing outfall system; construction of new 72" outfall pipe is more desirable. |
| Construction of a buried 84" pipe and seabed diffuser at 301(h) site | Involves excavation of contaminated outfall pipe sediments, and is more expensive than the tunnel option; actual outfall performance of this alternative is equal to the tunnel option, and so is rejected because of cost. |

the system and subjecting the system to potentially damaging pressure surges when the pipe refills. Each alternative must have protection against this phenomenon built into the system.

**Wave Protection.** This criterion requires that the outfall pipe and/or diffuser will not be moved by any extreme wave events.

**4.2.1.2 Additional Diffuser Design Criteria.** In addition to the operational criteria addressed above, options involving a diffuser have specific design criteria that must be met. Criteria discussed in this section are not applicable to the pipe rehabilitation alternative for the Existing Site; the only alternative considered that would not involve a diffuser.

**Diffuser Orientation.** To maximize initial dilution potential, the diffuser must be oriented perpendicular to the prevailing ocean currents. Any other orientation will prevent proper formation of plumes from individual ports, and allow them to merge prematurely.

**Diffuser Length.** The initial dilution of the effluent discharged through a diffuser increases with the length of the diffuser for a given effluent discharge rate, ambient current speed, and ambient density profile (CDM, Volume IV, 1989). Relationships between effluent flow rates, depth of water over the diffuser, ambient currents, and differences between effluent and ambient sea water densities were used to determine the most appropriate diffuser length. This methodology is detailed in CDM, Volume IV, 1989.

**Hydraulic Design Criteria.** These criteria ensure a uniform distribution of effluent along the diffuser, set minimum scour velocities (to prevent particle deposition in the outfall pipe and the diffuser ports), account for overall head losses, and set the number, spacing, and diameter of the discharge ports in the diffuser (CDM, Volume IV, 1989).

**4.2.1.3 Final Diffuser Design** Given the criteria mentioned above, a 200-m diffuser with twin, 4-inch diameter ports spaced every 16 feet, and oriented perpendicular to the predominant ambient ocean currents, was specified (see Section 6.3, CDM, Volume IV, 1989). This alignment was proposed for the two outfall alternatives utilizing a diffuser.

### 4.2.2 Description of Technology Alternatives

#### 4.2.2.1 Existing Outfall Site

**Rehabilitation of Existing Pipe.** The existing 60-inch cast iron pipe is 1000 m (3300 ft) long, and over its 80+ year life has accumulated sufficient grit and grime along its inner walls to reduce its hydraulic capacity. The rehabilitation plan includes lining the pipe with high density polyethylene (HDPE) pipe. The cast iron pipe would be cleaned with a hydraulically driven polyethylene "pig" that will allow the HDPE pipe to be inserted as a liner. The resulting interior pipe diameter would be 50.5 inches. This alternative would allow a maximum effluent discharge rate of 75 mgd.

**Construction of New Outfall and Diffuser.** A new 72-inch pipe would be constructed from the Fort Rodman area to the Existing Outfall Site. The length of the new outfall pipe would be approximately 1000 m (3300 ft). This pipe would have sufficient capacity to discharge 75 mgd of secondary effluent. The outfall would be placed in an excavated trench and backfilled with the appropriate fill and rip rap material. A multi-port seabed diffuser (as specified above) would be used at the outfall terminus.

**4.2.2.2 301(h) Site.** A 120-inch tunnel boring machine (TBM) would be used to bore a tunnel having an 18-inch concrete liner, resulting in an outfall pipe having a finished diameter of 84 inches. The outfall would terminate in a diffuser (as specified above) approximately 4.2 miles from the Fort Rodman area. This option would provide maximum capacity for 75 mgd of secondary effluent. A multi-port diffuser would be used at the outfall terminus.

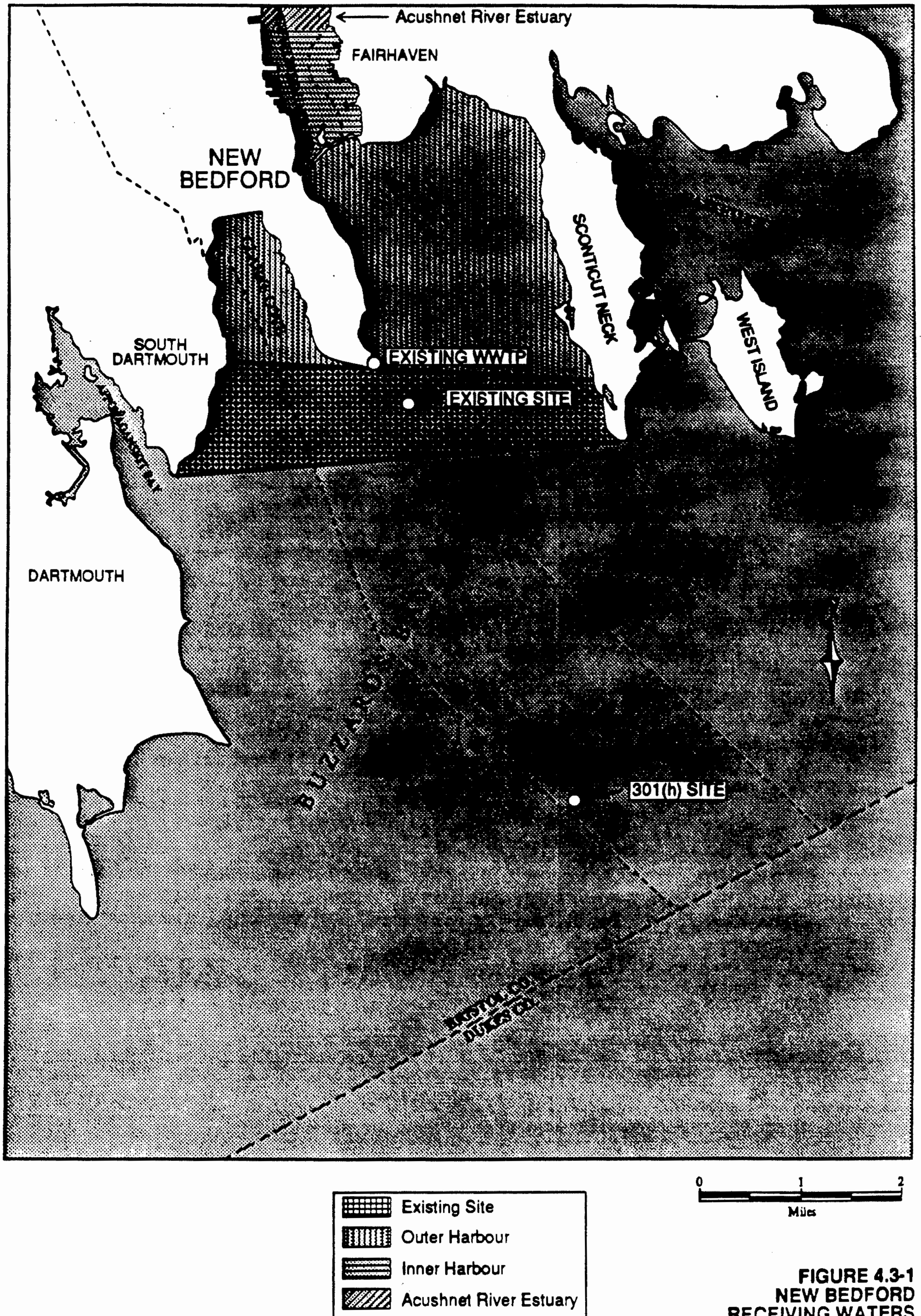
## 4.3 OUTFALL SITING ALTERNATIVES

The purpose of this section is to characterize the screening process used to identify potential sites for locating the effluent outfall. The analyses conducted by the City of New Bedford and CDM in the Phase I and Phase II Facilities Plans were used for this analysis (CDM, 1989).

### 4.3.1 Phase I Screening

During Phase I of the outfall planning, the receiving waters around New Bedford were divided into four zones. The waters were reviewed according to three primary criteria: the present water uses and classifications, known facts about water circulation, and specific projected water quality impacts related to the four zones. In addition, a simple model of tidal movement and sedimentation processes was used to evaluate the possible consequences of locating an outfall in each of the four possible siting zones.

**4.3.1.1 Description and Classification of Use.** The potential receiving waters for discharges from a secondary treatment plant were divided into the four zones outlined in Figure 4.3-1 and described below.




Adapted from CDM, 1989

**FIGURE 4.3-1**
**NEW BEDFORD**
**RECEIVING WATERS**

- Acushnet River Estuary - extends for more than 3 miles from the Saw Mill Dam in the Town of Acushnet to the U.S. Route 6 bridge at Popes Island.

- New Bedford Inner Harbor - the reach of water bounded by Popes Island to the north, the New Bedford hurricane barrier to the south, New Bedford to the east, and Fairhaven to the west.

- New Bedford Outer Harbor - all waters outside of the hurricane barrier inshore of a line from Moshers Point in South Dartmouth to the southern tip of Clarks Point extending eastward to Sconticut Neck, including Clarks Cove.

- Existing Primary Outfall - area near the existing New Bedford ocean outfall bounded by the Outer Harbor zone to the north, and to the south by a straight line drawn from Ricketsons Point below South Dartmouth to Wilbur Point on the southern tip of Sconticut Neck. The 301(h) Site is just beyond the southern boundary of this area.

For the first step of the Phase I screening the zones were described according to the current water uses and the State of Massachusetts water use classification. Each zone is briefly described in Table 4.3-1.

The Inner Harbor and Acushnet Estuary do not meet SB water quality standards because of high coliform levels and other contaminants. The entire area inshore of the hurricane barrier and most of the Outer Harbor is closed to shellfishing because of high fecal coliform levels (CDM, Volume I, 1989). A summary of the existing polychlorinated biphenyl (PCB) contamination of the sediments was also reviewed for each of the zones under consideration. Currently, the New Bedford Harbor area has extensive commercial fish and lobster closure areas due to PCB contamination (Figure 4.3-2). Area I is closed to all fishing activities, Area II is closed to the taking of lobster and bottom-feeding fish (eels, scup, flounder, and tautog). Area III is closed to the taking of lobster.

**4.3.1.2 Circulation In New Bedford Harbor.** The dynamics of water circulation in New Bedford Harbor were not characterized adequately until recently. Previous data were limited to the oceanographic surveys of Buzzards Bay proper (Summerhayes et al., 1977, and Rosenfeld et al., 1984) and data collected for the 301 (h) waiver applications by the City of New Bedford (CDM, 1979 and 1983b). More recent studies of the Harbor have been conducted in conjunction with EPA-sponsored activities as a result of Superfund remedial investigations and by various parties named as litigants in pending adjudicatory proceedings.

**TABLE 4.3-1**
**DESCRIPTION OF NEW BEDFORD RECEIVING WATERS CONSIDERED FOR SITING OF THE EFFLUENT OUTFALL**

---

Acushnet River Estuary

- o 510 acres*, average depth is 7 ft
- o recreational boating resource
- o commercial resource closed to fishing
- o SB classification

New Bedford Inner Harbor

- o 485 acres*, average depth is 14 ft
- o recreational boating resource
- o commercial resource closed to fishing
- o SB classification

New Bedford Outer Harbor

- o 580 acres*, average depth is 15 ft (Clarks Cove)
  3,000 acres, average depth is 18 ft (Clarks Point to Sconticut Neck)
- o recreational resource for beaches, swimming, sport fishing, and shellfishing
- o areas closed to fishing and shellfishing
- o SA classification

Vicinity of the Existing Outfall

- o 2,400 acres*, average depth 22 ft
- o vicinity closed to commercial shellfishing and lobstering
- o SA classification

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* approximate values based on mean low water.

Source: CDM, Volume I, 1989

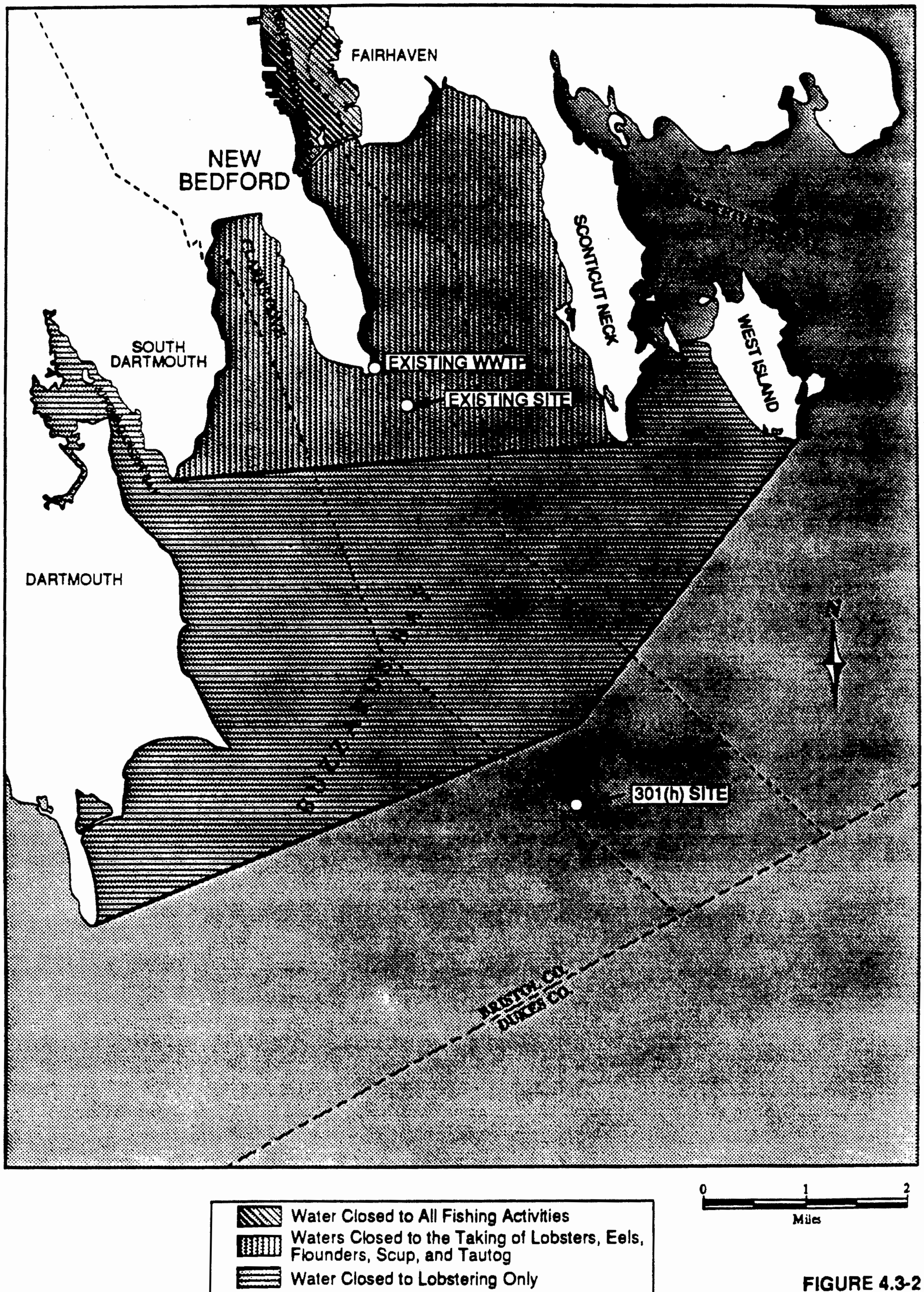


**FIGURE 4.3-2**
**AREAS SUBJECT TO PCB CLOSURES**

Adapted from CDM, 1989

For the Phase I screening analysis, studies on the circulation of the Outer Harbor were summarized (Geyer,1987; Geyer and Grant, 1986); the circulation dynamics are outlined in Table 4.3-2. An understanding of Harbor circulation dynamics is important in estimating New Bedford Harbor's capacity to assimilate and disperse discharges from a secondary wastewater treatment plant.

Circulation data for the Acushnet Estuary and the Inner Harbor were also briefly reviewed and indicate the following: 1) tidal currents dominate the motions of the inner harbor, 2) tidal currents away from constrictions tend to be weak (approximately 5 cm/s), 3) wind-driven currents can be as large as 10 cm/s, and 4) horizontal exchange is accomplished by tidal flow. This circulation analysis was considered in evaluating the zones for possible outfall sites.

**4.3.1.3 Receiving Water Analysis.** In this part of the Phase I analysis, the four receiving water zones were analyzed by several methods to quantify the impact of placing an outfall in each zone. The impacts considered were concentrations of selected conservative effluent constituents and particle settling rates. Due to the simplifications and assumptions involved in this preliminary evaluation, only the relative magnitude of the impacts on each potential outfall zone was estimated.

**Conservative Constituents.** To evaluate steady-state concentrations of conservative constituents, the EPA receiving water criteria outlined in the 1986 "Gold Book" were used in the analysis. To estimate the loading to any particular zone, a simplified mathematical model representing New Bedford Harbor was applied. The simplified model simulated the processes that transport and disperse effluent constituents through all zones (details of the model are provided in Appendix C of the Phase I Facilities Plan)(CDM, Volume I, 1989). The model yielded estimates of expected dilutions in each of the four zones given that a WWTP outfall was discharging in one of the zones. Based upon the dilution analysis, siting an outfall as far as possible from the Acushnet Estuary results in the most desirable conditions.

An estimate of the chemical constituent concentration in the receiving waters was derived using the estimated dilution factors, estimated inflow concentrations, and assumed chemical constituent removal efficiencies. Using dilution capability estimates for each zone, estimates of the ability to meet the current EPA "Gold Book" Criteria for constituents discharged from the WWTP were derived (New Bedford Industrial Pretreatment Program)(CDM, 1983c). The results indicated that, of the four areas considered in the evaluation, the region of the existing outfall would result in the highest level of criteria compliance. Locating the outfall in this region or farther out in Buzzards Bay was shown to result in more efficient dilutions of chemical

**TABLE 4-3.2**
**COMPONENTS OF CIRCULATION DYNAMICS IN**
**NEW BEDFORD OUTER HARBOR**

---

Tidal Currents

- currents in the outer harbor tend to be weak (5-7 cm/s)
- currents at the mouth are stronger (10-15 cm/s)
- tidal flushing does not appear to provide a rapid means of fluid exchange

Tide-Induced Residual Currents

- residual currents adjacent to Round Hill Point and West Island have mean velocities up to 5 cm/s and likely dominate transport to the outer part of the harbor

- numerical model results indicate minimal tide-induced flow through the interior of the harbor

Observed Residual Currents

- significant residual currents range form 1 to 4 cm/s
- wind-driven currents range 2-4 cm/s
- density-driven flow appears significant

Stratification

- annual salinity variation
- stronger stratification in summer due to temperature
- stratification results in a reduction of mixing, and likely influences nutrient fluxes and oxygen distribution

Flushing

- accomplished by low frequency currents
- least flushing occurs during moderate southerly winds
- stagnation of circulation may be severe

Nearshore Circulation and Combined Sewer Overflows(CSOs)

- little known about mixing next to the CSOs
- discharge from CSOs, especially during runoff events, is important to nearshore circulation

---

Adapted from: CDM, Volume I, 1989.

constituents than would a location in any of the other three zones.

**Particle Settling.** Mass flux estimates for suspended solids in the effluent and relative particle settling rates in the candidate outfall zones were used to estimate sediment accumulation resulting from the discharge. A description of the assumptions and constants used in the analysis is presented in Appendix C of the Phase I Facilities Plan (CDM, Volume I, 1989). Although the greatest rate of sediment deposition would occur in the zone where the existing outfall is located, placing the secondary treatment outfall in this area results in the lowest incremental settling rates when compared with natural accumulation.

**4.3.1.4 Conclusions and Recommendations of Phase I.** Based upon the analysis described above, siting of an outfall in the same zone as the present outfall, or further out in Buzzards Bay, would have less impact upon the Acushnet Estuary, Inner Harbor, and Outer Harbor segments of New Bedford Harbor than would siting of the outfall in any of the other three areas. Analyses applied in the Phase I study demonstrated that, of the four candidate areas considered, the present outfall site would have the lowest impact relative to chemical constituent input (CDM, 1989). The Existing Site, or a site further out into Buzzards Bay, would have less aesthetic impact upon the Harbor because the diffuser and outfall would be in deeper water than the other zones evaluated.

Subsequent to the evaluation of the four candidate areas for outfall siting, additional consideration was given to the effects of locating an outfall in any of the areas evaluated. It was recognized that location of the outfall in relatively shallow and enclosed waters which are classified as SA and SB could potentially jeopardize the recreational value of these waters. This potential was especially true for New Bedford Outer Harbor which is lined by numerous beaches and currently does not have restrictions on human contact with the waters. It was recommended in the CDM Phase I Report (Volume I, 1989) report that the 301(h) waiver site, which is several kilometers further out in Buzzards Bay, be considered as an alternative location for the outfall. Therefore, a second alternative site, the "301(h) Site" was added for evaluation.

### 4.3.2 Description of Alternatives

Two sites, the existing discharge site and the 301(h) Site, were considered in the Phase II Screening of alternatives for the wastewater treatment plant outfall location. The Existing Site (Figure 4.3-1) is located at the terminus of the present outfall from the Fort Rodman wastewater treatment facility. The site is located in outer New Bedford Harbor approximately 1000 m (3300 feet) south-southeast of Fort Rodman, at a depth of 9 m (29 feet), the total water depth at mean low water.

The 301(h) outfall site is located 7 km (22,200 ft) south of Clarks Point, south-southwest of Negro Ledge, at a depth of 14 m (45 ft), the total water depth at mean low water (Figure 4.3-1). The site was identified in the City of New Bedford's 301(h) waiver application (CDM, 1983).

### 4.3.3 Criteria for Evaluation

The two outfall site alternatives (Existing Site and 301(h) Site) are compared in this Draft EIS using a number of environmental and engineering criteria. These criteria, shown in Table 4.3-3, were approved by both the pertinent state and federal agencies and the Citizen's Advisory Committee for the facilities planning process. The environmental criteria used in the evaluation consider the ability to meet federal and state water quality criteria at the outfall sites and the effect of the effluent on marine resources at each site. Engineering criteria address the costs and difficulty associated with constructing an outfall at the two sites.

#### 4.3.3.1 Environmental Criteria

**Ability to Meet EPA Ambient Water Quality Criteria.** The potential for adverse effects on human health and marine biota was determined using the EPA "Gold Book" criteria. Anticipated levels of various chemicals at the edge of the mixing zone for the two candidate outfall sites were compared to several types of criteria:

- o aquatic toxicity criteria, i.e. levels estimated to be either acutely (CMC or criterion maximum concentration) or chronically (CCC or criterion continuous concentration) harmful to marine organisms.

- o human health criteria, i.e., levels at which consumption of contaminated fish and shellfish is estimated to increase the risk of cancer in humans by 1 in 100,000 ($10^{-5}$ criterion) or 1 in 1,000,000 ($10^{-6}$ criterion).

- o taste and odor criteria.

**Massachusetts Water Quality Standards.** The Massachusetts Water Quality Standards criteria focus on two types of pollutants. Standards are set for the "conventional pollutants" (e.g., dissolved oxygen, fecal coliform bacteria) to achieve adequate water quality for protection and propagation of aquatic life, contact recreation, and shellfish harvesting without depuration

**TABLE 4.3-3**
**NEW BEDFORD HARBOR OUTFALL SITING CRITERIA.**

| | |
|---|---|
| Environmental | |
| | Ability to meet EPA Ambient Water Quality Criteria |
| | Conformance with Massachusetts Water Quality Standards |
| | Avoidance of Adverse Sediment Accumulation |
| | Ability to Protect Local Species from Adverse Stress |
| | Ability to Maintain Ecosystem Structure |
| | Maintenance and Enhancement of Aesthetic Conditions |
| | Protection of Shoreline |
| | Protection of Marine Archeology |
| | Construction Impacts |
| Engineering | |
| | Reliability |
| | Flexibility |
| | Constructability |
| | Operational Complexity |
| | Power Needs |
| | Quality and Quantity of Dredged Material for Disposal and/or Relocation |
| | Cost |
| | Permitting |

Source: CDM, Volume IV, 1989.

(Class SA waters) (Table 4.3-4). Toxic substances are evaluated by the EPA human health criteria ($10^{-5}$ carcinogenicity risk).

**Avoidance of Adverse Sediment Accumulation.** Sediment accumulation can adversely affect bottom-dwelling invertebrates via burial or clogging of feeding mechanisms. In addition, the presence of toxic substances in sediments may threaten survival and/or be absorbed into the food chain ("bioaccumulation") of other marine organisms. An annual accumulation rate of 25 $g/m^2$ of sediment from natural and effluent sources has been determined by EPA to be potentially damaging to marine organisms.

**Ability to Protect Local Species from Adverse Stress.** Protection of endangered or economically important species often depends on maintaining critical habitats and uncontaminated food sources. In New Bedford Harbor, the local commercially important species occurring in candidate outfall areas are lobster (Homarus americanus), whelks (Busycon spp.), and hard-shell clams (Mercenaria mercenaria). Because dragging (commercial fishing using nets) is prohibited in Buzzards Bay, no finfish were designated as economically important. Additionally, two endangered species of sea turtles and eight endangered whale species occasionally use Buzzards Bay. Both immediate toxic effects and long-term chronic effects must be considered in the evaluation of this criterion. These factors must also be evaluated with respect to the importance of the species. This criterion is rated by evaluating such factors as dissolved oxygen, fecal coliform bacteria, and sediment contaminant levels. In addition, consideration was given to anticipated changes in key sediment characteristics (grain size, organic carbon) due to location of the outfall at each site. The distance of the outfall site from habitats was also important to the reproduction and survival of important indigenous species.

**Ability to Maintain Ecosystem Structure, Function and Stability.** This criterion was intended to evaluate the ability of the ecosystem to maintain structure, function, and stability with the addition or continuation of effluent discharge. The marine/estuarine ecosystem in New Bedford Harbor is typical of the area and is composed of the following basic functional groups: phytoplankton, zooplankton, bottom-dwelling invertebrates, and fish. Maintenance of the ecosystem was assessed by examining several critical parameters: predicted minimum oxygen levels; predicted sediment accumulation; chlorine levels in the water column remaining after chlorination; and sediment contaminant levels and subsequent bioaccumulation (uptake of contaminants by living organisms). Ecosystem stability is evaluated by determining if changes in community structure and function would occur due to the outfall (CDM, Volume IV, 1989).

**TABLE 4.3-4**
**COMMONWEALTH OF MASSACHUSETTS**
**WATER QUALITY STANDARDS FOR CLASS SA WATERS**

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The following minimum criteria are adopted and shall be applicable to all waters of the Commonwealth unless criteria specified for individual classes are more stringent.

| Parameter | Criteria |
|---|---|
| 1. Aesthetics | All waters shall be free from pollutants in concentrations or combinations that:<br>a) Settle to form objectionable deposits<br>b) Float as debris, scum, or other matter to form nuisances.<br>c) Produce objectionable odor, color, taste, or turbidity<br>d) Result in the dominance of nuisance species |
| 2. Radioactive Substance | Shall not exceed the recommended limits of the United States Environmental Protection Agency's National Drinking Water Regulations. |
| 3. Tainting Substances | Shall not be in concentrations or combinations that produce undesirable flavors in the edible portions of aquatic organisms. |
| 4. Color, Turbidity, Total Suspended Solids | Shall not be in concentrations or combinations that would exceed the recommended limits on the most sensitive receiving water use. |
| 5. Oil & Grease | The water surface shall be free from floating oils, grease, and petrochemicals, and any concentrations or combinations or combinations in the water column or sediments that are aesthetically objectionable or deleterious to the biota are prohibited. For oil and grease of petroleum origin, the maximum allowable discharge concentration is 15 mg/l. |

TABLE 4.3-4 (CONTINUED)

| | |
|---|---|
| 6. Nutrients | Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication. |
| 7. Other Constituents | Waters shall be free from pollutants alone or in combination that:<br><br>a) Exceed the recommended limits on the most sensitive receiving water use<br>b) Injure, are toxic to, or produce adverse physiological or behavioral responses in humans or aquatic life<br>c) Exceed site-specific safe exposure levels determined by bioassay using sensitive resident species. |

Additional Criteria

The following additional minimum criteria are applicable to coastal and marine waters for Class SA waters.

| Parameter | Criteria |
|---|---|
| 1. Dissolved Oxygen | Shall be a minimum of 85 percent of saturation at water temperatures above 77°F and shall be a minimum of 6.0 mg/l at water temperatures of 77°F (25°C) and below. |
| 2. Temperature Increase | None except where the increase will not exceed the recommended limits on the most sensitive water use. |
| 3. pH | Shall be in the range of 6.5-8.5 standard units and not more than 0.2 units outside of the naturally occurring range. |
| 4. Total Coliform Bacteria | Shall not exceed a median value of 70 MPN per 100 ml, and not more than 10 percent of the samples shall exceed 230 MPN per 100 ml in any monthly sampling period. |

Adapted from: CDM, Volume IV, 1989.

**Maintenance and Enhancement of Aesthetic Conditions.** Potential impacts on aesthetic conditions at the candidate outfall sites could occur as a result of the plume surfacing and nuisance algae blooms. This criterion is evaluated by determining the frequency of the effluent plume reaching the surface, expected dilution of the surfacing plume, and the probability of a nuisance algae bloom occurring (CDM, Volume IV, 1989).

**Protection of Shoreline Areas.** Shoreline areas on Clarks Point and both sides of the Outer Harbor are potentially vulnerable to effluent impacts such as the presence of floatable solids, elevated levels of coliform bacteria, and changes in sediment characteristics. The amount of effluent dilution available under extreme wind conditions is an important factor in the evaluation of the potential for shoreline impacts. The protection of shoreline areas was evaluated by determining the frequency and concentration of effluent reaching beach areas, the associated probabilities of floatables, and anticipated levels of fecal coliform bacteria in comparison to state standards (CDM, Volume IV, 1989).

**Protection of Marine Archeology.** Outfall and pipeline construction could potentially disturb areas of historic or archeological importance on the seabed. Any historic shipwrecks within 3 miles (4.8 km) of the outfall discharge or within 1 mile (1.6 km) of the proposed pipeline location were judged to be susceptible to construction impacts. The outfall sites are rated based on the proximity of known sites of significance and the likelihood of disturbance of these areas (CDM, Volume IV, 1989).

**Construction Impacts.** Other impacts related to construction that are used to compare the sites include: comparative construction duration; the amount of seabed area disturbed; the difficulty anticipated in disposal of dredged material; noise levels; and traffic/navigation impacts.

**4.3.3.2 Engineering Criteria.** Engineering criteria focus on the design, construction and operation of the outfall.

**Reliability.** The reliability criterion considers the ability of the outfall system to maintain operation without interruption under all anticipated conditions (CDM, Volume IV, 1989).

**Flexibility.** Alternatives were evaluated in terms of their ability to comply with water quality standards under current and projected future operating conditions, and their ability to meet future stricter water quality standards (CDM, Volume IV, 1989).

**Constructability.** The difficulty of constructing each alternative, the duration of construction, and probability of meeting the construction schedule are evaluated for each alternative (CDM, Volume IV, 1989).

**Operational Complexity.** The difficulty associated with maintenance and operation of the outfall system is evaluated for each alternative. (CDM, Volume IV, 1989).

**Power Needs.** Each candidate outfall alternative is evaluated according to the power needed for routine operation. (CDM, Volume IV, 1989).

**Quantity/Quality of Dredged Material for Disposal and/or Relocation.** Each alternative is evaluated with respect to the difficulty of disposing of material, primarily marine sediments, excavated during construction. In addition to the importance of dredged material volume, in New Bedford it is also necessary to consider the quality of the dredged material in terms of the amount of contaminants, particularly PCBs (CDM, Volume IV, 1989).

**Cost.** The construction costs (including the costs for the disposal of dredged material) are evaluated for this criterion. Disposal costs are in part determined by the quantity of material. Contaminant levels determine the available disposal options (and subsequent costs) (CDM, Volume IV, 1989).

**Permitting.** Permit requirements for outfall construction and operation are evaluated for the two candidate outfall sites (CDM, Volume IV, 1989).

# CHAPTER FIVE

# AFFECTED ENVIRONMENT

The proposed wastewater treatment plant (WWTP), solids disposal facility, and outfall will affect not only the site on which they are located, but will also have some degree of impact on the surrounding area. In the following sections, each of these aspects is discussed so that baseline conditions can be established against which potential impacts are evaluated (in Chapter 6).

## 5.1 LAND USE

### 5.1.1 Introduction

In this section, the existing and projected land use characteristics of the study areas around each of the alternative sites are discussed. Alternative sites for both the wastewater treatment plant and the solids disposal facilities are examined.

In addition, the status of existing transportation and utility corridors must also be known in order to determine what future impacts could occur.

### 5.1.2 Regulatory Framework

A knowledge of existing and projected land-use patterns is critical to assessing the impacts to host communities of the alternative treatment and disposal facilities. This section describes the regulatory framework governing the proposed facilities as they might affect land use.

**5.1.2.1 National Environmental Policy Act (NEPA).** The National Environmental Policy Act of 1969 (NEPA) requires that a detailed EIS be prepared for any proposed major federal action which is determined to have significant impact on the quality of the human environment. The development of an EIS is governed by the Council on Environmental Quality's "Regulations for Implementing the Procedural Provision of the National Environmental Policy Act" (40 CFR 1500-1508) and EPA's own NEPA Regulations (40 CFR Part 6). The purpose of NEPA and its supporting regulations is to ensure that: the probable environmental effects of the federal action are identified; a reasonable number of alternative actions are considered; environmental information is available for public understanding and scrutiny; and public and government agency participation is part of the decision process.

**5.1.2.2 Executive Order No. 11988: Floodplain Management.** As a result of this Executive Order, federal agencies which finance or assist construction or improvement projects are required to take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health and welfare, and restore and preserve the natural beneficial values served by floodplains. Each agency must determine whether the proposed action will occur in the floodplain and what the potential effects are. In addition, actions must be designed to avoid adverse effects and incompatible development in floodplains, and be consistent with the standards and criteria promulgated under the National Flood Insurance Program.

**5.1.2.3 Federal Coastal Zone Management Act of 1972.** The federal Coastal Zone Management Act of 1972 (16 USC 1451 et seq.) provides states with the authority to establish coastal zone management programs. Section 307 of the Act requires that federal agencies conducting or supporting projects affecting the coastal zone in states with approved coastal zone management programs comply with the program to the maximum extent practicable. The Massachusetts Coastal Zone Management Program is administered by the Office of Coastal Zone Management and is discussed in greater detail below.

**5.1.2.4 Federal Farmland Protection Policy Act.** The U.S. Soil Conservation Service (SCS) administers this program which involves the designation and protection of farmland from encroachment. A Farmland Conversion Impact Rating Form (Form AD 1006) must be completed by the project proponent for any activity planned in a unique, primary farmland designated by the state or town. The designation entitled Agriculture, Preservation, and Reservation (APR) is made and funded by a state. The SCS maps protected farmlands and reviews the Conversion Impact Rating Form. There are no farmlands designated as APR in New Bedford, however, there is a cranberry bog located in the northern portion of New Bedford off of Braley Road, approximately one mile north of Site 40. Although not an APR, the cranberry bog is considered a unique farmland and may require the completion of a Conservation Impact Rating Form should Site 40 be selected as the recommended sewage sludge disposal location.

**5.1.2.5 Massachusetts Environmental Policy Act (MEPA).** Similar to NEPA, the Massachusetts Environmental Policy Act (MEPA) and regulations under 310 CMR 11.00 require state agencies, or authorities created by state legislation, to fully evaluate environmental consequences of their actions before potentially causing significant environmental impact. It requires that agencies use all feasible means and measures to avoid or minimize damage to the environment. The MEPA regulations establish a process by which project proponents are required to first determine whether or not preparation of an Environmental Impact Report (EIR) is necessary to determine the impacts of state actions (permits, approvals, and financing). Secondly, it requires that the proponent address the potential environmental impacts of their proposed action.

Section 61 of this act defines the term "damage to the environment." It states that damage to the environment shall mean any "destruction, damage or impairment, actual or probable, to any of the natural resources of the commonwealth and shall include, but not be limited to ... excessive noise ... destruction of seashores, dunes, marine resources, open spaces, natural areas, parks, or historic districts or sites." Land use is a broad category contained in a number of the specific areas of concern within the section. The importance of potential impacts upon land uses in the act is evident in the definition of which projects automatically require preparation of an EIR: those projects which by their nature would have significant impacts upon existing land-use patterns.

MEPA also applies to all areas addressed in this Draft EIS.

**5.1.2.6 Massachusetts Coastal Zone Management Act.** As noted in Section 5.1.2.3, the Federal Coastal Zone Management Act of 1972, and 1976 Amendments, enabled states to develop comprehensive management plans for their coastal regions. The federal act also empowered states to develop coastal zone management programs (requiring federal approval) to review all federal funding, permitting, construction, and other actions proposed within the coastal zone for consistency with state coastal policies. The Massachusetts Office of Coastal Zone Management administers the federal law in the Commonwealth. A Massachusetts Coastal Zone Management (MCZM) Consistency Review is required for all projects that are located in the coastal zone (as delineated by MCZM) that involve federal action such as funding, permitting, or licensing, and for which an EIR has been prepared under MEPA.

**5.1.2.7 Chapter 91 Waterways License.** Chapter 91 Waterways Licenses are administered by the Massachusetts Department of Environmental Protection. Chapter 91 controls filling, construction of new structures, dredging, and disposal of dredged materials, or removal of sand and vegetation in tidelands seaward of the historic mean high-water line, in historic or filled tidelands, in certain great ponds and rivers, and in certain portions of Designated Port Areas.

**5.1.2.8 Zoning - Massachusetts Legislative Authority.** Chapter 40A of the Massachusetts General Laws empowers local communities to enact zoning bylaws and ordinances to regulate the use of land, buildings, and structures. Uses may be regulated to the full extent of the independent constitutional powers of communities to protect the health, safety, and general welfare of their present and future inhabitants. The specific nature of each community's zoning bylaw/ordinance as it relates to each of the sites being considered for wastewater treatment or residuals management facilities is discussed in the following sections. Local zoning ordinances and bylaws include some of the most restrictive requirements or prohibitions affecting land use.

According to the opinion issued by the City of New Bedford Solicitor, the siting of a WWTP is not subject to existing zoning conditions (CDM, Volume II, 1989). The City Code has no specific provision for or against the siting of a WWTP. If the intent of zoning is assessed, a treatment plant is generally compatible with Industrial B zoning.

### 5.1.3 Baseline Descriptions of Sites

The following sections describe both existing and proposed land uses in and around each alternative site. Existing land use was determined using 1986 aerials USGS maps, 1978 City aerials, and individual site visits.

Maps are provided showing the predominant land uses within a one-half mile radius of each site. Land use categories on the maps are defined in the following broad terms:

- Residential
- Public Land/Open Space/Vacant
- Commercial
- Industrial
- Public Facility

Although each map is generalized, the text provides greater detail on the types of land uses at and near each site. The text includes the following specific land use categories:

- Commercial
- Education
- Historic
- Industrial
- Institutional
- Municipal
- Multi-family residential
- Recreation/Open space
- Single family residential
- Vacant

#### 5.1.3.1 Site 1A Baseline Conditions

**Existing On-Site Land Use.** Site 1A is owned by the City of New Bedford (79 percent) and the federal government (21 percent) (CDM, Volume II, 1989). The primary land uses on-site are vacant (27.2 acres), educational (15.5 acres), and institutional (13.7 acres). Other uses include historical (10.4 acres), municipal/WWTP (7.8 acres), and recreational (4.8 acres), as shown in Figure 5.1-1.

The entire site is zoned Residential A. The existing WWTP and the institutional facilities do not conform to the zoning requirements, however, they are exempt from zoning.

The institutional users of the site include both the Army and Navy. The U.S. Army Reserve functions are housed in eleven buildings. The Army Reserve also uses a large portion of the institutional property for the storage and parking of trucks. Uses by the Navy include a Reserve Center and a Naval Institute. Educational and human services programs at Fort Rodman serve preschool and school-age children, and special needs adults.

Additional educational services include the Regional Vocational High School Marine Industries Division. Historic uses include Fort Taber and a series of batteries in two separate parcels which compose the Fort Taber Historical District. This district is listed in the National Register of Historic Places and the Inventory of Historic Assets of the Commonwealth. Recreational uses include a lighted soccer field and four tennis courts.

The existing primary wastewater treatment plant for New Bedford is located at the southern tip of Site 1A. This facility includes grit removal tanks, four primary clarifiers, a main building with a sludge incinerator, and a small parking lot. A 40-foot utility easement crosses part of the site, as do various water mains and the main sewer interceptor.

Vacant land includes batteries which are associated with the Fort Taber complex, but which are not listed on the National Register of Historical Places and are not easily accessible. Several small buildings on the vacant land were formerly used by the Coast Guard Reserve.

**Proposed On-Site Land Use.** Historically, the City of New Bedford has shown an interest in using Clark's Point for recreational purposes. The 1972 Open Space and Recreation Plan for New Bedford (City of New Bedford, 1972) included Fort Rodman in its inventory of City recreational resources. Recommended short-term changes included relocating or beautifying and screening the Army facilities, constructing a pier, upgrading existing recreational facilities, and creating a picnic area on top of one of the batteries. Long-term recommendations included limiting permanent structures within the limits of the flood hazard area defined by the Federal Emergency Management Agency (FEMA) as the 100-year floodplain. Other changes recommended included creating a softball field and visually screening the existing WWTP (CDM, Volume II, 1989).

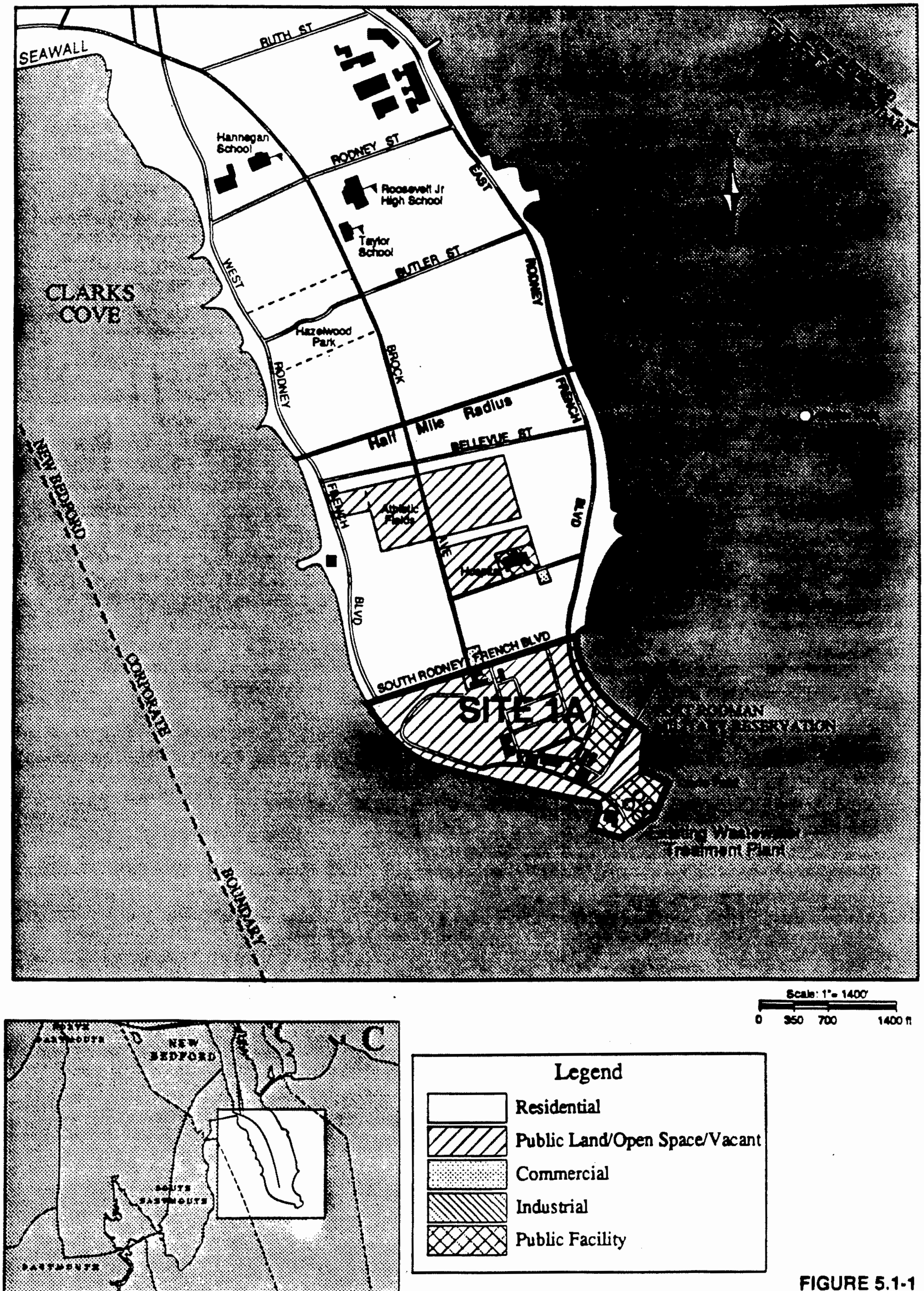



**FIGURE 5.1-1**
**LAND USE WITHIN A HALF MILE RADIUS OF ALTERNATIVE SITE 1A**

Adapted from CDM, 1989

In 1987, when the Open Space and Recreation Plan (OSRP) was prepared, Fort Rodman was identified as a possible site for the new WWTP plant. For this reason, Fort Rodman was not included in the OSRP as an area for development for recreational use.

**Existing Adjacent Land Use.** The site is surrounded by open water to the east, west and south. A total of 75 percent of the area within a one-half mile radius of the site is thus water. Predominant land uses to the north within this area are single family residential (approximately 450 dwellings), recreational/ open space, vacant, and educational (CDM, Volume II, 1989). Approximately 95 percent of the land within the half-mile radius is zoned Residencial A, with the land directly adjacent to the site zoned both Residential A and Business-Mixed-Use. A Business-Mixed-Use designation is intended to encourage mixed residential/business and commercial development. According to the zoning code, this designation allows stores, markets, restaurants, banks, offices and other retail services, in addition to the uses allowed in Residential A, B, and C districts. Land uses within a one-half mile radius are shown in Figure 5.1-1.

Recreational facilities include East Beach, which is a public beach with parking for 250 cars; Victory Park, which is open space with a soccer field; a flooded area used for ice skating; and Clegg Field, which has three baseball diamonds and a lighted soccer field.

**Proposed Adjacent Land Use.** The 1987 New Bedford Open Space and Recreation Plan calls for improvements to Victory Park. A feasibility study for construction of an outdoor skating rink and nature trail are planned. An additional future plan by the City for the area near Site 1A includes the re-lighting of the Clark's Point Lighthouse.

### 5.1.3.2 Site 4A Baseline Conditions

**Existing On-Site Land Use.** Site 4A consists of approximately 39 acres of land divided into 15 individual parcels. Ownership of the 15 parcels is divided between Palmer's Cove Limited Partnership (23.9 acres), New Bedford Radio Corporation (10.5 acres), BHR Inc. (1.9 acres), City of New Bedford (1.6 acres), and United Social Club of New Bedford (1.0 acre). As shown in Figure 5.1-2, the primary on-site land uses are: vacant (21.7 acres); recreational (11.7 acres); municipal (3.1 acres); and commercial (2.5 acres). All of the site is zoned Industrial B.

There are no buildings or facilities on the vacant land, which includes 1.6 acres within the tidal area located along the Acushnet River. A 10 foot wide sewer easement crosses the site. New Bedford Gas, Edison Light, and Commonwealth Electric all have easements on the site. Access to the tidal area from the south

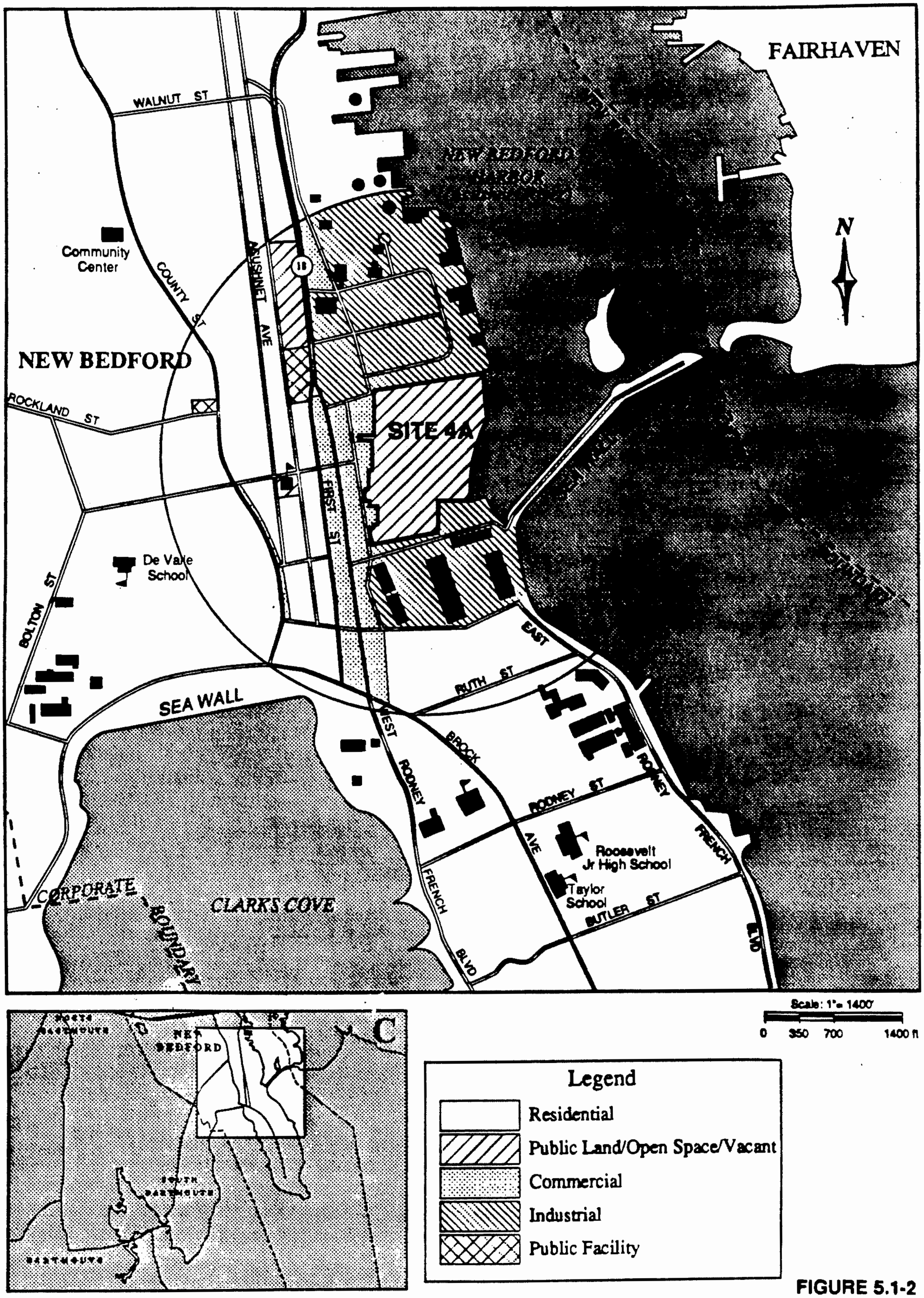



**FIGURE 5.1-2**
**LAND USE WITHIN A HALF MILE RADIUS OF ALTERNATIVE SITE 4A**

Adapted from CDM, 1989

is available by using a parking and boat ramp area adjacent to the site. The recreational land is used for a baseball and softball field, a lighted basketball court, and a soccer field. The parking lots on the site are used by employees of nearby businesses including ERT Printmaker, BHR, Inc. and Stride Rite. A radio tower and administration building, owned and operated by New Bedford Radio Inc., are also located on site.

**Proposed On-Site Land Use.** Site 4A is a part of the Designated Port Area identified by the MCZM for the New Bedford-Fairhaven Harbor area. This designation allows for the priority of water dependent uses in state and federal funding and allows a variance to the presumption of significance for many resource areas protected under the Massachusetts Wetlands Protection Act.

The major landowner at Site 4A, Old New Bedford Waterfront Corporation (ONBWC), has a major development plan for the site. This plan includes the construction of 968 residential condominiums, a waterfront park and walkway, a marina with 640 boat slips, and a restaurant/inn/retail area. A Draft Environmental Impact Report (EIR) for the project was submitted in June of 1988 (ONBWC, 1988). The plan, however, according to MCZM, would not meet the requirements of the Designated Port Area (CDM, Volume II, 1989).

The 1987 Open Space and Recreation Plan (OSRP) for New Bedford includes goals and objectives for the site. These goals include development of a pathway system for walking/jogging/bicycling use along the entire New Bedford waterfront including the riverfront section of Site 4A.

**Existing Adjacent Land Use.** Within a one-half mile radius of Site 4A, the primary land uses are industrial, commercial, and multi-family residential. Open water to the east accounts for approximately 40 percent of the area within a one-half mile radius of the site. Land use within a one-half mile radius is shown in Figure 5.1-2.

There are approximately 3,200 dwelling units within a half mile of the site. The dwellings are primarily multi-family, but there is also public and single-family housing. Additional land uses include vacant, commercial, recreational/open space, educational, and institutional.

Zoning within the one-half mile radius includes Industrial B, Residential C, and Business-Mixed-Use. Some but not all of the Industrial B land is a part of the Working Waterfront Overlay District. This includes the area to the north of the site from the boundary to Conway Street. This district is intended to permit and promote uses that require waterfront access, such as fish processing. Residential C designation allows for the highest density of family units per unit area, with up to 43 multi-family dwelling units per acre (CDM, Volume II, 1989).

**Proposed Adjacent Land Use.** Presently the Greater Boston Community Development, Inc. is in the process of building 75 units of housing and a recreational park area for the elderly on vacant land adjacent to Site 4A.

Recently, the South First Street neighborhood adjacent to the site has been studied by the Harvard University Kennedy School of Government in order to address the problems of high crime, high unemployment, and physical neglect in the neighborhood. Recommendations from the study included increased services for the elderly, police and social services, and physical improvements to the neighborhood (CDM, Volume II, 1989). The overall thrust of the South First Street revitalization project would be to increase needed community services, develop more affordable housing, and to rehabilitate deteriorated housing and unused property.

Other proposed uses for the vicinity of Site 4A include OSRP recommendations to improve the Gomes School playground and other community development plans for rehabilitation of Palmer's Island which entail the restoration of the lighthouse (City of New Bedford, 1987).

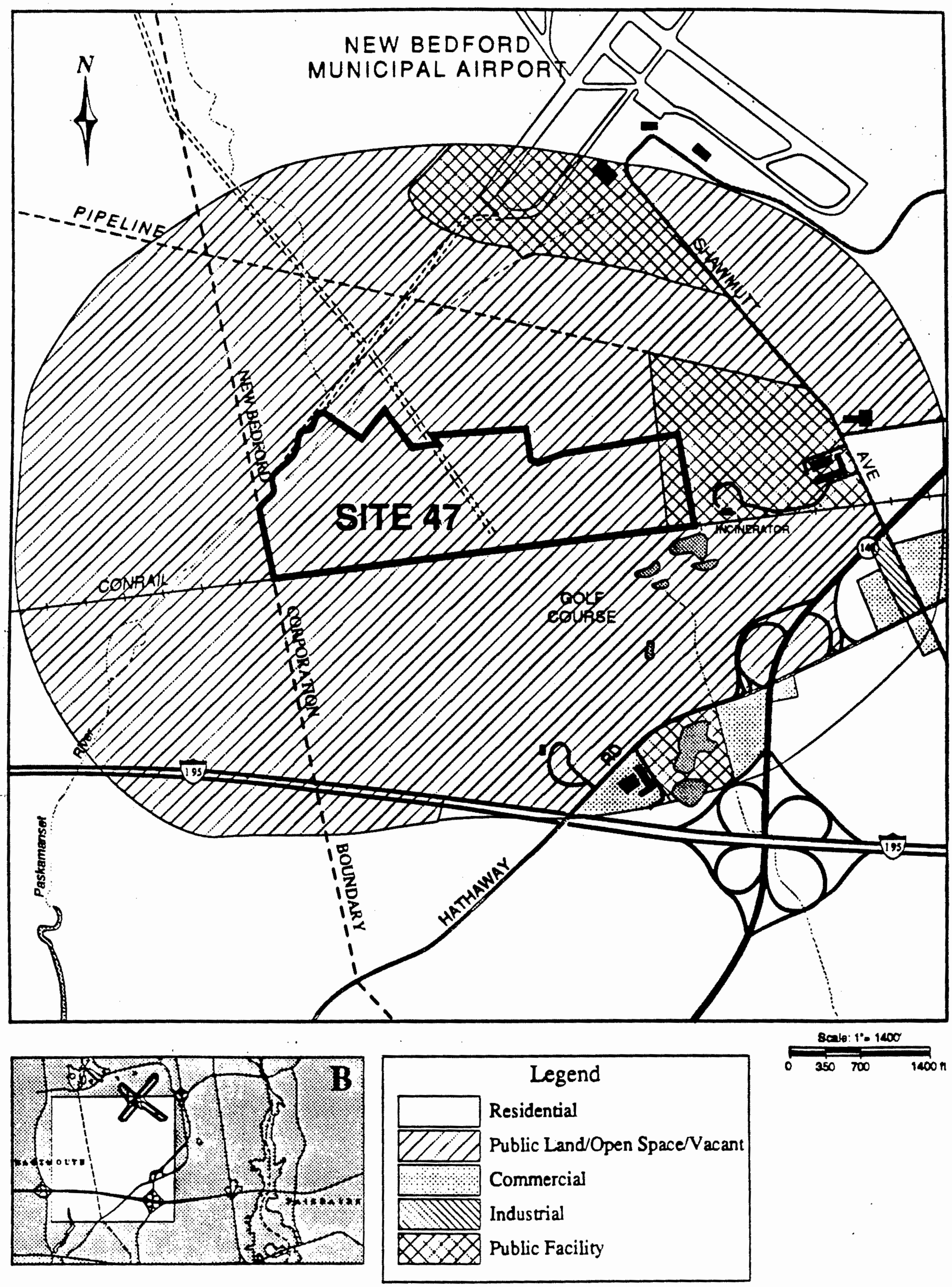
#### 5.1.3.3 Site 47 Baseline Conditions

**Existing On-Site Land Use.** Site 47, located on the western side of New Bedford between the New Bedford Municipal Golf Course and the municipal airport, is divided into seven land parcels. These are owned by the City of New Bedford (62.3 acres), G. Frank Grenier (40.5 acres), the Hawes Trust (10.1 acres), and Acushnet Saw Mills (4.4 acres). The western edge of the site borders the Paskamanset River.

Land uses on-site and within one-half mile are shown in Figure 5.1-3. Vacant land occupies most of the area of Site 47. Approximately 5 percent of the site is occupied by a municipally owned solid waste landfill. A water line easement bisects the site as shown in Figure 5.1-3, and the closest utilities are on Hathaway Road. The site is zoned Industrial B.

**Proposed On-Site Land Use.** No municipal or private plans for this site have been identified.

**Existing Adjacent Land Use.** The New Bedford Municipal Golf Course adjoins Site 47 to the south, while the Apponagansett Swamp borders the site to the north, east, and west. The primary land uses adjoining the site are vacant (60 percent), recreational (26 percent), and municipal (10 percent). Commercial and residential uses occupy the remaining 4 percent of the land area




Adapted from CDM, 1989

**FIGURE 5.1-3**
**LAND USE WITHIN A HALF MILE RADIUS OF ALTERNATIVE SITE 47**

within a one half-mile radius of the site. Most of the vacant land is comprised of the Apponagansett Swamp, while the New Bedford Golf Course is the primary recreational land use. Municipal land use includes the municipal solid waste landfill/incinerator and the New Bedford Water Works Building. Zoning designations for the surrounding land is mixed, including Industrial A and B, Residential A and B, and Business-Planned and Business-Mixed-Use.

**Proposed Adjacent Land Use.** Proposed land uses include commercial development on land presently occupied by the golf course. Three holes on the course (approximately 50 acres) would have to be relocated for this development to occur. The OSRP (City of New Bedford, 1987) includes recommendations to encourage investment in and maintenance of the golf course and a change from the present 5-year lease to a longer term lease.

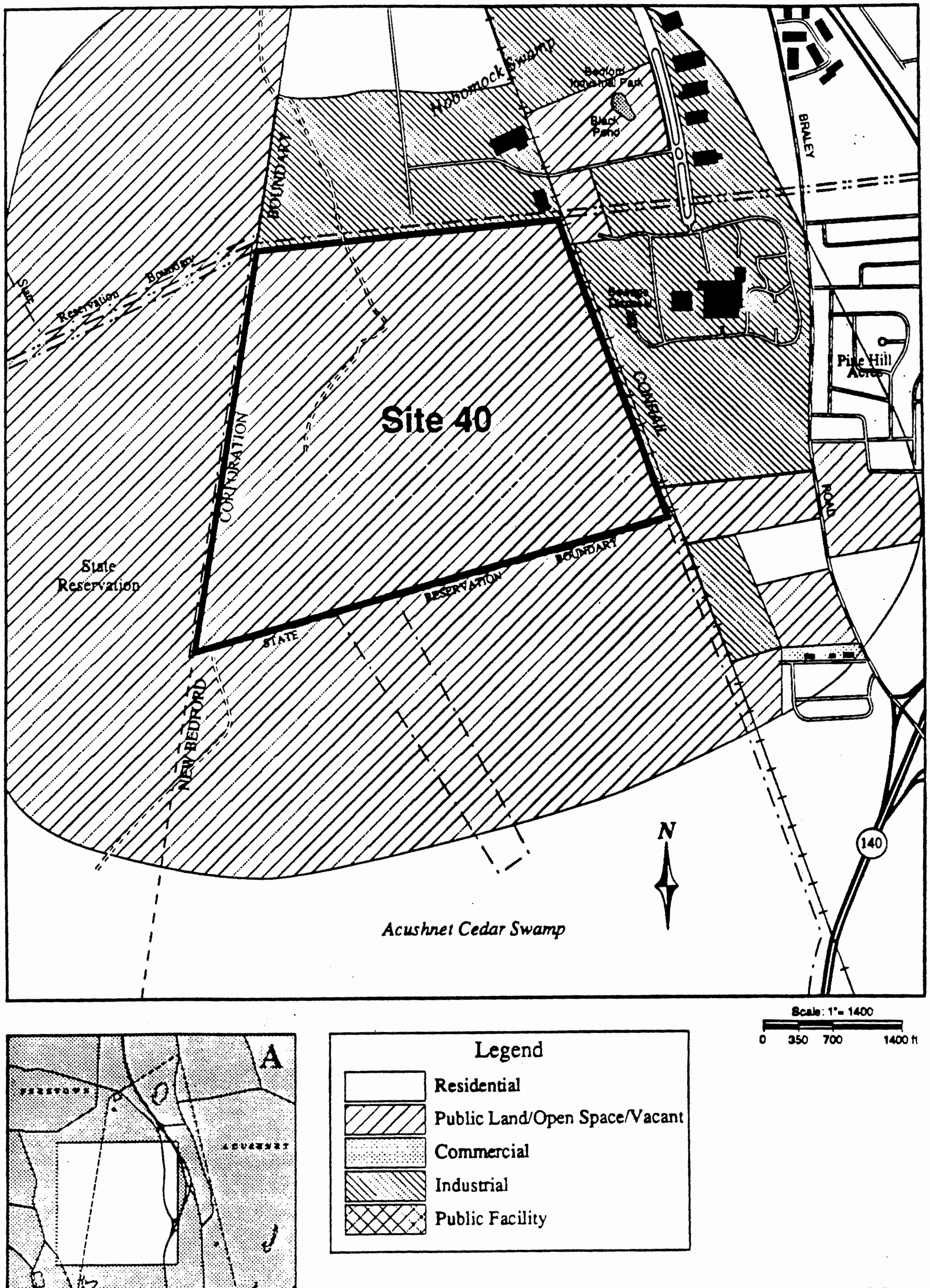
#### 5.1.3.4 Site 40 Baseline Conditions

**Existing On-Site Land Use.** Site 40 consists of one 383.5 acre parcel owned by the Polaroid Corporation, and is zoned Industrial C. The site forms the southernmost portion of an industrial park, but is completely vacant (Figure 5.1-4).

**Proposed On-Site Land Use.** Potential plans for the site include a bid by Eastern Energy Company (Spring 1989) to acquire the land at Site 40 for development of an electric power and steam generation plant. Eastern Energy is still negotiating with Polaroid Corporation to acquire the site.

**Existing Adjacent Land Use.** Adjacent land use includes vacant conservation land (Acushnet Cedar Swamp State Reservation) to the south and west of Site 40. Several manufacturing companies are located to the north of the site, a railroad easement abuts the eastern edge of the site, and a power line easement belonging to Commonwealth Electric abuts the northern edge of the Site 40. Of the land within a half-mile, 50 percent is zoned Industrial C, 45 percent is Residential B, and 5 percent is split between Industrial A, and Business-Mixed-Use (CDM, Volume III, 1989). Electricity, water, and phone lines are available in the adjacent industrial park. There are no residential areas within one-half mile of Site 40. Adjacent land use is shown in Figure 5.1-4.

**Proposed Adjacent Land Use.** No plans for the land adjacent to Site 40 were identified (CDM, Volume III, 1989).




Adapted from CDM, 1989

**FIGURE 5.1-4**
**LAND USE WITHIN A HALF MILE RADIUS OF ALTERNATIVE SITE 40**

### 5.1.4 Baseline Descriptions of Transportation Corridors and Traffic

#### 5.1.4.1 Introduction

Transportation resources and traffic are regulated by a variety of federal, state and local regulations. Activities affecting interstate highways of the United States are regulated by the federal government. Activities on state roadways are regulated by the Commonwealth, and municipalities have jurisdiction over local roads and streets. In general, a governmental body does not regulate who uses its roadways, although localities may post certain streets and roads prohibiting large trucks or the transport of hazardous material (EPA, 1989a).

#### 5.1.4.2 Traffic Analysis Methods

In order to determine baseline conditions for the transportation corridors, a traffic inventory was performed. Information collected during the inventory included:

- Traffic Volume Data: Pressure sensitive traffic counters were used to measure traffic volumes at key locations. These measurements were supplemented with traffic counts from the Massachusetts Department of Public Works and local sources, as available.

- Traffic Volume Characteristics: Peak hour volumes, average annual daily volumes, and vehicle classification were extracted from the volume data. Traffic volumes shown represent either Average Annual Daily Traffic or Average Daily Traffic (ADT). The former is adjusted to reflect monthly variation. The latter is adjusted to reflect daily variations. Peak traffic volume hours from 3:30 to 4:30 pm were determined from this 24 hour data. The 3:30 to 4:30 pm peak hour is earlier than that which is typically encountered, and reflects the 3:30 pm shift change in the mills.

- Roadway Classification: Roadways were classified based on the Massachusetts Department of Public Works classification system.

- Land Use: Types of land uses along each site access route were identified along with the location of any sensitive receptors.

- Physical Conditions: Information was gathered for each route regarding gradients, lane widths and usage, bridge clearances, weight limits, and traffic control devices.

**5.1.4.3 Projected Baseline Traffic At Site 1A.** Site 1A has a travel distance of approximately 1.9 miles from the nearest limited access highway. The primary route to the site would use Cove Street (from JFK Boulevard) and East Rodney French Boulevard. The portion along Cove Street is bordered by multi-family and single-family housing, businesses, and industrial use areas. The route along East Rodney French Boulevard is bordered by multi-family and single family housing, businesses, industrial use areas, and vacant land. The only sensitive receptor along the access route is a high-rise housing project for the elderly on East Rodney French Boulevard.

The traffic flow on the route to Site 1A is usually moderate. Near Fort Rodman, the average daily traffic (ADT) is about 3,500 vehicles. The traffic volume one mile north of the site on East Rodney French Boulevard is approximately 6,000 ADT. Along Cove Street, the ADT is approximately 10,000 near JFK Boulevard. All volumes are within the capacity of the roadways. Peak one-way volumes are about 450 vehicles per hour in the afternoon and 300 vehicles per hour in the morning. This vehicular volume allows for relatively free flow of traffic along the route (CDM, Volume II, 1989).

The secondary route to the site would use West Rodney French Boulevard along Clarks Cove. This route passes through the congested intersection of Brock Avenue, West Rodney French Boulevard and Cove Road, right onto Cove Street. The only sensitive receptor along this route is a center for handicapped persons.

Large truck traffic accounts for 6 percent of the total traffic along the route, while small trucks and vans account for another 18 percent of the flow. During the summer months some beach traffic occurs, predominantly in the mid-afternoon on weekdays. Existing roadway conditions for Site 1A are presented in Table 5.1-1. Figure 5.1-5 shows the primary and secondary access routes to the site.

**5.1.4.4 Projected Baseline Traffic At Site 4A.** Access to and from Site 4A follows a 0.32 mile route from the limited access highway (JFK Boulevard) onto Potomska Street and Front Street. This route is bordered primarily by industrial use areas, with a mixture of residences and businesses along a short section of the route. There are no sensitive receptors in the area. Table 5.1-1 presents the existing roadway conditions. Figure 5.1-6 shows the existing access route to the site.

Traffic volume is highest (approximately 6,200 ADT) at the intersection of Potomska Street and JFK Boulevard. The route along First Street has a traffic volume of approximately 4,300 ADT in the winter and 5,600 ADT in the summer. The higher summer volume is due to the increased recreational use of the site

## TABLE 5.1-1
## PHYSICAL ACCESS ROADWAY CONDITIONS

| Site | Streets | Distance | Classification | Travel Lane Pavement Width (feet) | Number of Lanes | Pavement Condition | Parking Permitted | Traffic Restrictions | Gradients |
|---|---|---|---|---|---|---|---|---|---|
| 1A | East Rodney French Boulevard | 8300' | Major Collector | 14 | 2 | Good | Prohibited in summer | None | None |
| | Cove Street | 1600' | Major Collector | 12 | 2 | Good | Yes on both sides | None | None |
| 4A | Front Street | 1400' | Not Classified | 12 | 2 | Very Good | No | None | None |
| | Potomska Street | 300' | Minor Collector | 16 | 2 | Very Good | No | None | None |
| 47 | Landfill Access Rd | 2000' | Not Classified | 14 | 2 | Good | No | None | None |
| | Shawmut Avenue | 1200' | Minor Collector | 18 | 2 | Fair | Yes on Northeast side | None | 4%,150'long |
| | Hathaway Road | 2100' | Major Collector | 14 | 2 | Good | No | None | 5%,350'long 6%,400'long |
| 40 | John Vertante Boulevard | 500' | Not Classified | 15 | 2 | Very Good | No | None | None |
| | Samuel Barnet Boulevard | 2800' | Not Classified | 15 | 2 | Very Good | No | Stop Sign | None |
| | Duchaine Boulevard | 2200' | Not Classified | 15 | 4 | Very Good | No | None | None |
| | Theodore Rice Boulevard | 1300' | Not Classified | 18 | 2 | Very Good | No | Stop Sign | None |
| | Braley Road | 800' | Minor Collector | 14 | 2 | Very Good | No | 15' Bridge Clearance and Stop Sign | None |

Adapted from: CDM, Volume V, 1989.

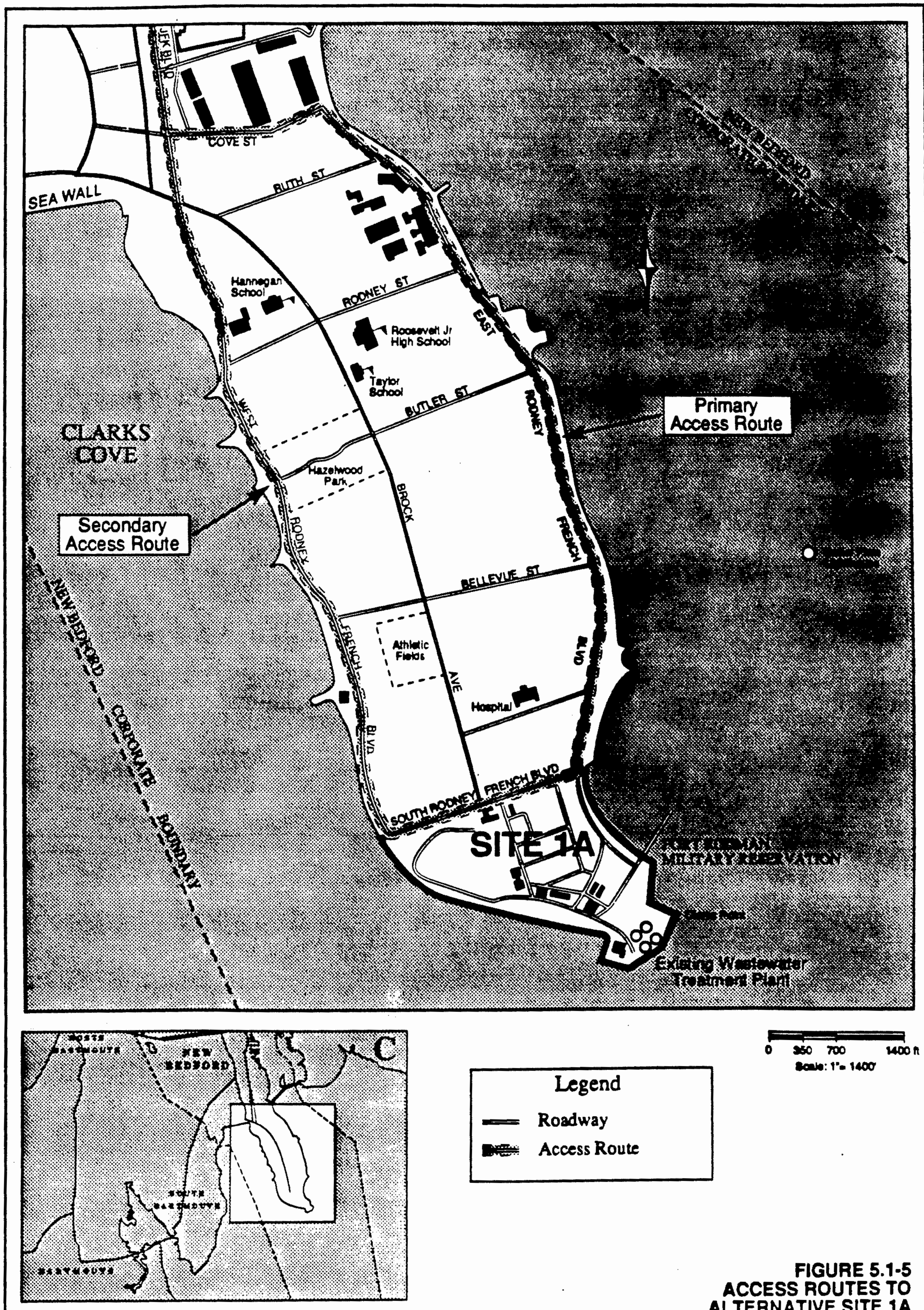
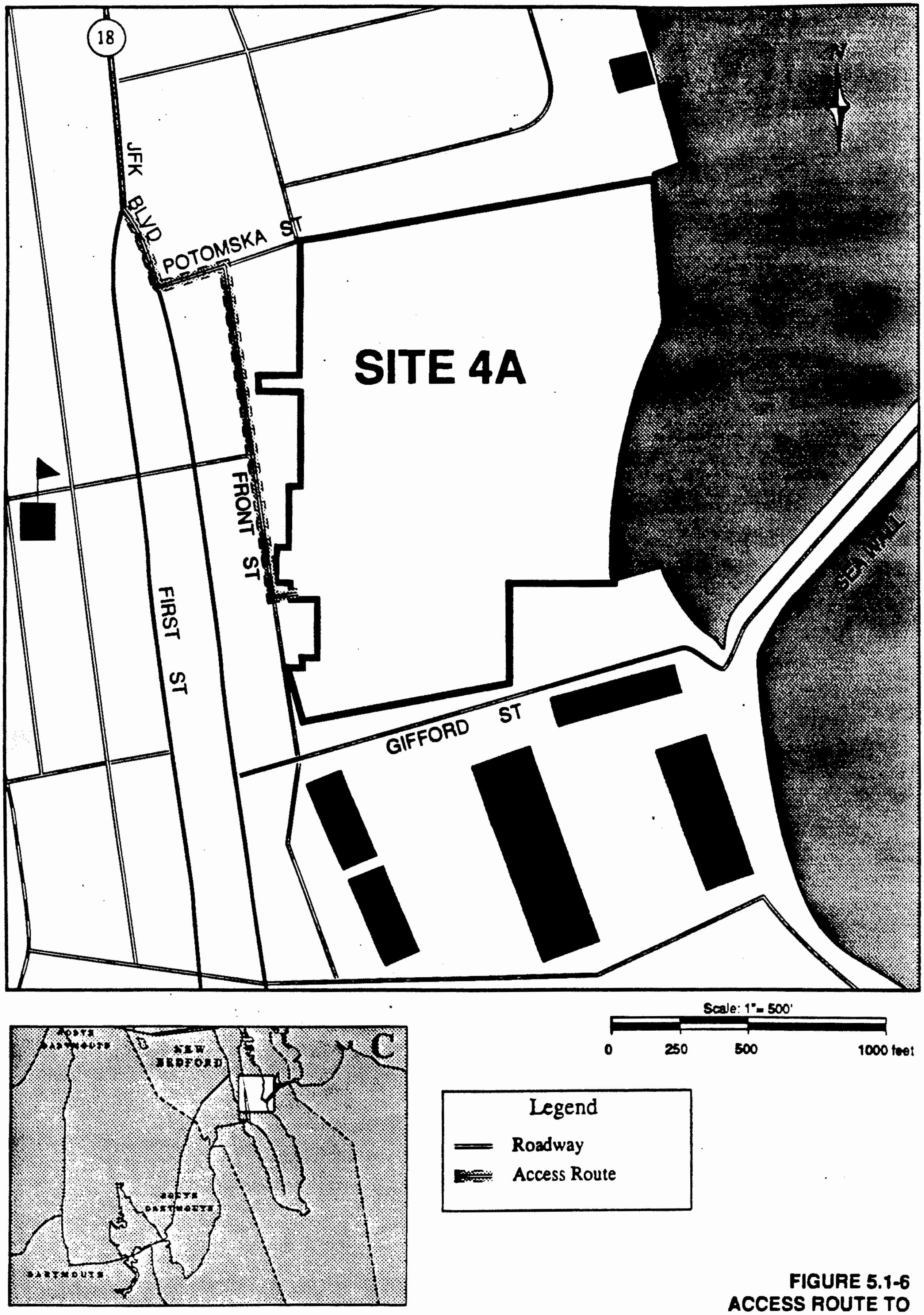



FIGURE 5.1-5
ACCESS ROUTES TO
ALTERNATIVE SITE 1A

Adapted from CDM, 1989




Adapted from CDM, 1989

FIGURE 5.1-6
ACCESS ROUTE TO
ALTERNATIVE SITE 4A

during the summer months, primarily of East Beach. Peak afternoon flow for Potomska Street at JFK Boulevard is 370 vehicles (westbound) and peak morning flow is 288 vehicles (eastbound). The peak hour volumes are well within roadway capacities (CDM, Volume II, 1989).

**5.1.4.5 Projected Baseline Traffic At Site 47.** The route to Site 47 is 0.25 miles longer than the route from the site because the northbound and southbound ramps from State Route 140 are 1/4 mile apart. Access to Site 47 from the highway (Rte 140) follows Hathaway Road to Shawmut Avenue which leads to the landfill/incinerator access road. Access to usable sections of Site 47 would require the development of an additional 2,000 feet of roadway adjacent to the existing solid waste landfill. Table 5.1-1 presents the road conditions for the existing portion of this route. Figure 5.1-7 shows the access route to the site.

The Hathaway Road portion of the route is bordered by single and multi-family housing, businesses, and vacant land. Shawmut Avenue is bordered primarily by industrial use areas and some businesses. There are no sensitive receptors in the area. Automobiles account for 80 percent of the approximately 14,900 ADT volume along Hathaway Road. Gradients along Hathaway Road are between 5 and 6 percent. On Shawmut Avenue, the ADT volume is approximately 3,740, well below the capacity of the roadway. Of this, 58 percent is due to automobiles with remaining volume comprised of truck traffic. (CDM, Volume II, 1989).

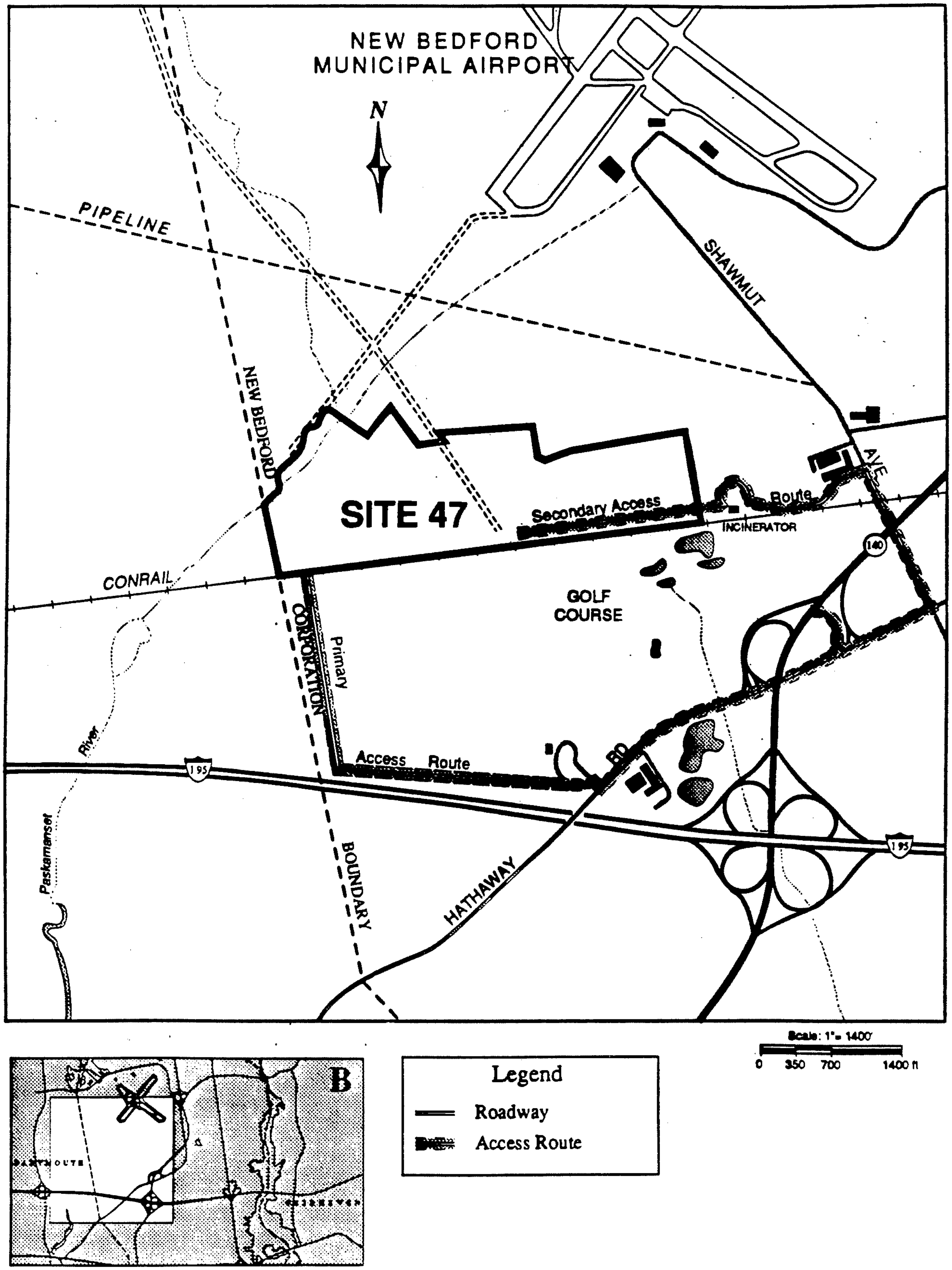
**5.1.4.6 Projected Baseline Traffic At Site 40.** Access to Site 40 is from Route 140, a limited access highway. The route to the site then follows several roadways. The primary access route to Site 40 includes a short segment of Braley Road where it intersects with Route 140. The route continues along Theodore Rice Boulevard to Duchaine Boulevard, then turns west onto Samuel Barnet Boulevard and South onto John Vertente Boulevard. All are in the industrial park. The total ADT for Theodore Rice Boulevard is about 4100, well below the capacity of the roadway.

There are no sensitive receptors along the access route. There are also no residential dwellings along the route to Site 40 (CDM, Volume II, 1989). Existing conditions along the route are presented in Table 5.1-1. Figure 5.1-8 shows the access routes to the site.

## 5.2 WATER QUALITY

### 5.2.1 Introduction

This section characterizes existing water quality conditions in New Bedford relevant to the siting of the WWTP, solids disposal facilities, and effluent outfall.




Adapted from CDM, 1989

**FIGURE 5.1-7**
**ACCESS ROUTES TO**
**ALTERNATIVE SITE 47**

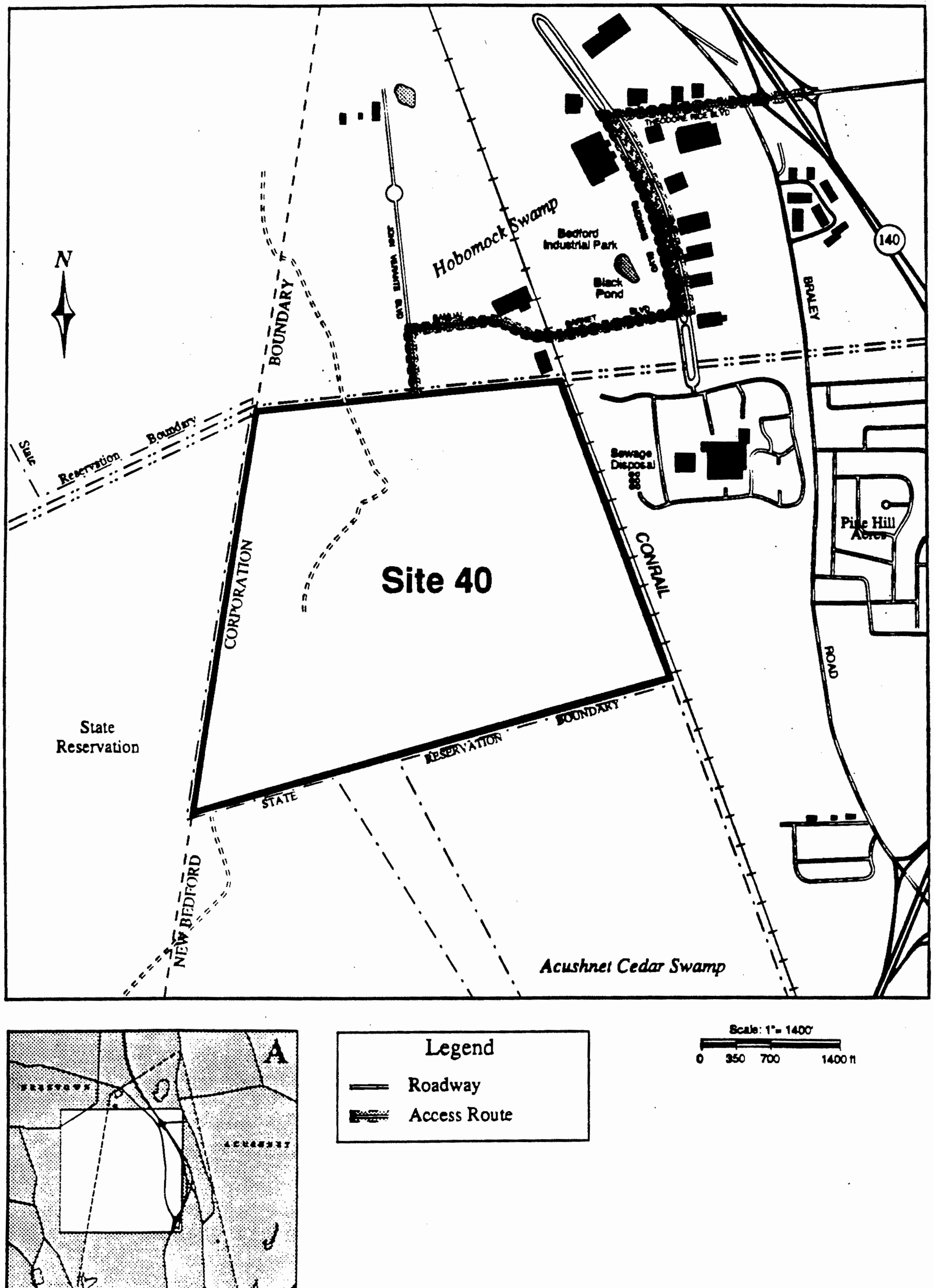



**FIGURE 5.1-8**
**ACCESS ROUTE TO**
**ALTERNATIVE SITE 40**

Adapted from CDM, 1989

### 5.2.2 Regulatory Framework

The following paragraphs summarize federal and state laws and regulations which govern and protect surface and subsurface water quality.

**5.2.2.1 Federal Clean Water Act.** The Federal Water Pollution Control Act, as amended by the Water Quality Act of 1987 and commonly referred to as the Clean Water Act (CWA), has a primary objective to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The national goals established to achieve this objective of the CWA are that the discharge of pollutants into waters of the United States be limited, and that water quality be sufficient to provide for the protection and propagation of fish, shellfish, and wildlife and provide for recreation in and on the water. Specific sections of the CWA which set out requirements relevant to this project are discussed below.

Section 301 of the CWA requires that technology-based discharge limitations be established for categories and classes of point sources of pollutants such as wastewater treatment facilities. For conventional pollutants, Section 301 requires that effluent limitations be based upon the application of the best conventional pollutant control technology (BCT). For toxic and nonconventional pollutants, Section 301 requires that effluent limitations be based upon the application of the best available technology economically achievable (BAT). Pretreatment standards are applied to direct discharges to publicly owned treatment works (POTWs) such as New Bedford's.

Section 302 authorizes the establishment of more stringent effluent limitations (including alternative BAT effluent control strategies) to protect water quality if technology-based controls established under Section 301 would not assure protection of the intended uses of the receiving waters (e.g., fisheries and recreational uses).

Section 303 of the CWA requires states to develop water quality standards that consist of designated uses for the waters, and water quality criteria to protect those uses. In addition, states are required to adopt the federal water quality criteria established for all toxic pollutants (pursuant to Section 304) if the discharge or presence of toxic pollutants could reasonably be expected to interfere with the designated uses adopted by the state. In the absence of numerical criteria, states are required to adopt criteria based upon biological monitoring or assessment methods consistent with those provided by the CWA.

Under Section 304 of the CWA, EPA is required to develop and publish criteria, based upon latest scientific knowledge, to be utilized by states in developing water quality standards. EPA is also required to develop and publish regulations establishing guidelines for the technology-based effluent limitations required in Section 301 of the CWA. This section also requires states to develop individual strategies to control toxic pollutant discharges into those waters where application of effluent limitations for point sources, required under Section 301, cannot reasonably attain or maintain applicable water quality standards or the designated uses of the waters. In addition, EPA is required to develop and publish guidance on methods for establishing and measuring water quality criteria for toxic pollutants on bases other than pollutant-specific criteria, including biological monitoring and assessment. Section 307(a) establishes the list of toxic pollutants (commonly referred to as "priority pollutants") subject to regulation pursuant to the CWA. Section 307(b) requires EPA to develop and promulgate pretreatment standards for the discharge of pollutants into POTWs.

Section 402 of the CWA establishes the National Pollutant Discharge Elimination System (NPDES) program. All discharges into navigable waters are required to obtain a NPDES permit, which incorporates the requirements of the sections discussed above, and establishes procedures for implementing the NPDES program.

Section 403 requires EPA to develop and promulgate guidelines for determining the effects of discharges on the degradation of ocean waters. All discharges to oceans must comply with these guidelines prior to issuance of an NPDES permit.

Section 404 establishes the requirements for obtaining a permit for the discharge of dredged or fill material to navigable waters. All discharges of dredge and fill materials must undergo a public interest analysis to determine whether the benefits reasonably expected to result from the activity outweigh the reasonably foreseeable detriments.

**5.2.2.2 Rivers and Harbors Act of 1899.** The Rivers and Harbors Act of 1899 provides protection for navigation and the navigable capacity of waters of the United States. Several sections of the Act delegate permitting authority to different agencies. Section 10 regulates excavation or deposition of material or creation of obstructions in navigable waters. This section applies to dredging, disposal of dredged materials, filling, and construction of any structure, fixed or floating, which may obstruct navigation, or any other modification of a navigable water of the United States. Section 10 permitting is administered by the U.S. Army Corps of Engineers (USACE) with the cooperation of EPA.

**5.2.2.3 Federal Safe Drinking Water Act (SDWA).** The SDWA was enacted in 1974 to ensure that all people served by public water systems would be provided with a supply of high quality water. The SDWA established a program to require compliance with national drinking water standards (Maximum Contaminant Levels, or MCLs) for contaminants that may have an adverse effect on public health. The SDWA also focused on the removal of contaminants found in water supplies as a preventive health measure and established programs intended to protect underground sources of drinking water from contamination. MCLs and MCL Goals (MCLGs) promulgated under the SDWA should be met for existing and future drinking water supply sources. MCLs are often used as groundwater clean-up goals.

**5.2.2.4 Massachusetts Clean Water Act.** The Massachusetts Clean Water Act regulates water quality through a multi-faceted regulatory process of water quality standards, effluent limitations, and permits. The Massachusetts Surface Water Quality Standards designate the uses for which the various surface waters of the Commonwealth shall be enhanced, maintained, and protected and describe the water quality criteria required to sustain the designated uses and maintain existing water quality.

In addition to protecting surface water, the Massachusetts CWA protects against pollution of groundwater. The DEP Division of Water Pollution Control groundwater quality standards and regulations provide that no person shall discharge pollutants into the groundwater of the Commonwealth without a currently valid permit. Massachusetts has promulgated drinking water supply regulations specifying MCLs, some of which are more stringent than the federal MCLs.

**5.2.2.5 Massachusetts Waterways License and Dredging Permits.** Waterways licenses and dredging permits are issued by DEP, Division of Wetlands and Waterways Regulation under MGL Chapter 91. All activities involving dredging and filling in tidelands require permits. Chapter 91 seeks to protect public rights for use of the tidelands and shore areas. Applications for permits are evaluated based upon conditions that protect public rights of fishing, waterfowl hunting, and navigation. Projects must also serve a proper public use and comply with the Massachusetts Coastal Zone Management Program. Existing regulations categorize dredged materials based on the level of contamination and assign areas where the material may be disposed.

**5.2.2.6 Massachusetts Certification for Dredging, Dredged Material Disposal, and Filling in Waters.** MGL Chapter 21, Section 27 requires that a water quality certification be granted by EOEA for any project disposing of materials in state waters (i.e., waters landward of the three-mile territorial sea limit). Water quality certification is charged to the states by the federal CWA. The Commonwealth must certify that disposal will not degrade waters below present water quality classifications.

Testing of disposal materials is required to determine if the state or federal water quality standards will be violated.

In addition, the Commonwealth also promulgated regulations to protect aquifers by purchasing land (the Aquifer Land Acquisition Program under Chapter 286 of the Acts of 1982), and regulations specifying criteria for the protection of groundwater supplies (Underground Water Source Protection).

**5.2.2.7 Sediment.** No federal or state regulations specify concentration limits for contaminants in sediment. However, EPA recently developed interim sediment criteria values considered to be protective of aquatic life for nonpolar hydrophobic organic compounds such as PCBs (EPA, 1988c). These criteria values are normalized to the measured levels of total organic carbon (TOC) in the sediment at a particular location to generate site-specific sediment quality criteria (SQC). SQC are generally considered protective of aquatic life.

### 5.2.3 Water Resources at WWTP and Sludge Disposal Sites

This section describes the existing surface and groundwater resources at candidate WWTP and solids disposal sites. For potential solids disposal facility sites, flood hazard areas, surface water proximity, and groundwater criteria were evaluated. Only flood hazard areas were determined for WWTP siting evaluation.

**5.2.3.1 Site 1A.** The special flood hazard areas for Site 1A (see Figure 5.5-1) were developed by site-specific computer modeling (CDM, Volume II, 1989). The total area of the site is approximately 79 acres, of which 54 acres (68 percent) are within the 100-year floodplain. The A-Zone (area of 100-year flood) and V-Zone (area of coastal floodplain subject to wave action) comprise 34 and 20 acres of the 100-year floodplain, respectively. The net developable area, which excludes only the V-Zone, is therefore 59 acres. There is no groundwater use in the area of Site 1A (CDM, Volume I, 1989).

**5.2.3.2 Site 4A.** The total area of Site 4A is 38.9 acres, of which 1.9 acres (5 percent) are within the 100-year flood plain along the Acushnet River (see Figure 5.5-2). No areas of Site 4A are within the V-zone. No floodway is designated for the Acushnet River, because flooding results from ponding behind the hurricane barrier. The developable area of this site outside the 100-year floodplain is 37.3 acres. There is no known groundwater use in the area of the site (CDM, Volume V, 1989).

**5.2.3.3 Site 47.** The total area of Site 47 is approximately 117 acres (CDM, Volume III, 1989). Twenty-seven acres (twenty two percent) are within the 100-year floodplain (see Figure 5.5-3).

The amount of developable area will be restricted by the presence of wetlands as discussed in Section 5.5.4.3.

There are no existing public water supply wells within 15,000 feet downgradient of Site 47. An area in the Apponagansett Swamp was identified as a potential well site in CDM's 1971 Report to the City of New Bedford on Waterworks Improvements. Because of the potential for groundwater contamination from existing facilities (Sullivans Ledge hazardous waste Superfund site and the Shawmut Avenue sanitary landfill) that are within one mile of the proposed well, the site is not considered to be a good location for a public water supply. There are no residential or other private wells within one half mile of Site 47.

There are no surface water bodies used for public drinking water within a 1-mile radius of Site 47. Dartmouth maintains town water supply wells in the Paskamanset River, approximately 20,000 feet downstream of the site, however the river is not used for drinking water in the immediate vicinity of the site. The maximum seasonal high groundwater table is expected to be within 4 feet of the ground surface over most of the site.

**5.2.3.4 Site 40.** Approximately 64 acres (16.7 percent) of the 384 acre site lie in the 100-year floodplain. The floodplain boundary is shown in Figure 5.5-4. There are no defined surface water bodies on the site, however, the Paskamanset River forms part of the western boundary. The Acushnet Cedar Swamp, adjacent to Site 40, is not used as a water supply and there are no plans to develop it (CDM, Volume III, 1989).

There are two existing wells (pumping approximately 1 mgd each) near Site 40. The two wells, the Polaroid and DeCor Wells, are 3,200 and 4,000 feet upgradient from Site 40, respectively. The wells are privately owned and are used for industrial purposes. There are no known plans to use these wells for public or private drinking water. Portions of Site 40 may be within the Zone II of these wells (the zone of contribution which is likely to at least include the zone of permeable soils in the immediate area that would contribute to well yield) (CDM, Volume III, 1989). There are no existing public or private drinking water supply wells within 15,000 feet downgradient of Site 40.

A portion of Site 40, about 5.7 acres, is identified as a potential high-yield groundwater source in the State Water Supply Protection Atlas. An additional 146.2 acres is classified as a medium yield source. This area, known as the Turner's Pond well site, has not been considered by the City of New Bedford as a supply well site since 1971.

Site 40 surface water drains into the Acushnet Cedar Swamp. The Hobomock Swamp and Black Pond are both within one-half mile of the site to the north. There are no surface water bodies used for public drinking water supply within a 1-mile radius of Site 40. The maximum seasonal high groundwater table is likely to be within 4 feet of the ground surface in some sections of Site 40.

### 5.2.4 Ambient Conditions at Outfall Sites

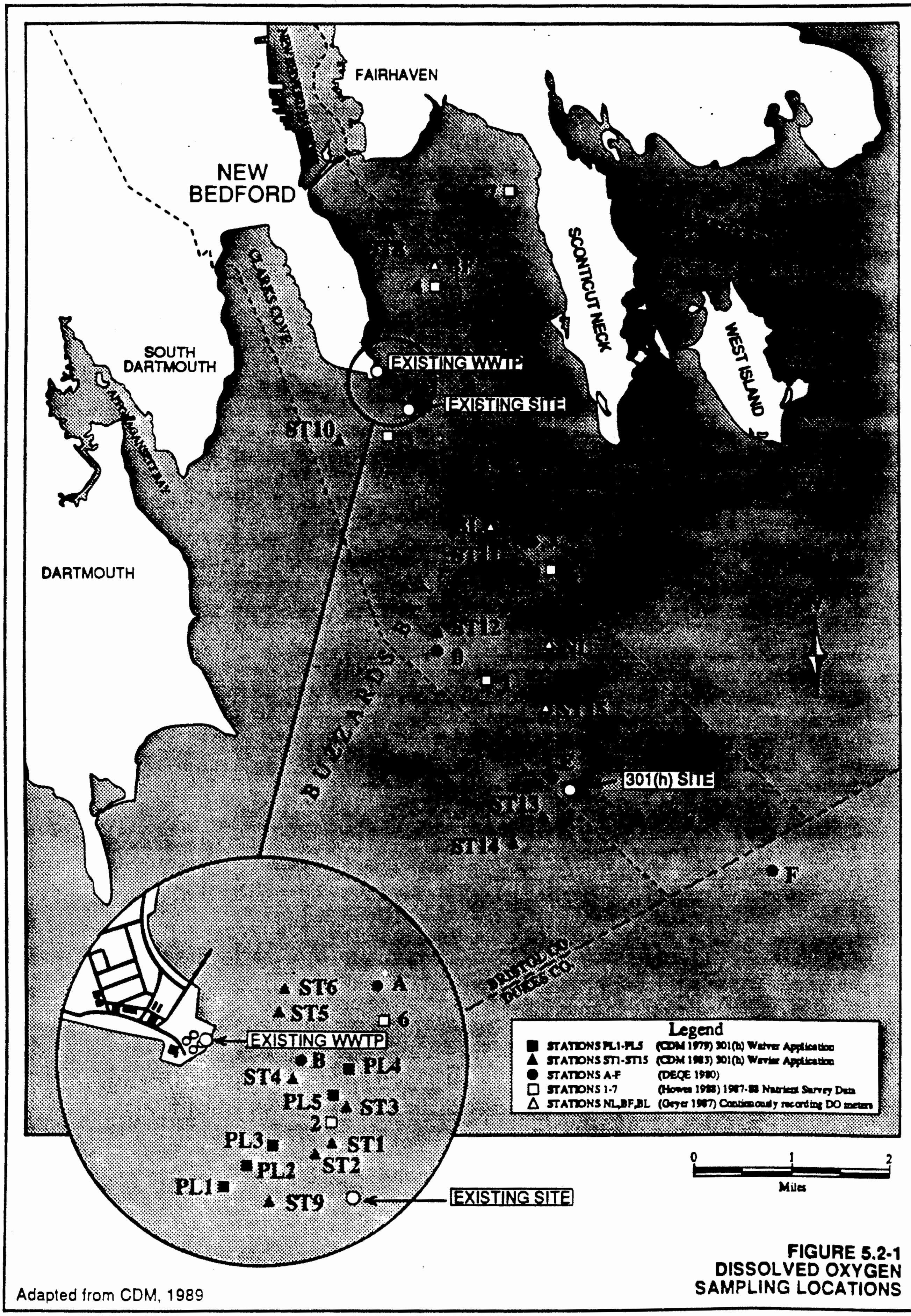
**5.2.4.1 Dissolved Oxygen in the Water Column.** The project area was divided into inner and outer harbor regions to compare differences in dissolved oxygen (DO) concentrations between the Existing Outfall Site and the 301(h) Site (Figure 5.2-1). Dissolved oxygen concentrations typically vary with depth. Concentrations in the upper layers of the water column are influenced by primary production (the production of oxygen by phytoplankton) and aeration at the surface, while concentrations in the lower layers are influenced by oxygen demanding (oxygen consuming) substances and benthic organisms in the sediments. Dissolved oxygen is critical for the survival of aquatic biota, and is therefore regulated by the Commonwealth of Massachusetts.

**Seasonal and Spatial Trends.** Scatter plots of seasonal DO concentrations for stations in both the inner and outer regions are shown in Figures 5.2-2 and 5.2-3. For both regions, dissolved oxygen concentrations were generally higher in winter than in summer. This is expected since dissolved oxygen solubility in water is inversely related to temperature.

Both regions exhibited typical summer patterns of higher concentrations in surface layers and lower concentrations in bottom layers. Because temperature stratification (the change in temperature per change in depth) is minimal, this difference in dissolved oxygen concentrations with depth is likely caused by both high productivity in the surface layers and sediment oxygen demand in the lower layers.

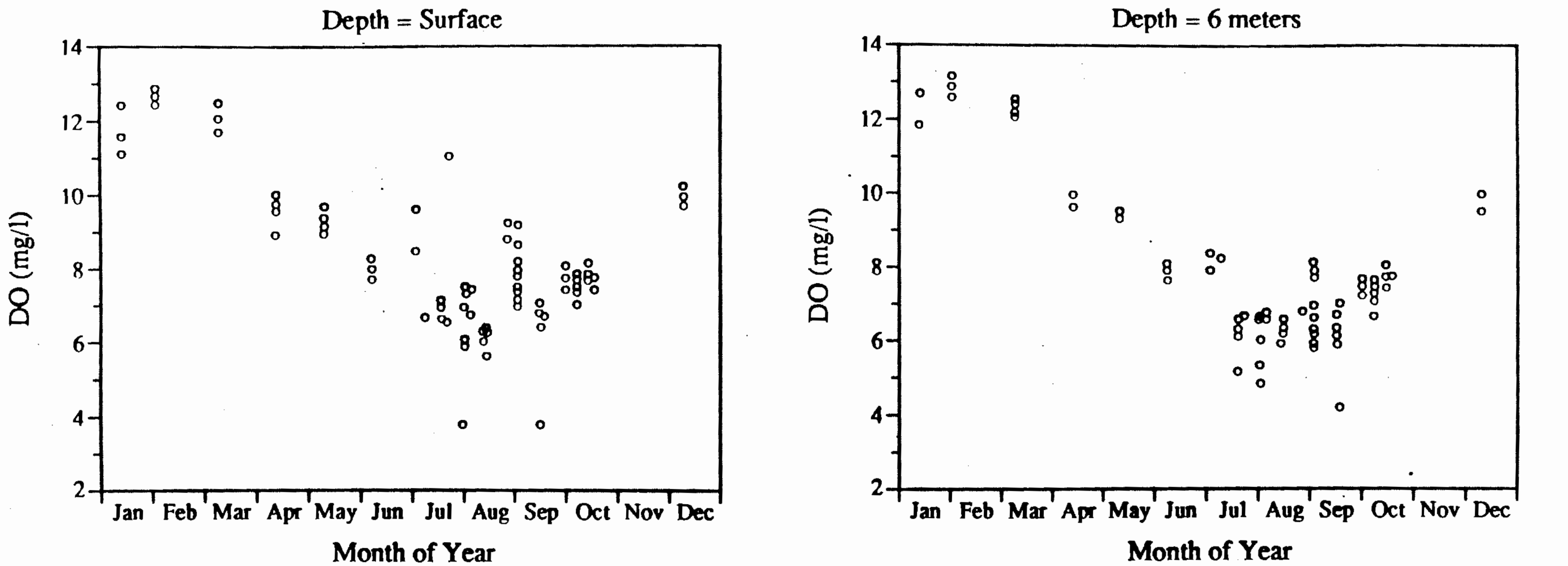
Spatially, concentrations were more variable among sites in the inner harbor than among outer region sites. For inner region sites, surface dissolved oxygen concentrations ranged from a low of approximately 3.5 mg/l in late summer to a high of approximately 13.0 mg/l in mid winter, with summer concentrations generally remaining between 5.0 and 8.5 mg/l. Concentrations in the bottom of the water column exhibited a slightly narrower range of values, generally remaining between 5.0 and 7.0 mg/l. Concentrations in the outer region exhibited an annual range of approximately 6.0 to 13.0 mg/l throughout the water column. Summer values tended to remain between 6.0 and 8.7 mg/l across all depths.

The variability in the inner region is attributed to the proximity of the existing effluent discharge, which influences the nutrient regime of nearby waters, in turn affecting biological activity and oxygen production. The lack of variability in the outer region suggests that the oxygen



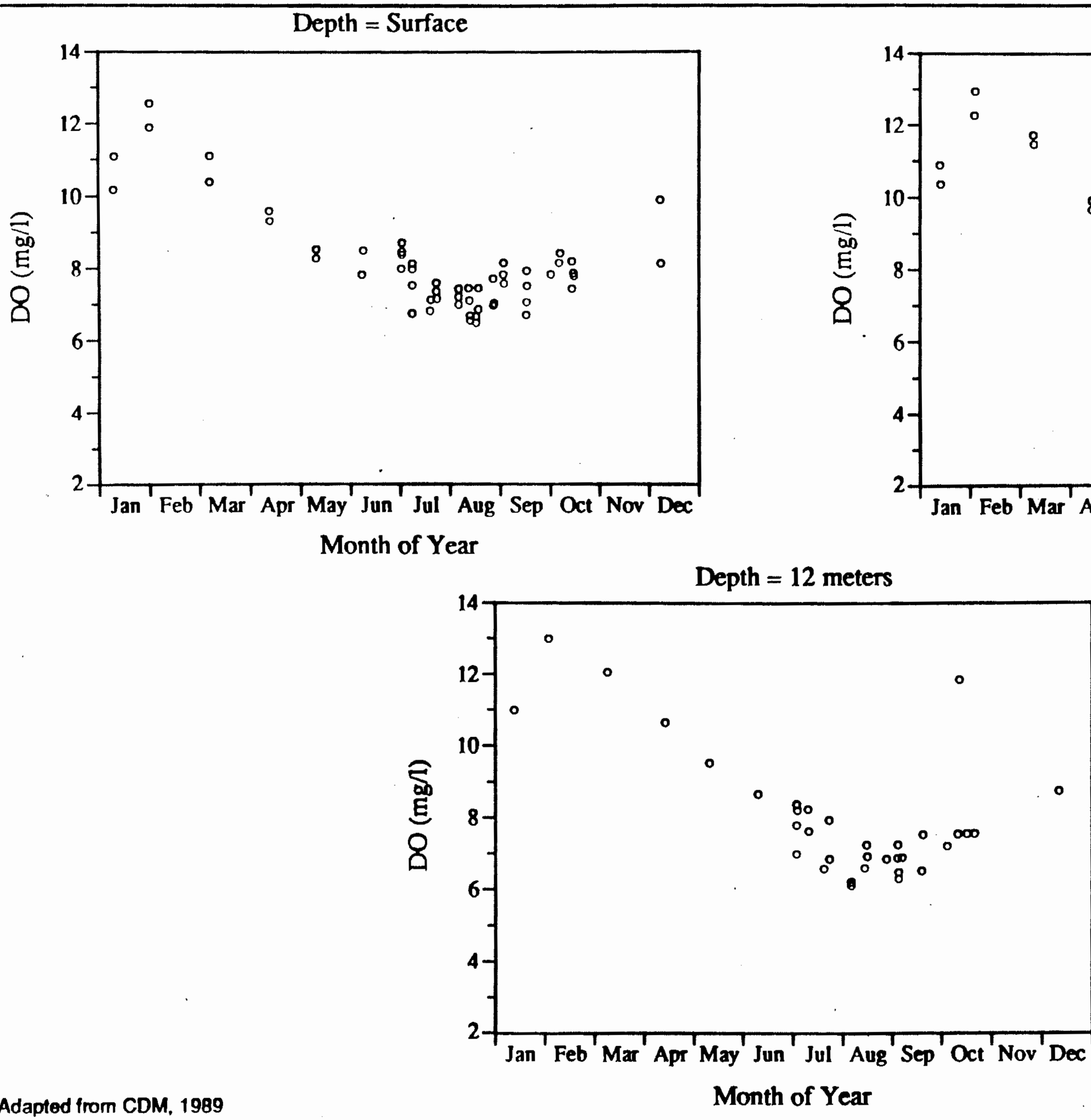

Adapted from CDM, 1989

FIGURE 5.2-1
DISSOLVED OXYGEN
SAMPLING LOCATIONS




Adapted from CDM, 1989

**FIGURE 5.2-2**
**SEASONAL DO IN THE INNER REGION**




Adapted from CDM, 1989

**FIGURE 5.2-3**
**SEASONAL DO IN THE OUTER REGION**

depleting effects of the existing effluent discharge are dispersed by the time water circulates to the outer region (CDM, Volume IV, 1989). Summer dissolved oxygen concentrations were always above 75 percent of saturation in the outer region, and above 65 percent in the inner region. Saturation data shows that bottom water saturation is always above 75 percent, except at the Existing Site.

**5.2.4.2 Ambient pH.** The range of pH observed near the existing effluent discharge was between 7.7 and 7.9 during a short study conducted in 1983 (CDM, 1983b). Data from three stations near the 301(h) Site exhibited a pH range of 7.9 to 8.3 during the same study. The Commonwealth of Massachusetts maintains a pH standard for waters receiving a waste discharge (between 6.5 and 8.5, and not more than 2 units beyond the naturally occurring range, 14 CMR 4.03). No other data, however, are available to describe ambient pH in the Harbor.

**5.2.4.3 Toxic Compounds in the Water Column.** Mid-depth ambient water column concentrations of metals, pesticides, volatile organic compounds, and semivolatile compounds were measured in New Bedford Harbor during January 1989 specifically for this study. Compounds detected, their concentrations, and EPA Water Quality Criteria are listed in Table 5.2-1.

Measurable quantities of volatile organic compounds and pesticides were not detected (CDM, Volume IV, 1989). Three semivolatile compounds (fluoranthene, phenanthrene, and pyrene) and total PCBs were detected at extremely low concentrations (Table 5.2-1). These concentrations exceed the 1 in 1,000,000 carcinogenicity risk criterion for PCBs only (Table 5.2-1).

Mean water column concentrations of cadmium, copper, lead, and PCBs (polychlorinated biphenyls) were collected during the EPA Superfund study of New Bedford Harbor. These compounds decreased with distance from the Inner Harbor (CDM, Volume IV, 1989).

Arsenic was the only metal detected that exceeded any criteria, and exceeded only the 1 in 1,000,000 carcinogenicity risk criterion (Table 5.2-1).

**5.2.4.4 Nutrients.** Concentrations of ammonia and inorganic nutrients were highest in surface waters near the Existing Site (See Figure 5.2-4 for sampling locations). Orthophosphate values at the existing site were generally four to five times higher and organic nitrogen values ten times higher than at the 301(h) Site. This pattern suggests that the elevated concentrations are the result of the existing effluent discharge (CDM, Volume IV, 1989).

Although silicate, an important nutrient for diatoms, exhibited a strong seasonal cycle, there was no difference in concentration between the Existing Outfall and the 301(h) Sites. This result

TABLE 5.2-1
**MEAN CONCENTRATION OF TOXIC SUBSTANCES DETECTED IN AMBIENT OCEAN SAMPLING AND CORRESPONDING USEPA TOXICITY CRITERIA**

| CONSTITUENT | AVERAGE AMBIENT CONCENTRATION | SALT WATER AQUATIC LIFE AND HUMAN HEALTH WATER QUALITY CRITERIA (1) | | | |
|---|---|---|---|---|---|
| | | CMC(2) | CCC(3) | TOXICITY(4) | 10-6 RISK(5) CARCINOGENICITY |
| fluoranthene | 0.006 | 40 | 16 | 54 | - - - |
| phenanthrene | 0.007 | 300 | - - - | - - - | 0.0311 |
| pyrene | 0.001 | 300 | - - - | - - - | 0.0311 |
| antimony | 0.092 | - - - | - - - | 45,000 | |
| arsenic | 1.013* | 69 | 36 | - - - | 0.0175 |
| cadmium | 0.0298 | 43 | 9.3 | - - - | - - - |
| chromium | 0.164 | 1,100 | 50 | - - - | - - - |
| copper | 0.436 | 2.9 | 2.9 | - - - | - - - |
| lead | 0.126 | 140 | 5.6 | - - - | - - - |
| mercury | 0.0064 | 2.1 | 0.025 | 0.146 | - - - |
| nickel | 0.423 | 75 | 8.3 | 100 | - - - |
| selenium | 0.005 | 410 | 54 | - - - | - - - |
| silver | 0.0012 | 2.3 | - - - | - - - | - - - |
| vanadium | 1.758 | | | | |
| zinc | 1.085 | 95 | 86 | - - - | - - - |
| Total PCBs | 0.00018* | 10 | 0.03 | - - - | 0.000079 |

(1) All units are in ug/l; from EPA Gold Book published in May 1986, updated in 1986, and again in May 1987.

(2) Criterion maximum concentration: protection for aquatic life against acute exposure.

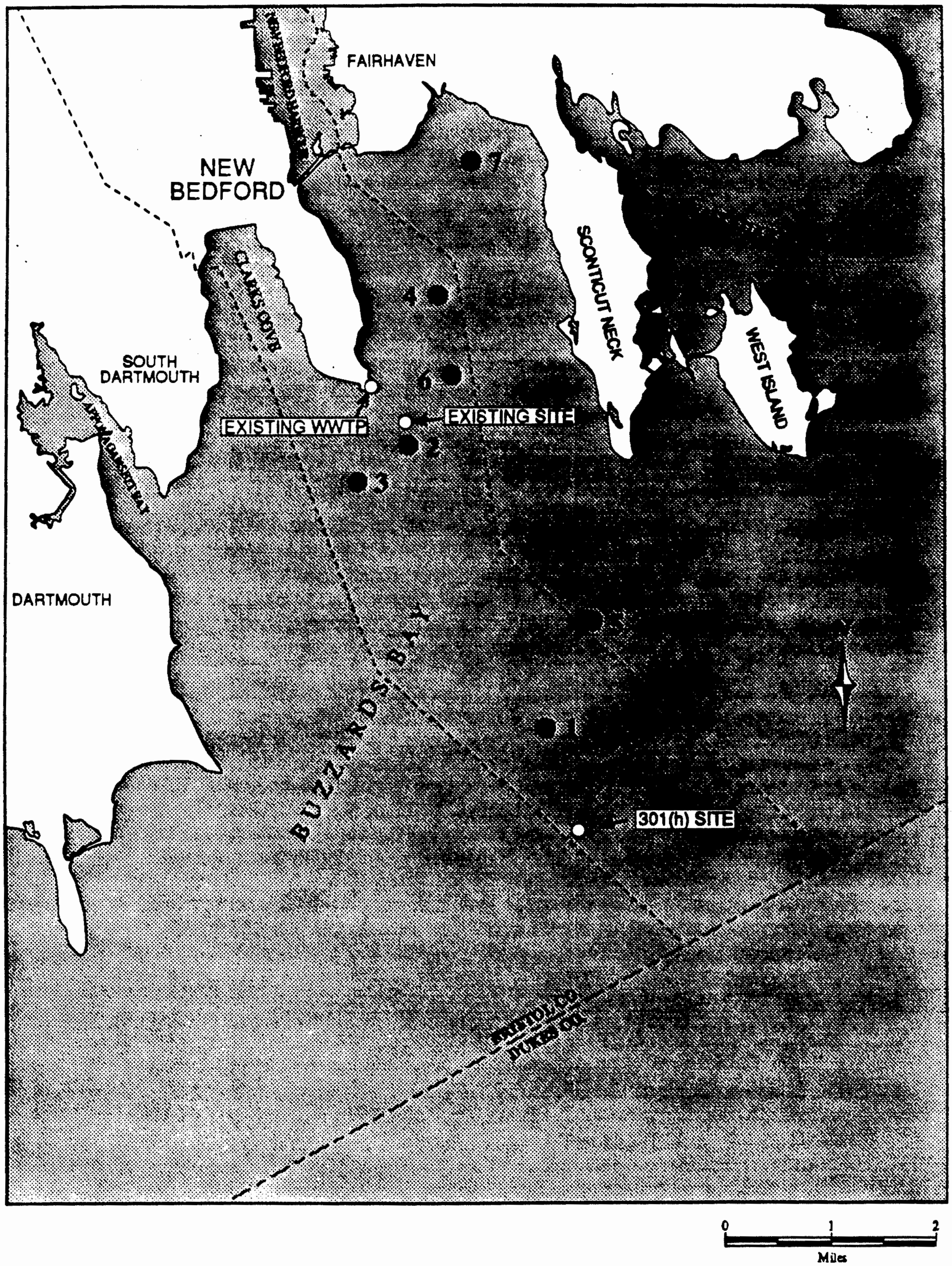
(3) Criterion continuous concentration: protection for aquatic life against chronic exposure.

(4) Human health criterion designed to protect the health functioning of specific organs (liver, heart, kidney, brain).

(5) Concentration that over long term exposure allows 1 person in 1,000,000 to suffer damage to genetic material that could cause cancer or genetic mutations.

* Exceeds carcinogencity criterion in the ambient water

Adapted from: CDM, Volume IV, 1989.




Adapted from CDM, 1989

**FIGURE 5.2-4**
**SAMPLING STATIONS FOR THE WATER COLUMN NUTRIENT STUDY**

may indicate that the existing effluent discharge is not the primary source of this nutrient (CDM, Volume IV, 1989).

Sediments play an important role in nutrient cycling in the Outer Harbor, as indicated by elevated concentrations of inorganic nutrients in waters overlying the sediment surface (CDM, Volume IV, 1989). Sediments also play an important role in the cyclingof other substances through the harbor ecosystem. This is discussed in the following section.

**5.2.4.5 Sediments.** The long-term history of human and industrial waste discharge to Buzzards Bay and New Bedford Harbor has left the sediments contaminated to a degree that potentially threatens both natural resources in the Bay and human health (CDM, Volume IV, 1989). Major contaminants identified in the Harbor and the Bay include PCBs, copper, lead, chromium, arsenic, and zinc. Organic wastes in the sediments can also consume oxygen, thereby decreasing the dissolved oxygen concentrations in the lower layers of the water column.

Locations of contaminated sediments in the Harbor are correlated with proximity to the existing effluent discharge (CDM, Volume IV, 1989). Degree of contamination is also related to sediment texture, with fine-grained sediments exhibiting greater levels of accumulation (Summerhayes et. al., 1977 cited in CDM, Volume IV, 1989).

The most recent data available for contaminant concentrations in the sediments come from the Superfund study, and are summarized in Table 5.2-2 (see Figure 5.2-5 for ~~sample locations~~). Sediment PCB, cadmium, and copper concentrations were highest in the Outer Harbor, dropping off rapidly beyond the underwater ledges at the mouth of the Harbor (CDM, Volume IV, 1989). Lead concentrations were more evenly distributed in the Outer Harbor, although very high concentrations were found near the Existing Site.

**Dredged Material Categories.** Sediments are placed into different categories for dredged and fill material according to Massachusetts regulations at 314 CMR 9.00: Certification for Dredging, Dredged Material Disposal and Filling in Waters. Classifying sediments according to these regulations provides a framework for comparing the practical differences in varying amounts of sediment contamination. The classifications, outlined in Table 5.2-3, in part determine the manner of disposal these sediments require, should excavation be necessary for construction of the new outfall. (CDM, Volume IV, 1989).

Sediments near the existing effluent discharge are in Category Three, which indicates the highest level of contamination. Further from the outfall toward the 301(h) Site more sediments are classified as Category Two, signifying an intermediate level of contamination. Throughout the remainder of Buzzards Bay

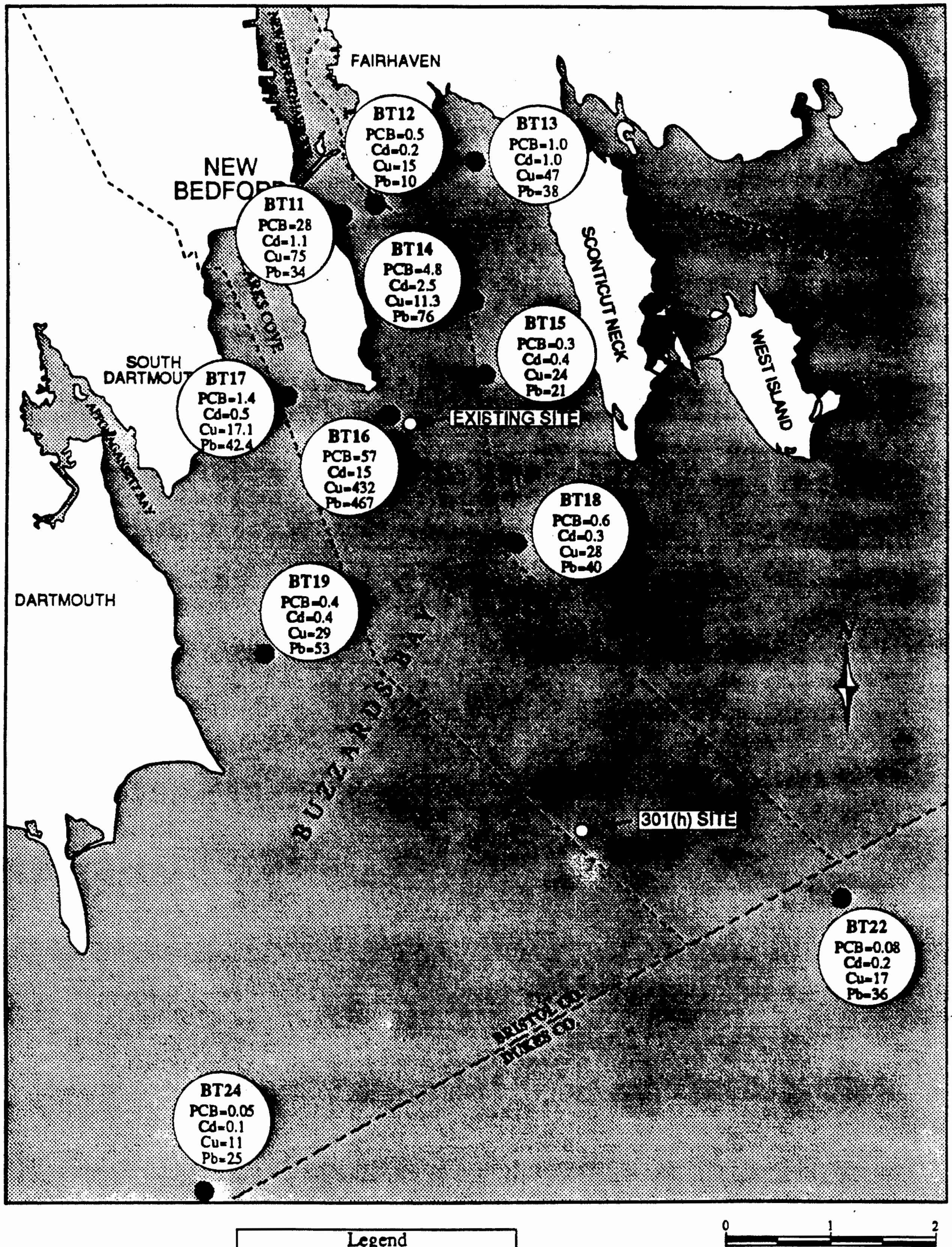
TABLE 5.2-2

CONTAMINANT CONCENTRATIONS (ppm) IN THE SEDIMENTS FROM THE SUPERFUND STUDY

| Station No. | Cadmium | Copper | Lead | PCBs | Category |
|---|---|---|---|---|---|
| BT11 | 0.19*-2.2 | 11.8*-154.0 | 9.0*-63.7* | 0.3-55.3* | 3 |
| average | 1.1 | 75.0 | 34.1 | 27.8 | 3 |
| BT12 | 0.14-0.18 | | | 0.005-1.64* | 3 |
| average | 0.16 | 15.5 | 9.8 | 0.5 | 2 |
| BT13 | 0.54*-1.53* | 23.6*-70.9* | 22.2*-53.9* | 0.34*-1.74* | 3 |
| average | 1.04 | 47.3 | 38.1 | 1.04 | 3 |
| BT14 | 1.97*-2.93* | 111*-115* | 61.4*-90.6* | 3.6*-5.9* | 3 |
| average | 2.45 | 113 | 76.0 | 4.8 | 3 |
| BT15 | 0.34*-0.45* | 23.6*-25.0* | 18.0*-24.8* | 0.26*-0.34* | 1 |
| average | 0.40 | 24.3 | 21.4 | 0.30 | 1 |
| BT16 | 6.29-22.7 | 307.0*-528.0* | 325.0-910.0* | 3.5*-226.2* | 3 |
| average | 14.7 | 432.0 | 467.0 | 56.7 | 3 |
| BT17 | 0.45*-0.54* | 13.8*-20.4* | 25.2*-59.5* | 1.2*-1.6* | 3 |
| average | 0.05 | 17.1 | 42.4 | 1.4 | 3 |
| BT18 | 0.19*-0.41* | 23.7*-30.9* | 25.3*-65.3* | 0.46-0.78 | 2 |
| average | 0.29 | 28.1 | 39.8 | 0.59 | 2 |
| BT19 | 0.33*-0.46* | 27.3*-30.2* | 43.0*-71.7* | 0.30-0.52 | 2 |
| average | 0.4 | 28.8 | 53.4 | 0.41 | 1 |
| BT22 | 0.19-0.20 | 15.7-18.3 | 33.4-37.6 | 0.06-0.09 | 1 |
| average | 0.20 | 17.0 | 35.5 | 0.08 | 1 |
| BT24 | 0.02-0.21 | 2.7-16.2 | 9.6-37.3 | 0.005*-0.08 | 1 |
| average | 0.1 | 11.4 | 25.2 | 0.05 | 1 |

NOTES: * - is an estimated value (below detection limit or otherwise).
Bold-faced concentrations fall into dredge and fill material category 3 as defined in 314 CMR 9.00.
Sample station number from original study.

Source: CDM, Volume IV, 1989.




| Legend | |
|---|---|
| BT22 | Sample Location |
| PCB | Poly Chlorinated Biphenyl |
| Cd | Cadmium |
| Cu | Copper |
| Pb | Lead |

Adapted from CDM, 1989

**FIGURE 5.2-5**
**CONCENTRATIONS OF POLLUTANTS IN SEDIMENTS (PPM)**

**TABLE 5.2-3**
**CLASSIFICATION OF DREDGE OR FILL MATERIAL**
**BY CHEMICAL CONSTITUENTS (ppm)**

| | Category One | Category Two | Category Three |
|---|---|---|---|
| arsenic | < 10 | 10-20 | > 20 |
| cadmium | < 5 | 5-10 | > 10 |
| chromium | < 100 | 100-300 | > 300 |
| copper | < 200 | 200-400 | > 400 |
| lead | < 100 | 100-200 | > 200 |
| mercury | < 0.5 | 0.5-1.5 | > 1.5 |
| nickel | < 50 | 50-100 | > 100 |
| PCBs | < 0.5 | 0.5-1.0 | > 1.0 |
| vanadium | < 75 | 75-125 | > 125 |
| zinc | < 200 | 200-400 | > 400 |

Adapted from: CDM, Volume IV, 1989.

sediments are classified as Category One, having the lowest level of contamination.

**Nutrient Cycling and Sediment Oxygen Demand.** Organic matter in New Bedford Harbor sediments is composed primarily of solids discharged in wastewater effluent and stormwater runoff as well as the decaying cells of primary producers. This organic matteris a major source of nutrients in the sediment and of sediment oxygen demand (SOD).

Studies conducted in September and October 1989 indicated that the SOD at the Existing Site was approximately 33 to 50 percent greater than at the 301(h) Site (CDM, Volume IV, 1989).

Although sediments near the Existing Outfall Site do not appear to dominate the overall nutrient balance at that location, ammonia flux was significantly greater than at the 301(h) Site (CDM, Volume IV, 1989). In general, differences in SOD and nutrient flux between the two candidate outfall sites are due primarily to the proximity of the Existing Site to the existing effluent discharge, and to other point and nonpoint sources in the Harbor watershed.

## 5.3 AIR QUALITY AND ODORS

### 5.3.1 Introduction

Wastewater treatment plants are known sources of air emissions of ozone precursors and odorous and toxic compounds. The significance of these emissions at a particular site depends on the existing air quality and the amounts of various components emitted into the air from the facility.

Site specific data for ambient air conditions were not collected for the proposed sites. Instead, the proposed sites were evaluated according to key criteria, as described below.

### 5.3.2 Regulatory Framework

Air quality and emissions of pollutants are regulated under the federal Clean Air Act (CAA) and Massachusetts Air Pollution Control Laws. These air quality regulations, standards, and guidelines define air emissions control technology requirements for the processing technologies under consideration, emission limits for specific categories of pollutants, and maximum allowable incremental and cumulative ambient air quality impacts of the project. Each applicable regulation is discussed below.

**5.3.2.1 National Ambient Air Quality Standards (NAAQS).** EPA requires the attainment and maintenance of primary and secondary NAAQS to protect public health and public welfare, respectively.

Standards have been established for the "criteria pollutants", as summarized in Table 5.3-1. These standards are not source-specific but rather are national limitations on ambient air quality. An area is considered "in attainment" of the NAAQS when pollutants do not exceed the annual average standards, and do not exceed the short-term (1-, 3-, 8-, and 24-hour) standards more than once per year.

**5.3.2.2. Prevention of Significant Deterioration (PSD).** The federal PSD regulations apply to the emission of selected pollutants from new major sources in areas that are in attainment of the NAAQS. A source is considered major if emissions of any regulated pollutant exceed 100 tons per year for 28 listed source types or 250 tons per year for any other source types. A WWTP is not one of the 28 listed sources, therefore, the proposed WWTP would only be considered a major source if emissions of any of the 15 pollutants (6 criteria pollutants and 9 other pollutants) regulated by the CAA would be greater than 250 tons per year.

**5.3.2.3 National Emissions Standards for Hazardous Air Pollutants (NESHAPs).** Under section 112 of the Clean Air Act, EPA is required to list hazardous air pollutants that must be controlled for industrial sources and to provide standards (or "NESHAPs") for each pollutant listed. This regulation establishes a uniform national standard for existing, modified, or new sources that emit the listed hazardous pollutants. The proposed WWTP is not expected to emit any air pollutant regulated under NESHAPs.

**5.3.2.4 New Source Performance Standards (NSPS).** NSPS are established for new sources of air emissions to ensure that new stationary sources reduce emissions to a minimum. These standards are for categories of stationary sources that cause, or contribute to, air pollution that may endanger public health or welfare. No standards are specified for WWTPs or sludge landfills.

**5.3.2.5 Massachusetts Clean Air Act.** The federal CAA is implemented in Massachusetts principally through Massachusetts regulations approved by EPA as part of the Massachusetts State Implementation Plan (SIP). The DEP has adopted Ambient Air Quality Standards that are judged necessary to protect public health, and are identical to the federal NAAQS. In Air Quality Regions in which the NAAQS are not being met ("non-attainment areas"), EPA's emissions offset policy adopted by DEP and the lowest achievable emissions rate (LAER) applies to facilities with the potential to emit 100 tons per year or more of any pollutant.

Less significant point sources of air pollution (i.e., less than 100 tpy) are subject to the state pre-construction review provisions, emissions limitations, and performance criteria.

TABLE 5.3-1. SUMMARY OF NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) [a]

| Pollutant | Averaging Time | NAAQS ($ug/m^3$) Primary [b] | Secondary [b] |
|---|---|---|---|
| Carbon monoxide (CO) | 8-hours<br>1-hour | 10,000<br>40,000 | (same as primary) |
| Lead(Pb) | Calendar quarter | 1.5 | 1.5 |
| Nitrogen dioxide ($NO_2$) | Annual | 100 | (same as primary) |
| Ozone($O_3$) [c] | 1-hour | 235 | (same as primary) |
| $PM_{10}$ | Annual<br>24-hours | 50<br>150 | (same as primary) |
| Total Suspended Particulates (TSP) | Annual [d]<br>24-hours | 75<br>260 | None<br>150 |
| Sulfur dioxide ($SO_2$) | Annual<br>24-hours<br>3-hours | 80<br>365<br>None | None<br>None<br>1,300 |

Source: EPA, 1989a

(a) NAAQS, other than those based on annual averages or annual gemometric means, are not to be exceeded more than once a year (except where noted).

(b) Primary ambient air quality standards define levels of air quality which EPA judges are necessary, with an adequate margin of safety, to protect the public health. Secondary ambient air quality standards define more stringent levels of air quality which are necessary to protect the public health from any known or anticipated adverse effects of a pollutant.

(c) The ozone standard is attained when the maximum hourly average concentration is exceeded for no more than one day of a calendar year.

(d) Determined as geometric mean; secondary annual standard is a guide for attaining secondary 24-hour standard.

Plans Approval and Emission Limitations require that prior to construction of any source that may contribute to a condition of air pollution, an application must be submitted to DEP for approval to construct such source. The application must contain construction plans certified by a professional engineer registered in Massachusetts and specifying Best Available Control Technologies (BACT). Application for approval to operate must be submitted to DEP following construction plans approval. DEP will determine emissions testing and limitations on a case-by-case basis.

Noise and Dust requirements prescribe general standards for control of noise and dust which are applicable to the construction phase. Asbestos removal during demolition is also subject to special notice, dust control, and handling and disposal procedures.

Facilities employing 250 or more daytime employee commuters at any time during a calendar year are required to implement a program designed to reduce commuter vehicle use. This requirement may apply during the construction phase of the proposed WWTP.

**5.3.2.6 DEP Air Toxics Program.** DEP has developed a list of Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for certain air toxics based on assessment of data evaluated for four public health effects categories: acute or chronic toxicity, carcinogenicity, mutagenicity, and developmental or reproductive toxicity. The 1989 Air Toxic Guidelines are derived using the information generated from a public health assessment. The TELs are 24-hour limits for noncarcinogenic pollutants and the AALs are an annual average based on $1 \times 10^{-6}$ health risk for carcinogenic pollutants. The AALs are guidelines used to assess a facility's contribution to ambient air toxics in a given area, and apply to all emission sources permitted by the Commonwealth.

**5.3.2.7 Massachusetts Odor Regulations.** In Massachusetts, odors are regulated in general terms, rather than through numerical limits by local boards of health and by the Divisions of Air Quality Control and Water Pollution Control of the DEP. In previous studies, the Massachusetts Secretary of Environmental Affairs required that there be no detectable odor when one part of ambient air from the project is diluted with one part of odor-free air (EPA, 1988b).

### 5.3.3 Methods of Assessment and Regional Meteorology

A method of assessing baseline air quality and meteorology was developed based on the existing characteristics of each site, available data, and air dispersion modeling requirements. For the purposes of air dispersion modeling, the sites were characterized according to their land use environment, background ambient levels of volatile organic compounds (VOC), toxic air pollutants impacts, and hydrogen sulfide ($H_2S$) and for attainment of the NAAQS. Specifically, the following criteria were followed in evaluating baseline air quality:

- o VOC estimates were based upon inventories of sources with emissions of VOCs greater than 40 tons per year (tpy) within 6 miles of the sites.

- o For assessment of toxics and $H_2S$ background levels, the ambient levels were estimated using concentrations reported in the literature (CDM, Volume III, Appendix G, 1989).

- o For dispersion modeling land use classification ("urban" or "non-urban"), the land within 1.9 miles of the sites was evaluated using the Auer (1978) technique (CDM, Volume II, 1989).

- o The air quality for geographical areas was classified as to whether the area is in attainment or not in attainment of the NAAQS/MAAQS based on existing data because these data provided a representative historical record of the ambient air quality in the vicinity of the sites.

There are 13 air monitoring stations maintained by the DEP in southeastern Massachusetts. However, there are only two locations near the sites being considered for the WWTP and sludge facilities. These are in New Bedford and Fairhaven. The data from these two sites are presented in Table 5.3-2.

Air quality in this region is classified as in non-attainment of the NAAQS for ozone ($O_3$); unclassified or in attainment for nitrogen dioxide ($NO_2$), carbon monoxide (CO), total suspended particulate (TSP) matter, and sulfur dioxide ($SO_2$).

Meteorological data are available for New Bedford, MA (temperature and precipitation) and Providence, RI (wind). Data from climatological summaries prepared by NOAA are summarized in Table 5.3-3. New Bedford has a mean annual temperature of 52.3 degrees F and a mean annual precipitation of 43.94 inches. Prevailing winds in the area are generally from the SW at an annual average speed of 10.6 mph.

### 5.3.4 Baseline Ambient Conditions

**5.3.4.1 Ambient Conditions for Site 1A.** The area surrounding Site 1A is identified as having low density land uses for more than 85 percent of the area within a 1.9 mile radius of the site.

**TABLE 5.3-2**
**BACKGROUND AIR QUALITY DATA**

| Pollutant | Averaging Period | Monitoring Station | Ambient Concentrations ($ug/m^3$) By Year 1985 | 1986 | 1987 | Federal and State Ambient Quality Standards ($ug/m^3$) |
|---|---|---|---|---|---|---|
| TSP | 24-hour | New Bedford(1) | 64 | 63 | 71 | none(2) |
| | Annual (geometric mean) | New Bedford(1) | 36 | 34 | 37 | none(2) |
| $SO_2$ | 3-hour | Fairhaven(3) | 169 | 115 | | 1,300(4) |
| | 24-hour | Fairhaven(3) | 67 | 66 | | 365(5) |
| | Annual | Fairhaven(3) | 17 | + | | 80(5) |
| CO | 8-hour average | Not monitored in Southeastern Massachusetts AQCR | | | | 9ppm(5) |
| Lead | Quarterly | Not monitored in Southeastern Massachusetts AQCR | | | | 1.5(6) |
| $PM_{10}$ | 24-hour | Not monitored in Southeastern Massachusetts AQCR | | | | 150(6) |
| | Annual | | | | | 50(6) |

1 New Bedford, 25 Water Street, YMCA; 1 mi N of 4A, 2.8 mi N of 1A, 2.7 mi SSE of 47, 6.5 mi SE of 40.
2 TSP Standard has been replaced by the Particulate Matter standard, $PM_{10}$
3 Fairhaven, Leroy Wood School; 3 mi ENE of 4A, 3 mi NE of 1A, 5 mi SE of 47, 6.7 mi SSE of 40.
4 Secondary standard
5 Primary Standard
6 Primary and Secondary
\+ Number of observations are insufficient to determine an accurate annual average

Therefore, the site area is classified as non-urban for air emissions dispersion modeling.

The inventory of existing sources within 6 miles (10 km) of the sites with emissions of volatile organic compounds (VOCs) greater than 40 tpy is presented in Table 5.3-4. The existing WWTP is the most significant source of odors in the area surrounding Site 1A. The existing sludge handling building and the dumping of septic waste are particularly significant sources. However, the WWTP is not included in the background inventory since it will no longer be a source once the new facility is in operation. Based on data from Table 5.3-3, the prevailing wind direction is generally to the southwest. The winds blow from the east south-east only 10 to 20 percent of the time, across the site toward the residences that are nearest Site 1A.

**Table 5.3-3**
**Meteorological Data**

| Month | Mean Temperature (F) | Mean Percipitation (in) | Wind Mean Speed (mph) | Wind Prevailing Direction |
|---|---|---|---|---|
| Jan | 31.6 | 4.06 | 11.4 | NW |
| Feb | 32.4 | 3.84 | 11.6 | NNW |
| Mar | 39.4 | 4.20 | 12.2 | WNW |
| Apr | 48.7 | 3.76 | 12.3 | SW |
| May | 58.4 | 3.35 | 10.9 | S |
| Jun | 67.3 | 2.73 | 10.0 | SW |
| Jul | 73.4 | 2.37 | 9.5 | SW |
| Aug | 72.6 | 4.26 | 9.3 | SSW |
| Sep | 65.7 | 3.35 | 9.5 | SW |
| Oct | 56.3 | 3.20 | 9.7 | NW |
| Nov | 46.4 | 4.16 | 10.5 | SW |
| Dec | 35.6 | 4.66 | 11.0 | WNW |
| Year | 52.3 | 43.94 | 10.6 | SW |

Source: NOAA Climatological Summaries for New Bedford, MA (temperature and precipitation) and Providence, RI (wind).

**5.3.4.2 Ambient Conditions for Site 4A.** Site 4A was classified as non-urban based upon the dispersion environment within 1.9 miles of the site (CDM, Volume II, 1989). The inventory of existing VOC sources within 6 miles of Site 4A is listed in Table 5.3-4.

While fish processing plants emit odors evident along MacArthur Drive, odors at the site are not perceptible. The wind blows across the site toward the nearby residences (north-north-east)

TABLE 5.3-4

LOCATIONS OF VOLATILE ORGANIC COMPOUND (VOC) SOURCES RELATIVE TO POTENTIAL WWTP AND SLUDGE FACILITIES SITES[1]

| Source<br>Total VOC Emissions | Tons<br>Per Year | Distance from Sites (miles) | | | |
|---|---|---|---|---|---|
| | | Site 1A | Site 4A | Site 47 | Site 40 |
| Aerovox Industries | 245 | 5.5 | 3.5 | 2.4 | 3.5 |
| Acushnet Co.-Plant A | 74 | 5.9 | 3.9 | 2.7 | 3.3 |
| Acushnet Co.-Plant B | 40 | 5.7 | 3.7 | 2.5 | 3.4 |
| Chamberlain Mfg | 78 | 5.6 | 3.5 | 1.5 | 3.2 |
| Cornell Dubiler Co. | 41 | 1.4 | 0.7 | 4.5 | * |
| PCI GP Inc. J.C. Rhod | 60 | * | * | 4.4 | 1.0 |
| U.S. Ring Binder Corp. | 40 | * | 4.0 | 1.6 | 2.7 |
| Brittany Dye and Print | 68 | 0.9 | 1.3 | 5.0 | * |
| Dartmouth Finishing | 47 | 1.6 | 0.5 | 4.2 | * |
| Fibre Leather Mfg. | 46 | 5.4 | 3.4 | 2.4 | 3.6 |

Adapted from: CDM, Volume II, 1989

(1) Sources emitting greater than 40 tons per year of VOCs
* Source is greater than 6 miles from the site

approximately 23 to 25 percent of the time, based on the data presented in Table 5.3-3.

**5.3.4.3 Ambient Conditions for Site 47.** The dispersion environment in the vicinity of Site 47 is classified as rural (CDM, Volume II, 1989). An existing potential source of odor is the existing solid waste landfill, however no odors were perceived at the golf course or along Shawmut Avenue. Wind from the west-northwest blows across the site towards the nearby residences approximately 23 to 25 percent of the time (CDM, Volume II, 1989). Major sources of VOC's in the vicinity are listed in Table 5.3-4.

**5.3.4.4 Ambient Conditions for Site 40.** Seventy-five percent of the area within 1.9 miles of Site 40 is classified as rural; the remaining 25 percent is classified as urban. The rural area is made up of forest (55 percent), industrial/commercial development (35 percent), and residential areas (10 percent). Major sources of VOC's in the area are listed in Table 5.3-4.

During site visits to Site 40, no perceptible odors were detected. There are no residences within 1/2 mile of the site and the only existing development within 1/2 mile is the previously described industrial park (CDM, Volume III, 1989).

## 5.4 NOISE

### 5.4.1 Introduction

Levels of noise are measured in units called decibels. Since the human ear cannot perceive all pitches or frequencies of sound equally well, these measures are adjusted or weighted to correspond to human hearing. This adjusted unit is known as the A-weighted decibel or dBA. The dBA describes a noise at just one moment, as very few noises are constant. To describe a fluctuating sound over time, one way is to treat it as if it had been a steady, unchanging sound. For this, an equivalent sound level ($L_{EQ}$) can be computed. The $L_{EQ}$ is the constant sound level that, in a given situation and time period conveys the same sound energy as the actual fluctuating sound.

The cumulative noise exposure scale used is the $L_{DN}$ (day-night equivalent sound level), which is calculated from a mathematical average of the sound energy received over a 24-hour period, with a 10 dBA penalty applied to any sound occurring at night (10 pm - 7 am). Another type of noise measure scale is the $L_{90}$. The $L_{90}$ is the noise level (in dBA) which is exceeded cumulatively for 90 percent of the time, and is a good measure of background ambient noise (EPA, 1989a).

Ambient noise levels were measured at the potential sites to characterize existing conditions. To collect the lowest background noise conditions in a 24-hour period, the monitoring was performed between 1 am and 5 am for sites 1A and 4A and 7 am to 4 pm for Sites 47 and 40. These data were used as the ambient noise levels when computing the projected increase in noise levels. Background noise levels were recorded during this time period by measuring 50 instantaneous readings at 10 second intervals. Monitoring stations were placed at the respective site boundaries and at the nearest sensitive receptor (a dwelling unit) (CDM, Volume II; Volume III, 1989). Measured noise levels were reported as the background $L_{90}$, the sound level that was exceeded 90 percent of the time.

### 5.4.2 Regulatory Framework

Noise is regulated by federal, state, and local legislation and policies. On the national level, noise guidelines are provided by the U.S. EPA. At the state level the Massachusetts DEP has published guidelines based primarily on consideration of the pre-existing ambient noise level. There are no local noise ordinances applicable to the proposed facility.

**5.4.2.1 Federal Noise Guidelines.** The Noise Control Act of 1972 established a national policy by statutory mandate to "promote an environment for all Americans free from noise that jeopardizes their public health and welfare" (42 U.S.C. 4901). EPA was directed by Congress to publish information about levels of environmental noise consistent with protection of public health and welfare, with an adequate margin of safety. These levels are presented in Table 5.4-1. Table 5.4-2 describes typical noise ranges on a single value of broad-band noise levels. (EPA, 1989a). There are two EPA review criteria that apply to the proposed solid disposal project. These include: increasing noise levels in excess of 15 dBA above background; or future noise levels that exceed 67 $L_{EQ}$.

**5.4.2.2 Massachusetts Noise Regulations and Guidelines.** The Massachusetts DEP noise regulations prohibit excess noise emissions, and are based primarily on the pre-existing ambient noise level. An increase of up to 10 dBA above the background ($L_{90}$) noise level is allowed. Therefore, the maximum allowable ambient noise level after the contribution of the new project is the $L_{90}$ + 10 dBA. These criteria apply at the facility property boundary. Massachusetts DEP also prohibits noise sources from producing a "pure tone condition", defined to occur when any octave band exceeds its two adjacent bands by more than 3 dBA.

**TABLE 5.4-1. SUMMARY OF NOISE LEVELS IDENTIFIED AS REQUISITE TO PROTECT PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY**

| EFFECT | LEVEL | | AREA |
|---|---|---|---|
| Hearing Loss | $L_{EQ}$(24 hr.) | ≤ 70 dB | All areas |
| Outdoor activity interference and annoyance | $L_{DN}$ | ≤ 55 dB | Outdoors in residential areas, farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use. |
| | $L_{EQ}$(24 hr.) | ≤ 55 dB | Outdoor areas where people spend limited amounts of time, such as school yards and playgrounds. |
| Indoor activity | $L_{DN}$ | ≤ 45 dB | Indoor interference and residential annoyance areas. |
| | $L_{EQ}$(24 hr.) | ≤ 45 dB | Other indoor areas with human activities such as schools. |

Source: EPA, 1974.

**TABLE 5.4-2.**
**TYPICAL DAYTIME AND NIGHTTIME RESIDUAL NOISE LEVELS AT URBAN AND SUBURBAN RESIDENTIAL AREAS ($L_{90}$)**

| Description | Typical Range (dBA) |
|---|---|
| Daytime | |
| Quiet Suburban Residential | 36 to 40 |
| Normal Suburban Residential | 41 to 45 |
| Urban Residential | 46 to 50 |
| Noisy Urban Residential | 51 to 55 |
| Very Noisy Urban Residential | 56 to 60 |
| Nightime | |
| Quiet Rural | < 30 |
| Quiet Suburban Residential | 30 to 40 |
| Suburban Residential | 40 to 45 |
| Quiet Urban Residential | 45 to 50 |
| Urban Residential | 50 to 55 |

Source: EPA, 1989a

### 5.4.3 Ambient Noise Conditions

**5.4.3.1 Ambient Conditions at Site 1A.** Ambient noise conditions were measured at three locations near Site 1A on October 27 and November 3 and 4, 1988. Two locations were at the site, with a third location (1A-3) in the residential neighborhood near the site (Figure 5.4-1). Measured noise levels are listed in Table 5.4-3. The $L_{90}$ noise levels measured at or near Site 1A ranged from 33 to 59 dBA. The primary noise source for the residential location was from the downtown area. Noise at location 1A-2 was predominantly from an electrical transformer (CDM, Volume II, 1989).

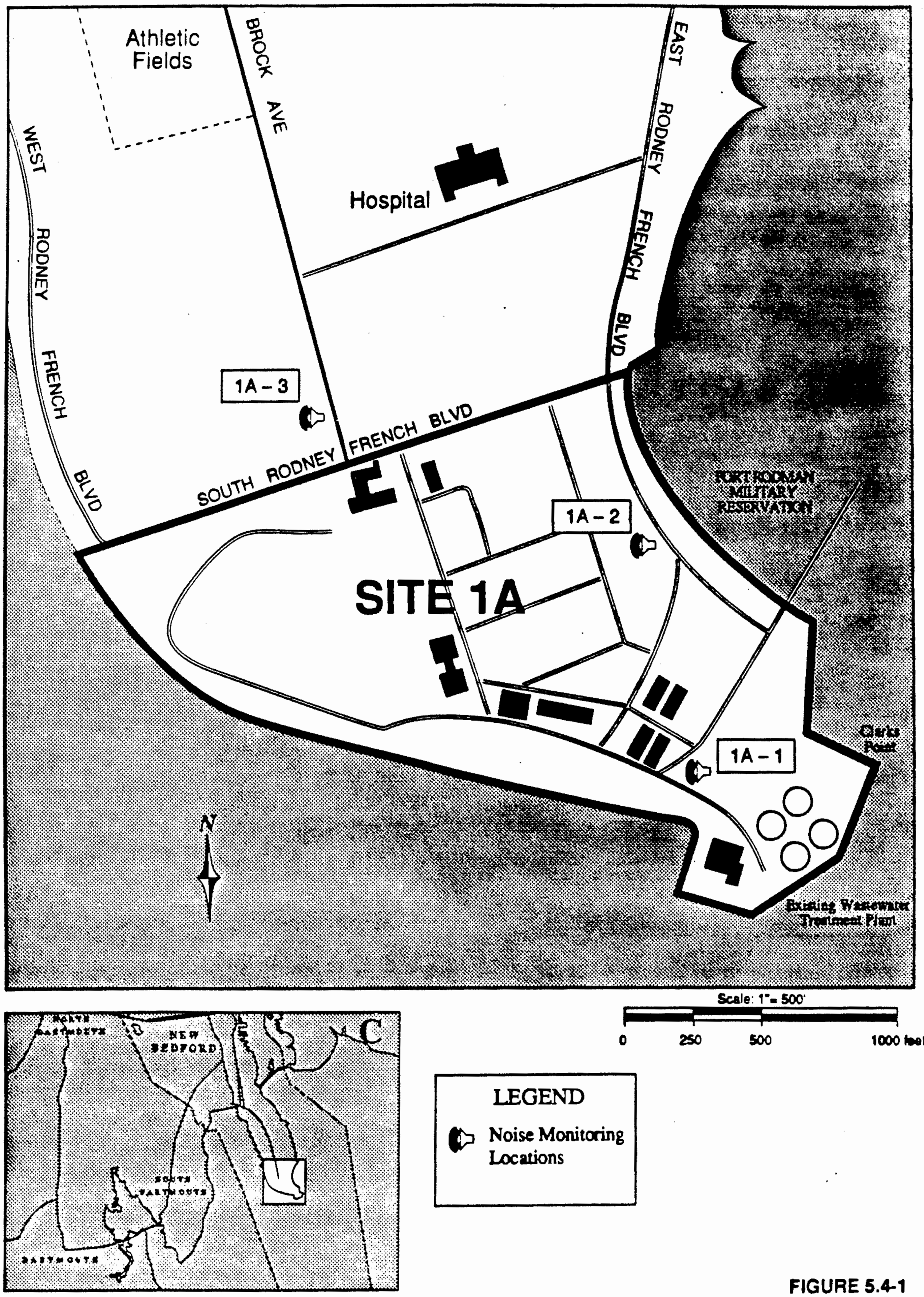
Additional noise monitoring was collected on May 22 and 23, 1989. Background $L_{90}$ and octave data were collected every other hour at the northeast corner of the site and at monitoring location 1A-3. These data are presented on Table 5.4-4. Background noise during this survey consisted mainly of traffic and residential noise (CDM, Volume V, 1989).

**5.4.3.2 Ambient Conditions at Site 4A.** Noise levels near Site 4A were measured at two locations on October 27 and November 3 and 4, 1988 (see Figure 5.4-2). One location, 4A-1, was located on the boundary of the proposed WWTP site. The second monitoring location (4A-2) was placed near the residences adjacent to the site. Noise levels ranged from 43 to 51 dBA, with the predominant noise source for both locations was traffic on JFK Boulevard (CDM, Volume II, 1989).

Additional noise monitoring data collected at monitoring location 4A-2 and at the northwest corner of the site during the May 22 and 23, 1989 survey is presented in Table 5.4-4. Background noise at these locations was dominated by traffic on JFK Boulevard (CDM, Volume V, 1989).

**5.4.3.3 Ambient Conditions at Site 47.** Two locations were monitored at Site 47 (Figure 5.4-3). Location 47-1 was located on the western side of the Shawmut Avenue landfill at the site boundary. The other location (47-2) was at the intersection of Hathaway Road and Whitlow Street in a residential area. The range of $L_{90}$ noise levels measured at or near Site 47 was 33 to 63 dBA (Table 5.4-3). Route 140 was the predominant noise source for location 47-2. Because of its location at the base of the landfill slope, 47-1 was screened from the noise of landfill operations, but recorded the noise of airport operations (CDM, Volume III, 1989).

Additional noise monitoring was also conducted at this site in 1989 at the western side of the proposed landfill and the intersection of Hathaway Rd. and Whitlow St. The noise levels




Adapted from CDM, 1989

**FIGURE 5.4-1**
**NOISE MONITORING LOCATIONS FOR ALTERNATIVE SITE 1A**

**TABLE 5.4-3**
**EXISTING $L_{90}$ NOISE LEVELS (dBA)**
**1988 SURVEY**

| Monitoring Station | 1 am | 2 am | 3 am | 4 am | 5 am | 7 am | 9 am | 11 am | 2 pm | Daytime |
|---|---|---|---|---|---|---|---|---|---|---|
| Site 1A 1A-1 | 33 * | 53 * | 45 | 45 | 45 | | | | | |
| 1A-2 | 37 * | 53 * | 37 | 47 * | 39 | | | | | |
| 1A-3 | 59 * | 37 | 39 | 41 | 41 | | | | | |
| Site 4A 4A-1 | 43 | 45 | 49 | 47 | 51 | | | | | |
| 4A-2 | 45 | 45 | 49 | 45 | 51 | | | | | |
| Site 47 47-1 | | | | | | 51 | 49 | 49 | 49 | 49 |
| 47-2 | 45 | 43 | 33 | 45 | 55 | 63 | 57 | 59 | 61 | 59 |
| Site 40 40-1 | | | | | | 41 ** | 47 | 43 | 45 | 47 |
| 40-2 | | | | | | 51 | 51 | 49 | 47 | 49 |

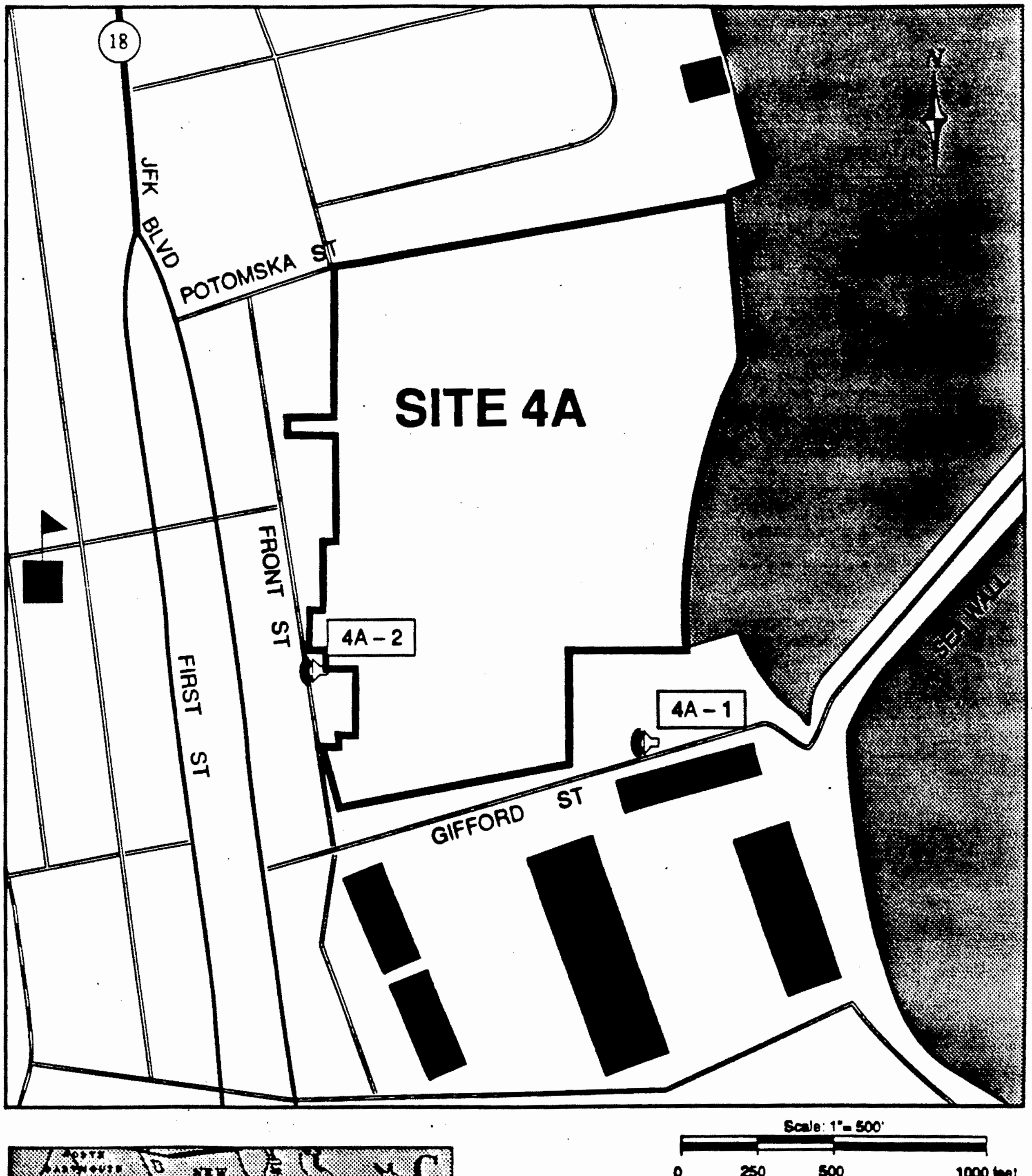
* Potential for Instrument Error
** This reading is not included in cumulative daytime reading.

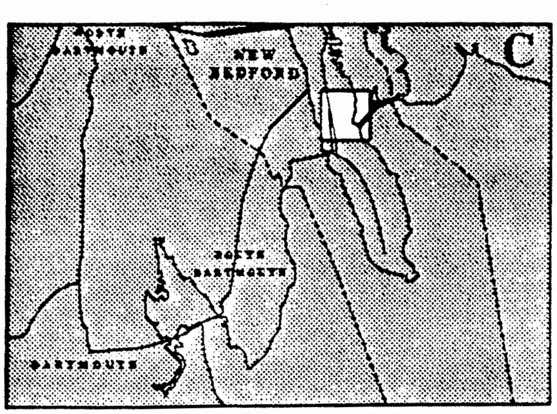
Adapted from: CDM, Volumes II and III, 1989.

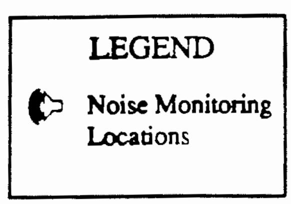
TABLE 5.4-4
EXISTING NOISE LEVELS (dBA)
1989 SURVEY

| LEVELS | Site 1A | | Site 4A | | Site 40 | | Site 47 | |
|---|---|---|---|---|---|---|---|---|
| | NE Corner | 1A-3 | 4A-2 | NW Corner | Power Line | Pine Acres | Western Side | Hathaway/ Whitlow Sts. |
| $L_{EQ}$ | 52-55 | 56-57 | 56-63 | 60-63 | 41-57 | 54-60 | 52-54 | 63-65 |
| $L_{90}$ | 43-49 | 35-48 | 45-55 | 47-53 | 41-47 | 47-51 | 49-51 | 57-63 |
| $L_{10}$ | 57-59 | 53-63 | 61-65 | 59-65 | NA | NA | NA | NA |

NA = Not Available
Adapted from: CDM, Volume V, 1989.




Adapted from CDM, 1989

**FIGURE 5.4-2**
**NOISE MONITORING LOCATIONS FOR ALTERNATIVE SITE 4A**

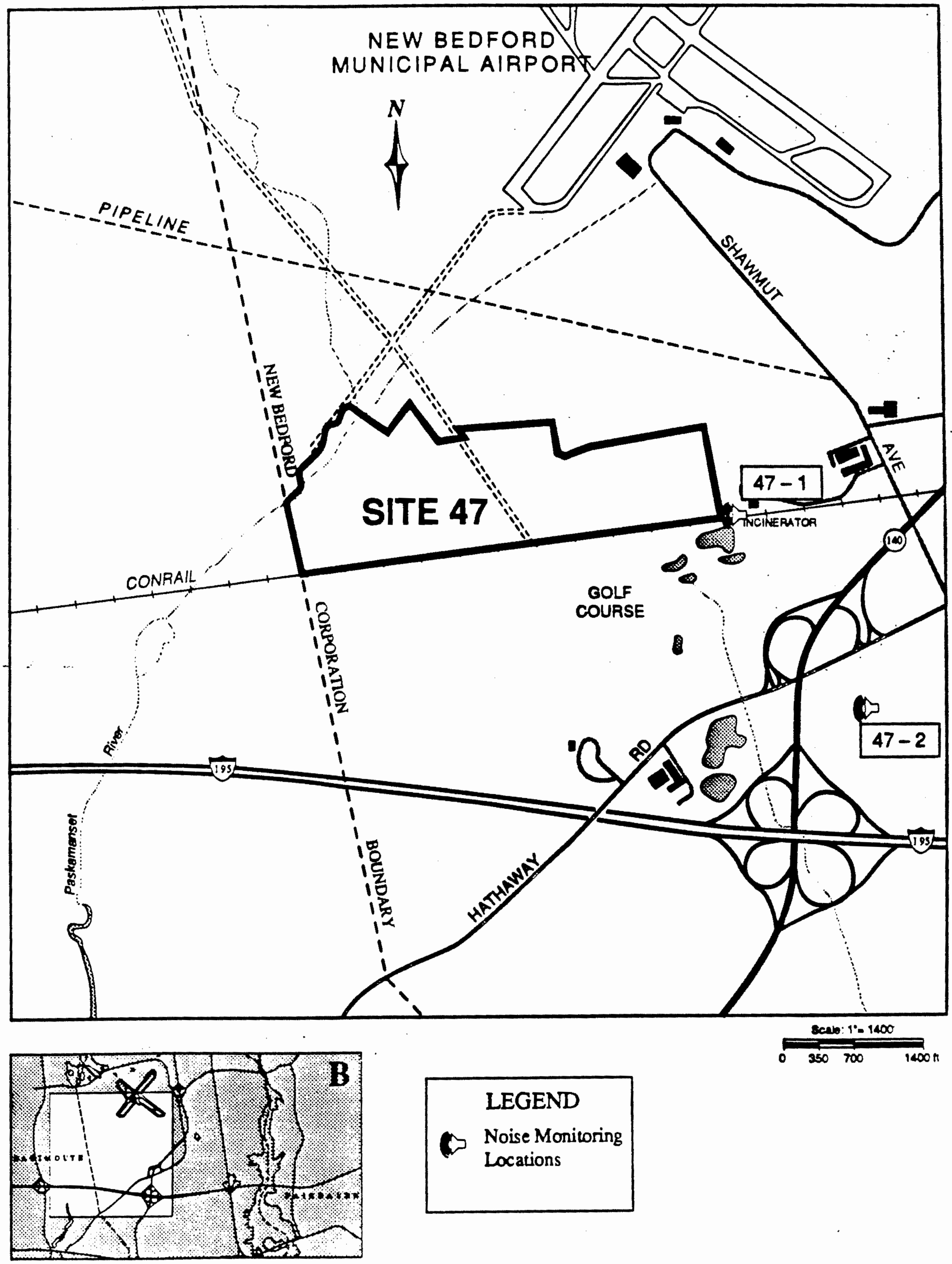



FIGURE 5.4-3
NOISE MONITORING LOCATIONS FOR
ALTERNATIVE SITE 47

Adapted from CDM, 1989

measured are presented in Table 5.4-4. The predominant sources of background noise during this survey were traffic and airplanes (CDM, Volume V, 1989).

**5.4.3.4 Ambient Conditions at Site 40.** Monitoring station 40-1 was located in an undeveloped area at the northern boundary of the site at the power line easement (Figure 5.4-4). Noise levels at this station measured during the reporting period ranged from 41 to 47 dBA. In contrast, station 40-2 was located in the Pine Hill Acres housing development (Figure 5.4-4). Noise levels at or near Site 40 ranged from 41 to 51 dBA (CDM, Volume III, 1989) (Table 5.4-3).

During the 1989 background noise survey at this site, monitoring stations were located at the power line easement and the Pine Acres Subdivision. The noise levels measured are presented in Table 5.4-4. The predominant sources of background noise during this survey was construction equipment and traffic (CDM, Volume V, 1989).

## 5.5 ECOSYSTEMS

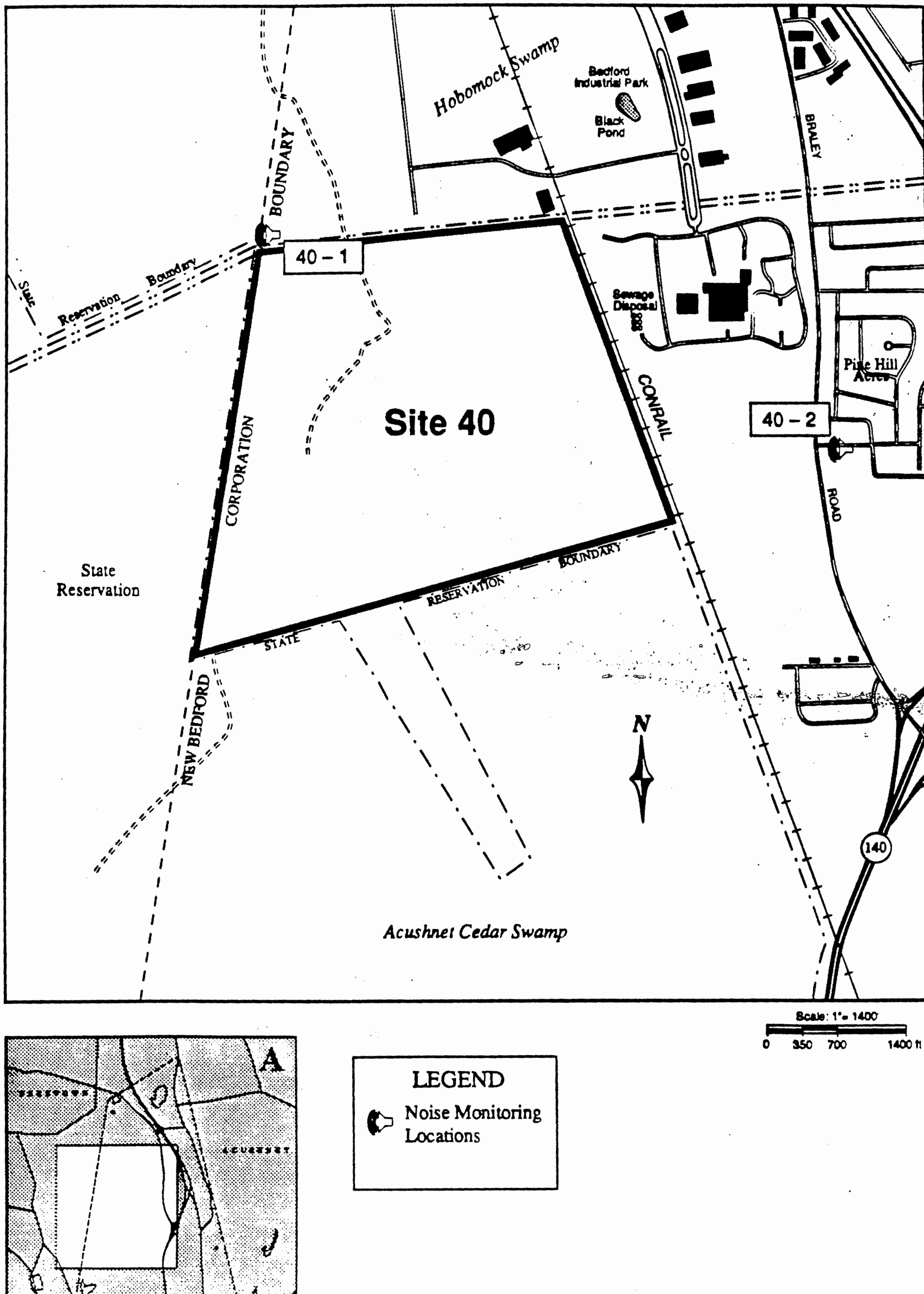
### 5.5.1 Introduction

This section presents a summary of regulations pertaining to the natural environment and describes existing biological communities in the vicinity of each alternative site for the proposed WWTP, effluent outfall, and solids disposal facilities.

### 5.5.2 Regulatory Framework

Terrestrial, wetland, and marine ecosystems are regulated and protected by an array of federal and state statutes and regulations. The following discussion summarizes the significant regulatory programs at the federal and state levels.

**5.5.2.1 Fish and Wildlife Coordination Act.** The National Environmental Policy Act (see Section 5.1.2.1) requires consideration of impacts to biota in accordance with the Fish and Wildlife Coordination Act. The implementing regulations of this Act state that any federal agency that proposes to control or modify any body of water must first consult with the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), and the appropriate state agency exercising administration over the wildlife resources of the affected state. The goal of the agency consultation is to eliminate, minimize, or mitigate adverse impacts to fish and wildlife. Advice from the USFWS and NMFS, the Act's administrators must be considered in the siting decisions.




Adapted from CDM 1989

**FIGURE 5.4-4**
**NOISE MONITORING LOCATIONS FOR ALTERNATIVE SITE 40**

**5.5.2.2 Endangered Species Act of 1973.** The Federal Endangered Species Act of 1973 requires that any proposed federal action not jeopardize the continued existence of endangered or threatened species or result in the destruction of critical habitat. Under Section 7 of the Act, EPA must consult with the USFWS and NMFS todetermine the presence of federally listed threatened or endangered species that would potentially be affected by the proposed action. If the USFWS or NMFS determines that the proposed project may affect the continued existence of a listed species, further consultation may require preparation of a biological assessment to evaluate the project impacts on the species.

**5.5.2.3 Marine Mammal Protection Act.** The Federal Marine Mammal Protection Act regulates or prohibits the taking of marine mammals. The Act defines "taking" as to harass, hunt, capture, or kill any marine mammal and includes harassment as part of the definition of taking in order to prohibit unintentional acts adversely affecting marine mammals (Bean, 1977). Construction or operation of an effluent outfall or disposal of dredged material cannot take marine mammals or reduce the species' ability to maintain optimum sustainable population levels.

**5.5.2.4 Marine Protection, Research, and Sanctuaries Act.** The Marine Protection, Research, and Sanctuaries Act (MPRSA, also known as the Ocean Dumping Act), regulates disposal activities in the ocean seaward of the territorial sea boundary. EPA and USACE are charged with developing and implementing regulatory programs to ensure that ocean disposal will not adversely affect human health and welfare, amenities, the marine environment, ecological systems, or economic opportunities in the ocean.

Section 102(a) of MPRSA requires EPA to issue permits for the dumping of materials into ocean waters, and charges EPA with developing criteria to use for review of ocean dumping permit applications. The criteria must address the potential impacts of the ocean dumping on human health, fisheries and aquatic resources, wildlife, shorelines and beaches, and marine ecosystems. The criteria must also consider the potential longevity of the effects, and alternatives to ocean dumping must be addressed.

Section 103 of the MPRSA establishes criteria for the designation of open-water dredged material disposal sites. Actual designation of disposal sites is performed by EPA and only designated sites may be used for disposal. USACE issues permits for the transport of dredged materials over waters of the U.S. for disposal at designated sites. Section 103 permits are issued only after consideration of those same factors discussed above for Section 102 permitting.

**5.5.2.5 Section 404 of the Clean Water Act.** Section 404 of the CWA regulates the discharge of dredged and fill materials to waters of the U.S., which includes filling wetlands. Guidelines for Specification of Disposal Sites for Dredged or Fill Material, promulgated under CWA Section 404, maintain that no discharge of dredged or fill material will be permitted if there is a practicable alternative that would have less adverse impact on the aquatic system.

**5.5.2.6 Section 10 of the Rivers and Harbors Act of 1899.** The Rivers and Harbors Act of 1899 provides protection for navigation and the navigable capacity of waters of the United States. Section 10, which is administered by USACE with the cooperation of EPA, regulates excavation, deposition of material, and creation of structures in navigable waters. This section applies to dredging, disposal of dredged materials, filling, and construction of any structure, fixed or floating, which may be navigation obstructions, or any other modification of a navigable water of the United States.

**5.5.2.7 Executive Order No. 11990.** Executive Order No. 11990 (Protection of Wetlands) states that federal agencies shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agencies' responsibilities for providing federally financed construction and improvements. Federal agencies are not to provide assistance for new construction located in wetlands unless no practicable alternative is found by the head of the agency and the harm to the wetlands that may result is minimized. The public must also be given the opportunity to review any new construction plans or proposal.

**5.5.2.8 Massachusetts Division of Marine Fisheries.** The Massachusetts Division of Marine Fisheries (DMF) reviews projects which may affect fisheries, and provides advice on reduction, mitigation, or elimination of fisheries impacts. No formal permits or approvals are granted. The DMF also reviews applications for Federal Section 404 and Section 10 permits granted by USACE.

**5.5.2.9 Massachusetts Natural Heritage and Endangered Species Program.** The Massachusetts Natural Heritage and Endangered Species Program (MNHP) provides advice to other agencies and reviews federal and state applications potentially affecting plant and animal species that are endangered, threatened, or of special concern in the Commonwealth of Massachusetts.

**5.5.2.10 Massachusetts Wetlands Protection Act.** The Massachusetts Wetlands Protection Act, which is administered by local conservation commissions, regulates work in a variety of resource areas including banks, beaches, dunes, land under water, areas subject to a 100-year flood, coastal and inland wetlands, and 100 feet from a specified wetland resource (the buffer zone). The Act seeks to protect wetlands habitats, fisheries, land containing shellfish, groundwater, water supplies, and wildlife habitat; prevent storm damage and control floods; and prevent pollution. The Act and promulgated regulations require that a Notice of Intent (NOI) or Determination of Applicability (to determine if an NOI is required) be submitted to the local conservation commission for projects that may potentially alter specified resource areas. Upon determination of applicability and submittal of an NOI, the conservation commission issues an Order of Conditions which must be followed during project construction and operation.

### 5.5.3 Terrestrial Ecosystems

This section describes terrestrial ecosystems (upland habitats and beaches) in terms of vegetation, wildlife, and the presence of any rare, threatened, or endangered species.

**5.5.3.1 Site 1A.** Site 1A has vegetation that is associated with a previously disturbed or developed area (see Appendix C, Table C-1). Much of the site is dominated by upland meadow species, however, in inland areas a shrub layer exists with a few associated wooded areas. The disturbed areas include mowed lawns and ornamental species associated with landscaped areas (CDM, Volume II, 1989). Site 1A also contains extensive coastal wetland resources, which are described in Section 5.5.4.1.

Various species of birds, mammals, amphibians, and reptiles are expected to use the site, based on habitat suitability and physical indicators (see Appendix C, Tables C-2 through C-4). The USFWS has noted that except for occasional transient individuals, no federally listed or proposed threatened or endangered species exist in the immediate project area. However, the piping plover (Charadrius melodus), a federally listed threatened species that nests, feeds, and rests on beach areas, is found in the nearby communities of Fairhaven, Dartmouth, and Westport. The Massachusetts Natural Heritage Program (MNHP) indicates that Site 1A is not known to contain or provide habitat for rare or endangered species.

**5.5.3.2 Site 4A.** Site 4A contains vegetation associated with a previously disturbed area (see Appendix C, Table C-5). Upland meadow species are present in areas of uneven fill, with interspersed patches of vegetation that are associated with wetlands (CDM, Volume II, 1989). There is also a coastal beach with patches of salt marsh (see Section 5.5.4.2).
Various species of birds, small mammals, and reptiles are expected to use the site, based on habitat suitability (see Appendix C, Tables C-6 through C-8). The MNHP, USFWS, NMFS, and the Wellfleet Audubon Society indicate that Site 4A is not known

to contain rare, threatened, or endangered species or provide habitat for them (CDM, Volume II, 1989).

**5.5.3.3 Site 47.** Site 47 has vegetation representative of a variety of habitats (see Appendix C, Table C-9). There are upland-mixed hardwood forest (dominated by white oak, Quercus alba) and freshwater wetland vegetated areas (including coniferous wetlands dominated by eastern hemlock, Tsuga canadensis) at Site 47 (see Section 5.5.4.3). Some areas have been clear-cut, and there is evidence of fires. There are many sapling, shrub, herbaceous, and moss-layer species at Site 47, both as a part of understory and as a part of disturbed areas (see Appendix C, Tables C-10 through C-12).

Various species of birds, mammals, amphibians, and reptiles are expected to utilize the site, based on habitat suitability (see Appendix C). The MNHP indicates that Site 47 is not known to contain rare or endangered species, provide habitat for them, or contain ecologically significant communities.

**5.5.3.4 Site 40.** Site 40 is relatively undisturbed, and contains a variety of habitat types, including upland-mixed hardwood forest, hemlock forest, and white cedar swamp (see Section 5.5.4.4). Numerous sapling, shrub, herbaceous, and moss-layer plant species have also been identified at this site (Appendix C, Table C-13).

Various species of birds, mammals, amphibians, and reptiles are expected to utilize the site, based on habitat suitability (see Appendix C, Tables C-14 through C-16). Rare or endangered species are not known to exist in upland portions of Site 40. However, the MNHP has expressed concern that because of the unique configuration of the Acushnet Cedar Swamp (described further in Section 5.5.4.4); the upland areas of Site 40 are valuable to the functioning of the adjoining wetlands.

### 5.5.4 Wetlands

This section summarizes available information describing wetland areas in terms of size (acreage), wetland classification, vegetation, wildlife, and wetland functional attributes.

**5.5.4.1 Site 1A.** Site 1A includes extensive coastal wetland resources along the shoreline; no freshwater wetlands exist at the site (Figure 5.5-1). Under the classification system used in the National Wetlands Inventory, these wetlands are classified as Marine Intertidal Beach/Bar (M2BB). Under the Massachusetts Coastal Wetlands Regulations, the types of coastal wetland resources present at the site include Land Under the Ocean, Coastal Beach, Coastal Bank, Coastal Dune, and Salt Marsh. Each of these resources is described briefly below.

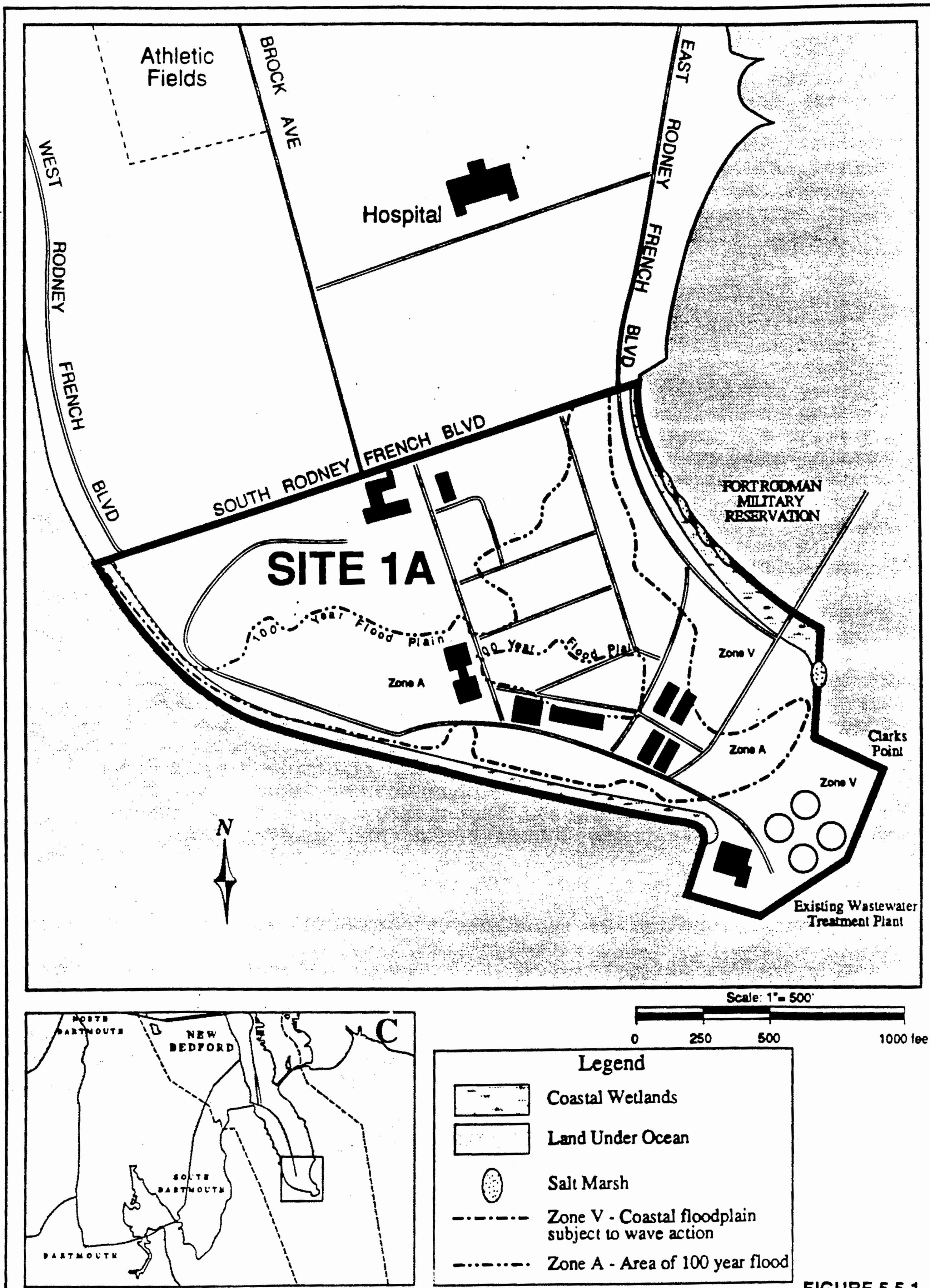



FIGURE 5.5-1
APPROXIMATE WETLAND AND 100 YEAR FLOODPLAIN BOUNDARIES AT ALTERNATIVE SITE 1A

Adapted from CDM, 1989

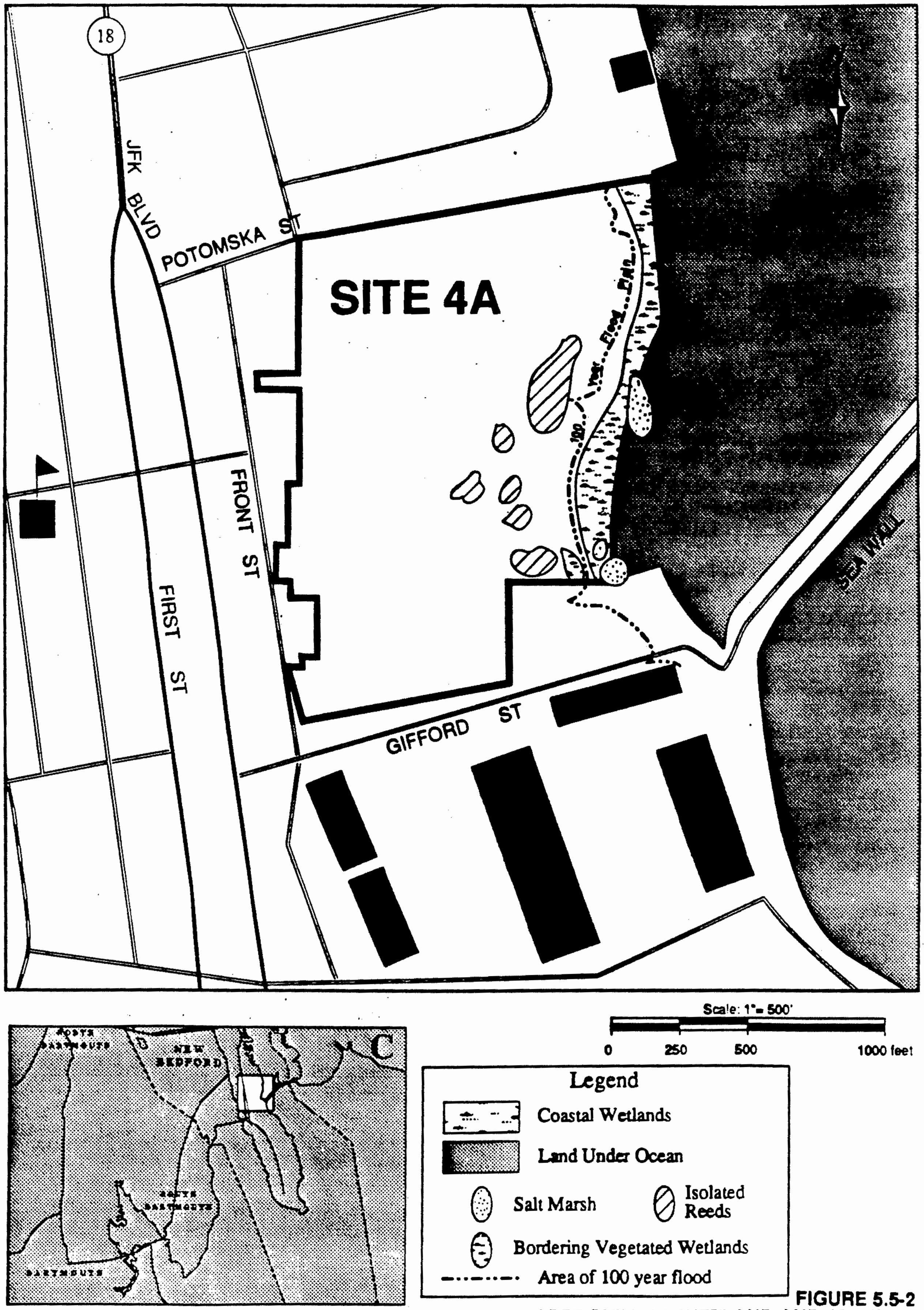
Land Under the Ocean is not actually located on Site 1A, as the boundary of the site extends only to mean low water (where Land Under the Ocean begins). This resource area borders the site on its eastern, southern, and western sides. Coastal Beach at Site 1A generally varies from 10 to 60 feet in width, and covers an area of approximately 3 acres along the eastern and western shores of the site. Coastal Bank varies from 10 to 40 feet in width, and covers a total of approximately 2.5 acres (CDM, Volume II, 1989). This resource area has been modified in some areas through construction of seawall bulkheads and rip rap/revetment. The extent of Coastal Dune at the site is about 2.5 acres; this resource is generally 10 to 40 feet wide, and lies above the high tide line. Vegetation here includes American beach grass (CDM, Volume II, 1989).

Salt Marsh at Site 1A is comprised of five distinct areas covering a total area of 6,050 square feet. These salt marsh patches are located in low wave energy zones along the eastern shore of the site. Species of vegetation identified here include salt marsh cordgrass (Spartina alterniflora), salt meadow hay (Spartina patens), and glasswort (Salicornia sp.).

Species of wildlife present in wetlands at Site 1A have not been identified. However, various species of birds, mammals, amphibians, reptiles, invertebrates and fish are expected to use these wetland resources based on range and habitat suitability (see Appendix C, Tables C-2 through C-4). MNHP and USFWS indicate that rare, threatened, or endangered species or suitable habitat for them are not known to occur on Site 1A. Although some endangered and threatened species have been observed in coastal southern New England waters, including the loggerhead sea turtle (Caretta caretta), leatherback turtle (Dermochelys coriacea), Kemp's Ridley turtle (Lepidochelys kempii), and green turtle Chelonia mydas), they are limited to open water estuarine and marine habitats adjacent to the site (Land Under the Ocean) and would not therefore be present within the marsh areas on the site itself.

The wetlands at Site 1A may be significant in terms of functional attributes such as wildlife habitat, storm damage prevention, marine fisheries, flood control, or prevention of pollution.

**5.5.4.2 Site 4A**. Site 4A, like Site 1A, contains primarily coastal wetland resources, including Land Under the Ocean, Coastal Beach, Coastal Bank, Coastal Dune, and Salt Marsh (See Figure 5.5-2). There are also some areas dominated by Phragmites sp. (probably Phragmites australis, the common reed), which is a wetland plant species, indicating that these areas may constitute wetlands. Approximately 2,000 square feet of this type of community is hydraulically connected with New Bedford Harbor, indicating that it would be regulated as a Bordering Vegetated Wetland (BVW) under the Massachusetts Wetlands Protection Act.




Adapted from CDM, 1989

**FIGURE 5.5-2**
**APPROXIMATE WETLAND AND 100 YEAR FLOODPLAIN BOUNDARIES AT ALTERNATIVE SITE 4A**

These areas may also be considered as wetlands as defined by federal criteria and regulated under Section 404 of the Clean Water Act (CDM, Volume II, 1989). Land Under the Ocean is not actually on Site 4A (as described above for Site 1A), but lies along the eastern edge of the site. Coastal Beach is extensive at this site, varying in width from about 100 to 200 feet, and covering approximately 4.5 acres along the shore. Coastal Bank is also present along the eastern shore, but is difficult to distinguish from Coastal Beach and Coastal Dune. Coastal Bank appears to cover approximately 0.3 acres, varying in width from 5 to 20 feet. The boundaries between Coastal Dune and other resource types are also difficult to distinguish, but the area of Coastal Dune appears to be about 0.3 acres; width of Coastal Dune varies between 0 and about 20 feet. Approximately 7,700 square feet of Salt Marsh exist on Site 4A, scattered in distinct patches along the intertidal zone. The dominant species of vegetation is salt marsh cordgrass (Spartina alterniflora), although glasswort (Salicornia) is also present.

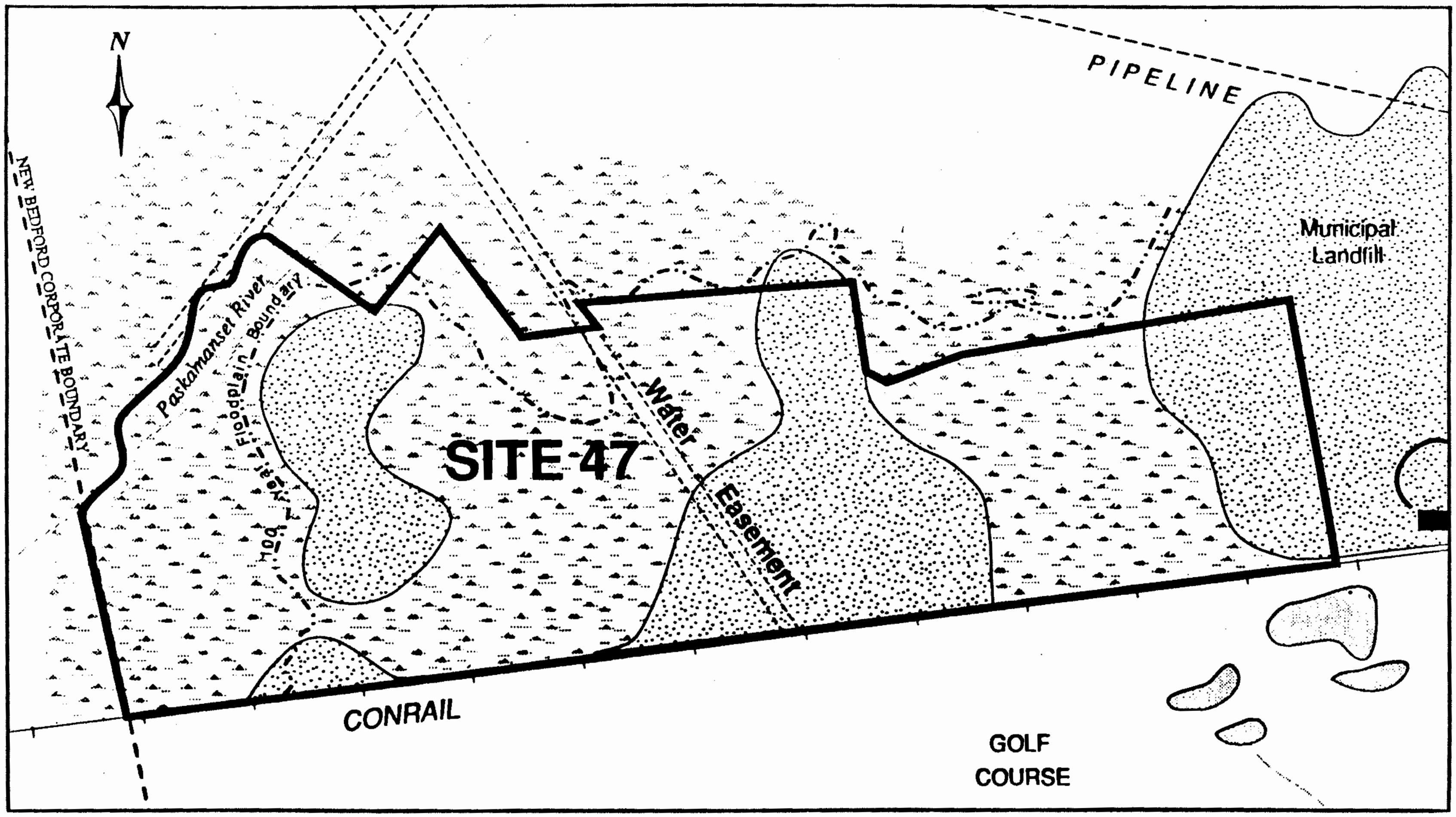
Birds, mammals, reptiles, amphibians, invertebrates, and fish are expected to use the various resource areas described above (see Appendix C, Tables C-6 through C-8). No rare, threatened, or endangered species, habitats for them, or ecologically significant natural communities have been identified at the site according to MNHP, USFWS, NMFS, and the Wellfleet Audubon Society.

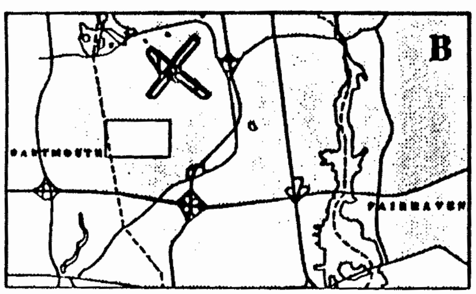
Similar to Site 1A, wetland resources at Site 4A may be significant in terms of various functional attributes.

**5.5.4.3 Site 47.** Site 47 contains an extensive area of Bordering Vegetated Wetland defined in the Massachusetts Wetlands Protection Act, as well as wetlands as defined by federal criteria described in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (EPA, 1989b).

Based on observations of soils, vegetation, and hydrology at the site, as defined by federal criteria (Ibid.), supplemented with soils information from Soil Conservation Service maps in the Bristol County soil survey report, the wetland encompasses approximately 85 acres of the 117 acre site. Approximate wetland boundaries according to federal criteria are shown in Figure 5.5-3. Data forms developed by the U.S. Army Corps of Engineers including information on soils, vegetation, and hydrology were completed for selected observation plots.

The wetland types at Site 47 include forested swamp, wet meadow, shrub swamp, and marsh, and are part of the Apponagansett Swamp system, one of the largest continuous freshwater wetland systems in southeastern Massachusetts.




Legend

- Wetlands
- Upland (Non-wetland)
- 100 Year Floodplain Boundary

Scale: 1"= 600'

0 300 600 1200 feet

Source: C-E Environmental Wetlands Assesment and CDM, 1989

**FIGURE 5.5-3**
**APPROXIMATE WETLAND AND 100 YEAR FLOODPLAIN BOUNDARIES AT ALTERNATIVE SITE 47**

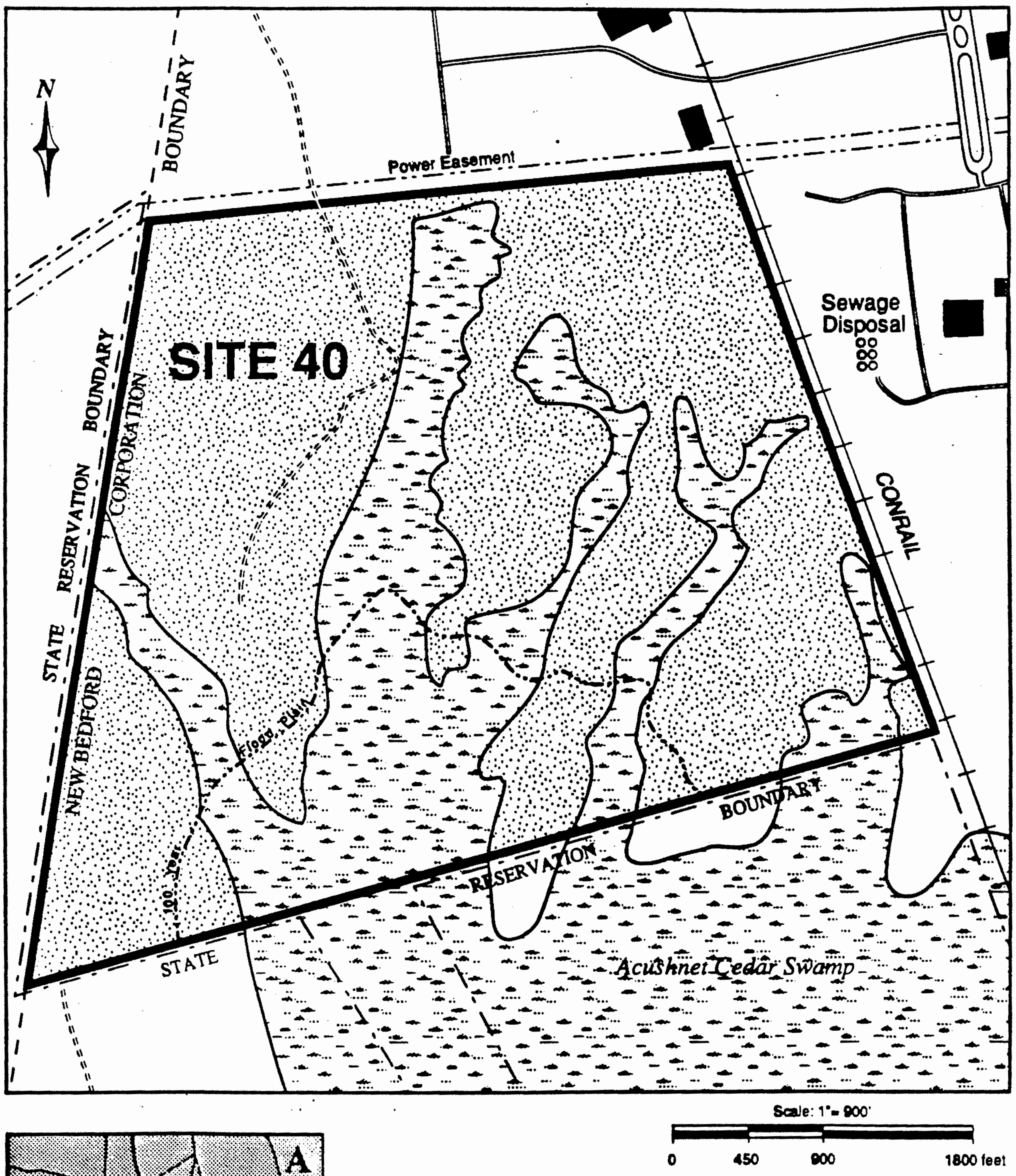
There are two general types of forested wetlands at the site: palustrine forested broad-leaved deciduous wetlands dominated by red maple (Acer rubrum), and palustrine forested needle-leaved evergreen wetlands dominated by eastern hemlock codominant with white pine (Pinus strobus) in some areas. Sweetpepperbush (Clethra alnifolia) is common in the shrub layer in much of the red maple swamp area; sphagnum (Sphagnum sp.) moss is common in the evergreen forested wetlands. Many other plant species exist in these wetland types, as well as in the marsh, wet meadow, and shrub swamp areas.

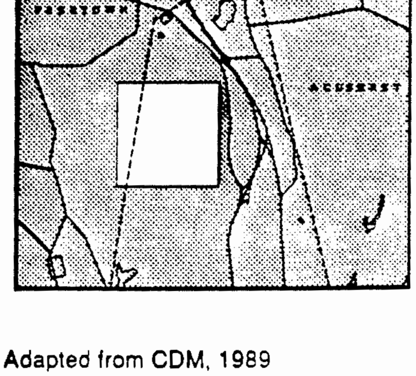
Numerous species of birds, mammals, reptiles, amphibians, and invertebrates are expected to utilize the wetland at Site 47 based on the diversity and interspersion of wetland types (see Appendix C, Tables C-10 through C-12). Fish habitat appears to be lacking on the site itself, although suitable fisheries habitat exists elsewhere in the Apponagansett Swamp. No rare or endangered species or habitats for them, or ecologically significant natural communities are known to exist on Site 47, according to the MNHP.

In addition to providing wildlife habitat, the wetland on Site 47 is also significant to the provision or protection of public water supply, flood control, and storm damage prevention. Also, portions of the site lie within the 100-year floodplain (the boundaries of which appear to follow the 60-foot National Geodetic Vertical Datum (NGVD) contours) which are classified as Bordering Land Subject to Flooding under the Massachusetts Wetlands Protection Act. These areas comprise approximately 26 acres (22 percent) of the site.

**5.5.4.4 Site 40.** Site 40 contains an extensive area of freshwater Bordering Vegetated Wetland, estimated to include approximately 114 acres of the 384 acre site (see Figure 5.5-4). These wetlands are part of the much larger Acushnet Cedar Swamp, an extensive area listed as a National Natural Landmark as a quality example of an Atlantic white cedar swamp. The wetlands at the site include a diversity of wetland types, including forested swamp, shrub swamp, wet meadow, and marsh. Atlantic White Cedar (Chamaeparis thyoides) is the dominant plant species throughout most of the southern wetland area on Site 40. Red maple is dominant in the forested swamp in the northern portion of the site. Numerous other plant species exist in these areas, forming a diverse plant community (CDM, Volume III, 1989). A list of plant species at Site 40 is presented in Appendix C, Table C-13.

The wetlands at the site are expected to provide habitat for numerous species of birds, mammals, amphibians, reptiles, and invertebrates (see Appendix C, Tables C-14 through C-16). The site is relatively undisturbed, and is diverse in terms of wetland type and plant species, increasing its value as wildlife




Legend
- Wetlands
- Uplands
- Area of 100 year flood

Adapted from CDM, 1989

FIGURE 5.5-4
APPROXIMATE WETLAND AND 100 YEAR
FLOODPLAIN BOUNDARIES AT ALTERNATIVE SITE 40

habitat. The MNHP has documented the Heartleaf Twayblade (Listera cordata, a state--listed Endangered species) and the Mystic Valley amphipod (Crangonyx aberrans a state special concern species) in the area of the Acushnet Cedar Swamp. This area is also moderately likely to provide suitable habitat for the Coastal Swamp Amphipod (Synurella chamberlaini, a state-listed Special Concern Species). Other state-listed Special Concern species associated with Atlantic white cedar swamps (such as the Acushnet Cedar Swamp) include Hessel's Hairstreak butterfly (Mitoura hesseli) and Dwarf Mistletoe (Arcenthobium pusillum)(Copeland, 1989).

In addition to providing wildlife habitat, the wetland on Site 40 is also significant to the provision or protection of water supply, flood control, and storm damage prevention. Portions of the site lie within the 100-year floodplain, (boundaries appear to follow the 70 foot NGVD contours) classified as Bordering Land Subject to Flooding under the Massachusetts Wetlands Protection Act. These areas comprise approximately 64 acres, or 17 percent, of the site.

### 5.5.5 Marine

**5.5.5.1 Phytoplankton Community Structure.** The phytoplankton community in New Bedford Harbor is composed of species common to New England estuaries and coastal waters. In a 1988 survey, nannoplankton (plants measuring less than 10 microns) were the most abundant constituent, averaging 99 percent of the total abundance (CDM, Volume IV, Appendix F, 1989). Other dominants include diatoms (Skeletonema costatum, Chaetocerus sp.), blue-green algae, and flagellates (Chroomonas) (CDM, 1983; CDM, Appendix F, 1989; Turner et al., 1989). Species that can cause nontoxic nuisance blooms, such as the large dinoflagellate Prorocentrum micans, were collected in low numbers (Turner et al., 1989). Red tide species were identified although they were below "bloom" levels; species responsible for paralytic shellfish poisoning were absent. As no information exists on the species composition of nannoplankton, the probability of brown tide cannot be assessed (CDM, Appendix F, 1989; Turner et al., 1989).

**Temporal Trends.** Population dynamics of phytoplankton are related to nutrient availability, temperature, light, and dissolved materials such as silicon and trace metals. Zooplankton grazing may also play an important role in structuring the phytoplankton community (CDM, Volume IV, Appendix F, 1989; Turner et al., 1989). The distribution and abundance of phytoplankton species show high seasonal and year-to-year variability. A winter-spring bloom is typical in New England coastal waters, coincident with increasing irradiance and temperature, along with a late summer-fall peak. A year-long survey in 1988 showed a summer-fall bloom and an absence of the typical winter-spring increases (CDM, Volume IV, Appendix F, 1989). This may be in part due to rainfall levels that were well below the thirty-year average (National Climactic Data Center, 1988). Preliminary results from 1989 show higher overall productivity and a well-defined winter-spring bloom (personal communication, Turner, 1989).

**Spatial Trends.** Abundance levels and species composition are generally similar between the existing outfall and 301(h) outfall sites. Abundances are slightly higher at the existing outfall site when compared to the 301(h) outfall site for both nannoplankton (101,624 cells/liter vs. 89,079 cells/liter) and diatoms (1021 vs. 699 cells/liter). New Bedford Harbor areas show different species composition and abundance levels than other areas in Buzzards Bay (Turner et al., 1989).

**Productivity and Biomass.** Measurement of the photosynthetically-active pigment chlorophyll gives another indicator of phytoplankton abundance. Nannoplankton contribute a minor portion of the total chlorophyll biomass in the phytoplankton community. Summer and fall biomass levels in 1988 were higher than winter and spring. In general, the existing outfall area has higher biomass per unit volume than the 301(h) outfall, reflecting the higher nutrient levels and greater phytoplankton abundance (CDM, Volume IV, Appendix F, 1989).

Primary production, a measurement of the amount of carbon fixed by plants in photosynthesis, averaged 354 $gC/m^2/yr$ in 1988 at the 301(h) Site, a level similar to unenriched areas of Narragansett Bay (CDM, Appendix F, 1989). In contrast, productivity was substantially higher at the existing outfall, measuring 832 $gC/m^2/yr$ in 1988, reflecting the higher nutrient levels at that site. Larger phytoplankton (>10 microns) contribute at least 80 percent of the total production, unlike Buzzards Bay and other New England areas, where nannoplankton are more important primary producers. In 1988, production was highest from August through December, and exceptionally low from January through May. The absence of a winter-spring bloom is not typical of New England coastal waters (CDM, Volume IV, 1989) and suggests 1988 may not be representative of average conditions. Production occurred throughout the water column.

**5.5.5.2 Zooplankton.** Zooplankton are planktonic animals that act as an important link in the food chain. Smaller forms graze on and crop phytoplankton and in turn are grazed upon by larger species. Copepods were the most numerous group, including earliest larval forms and typical New England species such as <u>Acartia tonsa</u> and <u>Paracalanus crassirostris</u> (CDM, 1979; Turner et al., 1989). These species were also dominants in Anraku's 1964 study of Buzzards Bay. Appendicularians and larval stages of arthropods such as barnacles, crabs, and shrimp; polychaetes and molluscs were also collected. Results from the very limited sampling effort showed no dramatic differences in zooplankton communities between the existing outfall and the 301(h) sites (CDM, 1979).

#### 5.5.5.3 Benthos

**Bottom Sediments.** The characteristics of bottom sediments are important in determining the community composition of benthic organisms. Survey results from 1983 indicate that the sediments at the existing outfall are mostly medium to fine sand, with low amounts (15 percent) of silt-clay. The 301(h) outfall site had finer sediments, classified as silt, and contained large quantities (63 percent) of silt-clay.

**Faunal Composition.** A complete discussion of faunal composition awaits completion of the most recent (Spring 1989) benthic survey. Historically, benthic infauna in New Bedford could be divided into four distinct communities:

(1) a community near the existing outfall characterized by pollution tolerant and opportunistic polychaetes such as Capitella capitata and Mediomastus ambiseta, which together composed over 50 percent of the samples collected.

(2) an offshore soft-bottom community, including the area near the offshore outfall alternative predominated by molluscs Nucula proxima and Mulinia lateralis along with the opportunistic polychaete Mediomastus ambiseta. This assemblage showed similarities to the Nucula proxima-Nephtys incisa assemblage identified in Sander's 1958 study of Buzzards Bay.

(3) a nearshore sandy assemblage characterized by amphipods (Ampelisca verilli, Byblis serrata); gastropods (Cerastoderma pinnulatum) and polychaetes. This assemblage was similar to the sandy-bottom community identified by Sanders (1958) from Buzzards Bay.

(4) an assemblage characteristic of the deeper locations in the study area with high amounts of silt-clay, and high densities of the mollusc Nucula proxima.

The number of benthic species ranged from 41 to 86 per 0.1 $m^2$ sample, with abundances ranging from 442 to 2241 per $m^2$. Species richness, one indication of the "health" of the community was generally higher in the vicinity of the 301(h) outfall site than at the existing outfall (CDM, 1983b).

Preliminary results from the 1988-1989 benthic survey showed patterns similar to those from historical surveys. In September 1988, the benthic community at the existing outfall site was composed almost exclusively (87 percent) of two pollution-tolerant polychaete worms (Mediomastus ambiseta and Carazziella hobsonae). The overwhelming dominance of the two species decreases with increasing distance from the outfall, as they are replaced with less resistant taxa. The number of species was lowest at the outfall and increased in the nearby area that was enriched but not stressed by organic material from the outfall. This is consistent with species distributional patterns noted by Pearson and Rosenberg (1978) in their study of the response of marine benthic fauna to organic (wood pulp) enrichment.

The benthic community at the 301(h) outfall site in most recent samples was dominated by the bivalve mollusc Nucula incisa and Levinsenia gracilis. Large benthic invertebrates were collected by otter trawls, including squid, a variety of crabs (hermit crab, Pagurus longicarpus; spider crab, Libinia sp.; green crab, Carcinus maenas; rock crab, Cancer irroratus; blue crab, Callinectes sapidus), mantis shrimp (Squilla empusa); and large molluscs, including the hard clam Mercenaria mercenaria (CDM, 1983b).

**5.5.5.4 Finfish.** Sport fishing takes place in New Bedford Harbor. The major species sought include bluefish (Pomatomus saltatrix), scup (Stenotomus chrysops), striped bass (Morone saxatilis), and Atlantic mackerel (Scomber scombrus) (Kolek, 1979 in CDM, Volume IV, 1989). As net fishing is not allowed in the Harbor, there is no commercial fishing.

Forty species have been collected at the two alternative outfall sites in historical surveys (Appendix C, Table C-17). Although 10 more species were collected at the existing outfall site than at the 301(h) Site, this is not necessarily an indication of a community difference, especially since these species are highly mobile. A small survey performed in the summer and fall of 1983 showed high numbers of species and total catches at the existing outfall site (Appendix C, Table C-18). Scup was the most abundant demersal (bottom-dwelling) species in the otter trawl samples; most were young of the year at both stations. Other dominants included juvenile black sea bass and winter flounder. Because of the small number of samples (4), no definite conclusions can be made about spatial differences. Few pelagic fish were caught in the survey, representing only 3 species (Appendix C, Table C-18). Menhaden was the most abundant species caught in gill nets. No significant seasonal differences were noted.

New Bedford's Inner Harbor is used by migrating alewives (Alosa pseudoharengus) passing from Buzzards Bay through the Acushnet River to Saw Mill Pond (Reback and DiCarlo, 1970 in CDM, Volume IV, 1989).

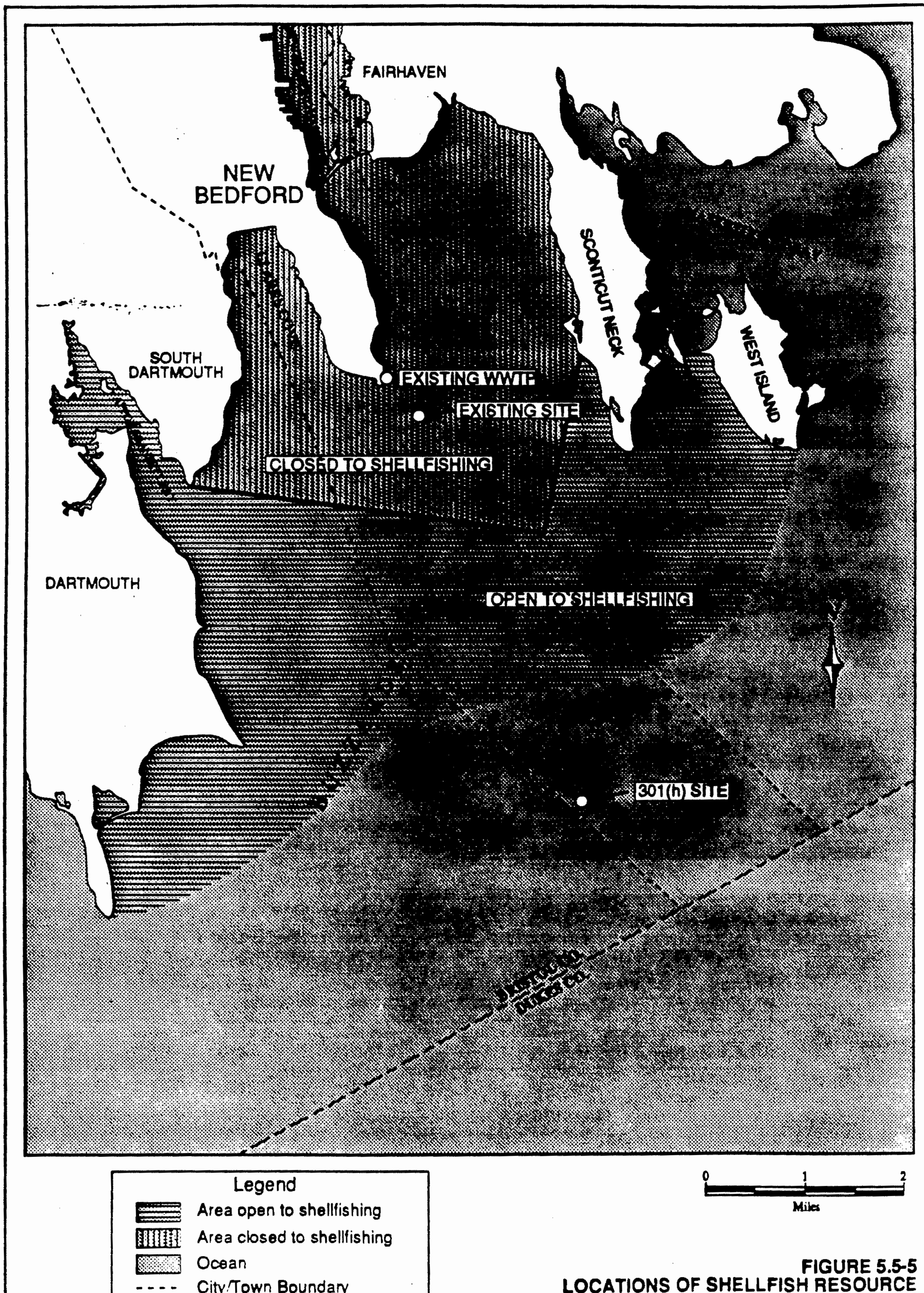
**5.5.5.5 Shellfish Resources.** Shellfish resources in the New Bedford area include soft-shell clam (Mya arenaria), hard-shell clam (Mercenaria mercenaria), ocean, mahogany, or black quahog (Artica islandica), bay scallops (Aequipecten irradians), oysters (Crassostrea virginica), whelks or conch (Busycon spp.) and lobster (Homarus americanus). Bivalve shellfish beds are shown in Figure 5.5-5. Blue crabs occur in Buzzards Bay in low numbers and therefore are not commercially harvested.

Many of the shellfish beds are closed to harvesting because of coliform bacteria contamination (Figure 5.5-5). Motile species (whelks and scallops) are not affected by the closure. High levels of polychlorinated biphenyls (PCBs) have led to the restriction of all lobster and finfish fishing activities to areas north of the hurricane barrier: lobster fishing restrictions extend to a line just north of the 301(h) Site (Figure 4.3-2).

The hard-shelled clam is the most important harvested mollusc because of its high resource value, estimated at 520,000 bushels (or nearly $5 million), in the closed area alone (CLF, 1988 in CDM, Volume IV, 1989). Commercial harvesting takes place both within the closed area, necessitating depuration, and outside the area closed to shellfishing. Commercially-harvestable shellfish beds are located in the Outer Harbor to at least 11 m in depth, and may even extend to depths as deep as 15 m at the mouth of the harbor (CDM, Volume IV, 1989). A limited sampling effort revealed no clams within 30 m of the existing discharge. However, harvestable clam beds were found from 20 to 80-m distance from the existing outfall as evidenced by densities deemed by local shellfisherman to be sufficient to support commercial harvesting (0.55 clams/$m^2$). In contrast, a limited sampling effort showed that combined hard-shelled clam and mahogany quahog densities at areas near the 301(h) outfall site were an order-of-magnitude lower than that necessary for commercial harvesting (CDM, Volume IV, 1989).

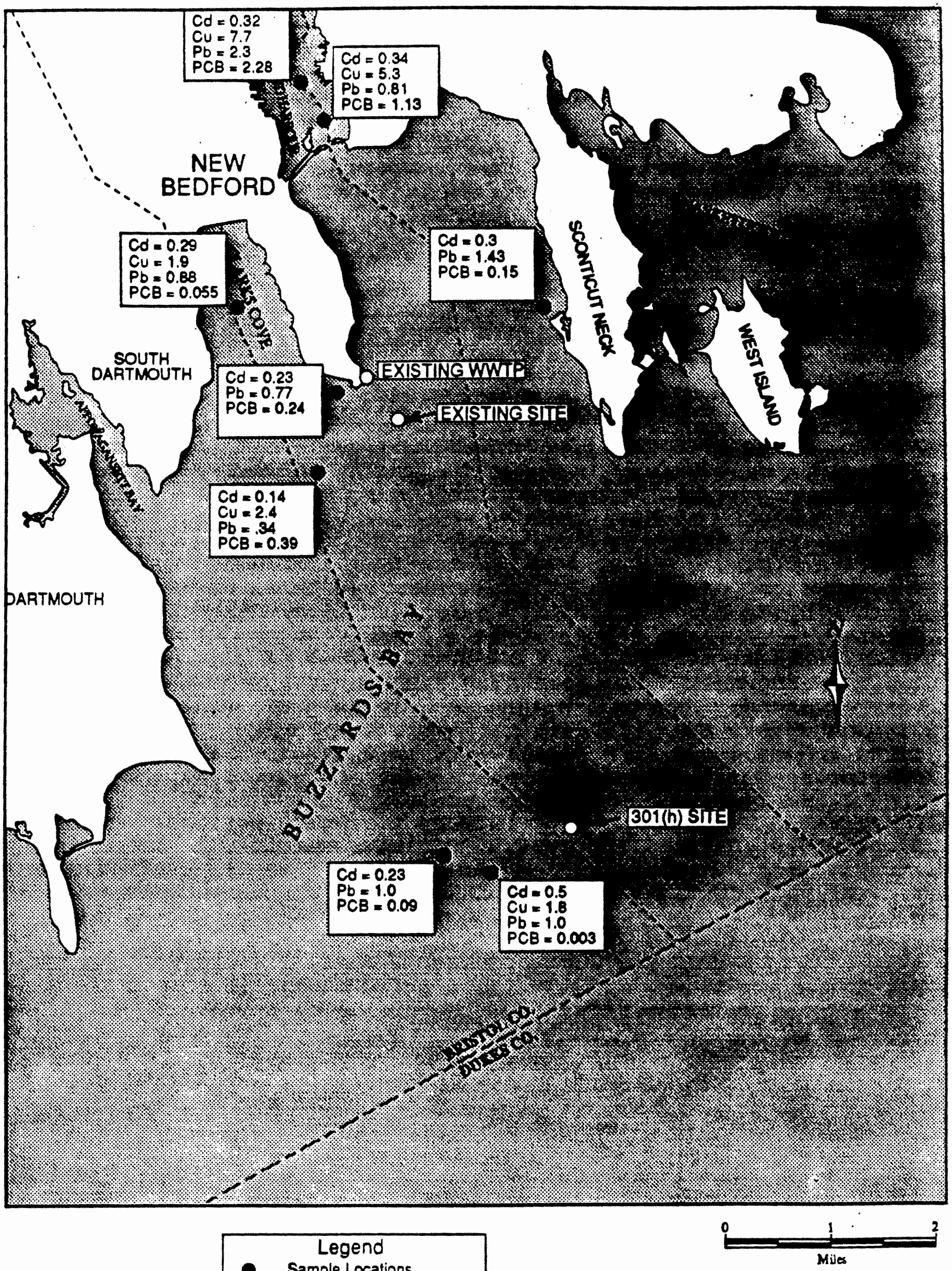
Hard clams in some New Bedford Harbor areas contained measurable levels of metals and PCBs. Although most PCB values were below the FDA tolerance level, clam tissue from one Inner Harbor location had PCBs measured at 2.28 ppm, above the 2 ppm tolerance limit (Figure 5.5-6; CDM, Volume IV, 1989). Concentrations of some metals and PCB's were highest in the inner harbor, decreasing with increasing distance (Figure 5.5-6).

Other harvestable molluscs are found in the harbor but are less important than hard clams. Whelk fishing in the Outer Harbor and Clarks Cove yields approximately 16,000 lbs of whelk per day, supporting 8 commercial fisherman. Soft-shell clams are found in the intertidal and shallow subtidal areas with suitable sediments (fine sand-sandy muds). Oysters are restricted to bulkheads and pilings in the Inner Harbor intertidal zone because of their need




Adapted from CDM, 1989

**FIGURE 5.5-5**
**LOCATIONS OF SHELLFISH RESOURCE AREAS AND SHELLFISH CLOSURE LINE**




Legend

● Sample Locations

Cd Cadmium

Cu Copper

Pb Lead

PCB Poly Chlorinated Biphenyl

Adapted from CDM, 1989

**FIGURE 5.5-6**
**CONCENTRATIONS OF POLLUTANTS IN HARD-SHELLED CLAMS (PPM)**

for a hard substrate for attachment. Bay scallops are found in shallow subtidal areas, especially eel grass beds, and are limited by lack of suitable habitat. Current seeding activities by the New Bedford shellfish warden may increase harvests of this species (CDM, Volume IV, 1989). Lobster fishing, once the most important commercial resource in the Harbor, has been prohibited due to high levels of PCBs. The areas closed to lobster trapping extends throughout the Outer Harbor to within 0.7 km of the 301(h) outfall site. The value of the (1987) fishery, which once supported 50 commercial and 100 recreational fisherman, was estimated to exceed $125,000 per year. No current estimates of the lobster population are available, but the lack of fishing activity has probably enhanced lobster densities (CDM, Volume IV, 1989).

Levels of toxicants in lobsters have been variable. Most recent surveys of PCBs in lobster show whole body levels are below the FDA tolerance levels at all sites sampled. However, PCB levels in hepatopancreas ("liver") tissue are above the FDA limit, even from the middle of Buzzards Bay (EPA, 1988 in CDM, Volume IV, 1989). There was no obvious relationship between contaminant levels and distance from New Bedford (CDM, Volume IV, 1989). This is expected because of the mobile habits of adult lobsters. Other studies suggest that PCB levels have decreased since 1976; however, trends are not clear-cut (CDM, Volume IV, 1989).

**5.5.5.6 Endangered Species.** The Endangered Species Act of 1973 defines endangered species as those "in danger of extinction throughout all or a significant portion of their range." A threatened species is likely to become endangered in all or part of its range. A number of endangered or threatened species may inhabit or receive nourishment from New Bedford Harbor or Buzzards Bay (Table 5.5-1). They include the shortnose sturgeon, eight whale species, and two sea turtle species. The U.S. Fish and Wildlife Service (G. Beckett, USFWS, June 21, 1988) notes no federally listed or proposed threatened or endangered species occur in the immediate vicinity of the existing or 301(h) outfall sites.

No habitats in the vicinity of either outfall alternative have been designated as critical for the species listed in Table 5.5-1. None of the listed whales have been sighted recently in Buzzards Bay. Sea turtle species have occasionally been observed in Buzzards Bay. In particular, the Ridley uses nearshore areas for feeding on prey such as small green crabs and mussels. Loggerheads may feed on benthic organisms in Buzzards Bay. The leatherback sea turtles feed on jellyfish from open bay waters (D. Beach, National Marine Fisheries Service, June 7, 1988). The piping plover (<u>Charadrius</u> <u>melodus</u>), a federally-listed threatened species, uses a number of beaches in New Bedford for feeding, nesting, and resting.

**TABLE 5.5-1**
**ENDANGERED SPECIES USING**
**BUZZARDS BAY OR NEW BEDFORD HARBOR**

| Common Name | Scientific Name | Known Distribution | Portion of Range Where Threatened or Endangered |
|---|---|---|---|
| Sturgeon, shortnose | Acipenser breviostrum | USA: Atlantic Coast-US/ Canada | Entire |
| Whale, Blue | Balaenoptera musculus | Oceanic | Entire |
| Whale, bowhead | Balaena mysticetus | Oceanic | Entire |
| Whale, finback | Balaenoptera physalus | Oceanic | Entire |
| Whale, gray | Eschrichtius gibbosus | Oceanic | Entire |
| Whale, humpback | Megaptera novaengliae | Oceanic | Entire |
| Whale, right | Eubalaena spp | Oceanic (all species) | Entire |
| Whale, Sei | Balaenoptera borealis | Oceanic | Entire |
| Whale, sperm | Physeter catodon | Oceanic | Entire |
| Leatherback, turtle | Dermochelys coriacea | Oceanic | Entire |
| Kemp's Ridley turtle | Lepidochelys kempii | Oceanic | Entire |

Adapted from: CDM, Volume IV, 1989.

## 5.6 SOCIOECONOMIC AND CULTURAL RESOURCES

This section discusses socioeconomic and cultural resources associated with each candidate site for the proposed WWTP, solids disposal, and outfall. Historic, archaeological, visual, socioeconomic, cultural, harbor, and recreational resources were identified.

### 5.6.1 Historic and Archaeological Resources

Historic resources are sites or buildings of historical significance to the City of New Bedford, the Commonwealth of Massachusetts, or the Nation. Archaeological resources include artifacts associated with prehistoric or historic uses of the area. The Boston University Office of Public Archaeology conducted a survey of existing historic and archaeological conditions at each of the sites, consisting primarily of background research and a field walkover. A summary of their findings is provided below. Details of the studies can be found in Appendix A of Volume II of the Draft EIR (CDM, Volume III, 1989).

#### 5.6.1.1 Regulatory Framework.

**National Historic Preservation Act (NHPA).** The National Historic Preservation Act of 1966 established the National Register of Historic Places ("National Register"), a list of significant buildings, sites, districts, structures, and objects maintained under the direction of the Secretary of the Interior. By mandating review of the effects of all federally funded or licensed projects on National Register eligible resources, Section 106 of the NHPA created an important mechanism to provide protection for those properties. Under Section 106, federal agencies are responsible for identifying National Register eligible properties and for assessing the effect of any federal action on them. The NHPA also establishes the Advisory Council on Historic Preservation ("Advisory Council"), which acts as the independent federal agency responsible for implementation of Section 106. The Advisory Council's "Protection of Historic Properties" and the National Register of Historic Places Criteria are the administrative rules for implementing the NHPA.

**National Environmental Policy Act (NEPA).** Through NEPA, historic preservation has become part of national environmental policy. Under NEPA, federal agencies must assess the impacts of major federal actions that affect the human environment, including historic and archaeological resources.

**Protection of Historic Properties.** These regulations of the federal Advisory Council govern the review process established by Section 106 of NHPA. They define the process used by a federal agency to meet the responsibilities dictated by the above legislation, commonly referred to as the "Section 106 process". Figure 5.6-1 illustrates the step-by-step process, which includes coordination with the State Historic Preservation Officer and other interested parties.

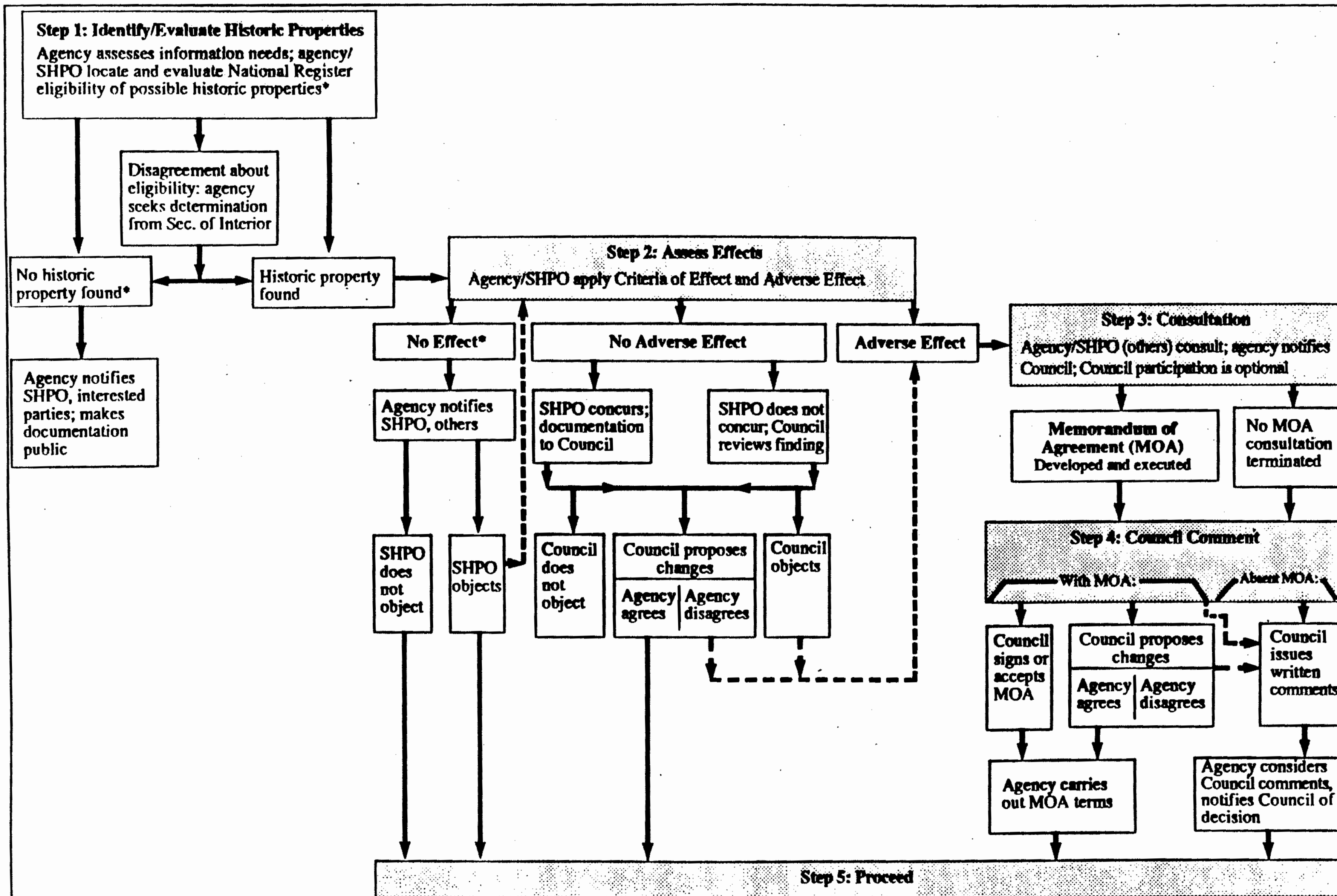
**National Register of Historic Places.** A property is eligible for the National Register if its significance in American history, architecture, archaeology, or culture is present in districts, sites, buildings, structures, or objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association. In addition, the property must 1) be associated with events or people that have made a significant contribution to history; 2) embody distinctive characteristics of a type, period, or method or construction; represent the work of a master; possess high artistic value; or represent a significant and distinguishable entity; or 3) have yielded or be likely to yield information important to history or prehistory (MHC, 1985).

**MGL Chapter 9, Sections 26-27 C.** Chapter 9 establishes the Massachusetts Historical Commission (MHC) and the Office of the State Archaeologist and their respective duties. It also mandates the MHC to administer the federal historic preservation program represented as the State Historic Preservation Office (SHPO).

**Massachusetts Underwater Archaeology Act.** This act established the Board of Underwater Archaeological Resources (BUAR) to protect and preserve historical, scientific, and archaeological information about underwater archaeological resources located within the water of the Commonwealth. The board has established rules and regulations for removing and salvaging underwater resources that have educational and historical value, for granting permits for exploration and salvage, and for maintaining an inventory of sites and materials salvaged.

**Massachusetts Environmental Policy Act (MEPA).** MEPA requires evaluation of projects in order to describe their environmental impacts and stipulates that agencies use all feasible means to avoid or minimize degradation of the natural and human environments, including historical and archaeological sites and structures of significance.

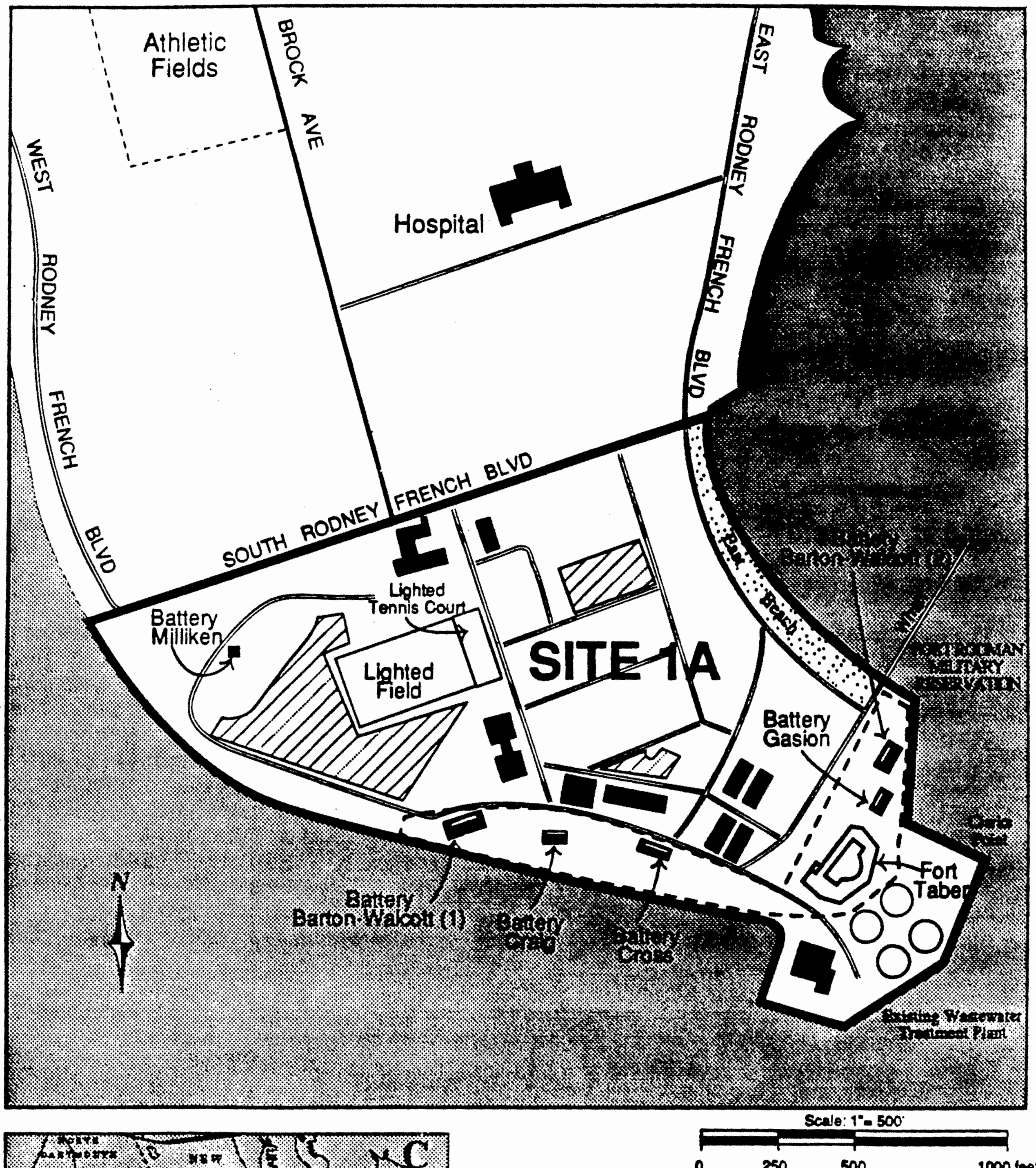
**5.6.1.2 Site 1A.** Because of its location, structures constructed on Site 1A were important in defending the City, dating as far back as the American Revolutionary War. Earthwork fortifications were erected on this site during the Revolution and at the start of the Civil War. Fort Taber, which presently occupies the site (see Figure 5.6-2), is a 2-story granite structure built in 1861 during the Civil War. The battery buildings next to Fort Taber were built during the Spanish-American War. The Fort and batteries are located in what is

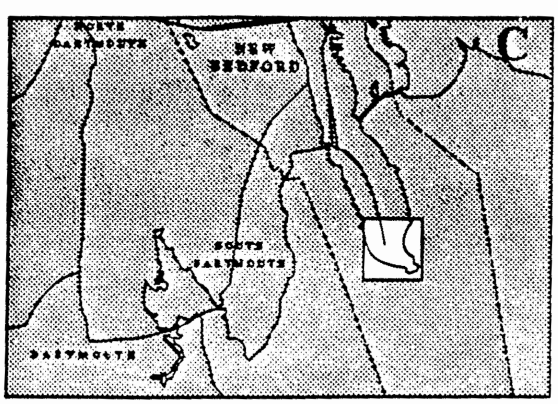



*Public may request Council review of agency's findings at these points.

Adapted from EPA Residuals SEIS, 1989

**FIGURE 5.6-1**
**THE BASIC STEPS OF SECTION 106 REVIEW**




Legend

- Area of Archaeological Investigation
- Historic District
- Shoreline and Beach

Adapted from CDM, 1989

**FIGURE 5.6-2**
**EXISTING HISTORICAL, ARCHAEOLOGICAL AND RECREATIONAL RESOURCES FOR ALTERNATIVE SITE 1A**

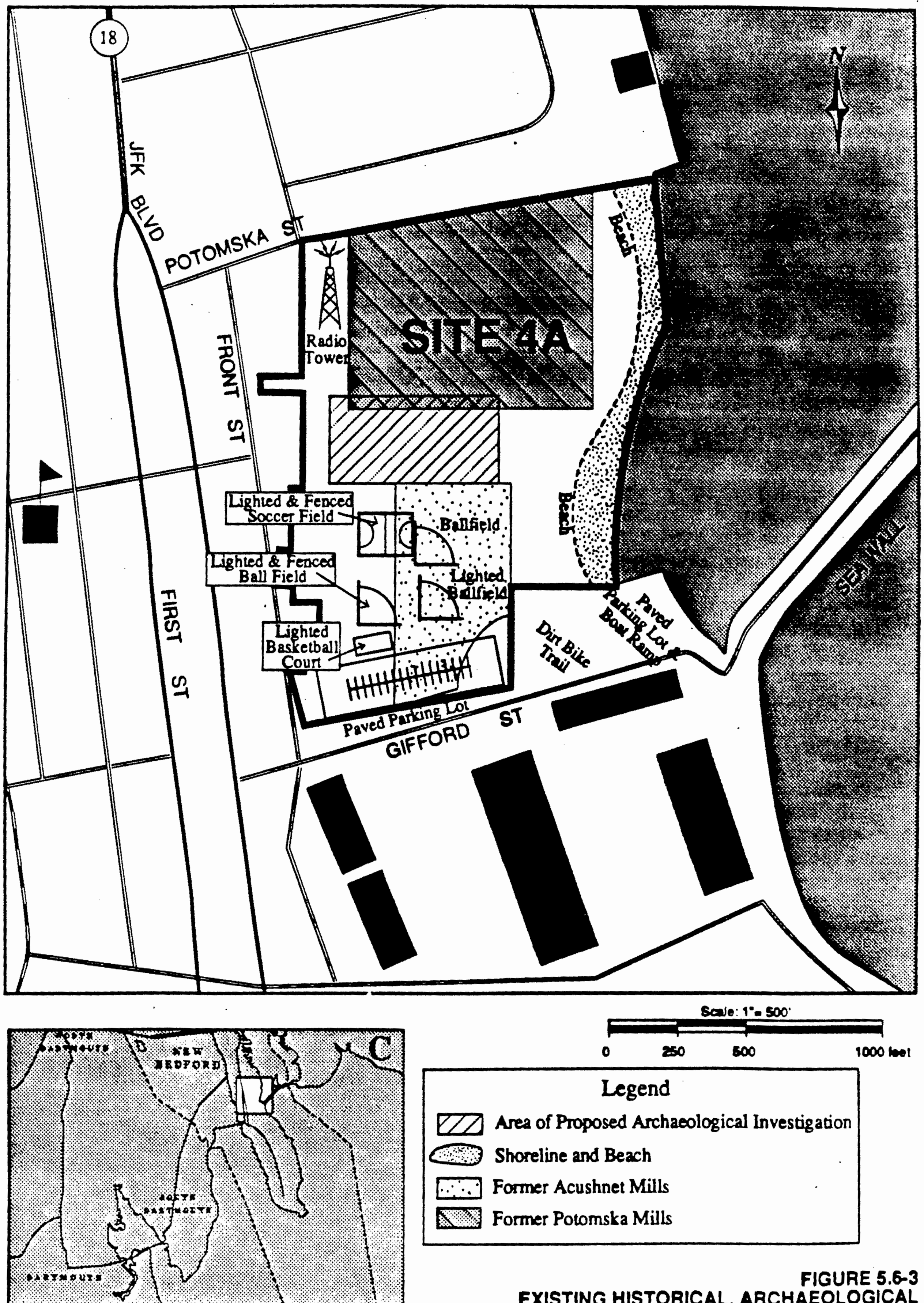
known as the Fort Taber Historic District, which is listed on the National Register. In the northwest section of Site 1A is a large casement battery (Battery Milliken) built in 1940, just prior to World War II. To the northeast section of the site is a colonial revival house, built in approximately 1901 as officers quarters. Past historical uses of the site also includes a lighthouse and keeper's residence. These structures were located just outside the site boundaries and to the south of the Fort from 1799 until the 20th century, when the beacon from the lighthouse was moved to the top of the Fort and the rest was demolished (CDM, Volume II, 1989). Although not currently part of the Fort Taber Historic District, these and other resources at Site 1A are considered eligible for the National Register.

Because of its location, researchers believe that the southern area of Site 1A may contain historic or prehistoric remains. However, the disturbance to the ground by both military and non-military uses may limit the area that contains intact archaeological resources. Further research indicates that there are additional deposits associated with a farmstead built in 1798 (Elia et al., 1989).

**5.6.1.3 Site 4A.** There are no existing historic structures at Site 4A, therefore this analysis is limited to past uses. The northern part of Site 4A contains a point of land called "Smoking Rocks" where it is believed that Indians held council fires, and where an earthwork fortification was built during the War of 1812 (see Figure 5.6-3). A candle factory was built on the site prior to 1836, and the Potomska Mill complex later occupied the site in 1871. The mill was expanded in 1877, and again in 1924. The mills were moved between 1935 and 1936 to what is now a residential area off-site. The Acushnet Mills were built on the southern portion of the site in 1882 and expanded in 1895. These buildings were demolished in 1931, with the exception of an office building that still remains on the site (CDM, Volume II, 1989).

Although there are no previously recorded archaeological sites within Site 4A, it is believed that the area may contain prehistoric artifacts as a results of the activities believed to have occurred at Smoking Rocks.

**5.6.1.4 Site 47.** According to historical maps of the area, no historic or archaeological sites are located on or near Site 47. However, geologic characteristics of this site (moderately well drained soils in close proximity to wetlands) are typical of prehistoric site locations in southeastern Massachusetts (CDM, Volume II, 1989). Although no documented archaeological sites exist at Site 47, the proximity to wetlands and the Paskamanset River suggest that this site has the potential for prehistoric remains and archaeological artifacts.




Adapted from CDM, 1989

FIGURE 5.6-3
EXISTING HISTORICAL, ARCHAEOLOGICAL AND RECREATIONAL RESOURCES FOR ALTERNATIVE SITE 4A

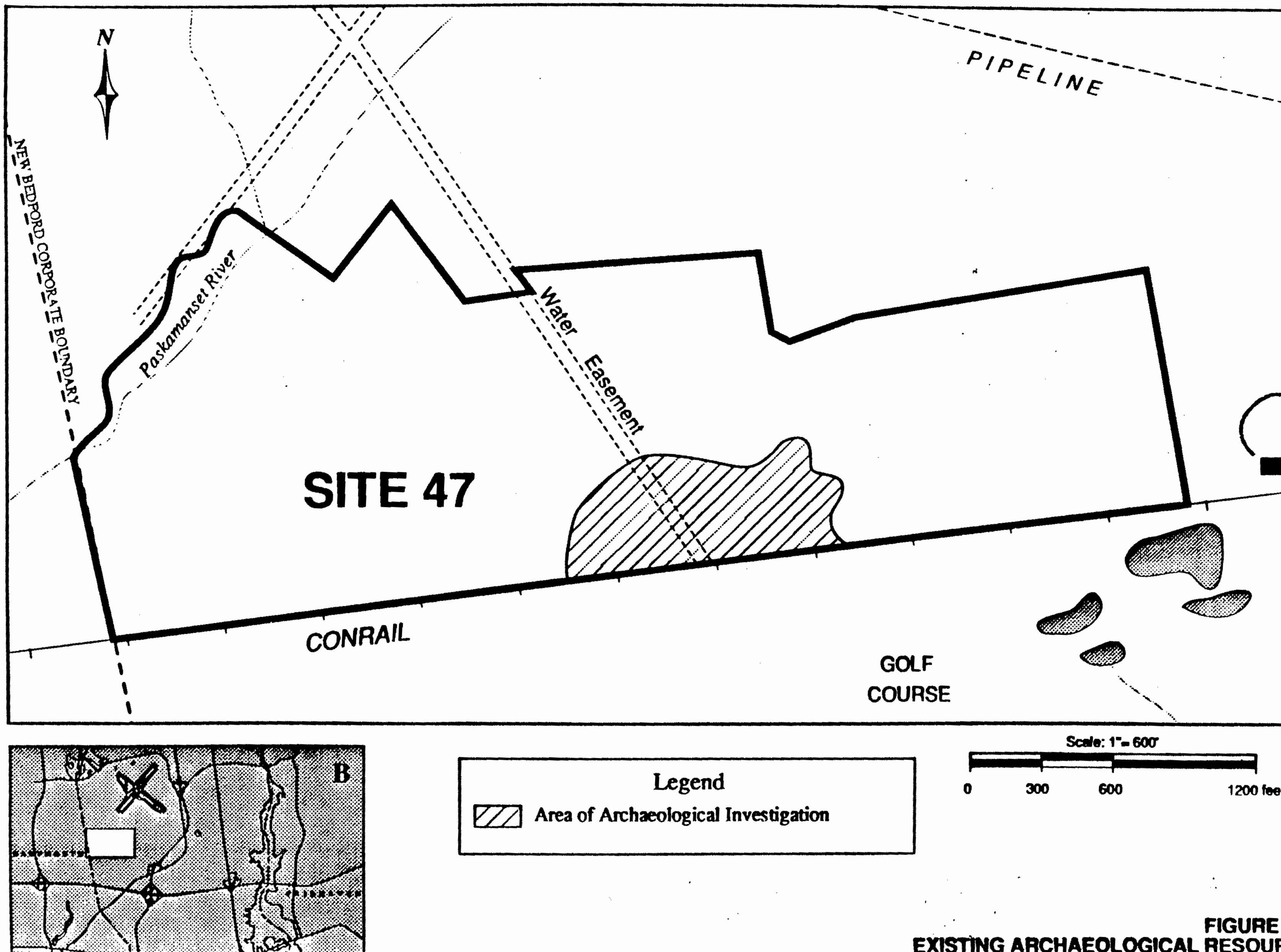
A detailed study involving some excavation of the area was performed to determine the potential historic and archaeological significance of the site. From the 168 shovel test pits that were taken in the more elevated section of the site, a total of 24 prehistoric artifacts were found (CDM, Volume II, 1989). This indicates that archaeological sites within Site 47 may be eligible for the National Register of Historic Places because of the prehistoric information they could provide the region (see Figure 5.6-4).

**5.6.1.5 Site 40.** No historic or prehistoric sites are documented for this area, and there are no existing structures, historic or otherwise, on Site 40 (see Figure 5.6-5). However, like Site 47, certain conditions (elevated dry soil surrounded by wetlands) indicate a potential for prehistoric site locations containing archaeological artifacts. The lack of historical development in the area indicates that these remains would most likely be undisturbed by 20th century activities.

A more detailed evaluation was performed on this site, consisting of 186 shovel test pits in a well drained section of the site, approximately 920 by 520 $ft^2$. Eighty-seven artifacts of both prehistoric and historic materials were recovered from 22 of the test pits. Historic artifacts consisted primarily of late 19th to 20th century glass and corroded iron objects, which were not considered historically significant. The prehistoric artifacts consisted primarily of quartz angular waste and flakes, which suggests that tool manufacturing or reworking may have occurred here. These artifacts may be significant, therefore this area could be eligible for listing in the National Register of Historic Places (CDM, Volume V, 1989).

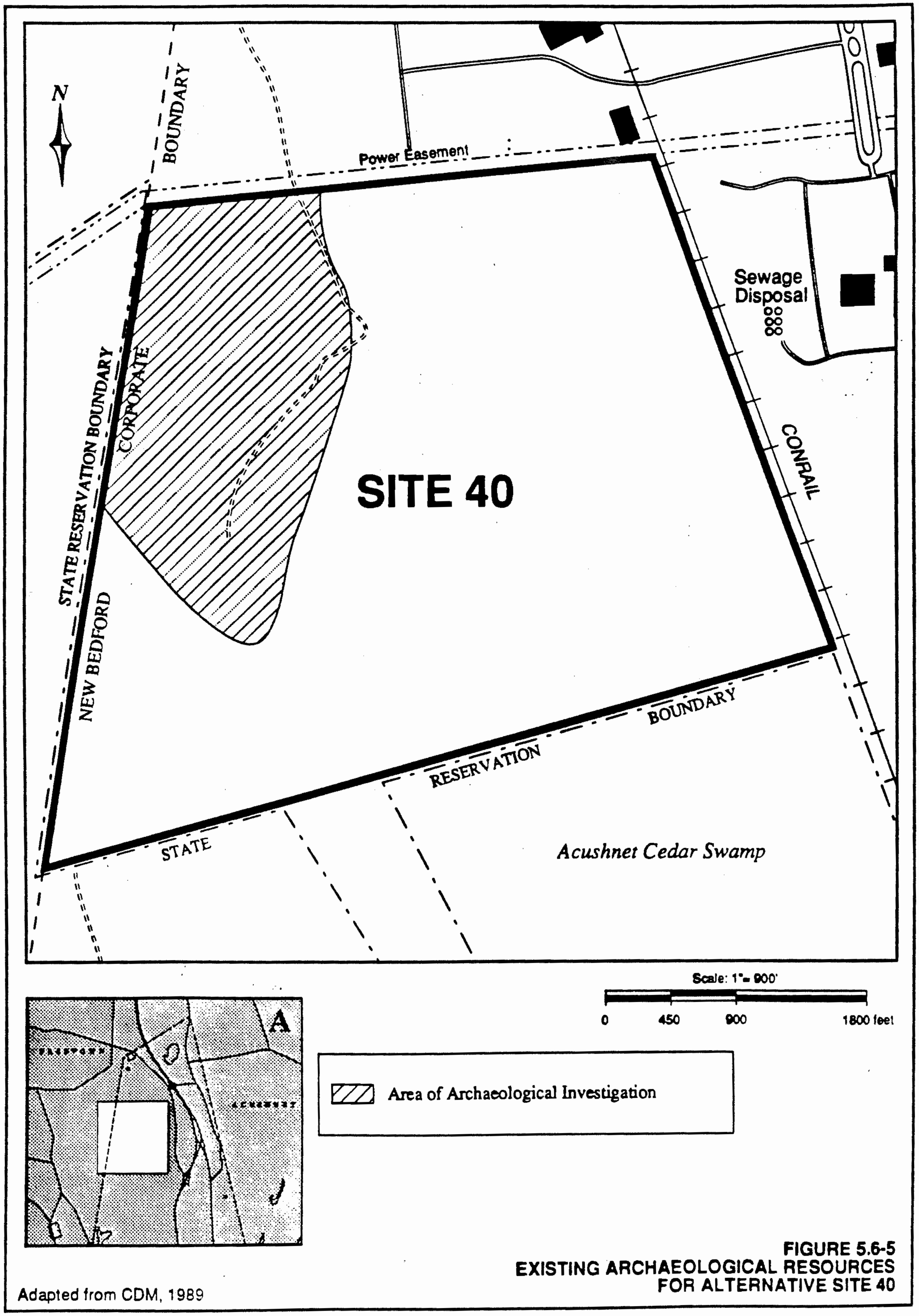
**5.6.1.6 Outfall Sites.** A study was performed to identify any historic shipwrecks located in the vicinity of the potential outfall locations (Appendix N, CDM, Volume IV, 1989). The area studied contains several prominent rocks and ledges that offer permanent bench marks from which wrecks were positioned. These include Great Ledge and Church Rock, both of which have known wrecks in their vicinity. Of the many wrecks that could potentially be located in the study area, only two have been identified, and are shown in Figure 5.6-6.

The <u>Yankee</u>, a 6,225-ton, 391-foot steam powered ship ran aground on Great Ledge in 1908 and subsequently settled to the east in the proposed 301(h) alignment. The wreckage is scattered over approximately 250,000 square feet. The historic significance of the Yankee lies with its involvement in the Spanish-American War, but its integrity may be questionable due to previous attempts to salvage the vessel (CDM, Appendix N, Volume IV, 1989). The other known site that appears to be close enough to the proposed 301(h) alignment to warrant further investigation is that of the



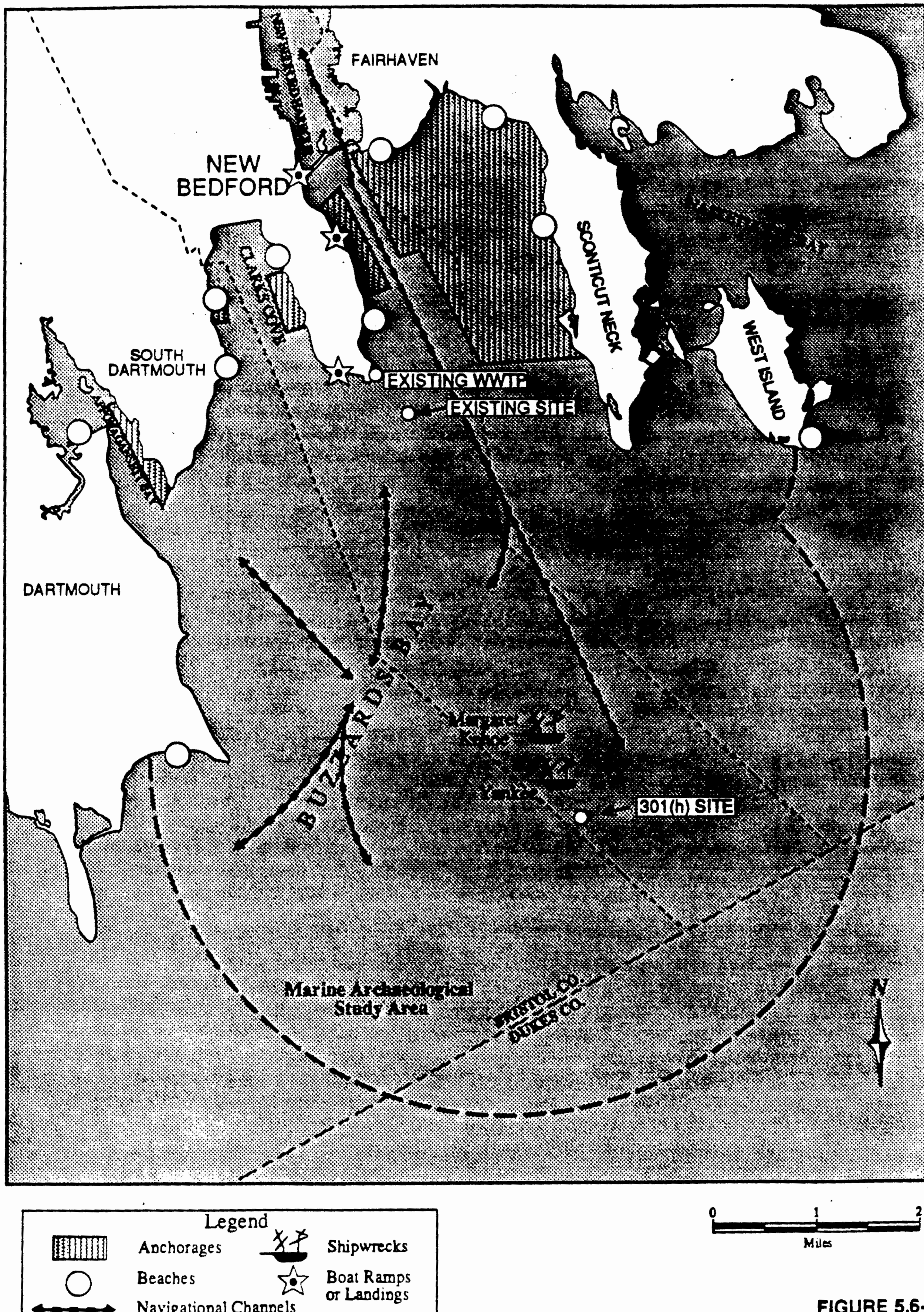

Adapted from CDM, 1989

**FIGURE 5.6-4**
**EXISTING ARCHAEOLOGICAL RESOURCES**
**FOR ALTERNATIVE SITE 47**




Adapted from CDM, 1989

**FIGURE 5.6-5**
**EXISTING ARCHAEOLOGICAL RESOURCES FOR ALTERNATIVE SITE 40**




Adapted from CDM, 1989

**FIGURE 5.6-6**
**EXISTING HISTORICAL, RECREATIONAL, AND HARBOR RESOURCES**

Margaret Kehoe. This 62-ton, 63-foot fishing vessel sank near Church Rock in 1963 (CDM, Appendix N, Volume IV, 1989).

In addition to historic features, the harbor area also shows some potential for prehistoric remains. Given the accepted environmental conditions favoring Paleo-Indian sites (such as below 400 foot present elevation and on small rivers and streams), the possibility of inundated sites from this period is fairly good (CDM, Appendix N, Volume IV, 1989).

Marine archaeologic investigations of submarine land within 3 miles of the candidate outfall sites and 0.5 miles on either side of the proposed outfall pipeline alignments showed that the silts and clays in the harbor are good preservation material. Therefore, any artifacts that may be there would most likely be well preserved. However, it is very likely that the installation of the existing outfall pipes destroyed the integrity of any materials that may have been there, thus decreasing the probability that any artifacts of significant value still exist at that location.

### 5.6.2 Visual Resources

Before determining the visual impact of the proposed facilities, it was necessary to determine the existing conditions for each site. Visual resources include scenic value and visibility. Data was collected to determine the area of the viewsheds and the quantity and quality of critical views.

**5.6.2.1 Site 1A.** This site is currently occupied by several buildings, and although many of these buildings are in poor condition, they offer a unique panoramic view of the harbor. The existing WWTP is south of Fort Taber and from ground level is effectively screened from the rest of the site by it. However, the foreground of all views from the top of the Fort are dominated by the presence of the WWTP. The surrounding views from the site range from residential to scenic maritime (CDM, Volume II, 1989).

**5.6.2.2 Site 4A.** Site 4A is a parcel of open land located along the Acushnet River. To the south of the site is a complex of mill buildings, to the north are fish processing buildings and a large power plant. Views across the water look directly east to Fairhaven and Palmer's Island. While the hurricane barrier blocks the view of the ocean, it creates the effect of an enclosed inlet. The view across the site is flat and unobscured by buildings or terrain. To the west of the site are residences. The site, bounded on two sides by industrial uses, provides a rare open view of the river from the inside of the city; a break in the otherwise continuous industrial edge of downtown New Bedford (CDM, Volume II, 1989).

**5.6.2.3 Site 47.** Site 47 is larger and more remote than Sites 1A and 4A. Site 47 is surrounded by the Apponagansett Swamp, and is characterized by a woodland comprised of both wetland and upland vegetation. Views from the site include the municipal golf course on the hill, an elevated section of Route 140, a nearby municipal landfill and incinerator, and a water tower. There are no landmarks that distinguish Site 47 from its surrounding woodlands (CDM, Volume II, 1989).

**5.6.2.4 Site 40.** Like Site 47, Site 40 is a remote site, bounded on two sides by the Acushnet Cedar Swamp. The other sides are bounded by a power line easement and railroad tracks. The site is characterized mostly by a woodland comprised of wetland and upland vegetation, and is mostly surrounded by densely wooded areas. The only view of this site is from the industrial park which is just beyond the power line. The view from the site is woods and the power line with the industrial park behind it.

### 5.6.3 Harbor Resources

Harbor resources are defined here as recreational, navigational, commercial, and historical/archaeological uses of the New Bedford Harbor. These resources are described for each alternative WWTP, solids disposal, and outfall site.

**5.6.3.1 Site 1A.** Site 1A is waterfront property. Resources associated with the site include recreational facilities, swimming beaches, and non-commercial fishing.

**5.6.3.2 Site 4A.** Site 4A is also on the waterfront. Because it is in an industrial setting, there are some commercial uses associated with the site. Recreational boating occurs near Site 4A.

**5.6.3.3 Outfall Sites.** The two outfall sites, the existing site in the Outer Harbor and the 301(h) site in Buzzards Bay, have many resources associated with them. The Inner Harbor is the largest commercial fishing port of the United States in terms of annual tonnage landed. More than 250 commercial vessels operate from New Bedford's inner harbor. The Outer Harbor and Buzzards Bay have several navigational channels and anchoring sites. The navigational channels are marked by the U.S. Coast Guard (See Figure 5.6-6). Fishing is the major resource in the Harbor. Finfish and shellfish resources at the candidate outfall sites are described in Section 5.5.5.4 and 5.5.5.5, respectively.

Clarks Cove and the Outer Harbor (where the existing site is located) support eight commercial and many recreational fishermen. However, shellfishing, lobstering, and the catching of bottom-dwelling fish such as flounder have been banned in this area (See Figure 4.3-2). The harbor areas are used mostly for their beaches and recreational boating, and there are several boat ramps and landings along the harbor (Figure 5.6-6). Anchor sites may be found on either side of the marked channels in the Outer Harbor, and there are several pleasure boats moored in Clarks Cove.

Shellfishing and lobstering occur near the 301(h) site although shellfish populations could not support commercial exploitation. Buzzards Bay is also heavily used for recreational boating.

### 5.6.4 Socioeconomic Resources

Socioeconomic resources include social, cultural, and economic opportunities. Economic opportunities are defined as land values and revenues that the City of New Bedford currently receives or would receive in the future from the site, such as taxes and project costs. Economic opportunities also include the potential economic and population growth of the community.

**5.6.4.1 Economic Conditions.** New Bedford had a total population in 1988 of 100,473 persons, which represents a 2 percent growth over 1980 population levels. However, the population dropped by 1.98 percent between 1980 and 1985. By contrast, the total population of the Commonwealth of Massachusetts dropped by 10.31 percent between 1980 and 1985. The City of New Bedford's population in 1980 was 98,478.

New Bedford had a July 1989 unemployment rate of 7.2 percent, and a per capita income of $10,677. Of the total employed persons aged 16 and over, 37.0 percent were employed in manufacturing. In 1980 there were 26,475 families of whom 14.1 percent were below the federal poverty level (more recent figures are not available).

By contrast, the Massachusetts unemployment rate was 4.6 percent during July 1989 and in 1980, 7.6 percent of families were below the poverty level. Of the total labor force of persons 16 and over, 26.0 percent were employed in manufacturing. The economy of New Bedford remained more stagnant than experienced in the Commonwealth as a whole, with higher poverty levels and unemployment. The greater percentage of manufacturing employment in New Bedford reflects its continued reliance on a slow growth economic sector. At the same time, however, the population of the SMSA has grown while that of other urban areas has declined, and the Commonwealth's overall population has remained stable.

Industrial values in New Bedford are low, probably due to the high differential tax rate charged industry and commerce by New Bedford ($ 35.99 per thousand versus $19.09 per thousand for residential). In any case there appears to be limited activity in this market at the moment.

The housing market in New Bedford is strong and there is a shortage of all housing types, including market rate housing. Housing prices tripled between 1980 and 1987. Building permits in the City have shown steady growth since 1980. The total number of dwelling units in the City increased by 1,785 between 1980 and 1987.

Total employment has been steady between 1976 and 1986. Declines in manufacturing, transportation, and communications and utilities were offset by growth in service, finance, construction, and mining sectors.

**Site 1A.** Site 1A is owned by both the City and the Federal Government and has an estimated current land value of $1.7 million. In acquiring some of this land from the Federal Government, the City agreed to several deed restrictions, which could potentially make it difficult for the land to be used as anything but its current or similar uses (e.g., another WWTP). Thus, although residential use is within the City's design for the redevelopment of New Bedford, development of Site 1A may be unlikely. The City currently receives no property tax from this site which houses the Army and Navy Reserves, a marine research laboratory, historical and tourist sites, a school for the handicapped, a learning center, a camp, and recreational facilities.

**Site 4A.** There are many owners of Site 4A. The land value of the site is currently estimated at $5.8 million. Improvements made to the site (e.g., development as light or heavy use) or mixed use, could increase the land value up to $162 million, with the City could receiving up to $3.4 million annually from taxes (WFA, 1989; Appendix D).

**Site 47.** More than half of Site 47 is owned by the City, and the rest is owned by three private parties. The current land value is estimated at $3.7 million for the full 117 acres. At the current industrial land tax rate, the City currently receives $294 in taxes per year from this site (CDM, Volume III, 1989). Improvements to the site (i.e., through industrial development) could increase the value to $75.6 million and annual tax revenues from this site could then be as much as $2.7 million (WFA, 1989; Appendix D).

**Site 40.** Site 40 is privately owned. The value of this site is currently assessed at $5.4 million, for the 90 acres that are suitable for building. However, this site is currently being considered for other uses (e.g., an industrial park or a cogeneration power plant). Use of this site for a cogeneration facility would increase the land value to over $145 million, and bring in a net annual revenue of $5.2 million. The present capitalized value to the City is estimated at $13.1 million (CDM, Volume III, 1989).

**5.6.4.2 Cultural Resources.** There are a number of social and cultural facilities, programs, activities, and associations located at and connected with Sites 1A and 4A. In addition, there are certain qualities and characteristics of the sites that give them social and cultural values beyond the activities located on them.

**Site 1A.** This site has aesthetic and cultural qualities enjoyed by no other site in New Bedford. Views of the site and from the site are unique. Also, the site has historic significance that must be respected. The site contains a number of educational facilities. The area to the north of Site 1A is a well-kept, attractive residential area.

**Site 4A.** Site 4A serves as open space in a densely developed portion of New Bedford. The site also provides views of the Acushnet River and Palmer's Island. In addition, the site contains outdoor recreational facilities, a radio station and a social club. A residential neighborhood lies to the west, across a divided thoroughfare.

**Site 47.** Site 47 serves as a buffer between the Municipal Golf Course and the airport. There are no social and/or cultural activities that occur at this site.

**Site 40.** Site 40 is undeveloped and is not available to the public for community uses because it is privately owned. There are no cultural resources identified at the site, and no cultural or community uses have been planned at the site.

**5.6.5 Recreational Resources**

Recreational activities include fishing, boating, waterskiing, and swimming, among others. Recreational resources at each site are described below, and shown in Figures 5.6-2 to 5.6-6.

**5.6.5.1 Site 1A.** There are many recreational uses of Site 1A including fishing and swimming at the beach. There is an area used as a recreational playing field, and some areas used for passive recreation, (e.g., bird watching).

**5.6.5.2 Site 4A.** The recreational uses of Site 4A are extensive. There is a boat ramp just off-site for bringing boats in and out of the river. However, there is no swimming or fishing in this area. There are also two baseball diamonds, a lighted softball diamond, a basketball court, and a bicycle racing track for more organized recreational activities.

**5.6.5.3 Site 47.** Because Site 47 is relatively inaccessible and surrounded by wetlands, there are no organized recreational activities that occur at this site. However, the site is suitable for passive recreational uses, such as bird watching and hiking.

**5.6.5.4 Site 40.** As mentioned in the previous section, Site 40 is undeveloped, therefore no organizational activities occur at this site. In addition, this site is privately owned, and not available to the public for any recreational uses.

**5.6.5.5 Outfall Sites.** Recreational activities are common in the coastal region of New Bedford. The Inner Harbor is used primarily for recreational boating and mooring of boats. In Clarks Cove, the Outer Harbor, and Buzzards Bay, boating, swimming, sport fishing, and even shellfishing (i.e., scallops) are allowed. Lobstering is allowed in Buzzards Bay, however, this is mostly for commercial and not recreational purposes. Finfish and shellfish resources at the candidate sites are described in Section 5.5.5.4 and 5.5.5.5, respectively.

# CHAPTER SIX

# IMPACTS

## 6.1 LAND USE IMPACTS

### 6.1.1 Impacts to On-site and Adjacent Land Use and Zoning

The construction of a wastewater treatment plant or solids disposal facilities at any site could potentially impact the existing on-site land use as well as the land use of the adjacent areas. The consideration of land use is important to ensure that conflicts are minimized and that any necessary mitigation measures are taken.

For each site evaluation, the following criteria were used to assess the potential impact of the proposed facilities to on-site and adjacent land use:

- compatibility with existing on-site and adjacent land uses;
- need for displacement of existing land uses;
- potential for buffering the proposed facility from adjacent uses;
- conflict with existing or proposed recreation or conservation uses;
- conformance with zoning; and,
- conformance with future plans (e.g., existing master plans) for the site and surrounding area.

The assessment of sites in terms of compatibility with on-site land use and zoning was based on the following ratings:

- A significant incompatibility between the proposed facility and on-site land use and zoning would occur if the proposed activities would conflict with existing zoning and land uses which cannot be relocated, or the site zoning or future planning designates the site for residential use.
- A moderate incompatibility between the proposed facility and on-site land use and zoning is one where the proposed activities would conflict with existing

on-site land uses that can be relocated and the site zoning or future plans target the site for business or other non-residential uses.

- An insignificant incompatibility between the proposed facility and the on-site land use and zoning is one where the proposed activities do not conflict with existing on-site land use and the site zoning or future plans target the site for industrial, municipal, or other non-residential uses.

The assessment of alternative sites in terms of compatibility with adjacent land use and zoning was based on the following ratings:

- A significant incompatibility between the proposed facility and adjacent land use and zoning is one where the proposed activities would conflict with adjacent land uses, with no buffering potential, and the adjacent zoning or future plans are primarily residential.

- A moderate incompatibility between the proposed facility and adjacent land use and zoning is one where the proposed activities would have minor conflicts with existing adjacent land uses, with some potential for buffering, and the adjacent zoning or future plans are designated primarily for business or other non-residential use.

- No significant incompatibility between the proposed solids disposal facility and adjacent land use and zoning would occur if the proposed activities would not conflict with adjacent land uses and adjacent zoning or future plans are primarily industrial, municipal, or non-residential.

**6.1.1.1 Site 1A On-site Land Use and Zoning.** Construction of the proposed facility at Site 1A would conflict with existing on-site land uses and require the displacement of various on-site land uses including educational and social services, recreational, and military facilities. The historic resources at Site 1A (Fort Taber and existing historic district) could be compatible with a treatment facility if mitigation measures were taken to minimize impacts to those resources (see Section 6.6).

The relocations necessary for project implementation at Site 1A would require significant City coordination efforts with federal, state and local agencies. All of the land now owned and occupied by the Army Reserve Command would be needed to build a WWTP. Therefore, if the proposed facility were constructed there, it would be necessary for the City to provide comparable facilities to the Army for relocation.

At the same time, it would be necessary to relocate several municipal programs currently occupying the educational land (e.g., the Head Start program, day care facilities, etc.) to a nearby site, and remove the public soccer field and Naval Reserve Center tennis courts. Because the soccer field at Site 1A is a federally funded recreational area, in order to release the facility, the City would have to find an alternative sports area (potentially with City funded improvements) to offset the federally funded parking area and fence at the present site.

The other obstacle to locating the proposed facility at Site 1A related to land use is that, although the City owns all of the other land required, there are deed restrictions currently limiting its use. In order to remove the deed restrictions on the educational and recreational land, the property would need to be returned by the City to the federal government, declared surplus to the needs of the Department of Education and the National Park Service, assigned to the GSA for disposition, and returned to the City of New Bedford. Discussions with the appropriate federal agencies have indicated that this would be acceptable.

There currently are no conservation land uses associated with the site. As for zoning, based on the opinion of New Bedford's City Solicitor, the siting of a treatment facility at Site 1A would not be subject to existing zoning regulations (CDM, Volume II, 1989). Presently, there are no City or private plans for the site. The 1987 Open Space and Recreation Plan (OSRP) did not specify recreation plans for Site 1A because at the time the OSRP was prepared, Site 1A was identified as a potential site for the new WWTP.

The overall predicted impact to on-site land use and zoning predicted from siting the WWTP at Site 1A is therefore moderate.

**6.1.1.2 Site 1A Adjacent Land Use and Zoning.** The new treatment plant would most likely be located at the center of the site, which is closer to the nearby residences than the existing WWTP. There is potential for buffering the adjacent residential neighborhood from the WWTP because Site 1A is separated from the residences by Rodney French Boulevard. Therefore, the proposed WWTP would be moderately incompatible with the approximately 450 single family residences within a one-half mile radius of Site 1A.

There are no recreation or conservation uses adjacent to the site that would be impacted by a WWTP located there. Indeed, mitigation measures planned for the site should improve waterfront access and neighborhood recreational opportunities.

Although siting a WWTP at Site 1A would be permissible under the City's current zoning laws (the City solicitor has stated that a public health facility such as a WWTP would not be subject to existing zoning regulations), use of the site for this purpose is not compatible with the residential zoning of the adjacent area.

Because there are no public or private plans for changes in land use adjacent to Site 1A, mitigative measures would be required to minimize any impacts on the nearby residences, and are discussed in Chapter 7.

The overall predicted impact to adjacent land use and zoning at Site 1A is therefore considered moderate.

**6.1.1.3 Site 4A On-site Land Use and Zoning.** The siting of the facility at Site 4A would not be compatible with the existing recreational land use on-site. The radio tower and vacant land however, would not be impacted by the proposed siting of a WWTP at Site 4A.

Significant City coordination efforts with local agencies would be required to relocate the existing land uses. The existing recreational resources would be displaced by siting the facility at Site 4A. A new park or improvements to existing parks in the area would be required to mitigate any impacts. For example, the parking area presently used by employees of the Berkshire Hathaway Mill Complex would be displaced and alternative plans for parking would be required. The 1987 OSRP plans for a bicycle/walking/jogging path, however, would be compatible with the facility siting. No conservation land uses are associated with Site 4A.

Because Site 4A is zoned Industrial B, locating the facility there would be compatible with the zoning requirements for this area. The proposed facility siting was determined to be compatible with plans for the site under MCZM Designated Port Area requirements which support the use of the site for maritime industrial purposes or other water-related activities (CDM, Volume II, 1989). Siting the WWTP at Site 4A would, however, conflict with the proposed Palmer's Cove development. The overall predicted impact to on-site land use and zoning at Site 4A is therefore considered moderate.

**6.1.1.4 Site 4A Adjacent Land Use and Zoning.** The multi-family and single family residences (3,200) in the vicinity of Site 4A would generally be incompatible with the proposed WWTP, and would require mitigation to minimize impacts. There is potential for buffering this residential area from the WWTP because Site 4A is separated from this area by JFK Boulevard.

The adjacent industrial and commercial land uses are presumed to be compatible with the siting of a facility at Site 4A. However, the New Bedford Seafood Dealers Association and the New Bedford Seafood Exchange, Inc. have voiced concern over the facility siting because of the possibility that a nearby WWTP would damage the image of the seafood processing industry.

The industrial, commercial, and vacant land uses could be potential buffers for nearby residential areas. There are no nearby recreational areas or conservation lands that would be incompatible with the facility siting.

The adjacent areas zoned Residential C and Business-Mixed-Use are not compatible with the siting of a facility at Site 4A. The areas that are zoned Industrial B, however, are compatible with the facility. The siting of a facility at Site 4A may not be compatible with plans to revitalize the South First Street area or with the proposal for elderly housing near Site 4A. The overall predicted impact to adjacent land use and zoning at Site 4A is therefore moderate.

**6.1.1.5 Site 47 On-site Land Use and Zoning.** Approximately 5 percent of Site 47 is occupied by a municipally owned solid waste landfill. The remainder of Site 47 is vacant. Consequently, locating the proposed solids disposal facility at Site 47 would be compatible with existing land use. No recreational or conservation land uses exist at the site, and no relocation efforts would be required if the proposed facility is located at Site 47.

The siting of the facility at Site 47 would be compatible with the zoning requirements for this area (Industrial B) and currently, there are no land use plans for the site. Therefore, the overall predicted impact to on-site land use and zoning at Site 47 is considered insignificant.

**6.1.1.6 Site 47 Adjacent Land Use and Zoning.** The proposed facility siting would be compatible with the adjacent municipal solid waste landfill, incinerator, and associated uses. It would also be compatible with the adjacent golf course. The sludge landfill would not interfere with proposed improvements to the municipal golf course because of the generally limited amount of landfilling activity and the presence of a wooded buffer area. In addition, siting the facility at Site 47 would be compatible with the municipal airport because FAA regulations would be met during design and construction of the facility.

There are no residential areas adjacent to Site 47 that would require buffering and the golf course would provide adequate buffering for other adjacent land uses. Although there are a few adjacent parcels of land that are zoned Residential A, they would not be incompatible with placement of a facility at Site 47 because distance and heavy vegetation would provide adequate buffering. Areas that are zoned Industrial B would be compatible with the facility siting. Also, there are no conservation lands near Site 47. There are no future plans for the land adjacent to Site 47. Therefore, the overall predicted impact to adjacent land use and zoning at Site 47 is considered insignificant.

**6.1.1.7 Site 40 On-site Land Use and Zoning.** Site 40 is vacant, therefore locating the proposed solids disposal facility there would be compatible with existing land use. There are no recreational or conservation land uses at Site 40 and there are no plans for such uses in the future. In addition, the siting of the facility at Site 40 would be compatible with the zoning requirements for the area (Industrial C).

The siting of a solids disposal facility at Site 40 would not be compatible with proposed plans to use the area. Currently, Eastern Energy Company has bid to acquire the land at Site 40 from Polaroid Corporation for the development of a coal-generated power plant on the site. Overall, however, the predicted impact to on-site land use and zoning at Site 40 is considered insignificant.

**6.1.1.8 Site 40 Adjacent Land Use and Zoning.** Because there is a large buffering area between the Acushnet Cedar Swamp State Reservation and the proposed landfill, the proposed facility would not be incompatible with the reservation. The proposed development would also be compatible with the adjacent industrial park. There are no residential areas adjacent to Site 40 that would require buffering. The 1987 OSRP did not specify any plans for Site 40, and the conservation lands near Site 40 are presumed to be adequately buffered.

Siting of the facility would be compatible with the intent of the Industrial B zoning, and the adjoining area zoned Residential C is assumed to be adequately buffered from Site 40. At the present time, locating the proposed facility at Site 40 would be compatible with any future plans for adjacent land use based on zoning. Therefore, the predicted overall impact to adjacent land use and zoning at Site 40 is considered insignificant.

### 6.1.2 Traffic and Transportation Impacts

The objective of the traffic analysis was to predict the impacts of facility-related vehicles on existing traffic conditions at each site and along the access routes to each site, both during construction and facility operation.

Traffic impacts during construction can be classified as significant, moderate, or insignificant impacts. Significant impacts are caused by conditions where all traffic would have to be re-routed during construction. Moderate impacts result from construction that would allow local traffic, but re-route through-traffic. Insignificant impacts result from construction that would impede traffic, but allow both local and through service. No traffic impacts would result when construction does not occur on or adjacent to existing streets.

The other criteria used to assess the consequences of each siting alternative relative to traffic and transportation are disruption of neighborhood character, maintenance of traffic flow, and difficulty of highway access. Disruption of neighborhood character was evaluated based on length of development, density of housing, and location of sensitive receptors along the travel routes. The disruption was evaluated as follows: a significant impact means that travel routes would pass through high-density residential areas with a large number of sensitive receptors; a moderate impact means that travel routes would pass through residential areas of low to medium density or through areas where there are sensitive receptors; and an insignificant impact means that travel routes would not pass through residential areas or through areas where there are sensitive receptors.

Maintenance of traffic flow was evaluated based on the roadway capacity and classification of the travel route, roadway gradients, potential for increased traffic delays, and potential impacts to the flow of traffic along the travel routes. Traffic flow was evaluated as follows: a significant impact means that the roadway traffic level would increase to or beyond the capacity of the roadway; a moderate impact means that the traffic flow would be increased but would not reach roadway capacity; an insignificant impact means that the traffic flow and delays would not change.

Ease of access was evaluated based on distance and travel time from a site to a major limited access highway, projected roadway traffic flows, and projected delays as a result of the project. Ease of access was evaluated as follows; a significant impact means that facilities-related vehicles would cause increased delays, reduction in traffic flow resulting in long periods of standing time, and excessive travel times to major highways; a moderate impact means that facilities-related vehicles would cause increased delay, reduction in traffic flow resulting in short periods of standing time, and moderate travel times to major highways; and an insignificant impact means that facilities-related vehicles would not cause increased delays or reduction in traffic flow and short travel time to major highways.

The 1985 "Highway Capacity Manual" (Transportation Research Board Special Report 209), defines six level of service categories ranging from "A" (for the best) to "F". These six level of service categories correspond with how most people would rate the quality of traffic operations at an intersection or section of roadway. The level of service and delay relationships are listed below.

| Level of Service | Expected Delay |
|---|---|
| A | little or none |
| B | short |
| C | average |
| D | long |
| E | very long |
| F | extremely long |

A typical design criterion for new intersections and improvements to existing intersections is that the intersection should provide a C Level of Service or better for all but the thirty highest hours of traffic demand for the year. Frequently, in urban areas, this standard is lowered to permit design for a D Level of Service or better for all but the worst hour of the average weekday. Intersections which offer an E or F level of service during any significant period of time are generally felt to require improvement.

**6.1.2.1 Site 1A.** The amount of traffic estimated to be generated by the construction of the WWTP at this site would total 138 cars and 35 trucks per day during the peak construction month. Once the plant were operational, 14 new car round trips would be generated and no new truck trips would be generated. The latter is due to the fact that septage is not planned to be accepted at this site. In order to compare traffic projections for the new WWTP against existing traffic conditions, these numbers represent only the additional number of vehicles associated with the new WWTP and do not include the number of vehicles generated by operation of the existing WWTP (CDM, Volume V, 1989). Table 6.1-1 shows the predicted peak number of trips generated for all four sites being evaluated.

During the peak construction period, construction trucks would pass a single point along the route approximately once every 14 minutes. This would have no measurable effect on roadway traffic conditions (CDM, Volume V, 1989). At the intersection of JFK Boulevard and Cove Street, trucks turning left onto Cove Street would have to do so from the right lane. This would occasionally block both southbound lanes. However, since the traffic signal at this location allows this movement to proceed before the opposing northbound traffic (protected left-turn phase), the northbound approaches would not be affected. Therefore, operational delays should be minimal (CDM, Volume V, 1989). Other locations along the route where traffic-related construction impacts might result in increased delays are along Cove Street where trucks might have to occasionally maneuver

**TABLE 6.1-1**

**TRIP GENERATION DURING PEAK PERIODS**
**(Average Number of Trips Per Day)**

| | Cars | Trucks | Total |
|---|---|---|---|
| Site 1A:[1] | | | |
| Construction | 138 | 35 | 173 |
| Operations | 14 | 0 | 14 |
| Site 4A: | | | |
| Construction | 152 | 58 | 210 |
| Operations | 74 | 48 | 122 |
| Site 47: | | | |
| Construction | 13 | 43 | 56 |
| Operations | 5 | 14 | 19 |
| Site 40: | | | |
| Construction | 13 | 43 | 56 |
| Operations | 5 | 14 | 19 |

(1) Number of trips not including those from existing WWTP.

Adapted from CDM, Volume V, 1989.

around other trucks serving the adjacent industries and on East Rodney French Boulevard at East Beach. At this latter location, some conflict could occur during the summer months, especially if occasional weekend construction activity were to coincide with peak beach use periods. Since the East Rodney French Boulevard/Cove Street route currently carries 200 to 300 trucks per day, the addition of 35 trucks is not likely to be noticeable (CDM, Volume V, 1989).

The 138 car round trips estimated to be generated by the construction at Site 1A are all attributable to the peak number of construction workers (138) that would be on-site (CDM, Volume V, 1989). Assuming a worst-case condition where there would be one worker per car, this would result in a total of 138 trips each way. It is further conservatively assumed that these workers would travel from the site during the PM peak hour (3:30-4:30 PM). Assuming that all 138 trips travel through the intersection of JFK Boulevard and Cove Street, the intersection would experience a noticeable increase in overall delay (CDM, Volume V, 1989). Typically, however, construction workers work an earlier shift than most other workers, and thus would travel outside of the peak hour.

Due to the small number of new trips generated by the operation of the wastewater treatment plant at Site 1A, its impact on the operation of the roadway network would be minimal. Even if it were assumed that all 14 new trips would occur during the PM peak hour (3:30-4:30), no change in the level of service at the intersections of JFK Boulevard and Cove Street and West Rodney French Boulevard/Cove Road/Brock Avenue would occur (CDM, Volume II, 1989). In reality truck trips, including sludge transport and material deliveries, would be spread out during the day.

Disruption to the neighborhood character by truck and automobile traffic to and from Site 1A during operation would result in a moderate impact. The density of housing along the route and presence of sensitive receptors were used to evaluate the impact (CDM, Volume II, 1989). The only sensitive receptor in the vicinity of Site 1A is a neighborhood health clinic that is one block west of East Rodney French Boulevard.

During construction, the intersection of JFK Boulevard and Cove Street would experience a noticeable increase in overall vehicle delay (CDM, Volume V, 1989). This however, is a worst case condition in which the peak number of construction workers would all pass through this one location coincident with the existing PM peak hour. Once operational, the facility is projected to have an insignificant effect on traffic flow. No increases in traffic delays or in traffic direction are expected.

As described in Section 5.1.4, the distance to Site 1A from the nearest major highway is greater than to Site 4A (see Figure 5.1-5). The difficulty of access is considered to be moderate due to the distance involved. Overall, projected traffic impacts from locating the WWTP at Site 1A are therefore considered moderate.

**6.1.2.2 Site 4A.** During construction of the WWTP at Site 4A, it is estimated that a total of 210 round trips would be generated. Of these, 152 would be cars and 58 would be truck trips. As was the case for Site 1A, these figures represent traffic during the peak construction period. Once operational, the WWTP would contribute a total of approximately 122 new trips: 74 car trips and 48 truck trips. These figures are greater than the comparable figures for Site 1A due to the fact that there are no existing trips to the site and projections for accepting septage at Site 4A are included (CDM, Volume V, 1989).

During peak construction, trucks would pass a single point along the route approximately once every 10 minutes. Currently, trucks make up four percent of the traffic on the route. The additional trucks generated by construction at Site 4A would increase this to five percent along Front Street. This increase should not be perceptible to businesses along this street (CDM, Volume V, 1989). From an operations standpoint, it is doubtful that construction trucks would experience difficulties. This is due to the fact that the intersections along the route are designed for truck traffic and currently have no operational deficiencies.

Construction workers commuting to Site 4A would be unlikely to adversely affect the level of service of nearby intersections (CDM, Volume V, 1989). For the worst case, however, when all 152 employee round trips passed through the intersection of Potomska Street/JFK Boulevard during the PM peak hour, operation could approach capacity conditions (CDM, Volume V, 1989).

Once in operation, the impact of the WWTP on traffic would be minimal. The 74 average weekday car round trips would have little effect on the Potomska Street/JFK Highway intersection given that it currently operates at B level of service during the PM Peak Hour (CDM, Volume V, 1989). The 48 truck round trips estimated to be generated at Site 4A correspond to only 6 trips per hour when distributed over an eight hour day. This would have minimal impacts on the surrounding intersections.

There are no sensitive receptors along the route to Site 4A, however there is low density residential housing along the access route. The area that the route traverses is zoned for industry and is primarily industrial in character. The disruption of neighborhood character is predicted to be insignificant.

The distance to the nearest major highway, JFK Boulevard, is only 0.32 miles. Because of the short distance, the trucks would not be expected to reach speeds greater than 10 to 13 miles per hour on the route. The estimated travel time from JFK Boulevard is expected to be about 2 minutes. Access to major highways is not considered to be a problem. Based upon the above factors, Site 4A is evaluated as very accessible for trucks.

Therefore, the predicted impact on traffic flow of locating the WWTP at Site 4A is considered insignificant based on factors including low existing traffic volumes, Potomska Street being classified as a minor collector designed for truck traffic, the absence of any roadway gradients, no minimal effect on traffic delays, and minimal expected changes to traffic flows.

**6.1.2.3 Site 47.** During construction of a solids disposal landfill, it is estimated that during the most intensive period of trucking activity, trucks would pass a single point along the route about once every six minutes. A maximum of 13 construction workers would be commuting to and from Site 47 during the construction period. Assuming a worst case condition of one worker per car, this would result in 13 car round trips. This would have no measurable effect on roadway conditions outside of peak periods (2 pm - 5 pm).

During peak periods, left-turning construction trucks would likely contribute to delays at the southbound on-ramp to Route 140 (CDM, Volume V, 1989). Construction trucks would not significantly disrupt neighborhood character along Hathaway Road, west of the overpass and along the site access road itself. East of the overpass, traffic volume would increase from 7.0 to 7.5 percent. This change would be imperceptible to the residents on the south side of the road. Similarly, the construction workers commuting to and from the site would unlikely affect roadway operation along Hathaway Road (CDM, Volume V, 1989).

The only significant traffic generated during operation of the solids disposal facility would be 14 truck round trips per day. The primary route does not pass through any major intersections. Surrounding land uses along the route are primarily commercial and open land, with only some residential development at the Route 140 northbound off-ramp and Hathaway Road. Existing traffic on this route is 15,680 vehicles per day (CDM, Volume V, 1989), and the addition of 14 truck round trips per day would have an insignificant impact. The only potential location where additional delays might occur would be at the intersection of Hathaway Road and the Route 140 Southbound on-ramp. At this location, the trucks would be turning left onto the on-ramp. Although through vehicles traveling on Hathaway Road might have to slow down or stop briefly, the roadway is wide enough to allow vehicles to pass the stopped trucks on the right, and therefore these delays would be minimal (CDM, Volume V, 1989).

Use of the secondary access route to Site 47 would have a moderate impact on traffic operations. Most of this impact would occur at the intersection of Shawmut Avenue and Hathaway Road, where trucks traveling to the site would be turning left onto Shawmut Avenue. However, operations at this intersection are variable depending upon whether two lanes of traffic form on the Hathaway Road approach. Additional impacts on traffic flow would result from the sections of the route with approximately 5 percent gradients on both Shawmut Avenue and Hathaway Road and commercial uses along Shawmut Avenue. There are no sensitive receptors along the route, and the residential areas have an average density of only four dwelling units per acre (CDM, Volume V, 1989).

The disruption to neighborhood character would not be significant at Site 47, based on factors such as the absence of sensitive receptors along the entire route, commercial land uses along Hathaway Road, and the low density of residential areas along the route. The difficulty of access to a major highway (Route 140) is insignificant due to the short distances involved. (CDM, Volume III, 1989).

Therefore, the siting of a solids disposal landfill at Site 47 is predicted to have an overall insignificant impact upon traffic flow.

**6.1.2.4 Site 40.** A sludge landfill at Site 40 would be constructed in the same manner as one at Site 47. Therefore, construction traffic volumes would be identical to those described above for Site 47. Access to Site 40 is through an industrial park. The access route to Site 40 passes through only one intersection, Braley Road/Phillips Road/Theodore Rice Boulevard. This unsignaled intersection currently operates at an F level of service during the PM peak hour (3:00-4:00 pm), when the industrial park empties and north-south traffic through the Rice Boulevard/Braley Road/Phillips Road intersection comes to a virtual standstill (CDM, Volume V, 1989). At this intersection, traffic on Phillips Road is controlled by a STOP sign, while traffic in and out of the industrial park has the right-of-way. Construction trucks attempting to use this intersection during the peak period would exacerbate those conditions. This could, however, be avoided by scheduling truck transport for other than the peak period.

Surrounding land uses are all industrial along the route. The addition of 14 truck round trips per day during facility operation to the existing traffic flow of 9,100 vehicles on Braley Road would be insignificant (CDM, Volume V, 1989). The impacts at the Braley Road/Phillips Road/Theodore Rice Boulevard intersection would be minimal, given the fact that the added traffic would have the right-of-way and could be scheduled for other than during the peak hour (CDM, Volume V, 1989).

The difficulty of access to a major highway is expected to be insignificant at Site 40. The travel time to Route 140 is relatively long due to stop signs and turns within the industrial park, however, the traffic volumes are usually relatively low.

Because the area traveled by the route is primarily industrial with some commercial uses along Theodore Rice Boulevard, the disruption of neighborhood character would be insignificant. There would also be no significant impact to traffic flow at Site 40, based on the fact that the roadways are designed for truck traffic, and the existing traffic flow is within capacity of the roadways. Therefore, traffic impacts associated with locating the solids disposal landfill at Site 40 are predicted to be insignificant.

## 6.2 WATER QUALITY IMPACTS

### 6.2.1 Water Quality at WWTP and Sludge Disposal Sites

Criteria were defined to assess the significance of impacts to surface water and groundwater resulting from construction or operation of the proposed facilities. Proximity to floodplain hazard areas was used to determine if the proposed facility would have significant, moderate, or insignificant impacts, as follows:

- location of the WWTP within the floodway of a 100-year floodplain of a riverine system or a coastal high energy hazard zone (V-Zone) was considered as a significant constraint to development;
- location of the WWTP within the 100-year floodplain (A-Zone) and outside riverine floodways and coastal high hazard areas was considered to be a moderate constraint; and
- location of the facility outside of any flood hazard areas was considered an insignificant constraint to development.

Impacts to surface water were rated as significant if the proposed facility would be located within any of the following:

- one-half mile upgradient or 500 feet downgradient (as defined by groundwater flow or surface water drainage) of a surface drinking water supply;
- 250 feet upgradient (as defined by groundwater flow or surface water drainage) of a perennial water course that drains to a surface drinking water supply; or
- 250 feet of a lake or river other than a drinking water supply.

A site not located within any of these areas was considered to have insignificant impacts to surface water.

Potential impacts to groundwater are considered as significant if one of the criteria listed below is met and no mitigation is possible; moderate if one of the criteria is met and mitigation is possible; or insignificant if none of the criteria are met. For the solids disposal facility, a criterion is met if the disposal area is:

- within a Zone II (see Section 5.2.3.4) area of an existing public water supply well;

- within an Interim Wellhead Protection Area (defined as a one-half mile protective radius from the well) or within 15,000 feet upgradient of an existing well for which a Zone II has not been calculated;
- less than 1/2 mile upgradient of a surface drinking water supply (as defined by groundwater flow or surface water drainage);
- less than 250 feet upgradient (as defined by groundwater flow or surface water drainage) of a perennial water drainage that flows to a surface drinking water supply where the disposal area was within 1 mile of the surface water supply;
- less than 500 feet downgradient of a surface water drinking supply (as defined by groundwater flow or surface water drainage);
- within 500 feet of a private drinking water supply well established as an existing or potential supply at the time of excavation;
- over a Sole Source Aquifer; or
- less than four feet above the maximum high groundwater table.

**6.2.1.1 Site 1A.** Of the 79 acres at Site 1A, 54 acres are in the 100-year floodplain (see Figure 5.5-1). Since land that is in the V-Zone designation is considered to have a significant impact on facility siting, all of the land in V-Zone (20 acres) is considered unusable. Therefore, there are 59 usable acres at Site 1A. The remaining area that is within the A-Zone (34 acres) would require mitigation measures such as filling or locating openings (e.g., doorways and ventilation openings) above the 100-year floodplain elevation to reduce risks of flooding.

EPA has determined that the construction of the WWTP at Site 1A would not constitute a "critical action" requiring protection from a storm of 500-year magnitude. A critical action, as defined in Executive Order 11988 is one that, if flooded, would create an added dimension to the flood disaster. Nevertheless, mitigation measures to offset potential flooding impacts are discussed in Section 7.3 of this draft EIS.

There are no surface water bodies on Site 1A, although it is bounded by New Bedford Harbor and Clark's Cove. Any potential groundwater contamination from the WWTP is not considered significant due to the coastal location of Site 1A, the lack of wells near the site, and the low probability of an accidental release of wastewater from the plant.

**6.2.1.2 Site 4A.** Of the 39 acres at Site 4A, 2 acres are in the 100-year floodplain (see Figure 5.5-2). No land at Site 4A is within the V-Zone, leaving 37 usable acres not requiring mitigation at Site 4A. Because the footprint of the WWTP fits into this usable area, impacts due to presence of the floodplain are insignificant for Site 4A.

There are no surface water bodies at Site 4A, though its eastern boundary is New Bedford Harbor. Groundwater contamination is not considered an issue due to the coastal location of the site, the lack of wells near the site, and the low probability of an accidental release of wastewater from the plant.

**6.2.1.3 Site 47.** Twenty-six acres of Site 47 are located within the 100-year floodplain. Although the Federal Emergency Management Agency (FEMA) has not evaluated Site 47 for a floodway determination, based on simple calculations a verification of floodplain size was conducted for Site 47 (CDM, Volume V, 1989). These calculations result in a developable area of 77.5 acres (see Figure 5.5-3).

There are no defined surface water bodies on Site 47, however, the Paskamanset River forms a part of the western boundary of the site, however, the river is greater than 250 ft. from the site (as required 310 CMR 10.04). The Town of Dartmouth maintains two public water supply wells in the river approximately four miles downstream meeting all state criteria for the protection of public water supplies. Based on the criteria used for assessment, impacts to surface waters are considered to be insignificant.

The maximum seasonal high groundwater table is likely to be within 4 feet of the ground surface in all sections of Site 47. Assuming mitigation procedures such as a 4-foot separation between the bottom of the liner and maximum high groundwater level are implemented during construction, moderate impacts to groundwater would occur at Site 47. However, potential water supply sources that were identified could only be developed with risk that they may be contaminated from existing waste disposal operations in the area (CDM, Volume III, 1989).

**6.2.1.4 Site 40.** About 64.2 acres of the site lie in the 100-year floodplain, leaving a developable area of 319 acres. This area allows for development of the site for solids disposal that would not result in significant impacts with respect to the flood hazard criteria.

Site 40 surface water drains into the Acushnet Cedar Swamp which is more than 250 feet from the proposed landfill footprint, therefore a level of buffering capacity is present and no significant impact to surface water bodies is expected. A stream enters the site along the power easement and flows in a southerly direction to enter the Cedar Swamp (CDM, Volume V, 1989). However, no surface bodies in the area of Site 40 drain to a surface drinking water supply. Consequently, no significant surface water impacts would result from the development of Site 40 for solids disposal. Construction and operation procedures will include measures to prevent impacts to surface water bodies in the area. Erosion control measures will be used during construction and the double-lined landfill will include containment dikes to capture runoff during operation.

The maximum seasonal high groundwater table is likely to be within 4 feet of the ground surface in all sections of Site 40. There are two existing 1-million-gallon per day (mgd) wells near the site, a Polaroid well and a DeCor well, 3,200 and 4,000 feet from Site 40, respectively. The wells are privately owned and are used for industrial purposes and not for public drinking water supplies. A portion of Site 40 was identified as being a potential groundwater supply resource that could have a Zone II designation in the State Water Supply Protection Atlas (see Section 5.2) (CDM, Volume III, 1989). However, a moderate impact on groundwater resources is predicted because mitigation is possible.

### 6.2.2 Surface Water Quality at Outfall Sites

Potential long-term changes in water quality under any proposed scenario will be caused by operation of the effluent outfall. Any construction impacts will likely be short-term, and will be caused by the resuspension of sediment-bound contaminants into the water column.

Water quality parameters of particular concern are dissolved oxygen, pH, fecal coliform bacteria, chlorine, and toxics. The anticipated impacts on the marine community caused by the predicted future levels of these parameters are discussed in Section 6.5.3.

**6.2.2.1 Dissolved Oxygen.** The current Massachusetts dissolved oxygen (DO) criterion for Class SA waters is a minimum value of 6 mg/l anywhere in the water column (310 CMR 4.03). Dissolved oxygen deficits at each candidate outfall location have been predicted for average and reasonable worst case hydrodynamic and effluent discharge conditions. Each outfall location was subsequently evaluated according to the frequency and magnitude of predicted violations of the dissolved oxygen standard.

Wastewater effluent contributes chemical and biological substances that, when decomposed by bacteria, reduce dissolved oxygen levels in both the water column and in the sediments. These substances are referred to as BOD (biochemical oxygen demand) and SOD (sediment oxygen demand). The predicted levels of BOD and SOD caused by the discharge of secondary treatment effluent at each location were subtracted from ambient dissolved oxygen concentrations in order to assess criterion violations.

**Predicted Oxygen Depletions.** Modeling results for both outfall alternatives at the Existing Site predict that the BOD component of oxygen depletions in the water column will, under average conditions, reduce dissolved oxygen concentrations in the lower portion of the water column by 0.38 mg/l. Under worst case conditions, the reduction is predicted to be 0.70 mg/l. Similarly, concentrations in bottom waters at the 301(h) Site will be reduced by 0.08 mg/l under average conditions and by 0.14 mg/l under worst case conditions (CDM, Volume IV, 1989).

Depletions in water column dissolved oxygen concentrations caused by SOD result from effluent solids and naturally-occurring organic materials (e.g., dead plankton, zooplankton fecal material) falling to the harbor bottom and being degraded by microorganisms, which utilize dissolved oxygen in the process. At the Existing Site, oxygen depletions in bottom waters resulting from SOD are predicted to be at least 0.42 mg/l under average conditions, and 1.73 mg/l under worst case conditions. The reductions in dissolved oxygen concentrations in bottom waters at the 301(h) Site are predicted to be 0.15 mg/l under average conditions and 0.43 mg/l under worst case conditions (CDM Volume IV, 1989).

The oxygen depletions predicted at the Existing Site may represent minimum values. Data generated for this study indicate that the existing site is nutrient-limited for parts of the year, thus the increased nitrogen loading may slightly increase productivity.

The major impact of a secondary discharge at the existing site is that the predicted areal extent of this high productivity will dramatically increase from the current estimated size of 1 $km^2$ to approximately 6 $km^2$ or two-thirds of the outer harbor (CDM, Volume IV, 1989). The large DO deficit associated with this level of productivity will also increase to encompass the same area.

**Criterion Violations.** Future dissolved oxygen concentrations are directly affected by the total oxygen demand from the water column and the sediments. Under the conditions modeled, the total dissolved oxygen demand at the Existing Site is predicted to be at least 0.80 mg/l under average conditions, and 2.43 mg/l under worst case conditions (Table 6.2-1). The total oxygen demand at the 301(h) Site is predicted to be 0.23 mg/l under average conditions and 0.57 mg/l under worst case conditions (Table 6.2-1).

A criterion violation will occur when the difference between the ambient oxygen concentration and the predicted depletion is less

**TABLE 6.2-1**
**REDUCTIONS IN DISSOLVED OXYGEN (mg/l) IN BOTTOM WATERS DUE TO MATERIALS IN THE WATER COLUMN AND SEDIMENT AT EXISTING OUTFALL AND 301(h) SITES**

| | Existing | | 301(h) | |
|---|---|---|---|---|
| | Average | Worst Case [1] | Average | Worst Case |
| Water Column | 0.38 | 0.70 | 0.08 | 0.14 |
| Sediment | 0.42 | 1.73 | 0.15 | 0.43 |
| Total | 0.80 | 2.43 | 0.23 | 0.57 |
| Ambient Summer Minimum Value[2] | 6.2 | 3.5[3] | 7.0 | 5.9[3] |
| Frequency of Violation of the State Standard | rare | frequent | never | rare |

[1] Worst-case = highly stratified waters with no wind, occurs mostly during summer months

[2] Includes the effects of currently-discharged effluent at the Existing Site

[3] Lowest recorded concentration

Source: CDM, Volume IV, 1989

than 6 mg/l. At the 301(h) Site, for example, given average DO depletions, an ambient DO concentration of at least 6.23 mg/l would be required, and at least 6.57 mg/l given worst case DO depletions, in order to avoid a violation. Since the average minimum summer dissolved oxygen concentration at the 301(h) Site is 7.0 mg/l (CDM, Volume IV, 1989), violations are not expected to occur under average conditions. Since dissolved oxygen concentrations rarely drop below 6.5 mg/l at the 301(h) Site on an annual basis (CDM, Volume IV, 1989) and conditions causing worst case depletions occur only during the summer, the potential for criterion violations under worst case conditions is minimal.

Determining the frequency of criterion violations for the Existing Site is more difficult, because the existing discharge is already impacting DO levels at the site. It is likely that DO levels from a new discharge would be similar to, if not lower than existing levels. Since summer ambient concentrations are currently below 6.0 mg/l a significant part of the time and fall as low as 3.5 mg/l under extreme conditions (CDM, Volume IV, 1989), the potential for violations clearly exists, under both average and worst case conditions. Therefore, the Existing Site presents a greater potential for criterion violations than the 301(h) Site.

Should the outfall be located at the 301(h) Site, dissolved oxygen concentrations at the Existing Site would be expected to improve beyond what is currently observed. The organic pool currently accumulated in the sediments at the Existing Site will eventually be exhausted and primary productivity will return to background levels.

**6.2.2.2 Temperature.** The Massachusetts water quality criteria state that the temperature increase resulting from a discharge should not exceed the recommended limits on the most sensitive water use. The temperature difference between the discharge and ambient waters is not anticipated to exceed 10°C (CDM, Volume IV, 1989). The daily temperature variation observed at both sites is approximately 1°C. The mixing zone temperature difference at both sites will not exceed the natural daily variation, and therefore no adverse temperature impacts are expected.

**6.2.2.3 pH.** pH is a measurement of the acidity or alkalinity level in a substance. The pH value is a result of a complex interaction of numerous biological and chemical activities as well as physical properties of the water column. The Massachusetts standard for pH for Class SA coastal waters ranges from 6.5 to 8.5 (14 CMR 4.03). Changes resulting from a discharge are not allowed to exceed 0.2 units outside the natural range. A small survey in 1983 recorded values of 7.7 to 7.9 at the existing outfall site and 7.9 to 8.3 at the 301(h) site (CDM, 1983).

The impacts of effluent discharge on ambient pH were estimated through the use of a pH-alkalinity model (EPA, 1982). Model results must be viewed conservatively because of the limited amount of available pH data and the model's assumption that the discharge plume will not reach the surface, a situation unlikely to occur in New Bedford's shallow waters. The pH level in receiving waters at the outfall is predicted to be 7.3, within the range of the Massachusetts criterion, but 0.4 units lower than the lowest value observed during the 1983 study. Since the predicted value is probably lower than what will actually occur (due to minimal field data and model assumptions), it is unlikely the effluent discharge would violate the Massachusetts pH standard (CDM, Volume IV, 1989). Because of the greater initial dilution at the 301(h) site, pH levels in the mixing zone should approach ambient levels; no criterion violations are expected.

**6.2.2.4 Fecal Coliform Bacteria.** Fecal coliform bacteria are "indicator" organisms used to screen for the presence of enteric viruses. There are several fecal coliform standards. The standard for direct human contact with the water (e.g., swimming) is 200 cells per 100 ml. The shellfish standard is 14 cells per 100 ml.

No violations of the direct contact standard are expected to occur at either site since the fecal coliform in the discharge will not exceed 200 cells per 100 ml under normal operating conditions. Violations of the shellfish standard are expected to occur at the existing site under conditions of maximum daily bacteria concentrations for maximum secondary effluent flows. The areal extent of these violations for the rehabilitation alternative ranges from 75,000 $m^2$ to 100,000 $m^2$ (0.03 $km^2$, 0.5 $km^2$, respectively), depending on the decay rate of the bacteria (CDM, Volume IV, 1989). Violations would also occur at the existing site with a diffuser, although the areal extent of these violations would be much less. No violations of the shellfish standard are expected to occur at the 301(h) site.

**6.2.2.5 Chlorine.** Chlorine is used to disinfect the effluent before discharge. A certain amount of chlorine will remain dissolved in the effluent as it mixes with ambient waters, depending on such factors as temperature, pH, distance from the outfall, and whether a dechlorination process is used. EPA's guidelines indicate that no adverse effects on marine organisms should occur if the 4-day average concentration remains below 0.0075 mg/l (chronic criterion) and the one-hour average is less than 0.013 mg/l (acute criterion) (both over a three-year period).

Dechlorination lessens the concentration of residual (remaining) chlorine. However, there are currently no plans to dechlorinate the effluent. Without dechlorination, chlorine residuals are expected to be between 0.5 and 1.0 mg/l in the effluent; given the low levels of initial dilution for the rehabilitation alternative, the EPA chronic criterion will not be met at the edge of the mixing zone (CDM, Volume IV, 1989). The existing site with a diffuser will not meet the chronic criterion the majority of the time. The longer outfall at the 301(h) Site will provide longer contact time for the chlorine, thus reducing the dosing required at the plant and resulting in lower chlorine residuals at the end of the pipe. The substantially greater levels of initial dilution at the 301(h) Site and lower chlorine residual concentrations will most likely enable compliance with the criterion at the edge of the mixing zone.

**6.2.2.6 Toxic Substances.** Concentrations of priority compounds at the edge of the mixing zone were determined in order to evaluate compliance with EPA water quality criteria. The mixing zone is defined at the "allocated impact zone," or zone of initial dilution (ZID), and is represented by the volume of ambient sea water entrained up to the point where the effluent plume reaches either the water surface or its trapping depth (Figure 6.2-1); the process of initial mixing occurs within this volume. EPA water quality criteria must be met at the edge of this zone.

Concentrations at the edge of the mixing zone are made up of the following components: ambient concentrations, concentrations due to other sources (such as point source dischargers), background buildup concentrations, and concentrations resulting from the initial dilution of the effluent plume.

Four types of EPA water quality criteria are applicable to these analyses, two for the protection of aquatic life and two for the protection of human health. The criterion maximum concentration (CMC), the acute toxicity criterion for aquatic life, is the concentration of a constituent not to be exceeded on more than one day in a three year period. Similarly, the criterion continuous concentration (CCC) is the concentration not to be exceeded more than four consecutive days in a three year period, and reflects the impacts of chronic exposure to a constituent. The human health criteria describe the likelihood of developing cancer due to long term ingestion of seafood containing a carcinogenic substance. The $10^{-5}$ risk criterion is the concentration that will allow 1 incremental cancer case in 100,000 people due to long-term exposure, while the $10^{-6}$ risk criterion is the concentration that will allow 1 incremental cancer case in 1,000,000 people.

Predicted exceedances of these criteria are summarized in Table 6.2-2. Copper, cyanide, and DDT exceed CCC or CMC criteria for the existing site with diffuser alternative; arsenic and DDT exceed human health criteria at both risk levels. Beryllium exceeds the human health criteria at the $10^{-6}$ level. For the rehabilitation alternative, copper, cyanide, bis(2-ethylhexyl)

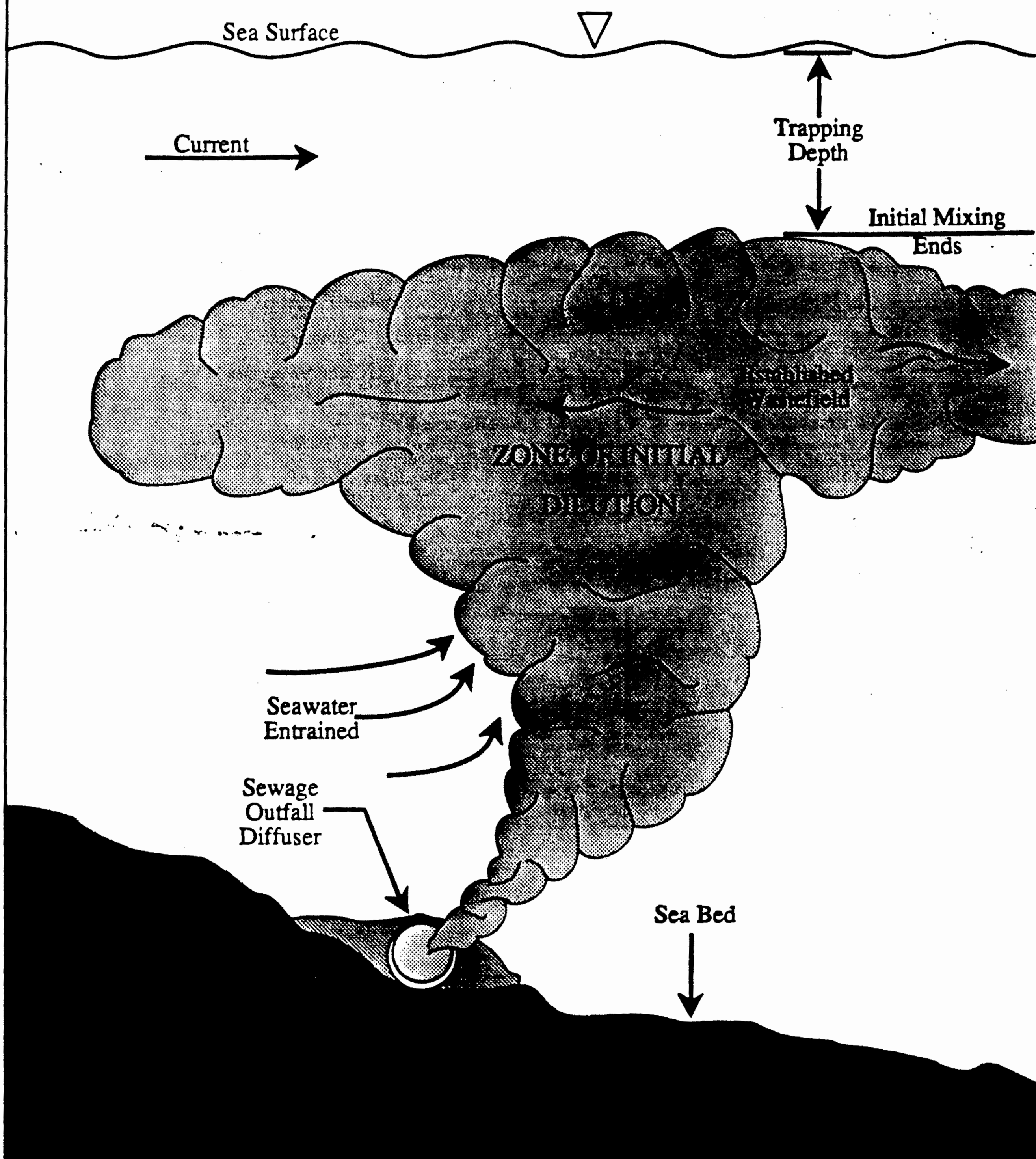



FIGURE 6.2-1
SCHEMATIC DEFINITION
OF THE MIXING ZONE

Adapted from CDM, 1989

**TABLE 6.2-2**
**SUMMARY OF PREDICTED EXCEEDANCES OF EPA WATER QUALITY CRITERIA IN THE MIXING ZONE UNDER WORST CASE ASSUMPTIONS.[1]**

| CONSTITUENT | CRITERION TYPE[2] | CRITERION CONC. (ng/l) | PREDICTED CONC. (ng/l) | RATIO OF PREDICTED CONC. TO CRITERION CONCENTRATION |
|---|---|---|---|---|
| <u>Existing Site with Diffuser</u> | | | | |
| Copper | CMC | 2,900 | 3,721 | 1.28 |
| | CCC | 2,900 | 3,357 | 1.16 |
| Cyanide | CCC | 1,000 | 1,092 | 1.09 |
| 4,4'-DDT | CCC | 1.0 | - | - |
| | $10^{-6}$ | 0.024 | 0.310 | 12.92 |
| | $10^{-6}$ | 0.24 | 8.310 | 1.29 |
| Arsenic | $10^{-6}$ | 18 | 1062 | 59 |
| | $10^{-5}$ | 180 | 1062 | 5.9 |
| Beryllium | $10^{-6}$ | 117 | 239 | 2.04 |
| <u>Rehabilitation Alternative</u> | | | | |
| Copper | CMC | 2,900 | 7,078 | 2.44 |
| | CCC | 2,900 | 7,078 | 2.44 |
| Cyanide | CMC | 1,000 | 1,757 | 1.76 |
| | CCC | 1,000 | 1,757 | 1.76 |
| bis(2-ethylhexyl) phthalate | CCC | 3,400 | 3,486 | 1.025 |
| Lead | CCC | 5,600 | 8,416 | 1.50 |
| Mercury | CCC | 25 | 36 | 1.44 |
| Nickel | CCC | 8,300 | 14,125 | 1.70 |
| 4,4'-DDT | CCC | 1.0 | - | - |
| | $10^{-6}$ | 0.024 | 0.550 | 22.92 |
| | $10^{-5}$ | 0.24 | 0.550 | 2.29 |

TABLE 6.2-2 (CONTINUED)
SUMMARY OF PREDICTED EXCEEDANCES OF EPA WATER QUALITY CRITERIA IN THE MIXING ZONE UNDER WORST CASE ASSUMPTIONS.[1]

| CONSTITUENT | CRITERION TYPE[2] | CRITERION CONC. (ng/l) | PREDICTED CONC. (ng/l) | RATIO OF PREDICTED CONC. TO CRITERION CONCENTRATION |
|---|---|---|---|---|
| Arsenic | $10^{-6}$ | 18 | 160 | 64.44 |
| | $10^{-5}$ | 180 | 1160 | 6.44 |
| Beryllium | $10^{-6}$ | 117 | 687 | 5.87 |
| <u>301(h) Site</u> | | | | |
| 4,4'-DDT | CCC | 1.0 | - | - |
| | $10^{-6}$ | 0.024 | 0.066 | 2.75 |
| Arsenic | $10^{-6}$ | 18 | 1026 | 57.0 |
| | $10^{-5}$ | 180 | 1026 | 5.70 |

[1] Modeled for the discharge of 75 mgd of secondary effluent. From Table 7-36, CDM, Volume IV, 1989 and supplemental data submitted by CDM, October 16, 1989.

[2]CMC = criterion maximum concentration for the protection of aquatic life against acute exposure.

CCC = criterion continuous concentration for the protection of aquatic life against chronic exposure.

$10^{-6}$ = human health criterion limiting carcinogenicity risk to one in a million, given a lifetime exposure.

$10^{-5}$ = human health criterion limiting carcinogenicity risk to one in one hundred thousand, given a life time exposure.

phthalate, lead, mercury, nickel, and DDT exceed one or both of the aquatic toxicity criteria, while DDT and arsenic exceed human health criteria at both risk levels. Beryllium exceeds the human health criteria at the $10^{-6}$ level. At the 301(h) Site, DDT exceeds the CCC and the $10^{-6}$ human health criterion, and arsenic exceeds human health criteria at both risk levels.

In all, aquatic life criteria are exceeded for three compounds for the existing site with diffuser alternative, for seven compounds for the rehabilitation alternative, and only one compound for the 301(h) site. Similarly, human health criteria are exceeded for three compounds for both of the existing site options, and for two compounds for the 301(h) Site option.

Exceedances of the greatest magnitude occur for the $10^{-6}$ risk criterion for arsenic for each of the alternatives (approximately 60:1). Ambient concentrations of arsenic already exceed the criteria at both outfall locations. Otherwise exceedances are generally on the order of 2 to 6 times the criterion concentrations.

**6.2.2.7 Nutrients.** Wastewater discharges have been shown to cause nutrient enrichment in marine waters (Mearns et al., 1982; Malone, 1982; Oviatt et al.; 1987). Moderate increases in nutrients may result in stimulation of the entire marine community by increasing phytoplankton growth, respiration, secondary production and eventually density of predators such as fish. However, above certain nutrient levels the stimulation cannot be assimilated by the marine systems. Above this critical level, significant shifts in species composition or even excessive oxygen demand and anoxia may occur (Mearns et al., 1982).

The secondary effluent is expected to discharge approximately 2270 kg/day of nitrogen (as Total Kjeldahl Nitrogen). This represents an estimated increase in nitrogen of 17% over the current primary effluent discharge. For the purpose of this analysis of nutrient enrichment, total nitrogen concentrations in the effluent have been used to determine if the water column is changed or degraded by changes in primary productivity due to added nutrients. Nitrogen threshold values were derived from long-term marine system nutrient addition studies using multiple dose levels (Oviatt et al., 1986; Frithsen et al., 1985). Degraded conditions are defined as having water column nitrogen concentrations greater than 0.5 mg/l and changed conditions are defined as having nitrogen concentrations between 0.14 and 0.5 mg/l (EPA, 1988b). By utilizing nitrogen loadings from the average flow (30 mgd in DEIR, 34 mgd with CSO flow) and initial dilution values, and by treating nitrogen as a conservative constituent, it is possible to predict water column nitrogen concentrations which would result in degraded or changed water quality within the mixing zone. For the rehabilitation alternative, the concentrations dramatically exceed the degraded threshold during even the best possible initial dilution. For the existing site with a diffuser, the concentrations are lower, but still exceed the degraded threshold. The initial dilution varies greatly at the 301(h) Site, under worst case conditions the predicted concentrations slightly exceed the degraded value. The majority of the time, the initial dilution is sufficient to place the discharge in the changed category.

### 6.2.3 Sediments

**6.2.3.1 Sediment Accumulation.** Sediment accumulation from the effluent is estimated to be 46 $g/m^2/yr$ at the existing outfall site, 2 percent of the natural sedimentation in that area (3000 $g/m^2/yr$). At the 301(h) Site, sediment accumulation from the effluent is expected to be 33 $g/m^2/yr$, 4 percent of the background accumulation rate (780 $g/m^2/yr$). This analysis assumes the discharge of 120 mgd of blended effluent (75 mgd secondary effluent, 45 mgd primary effluent) so the actual accumulation using only secondary effluent will be less. Organic matter is conservatively estimated to increase by approximately 9 percent at the 301(h) Site and 4 percent at the existing outfall site (CDM, Volume IV, 1989).

**6.2.3.2 Toxic Substances.** Effluent discharge will increase the concentrations of toxic substances in the sediments. The concentrations are estimated by determining the concentration in the effluent, the deposition rate, and the amount of dilution. Under the rehabilitation alternative, additional high concentrations of contaminants will be added to the sediments surrounding the outfall due to the disposal of the accumulated grit within the outfall pipe. Table 6.2-3 shows the concentrations of contaminants in the grit. Table 6.2-4 shows the existing concentrations of various toxics and the additional amount predicted from effluent discharge. Again, the values estimated were using a blended effluent, so actual concentrations of toxic chemicals ending up in the sediments from the discharge will be less. With the exception of arsenic, existing sediment concentrations of toxic chemicals were higher at the existing site than at the 301(h) Site.

Because of a lower deposition rate at the 301(h) Site, effluent material is predicted to make up a larger proportion of settlable solids, resulting in the addition of higher concentrations of toxic substances than at the existing outfall site. The amounts expected from the effluent are generally one to two orders of magnitude lower than existing concentrations in the sediments. In other words, assuming no loss from the sediments, toxics in the effluent would increase overall sediment concentrations by a total of 0.4 percent at the existing outfall site and 14 percent at the 301(h) Site. However, the total levels of toxic compounds

TABLE 6.2-3

CONTAMINANTS IN OUTFALL SEDIMENT DEPOSITS

| Contaminant | 60-inch Outfall |
|---|---|
| antimony | <2.5 - 4.6 |
| arsenic | 3.7 - 3.9 |
| beryllium | <1.0 |
| cadmium | 160 - 350 |
| chromium | 410 - 660 |
| copper | 680 - 810 |
| lead | 160 - 170 |
| mercury | .68 - 1.8 |
| nickel | 470 - 520 |
| selenium | <1.0 - <2.0 |
| silver | <2.0 |
| thallium | <1.0 |
| zinc | 1100 - 1300 |
| benzene | <0.01 - 0.25 |
| 1,4-dichlorobenzene | <0.01 - <0.1 |
| ethylbenzene | <0.01 - 0.19 |
| methylene chloride | <0.01 - 2.3 |
| toluene | <0.01 - 0.14 |
| boron | 410 - 610 |
| molybdenum | 5.9 - 19 |
| Arochlor 1016 | <2.0 - <5.0 |
| Arochlor 1221 | <2.0 - <5.0 |
| Arochlor 1232 | <2.0 - <5.0 |
| Arochlor 1242 | <5.0 - 5.7 |
| Arochlor 1248 | <2.0 - <5.0 |
| Arochlor 1254 | 3.4 - <5.0 |
| Arochlor 1260 | <2.0 - <5.0 |

NOTE: All concentrations in mg/kg

Source: CDM, Volume IV, 1989.

**TABLE 6.2-4**
**ESTIMATED CONCENTRATIONS OF TOXIC COMPOUNDS IN SEDIMENTS RESULTING FROM BLENDED EFFLUENT AT TWO CANDIDATE OUTFALL SITES**

| | Existing Outfall Site | | 301(h) Outfall Site | | | |
|---|---|---|---|---|---|---|
| Compound | Additional Concentration Resulting from Effluent [1] (ppm) | Concentration Currently in Sediments [2] (ppm) | Additional Concentration Resulting from Effluent [1] (ppm) | Concentration Currently in Sediments [2] (ppm) | Concentration below which toxic effects do not occur (ppm) | Literature Source |
| Arsenic | 0.02 | 9.9 | 0.04 | 12.3 | 128 | Peddicord, 1980 |
| Beryllium | 0.3 | - | 0.9 | - | - | - |
| Chromium | 1.9 | 332.5 | 5.1 | 31.8 | 720 | Swartz et al., 1986 |
| Copper | 1.8[3] | 786.7 | 4.9 | 15.4 | 547 | Swartz et al., 1986 |
| Lead | 0.8 | 520 | 2.3 | 34.5 | 252 | Swartz et al, 1986 |
| Mercury | 0 | 2.6 | 0 | 0.03 | 1.47;6 | Peddicord, 1980; Calabrese et al., 1982 |

**TABLE 6.2-4 (CONTINUED)**
**ESTIMATED CONCENTRATIONS OF TOXIC COMPOUNDS IN SEDIMENTS RESULTING FROM BLENDED EFFLUENT AT TWO CANDIDATE OUTFALL SITES.**

| | Existing Outfall Site | | 301(h) Outfall Site | | | |
|---|---|---|---|---|---|---|
| Compound | Additional Concentration Resulting from Effluent [2] (ppm) | Concentration Currently in Sediments [3] (ppm) | Additional Concentration Resulting from Effluent [2] (ppm) | Concentration Currently in Sediments [3] (ppm) | Concentration below which toxic effects do not occur (ppm) | Literature Source |
| Nickel | 0.9 | 33.6 | 2.6 | 8.3 | 85 | Swartz et al., 1986 |
| Silver | 0.1 | - | 0.3 | - | 6 - 10 | Calabrese et al., 1982 |
| Zinc | 3.2 | 860 | 9.0 | 41.8 | >709 | Swartz et al., 1986 |
| PCBs[4] | 0.02 | 17.9 | 0.04 | ND | >20;5.2 | Reed et al., 1982; Rubenstein et al., 1984 |

[1] Source: Table 8-1, CDM, Volume IV, 1989 (Stations NB3, S1, S2)

[2] Source: Table 4-6, CDM, Volume IV, 1989 (Stations S8 and S9)

[3] Erroneously reported as 11.7 in CDM, Volume IV, 1989

[4] EPA standard (1.0 ppm) available only for PCBs

ND = Not Detected
Source: CDM, Volume IV, 1989 and EPA, 1988b.

would be higher at the existing outfall site (with or without effluent) than at the 301(h) Site.

## 6.3 AIR QUALITY AND ODOR IMPACTS

This section presents an evaluation of potential impacts of the proposed facilities on the ambient air quality of the surrounding environment. In addition, impacts from air emissions were evaluated because of their potential to cause odors or be a health hazard.

The standards of measurement for assessing the potential air quality impacts from the proposed facilities are:

- o the National Ambient Air Quality Standards (NAAQS) and Massachusetts Ambient Air Quality Standards (MAAQS) for carbon monoxide, nitrogen oxides, ozone, particulate matter, sulfur dioxide, and lead;
- o DEP Allowable Ambient Levels (AALs) and threshold effects limits (TELs) for toxic air pollutants; and
- o Odor Threshold Levels.

Criteria used to evaluate the impacts as insignificant, moderate, or significant are defined as follows:

- o impacts are considered significant if predicted pollutant concentrations would be greater than the air quality standards or guidelines and could not be mitigated using the best available control technology;
- o impacts are considered moderate if predicted pollutant concentrations would be greater than the air quality standards or guidelines, but could be mitigated using best available control technology; and
- o an insignificant impact results if it is predicted that the facility would meet all of the applicable air quality standards or guidelines.

The proposed WWTP could be a major emitter of VOCs. Odors emanating from a typical WWTP include a variety of compounds including hydrogen sulfide ($H_2S$), which was identified as the primary odorous compound present. Several dispersion models were used to evaluate the impact of odors and toxics potentially emitted (CDM, Volume II, 1989). The Industrial Source Complex (ISC) model was used to predict odor and air toxics impacts from point and area sources for averaging periods equal to or greater than one hour. The COMPLEX I model was used to predict air toxics impacts from point sources in areas with elevated terrain.

The INPUFF model was used to predict impacts from odor sources for averaging times less than one hour. The MISRA model was used to assess the effect of sea breeze fumigation on point sources.

The ISC model predicts downwind concentrations based on prevailing meteorological conditions and pollutant emission rates from the various stacks of the WWTP. ISC was run using 5 years of meteorological data obtained from the Providence, Rhode Island airport (surface observations) and Chatham, MA (upper air data). Maximum downwind concentrations were predicted for 1-hour, 24-hour, and annual averaging periods. Both VOCs and odors were modeled using this approach (see CDM, Volume III, Appendix G, and CDM, Volume V, 1989).

At the proposed solids disposal facilities, the material that is disposed of at the landfill will be stabilized with lime or via the CHEMFIX process at the WWTP. The material should therefore not be a VOC emission source (CDM, Volume III, 1989). The primary concern at the facilities will be the generation of fugitive dust from the landfilling operations (e.g., trucks travelling over dirt roads and earthmoving activities). In addition, ammonia could be emitted from chemically fixed and lime-stabilized sludge during the handling of the material. However, with proper landfill operation, periodic covering of the filled material should prevent the release of any emissions.

### 6.3.1 Site 1A

The New Bedford area is designated as "not in attainment" for the ozone ambient air quality standard and the proposed facility has the potential to emit greater than 100 tons-per-year (tpy) of VOCs. Therefore, the lowest achievable emission rate (LAER) with emission controls for VOCs will be required, and emission offsets will be necessary if total emissions exceed 100 tpy. An emission offset is defined as a legally enforceable reduction in the rate of actual emissions from an existing facility (as approved by the Massachusetts DEP) to offset that increase in emissions of air contaminants from a new or modified source. Any major new stationary source, such as a WWTP, must obtain a reduction of VOC emissions from an existing source, as well as obtain the lowest achievable emission rate (LAER) in order to begin operation. State regulations specify requirements for emission offsets and non-attainment reviews and establish an equation to determine the allowable offset dependent upon distance between the new and existing sources and other conditions.

The air quality impacts at Site 1A were predicted for the area in and around Taber Park. The combined impacts of all emissions stacks were modeled and the predicted concentrations for all compounds were less than the applicable AAL or TEL. The modeled concentration which most closely approached the limit was for

Tetrachloroethylene, at 85 percent of the AAL (CDM, Volume V, 1989). These results are presented in Tables 6.3-1 and 6.3-2.

Odor impacts were evaluated by comparing highest 1-hour predicted concentrations to the odor thresholds for various potentially odorous compounds. Tables 6.3-3 and 6.3-4 present a comparison of predicted concentrations to the odor thresholds. Predicted concentrations of VOC's were all less than one tenth their Odor Threshold Concentration (OTC). Concentrations of hydrogen sulfide and ammonia emitted from the sludge processing stack were also predicted to be below their respective odor thresholds. Therefore, predicted odor impacts are considered insignificant. However, the potential combined effects of emissions of odorous compounds from numerous stacks have not been evaluated. Overall, the long-term air quality and odor impacts from siting the WWTP at Site 1A are predicted to be moderate.

Construction activities at the site will also impact the surrounding community. Fugitive dust will be generated from the demolition, earthmoving, stone crushing, loam spreading, and truck traffic on the site. The particulate matter generated from these activities is not contaminated, thus it is appropriate to compare predicted concentrations to the $PM_{10}$ standard. The $PM_{10}$ concentrations are predicted to exceed the 24-hour standard (150 $ug/m^3$) within 1,000 feet of the active construction area under certain meteorological conditions (CDM, Volume V, 1989). Wind erosion could also contribute to ambient particle levels also, however, these impacts are only important with sustained winds greater than 15 mph. Dust suppressants could be used to reduce fugitive dust on main truck haulage routes (CDM, Volume V, 1989).

### 6.3.2 Site 4A

Site 4A is also within the "non-attainment" area for ozone, therefore the lowest achievable emission rate (LAER) for VOC would be required and emission offsets may be necessary as described above for Site 1A. The predicted ground-level stack concentrations for emissions from the WWTP at Site 4A are less than the AALs and TELs, as shown in Table 6.3-5. Predicted odor impacts from the facility at Site 4A are less than the Odor Threshold Concentrations for VOC's, hydrogen sulfide, and ammonia as shown in Tables 6.3-3 and 6.3-4. Again, however, potential odor impacts from combined sources have not been evaluated. Overall, the air quality and odor impacts from locating the WWTP at Site 4A are predicted to be moderate.

### 6.3.3 Site 47

Emissions of VOC's are expected to be negligible because the sludge will be fixed at the WWTP prior to disposal. The lime stabilization and chemical fixation processes have been shown to reduce or prevent odorous emissions such as ammonia (CDM, Volume

**TABLE 6.3-1**
**SITE 1A, AT SITE**
**COMBINED MAXIMUM GROUND-LEVEL CONCENTRATIONS [1]**

| Compound | Averaging Time | Highest Combined Concentration in Five-Year Period (ug/m$^3$) | DEP Guideline (24-Hour TEL Annual AAL) (ug/m$^3$) | Highest Combined Concentration as % of TEL or AAL |
|---|---|---|---|---|
| Acetone | 24-Hour | 3.80 | 160.54 | 2.37% |
| | Annual | 0.104 | 160.54 | 0.06% |
| Benzene | 24-Hour | 0.212 | 1.74 | 12.21% |
| | Annual | 0.00855 | 0.12 | 7.12% |
| 2-Butanone | 24-Hour | 1.94 | 32.07 | 6.06% |
| | Annual | 0.0211 | 32.07 | 0.07% |
| Chloroform | 24-Hour | 0.234 | 132.76 | 0.18% |
| | Annual | 0.0133 | 0.04 | 33.18% |
| 1,2-Dichloro-ethane | 24-Hour | 0.270 | 11.01 | 2.45% |
| | Annual | 0.00945 | 0.04 | 23.63% |
| 1,2-Dichloro-ethene | 24-Hour | 0.109 | 215.62 | 0.05% |
| | Annual | 0.00380 | 107.81 | 0.00% |
| Ethylbenzene | 24-Hour | 0.414 | 118.04 | 0.35% |
| | Annual | 0.0114 | 118.04 | 0.01% |
| 4-Methyl, 2-Pentanone | 24-Hour | 0.359 | 55.7 | 0.64% |
| | Annual | 0.0101 | 55.7 | 0.02% |
| Methylene Chloride | 24-Hour | 0.277 | 9.45 | 2.93% |
| | Annual | 0.00894 | 0.24 | 3.73% |
| 1,1,2,2-Tetra-chloroethane | 24-Hour | 0.152 | 18.67 | 0.82% |
| | Annual | 0.00458 | 0.02 | 22.89% |
| Tetrachloro-ethylene | 24-Hour | 0.582 | 922.18 | 0.06% |
| | Annual | 0.017 | 0.02 | 85.00% |
| Toluene | 24-Hour | 2.05 | 10.24 | 20.02% |
| | Annual | 0.0632 | 10.24 | 0.62% |
| 1,1,1,-Tri-chloroethane | 24-Hour | 0.564 | 1038.37 | 0.05% |
| | Annual | 0.0174 | 1038.37 | 0.00% |
| Trichloro-ethylene | 24-Hour | 0.419 | 36.52 | 1.15% |
| | Annual | 0.0214 | 0.61 | 3.50% |
| Total Xylenes | 24-Hour | 1.63 | 11.8 | 13.85% |
| | Annual | 0.156 | 11.8 | 1.33% |

[1] Concentrations are for ambient air use in aeration tanks, and for VOC emissions from Stack Nos. 4 and 6 being 95% controlled.

Source: CDM, Volume V, 1989.

TABLE 6.3-2
SITE 1A, BEYOND SITE BOUNDARY
COMBINED MAXIMUM GROUND-LEVEL CONCENTRATIONS[1]

| Compound | Averaging Time | Highest Combined Concentration in Five-Year Period ($ug/m^3$) | DEP Guideline (24-Hour TEL) (Annual AAL) ($ug/m^3$) | Highest Combined Concentration as % of TEL or AAL |
|---|---|---|---|---|
| Acetone | 24-Hour | 2.15 | 160.54 | 1.34% |
| | Annual | 0.0512 | 160.54 | 0.03% |
| Benzene | 24-Hour | 0.154 | 1.74 | 8.86% |
| | Annual | 0.00521 | 0.12 | 4.34% |
| 2-Butanone | 24-Hour | 1.10 | 32.07 | 3.43% |
| | Annual | 0.0104 | 32.07 | 0.03% |
| Chloroform | 24-Hour | 0.162 | 132.76 | 0.12% |
| | Annual | 0.00775 | 0.04 | 19.38% |
| 1,2-Dichloro-ethane | 24-Hour | 0.213 | 11.01 | 1.94% |
| | Annual | 0.00592 | 0.04 | 14.81% |
| 1,2-Dichloro-ethene | 24-Hour | 0.0621 | 215.62 | 0.03% |
| | Annual | 0.00194 | 107.81 | 0.00% |
| Ethylbenzene | 24-Hour | 0.286 | 118.04 | 0.24% |
| | Annual | 0.00676 | 118.04 | 0.01% |
| 4-Methyl, 2-Pentanone | 24-Hour | 0.275 | 55.7 | 0.49% |
| | Annual | 0.00681 | 55.7 | 0.01% |
| Methylene Chloride | 24-Hour | 0.204 | 9.45 | 2.15% |
| | Annual | 0.00541 | 0.24 | 2.26% |
| 1,1,2,2-Tetra-chloroethane | 24-Hour | 0.0974 | 18.67 | 0.52% |
| | Annual | 0.00254 | 0.02 | 12.72% |
| Tetrachloro-ethylene | 24-Hour | 0.427 | 922.18 | 0.05% |
| | Annual | 0.0144 | 0.02 | 71.79% |
| Toluene | 24-Hour | 1.49 | 10.24 | 14.51% |
| | Annual | 0.0381 | 10.24 | 0.37% |
| 1,1,1-Tri-chloroethane | 24-Hour | 0.397 | 1038.37 | 0.04% |
| | Annual | 0.0103 | 1038.37 | 0.00% |
| Trichloro-ethylene | 24-Hour | 0.300 | 36.52 | 0.82% |
| | Annual | 0.0128 | 0.61 | 2.10% |
| Total Xylenes | 24-Hour | 0.956 | 11.8 | 8.10% |
| | Annual | 0.0751 | 11.8 | 0.64% |

[1] Concentrations are for ambient air use in aeration tanks, and for VOC emissions from Stack Nos. 4 and 6 being 95% controlled.

Source: CDM, Volume V, 1989.

## TABLE 6.3-3

## MAXIMUM 1-HOUR ORGANIC ODOR CONCENTRATIONS FROM THE NEW BEDFORD WWTP

| Compound | Odor Threshold Concentration ($ug/m^3$) | Maximum Cumulative 1-Hour Concentrations: Site 1A, At Site ($ug/m^3$) | Site 1A, At Site (% of OTC) | Site 1A, Beyond Site ($ug/m^3$) | Site 1A, Beyond Site (% of OTC) | Site 4A, Beyond Site ($ug/m^3$) | Site 4A, Beyond Site (% of OTC) |
|---|---|---|---|---|---|---|---|
| Acetone | 20,700 | 28.1 | 0.1% | 11.6 | 0.1% | 7.74 | <0.1% |
| Benzene | 14,900 | 1.47 | <0.1% | 0.815 | <0.1% | 0.899 | <0.1% |
| 2-Butanone | 350 | 14.3 | 4.1% | 5.91 | 1.7% | 3.90 | 1.1% |
| Chloroform | 1,000,000 | 1.65 | <0.1% | 0.858 | <0.1% | 0.859 | <0.1% |
| 1,2-Dichloroethene | 341 | 0.833 | 0.2% | 0.349 | 0.1% | 0.259 | 0.1% |
| Ethylbenzene | 615,000 | 3.00 | <0.1% | 1.53 | <0.1% | 1.55 | <0.1% |
| Methylene Chloride | 743,400 | 1.87 | <0.1% | 1.06 | <0.1% | 1.16 | <0.1% |
| 4-Methyl 2-Pentanone | 410 | 2.32 | 0.6% | 1.40 | 0.3% | 1.40 | 0.3% |
| 1,1,2,2-Tetrachloro-ethane | 3,480 | 1.09 | <0.1% | 0.509 | <0.1% | 0.409 | <0.1% |
| Tetrachloroethylene | 34,400 | 4.11 | <0.1% | 2.31 | <0.1% | 2.73 | <0.1% |
| Toluene | 640 | 14.3 | 2.2% | 7.89 | 1.2% | 8.79 | 1.4% |
| Total xylenes | 220 | 12.4 | 5.6% | 5.29 | 2.4% | 4.04 | 0.1% |

NOTES

<u>Maximum cumulative impact</u> is conservatively assumed to be the unpaired-in-space-and-time sum of the maximum 1-hour ground-level impacts for each of the VOC emitting stacks.

OTC = Odor Threshold Concentration

Source: CDM, Volume V, 1989

TABLE 6.3-4

MAXIMUM 1-HOUR INORGANIC ODOR CONCENTRATIONS
FROM THE NEW BEDFORD WWTP

| | | Site 1A | | | | Site 4A | |
|---|---|---|---|---|---|---|---|
| | | At Site | | Beyond Site | | Beyond Site | |
| Pollutant | Stack Number | (ug/m$^3$) | (% of OTC) | (ug/m$^3$) | (% of OTC) | (ug/m$^3$) | (% of OTC) |
| Hydrogen Sulfide | 1 | 0.62 | 95% | 0.22 | 34% | 0.43 | 63% |
| | 3 | 0.36 | 55% | 0.21 | 32% | 0.13 | 20% |
| | 4 | 0.15 | 23% | 0.65 | 7.5% | NA | NA |
| | 6 | 0.29 | 45% | 0.20 | 31% | 0.14 | 22% |
| | 7 | 0.081 | 12% | 0.066 | 10% | 0.11 | 17% |
| | 19 | 0.069 | 11% | 0.039 | 6% | 0.047 | 7% |
| Ammonia | 19 | 0.86 | 3.3% | 0.49 | 1.9% | 0.59 | 2.3% |

NOTES

OTC = Odor Threshold Concentration
Ammonia Odor Threshold Concentration = 26 ug/m$^3$
Hydrogen Sulfide Odor Threshold Concentration = 0.65 ug/m$^3$

Source: CDM, Volume V, 1989

TABLE 6.3-5
SITE 4A
COMBINED GROUND-LEVEL CONCENTRATIONS FOR ALL STACKS[1]

| Compound | Averaging Time | Highest Combined Concentration in Five-Year Period (ug/m$^3$) | DEQE Guideline (24-Hour TEL) (Annual AAL) (ug/m$^3$) | Highest Combined Concentration as % of TEL or AAL |
|---|---|---|---|---|
| Acetone | 24-Hour | 1.38 | 160.54 | 0.86% |
| | Annual | 0.0436 | 160.54 | 0.03% |
| Benzene | 24-Hour | 0.195 | 1.74 | 11.23% |
| | Annual | 0.00667 | 0.12 | 5.55% |
| 2-Butanone | 24-Hour | 0.704 | 32.07 | 2.20% |
| | Annual | 0.00891 | 32.07 | 0.03% |
| Chloroform | 24-Hour | 0.177 | 132.76 | 0.13% |
| | Annual | 0.00935 | 0.04 | 23.38 |
| 1,2-Dichloro- ethane | 24-Hour | 0.293 | 11.01 | 2.66% |
| | Annual | 0.00773 | 0.04 | 19.32% |
| 1,2-Dichloro- ethene | 24-Hour | 0.0445 | 215.62 | 0.02% |
| | Annual | 0.00183 | 107.81 | 0.00% |
| Ethylbenzene | 24-Hour | 0.319 | 118.04 | 0.27% |
| | Annual | 0.00816 | 118.04 | 0.01% |
| 4-Methyl, 2-Pentanone | 24-Hour | 0.302 | 55.7 | 0.54% |
| | Annual | 0.00744 | 55.7 | 0.01% |
| Methylene Chloride | 24-Hour | 0.0252 | 9.45 | 2.66% |
| | Annual | 0.00675 | 0.24 | 2.81% |
| 1,1,2,2-Tetra- chloroethane | 24-Hour | 0.0748 | 18.67 | 0.40% |
| | Annual | 0.00265 | 0.02 | 13.26% |
| Tetrachloro- ethene | 24-Hour | 0.600 | 922.18 | 0.07% |
| | Annual | 0.0194 | 0.02 | 96.97% |
| Toluene | 24-Hour | 1.92 | 10.24 | 18.74% |
| | Annual | 0.049 | 10.24 | 0.48% |
| 1,1,1-Tri- chloroethane | 24-Hour | 0.495 | 1038.37 | 0.05% |
| | Annual | 0.0131 | 1038.37 | 0.00% |
| Trichloro- ethylene | 24-Hour | 0.380 | 36.52 | 1.04% |
| | Annual | 0.0165 | 0.61 | 2.70% |
| Total Xylenes | 24-Hour | 0.674 | 11.8 | 5.71% |
| | Annual | 0.0613 | 11.8 | 0.52% |

[1] These concentrations are for ambient air use in aeration tanks, and for VOC emissions from Stack Nos. 4 and 6 being 95% controlled.

Source: CDM, Volume V, 1989.

V, 1989). Furthermore, the landfilled sludge material would be covered with soil daily.

Gases could be generated in the landfill due to anaerobic decay of the sludge over long periods of time (5 to 10 years). These gases could contain odorous compounds such as hydrogen sulfide. This potential source of odor impacts is, however, mitigable by maintaining the integrity of the landfill surface or installing a passive gas collection system (CDM, Volume V, 1989).

Overall, the use of Site 47 as a solids disposal facility is not predicted to result in significant air quality or odor impacts.

### 6.3.4 Site 40

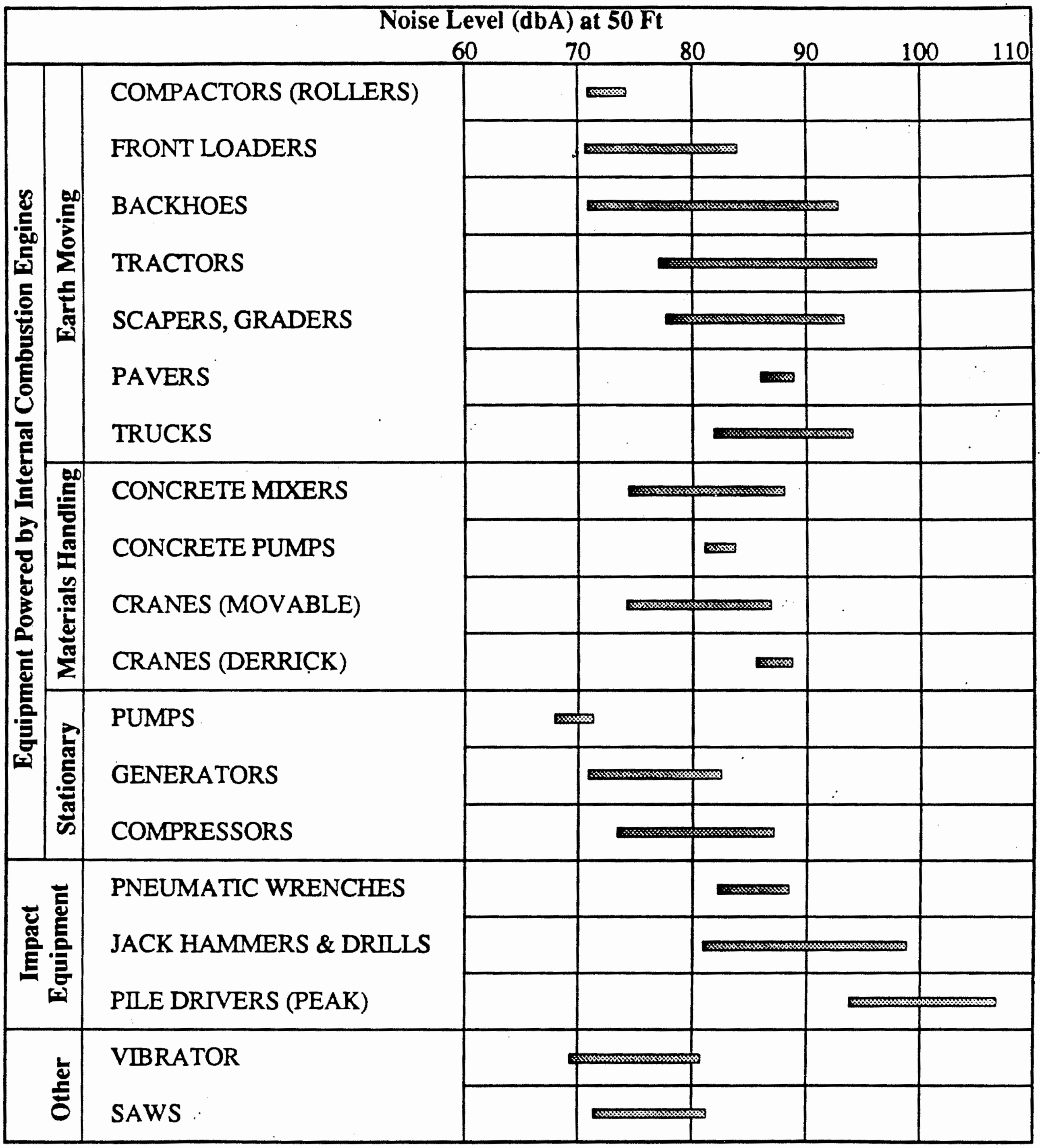
The air quality and odor impacts at Site 40 would be very similar to those described for Site 47. Therefore, the air quality and odor impacts resulting from location of the solids disposal at Site 40 are not predicted to be significant.

## 6.4 NOISE IMPACTS

Noise impact is assessed according to two criteria: the extent to which specific noise level criteria are exceeded and the estimated extent to which people will be adversely affected. The construction activities associated with each proposed facility were analyzed for an increase in ambient noise levels. Noise levels were adjusted for sound loss caused by divergence, barriers, and attenuation. Typical operating noise levels associated with individual pieces of construction equipment which would be used at the sites are shown in Figure 6.4-1.

To estimate baseline noise levels for the proposed WWTP, projected noise emissions for the equipment that will make up the WWTP were obtained from equipment manufacturers. These projected noise emissions were then used to model total predicted noise from a WWTP. This same approach was used to predict noise levels from proposed solids disposal facilities (personal communication between C. Baker, CDM and G. Ruta, EPA, November, 1989). Projected noise levels for the proposed WWTP and solids disposal facility were adjusted for sound loss due to divergence over the distance that sound travels from the site to a sensitive receptor. The projected values at the receptor were computed by adding the projected noise level to the measured background noise level at that receptor (CDM, Volume V, 1989).

The Massachusetts DEP noise guidelines (Section 5.4.2) specify that operation of the proposed facilities should not increase the background noise level more than 10 dBA. An increase in the background noise level is interpreted as an increase above the residual, or $L_{90}$, levels as described in Section 5.4.1. EPA




NOTE: Based on limited available data samples.

SOURCE: U.S. Environmental Protection Agency, December 1971, *Noise From Construction Equipment and Operation, Building Equipment and Home Appliances,* NTID 300.1 Government Printing Office 5500-0044.

**FIGURE 6.4-1**
**CONSTRUCTION EQUIPMENT NOISE RANGES**

Adapted from CDM,1989

guidelines direct that projected noise levels should not increase more than 15 dBA above existing background, or exceed an $L_{EQ}$ of 67 dBA. Predicted impacts are considered significant if these levels are exceeded.

Noise levels were modeled at each site assuming good engineering practices are used for noise control. These include housing noisy equipment in buildings or housings, using acoustical dampening and barriers, and muffling generators and noisy exhausts. The lowest measured hourly $L_{90}$ values were used as the existing background noise levels.

### 6.4.1 Site 1A

During construction of the WWTP at Site 1A, the most equipment-intensive period would be during months 2 to 28. If all of the equipment present during this time were used simultaneously, the $L_{EQ}$ could reach 104 dBA at 50 feet away. However, this would not occur frequently or over an extended time period. Rock removal would be the noisiest construction activity. Rock drills could generate up to 98 dBA at 50 feet away, and the on-site rock crusher would generate about 90 dBA at 50 feet. Rock drills would be used intermittently and the rock crusher would be in use almost continuously during the construction day. Blasting would also be necessary during construction and would occur four to five times daily. These activities would take place over a period not longer than 6 months (CDM, Volume V, 1989 and personal communication between C. Baker, CDM and G. Ruta, EPA, November, 1989).

Construction noise dissipates at least 6 dBA with every doubling of the distance from the source. Therefore, typical sustained construction noise levels at the northern property boundary due to rock drilling could range from 53 to 75 dBA $L_{EQ}$. Intermittent peak noise levels at the northern property boundary due to rock drilling could range from 73 to 83 dBA. In comparison, existing daytime noise levels at the site are currently dominated by traffic noise, range from 33 to 57 dBA ($L_{90}$), and are considered "normal suburban residential" (see Section 5.4) (CDM, Volume V, 1989).

Typical sustained construction workday $L_{EQ}$ would be audible over background noise levels within 1000 feet of the site. At the residences closest to the site (on the north side of Rodney French Boulevard), outdoor daytime noise levels would be increased by about 9 dBA, to about 64 dBA. Indoor noise levels would be 49 to 54 dBA, similar to those currently existing (CDM, Volume V, 1989).

Once the WWTP is operational, the ambient noise level would increase by 0.8 dBA at the northeast corner of the site, and an increase of 3.0 dBA would occur at the sensitive receptor monitoring station 1A-3 (see Figure 5.4-1) (CDM, Volume V, 1989).

Projected sound levels and increases associated with WWTP operation are shown in Table 6.4-1.

Occasionally, the plant might operate a stand-by generator when area power failures occur. This would result in slight increases in noise levels at all monitoring locations, but they would not exceed the state criterion (CDM, Volume V, 1989). Also, although EPA guidelines would be exceeded during construction, because the impacts are mitigable, the overall impact would only be moderately significant.

### 6.4.2 Site 4A

During construction of the WWTP at Site 4A, the most equipment intensive period would be during months 2 to 28. If all equipment present during this time were used simultaneously, the $L_{EQ}$ could reach 100 dBA at 50 feet away. However, this would happen rarely and not for a sustained period of time.

On the basis that noise dissipates 6 dBA with every doubling of distance from the source, construction noise levels at the property boundaries could range from 55 to 83 dBA $L_{EQ}$. Residences on the western side of JFK Boulevard and south of the industrial park would be 1000 feet or more away from construction noise sources and partially shielded by other structures. It is unlikely that increased noise levels from construction would be perceptible at these receptors (CDM, Volume V, 1989). Existing noise levels near the site are dominated by traffic noise and range from 43 to 63 dBA ($L_{90}$) .

After the WWTP is operational, noise level increases at Site 4A would not be considered significant. An increase in noise levels of 1.1 dBA would occur at the receptor location 4A-2 (Figure 5.4.2) and an increase of 0.6 dBA would occur at the northwest corner of the site. Therefore, the state criterion would not be exceeded at nearby residences. Future sound levels and increases associated with WWTP operation are shown in Table 6.4-1 (CDM, Volume V, 1989).

If the back-up generator were operating, noise levels would increase slightly, but still they would not exceed the state criterion (CDM, Volume V, 1989) or EPA guidelines. Thus, considering construction noise and operational noise, the overall impact would be moderate.

### 6.4.3 Site 47

During the construction period, if all major pieces of equipment (except the wood chipper) were used simultaneously, the $L_{EQ}$ could

TABLE 6.4-1

FUTURE SOUND LEVELS AND INCREASES ASSOCIATED WITH A WWTP

| Noise Monitoring Station | Future Noise Level (dBA) | Increase in Existing Noise Level (dBA) |
|---|---|---|
| No Mitigation | | |
| 1A-1 | 48.8 | 3.8 |
| 1A-3 | 50.3 | 13.3* |
| 4A-1 | 47.7 | 4.7 |
| 4A-2 | 59.7 | 14.7* |
| Mitigation of Blower and Motor Noise | | |
| 1A-1 | 46.3 | 1.3 |
| 1A-3 | 43.6 | 6.6 |
| 4A-1 | 44.6 | 1.6 |
| 4A-2 | 52.2 | 7.2 |

*Indicates DEP criterion (10 dBA) exceeded.

reach 89 dBA at 50 feet away. The wood chipper alone would generate 90 dBA at 50 feet, but it will be used for only 2.5 months. Because noise dissipates 6 dBA with every doubling of distance from the source, noise levels at the edge of the golf course could range from 68 to 78 dBA $L_{EQ}$.

Existing daytime noise levels near Site 47 are dominated by traffic noise and air traffic at the airport. Daytime $L_{90}$ levels range from 33 to 63 dBA. The worst case construction $L_{EQ}$ would be audible over background noise levels within about 400 feet of the site, which includes a portion of the golf course. No residences or other sensitive receptors would be affected because they are adequately buffered by vacant land and intervening transportation noise sources. Based on this analysis, no mitigation measures are necessary to minimize noise impacts (CDM, Volume V, 1989).

Once the solids disposal facility was operational, noise level increases at Site 47 would be insignificant. The predicted increase in noise level at the Hathaway Rd. and Whitlow St. intersection would be 0.1 dBA. Estimated noise levels at the western side of the proposed landfill would be 59 to 64 dBA (depending on which measurement method is used) and is predicted to exceed both the state and the EPA criteria when equipment is operated immediately adjacent to the site boundary. However, operations near the site boundary would be infrequent. In addition, activity at the landfill would be intermittent, with equipment being used 25 percent of the time (CDM, Volume III; Volume V, 1989). Future sound levels and increases associated with operation of a solids disposal facility at Site 47 are shown in Table 6.4-2. Noise level increases at the nearest sensitive receptor (residences at the intersection of Hathaway Road and Whitlow Street) would be considered insignificant even without mitigation.

### 6.4.4 Site 40

Because a landfill at Site 40 would be constructed in the same manner as Site 47, predicted construction-related noise generated would be identical (CDM, Volume V, 1989).

After the solids disposal facility was operational, noise level increases at the Site 40 boundaries could be as high as 21.5 to 25 dBA (depending on noise measurement type), which exceeds both the state and EPA criteria. However, operations in this area would be infrequent. There would be no significant increases in noise levels at the nearest sensitive receptors which are houses in the Pine Hill Acres development (less than 1 dBA). Future sound levels and increases associated with facility operation at Site 40 are shown in Table 6.4-2.

## TABLE 6.4-2

## FUTURE SOUND LEVELS AND INCREASES ASSOCIATED WITH A SOLIDS DISPOSAL FACILITY

| Location | Distance to Receptor from Solids Disposal (feet) | | Background Noise Level* | Predicted Noise Level* | Increase in Noise Level* |
|---|---|---|---|---|---|
| 40-1 (Power Line Easement) site boundary | 200 | $L_{90}$ | 47.0 | 68.5 | 28.5**,+ |
| | | $L_{eq}$ | 49.0 | 73.7+ | 24.7 |
| 40-2 (Pine Acres Subdivision) sensitive receptor | 4000 | $L_{90}$ | 49.0 | 49.9 | 0.9 |
| | | $L_{eq}$ | 47.7 | 58.1 | 0.4 |
| 47-1 (Western Side of Landfill) site boundary | 200 | $L_{90}$ | 49.0 | 68.5 | 19.5**,+ |
| | | $L_{eq}$ | 53.1 | 73.7+ | 20.6 |
| 47-2 (Hathaway Road and Whitlow Street) sensitive receptor | 4000 | $L_{90}$ | 59.0 | 59.1 | 0.1 |
| | | $L_{eq}$ | 64.2 | 64.3 | 0.1 |

* Represents worst case conservative scenario. Operations would normally occur more than 200 feet from site boundary. Also, noise will be intermittent.

** Indicates DEP criterion (10 dBA) exceeded

\+ Indicates EPA criteria (15 dBA or 67 $L_{EQ}$) exceeded

## 6.5 ECOSYSTEM IMPACTS

This section summarizes the potential impacts to the existing biological communities in the vicinity of each alternative site for the proposed WWTP, solids disposal facility, and effluent outfall.

### 6.5.1 Terrestrial

Criteria for evaluating impacts to terrestrial ecosystems are based on the presence of rare, threatened, or endangered species or their habitat, or ecologically significant natural areas as identified by the MNHP, USFWS, NMFS, or the Wellfleet Audubon Society. Findings of significant, moderate, or insignificant ecological impacts are assigned for each site use as follows:

- if rare, threatened, or endangered species or their habitats are present, and direct impacts (i.e., loss of species or habitat) to these species are predicted due to construction or operation of the facility, siting of the facility is considered to result in significant ecological impacts;

- if rare, threatened, or endangered species or their habitats are present but direct impacts to these species due to construction or operation of the facility are not predicted, or impacts to significant natural communities are predicted, siting of the facility is considered to result in moderate ecological impacts; and

- if no rare, threatened, or endangered species or their habitats are present, and no impacts to significant natural communities are predicted, siting of the facility is considered to result in insignificant ecological impacts.

**6.5.1.1 Site 1A.** As described in Section 5.5.3.1, the USFWS has noted that except for occasional transient individuals, no federally listed or proposed rare, threatened, or endangered species exist in the immediate project area. The piping plover (Charadrius melodus), a federally listed threatened species that nests, feeds, and rests on beach areas, is found in the nearby communities of Fairhaven, Dartmouth, and Westport but is not known to occur at Site 1A. The Massachusetts Natural Heritage Program (MNHP) has not indicated that Site 1A is known to contain or provide habitat for rare or endangered species.

Because no rare, threatened, or endangered species or their habitats or significant natural communities are present at Site

1A, siting of the proposed WWTP at Site 1A is considered to result in insignificant terrestrial ecological impacts.

**6.5.1.2 Site 4A.** No known rare, threatened, or endangered species or their habitats, or ecologically significant natural communities have been reported to occur in the upland area on or near Site 4A. Therefore, siting of the proposed WWTP at Site 4A is considered to result in insignificant terrestrial ecological impacts.

**6.5.1.3 Site 47.** No rare, threatened, or endangered species or their habitats, or ecologically significant natural communities are known to occur on upland portions of Site 47. Therefore, based on criteria specified above, siting of a solids disposal facility at Site 47 is considered to result in insignificant terrestrial ecological impacts.

**6.5.1.4 Site 40.** The MNHP reported that the Mystic Valley amphipod (a "species of special concern") occurs in the Acushnet Cedar Swamp, part of which is located on Site 40 (outside of the sludge disposal facility footprint). Additionally, the Acushnet Cedar Swamp is listed as a National Natural Landmark as a quality example of an Atlantic white cedar swamp.

Because the Acushnet Cedar Swamp is habitat for a species of special concern (the Mystic Valley amphipod), this project would require erosion and sedimentation control as mitigative measures in order to meet the performance standards specified in the Massachusetts Wetlands Protection Act (WPA). Assuming the facility is built with the appropriate mitigative measures, impacts to ecosystems associated with construction of a solids disposal facility at Site 40 are rated as insignificant according to criteria presented above.

**6.5.2 Wetlands**

Impacts to wetlands associated with siting the WWTP or solids disposal facility were evaluated according to the following evaluation criteria:

- if siting (i.e., construction or operation) of the facility would permanently alter any coastal wetlands or more than 5000 square feet of Bordering Vegetated Wetland (BVW) regulated under the Massachusetts Wetlands Protection Act (WPA), <u>or</u> more than 1 acre of wetlands regulated under Section 404 of the Clean Water Act (CWA), the proposed use of the site was considered to result in significant impacts to wetlands;

- if siting of the facility would alter no coastal wetlands, and less than 5000 square feet of BVW regulated under the WPA or 1 acre of wetlands regulated under the CWA, or alterations to one or more resource areas identified in the WPA could be mitigated according to performance standards specified in the WPA, the proposed use of the site was considered to result in moderate impacts to wetlands; and

- if siting of the facility would alter no wetlands regulated under the WPA or the CWA, the proposed use of the site was considered to result in insignificant impacts to wetlands.

**6.5.2.1 Site 1A.** The proposed WWTP is not predicted to result in temporary or permanent direct impacts to coastal wetland resources at Site 1A, as the facility would be built entirely in upland areas (no freshwater wetlands exist on this site). However, indirect impacts to coastal wetlands could occur due to erosion and sedimentation during construction. Filling of Bordering Land Subject to Flooding (100-year flood zone, as defined in the WPA) would also occur at this site.

The proposed development of Taber Park would require work within the buffer zone of coastal wetlands, including moving of heavy equipment, regrading of lawn areas, and renourishment of sand beach areas. However, this work would not affect coastal wetland resources because areas of established wetland vegetation (i.e., saltmarsh areas on the eastern shore) would be avoided.

Assuming that storage of floodwater can be provided to compensate for the loss of Bordering Land Subject to Flooding, construction of the WWTP is considered to result in moderate impacts to wetlands at Site 1A.

**6.5.2.2 Site 4A.** Construction of the proposed WWTP at Site 4A is not predicted to result in any direct impacts to coastal wetland resources. However, construction of the treatment facility would result in the filling of approximately 2000 square feet of BVW on site. The isolated patches of reeds on site (see Section 5.5.4.2) would also be filled; these areas are not classified as BVW as they are hydraulically isolated from other resource areas. They may, however, be regulated as wetlands under Section 404 of the Clean Water Act if they meet federal criteria for soils, vegetation, and hydrology.

Because less than 5000 square feet of BVW would be altered at this site, and mitigative measures may be possible to compensate for the loss of 2000 square feet of BVW (e.g., construction of replacement wetlands), construction of the WWTP at Site 4A is considered to result in moderate impacts to wetlands.

**6.5.2.3 Site 47.** Based on documented investigations at Site 47 (C-E Environmental Wetlands Assessment, 1989), construction of the Final Phase Sludge Landfill (47B) as shown in Figure 3.3-4 would result in filling of more than 1 acre of federally protected wetlands and more than 5000 square feet of BVW (see Section 5.5.4.3). Therefore, construction of both the Initial and Final phases of the solids disposal facility at Site 47 is considered to result in significant impacts to wetlands.

Construction of only the Initial Phase Sludge Landfill (47A) as shown in Figure 3.3-4 would not result in significant impacts to wetlands because no state or federally regulated wetlands would be filled, based on the results of the Wetlands Assessment performed by C-E Environmental, Inc. However, because this assessment was preliminary, a complete wetlands delineation in accordance with federal guidelines and in consultation with EPA and the U.S. Army Corps of Engineers would be necessary if this site is selected.

**6.5.2.4 Site 40.** The sludge disposal facility at Site 40 could be built entirely in upland areas (see Figs. 3.3-5 and 5.5-4), and therefore would not result in direct impacts (i.e., filling) to wetlands (i.e., the Acushnet Cedar Swamp). However, because the proposed construction site is located upgradient from the swamp, it is possible that erosion of surface soils during construction and subsequent sedimentation in the swamp could occur.

Because the Acushnet Cedar Swamp is potentially habitat for several species of special concern, this project would require erosion and sedimentation control as mitigative measures in order to meet the performance standards specified in the WPA which state that "...no project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species," as identified by the MNHP. Assuming the facility is built with the appropriate mitigative measures, impacts to wetlands associated with construction of a solids disposal facility at Site 40 are considered insignificant. However, the MNHP has expressed concern that because the Acushnet Cedar Swamp is a very significant natural area and given the importance of Site 40 to the entire ecologic system, development of the site for use as a sludge landfill should be avoided (Copeland, 1989).

### 6.5.3 Marine

**6.5.3.1 Construction.** Construction impacts in the marine environment will vary depending on the alternative selected. Rehabilitation of the existing pipe without a diffuser will involve a small amount of disturbance to the marine environment. The only underwater work will occur at the outfall terminus (installation and removal of an outfall plug; recovery of cleaning plug; installation of a pipe liner). No excavation of marine sediments will be necessary (CDM, Volume IV, 1989).

Cleaning the existing pipe will cause an unknown volume of sediment deposits in the pipe to be dispersed onto the surrounding seabed. Grain size characteristics of the deposits have not been determined; diver observations suggest it is compacted clay (CDM, Volume IV, Appendix H, 1989). These deposits have high levels of contaminants. Cadmium, chromium, copper, lead, mercury, nickel, zinc, and some forms of PCBs have concentrations in the Massachusetts's DEP dredged material category three, the highest category of contamination. The concentrations of contaminants in the outfall deposits are equivalent to or higher than levels in the sediments surrounding the existing outfall (CDM, Volume IV, 1989). Deposit dispersal will increase the contaminant load in the outfall area, with undetermined acute and chronic effects to the nearby biota. Benthic invertebrates may be buried by the material, depending on the volume. Filter feeding organisms are particularly sensitive to the deposition of fine clay materials. Recolonization of the area to its former state will depend on the similarity of the sediments to those originally present. Substantial changes in grain size, organic carbon, and contaminant level will slow the return of the area to its original state.

Construction impacts at the existing outfall site resulting from installation of a new pipe and diffuser would include sediment disturbance and habitat destruction. Approximately 1500 $m^2$ of bottom habitat would be permanently lost due to installation of the outfall diffuser. An additional 27,000 $m^2$ would be disturbed during excavation of a trench for the new pipe, extending from the intertidal area at the wastewater treatment plant (including rip-rap and wave break areas) to the outfall terminus 3300 feet offshore (CDM, Volume IV, 1989). Motile species (fish, lobster) can be expected to avoid short-term construction disturbance. Bottom-dwelling invertebrates (mainly small polychaete worms and molluscs) will not survive sediment removal. Organisms from the surrounding area should rapidly repopulate the area within a matter of weeks. Species from more distant locations will recolonize the area more slowly, depending on such factors as the timing of their recruitment period, the suitability of the new sediment for settlement, and the organisms already present. Complete recolonization should occur within two to three years, provided sediment characteristics have not drastically changed.

Excavation and off-site disposal of uncontaminated sediments from construction of a new pipe at the existing outfall site would cause temporary increases in suspended materials in the water column in the immediate work area, increasing turbidity and releasing sediment-bound nutrients and organic materials. Increased turbidity may decrease primary productivity and increase biochemical oxygen demand, in turn decreasing dissolved oxygen. These conditions may temporarily threaten the survival of sensitive organisms such as larval invertebrates and bottom-dwelling filter-feeding organisms.

The impact of greatest concern from construction of a new pipe at the existing outfall site would be disturbance of approximately 14,000 $m^3$ of highly contaminated sediments (Massachusetts DEP dredged material category three, the highest level of contamination). During the dredging process, sediments would be unavoidably dispersed into the water column, decreasing water quality and increasing the availability of toxic chemicals to marine organisms. As there is no direct correlation between levels of contaminants in sediments and changes in water quality resulting from dredging, it is difficult to predict the extent of potential impacts on marine organisms (CDM, Volume IV, 1989).

Because an outfall at the 301(h) Site would be constructed by tunnelling rather than dredging, construction impacts at this site will be limited to bottom disturbance at the outfall terminus. Approximately 1200 $m^2$ of bottom habitat would be lost as a result of construction of the outfall diffuser. The primary residents of this area are small polychaete worms and molluscs; there are no documented shellfish beds or lobster fishing areas in the immediate vicinity of the diffuser (CDM, Volume IV, 1989).

**6.5.3.2 Operations.** Operational impacts on marine resources will occur as a result of the discharge of effluent. Changes in water quality, including concentrations of dissolved oxygen, nutrients, and toxic chemicals, may have significant impacts on the biota. The impacts of these changes are discussed below.

**Toxic Substances.** Toxic substances can directly affect aquatic biota, and indirectly affect human health via the consumption of contaminated seafood.

**Effects on Aquatic Life.** The effects of toxic chemicals on aquatic life can be divided into two response categories, lethal and sublethal. The potential for lethal responses is estimated in three ways: 1) by comparing predicted water column contaminant concentrations to EPA water quality criteria 2) by conducting Whole Effluent Toxicity (WET) tests and 3) by comparing predicted sediment contaminant concentrations to threshold values in the literature.

Effects of toxic chemicals on marine life were evaluated by comparing predicted concentrations (based on modeling results) with the EPA aquatic life criteria for acute and chronic effects on aquatic organisms (CCC and CMC). At the 301(h) Site, one compound (4,4'-DDT) is expected to exceed the EPA chronic criterion; none will violate the acute criteria. At the existing site, if a diffuser is installed, one compound will exceed the acute criterion and three will exceed the chronic criteria (see Table 6.2-2). Rehabilitation of the existing site is predicted to result in exceedances of two acute and seven chronic criteria. Of particular concern, copper concentrations anticipated at the edge of zone of initial dilution at the existing outfall site under the rehabilitation option would be slightly higher than the level (commonly referred to as EPA Gold Book, 1986) that has been shown to be acutely toxic to the blue mussel. Mercury and cyanide levels at the existing outfall site may exceed the EPA acute and chronic aquatic toxicity criteria (depending on the alternative selected; see Table 6.2-2) but are well below the most sensitive level for saltwater species in the Quality Criteria for Water (EPA, 1986). As only one compound exceeds the aquatic toxicity criteria at the 301(h) Site, potential acute and chronic effects on aquatic organisms will be lower in comparison to the existing outfall site, where as many as seven compounds exceed the criteria.

Whole Effluent Toxicity (WET) tests take into account the availability of the toxic agent for organismal uptake and the possible combined effects of different chemicals. WET tests were conducted by exposing biota to varying concentrations of primary and "mock" secondary effluent. Experimental exposure to secondary effluent suggested that acute (or immediate) effects would be avoided at the expected dilution at both candidate outfall locations. Based on WET tests with secondary effluent, it appears that the effluent dilution required to avoid chronic toxicity would be met the majority of the time at the 301(h) Site, but is never achieved under the rehabilitation option (Table 6.5-1). The existing site with a diffuser would meet the initial dilution required to avoid chronic effects 71% of the time. The initial dilution required to meet the no observable effects level (NOEL) is 62 to 1. This dilution will not be met with the rehabilitation alternative. It will rarely be met at the existing site with a diffuser. At the 301(h), it will be met under average conditions and occasionally not met under worst case conditions. Results from the toxicity tests with New Bedford's primary treated effluent were somewhat variable reflecting the variable nature of the effluent itself. A discharge at the 301(h) Site will be more dilute and therefore less toxic to marine organisms than effluent at the existing outfall site.

Comparing sediment threshold values (concentrations below which no toxic effects occur) for toxics from the literature to predicted or ambient sediment data may also aid in predicting potential impacts. Concentrations currently found in the sediments near the existing outfall approach or exceed the literature threshold limits for copper, lead, zinc, and PCBs (see Table 6.2-4). Sediment concentrations at the 301(h) Site currently do not exceed any threshold limits. It is likely that concentrations at the existing site would increase and have additional exceedances if the grit accumulated within the outfall was discharged during construction of the rehabilitation option. Over the long-term, it is predicted that sediment concentrations at the existing site would decrease below threshold levels. Sediment contaminant concentrations at the 301(h) Site would increase slightly if a discharge was placed there, but the table

## TABLE 6.5-1

## INITIAL DILUTION VALUES BASED ON EXPECTED EFFLUENT LOADS

| | Initial Dilution | | Percent of Required Dilution[3] | |
|---|---|---|---|---|
| | Average[2] | Worst Case | Chronic Toxicity | No Adverse Effects Level |
| Rehabilitation Alternative | | | | |
| 30 mgd | 11.6 | 11.6 | 26 | 19 |
| 75 mgd | 8.1 | 8.1 | 18 | 13 |
| Existing Site with A Diffuser | | | | |
| 30 mgd | 52.9 | 35.6 | 117 | 85 |
| 75 mgd | 27.9 | 26.1 | 62 | 45 |
| 301(h) Site | | | | |
| 30 mgd | 174.2 | 43.5 | 387 | 279 |
| 75 mgd | 69.8 | 34.0 | 155 | 112 |

[1] Units are cubic meters of seawater mixing with one cubic meter of effluent.
[2] Averages assume normal distributions.
[3] Using average initial dilution values and required dilution to avoid chronic toxicity as 45 to 1 and to avoid any adverse effects as 62.5 to 1.

concentrations would be below threshold levels and lower than concentrations at the existing site.

Bioaccumulation of toxic chemicals is a significant sublethal effect, which may result from high concentrations of chemicals in the water column, the sediments, or the diet. EPA sediment bioaccumulation criteria have been established only for PCBs. The estimated PCB concentration in the sediments resulting from the effluent is less than the EPA criterion of 1 ppm at both sites. However, present sediment concentrations at the Existing Site are above the EPA criterion; no PCBs have been detected at the 301(h) Site (see Table 6.2-4). Thus PCB levels at the existing outfall site will continue to be of concern for bioaccumulation. Bioaccumulation of PCBs from sediments at the 301(h) Site are not predicted to be significant.

The bioaccumulation of PCBs and some metals has been very briefly examined in some shellfish species in New Bedford Harbor. Lobster (Homarus americanus) and hard clams (Mercenaria mercenaria) from both the Inner and Outer Harbor areas have tissues with elevated levels of metals and PCBs (CDM, Volume IV, 1989). While it is impossible to separate effluent effects from the myriad of other sources, it is clear that contaminants in New Bedford are being taken up by marine biota, with unknown effects. PCBs are of particular concern because of their ability to be bioaccumulated and biomagnified. Their toxicity increases with length of exposure and position of the exposed species in the food web. Effluent discharge would continue to add contaminants to the system and become a more important source for bioaccumulation as other sources are mitigated or eradicated. Impacts will most likely be more severe at the Existing Site than at the 301(h) Site because of the higher concentrations of toxic compounds already existing in sediments at the site.

**Effects on Human Health.** The EPA water quality criteria for human toxicity and carcinogenicity identify water column concentrations of pollutants which may result in increased cancer risk to humans due to the consumption of seafood containing those pollutants. For seafood consumption, these "carcinogenicity criteria" are based on assumed bioconcentration factors in seafood and assumed lifetime consumption of approximately 6.5 g/day (5.2 lb/yr) of seafood from the area exposed to the water column concentration. Three compounds are predicted to exceed these criteria at the $10^{-6}$ risk level (i.e. one additional cancer case per million people) for either alternative at the existing outfall site and two at the 301(h) Site (see Table 6.2-2). In addition, PCBs are expected to continue to exceed the human health criteria at both sites, although the extent of the exceedance has not been predicted. The highest exceedance at either site is for arsenic, which already exceeds the criterion (at both the $10^{-5}$ or 1 in 100,000 and $10^{-6}$ risk levels) in the ambient water. Despite the current conditions, no evidence of adverse effects from the consumption of seafood has been reported (CDM, Volume IV, 1989), and studies have demonstrated that, at least in some resident bottom fish, arsenic does not accumulate in body tissue (de Goeij, et al., 1974 in CDM, Volume IV, 1989). The magnitude of the other exceedances at the existing outfall site is small. Because of the conservative nature of these criteria (e.g. it is unlikely that any person would, throughout their lifetime, consume 5.2 lb/yr of seafood caught solely from the affected area), it is unlikely that a discharge at either site would actually result in an adverse impact on public health.

**Chlorine Toxicity.** Anticipated chlorine residual concentrations (0.5 to 1.0 mg/l) are expected to exceed the EPA chronic criteria under certain conditions at the edge of the mixing zone for both alternatives at the existing site (CDM, Volume IV, 1989). The anticipated levels are above concentrations known to be acutely toxic to oyster larvae and juveniles, and copepods (Heinle and Bevean, 1977; Roberts and Gleeson, 1978). Adverse effects from chlorine should be avoided at the 301(h) Site for several reasons. First, the longer outfall pipe will increase retention time, thus allowing for lower dosing of chlorine at the plant. Secondly, the higher effluent dilution would further lower chlorine levels, so chlorine residual concentrations would most likely be met at the edge of the mixing zone.

**Nutrient Enrichment.** Phytoplankton response to additional nutrients may be estimated from nutrient spike experiments. Nutrient spike experiments using phytoplankton from the existing site resulted in increased primary production in approximately two-thirds of the tests; half of these enhanced productivity by more than 50 percent (CDM, Volume IV, Appendix G, 1989). No dramatic changes in species composition occurred, and the experiments did not trigger nuisance or toxic blooms. Nuisance and toxic blooms have not been noted in studies of the phytoplankton community (CDM, 1983b; CDM, Appendix F, 1989). These results and results from the water column nutrient survey suggest that primary productivity at the existing site may be nutrient-limited for parts of the year and may increase slightly in response to secondary effluent discharge without a dramatic change in species composition or initiation of nuisance or toxic blooms.

Secondary effluent would also stimulate primary productivity at the 301(h) Site. Three-quarters of the nutrient spike experiments resulted in increased primary productivity, most by more than 50%. Secondary effluent additions did not change species composition or initiate nuisance/toxic blooms. This is consistent with similar experiments on populations from Vineyard Sound (Dunstan and Menzel, 1971; Vince and Valiela, 1973).

Increased productivity at both candidate outfall sites would most likely result in increased levels of organic material in sediments, resulting in increased sediment oxygen demand. However, the phytoplankton species composition and seasonal population dynamics are not expected to change (CDM, Volume IV, 1989). Subsequent effects on grazing zooplankton, which may have a role in controlling phytoplankton dynamics (CDM, Volume IV, Appendix F 1989; Turner et al., 1989) cannot be determined. The most important effect will be the resultant increase in oxygen demand (see Section 6.2.1.1).

A potential adverse effect of increasing primary productivity is the increased potential for nuisance blooms. Such blooms may reduce dissolved oxygen to levels toxic to marine organisms. However, chlorophyll a (the pigment related to photosynthesis) levels at both sites are expected to remain below levels correlated with nuisance blooms (CDM, Appendix F, 1989). The potential for algal blooms of "brown tide" will probably remain unchanged, as preliminary research suggests that blooms are related to weather conditions rather than specific nutrient input or other measures of eutrophication (Wise, 1987).

**Organic Enrichment.** The typical model describing the effects of sewage inputs includes zone devoid of life close to the effluent discharge point; a polluted zone where only a few tolerant species occur, often in high abundances; and an unaffected zone (Pearson and Rosenburg, 1976). In some cases, the effluent causes enrichment with no adverse effects, increasing abundance, biomass, and number of species (Dauer and Conner, 1980).

The invertebrate community at the existing outfall site is typical of a polluted zone near a sewage outfall. The fauna is composed of a low number of species, most of which are tolerant of enriched or disturbed conditions (CDM, Volume IV, 1989). At this site the discharge of secondary effluent should result in reduced deposition of organic material (from effluent solids) from what is currently occurring as a result of the primary effluent. Although organic enrichment should decrease, contaminants will remain in the sediments, making it difficult to predict the level of recovery of the benthos. In general, studies have shown that reduction of organic inputs leads to improvement of the benthic community in shallow waters in less than five years (Boesch and Rosenberg, 1981). At the existing outfall, species diversity may increase with the reduction in organic inputs depending on dissolved oxygen levels and contaminant concentrations.

The addition of secondary effluent at the 301(h) Site will increase input of organic material to the water column and sediments. Enhancement of primary productivity will result in further increases of organic inputs (CDM, Volume IV, 1989). Studies show no consistent response of bottom-dwelling biota to various levels of organic input (Oviatt et al., 1987). Effects caused by the addition of effluent, should they occur, would be in the form of increased community production.

**Dissolved Oxygen.** If summer oxygen levels in the Inner Harbor are used to predict worst case oxygen conditions at the existing outfall during secondary effluent discharge, it can be assumed that dissolved oxygen will drop below 6 mg/l and occasionally even below 4 mg/l (see section 6.2-1). Decreases below 5.0 mg/l, may cause adverse effects on lobsters at 24° C (CDM, Volume IV, 1989). Other species (e.g., hard-shell clams) are more tolerant of dissolved oxygen levels below the state standard. As levels are not expected to drop to anoxic or hypoxic (<3.0 mg/l) conditions, little effect is expected on fish, which can avoid temporary adverse conditions. At the 301(h) Site, dissolved oxygen is never expected to drop below the state standard under average conditions, and only rarely (and never below 5 mg/l) under adverse conditions (CDM, Volume IV, 1989).

Low dissolved oxygen concentrations increase the toxicity of many pollutants, particularly ammonia (Rand and Petrocelli, 1985). A discharge at the existing site may exacerbate potential toxicity problems during periods of low ambient D.O. concentrations.

**Fecal Coliform.** Shellfish beds in the vicinity of the existing outfall are currently closed because of bacterial contamination from sources other than the existing outfall. Exceedances of the coliform standard for shellfish are predicted for discharge at the Existing Site for the rehabilitation alternative in a small area (400 m x 250 m) under worst case conditions. This area of exceedance would be smaller for the existing site with a diffuser alternative. No violations of fecal coliform bacteria standards for shellfish are expected at the 301(h) Site. No large populations of hard-shell clams or important lobster fishing areas have yet been identified near the 301(h) Site, so no adverse effects are expected (CDM, Volume IV, 1989).

**Endangered Species.** There are no threatened or endangered species that rely on habitats in either outfall area, therefore, no adverse impacts are expected. Several threatened and endangered sea turtle species have been sighted in Buzzards Bay. As the effluent plume will only affect a small area of the Bay, exposure to the discharge plume should be rare for these species. Furthermore, their mobility will allow them to avoid the discharge plume (CDM, Volume IV, 1989). The most serious potential adverse impact would be through biomagnification of contaminants in key prey species. The threatened loggerhead turtle feeds on benthic organisms in bay areas such as Buzzards Bay. As juveniles, the endangered Kemp's Ridley turtle consumes benthic organisms such as green crabs and mussels, two species that readily accumulate toxics, in New England nearshore areas. Contaminants could accumulate in these two species with unknown but possibly carcinogenic effects. As leatherback turtles rely on jellyfish, adverse effects from consumption would be minimal (letter from D. Beach, NMFS, June 7, 1988). However, because of the small areas that could be affected relative to Buzzards Bay and other feeding areas of the species, it is not likely that an outfall at either site would substantially impact the population of endangered species.

## 6.6 SOCIOECONOMIC AND CULTURAL RESOURCE IMPACTS

This section identifies potential impacts to existing socioeconomic and cultural resources at each candidate site.

### 6.6.1 Historic and Archaeological Resources

This section evaluates the impact that the proposed WWTP, solids disposal facilities, or outfall might have on historic or archaeological resources at the alternative sites. The impact of the project on a cultural resource is considered to be significant if the resource is listed or eligible for listing on the National Register of Historic Places, and the facility will have an adverse impact on the resource.

Identification of potentially eligible resources in the project area is the first step of the Section 106 process, followed by a determination of whether or not the proposed activities will affect the resource, and if so, whether the effect will be adverse. Eligibility of a resource is determined in consultation with the State Historic Preservations Officer (the Massachusetts Historical Commission, or MHC) and EPA.

The Advisory Council on Historic Preservation provides a clear step-by-step process to be used in determining effect (Figure 5.6-1). Generally, a finding of adverse effect is made if the project will result in the destruction or negative alteration of a National Register eligible property, isolate the property from its environment, degenerate its setting, result in neglect, or generally cause harm to it (MHC, 1985).

**6.6.1.1 Site 1A.** Several historic structures were found on Site 1A that are within the Fort Taber Historical District or eligible for inclusion in the District or otherwise eligible for the National Register. The District includes the fort itself, several batteries and a Colonial Revival house. Some archaeological and historic artifacts, potentially from farmsteads once on the site and aboriginal activities, were also found (CDM, Volume V, 1989). If Site 1A is selected for the WWTP, mitigation measures to minimize adverse impacts to the District must be developed for inclusion as stipulations in a Memorandum of Agreement (MOA) as dictated by the Section 106 process and in consultation with MHC, EPA, and the Advisory

Council on Historic Preservation. Possible mitigation measures for adverse impacts include:

- o documentation of each affected structure in accordance with procedures outlined by the Historic American Building Survey (HABS) and the Historic Architectural Engineering Record (HAER);

- o rehabilitation or restoration of affected structures in accordance with National Parks Service guidelines; and

- o preparation of exhibits of historical documents and artifacts to interpret the history of Clark's Point (particularly its military uses) for the public.

Although there might be some impacts to historic structures on Site 1A, the measures mentioned above would help to reduce or eliminate adverse impacts. Because of the potential impacts to historical data at the farmstead location, a more detailed evaluation to determine National Register eligibility will be necessary if Site 1A is selected.

**6.6.1.2 Site 4A.** Because there are no historic structures on Site 4A, a WWTP at this site would have no adverse impact on historic resources. There are some properties adjacent to the site that may be historically significant, and although no significant archaeological artifacts were found at this site, it is possible that there are significant archaeological deposits that might be impacted during construction of a WWTP. Therefore, more information on the potential National Register eligibility of these resources will be necessary if Site 4A is chosen.

**6.6.1.3 Site 47.** Although there are no historic buildings or prehistoric sites on Site 47, potentially significant archaeological artifacts were found in subsurface soils during a detailed site study (CDM, Volume V, 1989), and could be disturbed during construction. If Site 47 is selected for construction of the solids disposal landfill, more intensive investigations will be necessary to determine if the archaeological sites are eligible for the National Register.

**6.6.1.4 Site 40.** Although there are no historic structures on Site 40 or any evidence of historic or prehistoric uses at this site, the topography is typical of areas that contain prehistoric and archaeological artifacts (CDM, Volume V, 1989). A detailed site study revealed archaeological artifacts in subsurface soils. No prehistoric artifacts were found, however it is still possible that they exist and could be disturbed during construction. Similar to Site 47, if this site is selected, further investigations will be necessary.

**6.6.1.5 Outfall Sites.** Any significant marine archaeological resources (e.g., shipwrecks) near the existing outfall site were probably disturbed during the filling of Clark's Point and the construction of the two existing outfall pipes. Because the rehabilitation alternative does not include marine construction, no further significant impact to any archaeological resources present would be expected.

Historic and archaeological resources identified in the vicinity of the 301(h) Site, however, could be affected by construction of the outfall at that location. Further studies to identify any National Register eligible resources in that area will be necessary if the 301(h) Site is selected.

### 6.6.2 Visual Resources

This section discusses the impacts of the proposed facility on the aesthetics of the sites and surrounding areas. Sites were evaluated in terms of the visual compatibility of the proposed facility with the surrounding area, critical viewpoints, the extent of views affected, and the feasibility of buffering the proposed facility from the surrounding area. An impact is considered significant if the site has considerable scenic value that would be substantially changed from the existing conditions, moderate if the site has scenic value that might be impacted by the facility and the facility is visible from several viewpoints, and insignificant if the facility would have only minor effects on the scenic value of the site.

**6.6.2.1 Site 1A.** Site 1A provides an open view of the water to the south, residences to the north, and the fort and gun batteries that are located on the site. There are a number of adjacent locations from which the proposed WWTP would be visible. In addition, the site provides a view of the historic fort from the water. Although the proposed facility would not affect the view from the water because it is located further inland than the existing facility, it could affect the view of the water from the residential section, as well as from Fort Taber and its surrounding earthworks, barracks, and batteries. Thus, the proposed facility would have a significant impact on visual resources at Site 1A.

**6.6.2.2 Site 4A.** Site 4A is unusual in that there is an open view to the Inner Harbor from the site, yet there are many large industrial buildings around it. Therefore, although the view of the water would be blocked by the proposed facility, it would be compatible with the surrounding areas. Views of the proposed WWTP at Site 4A would be limited by the mill buildings to the south, various industrial buildings (e.g., a fish processing building) to the north, and the hurricane barrier. Although the site is visible from the residences west of the site and from the highway bordering the site, views from these areas would not be significantly degraded. Thus, the proposed facility would have a moderate impact on visual resources at Site 4A.

**6.6.2.3 Site 47.** Site 47 is surrounded by the Apponagansett Swamp, a landfill, and the municipal airport. In addition, there are no residences near Site 47, and the facility would only be visible from the higher areas surrounding the site. Thus, the facility would have an insignificant impact on visual resources.

**6.6.2.4 Site 40.** Site 40 is near the location of the proposed Crapo Hill landfill and adjoins an industrial park. Views of the site are limited to the industrial park and elevated areas (such as from the Town of Dartmouth), and are further limited by a power line and existing vegetation. Therefore, the proposed facility would have an insignificant effect on the visual resources at Site 40.

**6.6.2.5 Outfall Sites.** In Buzzards Bay, the water column does not stratify very strongly, and the discharge plume would surface at either of the outfall locations. The plume would always surface at the existing site without a diffuser, and 78 percent of the time with a diffuser. At the 301(h) Site, the plume would surface approximately 57 percent of the time. With the significant additional dilution at the 301(h) Site (relative to the existing site), discoloration and therefore visual impacts would be dramatically less evident.

### 6.6.3 Harbor Resources

Harbor resources include bathing beaches, fishing areas, and commercially important shellfishing areas. Potential impacts on these resources are discussed below.

**6.6.3.1 Site 1A.** Public bathing beaches and fishing areas are the primary harbor resources at Site 1A. As discussed in Section 6.3, potentially odorous compounds emitted from the WWTP are not predicted to exceed odor threshold levels beyond the site boundary. However, potential odor impacts from combined sources were not evaluated. Also, as discussed in Section 6.4, after mitigation, potential noise level increases at the closest beach areas to Site 1A (near noise receptor 1A-1, see Figure 5.4-1) would be insignificant.

Even if no odor or noise impacts occur outside the site boundary, users of nearby beaches and fishing areas may elect not to visit those areas closest to the WWTP because of negative perceptions associated with the plant.

**6.6.3.2 Site 4A.** Harbor resources at Site 4A, (i.e., recreational boating), are not expected to be impacted by a facility at the site because boating areas near the site are already degraded. As discussed in Section 6.3 and 6.4

respectively, odor and noise impacts outside the site boundary are not predicted to be significant. Therefore predicted effects to harbor resources at this site are not considered significant.

**6.6.3.3 Outfall Sites.** Discharge of effluent at either outfall site is not expected to affect potential commercial fishing in the harbor or lead to any increased bans on shellfishing. In fact, when CSO discharges are eliminated, the current ban on shellfishing in Clark's Cove may be able to be lifted. Shellfishing resources in this area are valued at an estimated $5,000,000 per year.

A small shellfish closure area around either the existing site or the 301(h) outfall site (in accordance with the Coastal Zone Management (CZM) rule of closure around any sewer discharge) would be imposed. The value of this area of shellfish closure at the existing site has been estimated to be $143,000 in one year. Shellfish data presented to date on the 301(h) Site do not show a commercially viable population existing there. Potential impacts on non-commercially important species are discussed in Chapter 6.5.

There will be no significant impacts on beaches resulting from an effluent discharge at either candidate outfall site. Modeling results indicate that fecal coliform counts resulting from the discharge will be less than 1/200 of that needed to close a beach. With the inclusion of CSO discharge into the system, some beaches may actually be closed less frequently. Also, there is not predicted to be any exceedances of EPA water quality criteria protective of human health at any shoreline areas. In a worst case situation, the dilution of the effluent at the nearest beach would be 23 to 1 for the rehabilitation alternative, 24 to 1 for the existing site with a diffuser and 55 to 1 for the 301(h) Site.

The impacts on navigational channels and anchoring sites due to construction of the outfall have not been specifically evaluated, but are not expected to be significant (CDM, Volume IV, 1989).

#### 6.6.4 Socioeconomic Resources

This section evaluates impacts of program costs, and the resources (community uses, cultural activities, or community programs) that would be displaced by the proposed facility. Growth and development of the surrounding areas are also part of socioeconomic resources. Although impacts of the proposed facility on growth and development are difficult to predict, induced development or rehabilitation of neighborhoods adjacent to the alternative sites, which might occur with land development other than a WWTP or a landfill, could be adversely impacted (WFA, 1989). In addition, the City's ability to finance the project may negatively affect development in the short term, and increased user fees may have negative impacts on the City in terms of residential and industrial growth (WFA, 1989). Socioeconomic resources that may be impacted by the proposed facility include social-cultural resources (i.e., social or cultural facilities, activities, and programs) and economic resources such as tax revenues and capital. Funding sources for the capital expenses include state and federal assistance, however, regardless of the funding source, capital costs (i.e., for construction and operation of the facility) would strain the fiscal resources of the City (WFA, 1989). A measure of economic impact is lost opportunity cost which is the benefit or revenue that the City would realize if a site were developed for other uses (see EPA's "Lost Opportunity Cost Analysis" in Appendix D). Projected impacts to economic resources were rated as:

- significant if the site has a high suitability for alternative development with high potential for increasing tax revenues, and with existing proposals for such development;
- moderate if the site is suitable for alternative development with the potential to increase tax revenues, but is without proposals for such development; and
- insignificant if the site has minimal suitability for alternative development, minimal additional tax revenues from alternative development, and is without proposals for such development.

Projected impacts to social-cultural resources were rated as;

- significant if the site has existing community uses or existing aesthetic or cultural qualities which would be difficult to duplicate at another site;
- moderate if the site has existing community uses or existing aesthetic or cultural qualities that could be duplicated or replaced at another location; and
- insignificant if the site has no existing uses and no existing aesthetic or cultural qualities.

**6.6.4.1 Site 1A.** The capital cost of building a WWTP at Site 1A would be approximately $176 million. This includes the treatment plant, site aquisition and preparation, and off-site conveyance system costs. Operations and maintenance costs are estimated at over $5.9 million per year.

A detailed analysis of potential uses for the site other than a WWTP is presented in Appendix D, along with a discussion of potential economic benefits to the City from these alternative uses. Potential alternatives identified at this site include combinations of park land, housing, and marina space (WFA, 1989). The benefits associated with these potential developments include annual tax revenues of up to $1.6 million, improved access to the waterfront, additional housing, additional park land, consistency with community desire for water-related use, and possible inducement for rehabilitation of bordering neighborhoods. The costs associated with these potential uses would include provisions for city services, education, and park maintenance (see Appendix D).

In addition to lost economic opportunities and costs, the proposed WWTP at Site 1A would significantly impact social and cultural resources. This site houses educational programs, historic buildings, recreational facilities, and a marine institute, some of which would be displaced by the proposed facility. The primary impact would be short-term disruption while the programs were being relocated. Except for the negative impact from a public access standpoint of having a WWTP in close proximity to historic Fort Taber, the WWTP could have an overall positive long-term impact on the facilities currently located at Site 1A. Relocation to the adjacent Poor Farm Site (CDM, Volume V, 1989) would provide the displaced programs with modern new facilities.

**6.6.4.2 Site 4A.** The capital cost of building a wastewater treatment facility at Site 4A would be approximately $194 million. This includes the treatment plant, site aquisition and preparation, and off-site conveyance system costs..

As discussed in Appendix D, other possible uses for Site 4A include industrial and mixed uses that could potentially bring the City between $1.5 and $3.4 million annually in property taxes (WFA, 1989). These developments could also bring improvements to an under-utilized site (consistent with the Economic Development Commission's goal of increased industrial development and improved access to water resources), and even lead to improvement or rehabilitation of surrounding neighborhoods. Social and cultural resources at Site 4A would not be as significantly impacted as at Site 1A although the Cape Verdean Social Club and other activities such as basketball, baseball, and soccer would be displaced.

**6.6.4.3 Site 47.** The total capital cost of constructing a 20-year sludge landfill at Site 47 is estimated to be $18.3 million. This includes a $10 million cost for the 20-year sludge landfill and site aquisition and preparation costs of $8.3 million. Included in these costs is the $2.3 million purchase price for the half of Site 47 that is not currently owned by the City.

Annual operation and maintenance costs would be approximately an additional $0.28 million (CDM, Volume V, 1989).

Other potential uses of the site include an industrial park, although limited access decreases the potential of this site for any alternative uses. It is estimated that an industrial park at the site could generate tax revenues of up to $2.7 million annually (see Appendix D for further detail). There are no social or cultural resources at Site 47, and limited access to the site minimizes the potential for such activities. Therefore, impacts to these resources as a result of the proposed facility would be insignificant.

**6.6.4.4 Site 40.** The total capital cost of constructing a 20-year sludge landfill at Site 40 would be approximately $19.3 million. This includes a $10 million cost for the 20-year sludge landfill and site aquisition and preparation costs of $9.3 million. Included in these costs is the estimated $5.35 million land acquisition cost. Annual operation and maintenance costs would be approximately an additional $0.30 million (CDM, Volume V, 1989).

This site has good potential for alternative development which could result in tax revenues of up to $5.2 million per year and a capitalized net revenue to the City of approximately $66 million (CDM, Volume V, 1989). Therefore, a landfill at this site could result in a significant impact on economic resources. Similar to Site 47, there would not be any impact to social or cultural resources at Site 40 because none are present on-site.

**6.6.4.5 Rehabilitated Outfall.** For the comparison of costs associated with each outfall alternative, capital costs alone are considered. The operation and maintenance costs are dominated by the costs associated with the electricity required to run the pumps. These costs are included in the cost estimates for the treatment plant. The cost of rehabilitating the outfall at the existing site has been estimated to be approximately $5,000,000. Shellfish beds around the existing discharge would be closed in accordance with Massachusetts CZM regulations, representing a potential loss of a resource estimated at $143,000 a year.

**6.6.4.6 Existing Site with Diffuser.** The capital cost of building a new outfall pipe with a diffuser at the existing site has been estimated to be $19,900,000. There may be additional costs associated with the disposal of contaminated sediments from this site. The cost associated with this can range from almost nothing (depending on Superfund coordination) to $15,000,000. A similar area of shellfish beds would be closed representing a potential loss of resource worth $143,000.

**6.6.4.7 301(h) Site.** The capital costs associated with building an outfall with diffuser out to the 301(h) Site has been estimated at $70,000,000. Currently shellfish data indicates there is not a commercially viable shellfish population at the 301(h) Site. There is no commercial fishing at the site, so placing a discharge there would not interfere with any commercial fishing or shellfishing activities.

### 6.6.5 Recreational Resources

This section discusses the potential impacts to recreational resources at each alternative site that would result from the use of the site for the WWTP, landfill, or effluent outfall. Potential impacts to recreational resources are also discussed in relation to land use in Section 6.1 of this Draft EIS.

**6.6.5.1 Wastewater Treatment Plant Site Alternatives.** There are currently many recreational uses of Site 1A. For example, there are several playing fields, and a beach used for fishing and swimming. Although the beaches and recreational fishing, swimming, and boating will not be displaced by the use of the site for a WWTP (see Section 6.6.3.1), many other resources (i.e., the tennis courts and the playing fields) would be displaced, and therefore a WWTP at this site is considered to have a significant impact to recreational resources.

There are many recreational uses of Site 4A, including baseball, softball, basketball, soccer, and bicycle racing. These resources would all be displaced by use of the site for a WWTP. Therefore, the facility would have significant impacts to recreational resources at Site 4A. Section 6.1.1.3 also contains a discussion of potential land use impacts at Site 4A, including recreational land uses.

**6.6.5.2 Solids Disposal Site Alternatives.** Because there are no organized recreational uses of Sites 47 and 40, use of either of these sites for a solids disposal facility would not have significant impacts from a recreational standpoint. Also, as discussed in Section 6.1.1.6, no impacts are predicted on use of the golf course adjacent to Site 47.

**6.6.5.3 Outfall Sites.** Although there would be no displacement of recreational activities at either outfall location, the decreased visual and aesthetic quality due to the outfall discharge rising to the surface could severely inhibit some recreational uses of the water (i.e., windsurfing and boating) in the immediate areas of these discharges. These areas wold be small, however, in relation to available recreation area in Buzzards Bay and the Outer Harbor, so significant impacts on recreational resources in these areas are not predicted.

# CHAPTER SEVEN

# SUMMARY OF IMPACTS, MITIGATION, AND ACCEPTABLE ALTERNATIVES

## 7.1 INTRODUCTION

Preceding chapters screened and described alternative wastewater and solids processing and disposal methods; described conditions at alternate sites for the WWTP, solids disposal facilities, and effluent outfall; and predicted impacts from the activities proposed at each of the sites. This chapter discusses the relationship between this project and the New Bedford Harbor Superfund site, reviews the information presented in the earlier chapters, and synthesizes and compares findings on sites and proposed technologies. The areas of impact at each site are briefly discussed in terms of significance, mitigation for the significant impacts is evaluated, and the acceptability of each alternative is considered. Also, the acceptable combinations of technology options and alternative locations for the WWTP, solids disposal facilities, and effluent outfall are discussed.

## 7.2 COORDINATION WITH SUPERFUND

New Bedford Harbor, particularly those areas referred to in this document as the Acushnet River Estuary and the Inner Harbor, is heavily contaminated with polychlorinated biphenyls (PCBs), heavy metals, and possibly other industrial wastes. Elevated concentrations of PCBs were first reported in harbor sediments in 1976 and many investigations since then have documented the widespread contamination of water, sediments, and biota. In 1982, New Bedford Harbor and adjacent areas of Buzzards Bay were designated a "Superfund site" pursuant to the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and remedial action planning was initiated. This work is ongoing.

Superfund activities in New Bedford have potential implications for the wastewater treatment facilities plan, and the contaminated sediments that led to the area being listed as a Superfund site present potential difficulties for certain aspects of WWTP and outfall construction.

Construction of outfall-related facilities would include the movement and/or removal and disposal of contaminated sediments. Removal activities would resuspend sediments and increase the exposure of aquatic biota to contaminants in the sediments (see Section 7.5, below). The U.S. Army Corps of Engineers is currently conducting a study on the consequences of disturbance of existing sediments and the subsequent release of PCBs to the environment. Sediment control techniques such as silt curtains and barrier shields are being evaluated in the study and appear able to confine sediment disturbance and minimize water quality impacts, where conditions will allow them to be employed.

Because of these considerations, it is probable that any construction conducted in areas of high contamination (e.g., at the existing outfall site or offshore of Site 4A) would require special techniques to minimize environmental impacts. Such control techniques are likely to affect both cost and schedule.

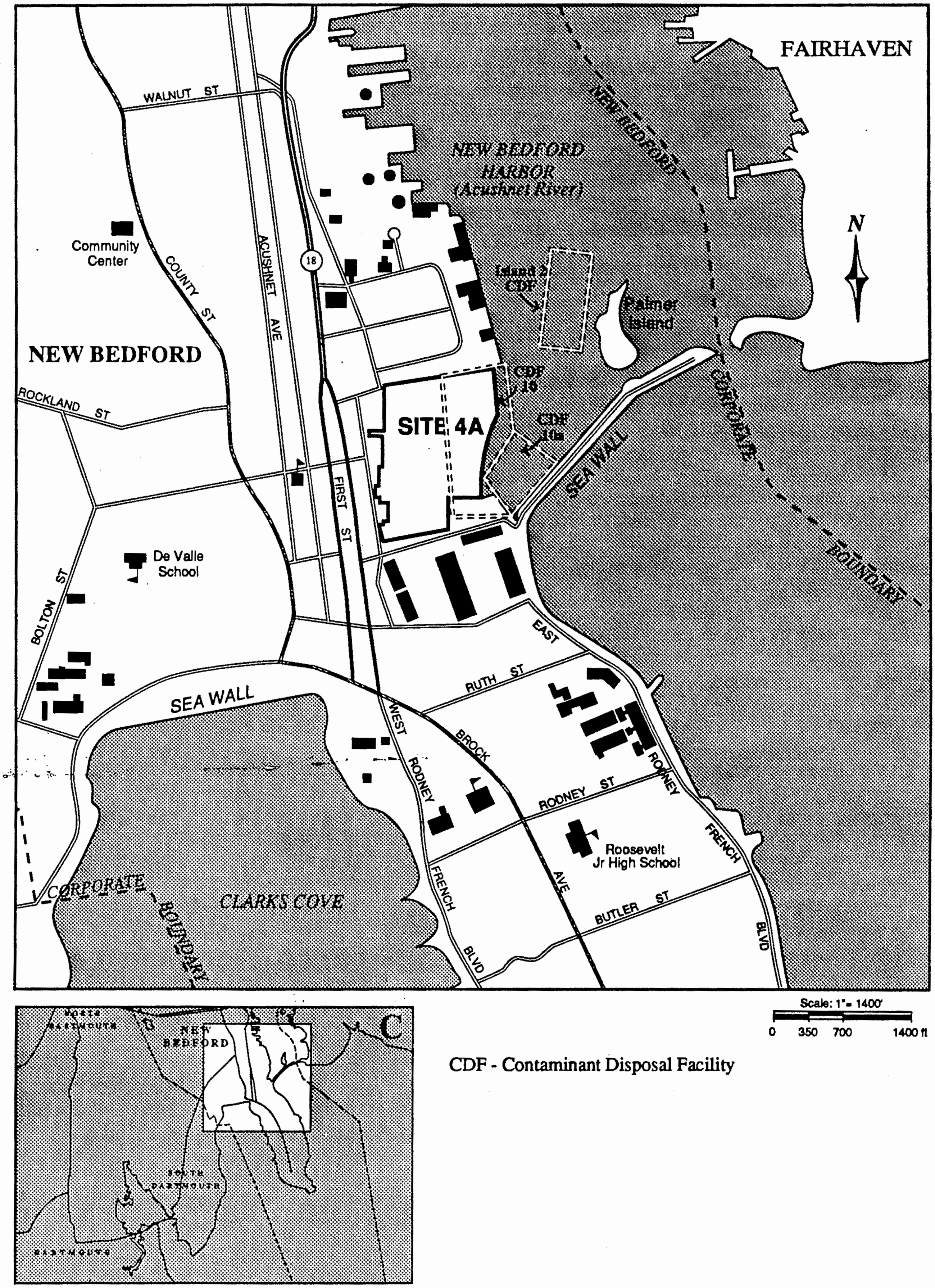
In addition to the potential problems caused by disturbance of contaminated sediments at a construction site, any construction options that require disposal of large amounts of contaminated sediment, such as trenching for a buried pipe, would also require locating a disposal site for the excavated sediment. Most harbor sediments are too contaminated for ocean disposal and other disposal or treatment options would be considerably more expensive.

Some options under consideration by the New Bedford Harbor Superfund program for disposal of contaminated sediments would not be compatible with alternatives being considered in the WWTP facilities planning process. When issued, the Superfund Feasibility Study will identify potential locations in the harbor for contained disposal facilities (CDFs) to receive contaminated sediments removed during remediation. Potential CDF Sites 10 and 10A are both located near WWTP Site 4A (see Figure 7.2-1) and would be incompatible with the location of the WWTP at Site 4A. No other WWTP sites under consideration would be impacted by CDF sites as currently projected. Because decisions regarding the type and extent of remediation to be conducted at the Superfund site are still pending, for the purposes of this Draft EIS, potential conflicts were assumed to be avoidable.

Finally, should the full dredging alternative currently under consideration for Superfund remediation be constructed, the shape of the harbor would be altered and it is possible that hydrodynamic modeling conducted to evaluate WWTP outfall siting could be invalidated, particularly for sites closer to shore. This potential effect is very conjectural and it is impossible to evaluate at this time.

## 7.3 COMPARISON OF WWTP ALTERNATIVES

The screening of the candidate WWTP sites conducted in Section 2.3 resulted in the selection of Sites 1A and 4A as the candidate facility locations. Potential environmental, socioeconomic, cultural, and institutional impacts caused by construction and operation of a plant at these two sites were evaluated in Chapter 6. The level of impacts was rated as either significant, moderate, or insignificant; these ratings are summarized in




CDF - Contaminant Disposal Facility

Adapted from CDM, 1989

**FIGURE 7.2-1**
**PROPOSED CONTAMINANT DISPOSAL FACILITIES NEAR ALTERNATIVE SITE 4A**

Table 7.3-1 and in the discussion below. The remaining step in the selection of a WWTP location involves the comparison of the two sites based on their relative impacts and development of mitigation measures which could reduce or eliminate those impacts.

### 7.3.1 Summary of Impacts

The following discussion summarizes the findings presented in Chapter 6 of this Draft EIS with regard to the WWTP. In particular, the discussion focuses on those factors for which significant impacts were predicted or which were most important in the decision-making process. Potential impacts occurring during both WWTP construction and WWTP operation are included.

**7.3.1.1 Construction.** Short-term reversible construction impacts may include increased traffic, fugitive dust, and noise. The severity of these impacts is directly related to the length of time required to construct the WWTP. There would be moderate traffic impacts from construction of a plant at either Site 1A or 4A. Up to 138 additional cars and 35 additional trucks per day would travel to and from Site 1A, and 152 cars and 58 trucks per day to and from Site 4A, during construction. However, this additional traffic does not represent a large increase in traffic levels currently existing on the routes to both sites. In addition, fugitive dust would be generated at both sites from demolition, earthmoving, stone crushing, loam spreading, and truck traffic.

Typical sustained construction workday noise would be audible over background noise levels at either site. Noise levels would be highest when rock drills and rock crushers were operating, and when blasting took place. During this time, which should not last more than 6 months, peak noise levels at the site boundaries could range up to 75 dBA and 83 dBA at Sites 1A and 4A, respectively. Typical sustained construction noise levels at the nearest residences would increase about 9 dBA at Site 1A but would not audibly increase at Site 4A because the residences are at least 1000 feet away from construction noise sources and are separated from the site by a highway.

The only long-range, irreversible impacts due to construction would be alteration of sensitive areas caused by filling. Although coastal wetland resources would be avoided at either site, some filling of Bordering Land Subject to Flooding would be necessary at Site 1A, and filling of approximately 2000 $ft^2$ of Bordering Vegetated Wetlands (BVW) and isolated patches of reeds would be required to construct the WWTP at Site 4A.

**7.3.1.2 Operation.** The construction of a wastewater treatment plant at either Site 1A or 4A would, to a certain extent,

**TABLE 7.3-1**

**SUMMARY OF IMPACT EVALUATIONS FOR WWTP SITING ALTERNATIVES**

| Impact Category | Site 1A | Site 4A |
|---|---|---|
| Conflict with On-site Land Use and Zoning | Moderate | Moderate |
| Conflict with Adjacent Land Use and Zoning | Moderate | Moderate |
| Traffic | Moderate | Insignificant* |
| Flood Hazard | Moderate | Insignificant |
| Surface Water Quality | Insignificant | Insignificant |
| Ground Water Quality | Insignificant | Insignificant |
| Air Quality and Odors | Moderate | Moderate |
| Noise | Significant* | Moderate* |
| Terrestrial Ecosystems | Insignificant | Insignificant |
| Wetlands | Moderate | Moderate |
| Historic and Archaeological Resources | Significant | Moderate |
| Visual | Significant | Moderate |
| Harbor Resources | Insignificant | Insignificant |
| Socioeconomic Resources | Significant | Significant |
| Recreational Resources | Significant | Significant |

* Represents impacts resulting from construction; impacts during operation would be insignificant

conflict with existing on-site and adjacent land use. At Site 1A, the existing educational, social service, recreational, and military facilities would be displaced, thereby requiring significant coordination between the City and federal, state, and local agencies to relocate and replace those facilities. In addition, there are currently deed restrictions on certain portions of the site which would have to be removed before it could be used for a WWTP. At Site 4A, the WWTP would not be compatible with the existing use of the site for recreation and as a parking area for local industry; these uses would be displaced. However, the relocation effort required at Site 4A would not be as major as that required at Site 1A.

A WWTP would not be compatible with adjacent residential land use at either candidate site. There are approximately 450 single family residences within a one-half mile radius of Site 1A and 3,200 multi-family and single family residences near Site 4A. The residences at Site 1A are separated from the site by Rodney French Boulevard and those at Site 4A are separated from the site by a major highway. These roads could act as buffers to help minimize the potential for any adjacent land use impacts from a new WWTP.

During operation of a WWTP, 14 additional car and no additional truck (over present conditions), and 74 car and 48 truck trips would be required each day at Site 1A and 4A respectively. Site 1A, due to its proximity to residential areas and its distance from major highways, has a greater potential for traffic impacts than Site 4A. The main access route to Site 1A is Rodney French Boulevard, so additional traffic associated with the WWTP could impact the nearby residential dwellings and local health clinic. Locating a WWTP at Site 4A, however, would not produce any noticeable traffic impacts because it is located adjacent to a major limited access highway.

The fact that part of Site 1A is located within the 100-year floodplain would be a moderate constraint on development at that site. Although the WWTP would be located outside of the coastal high energy hazard zone (V-Zone), without mitigation the treatment plant would be vulnerable to a flood of 100-year magnitude. Floodplain impacts are not a significant concern at Site 4A because only two acres of that site are in the 100-year floodplain and the site is protected by a hurricane barrier. Overall, given the proposed level of flood protection for Site 1A (discussed in Section 7.3.2.2, below), both sites are comparable with respect to potential flood hazards.

It is projected that there would be moderate air quality impacts from locating the WWTP at either of the two alternative sites. Both sites are in areas designated as "not in attainment" for the ozone ambient air quality standard and the proposed facility has the potential to emit greater than 100 tons per year (tpy) of VOCs. Therefore, the lowest achievable emission rate (LAER) with emission controls for VOCs will be required. In addition, if the facility still were to emit more than 100 tpy of VOCs even after application of LAER control, emissions offsets would be necessary (see Section 6.3.1). Potential emissions of all other compounds are not predicted to exceed state or federal standards at either candidate site. Overall, both sites are considered equal with respect to compliance with air toxic and odor criteria. Although any air quality impacts at Site 4A would affect a larger population (because there are more residences within one-half mile of Site 4A than there are at Site 1A), these differences are not significant compared to other assumptions made in the air quality analysis (CDM, Volume V, 1989).

Impacts associated with plant operation noise would not be significant at either candidate WWTP site. During normal operation at Site 1A, the ambient noise level is predicted to increase by approximately 0.8 dBA at the northeast corner of the site boundary and 3.0 dBA along Brock Avenue near the residences on Rodney French Boulevard. Similarly at Site 4A, a predicted increase in noise levels of approximately 0.6 dBA would occur at the northwest corner of the site and 1.1 dBA in the adjacent residential area. In both cases, the projected noise levels in the adjacent residential areas do not exceed the noise criteria, and thus no significant noise impacts to nearby residences would result from WWTP operation at either site.

No significant terrestrial ecology or wetlands impacts are predicted from siting the WWTP at either Site 1A or 4A, other than the irreversible impacts resulting from construction, as described above in Section 7.3.1.1.

Socioeconomic and cultural resource impacts associated with the location of a wastewater treatment plant in the City of New Bedford include impacts to historic, archaeological, visual, and recreational resources as well as socioeconomic impacts such as lost opportunity costs.

Location of a WWTP at Site 1A could have a significant impact on historic and archaeological resources because the site contains the Fort Taber Historical District and several other historic structures and artifacts potentially eligible for inclusion in the District or listing in the National Register (CDM, Volume V, 1989). Should Site 1A be chosen for the WWTP, a more detailed evaluation to determine National Register eligibility would be necessary in order to comply with the National Historic Preservation Act, and develop any necessary mitigation for adversely affected National Register eligible resources. Location of a WWTP at Site 4A is predicted to have a moderate impact on historic and archaeological resources because although no National Register eligible resources have yet been identified, the site could potentially contain archaeological artifacts from prehistoric times, the War of 1812, and a 19th century candle factory. Again, a more detailed survey of the site and several adjacent properties would be required if the site is selected for the WWTP.

The proposed treatment facility is expected to have a significant impact on visual resources at Site 1A but only a moderate impact at Site 4A. The existing conditions at Site 1A provide an open view of the ocean from the Fort Taber area and adjacent residential neighborhoods; thus there are a number of locations from which the WWTP would be visible. At Site 4A, existing visual quality would be only moderately impacted because views of the site are limited by the adjacent industrial buildings and the hurricane barrier. The highway bordering the site to the west separates it from the only residential area from which the WWTP would be visible; thus views from that neighborhood would not be greatly degraded.

Locating the WWTP at either candidate site would have a significant impact on recreational uses on-site. At Site 1A, tennis courts and playing fields would be displaced by construction of the WWTP. At Site 4A, there are many recreational uses including baseball, softball, basketball, soccer, and bicycle racing. These resources would all be displaced by using the site for a WWTP. In addition, although there are not predicted to be any significant noise, odor or water quality impacts in these areas, use of beaches and water near both sites for swimming, boating, and recreational fishing might decrease because of negative perceptions about the WWTP. There is a major difference between the two alternative sites in the projected socioeconomic impacts associated with locating the WWTP at Site 1A versus Site 4A. The cost of building the WWTP (capital and O&M) is roughly the same for both sites. However, the potential development revenues that might be realized at the two sites in the absence of a WWTP differ significantly. Potential alternate uses of Site 1A, which include combinations of housing, park land, and marina space, could generate annual tax revenues of up to $1.6 million. Although there could also be non-quantifiable benefits associated with alternate development at Site 1A (e.g., additional housing, additional parkland, improved access to the waterfront) the deed restrictions on portions of the site make it uncertain as to whether such plans could be implemented. Alternate use of Site 4A for industrial or mixed uses such as the proposed Palmer's Cove development could generate up to $3.4 million annually in property taxes to the City. In addition, development at Site 4A could bring improvements to an under-utilized site, be consistent with the New Bedford Economic Development Commission's goal of increased industrial development, improve access to the waterfront, and even possibly lead to improvement or rehabilitation of surrounding neighborhoods. In addition, this type of development at Site 4A seems to have a higher likelihood of occurring than those discussed for Site 1A if not used for the WWTP.

### 7.3.2 Mitigation

In any construction project, careful engineering and design can help to avoid many of the predicted adverse impacts. In the case of the proposed wastewater treatment plant, a combination of good design and mitigation should help to reduce or eliminate the predicted impacts from the facility. This section discusses measures that can be taken to mitigate the impacts identified in the previous section.

**7.3.2.1 Construction.** To mitigate traffic problems during construction at Site 1A, EPA recommends that a police officer be stationed at the intersection of JFK Boulevard and Cove Street during peak hours throughout the construction period. Greater enforcement of loading and parking restrictions along Cove Street would enable free flow of large trucks through the area. Also, adjustment of WWTP work shifts around the peak hour flows would reduce potential congestion during these times. Another mitigation measure worthy of further investigation is having construction traffic use the secondary access route when travelling to the site and the primary route when leaving the site. This could help minimize congestion and delays by reducing the number of necessary left-hand turns.

Traffic problems would not be as severe at Site 4A and could be avoided with minimal mitigation. It would be necessary to keep narrow twelve-foot lanes open in the right-of-way to allow access from abutting properties to Blackmere and Gifford Streets (and possibly other adjacent streets if extensive utility relocations are required) because no alternative routes exist to service those properties. In addition, it is recommended that a no-parking policy be instituted on the residential collector streets McGurk, Viall, Salisbury, Ashley, Roosevelt, Cleveland, and Abbott Streets if they were to become the only way trucks could access the industries on the north side of Cove Street.

To mitigate air quality impacts during construction, it is recommended that dust suppressants be applied to main truck haulage routes within the site to reduce fugitive dust emissions.

Construction noise impacts at Site 1A should be minimized by placing a noise barrier such as an acoustic wall or berms along the northern boundary of the site. This would reduce typical sustained construction noise levels at residences across the street by 10 dBA. In addition, use of the best available noise muffling equipment on all large pieces of construction equipment could achieve up to an additional reduction of 10 dBA in daytime noise. With these two measures, construction noise levels at the residences would only occasionally be audible over the prevailing ambient traffic noise. Further mitigation measures such as temporary barriers or enclosures may also be needed to control peak noise levels due to blasting and rock drilling.

**7.3.2.2 Operation.** Potential land-use mitigation measures at Site 1A include relocation of Army and educational facilities (providing them with comparable facilities at other sites within the City of New Bedford), and development of a waterfront park and recreational fields adjacent to the WWTP. The proposed Taber Park (CDM, Volume V, 1989) would not only act as a buffer to the adjacent neighborhoods, but would also improve public access to the waterfront, provide recreational opportunities, and help preserve the Fort Taber Historical District by restoring the fort and flanking batteries and documenting the history of Clark's Point through signage and public exhibits of historic documents, photographs, and artifacts.

On-site and adjacent land use impact mitigation measures at Site 4A include projects to improve public access to the waterfront and upgrading the South First Street neighborhood. Waterfront access projects include creation of a Palmer's Island Park, improvements to Palmer's Island, upgrading of the existing boat ramp, and provision of parking facilities for the public and for the industrial buildings located south of the site. Public infrastructure and facility improvements could include building improvements and the creation of a neighborhood civic organization.

In order to minimize traffic impacts due to plant operation at Site 1A, level of service (LOS) improvements could be made (CDM, Volume V, 1989). Although LOS impacts from the proposed WWTP would be negligible, conditions at the intersection of West Rodney French Boulevard/Cove Road and Brock Avenue during the peak PM hour are already congested. Transport during the peak period should be avoided and improvements such as resetting signal timing, making channelization and geometric improvements, and widening pavement to help increase the capacity of the intersection are recommended.

EPA has determined that constructing a WWTP in the floodplain at Site 1A would not constitute a critical action requiring protection from a storm of 500-year magnitude. Nevertheless, EPA and the Federal Emergency Management Agency (FEMA) recommend that a WWTP built at Site 1A be designed to withstand greater than the 100-year flood. Mitigation measures which would provide protection at the 500-year stillwater level (no wave action), include:

- o construction of all facilities outside of the V-Zone or coastal high hazard zone;
- o raising site grading to above elevation 11.5 ft.;
- o constructing all first floors of buildings above elevation 13.5;
- o for buildings with basements, insuring that water cannot reach basements until flood level exceeds 13.5;
- o providing stoplogs or equivalent for all garage entrances to buildings to keep water out up to elevation 13.5; and
- o mounting drives above elevation 13.5 on all process tankage.

These measures are a part of the City's recommended plan. Taking these measures would ensure that valuable equipment would be protected from water damage during a 500-year flood. No protection would be installed to prevent inundation of tanks by flood waters rising above elevation 13.5 because saltwater intrusion would not damage the tanks, but only interrupt operations, which could be resumed once floodwaters had receded.

At both Sites 1A and 4A, the level of mitigation needed to meet air quality standards is achievable through control technologies normally applied to WWTPs. These include the use of the lowest achievable emission rate with emission controls for VOCs and possibly emission offsets, as described above.

Once the WWTP is operational, mitigation of noise impacts would be accomplished through good engineering practice, including muffling blower intakes, noise exhausts or generators, housing motors, and using acoustical dampening, and barriers around noisy equipment.

Further investigation to determine National Register eligibility of resources would be necessary for either site selected for the WWTP, in order to develop a mitigation strategy and comply with the provisions of the National Historic Preservation Act. Potential measures to reduce or eliminate adverse impacts to historic resources include:

- o documenting each affected structure in accordance with procedures outlined by the Historic American Building Survey and the Historic Architectural Engineering Record;

- rehabilitating or restoring affected structures in accordance with National Park Service guidelines; and

- preparing exhibits of historic documents and artifacts to interpret the history of Clark's Point (particularly its military uses) for the public.

Mitigation measures to reduce the visual impacts of locating the new WWTP at Site 1A are incorporated in the proposed Taber Park mitigation plan discussed above (and described fully in Chapter 12 of Volume II of the Draft Environmental Impact Report, CDM, Volume II, 1989). The park improvements would rejuvenate the site, which is currently in disrepair, and significantly improve its appearance. The view of the site from the water would be improved when the existing treatment plant is demolished and plantings would be used along South Rodney French Boulevard to screen views of the new WWTP from the adjacent residential neighborhood. Similarly for Site 4A, the proposed neighborhood improvements discussed in relation to mitigation of land use impacts would also mitigate visual impacts at the site.

The benefits of the proposed Taber Park plan at Site 1A and neighborhood improvements at Site 4A would also help to offset the potential socioeconomic impacts to the City associated with constructing a WWTP at one of its two remaining undeveloped waterfront sites.

Although there would be some displacement of recreational resources if the proposed WWTP were located at either Site 1A or Site 4A, these impacts would be mitigated by improved public access to the waterfront and the new recreational facilities that have been proposed as part of the Taber Park and Palmer's Island mitigation plans. These plans include provisions for picnic areas, hiking paths, and boating facilities.

### 7.3.3 Acceptable Alternatives

The evaluation of the WWTP siting alternatives presented above and in Chapter 6 incorporated the impacts predicted during construction and operation of the WWTP and the mitigation measures capable of reducing or eliminating these impacts. Some of the more problematic factors for both sites included construction traffic and noise, floodplain issues, visual and aesthetic impacts and socioeconomic impacts. As discussed above, however, all significant impacts can be mitigated. After mitigation, the predicted environmental, socioeconomic, institutional and cultural impacts of a WWTP at either Site 1A or Site 4A are considered acceptable.

## 7.4 COMPARISON OF SOLIDS DISPOSAL ALTERNATIVES

Impacts related to environmental, socioeconomic, cultural and institutional issues were evaluated in Chapter 6 of this Draft EIS for candidate solids disposal Sites 47 and 40. As discussed in Chapter 3, these sites are also being considered for use with other existing or planned facilities outside of New Bedford, in particular the Crapo Hill Landfill. Other potential impacts from disposal of fixed sludge at these facilities are assumed to be the same as existing or planned impacts because the fixed sludge would be similar to cover materials used or planned for use at these sites. Impacts at Sites 40 and 47 were rated by the level of impact expected, ranging from insignificant to significant impacts. These evaluations are summarized in Table 7.4-1 and discussed below for all issues addressed. The remaining step in the selection of a solids disposal location involves the comparison of the two sites based on their relative impacts and development of mitigation measures which could reduce or eliminate those impacts.

### 7.4.1 Summary of Impacts

The following discussion summarizes the findings presented in Chapter 6 of this Draft EIS with regard to solids disposal facilities. In particular, the discussion focuses on those factors for which significant impacts were predicted or which were most important in the decision-making process. Potential impacts occurring during both construction and operation of solids disposal facilities are included.

**7.4.1.1 Construction.** Short-term reversible construction impacts may include increased traffic, fugitive dust and noise, and potential wetlands and ecological impacts. Approximately 13 car and 43 truck trips per day would occur during construction at either Site 40 or 47. If the primary access route is used, traffic impacts due to construction at Site 47 would occur only during peak evening flow (2 pm - 5 pm), when left-turning trucks could contribute to delays at the southbound on-ramp to Route 140. However, if the secondary route is used, both traffic flow and access to major highways could be impacted. Traffic impacts during construction activities at Site 40 could include increased delays at the intersection of Rice Boulevard/Braley Road/Phillips Road between 3 pm and 4 pm on workdays.

Fugitive dust emissions created during construction could potentially cause an impact to off-site receptors at both sites.

Noise from construction of solids disposal facilities at Site 47 would be audible only within about 400 feet of the site, which includes a portion of the golf course (noise levels of up to 78 dBA at the edge of the course are predicted). No residences

## TABLE 7.4-1

## SUMMARY OF IMPACT EVALUATIONS FOR SOLIDS DISPOSAL SITING ALTERNATIVES

| Impact Category | Site 47 | Site 40 |
|---|---|---|
| Conflict with On-site Land Use and Zoning | Insignificant | Insignificant |
| Conflict with Adjacent Land Use and Zoning | Insignificant | Insignificant |
| Traffic | Moderate* | Moderate* |
| Flood Hazard | Insignificant | Insignificant |
| Surface Water Quality | Insignificant | Insignificant |
| Groundwater Quality | Moderate* | Moderate* |
| Air Quality and Odors | Insignificant | Insignificant |
| Noise | Insignificant | Insignificant |
| Terrestrial Ecosystems | Insignificant | Insignificant |
| Wetlands | Significant** | Insignificant |
| Historic and Archaeological Resources | Moderate | Moderate |
| Visual | Insignificant | Insignificant |
| Socioeconomic Resources | Insignificant | Significant |
| Recreational Resources | Insignificant | Insignificant |

* Represents impacts resulting from construction; impacts during operation would be insignificant.

** Insignificant if only the Initial Phase Landfill area developed.

would be affected. Construction activities at Site 40 would increase noise levels at site boundaries, but noise increases at the nearest residences (Pine Hill Acres) would not be significant.

Construction of a 20-year (both Initial and Final phase) solids disposal landfill at Site 47 would result in significant wetlands impacts. Specifically, construction of the Final Phase of the sludge landfill (see Section 6.5.2) at the site would result in filling of a large area of wetlands. In contrast, no wetlands would need to be filled in order to develop only the Initial Phase of the sludge landfill at Site 47 as part of the alternative including use of chemically fixed sludge as daily cover at the Crapo Hill Landfill. No wetland filling would be required for construction of solids disposal facilities at Site 40.

Other potential impacts due to construction activity at Site 40 include erosion and siltation, which could impact wetlands in the adjacent Acushnet Cedar Swamp. In addition, several species of special concern are reported to occur in the Acushnet Cedar Swamp and could be affected by development at Site 40 unless precautions are taken.

**7.4.1.2 Operation.** Both Site 40 and Site 47 are currently vacant and there are no existing adjacent residential areas. Some areas adjacent to Site 47 are zoned for residential use, but they are far from the facility area and buffered by vegetation. Industrial uses around the sites (including the municipal solid waste landfill and incinerator adjacent to Site 47) would be compatible with the proposed solid waste facilities. Therefore, no significant land use impacts are predicted for use of either site for solids disposal.

Traffic generated during operation of solids disposal facilities at either Site 40 or Site 47 include 5 car and 14 truck trips per day. These would not result in significant impacts because the additional traffic would be only a small increase from existing conditions, and it would be consistent with the general character of the routes.

The maximum level of seasonal high groundwater at Site 47 is likely to be within four feet of the ground surface on most if not all of the site. Therefore, the State landfill design criterion of a 4 foot minimum separation between the bottom of the landfill liner and the maximum high groundwater level would not be met without raising the ground elevation of much of the area, resulting in potentially significant impacts. This same situation exists at Site 40. In addition, groundwater near Site 40 is currently used for industrial purposes, and a portion of the site has been preliminarily identified as being within the

Zone II area of a possible future public drinking water supply (although the likelihood of that supply being developed is low because of other potential existing contamination problems). No groundwater supply impacts are anticipated at Site 47. Because runoff from solids disposal facilities would be controlled at either site, no surface water impacts are predicted.

No air quality or odor impacts are predicted at Sites 40 or 47 because the sludge will undergo either chemical fixation or lime stabilization at the WWTP, which will minimize volatilization of organic material prior to transport to the disposal site. Also, there are no sensitive receptors in the immediate area of either site.

Again, because there are no residential areas or other sensitive receptors adjacent to either Site 40 or 47, noise impacts during operation of solids disposal facilities are not predicted to be significant. Noise level increases at the closest residential areas, the Pine Acres Subdivision (near Site 40) or the Hathaway Road/Whitlow Street intersection (near Site 47), are predicted to be less than 1 dBA.

As discussed above, the Acushnet Cedar Swamp is suitable habitat for several species designated by the Massachusetts Natural Heritage Program as being of special concern. However, because no significant noise or surface water impacts are predicted from operation of solids disposal facilities at Site 40, no impact on these species is predicted to result from operation of such facilities.

No visual impacts are predicted to result from operation of solids disposal facilities at either Site 40 or 47 because they are not near residences and views would be buffered by vegetation at either site.

Potentially significant archaeological artifacts were found during investigations at both Sites 40 and 47. More intensive investigations would be necessary to determine if these potential resources are eligible for the National Register, if either site is selected.

### 7.4.2 Mitigation

As with the WWTP, careful engineering and design can help to avoid many of the adverse impacts predicted from construction and operation of the proposed solids disposal facilities. This section discusses measures that can be taken to mitigate the impacts identified in the previous section.

**7.4.2.1 Construction.** It is recommended that possible traffic impacts at Site 47 be mitigated by using the primary access route (for implementation of only the Initial Phase Landfill) or splitting traffic between the two routes (for implementation of both Initial and Final Phases of the landfill).

At both Site 47 and Site 40 fugitive dust emissions created during construction and operation should be mitigated through the use of good engineering practices such as sprinkling water or a dust suppressant on both access roads and the landfill area.

Impacts to wetlands due to the extensive filling that would have to occur during construction of a Final Phase Landfill at Site 47 could not be reasonably mitigated. However, should only the Initial Phase Landfill be constructed, impacts to wetlands at Site 47 could be avoided by developing only the upland area east of the water main and utilizing the primary access route.

To alleviate possible impact on the Acushnet Cedar Swamp and its special habitat, both buffer zones and erosion and sedimentation control measures (e.g., containment berms, use of double liners, and erosion control techniques such as silt curtains and haybales) should be implemented at Site 40.

**7.4.2.2 Operation.** The major impact associated with operation of solids disposal facilities at either Site 40 or 47 is potential groundwater impacts. Mitigation would be required for either site to be suitable for a landfill. The sites would require extensive filling to ensure the required 4-foot separation between the bottom-most landfill liner and the seasonal high groundwater. In addition, more extensive investigations would have to be conducted at Site 40 to determine accurate boundaries for the Zone II area of the potential water supply. It is the current policy of the Massachusetts Department of Environmental Protection that landfills not be constructed within the Zone II area of any existing or potential public drinking water supply. Therefore, the boundaries of such an area at Site 40 would dictate the size and layout of any potential landfill there.

### 7.4.3 Acceptable Alternatives

The evaluation of the solids disposal facilities alternatives presented above and in Chapter 6 incorporated the impacts predicted by the construction and operation of facilities at the two candidate sites alone or in conjunction with use of chemically fixed sludge as daily cover at the proposed Crapo Hill municipal solid waste landfill or other landfill facilities outside New Bedford. Mitigation measures capable of reducing or eliminating predicted impacts were discussed above. The major problematic factors for both sites were potential groundwater and wetlands impacts.

As noted above, significant wetlands impacts which would occur from construction of the Final Phase Landfill at Site 47 could not be mitigated. Therefore EPA finds that this alternative is not environmentally acceptable. After mitigation, the predicted environmental, socioeconomic, institutional and cultural impacts of a solids disposal landfill in the Initial Phase Landfill area at Site 47 along with use of the chemically fixed sludge at other disposal facilities would be acceptable. Similarly, a solids disposal landfill along with use of other proposed solids disposal facilities for the chemically fixed sludge would be acceptable at Site 40 contingent on the landfill layout avoiding the potential public water supply Zone II boundary (as discussed above, additional study would be required to more accurately define the Zone II boundary).

## 7.5 COMPARISON OF OUTFALL ALTERNATIVES

The screening of outfall alternatives conducted in Chapter 4 resulted in the selection of three combinations of sites and technologies for detailed analysis: rehabilitation of the existing outfall at the Existing Site, construction of a new pipe and diffuser at the Existing Site, and construction of a new tunnel and diffuser at the 301(h) Site. Potential environmental, socioeconomic, cultural, and institutional impacts caused by construction and operation of the new secondary effluent outfall alternatives were evaluated in Chapter 6. Table 7.5-1 contains a summary of the predicted impacts. The remaining step in the selection of an outfall site involves the comparison of the alternatives based on their relative impacts and development of mitigation measures which could reduce or eliminate those impacts.

### 7.5.1 Summary of Impacts

The following discussion summarizes the findings presented in Chapter 6 of this Draft EIS with regard to outfall alternatives. In particular, the discussion focuses on those factors for which significant impacts were predicted or which were most important in the decision-making process. Potential impacts occurring during both construction and operation of the outfall alternatives are included.

**7.5.1.1 Construction.** Short-term reversible impacts predicted to occur during construction of the 3 outfall alternatives considered include potential water quality and benthic impacts (Table 7.5-1). Temporarily diminished water quality can be anticipated during dredging and disposal activities associated with the installation of a new pipe at the Existing Site. During dredging, PCBs and other contaminants would be unavoidably dispersed into the water column, increasing their

**TABLE 7.5-1**
**OUTFALL SITING CRITERIA SUMMARY**

| CRITERION | OUTFALL SITE | | |
|---|---|---|---|
| | Existing | | |
| | Rehabilitation | Diffuser | 301(h) |
| WATER QUALITY IMPACTS | | | |
| A. Toxic Substances Exceedences of: | | | |
| CCC | 7 | 3 | 1 |
| CMC | 2 | 1 | 0 |
| $10^{-6}$ | 3 | 3 | 2 |
| $10^{-5}$ | 2 | 2 | 1 |
| B. Dissolved Oxygen Worst Case Total D.O. Depletion | 2.43 mg/l | 2.43 mg/l | 0.57 mg/l |
| C. Temp. and pH Standards | MET | MET | MET |
| D. Maximum Area of Predicted Fecal Coliform Violations (Shellfish Standard) | 100,000m$^2$ | <100,000m$^2$ | NONE |
| E. Chlorine Toxicity Chronic Criterion | VIOLATION FOR AVG. & WORST CASE | VIOLATION FOR AVG. & WORST CASE | VIOLATION NOT LIKELY |
| F. Available Dilution | | | |
| Average | | | |
| 30 mgd | 11.6 | 52.9 | 174.2 |
| 75 mgd | 8.1 | 27.9 | 69.8 |
| Worst Case | | | |
| 30 mgd | 11.6 | 35.6 | 43.5 |
| 75 mgd | 8.1 | 26.1 | 34.0 |
| G. Nutrient Enrichment of the Mixing Zone | | | |
| Average | Degraded | Degraded | Changed |
| Worst Case | Degraded | Degraded | Changed |
| SEDIMENT IMPACTS | | | |
| A. Total Predicted Maximum Steady State Rate of Accumulation (G/M$^2$) | 11 | 11 | 8 |

**TABLE 7.5-1 (CONTINUED)**
**OUTFALL SITING CRITERIA SUMMARY**

| CRITERION | OUTFALL SITE | | |
|---|---|---|---|
| | Existing | | |
| | Rehabilitation | Diffuser | 301(h) |
| B. Existing Total Sum of Metals in Sediment (ug/g) | 2707 | 2707 | 145 |
| C. Additional Metals Predicted in the Sediments Resulting from Discharge (ug/g) | 8 | 8 | 15 |
| D. Increase in Organic Carbon Levels (g carbon/$m^2$/yr) | up to 165 | up to 165 | 354 |
| ECOSYSTEM IMPACTS | | | |
| A. Total Aquatic Life Criteria Violations | 9 | 4 | 1 |
| B. Potential for Critical Low Dissolved Oxygen Event | MODERATE | MODERATE | LOW |
| C. Effects of Sediment Impacts | MINOR | MINOR | MINOR |
| D. Effects of Chlorine Toxicity | SIGNIFICANT | SIGNIFICANT | NONE |
| E. Changes in Phytoplankton Productivity due to Effluent | INCREASE | INCREASE | INCREASE |
| F. Long Term Impacts to Benthic Community | CONTINUED SIGNIFICANT TO MODERATE IMPACTS | CONTINUED MODERATE IMPACTS | NEGLIGIBLE |
| AESTHETIC IMPACTS | | | |
| A. Potential for Nuisance Algal Blooms | UNCHANGED | UNCHANGED | UNCHANGED |
| B. Percentage of Time Plume Surfaces | 100% | 78% | 57% |
| C. Dilution of Surfacing Plume | <8 | 28-98 | 45-174 |
| D. 50-Percentile Dilution of Surfacing Plume | <8 | 35 | 80 |

**TABLE 7.5-1 (CONTINUED)**
**OUTFALL SITING CRITERIA SUMMARY**

| CRITERION | OUTFALL SITE | | |
|---|---|---|---|
| | Existing | | |
| | Rehabilitation | Diffuser | 301(h) |
| E. Shoreline Protection | EXCELLENT | EXCELLENT | EXCELLENT |
| CONSTRUCTION IMPACTS[1] | | | |
| A. Duration (months) | 8 | 17 | 38 |
| B. Water Quality Impacts* | Moderate | Moderate | Negligible |
| C. Impacts to Benthic* Organisms | Moderate | Negligible | Negligible |
| D. Total Area of Bottom Disturbance ($m^2$) | 0 | 27,000 | 1,200 |
| E. Volume of Dredge Spoil for off-site Disposal ($m^3$) | 0 | 14,000 | 73,000 |
| F. Dredge Spoil Category | N/A | 3 | 1 |
| G. Protection of Marine Archaeology | EXCELLENT | GOOD | FAIR |
| SOCIOECONOMIC IMPACTS | | | |
| A. Reliability | EXCELLENT | EXCELLENT | EXCELLENT |
| B. Flexibility for Future Needs | POOR | FAIR | GOOD |
| C. Operational Complexity | MODERATE | MODERATE | MODERATE |
| D. Power Needs (1,000 kw-hrs) | 332 | 183 | 777 |
| E. Capital Costs ($M) | 4-5 | 20 | 70 |
| F. Cost of Spoils Disposal ($M) | 0-1 | 0-15 | 0 |
| G. Degree of Additional Pretreatment | EXTENSIVE | MODERATE | LOW |
| H. Permitting | EXTENSIVE | EXTENSIVE | EXTENSIVE |

*Short term Impacts

[1]Includes environmental, cost, duration

bioavailability. Although dredging would also be required during construction of a new diffuser at the 301(h) Site, the amount of material dredged and the contaminant levels in the sediment would be much lower.

Irreversible impacts occurring during construction are related to habitat disturbance. Approximately 1200 $m^2$ of seabed would be destroyed during construction of a diffuser at the 301(h) Site. Installation of a new pipe at the existing outfall would result in the loss of 27,000 $m^2$ of benthic habitat. Rehabilitation of the existing outfall would result in dispersal of contaminated debris from the pipe to the area immediately surrounding the existing outfall during the cleaning process. This would result in increased concentrations of toxics in the sediment and potentially alter sediment grain size in the area surrounding the outfall. A small area of undetermined size of the seabed would be covered with contaminated debris, threatening survival of benthic organisms and increasing risks from bioaccumulation. Recolonization of the area would be delayed until sediment reworking returns the sediments to a condition favorable for resettlement.

The presence of shipwrecks near the 301(h) Site increases the potential for archeological impacts during construction at this site.

#### 7.5.1.2 Operation.

**Water Quality.** Secondary effluent discharge is predicted to result in levels of contaminants that exceed EPA's human health and aquatic toxicity criteria for all three outfall alternatives. These predicted exceedances are shown in Table 7.5-1.

Massachusetts' water quality criteria are predicted to be upheld more frequently at the 301(h) Site than at the Existing Site (either option). Predicted worst case oxygen depletions are more than four times greater at the Existing Site than at the 301(h) Site. Violations of the Massachusetts dissolved oxygen standard of 6.0 mg/l are predicted to occur much more frequently at the Existing Site than at the 301(h) Site. Bacteria in the effluent discharged at the existing outfall site under worst case conditions may cause some areas to exceed fecal coliform standards for shellfish; no adverse effects are expected at the 301(h) Site (Table 7.5-1).

Effluent toxicity testing indicates that the secondary effluent would be chronically toxic to sensitive marine species at anticipated dilution levels at the existing outfall site, whereas chronic toxicity concentrations would be averted approximately 90 percent of the time at the 301(h) Site, because of the increased dilution available. Residual chlorine levels at the Existing

Site are predicted to exceed the EPA chronic criteria at the edge of the mixing zone and acute toxicity values for chlorine for shellfish larvae will also be exceeded at this site. The 301(h) Site will not have chlorine toxicity problems due to increased dilution capabilities and longer chlorine contact time allowing for lower chlorine dosing at the plant.

**Sediment Quality.** Effluent discharge is predicted to increase the levels of trace metals and PCBs in the sediments. The proportion of these materials accumulating in sediments as a result of a new outfall will be higher at the 301(h) Site than the existing outfall site because the natural sedimentation rate is lower at the 301(h) Site. However, because concentrations currently in the sediments are much higher at the existing outfall site, the total amount of metals in sediments would remain higher at this site for a very long time. EPA has not yet developed sediment toxicity criteria for metals; however a sediment criterion does exist for PCBs. PCB levels in sediments are predicted to continue to exceed this standard at the existing outfall site, but will not exceed the standard at the 301(h) Site.

Effluent discharge is also predicted to increase sediment organic carbon levels by approximately 4 percent at the Existing Site and 9 percent at the 301(h) Site (Table 7.5-1); again the greater increase at the 301(h) Site is due to the lower natural sedimentation rate at that site, and again the total organic carbon level at the Existing Site would remain much higher than that at the 301(h) Site for some period of time because of the effects of the existing discharge.

**Ecosystems.** The biological response to changes in water and sediment quality is difficult to predict. It seems likely that additional nutrient input will result in increased primary productivity at both candidate sites, perhaps as much as double the current level at the 301(h) Site. Extremely high levels of primary productivity currently occur at the existing outfall site due primarily to the current discharge. There is evidence to indicate that nutrient limitation does exist for part of the year and thus the input of additional nutrients from a new secondary discharge may slightly increase these high levels. The major result of a secondary discharge at the Existing Site would be the dramatic increase in the areal extent of this high level of productivity from the current estimated 1 $km^2$ to approximately 6 $km^2$ or two thirds of the outer harbor.

Organic carbon inputs to sediment resulting from enhanced primary production will add to the organic carbon input from the effluent. Sediment organic enrichment has a range of effects on the underlying benthic community. In some cases, enrichment enhances benthic productivity, while in other cases a stress-tolerant benthic community results. Because organic loadings expected from the secondary effluent are significantly less than those from the current primary effluent, the overall organic loading from a new discharge at the Existing Site is expected to decrease. As a result, the health of the benthic community at the existing outfall site may potentially improve, becoming more diverse and productive as organic input lessens. At the 301(h) Site, increased organic input from a new discharge is predicted to enhance benthic productivity without stressing the resident infauna.

The predicted exceedances of water quality criteria and standards at the candidate outfall sites may also affect biological communities. Potential dissolved oxygen concentrations below 5 mg/l at the Existing Site could have adverse impacts on shellfish and other benthic organisms near that site. Dissolved oxygen levels are not expected to drop to anoxic or hypoxic (< 3.0 mg/l) conditions, so fish or other motile species are not expected to be impacted.

The predicted worst case chlorine residual concentrations around the Existing Site are above concentrations known to be acutely toxic to some marine species. Also, 9 and 4 EPA water quality criteria for the protection of aquatic life are predicted to be exceeded at the Existing Site for the rehabilitation and new pipe and diffuser alternatives, respectively. In particular, predicted copper concentrations are higher than levels shown to be acutely toxic to blue mussels.

Also as discussed above, the rehabilitation option at the Existing Site would never meet the predicted dilution required to avoid chronic toxicity to sensitive marine species (the new pipe and diffuser option at the Existing Site would meet required dilution approximately 70 percent and the 301(h) Site approximately 90 percent of the time). Although the tests used to predict this dilution were variable, the increased dilution at the 301(h) Site ensures less potential ecosystem impacts than at the Existing Site.

Neither of the candidate outfall areas contain critical habitat for threatened or endangered species during any of their life stages. Although higher levels of contaminants and more frequent plume surfacing would occur at the existing outfall site in comparison to the 301(h) Site, endangered and threatened species rarely occur in the project area, so the probability of adverse impacts to these species at either site is low.

**Aesthetics.** Aesthetics impacts are related to the amount of time that the discharge plume reaches the surface. Effects will be most severe at the existing outfall site, where the discharge plume will reach the surface all (under the rehabilitation option) or nearly all (for the new pipe and diffuser option) of the time. The plume will surface a little more than half of the time at the 301(h) Site. At the 301(h) Site, when the plume does surface, it will be much more dilute, thereby reducing aesthetic impacts.

No changes in the potential for nuisance algae blooms (such as red or brown tide) are predicted for either site, and shoreline impacts from an outfall at either site are not expected.

**Socioeconomic.** Other impacts must be considered in evaluating the outfall alternatives. The long duration, high complexity, and large disposal needs for construction of the 301(h) alternative obviously cause increased costs, currently estimated at $70 million. At the existing outfall site, installation of a new pipe and diffuser will involve construction of moderate duration and complexity. Disposal of contaminated sediments for this alternative would pose a logistical and costly challenge as well as an environmental risk. Construction costs without disposal are estimated at $20 million. The rehabilitation option at the existing outfall site has the lowest impact in terms of construction duration, complexity, and cost ($4-5 million). However, some level of additional treatment would be needed in order to correct predicted toxicity problems at this site. This could include a pretreatment/source reduction program to decrease the amount of toxics reaching the treatment plant (see Section 7.5.2.2 below) or additional wastewater treatment processes designed to remove problematic toxic pollutants once they have been fully identified. The cost of such toxicity reduction measures has not been determined, however because the necessary toxicity reduction is quite large, it is likely that the costs of such measures could be high.

The ability to meet future water quality needs must also be considered in addition to the present needs. The outfall's flexibility in meeting future water quality criteria is dependent on its potential for dilution. Both options at the existing outfall site are less able to meet the anticipated water quality needs of the future than the 301(h) Site.

### 7.5.2 Mitigation

Some of the impacts discussed above can be avoided by careful engineering and design of the outfall. This section discusses measures that can be taken to mitigate the impacts identified in the previous section.

**7.5.2.1 Construction.** Sediment control techniques such as silt curtains and barrier shields could be used to help confine sediment disturbance and minimize water quality impacts, where conditions will allow them to be deployed. Also, early identification of sensitive areas (e.g., shellfish beds, known spawning grounds, likely habitats for endangered species, archaeologically-important areas), can enable their protection to be factored into the final design.

**7.5.2.2 Operation.** The only potentially feasible way of avoiding the adverse water quality biological impacts associated with outfall operation is to reduce the amount of toxic and organic materials in the secondary effluent being discharged. This could be effected to some degree by implementation of a Toxicity Reduction and Evaluation program. This program should identify the following:

- the agent(s) responsible for the effluent toxicity problem;
- locations of important sources of toxic agents;
- locations of important sources of pollutants predicted to exceed EPA Water Quality Criteria (see Table 6.2-2);
- correlations between different land uses and delivery of the pollutants specified in Table 6.2-2 through CSOs;
- a measure of the total in-plant capacity for removal of these pollutants; and
- a framework for allocating the treatment plant's pollutant removal capacity among polluters/regions in the watershed.

Implementation of the program should encourage (1) an evaluation of future land use and zoning decisions and city-wide growth trends in light of their anticipated demand on the treatment plant, and (2) cooperation between the City of New Bedford and private industry through pretreatment pollutant reductions and/or transfers of allowable pollutant allocations. The extent of predicted toxicity problems at the Existing Site make it unlikely that all such problems could be mitigated at this site even after implementation of an extensive Toxicity Reduction and Evaluation program.

### 7.5.3 Acceptable Alternatives

The evaluation of the outfall alternatives presented above and in Chapter 6 incorporated the impacts predicted during construction and operation of each alternative and the mitigation measures capable of reducing or eliminating these impacts. Some particularly problematic areas of the alternatives are discussed and compared below.

In regard to regulatory issues, effluent discharges at the Existing Site would violate state water quality standards and federal human health and aquatic toxicity criteria under average conditions. Although some violations would also occur at the 301(h) Site, they will be less numerous, less severe and will occur primarily under worst case conditions. Thus the 301(h) Site offers a clear advantage over the existing outfall site in its ability to meet regulations.

Fewer adverse impacts from outfall construction and operation will occur at the 301(h) Site in comparison to the existing outfall site, specifically:

- risks to human health and aquatic biota from contaminants in the water column will be higher at the existing outfall site than at the 301(h) Site;

- dissolved oxygen levels will be lower at the existing outfall site than at the 301(h) Site, increasing risks to aquatic biota;

- sediment contaminant levels will be higher at the existing outfall site than at the 301(h) Site, increasing the potential for toxic effects and bioaccumulation;

- under certain conditions a small area will be contaminated by fecal coliform bacteria at the existing outfall site, presenting a potential public health impact from consumption of shellfish from this area, whereas at the 301(h) Site no such violation will occur;

- both rehabilitation and new pipe/diffuser construction at the existing outfall site will necessitate disturbance or dredging of contaminated materials (pipe debris from cleaning in the case of the former, dredging contaminated materials in the case of the latter) increasing risks to aquatic biota and humans; and

- plume surfacing will occur more frequently at the existing outfall site in comparison to the 301(h) Site, decreasing the aesthetic nature of the site.

The 301(h) Site is preferable to the existing outfall site, because there will be fewer long-term impacts from secondary effluent discharge. In addition, environmental conditions should substantially improve at the existing outfall site following termination of effluent discharge.

Construction costs must be factored into the selection of the preferred alternative. The 301(h) Site is substantially more expensive than either alternative at the existing outfall site. However, the least expensive alternative (rehabilitation) provides only a short-term solution to New Bedford's water quality needs.

Approximately half a billion dollars will be spent on the study and rehabilitation of New Bedford Harbor over the next several years for projects including new CSO facilities, the new Wastewater Treatment Plant, the Superfund Project and the National Estuaries Program. The additional cost of extending the outfall to the 301(h) Site, in light of all the time and money that will be spent on New Bedford Harbor, is far outweighed by the superior performance compared to that of the Existing Site alternatives. Operation of the outfall plays a major role in the overall quality of the harbor and Buzzards Bay; it would be shortsighted to allow cost to overrule other long-term environmental issues which might undermine the planning and expenditures involved in the programs described above.

Therefore, it is EPA's conclusion that, based on current information, either outfall alternative at the Existing Site is not acceptable. This conclusion is based on both regulatory and environmental concerns. An outfall at the 301(h) Site would be environmentally acceptable.

## 7.6 RECOMMENDED PLAN

Table 7.6-1 lays out the acceptable sites and technologies for wastewater treatment and related activities for New Bedford. The acceptability of each option was made based on information available at this time; should further information become available, these determinations are subject to change. In particular, any further work presented by the City in its Final EIR/FP will be reviewed in EPA's Final EIS (scheduled for issuance in April 1990).

Having determined that the options presented in Table 7.6-1 are environmentally acceptable and that all are constructable and will provide a reliable component of wastewater treatment facilities for the planning period, the remaining task is to combine the possible components into one integrated plan. The City of New Bedford, as the entity that will have to build and operate the facilities, has the primary voice in determining what combination of sites and processes would most optimally serve its needs. The EPA's role is to evaluate the City's proposed program

**TABLE 7.6-1**
**ENVIRONMENTALLY ACCEPTABLE COMPONENTS OF THE PLAN**

| Secondary WWTP | Effluent Outfall | Solids Disposal |
|---|---|---|
| Site 1A | 301(h) Site | Crapo Hill* |
| Site 4A | | Site 47 (Initial Phase) |
| | | Site 40* |

* only chemically fixed sludge to Crapo Hill landfill, with backup landfill capacity at Site 40 or 47 for disposal of either chemically fixed or lime stabilized sludge.

and alternatives to it in accordance with NEPA and to ensure that the sites and technologies chosen are environmentally acceptable and will result in long-term compliance with the Clean Water Act.

The City has chosen as its recommended plan a combination of secondary wastewater treatment at Site 1A, effluent discharge through the existing outfall pipe (after rehabilitation) at the existing outfall site, and sludge dewatering and "Chemfix" treatment at the WWTP site with use of the "Chemfixed" sludge as daily cover at the Crapo Hill Landfill (with a backup Initial Phase Landfill at Site 47). Each of these components is acceptable to the EPA (assuming the recommended mitigation measures are taken) with the exception of the outfall site. As discussed above, EPA believes, based on current information, that potential environmental impacts resulting from a secondary effluent discharge at the Existing Site would be unacceptable. Of the alternatives evaluated in the City's Draft EIR/FP and this Draft EIS, only the new outfall and diffuser at the 301(h) site would be environmentally acceptable. We do not believe that the additional costs associated with this alternative outweigh the environmental protection it will afford.

# CHAPTER EIGHT

# PUBLIC PARTICIPATION PROGRAM

## 8.1 INTRODUCTION

The Environmental Impact Statement (EIS) process ensures the public an opportunity for involvement in assessing projects subject to environmental review, under the National Environmental Policy Act (NEPA). Public involvement throughout the review process helps to ensure that the resulting plans, recommendations, and policies are environmentally and technically appropriate. In addition, NEPA (under 40 CFR Parts 6 and 25) and the Council on Environmental Quality's regulations (40 CFR 1500 et. seq.) require a public participation program. NEPA's regulations are implemented for projects potentially funded by the Clean Water Act.

The public participation program conducted for this Draft EIS meets EPA's and the City of New Bedford's program requirements. EPA's program was supplemented by and coordinated with the City's facilities planning/EIR process. The following sections identify the major public participation activities.

## 8.2 MAJOR PUBLIC PARTICIPATION ACTIVITIES

### 8.2.1 Scoping Meeting

EPA held a formal meeting in New Bedford at the Buttonwood Library on March 23, 1988. The purpose of the meeting was to identify public concerns and environmental issues for examination and analysis in the Draft EIS. The public was also informed of their opportunities for involvement. Notice of the meeting was published in The New Bedford Standard Times, and sent to everyone on the project mailing list. Issues identified during the scoping meeting are discussed in Section 8.4.

### 8.2.2 Citizens Advisory Committee

In order to maximize public input during the EIR/EIS process, the Secretary of the Executive Office of Environmental Affairs (EOEA), at the time, James Hoyte, directed that a Citizens Advisory Committee (CAC) be established for the New Bedford Wastewater Treatment Project. The initial members of the CAC were appointed by the Mayor of New Bedford, John Bullard, to observe, review, and comment on the siting process and technologies to be evaluated in the facilities plan.

The CAC currently has 21 members and is chaired by Jeffrey Osuch of Fairhaven. The CAC is comprised of persons from environmental, businesses, industry, civic, and neighborhood groups. Membership on the CAC is not limited to New Bedford residents, but includes residents of other potentially affected areas, including Acushnet, Dartmouth, and Fairhaven.

The CAC has been continuously involved in the EIR/EIS process. Monthly meetings were held to respond to project issues, assist in the planning and conducting of public meetings, and comment on recommended plans. CAC meetings were held between June 1988 and August 1989, with every meeting open to the public. Meetings were posted in the New Bedford Standard Times and at New Bedford City Hall and in surrounding community town halls. Meetings minutes are available for public review at various libraries in the area (Table 8.3-1).

The CAC held a workshop in December 1988 to evaluate the siting alternatives and make a recommendation to the mayor of New Bedford. The CAC voted to recommend Site 47 as their preferred site for construction of the wastewater treatment plant.

### 8.2.3 Technical Advisory Group

The Technical Advisory Group (TAG) consists of representatives from state and federal agencies which have an interest in the project development and focuses on agency coordination. The TAG includes all funding and regulatory groups as well as advising groups on the federal, state and local levels. These groups include state and federal marine fisheries, coastal zone management, public health agencies, and the U.S. Army Corps of Engineers. The TAG met at critical points in the planning process to provide technical input and to raise any concerns they might have regarding the results of the facilities planning and the recommendations being made.

### 8.2.4 Public Meetings and Hearings

In addition to the scoping meeting, EPA staff have attended meetings with the CAC and TAG to convey information and stay aware of public concerns. These public meetings are held to notify a broader representation of the community of the work in progress. Input and opinions from the public are encouraged and key issues and impacts related to facilities siting and alternatives are discussed. Upon release of this Draft EIS, a public hearing will be held by EPA. This hearing will take place during the comment period to solicit public comment and determine public concern regarding the Draft EIS. Public testimony will be recorded and written comments will also be accepted during this period. The Final EIS will be prepared taking these comments

**TABLE 8.3-1**
**REPOSITORIES**

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Reference Department
New Bedford Free Public Library
613 Pleasant Street
New Bedford, MA 02740
(508) 991-6275

Mon. Tues. Thur. 9-9
Wed. 12-9
Friday, Sat. 9-5

Russell Memorial Library
88 Main Street
Acushnet, MA 02743
(508) 995-5414
Tues. Thur. 1-8
Wed. 10-6 Sat. 10-1

Millicent Library
45 Center Street
Fairhaven, MA 02719
(508) 992-5342

Mon. & Weds. 9-8
Tues. Thur. Friday & Sat. 9-6

Southworth Library
723 Dartmouth Street
South Dartmouth, MA 02748
(508) 999-0726

Mon. Friday & Sat. 9-5
Tues. Weds. & Thur. 9-8

U.S EPA Library
15th Floor
JFK Federal Building
Boston, MA 02203
(617) 565-3300

Mon. - Friday 8:30-4:30

into account, and will contain a summary of the public comments and of EPA's responses to the issues raised.

## 8.3 SUPPORT SERVICES

### 8.3.1 Announcements and Notice of Availability

A news information package was prepared and sent to appropriate media, including The New Bedford Standard Times and other local papers and radio stations. This package announced the location and time of the public hearing and the time frame for public comments. Also, a notice of availability was sent to interested parties included on EPA's mailing list.

### 8.3.2 List of Repositories

This Draft EIS has been distributed to the local repositories shown in Table 8.3-1, where it is available for public review. Repositories were selected not only in New Bedford but also in other nearby towns that could potentially be affected by this project. Interested parties may also review minutes of the CAC and TAG meetings at these locations.

### 8.3.3 Mailing List and Interested parties

A mailing list has been developed by EPA and the City of New Bedford. This list includes approximately 700 people and organizations who have indicated an interest in this project, or who attended CAC or public meetings during preparation of the Draft EIS.

## 8.4 ISSUES

In preparation of this Draft EIS, many concerns and issues were raised at the scoping meeting, CAC and TAG meetings, and through letters and other forms of communication. EPA has focused its efforts during preparation of the Draft EIS to address and be sensitive to these issues. The public review and formal public hearing on the Draft EIS will generate additional comments to be addressed in the Final EIS. The general issues and concerns that were recurring and applicable to the EIS are listed below, along with references to the sections of the Draft EIS in which these issues are addressed.

### 8.4.1 Air Quality, Odors, and Noise

Concerns were raised over the quality of air in the vicinity of the new wastewater treatment plant during construction, especially at sensitive receptors such as adjacent residential areas and other facilities used by the general public. Odors and transmission of airborne pathogens and non-conventional pollutants associated with operation of the treatment plant and solids disposal facilities were of particular concern. These issues are addressed in Section 6.3 and 6.4 and mitigation measures for all significant impacts are discussed in Chapter 7.

### 8.4.2 Transportation/Traffic

Questions were raised concerning projected traffic increases during construction and operation of the new treatment facilities and their impact on existing road conditions. Also of high priority were the affects of traffic vibration, noise, and congestion on the surrounding community and what mitigation options are available. Other concerns were regarding sludge transport malfunctions. Transportation/Traffic impacts are discussed in Section 6.1.

### 8.4.3 Property Values

The effect of the facilities on private and public property values and the property tax base in the area were issues that were brought up. Effects on property values and tax revenues and possible mitigation are addressed in Section 6.6 and Chapter 7, respectively.

### 8.4.4 Land Use Conflicts

Town officials and developers were concerned that some of the sites considered for the facility were also proposed for other public and private use (e.g., the Palmer's Cove development, industrial uses). They were anxious that these conflicts be resolved, and that the facilities not interfere with proposed development and land-use plans for the community. Potential land use conflicts and mitigation measures are addressed in Sections 6.1 and Chapter 7, respectively.

### 8.4.5 Cultural Resources

For some, concern was expressed that significant historic or archaeological resources on the sites would be disturbed or destroyed. The presence of such resources and mitigation of impacts to them are discussed in Section 6.6 and Chapter 7, respectively.

### 8.4.6 Wetlands/Biological Resources

Another issue raised was the fear of destruction and ultimate loss of wetlands and floodplain habitats for rare or endangered flood protection at the coastal sites (especially Site 1A). Concern was also expressed over the long-term impacts to fisheries and shellfish habitats (including closures), functional value of wetlands, and the possible disruption of the food chain. All of these issues are addressed in Sections 6.2 and 6.5, and mitigation for these impacts are addressed in Chapter 7.

### 8.4.7 Water Supply

The issue of locating a landfill near a potential municipal or private water supply was raised. Discussion of this issue can be found in Section 6.2.

### 8.4.8 Socioeconomic

Socioeconomic issues identified included: the cost of the facilities (capital O & M costs), change in the local tax burden, opportunities for funding, amortization of capital costs of construction and land acquisition, user fees, demands on the municipal infrastructure, and lost opportunity costs associated with locating a treatment facility on a given site. These issues are addressed in Section 6.6.

### 8.4.9 Institutional

Permits and approvals required for operation of the treatment facilities, site acquisition difficulties (i.e., deed restrictions, eminent domain proceedings), interagency coordination, and regulatory complexity were all identified as issues. Cumulative impacts from the relationship between the proposed treatment facilities and other construction projects in the City and State were also identified as issues. Institutional issues are addressed in Section 6.6.

### 8.4.10 Reuse of Residuals

The suggestion was made that technologies that result in beneficial reuse of sludge products be used if possible. These technologies include composting and chemical fixation of sludge for use as landfill cover material. The assessment of sludge processing technologies is discussed in Section 3.2.

### 8.4.11 Community Perception

Many citizens were concerned that as the host to the wastewater treatment plant their neighborhood might develop a negative image and that civic pride and local industry (e.g., commercial fishing) would suffer. This was an issue for both candidate wastewater treatment plant sites, however the impact of such perceptions is not quantitative and therefore not addressed in this Draft EIS. Another concern was related to visual impacts by the treatment facility on the view from the New Bedford waterfront and residential areas adjacent to the sites. Visual issues are addressed in Sections 6.6.

### 8.4.12 Water Resources

The main issues related to water resources were: impacts to water quality from effluent discharges or releases from treatment plant malfunctions, impacts to sediment quality from the outfalls, and the fate of PCBs and metals in treated effluent. These issues are addressed in Section 6.2.

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# APPENDIX A
# WASTEWATER TREATMENT PLANT

**TABLE A-1**
**TREATMENT TECHNOLOGIES ELIMINATED DURING PHASE I SCREENING**

| TECHNOLOGY | REASONS FOR ELIMINATION |
|---|---|
| Preliminary Treatment | |
| Velocity Controlled Grit Channels | Can't maintain horizontal velocity at low flow and potential odor problems from organics in grit |
| Preaeration Basin | Requires excessive surface area |
| Cyclone Primary Degritting | Material handling problems experienced at existing New Bedford Plant and not recommended for use in combined sewer systems |
| <u>Primary Treatment</u> | |
| Tray Clarifiers | Never been used in municipal plants, difficult and costly to construct |
| Inclined Tube Settlers | Never been used for wastewater treatment, more costly and difficult to maintain |
| <u>Secondary Treatment</u> | |
| Burns-McDonnell Treatment System | Lacks experience; costs for large treatment plant unknown; large acreage and spoils disposal requirements |
| Powdered Carbon | Lacks experience at large plants; may be operationally complex |
| Deep Shaft | Lacks experience at large plants; difficult construction; increased spoils disposal |

**TABLE A-1 (CONTINUED)**
**TREATMENT TECHNOLOGIES ELIMINATED DURING PHASE I SCREENING**

| TECHNOLOGY | REASONS FOR ELIMINATION |
|---|---|
| Sequencing Batch Reactor | Lacks experience at large plants; operational complexity at high flows; plugging of aeration equipment |
| Trickling Filter | Filters inefficient and unreliable in variable climates; excessive area required |
| Biological Filtration | Not widely used in U.S.; lacks experience at large plants |
| Coupled System | Filters inefficient and unreliable in variable climates; not typically used for large plants |
| Pulsed Bed | Filtration alone not sufficient to meet secondary treatment requirements |
| Physical-Chemical Treatment | Excessively costly; complex; unreliable for large flows |
| High-Rate Clar. Filtration Microscreen | Complex; high operation and maintenance needs; difficult to maintain consistency effluent or quality with variations in influent conditions |
| Tray Clarifier | Lacks experience in municipal wastewater treatment |
| <u>Disinfection</u> | |
| Liquid Chlorine followed by Dechlorination | Eliminated due to safety concerns |

**TABLE A-1 (CONTINUED)**
**TREATMENT TECHNOLOGIES ELIMINATED DURING PHASE I SCREENING**

| TECHNOLOGY | REASONS FOR ELIMINATION |
| --- | --- |
| Ozonation | Difficult to operate, significant electrical demands and potential safety concerns. |
| Ultraviolet Irradiation | Lacks experience in large municipal wastewater plants |

Source: CDM, Volume I, 1989.

**TABLE A-2**
**PRELIMINARY TREATMENT TECHNOLOGIES PHASE II**
**SCREENING OF ALTERNATIVES**

| Criteria | Evaluation | | Comments |
|---|---|---|---|
| | Climber Screens | Catenary Screens | |
| Area Requirements | --- | --- | Screening building areas are the same. |
| Reliability/Flexibility | Average | Average | The catenary alternative is preferred from an operational and maintenance standpoint. |
| Constructibility | Normal | Normal | No unusual construction conditions. |
| Safety | Normal | Normal | Requirements are common to other screening facilities. |
| Operators Required | Average | Average | Alternatives require the same number of operations personnel. |
| Operational Complexity | Average | Average | Highly skilled operators and maintenance staff are not required. |
| Power Efficiency | Average | Average | Power needs are the same. |
| Residuals Aspects | Good | Good | Screening removal efficiencies are the same. Both alternatives treat the same influent. |

**TABLE A-2 (CONTINUED)**
**PRELIMINARY TREATMENT TECHNOLOGIES PHASE II**
**SCREENING OF ALTERNATIVES**

| Criteria | Evaluation | | Comments |
|---|---|---|---|
| | Climber Screens | Catenary Screens | |
| Spoils Disposal | Average | Average | Screening building areas are the same. |
| VOC Emissions | Low | Low | Both alternatives cause minimal turbulence and will not emit VOCs. |
| Odors | Average | Average | The off gas from both alternatives will be captured and treated. |
| Noise Control | Low | Low | Both alternatives are enclosed. |
| Aesthetics | Average | Good | Climber alternative requires a higher building. |
| Effluent Quality | Average | Average | Both alternatives provide efficient screening. |
| Cost Effectiveness | | | |
| Present Worth Costs | $1,083,000 | $843,400 | Costs do not include common facilities such as screenings building, odor control, etc. |
| Capital Costs | $498,800 | $303,800 | |
| Annual Operation and Maintenance Costs | $53,700 | $52,300 | |

Adapted from: CDM, Volume III, 1989.

**TABLE A-3**
**GRIT REMOVAL TECHNOLOGIES PHASE II SCREENING OF ALTERNATIVES**

| Criteria | Evaluation | | Comments |
| --- | --- | --- | --- |
| | Aerated Grit Chambers | Centrifugal Grit Chambers | |
| Area Requirements | --- | --- | Area requirements are nearly identical. |
| Reliability/ Flexibility | Average High | Average Average | Both alternatives operate effectively over the flow range. Aerated is more mechanical. Centrifugal requires a higher degree of flow control. Centrifugal chambers do not perform well outside design flow ranges. |
| Constructability | Normal | Normal | No unusual construction conditions. |
| Safety | Normal | Normal | Requirements are common to other facilities. |
| Operators Required | Average | Average | Alternatives require the same number of people. |

**TABLE A-3 (CONTINUED)**
**GRIT REMOVAL TECHNOLOGIES PHASE II SCREENING OF ALTERNATIVES**

| Criteria | Evaluation: Aerated Grit Chambers | Evaluation: Centrifugal Grit Chambers | Comments |
|---|---|---|---|
| Operational Complexity | Average | High | Highly Skilled operators and maintenance staff are required. |
| Power Efficiency | Low | Average | Aerated alternative requires more power because of air compressors. |
| Auxiliary Needs | Process air | --- | The aerated grit system needs a supply of process air |
| Residuals Aspect | Good | Good | Grit removal efficiencies are the same. |
| Soils Disposal | Average | Average | The facility areas are the same. |
| VOC Emissions | High | Low | Air emissions for aerated grit are higher. |
| Odors | Average | Average | The off gas from both alternatives will be captured and treated. |

**TABLE A-3 (CONTINUED)**
**GRIT REMOVAL TECHNOLOGIES PHASE II SCREENING OF ALTERNATIVES**

| Criteria | Evaluation | | Comments |
|---|---|---|---|
| | Aerated Grit Chambers | Centrifugal Grit Chambers | |
| Noise Control | Low | Low | Both alternatives are enclosed. |
| Aesthetics | Good | Good | The auxiliary systems will be housed in the Fine Screens Building. |
| Effluent Quality | Average | Average | Both alternatives meet the required removal criteria. |
| Cost Effectiveness | | | |
| Present Worth Costs * | $2,015,800 | $1,739,600 | --- |
| Capital Costs | $750,300 | $574,600 | --- |
| Annual Operation and Maintenance Costs | $129,100 | $131,200 | --- |

* Present Worth Costs include replacement and salvage costs.

Adapted from: CDM, Volume III, 1989.

**TABLE A-4**
**PRIMARY TREATMENT TECHNOLOGIES PHASE II SCREENING OF ALTERNATIVES**

| Criteria | Evaluation | | Comments |
|---|---|---|---|
| | Regular Clarifiers | Circular Clarifiers | |
| Area Requirements | Average | High | Circular clarifiers require 40% more land area. |
| Reliability/ Flexibility | Average | Average | Both alternatives operate effectively over the flow range. |
| Constructibility | Normal | Normal | No unusual construction conditions. |
| Safety | Normal | Normal | Requirements are common. |
| Operators Required | Average | Average | Alternatives require the same number of people. |
| Operational Complexity | Average | Average | Requirements are common. |
| Power Efficiency | Average | High | Power consumption is about equal except for ventilation systems. The circular clarifier system is larger. |
| Auxilary Needs | ---- | ---- | ---- |
| Residual Aspects (ton/day of sludge) | | | TSS removal efficiencies are equal. |

**TABLE A-4 (CONTINUED)**
**PRIMARY TREATMENT TECHNOLOGIES PHASE II SCREENING OF ALTERNATIVES**

| Criteria | Evaluation: Rectangular Clarifiers | Evaluation: Circular Clarifiers | Comments |
|---|---|---|---|
| Annual Average Loading | 18.6 | 18.6 | |
| Maximum Month Loading | 29.7 | 29.7 | |
| Wet Weather Influent Loading | 16.4 | 16.4 | |
| Spoils Disposal | Average | Average | The quantity of spoils from the construction of the circular clarifiers will be higher. |
| VOC Emissions | Average | High | VOC emissions are approximately the same, however the volume of air for the circular clarifier will be higher due to dome type cover. |
| Odors | Average | Average | Both alternatives are expected to emit the same quantity of odors. |
| Noise Control | Low | Low | Alternatives do not generate noise. |
| Aesthetics | Good | Average | The profile of the covered rectangular tanks will be lower than the dome covered circular tanks. |

**TABLE A-4 (CONTINUED)**
**PRIMARY TREATMENT TECHNOLOGIES PHASE II SCREENING OF ALTERNATIVES**

| Criteria | Evaluation | | Comments |
|---|---|---|---|
| | Rectangular Clarifiers | Circular Clarifiers | |
| Effluent Quality | Average | Average | Both alternatives meet the required removal criteria. |
| Cost Effectiveness | | | |
| Present Worth Costs* | $5,569,500 | $7,668,900 | --- |
| Capital Costs | $3,850,100 | $5,360,300 | --- |
| Annual Operation and Maintenance Costs | $170,900 | $236,400 | --- |

* Present Worth Costs include replacement and salvage costs.

Adapted from: CDM, Volume III, 1989.

**TABLE A-5**
**BIOLOGICAL SECONDARY TREATMENT TECHNOLOGIES PHASE II**
**SCREENING OF ALTERNATIVES**

| Criteria | Evaluation: Air Activated Sludge | Oxygen Activated Sludge | Anaerobic Selector | Rotating Biological Contractors | Comments |
|---|---|---|---|---|---|
| Area Requirements | Average | Average | Average | High | Area requirements for air and oxygen activated sludge and anaerobic selector can be considered to be equal. RBCs require more space. |
| Reliability/ Flexibility | High | High | High | Average | All three activated sludge systems are well proven treatment technologies with sufficient system redundancy. |
| Construc- tibility | Normal | Normal | Normal | Normal | None of the alternatives introduce any atypical construction concerns. |
| Safety | Normal | Normal | Normal | Normal | ---- |
| Operators Required | Average | Greater | Average | Average | Oxygen activated sludge requires slightly more operators because of the oxygen generation facility. |

**TABLE A-5 (CONTINUED)**
**BIOLOGICAL SECONDARY TREATMENT TECHNOLOGIES PHASE II**
**SCREENING OF ALTERNATIVES**

| Criteria | Evaluation: Air Activated Sludge | Oxygen Activated Sludge | Anaerobic Selector | Rotating Biological Contractors | Comments |
|---|---|---|---|---|---|
| Operational Complexity | Average | High | Average | Low | Maintenance of the oxygen generation unit should be performed under a service contract with the manu- facturer. |
| Power Efficiency | Average | High | Average | Low | Power needs are similar for all activated sludge alternatives. The oxygen activated sludge alternative is the most efficient. |
| Residuals Aspects (tons/day of sludge) | | | | | |
| Annual Average Loading | 10.5 | 10.5 | 11.0 | 9.9 | RBCs produced less waste than other three alternatives. All four alternatives treat the same influent and the characteristics of the waste activated sludge are expected to be similar. |
| Maximum Month Loading | 18.7 | 18.7 | 19.1 | 15 | |
| Wet Weather Loading | 14.4 | 14.4 | 14.9 | 12.1 | |

**TABLE A-5 (CONTINUED)**
**BIOLOGICAL SECONDARY TREATMENT TECHNOLOGIES PHASE II**
**SCREENING OF ALTERNATIVES**

| Criteria | Evaluation | | | | Comments |
|---|---|---|---|---|---|
| | Air Activated Sludge | Oxygen Activated Sludge | Anaerobic Selector | Rotating Biological Contractors | |
| Spoils Disposal | Average | Average | Average | Average | Quality and quantity of spoils is expected to be about the same for all alternatives. |
| VOC Emission (scfm peak and average) | Average | Low | Average | High | Compared to other alternatives oxygen activated sludge has a distinct advantage in the control of odors and VOCs, in terms of the air volume to be treated. |
| Odors | Average | Average | Average | Average | ---- |
| Noise Control | Average | High | Average | Low | Most equipment would have to be enclosed in buildings to keep noise below allowable ambient noise levels. |
| Aesthetics | Average | Average | Average | Average | ---- |
| Effluent Quality | Average | Average | Average | Average | All four processes can meet the effluent quality criteria. |

TABLE A-5 (CONTINUED)
BIOLOGICAL SECONDARY TREATMENT TECHNOLOGIES PHASE II
SCREENING OF ALTERNATIVES

| Criteria | Evaluation | | | | Comments |
|---|---|---|---|---|---|
| | Air Activated Sludge | Oxygen Activated Sludge | Anaerobic Selector | Rotating Biological Contractors | |
| Cost Effectiveness | | | | | |
| Present Worth Costs* | $15,623,600 | $18,362,900 | $16,602,200 | $39,049,800 | The air and oxygen activated sludge alternatives should be considered equal in terms of present worth costs. |
| Capital Costs | $10,567,000 | $12,685,500 | $11,230,500 | $29,748,500 | -- |
| Annual Operation | $496,800 | $528,700 | $526,300 | $653,000 | Annual operating costs slightly favor the air activated sludge alternative. |

* Present Worth Costs include replacement and salvage costs.

Adapted from: CDM, Volume III, 1989.

**TABLE A-6**
**SECONDARY TREATMENT SEDIMENTATION TECHNOLOGIES**
**PHASE II SCREENING OF ALTERNATIVES**

| Criteria | Evaluation: Rectangular Clarifiers | Evaluation: Circular Clarifiers | Comments |
|---|---|---|---|
| Area Requirements | Average | High | Circular clarifiers require 40% more land area. |
| Reliability/Flexibility | Average | Average | Both alternatives operate effectively over the flow range. |
| Constructibility | Normal | Normal | No unusual construction conditions |
| Safety | Normal | Normal | Requirements are the same. |
| Operators Required | Average | Average | Alternatives require the same number of people. |
| Operational Complexity | Average | Average | Requirements are the same. |
| Power Efficiency | Average | Average | Power consumption is about equal. |
| Auxiliary Needs | ---- | ---- | ---- |

**TABLE A-6 (CONTINUED)**
**SECONDARY TREATMENT SEDIMENTATION TECHNOLOGIES**
**PHASE II SCREENING OF ALTERNATIVES**

| Criteria | Evaluation | | Comments |
|---|---|---|---|
| | Rectangular Clarifiers | Circular Clarifiers | |
| Residual Aspects (tons/day) | ---- | ---- | TSS removal efficiencies are equal. For residual quantities, see Table 4-20. |
| Spoils Disposal | Average | High | The quantity of spoils from the construction of the circular clarifiers will be higher. |
| VOC Emissions | Average | Average | No controls are provided due to minimal emission rates. |
| Odors | Average | Average | Both alternatives would emit similar odors. |

**TABLE A-6 (CONTINUED)**
**SECONDARY TREATMENT SEDIMENTATION TECHNOLOGIES**
**PHASE II SCREENING OF ALTERNATIVES**

| Criteria | Evaluation | | Comments |
|---|---|---|---|
| | Rectangular Clarifiers | Circular Clarifiers | |
| Noise Control | Low | Low | Alternatives do not generate noise. |
| Aesthetics | Good | Average | The profile of the covered rectangular tanks will be lower than the dome covered circular tanks. |
| Effluent Quality | Average | Average | Both alternatives meet the required removal criteria. |
| Cost Effectiveness | | | |
| Present Worth Costs* | $9,011,500 | $10,736,400 | --- |
| Capital Costs | $7,327,200 | $8,319,500 | --- |
| Annual Operation and Maintenance Costs | $154,000 | $243,000 | --- |

* Present Worth Costs include replacement and salvage costs.

Adapted from: CDM, Volume III, 1989.

TABLE A-7
RECOMMENDED UNIT PROCESSES DESIGN

| | |
|---|---|
| CATENARY COARSE BAR SCREENS | |
| Number of Screens | 3 |
| Size | 2 in. spacing |
| Width | 5 ft. |
| Height | 10 ft. |
| Channel Size | |
| Width | 4 ft. |
| Length | 20 ft. |
| Sluice Gates | 6 |
| RAW WASTEWATER PUMPS | |
| Number | 4 |
| CATENARY FINE BAR SCREENS | |
| Number | 3 |
| Size | 3/4 in. spacing |
| Width | 5 ft. |
| Height | 10 ft. |
| AERATED GRIT TANKS | |
| Number | 2 |
| Size | |
| Length | 55 ft. |
| Width | 20 ft. |
| Side wall depth | 10 ft. |
| Peak Flow Capacity, ea. | 38 mgd |
| Detention time at peak flow | 3 minutes |
| Air Supply | 3 to 6 cfm per linear ft |
| Capture Efficiency | 95% of material > 0.3 mm diameter<br>Specific Gravity = 2.65 |
| GRIT SLURRY PUMPS | |
| Number (include 1 standby pump) | 3 |
| Capacity | 450 gpm at 30 ft tdh |
| Horsepower | 15 hp |

| | DRY WEATHER FLOW | WET WEATHER FLOW |
|---|---|---|
| RECTANGULAR SETTLING TANKS | | |
| Number | 6 | 6 |
| Size | | |
| Length, ft. | 130 | 130 |
| Width, ft. | 48 | 48 |
| Side wall depth, ft | 12 | 18 |
| Total Surface Area, sf | 37,440 | 37,440 |
| Overflow Rates, gpd/sf | | |
| @ Average Flow of 30 mgd | 801 | --- |

TABLE A-7 (CONTINUED)
RECOMMENDED UNIT PROCESSES DESIGN

| | | |
|---|---|---|
| @ Peak Flow of 75 mgd | 2,003 | --- |
| @ Peak Flow of 45 mgd | --- | 1,202 |
| Detention Time, hrs | | |
| @ Average Flow of 30 mgd | 2.7 | --- |
| @ Peak Flow of 75 mgd | 1.1 | --- |
| @ Peak Flow of 45 mgd | --- | 2.7 |
| **AERATION BASIN** | | |
| Hydraulic residence time (hr) | 5.6 | |
| F/M ratio (lb BOD/lb MLVSS/day) | 0.42 | |
| SRT (day) | 5 | |
| MLSS (mg/l) | 2,030 | |
| Volatile solids (%) | 75 | |
| Effluent soluble BOD (mg/l) | 6 | |
| lb Oxygen required/ lb BOD removed oxygen | 1.03 | |
| Transfer coefficients | | |
| Alpha | 0.45 | |
| Beta | 0.98 | |
| Minimum aeration basin Dissolved oxygen concentration (mg/l) | 2.0 | |
| **TANKAGE** | | |
| Total volume (mil. gal.) | 9.7 | |
| Number of tanks | 4 | |
| Number of compartments per tank | 4 | |
| Tank dimensions, (ft) (W x L x D) | 60 x 300 x 18 | |
| Tank surface area ($ft^2$) | 18,000 | |
| Tank volume ($ft^3$) | 324,000 | |
| **AERATION EQUIPMENT** | | |
| Type | Fine bubble diffused air | |
| Total number of diffusers | 13,000 | |
| Total blank spaces for additional diffusers | 1,300 | |
| **BLOWERS** | | |
| Type | Single stage centrifugal | |
| Number of blowers (including 1 standby) | 3 | |
| Design inlet capacity (scfm) | 13,000 | |
| Motor horse power per blower | 800 | |
| Blower building area ($ft^2$) (2 stories) | 10,000 | |

TABLE A-7 (CONTINUED)
RECOMMENDED UNIT PROCESSES DESIGN

| | |
|---|---|
| RECTANGULAR SETTLING TANKS | |
| Number | 6 |
| Size | |
| Length, ft. | 232 |
| Width, ft. | 58 |
| Side wall depth, ft. | 15 |
| Total Surface Area, sf | 80,736 |
| Overflow Rates, gpd/sf | |
| @ Average Flow of 30 mgd* | 409 |
| @ Peak Flow of 75 mgd* | 966 |
| Solids Loading, lbs/day/sf | |
| @ Average Flow & RAS Flow = 13 mgd | 11.4 |
| @ Peak Flow of & RAS Flow = 25 mgd | 21.6 |
| DISINFECTANT | Sodium Hypochlorite |
| Dosage | |
| Secondary Effluent | 2 - 12 mg/l |
| Primary Effluent | 5 - 24 mg/l |
| Contact Basins for Secondary Effluent | |
| Number of Units | 2 |
| Dimensions | |
| Length, ft. | 145 |
| Width, ft. | 60 |
| Side Wall Depth, ft. | 12 |
| Total Volume, cf | 208,800 |
| Minimum Detention Time, minutes | |
| @ peak flow of 75 mgd | 30 |
| Contact Basins for Primary Effluent (CSO) | |
| Number of Units | 2 |
| Dimensions | |
| Length, ft. | 145 |
| Width, ft. | 36 |
| Side Wall Depth, ft. | 12 |
| Total Volume, cf | 125,280 |
| Minimum Detention Time, minutes | |
| @ peak flow of 45 mgd | 30 |

Adapted from: CDM, Volume V, 1989.

TABLE A-8
SITES EVALUATED IN PHASE I/LEVEL 2 SCREENING
OF WWTP SITES

| Site No. | Site Description |
|---|---|
| 1a | Army land and existing WWTP |
| 1b | Existing WWTP and filling into Buzzards Bay |
| 3 | Berkshire-Hathaway Mill Complex (south of Gifford) |
| 4a | Standard-Times Field (north of Gifford) |
| 4b | Filling into Acushnet River from Standard-Times Field |
| 7 | Railroad Property (west of Herman Melville Blvd.) |
| 8 | Property north of North Terminal (east of Herman Melville Blvd.) |
| 10 | Property north of Hathaway Road |
| 11 | Sullivan's Ledge (south of Hathaway Road) |
| 13 | Property east of Belleville Ave. between Sawyer St. and Coffin Ave. |
| 14 | Water Department/Solid Waste Landfill (west of Shawmut Avenue) |
| 16 | Property behind Chamberlain Manufacturing (east of Rte. 140) |
| 17 | Foreign Trade Zone/Air Industrial Park (west of Aviation Way) |
| 18 | New Bedford Municipal Airport |
| 20 | Property west of Church Street, east of Rte. 140 |
| 22 | Great Cedar Swamp (west of railroad tracks) |
| 23 | Property north of Arnoff Street |
| 25 | Property east of Braley Road, south of the Freetown line |
| 26 | Property north of Sassaquin Pond |
| 28 | Property opposite Goodyear (east of Orchard) |
| 29 | Sargent Field/City Yard (north of Mayfield) |
| 30 | Vacant land opposite high school (south of Durfee) |
| 33 | Building 19 and adjacent area (east of Shawmut Avenue) |
| 34 | NYNEX Garage (north of Nash Road) |
| 35 | Salvage yard adjacent to Rte. 140 (south of Nash Road) |
| 36 | Salvage yd and vacant portion of airport (north end of Shawmut Ave.) |
| 37 | Vacant area west of Church Street |
| 38 | Undeveloped area adjacent to railway spur (east of Rte. 140) |
| 40 | Industrial Park (west of Duchaine Blvd.) |
| 41 | Polaroid site (west of Phillips Road) |
| 42 | Site between Rte 140 and Phillips Road |
| 43 | Atlantic Mill Buildings (north of Rte. 195) |
| 44 | Revere and Wamsetta (east of Herman Melville Blvd, south of Kilburn) |
| 45 | Commonwealth Electric Company site (east of JFK Memorial Drive) |
| 46 | Acushnet/Ashley Blvd. |

Adapted from: CDM, Volume I, 1989.

# APPENDIX B
# SOLIDS DISPOSAL

**TABLE B-1**
**CRITERIA USED FOR SCREENING OF SOLIDS TREATMENT TECHNOLOGIES AND DISPOSAL OPTIONS**

| Criteria | Description | Rating |
|---|---|---|
| Reliability | The level of assurance that the proposed process will consistently achieve the required process under an expected range of operation conditions. | low, average, high |
| Flexibility | The ability of the proposed process to operate under upset conditions or major changes in flows or loadings. | low, average, high |
| Constructability | Aspects of construction including the difficulty, the duration, and the scheduling. | difficult, normal |
| Safety | The level of precautions needed to reduce risks to plant personnel and the surrounding community. | special, normal |
| Operators Required | The number of operators and maintenance personnel required to operate and maintain the proposed process technology. | greater, average, fewer |
| Operational Complexity | The degree of difficulty and the level of skill required to maintain the process. | difficult, average, simple |

**TABLE B-1 (CONTINUED)**
**CRITERIA USED FOR SCREENING OF SOLIDS TREATMENT TECHNOLOGIES AND DISPOSAL OPTIONS**

| Criteria | Description | Rating |
|---|---|---|
| Power Efficiency | The amount of power necessary to complete the process. | low, average, high |
| Auxiliary Needs | Any additional needs required for a process technology. | (no auxiliary or specific need) |
| Residuals Aspects | Assessment of the quality and quantity of residuals generated by a proposed process, in determining the difficulty of collection, processing, and disposal of residuals. | difficult, average, good |
| *Spoils Disposal | The amount of soils excavation and the difficulty in the disposal of such material when compared to the reference unit process. | difficult, average, good |
| Air Emissions Control | The level of control necessary to limit air emissions to acceptable levels. | difficult, average, good |
| Noise Control | The amount of effort required to control noise to acceptable levels. | difficult, average, good |
| Aesthetics | The relative visual impact of the proposed process on the surrounding communities. | average, good |

* Criteria for Phase II screening only
Adapted from CDM, Volume I and III, 1989

**TABLE B-2**
**SOLIDS TREATMENT AND DISPOSAL TECHNOLOGIES**
**ELIMINATED DURING PHASE I SCREENING**

| Technology | Reasons for Elimination |
|---|---|
| **Thickening** | |
| Gravity Thickening (secondary treatment sludge) | low performance, higher costs and large amount of land required |
| Dissolved Air Floatation | high operation costs |
| Reactor Drum | lack of operating data for large plants |
| **Conditioning** | |
| Thermal Conditioning | high capital costs, high labor costs, and high energy requirements |
| **Dewatering** | |
| Vacuum Filtration | high energy requirements |
| Recessed Plate Filter Press | high capital costs, batch process |
| **Stabilization** | |
| Aerobic Digestion | little sludge volume reduction, no energy by-product, high energy cost |
| Chlorine Oxidation | high operating costs |
| Disinfection | redundant: other processes disinfect sufficiently |
| **Incineration** | |
| Multiple Hearth Furnace | difficult to maintain heat, high maintenance |
| Rotary Kiln | complex operation, formation of clinker and high particle loadings |
| Infrared Incinerator | high cost, large area required |
| **Composting** | |
| Windrow Composting | sensitivity to environmental factors, high maintenance, possible anaerobic conditions |

Adapted from: CDM, Volume I, 1989.

**TABLE B-3**
**EVALUATION MATRIX OF WASTE ACTIVATED SLUDGE (WAS) THICKENING TECHNOLOGIES**

| | Gravity Belt Thickener | Dissolved Air Flotation | Centrifuge |
|---|---|---|---|
| Reliability | Average | Average | Average |
| Flexibility | Average | Average | Average |
| Constructability | Normal | Normal | Normal |
| Safety | Normal | Normal | Normal |
| Operators Required | Average | Fewer | Fewer |
| Operational Complexity | Simple | Difficult | Average |
| Power Efficiency | High | Low | Low |
| Auxiliary Needs | Yes(1) | Yes(2) | Yes(3) |
| Residuals | Average | Average | Average |
| Air Emissions Control | Average | Average | None |
| Noise Control | Average | Average | Difficult |
| Aesthetics | Good | Good | Good |
| Cost Effectiveness | | | |
| Capital | | | |
| Structure | $1,211,000 | $2,432,000 | $1,297,000 |
| Equipment | 1,880,000 | 1,385,000 | 5,548,000 |
| Total | $3,091,000 | $3,817,000 | $6,845,000 |
| Operation & Maintenance | | | |
| Labor | 76,700 | 54,800 | 54,800 |
| Power | 3,400 | 21,900 | 40,900 |
| Chemicals | 38,800 | 22,200 | 0 |
| Materials and Supplies | 56,400 | 41,500 | 83,000 |
| Total | $175,300 | $140,400 | $178,700 |
| Present Worth O&M (20 YRS + 85/8%) | $1,644,000 | $1,317,000 | $1,676,000 |
| Total Present Worth | $4,735,000 | $5,134,000 | $8,521,000 |

(1) Plant water for belt washing plus chemical feed equipment
(2) Chemical feed equipment and high pressure air system
(3) Hot water and backup chemical feed equipment

Adapted from: CDM, Volume III, 1989.

**TABLE B-4**
**EVALUATION MATRIX FOR HIGH SOLIDS DEWATERING TECHNOLOGIES**

| | Centrifuge | Recessed Plate and Frame Filter Press | Diaphram Filter Press |
|---|---|---|---|
| Reliability | Average | Average | Low |
| Flexibility | Average | Low | Low |
| Constructability | Normal | Difficult | Difficult |
| Safety | Normal | Special | Special |
| Operators Required | Average | Greater | Greater |
| Operational Complexity | Average | Difficult | Difficult |
| Power Efficiency | Average | Average | Average |
| Auxiliary Needs | Yes(1) | Yes(2) | Yes(3) |
| Residuals | Average | Average | Average |
| Air Emissions Control | None | Average | Average |
| Noise Control | Average | Average | Average |
| Aesthetics | Good | Good | Good |
| Cost Effectiveness | | | |
| Capital Cost | | | |
| Structure | $2,745,000 | $3,504,000 | $3,504,000 |
| Equipment | $6,007,000 | $10,900,000 | $7,406,000 |
| Sub-total | $8,752,000 | $14,404,000 | $10,910,000 |
| Operation & Maintenance | | | |
| Labor | $54,500 | $111,800 | $100,500 |
| Power (4) | $20,400 | $17,750 | $13,250 |
| Chemicals (5) | $140,500 | $176,300 | $176,300 |
| Mat'ls & Supplies | $11,500 | $16,500 | $16,500 |
| Sub-total | $226,900 | $322,350 | $306,550 |
| P.W. O&M Costs (20 yrs + 85/8 %) | $2,127,868 | $3,022,998 | $2,874,826 |
| Total Present Worth | $10,879,868 | $17,426,998 | $13,784,826 |

(1) Special equipment pad and floor slab design for vibration, chemical feed equipment, hot water.
(2) Chemical feed equipment, high pressure sludge pumps, precoat system, filter media washing system.
(3) Chemical feed equipment, high pressure water or air system, precoat system, filter media washing system.
(4) Power = $0.055/kwh
(5) Polymer = $2.10/lb

Adapted from: CDM, Volume III, 1989.

**TABLE B-5**
**EVALUATION MATRIX FOR INCINERATION TECHNOLOGIES**

| | Fluidized Bed | Multiple Hearth |
|---|---|---|
| Reliability | Average | Low |
| Flexibility | Average | Low |
| Constructability | Normal | Normal |
| Safety | Special | Special |
| Operators Required | Average | Average |
| Operational Complexity | Average | Average |
| Power Efficiency | Average | Low |
| Auxiliary Needs[(1)] | Yes | Yes |
| Residuals | Average | Average |
| Air Emissions Control | Average | Average |
| Noise Control | Average | Average |
| Aesthetics | Average | Average |
| Cost Effectiveness | | |
| Capital Cost | | |
| Structure | $1,598,000 | $1,705,000 |
| Equipment | $6,888,000 | $8,812,000 |
| Sub-total | $8,486,000 | $10,517,000 |
| Operation & Maintenance | | |
| Labor | $206,000 | $245,000 |
| Power[(2)] | $67,000 | $51,000 |
| Fuel | $50,000 | $564,000 |
| Mat'ls & Supplies | $70,000 | $98,000 |
| Sub-total | $393,000 | $958,000 |
| P.W. O&M Costs (20 yrs + 85/8%) | $3,685,554 | $8,984,124 |
| Total Present Worth | $12,171,554 | $19,501,124 |

(1) Both options will require air emissions control equipment. This equipment is described in the process train evaluations.
(2) = $0.55/kwh

Adapted from: CDM, Volume III, 1989

**TABLE B-6**
**EVALUATION MATRIX FOR COMPOSTING TECHNOLOGIES**

| | In-Vessel Composting | Mechanical Composting | Static Pile |
|---|---|---|---|
| Reliability | Average | Average | High |
| Flexibility | Average | Average | High |
| Constructability | Difficult | Difficult | Normal |
| Safety | Normal | Normal | Normal |
| Operators Required | Average | Average | Greater |
| Operational Complexity | Average | Average | Average |
| Power Efficiency | Average | Average | High |
| Auxiliary Needs[1] | Yes | Yes | Yes |
| Residuals | Difficult | Difficult | Difficult |
| Air Emissions Control | Difficult | Difficult | Difficult |
| Noise Control | Average | Average | Average |
| Aesthetics | Good | Good | Average |
| Cost Effectiveness | | | |
| Capital Cost | | | |
| Structure | $9,626,000 | $14,701,000 | $19,413,000 |
| Equipment | $8,936,000 | $4,394,000 | $2,964,000 |
| Sub-total | $18,562,000 | $19,095,000 | $22,377,000 |
| Operation & Maintenance | | | |
| Labor | $224,000 | $199,000 | $312,000 |
| Power[2] | $260,000 | $201,000 | $114,000 |
| Bulking Agent | $402,000[3] | $402,000[3] | $424,000[4] |
| Mat'ls & Supplies | $179,000 | $80,000 | $60,000 |
| Misc. | $50,000 | $50,000 | $50,000 |
| Fuel | $0 | $79,000 | $95,000 |
| Sub-total | $1,115,000 | $1,011,000 | $1,055,000 |
| P.W. O&M Costs (20 yrs + 85/8%) | $10,456,470 | $9,481,158 | $9,893,790 |
| Total Present Worth | $29,018,470 | $28,576,158 | $32,270,790 |

(1) All systems require a source of bulking material.
(2) Power costs @ $0.055/kwh
(3) Sawdust cost @ $8.00/cy
(4) Woodchip costs @ $7.00/cy

Adapted from: CDM, Volume III, 1989.

TABLE B-7
RECOMMENDED THICKENER AND DEWATERING UNIT PROCESS DESIGN

| | | |
|---|---|---|
| **Gravity Thickeners** | | |
| No. of Units | 4 | |
| Diameter, ft | 36 | |
| Side Water Depth, ft | 10 | |
| Percent Feed Solids | 1.5-2.0 | |
| Solids Loading Rate, lb/sf/day | | |
| Average (w/4 units) | 9.1 | |
| Maximum 3 day (w/4 units) | 20.5 | |
| Hydraulic Loading Rate, gpd/sf | 600 | |
| Thickened Solids, % | 5.0-6.0 | |
| Solids Capture, % | 90 | |
| **Gravity Belt Thickeners** | | |
| No. of Units | 8 | |
| Size of Units, meters | 2 | |
| Operation | | |
| Days/Week | 7 | |
| Hours/Day | 10 | |
| Percent Feed Solids | 0.5 | |
| Solids Loading Rate, lb/hr/m | | |
| Average (w/4 units) | 263 | |
| Maximum (w/7 units) | 266 | |
| Hydraulic Loading Rate, gpm/m | | |
| Average (w/4 units) | 105 | |
| Maximum (w/7 units) | 106 | |
| Thickened Solids, % | 5.0 | |
| Solids Capture, % | 90 | |
| Polymer Usage, lb/dry ton | 5.0 | |
| **Centrifuges** | **Raw** | **Digested** |
| No. of Units | 5 | 5 |
| Operation: Days/week | 5 | 5 |
| Hours/day | 10 | 10 |
| Percent Solids | 5 | 3.4 |
| Hydraulic Loading Rate, gpm | | |
| Average Design Yr. (w/3 units) | 98 | 88 |
| Max. Design Yr. (w/4 units) | 122 | 123 |
| Cake Solids, % | 30 | 27 |
| Solids Capture, % | 95 | 95 |
| Polymer Usage, lb/dry ton | 8 | 12 |

Adapted from: CDM, Volume III, 1989

TABLE B-8

RECOMMENDED CHEMICAL FIXATION PROCESS DESIGN

| | |
|---|---|
| No. of Pug Mill Mixers | 2 |
| Operation | |
| Days/week | 5 |
| Hour/day | 10 |
| Portland Cement Addition, % wet weight | 15 |
| Bulk Density | 90 |
| Cement Usage, lb/day (5 days/week) | |
| Average Design Yr | 36,033 |
| Max. Design Yr | 59,045 |
| Cement Usage, cf/day (5 days/week) | |
| Average Design Yr | 400 |
| Max. Design Yr | 656 |
| Silicate Usage, gal/day (5 days/week) | |
| Average Design Yr | 1,201 |
| Max. Design Yr | 1,968 |
| Pugmill Loadings, tons/hr (5 days/week) | |
| Average Design Yr | 14 |
| Max. Design Yr | 23 |
| No. of Silos | 3 |
| Height of Silo, ft | 28 |
| Volume of Silo, cf | 2,426 |
| Silo Storage, days | |
| Average Design Yr | 25.4 |
| Max. Design Yr. | 15.5 |
| No. of Silicate Tanks | 1 |
| Volume of Silicate Tank, gal | 10,000 |
| Silicate Storage, days | |
| Average Design Yr | 11.7 |
| Max. Design Yr | 7.1 |

Adapted from: CDM, Volume III, 1989

TABLE B-9

RECOMMENDED LIME STABILIZATION PROCESS DESIGN

| | |
|---|---|
| No. of Pug Mill Mixers | 2 |
| Operation | |
| Days/week | 5 |
| Hour/day | 10 |
| Lime Addition, % | 25 |
| Bulk Density | 55 |
| Lime Usage, lb/day (5 days/week) | |
| Average Design Yr | 18,016 |
| Max. Design Yr | 29,523 |
| Lime Usage, cf/day (5 days/week) | |
| Average Design Yr | 328 |
| Max. Design Yr | 537 |
| Pugmill Loadings, tons/hr (5 days/week) | |
| Average Design Yr | 13 |
| Max. Design Yr | 21 |
| No. of Silos | 3 |
| Height of Silo, ft | 28 |
| Volume of Silo, cf | 2426 |
| Storage, days | |
| Average Design Yr | 31.1 |
| Max. Design Yr | 19.0 |

Adapted from: CDM, Volume III, 1989

TABLE B-10
LANDFILL SURVEY

| Landfill Location | Sludge Disposal Permit | Estimated Landfill Closure Date | Expansion Plans | Willing to Accept Sludge/ Sewage Ash | Willing to Accept Chemically Fixated/Composted Sludge as Cover | Comments |
|---|---|---|---|---|---|---|
| Bridgewater | Yes | 1987 | No | No | No | Town of Bridgewater accepts no out-of-town sludge. |
| Chatham | Yes | 1996 | No | No | No | Almost at capacity, contracting to have sludge disposed of. Has sufficient cover. |
| Dennis | Yes | 1998 | No | No | No | |
| Fall River (BFI) | Yes | 1997+ | (1) | Yes | Maybe | Require 20% solids, non-toxic; can handle 240 tpd for 10-20 years. $75/ton, negotiable. |
| Grafton | Yes | Closed | No | No | No | Closed 1987. |
| Mansfield | Yes | Closed | No | No | No | Closed August 1, 1987. |
| Marshfield | Yes | 1995 | No | No | Maybe | Should write letter to Jack Whippen of DPW, explaining Chemfix process and explain that it has been permitted for daily cover. |

TABLE B-10 (CONTINUED)
LANDFILL SURVEY

| Landfill Location | Sludge Disposal Permit | Estimated Landfill Closure Date | Expansion Plans | Willing to Accept Sludge/ Sewage Ash | Willing to Accept Chemically Fixated/Composted Sludge as Cover | Comments |
|---|---|---|---|---|---|---|
| Middleborough | Yes | 1987+ | (1) | No | No | Planning to contract out for sludge disposal; no use for daily cover material. |
| New Bedford | Yes | 1988 | Yes | Yes | Yes | Enough capacity for approximately 5 years. |
| North Attleborough | Yes | 1997 | No | No | No | |
| Norton | Yes | Closed | No | No | No | Closed July 1, 1987. |
| Plymouth | Yes | 1987 | No | No | No | No capacity for out-of-town sludge. |
| Rockland | Yes | 1993 | (1) | No | Maybe(2) | Write letter to Board of Health explaining sludge characteristics and quantities. |
| Scituate | Yes | 1996 | No | No | No | Sludge disposal limited to Scituate. |
| Tauton | Yes | 1990 | No | No | No | Accepts no out-of-town sludge. |

(1) Unknown.
(2) Willingness to accept sludge ash or compost material not yet determined.

Adapted from: CDM, Volume I, 1989.

TABLE B-11
SITES EVALUATED IN PHASE I/LEVEL 2 SCREENING
OF SOLIDS DISPOSAL SITES

| Site No. | Site Description |
|---|---|
| 1a | Army land and existing WWTP |
| 1b | Existing WWTP and filling into Buzzards Bay |
| 3 | Berkshire-Hathaway Mill Complex (south of Gifford) |
| 4a | Standard-Times Field (north of Gifford) |
| 4b | Filling into Acushnet River from Standard-Times Field |
| 7 | Railroad Property (west of Herman Melville Blvd.) |
| 8 | Property north of North Terminal (east of Herman Melville Blvd.) |
| 10 | Property north of Hathaway Road |
| 11 | Sullivan's Ledge (south of Hathaway Road) |
| 13 | Property east of Belleville Ave. between Sawyer St. and Coffin Ave. |
| 14 | Water Department/Solid Waste Landfill (west of Shawmut Avenue) |
| 16 | Property behind Chamberlain Manufacturing (east of Rte. 140) |
| 17 | Foreign Trade Zone/Air Industrial Park (west of Aviation Way) |
| 18 | New Bedford Municipal Airport |
| 20 | Property west of Church Street, east of Rte. 140 |
| 22 | Great Cedar Swamp (west of railroad tracks) |
| 23 | Property north of Arnoff Street |
| 25 | Property east of Braley Road, south of the Freetown line |
| 26 | Property north of Sassaquin Pond |
| 28 | Property opposite Goodyear (east of Orchard) |
| 29 | Sargent Field/City Yard (north of Mayfield) |
| 30 | Vacant land opposite high school (south of Durfee) |
| 33 | Building 19 and adjacent area (east of Shawmut Avenue) |
| 34 | NYNEX Garage (north of Nash Road) |
| 35 | Salvage yard adjacent to Rte. 140 (south of Nash Road) |
| 36 | Salvage yd and vacant portion of airport (north end of Shawmut Ave.) |
| 37 | Vacant area west of Church Street |
| 38 | Undeveloped area adjacent to railway spur (east of Rte. 140) |
| 40 | Industrial Park (west of Duchaine Blvd.) |
| 41 | Polaroid site (west of Phillips Road) |
| 42 | Site between Rte 140 and Phillips Road |
| 43 | Atlantic Mill Buildings (north of Rte. 195) |
| 44 | Revere and Wamsetta (east of Herman Melville Blvd, south of Kilburn) |
| 45 | Commonwealth Electric Company site (east of JFK Memorial Drive) |
| 46 | Acushnet/Ashley Blvd. |

Adapted from CDM, Volume I, 1989.

**TABLE B-12**
**POSSIBLE SITE COMBINATIONS FOR SOLIDS DISPOSAL**

| Site Combinations | Total Acreage |
| --- | --- |
| 7 - 8 | 42 |
| 7 - 44 | 78 |
| 8 - 44 | 56 |
| 13 - 43 | 37 |
| 33 - 35 | 37 |
| 34 - 35 | 29 |
| 14 - 36 | 47 |
| 20 - 37 | 68 |
| 17 - 18 | 67 |
| 41 - 42 | 85 |
| 20 - 38 | 59 |

Adapted from: CDM, Volume I, 1989.

## TABLE B-13
## CONTIGUOUS USABLE ACREAGE

| Site | % Wetland | % Floodplain | % Surface Water | Approximate Contiguous Net Usable Acreage |
|---|---|---|---|---|
| 1A | 0 | 100 | 0 | 0 |
| 1B | 5 | 100 | 0 | 0 |
| 3 | 0 | 10 | 0 | 25 |
| 4A | 10 | 40 | 0 | 22 |
| 7 | 0 | 5 | 0 | 32 |
| 8 | 1 | 100 | 0 | 0 |
| 10 | 0 | 0 | 0 | 32 |
| 11 | 0 | 0 | 0 | 14 |
| 13 | 1 | 45 | 0 | 7 |
| 14 | 100 | 100 | 0 | 0 |
| 16 | 70 | 0 | 20 | 12 |
| 17 | 30 | 0 | 0 | 25 |
| 18 | 50 | 0 | 0 | 10 |
| 20 | 40 | 0 | 0 | 20 |
| 22 | 80 | 80 | 5 | 58 |
| 23 | 10 | 0 | 5 | 16 |
| 25 | 70 | 0 | 0 | 14 |
| 26 | 60 | 20 | 0 | 34 |
| 28 | 1 | 0 | 0 | 15 |
| 29 | 0 | 0 | 0 | 31 |
| 30 | 15 | 0 | 0 | 14 |
| 33 | 0 | 0 | 0 | 23 |
| 34 | 25 | 0 | 2 | 11 |
| 35 | 20 | 0 | 2 | 11 |
| 36 | 60 | 0 | 0 | 10 |
| 37 | 40 | 0 | 0 | 20 |
| 38 | 40 | 0 | 0 | 18 |
| 40 | 50 | 10 | 1 | 140 |
| 41 | 50 | 45 | 15 | 11 |
| 42 | 20 | 0 | 5 | 15 |
| 43 | 0 | 24 | 0 | 14 |
| 44 | 5 | 10 | 5 | 36 |
| 45 | 0 | 0 | 0 | 22 |
| 46 | 0 | 0 | 0 | 25 |
| 47 | 0 | 0 | 0 | 50 |
| Combined Sites | | | | |
| 7- 8 | 0 | 30 | 0 | 32 |
| 7-44 | 5 | 10 | 2 | 68 |
| 17-18 | 40 | 0 | 0 | 35 |
| 8-44 | 5 | 30 | 3 | 36 |

**TABLE B-13 (CONTINUED)**
**CONTIGUOUS USABLE ACREAGE**

| Site | % Wetland | % Floodplain | % Surface Water | Approximate Contiguous Net Usable Acreage |
|---|---|---|---|---|
| 20-38 | 40 | 0 | 0 | 38 |
| 33-35 | 10 | 0 | 0 | 33 |
| 34-35 | 20 | 0 | 0 | 22 |
| 14-36 | 90 | 70 | 2 | 10 |
| 20-37 | 40 | 0 | 0 | 40 |
| 41-42 | 40 | 25 | 19 | 26 |
| 13-43 | 0 | 35 | 0 | 20 |

Adapted from: CDM, Volume I, 1989.

## TABLE B-14
## VOLUME AND AREA REQUIREMENTS OF SLUDGE DISPOSAL OPTIONS

| | Anaerobic Digestion Lime Stab. w/L.S. | Anaerobic Digestion Lime Stab. w/H.S. | In-vessel Com-posting w/Lime Stab. & L.S | In-vessel Com-posting w/Lime Stab. & H.S. | Incin. with w/Lime Stab. & L.S. | Incin. with w/Lime Stab. & H.S. | Lime Stab. & L.S. | Lime Stab. & H.S. | Chemical Fixation w/& L.S. | Chemical Fixation w/H.S. |
|---|---|---|---|---|---|---|---|---|---|---|
| Volume (cy/day) (5d/wk) | | | | | | | | | | |
| Sludge/Ash | 211.0 | 101.0 | 115.0 | 68.0 | 163.0 | 124.0 | 13.2 | 13.2 | 221.0 | 129.0 |
| Grit & Screening | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| Bulking Material | 395.5 | 116.0 | 227.5 | 124.5 | 178.0 | 139.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Daily Cover | 108.5 | 40.6 | 62.4 | 36.5 | 62.3 | 48.7 | 5.1 | 5.1 | 42.5 | 25.9 |
| Intermediate Cover | 92.7 | 34.8 | 53.3 | 31.5 | 53.4 | 41.7 | 4.2 | 4.2 | 35.4 | 21.6 |
| Final Cover | 76.8 | 29.0 | 44.2 | 25.7 | 44.5 | 34.8 | 3.7 | 3.7 | 30.7 | 18.7 |
| Total | 899.5 | 336.4 | 517.4 | 301.2 | 516.2 | 403.2 | 41.2 | 41.2 | 344.6 | 210.2 |
| Total Volume (mill cy) | | | | | | | | | | |
| 20 yr Volume | 4.69 | 1.75 | 2.70 | 1.57 | 2.69 | 2.10 | 0.21 | 0.21 | 1.80 | 1.10 |
| 18 yr Volume w/2 yr Backup | - | - | 2.90 | 1.63 | 2.89 | 2.11 | 0.66 | 0.66 | - | - |
| 15 yr Volume w/5 yr Backup | - | - | 3.20 | 1.73 | 3.19 | 2.13 | 1.33 | 1.33 | - | - |
| 5 yr Volume Backup | 1.17 | 0.44 | - | - | - | - | - | - | 0.45 | 0.27 |
| 2 yr Volume Backup | 0.47 | 0.18 | - | - | - | - | - | - | 0.18 | 0.11 |
| Area Required (acres) | | | | | | | | | | |
| 20 yr Volume | 113.6 | 45.8 | 67.9 | 41.5 | 67.8 | 54.0 | 7.8 | 7.8 | 46.8 | 30.1 |
| 18 yr Volume w/2 yr Backup | - | - | 72.5 | 42.9 | 72.4 | 54.2 | 19.4 | 19.4 | - | - |
| 15 yr Volume w/5 yr Backup | - | - | 79.4 | 45.3 | 79.3 | 54.7 | 35.8 | 35.7 | - | - |
| 5 yr Volume Backup | 32.0 | 13.8 | - | - | - | - | - | - | 14.0 | 9.4 |
| 2 yr Volume Backup | 14.5 | 6.7 | - | - | - | - | - | - | 6.8 | 4.7 |

L.S. indicates low solids dewatering
H.S. indicates high solids dewatering

Adapted from: CDM, Volume III, 1989.

**TABLE B-15**
**SOLIDS DISPOSAL OPTIONS FOR SITES IN NEW BEDFORD**
(Based on Average Year)

| | Disposal Option/Available Volume | | Site 20 without Impacts | Site 40 without Impacts | Site 47 without WWTP |
|---|---|---|---|---|---|
| Available volume at each site | | | 0.41 mill cy | 1.89 mill cy | 1.55 mill cy |
| 1) | Incineration with High Solids, 15 year ash landfill + 5 year lime stab. sludge landfill vol. | 0.71 mill cy 20.7 ac | no (16.1 yrs) | yes | yes |
| 2) | Chemical Fixation with High Solids, 20 year landfill vol. | 1.10 mill cy 30.1 ac | no (7.5 yrs) | yes | yes |
| 3) | Incineration with Low Solids, 15 year ash landfill + 5 year lime stab. sludge landfill vol. | 1.33 mill cy 35.8 ac | no (6.2 yrs) | yes | yes |
| 4) | Anaerobic Digestion with High Solids, 18 year landfill vol. +2 yr lime stab. | 1.63 mill cy 43.0 ac | no (5.0 yrs) | yes | no (19.0 yrs) |
| 5) | Lime Stabilization with High Solids, 20 year landfill vol. | 1.75 mill cy 45.8 ac | no (4.7 yrs) | yes | no (17.7 yrs) |
| 6) | Chemical Fixation with Low Solids, 20 year landfill vol. | 1.80 mill cy 46.8 ac | no (4.7 yrs) | yes | no (17.2 yrs) |

**without impacts** = Available landfill volume without impacting wetlands or high and medium yield groundwater areas.

TABLE B-15 (CONTINUED)
SOLIDS DISPOSAL OPTIONS FOR SITES IN NEW BEDFORD
(Based on Average Year)

| Disposal Option/Available Volume | | | Site 20 without Impacts | Site 40 without Impacts | Site 47 without WWTP |
|---|---|---|---|---|---|
| Available volume at each site | | | 0.41 mill cy | 1.89 mill cy | 1.55 mill cy |
| 7) | Invessel with High Solids, 18 year land-fill vol. + 2 yr lime stab. backup | 2.11 mill cy 54.3 ac | no (3.9 yrs) | no (17.9 yrs) | no (14.7 yrs) |
| 8) | Invessel with Low Solids, 18 year landfill vol. + 2 yr lime stab. | 2.89 mill cy 72.4 ac | no (2.8 yrs) | no (13.1 yrs) | no (10.7 yrs) |
| 9) | Anaerobic Digestion with Low Solids, 18 year landfill vol. + 2 yr lime stab. | 2.90 mill cy 72.5 ac | no (2.8 yrs) | no (13.0 yrs) | no (10.7 yrs) |
| 10) | Lime Stabilization with Low Solids, 20 year landfill vol. | 4.69 mill cy 113.6 ac | no (1.7 yrs) | no (8.1 yrs) | no (6.6 yrs) |

NOTES

mill cy = million cubic yards
Area requirements do not include buffer
Yes or no indicates whether or not the site can support designated landfill volume.

**without impacts** = Available landfill volume without impacting wetlands or high and medium yield groundwater areas.

( ) - Landfill Life Expectancy in Years

Adapted from: CDM, Volume III, 1989.

# APPENDIX C

## SPECIES LISTS FOR ALTERNATIVE SITES

TABLE C-1. PLANT SPECIES OBSERVED AT SITE 1A

| Scientific Name | Common Name |
|---|---|
| Acer platanoides | Norway maple |
| Asclepias syriaca | Common milkweed |
| Aster sp. | Aster |
| Chenopodium sp. | Goosefoot |
| Cucurbita sp. | Squash |
| Daucus carota | Queen Anne's lace |
| Elymus sp. | Rye grass |
| Gramineae | Grasses |
| Lonicera sp. | Honeysuckle |
| Lycopersicum esculentum | Tomato |
| Matteuccia struthiopteris | Ostrich fern |
| Myrica pensylvanica | Northern bayberry |
| Osmunda regalis | Royal fern |
| Pinus banksiana | Jack pine |
| Polygonum sp. | Smartweed |
| Populus deltoides | Common cottonwood |
| Populus tremuloides | Trembling aspen |
| Prunus maritima | Beach plum |
| Prunus virginiana | Choke cherry |
| Pyrus malus | Apple |
| Quercus rubra | Red oak |
| Quercus sp. | Oak |
| Quercus velutina | Black oak |
| Rhus typhina | Staghorn sumac |
| Rosa sp. | Rose |
| Rumex crispus | Curly dock |
| Salicornia sp. | Glasswort |
| Salix sp. | Willow |
| Sassafras albidum | Sassafras |
| Smilax sp. | Catbriar |
| Solanum dulcamara | Bittersweet |
| Solidago sp. | Goldenrod |
| Spartina alterniflora | Saltwater cordgrass |
| Spartina patens | Salt meadow grass |
| Ulmus americana | American elm |
| Vaccinium corymbosum | Highbush blueberry |
| Viburnum recognitum | Northern arrowwood |
| Vicia Cracca | Cow vetch |

Source: CDM, Vol II, 1989

TABLE C-2. BIRDS EXPECTED AT SITE 1A*

| Scientific Name | Common Name | Habitat and Suitability+ FO | SO | ES | CR | BO | SB | Abundance in New England |
|---|---|---|---|---|---|---|---|---|
| Agelaius phoeniceus | Red-winged blackbird | | | U | | | | Abundant |
| Ammodramus henslowii | Henslow's sparrow | P | | U | | | | Rare, local |
| Ammodramus savannarum | Grasshopper sparrow | U | | | | | | Uncommon |
| Anas acuta | Northern pintail | | | P | | | | Locally common |
| Anas crecca | Green-winged teal | | | U | | | | Uncommon |
| Anas discors | Blue-Winged teal | | | U | | | | Rare |
| Anas platyrhynchos | Mallard | | | U | | | | Common |
| Anas rubripes | American black duck | | | P | | | | Abundant to uncommon |
| Asio flammeus | Short-eared owl | | | P | | | | Locally common |
| Aythya collaris | Ring-necked duck | | | | | U | | Rare |
| Aythya valisineria | Canvasback | | | | | P | | Uncommon and local |
| Botaurus lentiginosus | American bittern | | | U | | | | Common |
| Branta canadensis | Canada goose | | | P | | | | Common |
| Bucephala albeola | Bufflehead | | | U | | U | | Common |
| Buteo lagopus | Rough-legged hawk | U | U | P | | | | Rare |
| Butorides striatus | Green-backed heron | | | U | | | | Uncommon to common |
| Calcarius lapponicus | Lapland longspur | | | U | U | | | Uncommon |
| Caprimulgus vociferus | Whip-poor-will | U | U | | | | | Locally common/uncommon |
| Cardinalis cardinalis | Northern cardinal | | U | | | | | Common |
| Carduelis hornemanni | Hoary redpoll | P | | | | | | Rare |
| Carduelis tristis | American goldfinch | U | U | | | | | Common |
| Chaetura pelagica | Chimney swift | U | U | | U | | P | Abundant |
| Charadrius vociferus | Killdeer | | | U | U | | | Common |
| Chordeiles minor | Common nighthawk | U | U | | U | | U | Locally common to rare |
| Circus cyaneus | Northern harrier | U | U | U | | U | | Locally common |
| Cistothorus palustris | Marsh wren | | | P | | | | Uncommon |
| Coccyzus erythropthalmus | Black-billed cuckoo | | U | | | | | Uncommon |
| Colinus virginianus | Northern Bobwhite | U | U | | | | | Locally common/uncommon |
| Columba livia | Rock dove | U | | | | | P | Abundant |
| Corvus brachyrhynchos | American crow | U | U | U | U | | | Common |
| Corvus ossifragus | Fish crow | | | U | | | | Uncommon to rare |
| Cygnus olor | Mute swan | | | P | | | | Locally common |
| Dendroica petechia | Yellow warbler | | U | | | | | Common |
| Eremophila alpestris | Horned lark | | | | U | | | Locally common |
| Gavia immer | Common loon | | | U | | P | | Common |
| Geothlypis trichas | Common yellowthroat | | U | | | | | Common |
| Ixobrychus exilis | Least bittern | | | U | | | | Uncommon to rare |
| Junco hyemalis | Dark-eyed junco | U | U | | | | | Common to uncommon |
| Larus argentatus | Herring gull | | | U | U | U | | Common |
| Larus delawarensis | Ring-billed gull | | | U | | U | | Locally common |
| Larus marinus | Great black-backed gull | | | U | U | U | | Common |
| Melospiza melodia | Song sparrow | U | U | | | | | Abundant |
| Mergus serrator | Red-breasted merganser | | | U | | P | | Common |
| Molothrus ater | Brown-headed cowbird | U | U | | | | | Common |

TABLE C-2. BIRDS EXPECTED AT SITE 1A* (Cont.)

| Scientific Name | Common Name | Habitat and Suitability+ | | | | | | Abundance in New England |
|---|---|---|---|---|---|---|---|---|
| | | FO | SO | ES | CR | BO | SB | |
| Nycticorax nycticorax | Black-crowned night-heron | | | P | | | | Common |
| Nycticorax violaceus | Yellow-crowned night-heron | | | P | | | | Locally common |
| Pandion haliaetus | Osprey | | | P | | U | | Uncommon to rare |
| Passer domesticus | House sparrow | U | U | | | | | Abundant |
| Passerculus sandwichensis | Savannah sparrow | | | P | | | | Locally common/uncommon |
| Passerina cyanea | Indigo bunting | | U | | | | | Common |
| Phasianus colchicus | Ring-necked pheasant | U | P | | | | | Common |
| Pheucticus ludovicianus | Rose-breasted grosbeak | | U | | | | | Common |
| Plectrophenax nivalis | Snow bunting | U | | | | | | Common to uncommon |
| Podilymbus podiceps | Pied-billed grebe | | | U | | P | | Locally common |
| Pooecetes gramineus | Vesper sparrow | U | U | U | | | | Uncommon |
| Quiscalus quiscula | Common grackle | U | | | | | | Abundant |
| Rallus elegans | King rail | | | U | | | | Uncommon to rare |
| Rallus limicola | Virginia rail | | | U | | | | Uncommon |
| Spizella arborea | American tree sparrow | | U | | | | | Common |
| Spizella pusilla | Field sparrow | U | U | | | | | Common |
| Sterna hirundo | Common tern | | | U | P | P | | Locally abundant |
| Sturnella magna | Eastern meadowlark | U | | | | | | Uncommon |
| Zenaida macroura | Mourning dove | U | U | | | | | Common |
| Zonotrichia albicollis | White-throated sparrow | U | P | | | | | Uncommon |

*Based on a habitat assessment using DeGraaf and Rudis (1986)

+The following habitat types and suitability modifiers (specified in Degraaf and Rudis) were used in this habitat assessment:

FO=Forb (Terrestrial/Upland field)
SO=Shrub/Old Field (Terrestrial/Upland field)
ES=Estuary/Salt Marsh
BO=Bay/Ocean (Wetland or Deepwater/Marine)
CR=Coastal Beach/Rocks (Wetland or Deepwater/Marine)
SB=Structure/Building (Other)
P=Preferred habitat
U=Utilized habitat

Note: Species were included only if special habitat needs exist nearby or are not specified in DeGraaf and Rudis (1986).

TABLE C-3. MAMMALS EXPECTED AT SITE 1A*

| Scientific Name | Common Name | Habitat and Suitability+ FO | SO | ES | CR | BO | SB | Abundance in New England |
|---|---|---|---|---|---|---|---|---|
| Blarina brevicauda | Short-tailed Shrew | U | U | U | | | | Common |
| Didelphis virginiana | Virginia Opossum | U | U | U | | | | Common to uncommon |
| Eptesicus fuscus | Big Brown Bat | U | U | U | | | P | Common |
| Marmota monax | Woodchuck | P | U | | | | | Common |
| Mephitis mephitis nigra | Striped Skunk | U | P | U | U | | | Common |
| Microtus pennsylvanicus | Meadow Vole | P | U | U | U | | | Abundant |
| Mus musculus | House Mouse | U | U | | | | P | Abundant |
| Odocoileus virginianus borealis | White-tailed Deer | U | U | U | U | | | Common |
| Parascalops breweri | Hairy-tailed Mole | U | U | | | | | Locally common |
| Peromyscus leucopus | White-footed Mouse | U | P | | U | | U | Common |
| Peromyscus maniculatus | Deer Mouse | | U | | | | P | Common |
| Procyon lotor | Raccoon | U | U | U | U | | | Common |
| Rattus norvegicus | Norway Rat | U | U | U | U | | P | Abundant |
| Scalopus aquaticus aquaticus | Eastern Mole | U | U | | | | | Locally common |
| Sciurus carolinensis pennsylvanicus | Gray Squirrel | | | | | | U | Common to abundant |
| Sylvilagus floridanus | Eastern Cottontail | P | P | U | | | | Abundant |
| Sylvilagus transitionalis | New England Cottontail | U | P | U | | | | Uncommon |
| Tamias striatus | Eastern Chipmunk | | U | | | | | Common |
| Tamiasciurus hudsonicus | Red Squirrel | | | | | | U | Common to uncommon |
| Vulpes vulpes | Red Fox | U | U | U | U | | | Common to uncommon |
| Zapus hudsonius | Meadow Jumping Mouse | U | U | U | | | | Locally common |

*Based on a habitat assessment using DeGraaf and Rudis (1986)

+The following habitat types and suitability modifiers (specified in Degraaf and Rudis) were used in this habitat assessment:

FO=Forb (Terrestrial/Upland field)
SO=Shrub/Old Field (Terrestrial/Upland field)
ES=Estuary/Salt Marsh
BO=Bay/Ocean (Wetland or Deepwater/Marine)
CR=Coastal Beach/Rocks (Wetland or Deepwater/Marine)
SB=Structure/Building (Other)
P=Preferred habitat
U=Utilized habitat

Note: Species were included only if special habitat needs exist nearby or are not specified in DeGraaf and Rudis (1986).

TABLE C-3. MAMMALS EXPECTED AT SITE 1A*

| Scientific Name | Common Name | Habitat and Suitability+ FO | SO | ES | CR | BO | SB | Abundance in New England |
|---|---|---|---|---|---|---|---|---|
| Blarina brevicauda | Short-tailed Shrew | U | U | U | | | | Common |
| Didelphis virginiana | Virginia Opossum | U | U | U | | | | Common to uncommon |
| Eptesicus fuscus | Big Brown Bat | U | U | U | | | P | Common |
| Marmota monax | Woodchuck | P | U | | | | | Common |
| Mephitis mephitis nigra | Striped Skunk | U | P | U | U | | | Common |
| Microtus pennsylvanicus | Meadow Vole | P | U | U | U | | | Abundant |
| Mus musculus | House Mouse | U | U | | | | P | Abundant |
| Odocoileus virginianus borealis | White-tailed Deer | U | U | U | U | | | Common |
| Parascalops breweri | Hairy-tailed Mole | U | U | | | | | Locally common |
| Peromyscus leucopus | White-footed Mouse | U | P | | U | | U | Common |
| Peromyscus maniculatus | Deer Mouse | | U | | | | P | Common |
| Procyon lotor | Raccoon | U | U | U | U | | | Common |
| Rattus norvegicus | Norway Rat | U | U | U | U | | P | Abundant |
| Scalopus aquaticus aquaticus | Eastern Mole | U | U | | | | | Locally common |
| Sciurus carolinensis pennsylvanicus | Gray Squirrel | | | | | | U | Common to abundant |
| Sylvilagus floridanus | Eastern Cottontail | P | P | U | | | | Abundant |
| Sylvilagus transitionalis | New England Cottontail | U | P | U | | | | Uncommon |
| Tamias striatus | Eastern Chipmunk | | U | | | | | Common |
| Tamiasciurus hudsonicus | Red Squirrel | | | | | | U | Common to uncommon |
| Vulpes vulpes | Red Fox | U | U | U | U | | | Common to uncommon |
| Zapus hudsonius | Meadow Jumping Mouse | U | U | U | | | | Locally common |

*Based on a habitat assessment using DeGraaf and Rudis (1986)

+The following habitat types and suitability modifiers (specified in Degraaf and Rudis) were used in this habitat assessment:

- FO=Forb (Terrestrial/Upland field)
- SO=Shrub/Old Field (Terrestrial/Upland field)
- ES=Estuary/Salt Marsh
- BO=Bay/Ocean (Wetland or Deepwater/Marine)
- CR=Coastal Beach/Rocks (Wetland or Deepwater/Marine)
- SB=Structure/Building (Other)
- P=Preferred habitat
- U=Utilized habitat

Note: Species were included only if special habitat needs exist nearby or are not specified in DeGraaf and Rudis (1986).

TABLE C-4. REPTILES AND AMPHIBIANS EXPECTED AT SITE 1A*

| Scientific Name | Common Name | Habitat and Suitability+ | | | | | | Abundance in New England |
|---|---|---|---|---|---|---|---|---|
| | | FO | SO | ES | CR | BO | SB | |
| Coluber c. constrictor | Northern Black Racer | U | U | | | | U | Locally abundant |
| Opheodrys v. vernalis | Smooth Green Snake | U | U | | | | | Common |
| Storeria d. dekayi | Northern Brown Snake | U | U | | | | | Common |
| Thamnophis s. sirtalis | Eastern Garter Snake | U | U | | | | U | Very abundant |

*Based on a habitat assessment using DeGraaf and Rudis (1986)

+The following habitat types and suitability modifiers (specified in Degraaf and Rudis) were used in this habitat assessment:

FO=Forb (Terrestrial/Upland field)
SO=Shrub/Old Field (Terrestrial/Upland field)
ES=Estuary/Salt marsh
CR=Coastal Beach/Rocks (Wetland or Deepwater/Marine)
BO=Bay/Ocean (Wetland or Deepwater/Marine)
SB=Structure/Building (Other)
P=Preferred habitat
U=Utilized habitat

Note: Species were included only if special habitat needs exist nearby or are not specified in DeGraaf and Rudis (1986).

TABLE C-5. PLANT SPECIES OBSERVED AT SITE 4A

| Scientific Name | Common Name |
|---|---|
| Aster sp. | Aster |
| Chenopodium sp. | Goosefoot |
| Cichorium intybus | Chicory |
| Daucus carota | Queen Anne's lace |
| Gramineae | Grasses |
| Linaria vulgaris | Butter-and-eggs |
| Myrica pensylvanica | Northern bayberry |
| Phragmites australis | Common reed |
| Phytolacca americana | Pokeweed |
| Rhus glabra | Smooth sumac |
| Rosa sp. | Rose |
| Rumex crispus | Curly dock |
| Salicornia sp. | Glasswort |
| Salix sp. | Willow |
| Spartina alterniflora | Saltwater cordgrass |
| Ulmus americana | American elm |

Source: CDM, Vol II, 1989

TABLE C-6. BIRDS EXPECTED AT SITE 4A*

| Scientific Name | Common Name | Habitat and Suitability+ FO | SO | ES | CR | BO | Abundance in New England |
|---|---|---|---|---|---|---|---|
| Agelaius phoeniceus | Red-winged blackbird | | | U | | | Abundant |
| Ammodramus henslowii | Henslow's sparrow | P | | U | | | Rare, local |
| Ammodramus savannarum | Grasshopper sparrow | U | | | | | Uncommon |
| Anas acuta | Northern pintail | | | P | | | Locally common |
| Anas crecca | Green-winged teal | | | U | | | Uncommon |
| Anas discors | Blue-Winged teal | | | U | | | Rare |
| Anas platyrhynchos | Mallard | | | U | | | Common |
| Anas rubripes | American black duck | | | P | | | Abundant to uncommon |
| Asio flammeus | Short-eared owl | | | P | | | Locally common |
| Aythya collaris | Ring-necked duck | | | | | U | Rare |
| Aythya valisineria | Canvasback | | | | | P | Uncommon and local |
| Botaurus lentiginosus | American bittern | | | U | | | Common |
| Branta canadensis | Canada goose | | | P | | | Common |
| Bucephala albeola | Bufflehead | | | U | | U | Common |
| Buteo lagopus | Rough-legged hawk | U | U | P | | | Rare |
| Butorides striatus | Green-backed heron | | | U | | | Uncommon to common |
| Calcarius lapponicus | Lapland longspur | | | U | U | | Uncommon |
| Caprimulgus vociferus | Whip-poor-will | U | U | | | | Locally common/uncommon |
| Cardinalis cardinalis | Northern cardinal | | U | | | | Common |
| Carduelis hornemanni | Hoary redpoll | P | | | | | Rare |
| Carduelis tristis | American goldfinch | U | U | | | | Common |
| Chaetura pelagica | Chimney swift | U | U | | U | | Abundant |
| Charadrius vociferus | Killdeer | | | U | U | | Common |
| Chordeiles minor | Common nighthawk | U | U | | U | | Locally common to rare |
| Circus cyaneus | Northern harrier | U | U | U | | U | Locally common |
| Cistothorus palustris | Marsh wren | | | P | | | Uncommon |
| Coccyzus erythropthalmus | Black-billed cuckoo | | U | | | | Uncommon |
| Colinus virginianus | Northern Bobwhite | U | U | | | | Locally common/uncommon |
| Columba livia | Rock dove | U | | | | | Abundant |
| Corvus brachyrhynchos | American crow | U | U | U | U | | Common |
| Corvus ossifragus | Fish crow | | | U | | | Uncommon to rare |
| Cygnus olor | Mute swan | | | P | | | Locally common |
| Dendroica petechia | Yellow warbler | | U | | | | Common |
| Eremophila alpestris | Horned lark | | | | U | | Locally common |
| Gavia immer | Common loon | | | U | | P | Common |
| Geothlypis trichas | Common yellowthroat | | U | | | | Common |
| Ixobrychus exilis | Least bittern | | | U | | | Uncommon to rare |
| Junco hyemalis | Dark-eyed junco | U | U | | | | Common to uncommon |
| Larus argentatus | Herring gull | | | U | U | U | Common |
| Larus delawarensis | Ring-billed gull | | | U | | U | Locally common |
| Larus marinus | Great black-backed gull | | | U | U | U | Common |
| Melospiza melodia | Song sparrow | U | U | | | | Abundant |
| Mergus serrator | Red-breasted merganser | | | U | | P | Common |
| Molothrus ater | Brown-headed cowbird | U | U | | | | Common |
| Nycticorax nycticorax | Black-crowned night-heron | | | P | | | Common |

TABLE C-6. BIRDS EXPECTED AT SITE 4A* (cont.)

| Scientific Name | Common Name | FO | SO | ES | CR | BO | Abundance in New England |
|---|---|---|---|---|---|---|---|
| | | Habitat and Suitability+ | | | | | |
| Nycticorax violaceus | Yellow-crowned night-heron | | | P | | | Locally common |
| Pandion haliaetus | Osprey | | | P | | U | Uncommon to rare |
| Passer domesticus | House sparrow | U | U | | | | Abundant |
| Passerculus sandwichensis | Savannah sparrow | | | P | | | Locally common/uncommon |
| Passerina cyanea | Indigo bunting | | U | | | | Common |
| Phasianus colchicus | Ring-necked pheasant | U | P | | | | Common |
| Pheucticus ludovicianus | Rose-breasted grosbeak | | U | | | | Common |
| Plectrophenax nivalis | Snow bunting | U | | | | | Common to uncommon |
| Podilymbus podiceps | Pied-billed grebe | | | U | | P | Locally common |
| Pooecetes gramineus | Vesper sparrow | U | U | U | | | Uncommon |
| Quiscalus quiscula | Common grackle | U | | | | | Abundant |
| Rallus elegans | King rail | | | U | | | Uncommon to rare |
| Rallus limicola | Virginia rail | | | U | | | Uncommon |
| Spizella arborea | American tree sparrow | | U | | | | Common |
| Spizella pusilla | Field sparrow | U | U | | | | Common |
| Sterna hirundo | Common tern | | | U | P | P | Locally abundant |
| Sturnella magna | Eastern meadowlark | U | | | | | Uncommon |
| Zenaida macroura | Mourning dove | U | U | | | | Common |
| Zonotrichia albicollis | White-throated sparrow | U | P | | | | Uncommon |

*Based on a habitat assessment using DeGraaf and Rudis (1986)

+The following habitat types and suitability modifiers (specified in Degraaf and Rudis) were used in this habitat assessment:

FO=Forb (Terrestrial/Upland field)
SO=Shrub/Old Field (Terrestrial/Upland field)
ES=Estuary/Salt Marsh
BO=Bay/Ocean (Wetland or Deepwater/Marine)
CR=Coastal Beach/Rocks (Wetland or Deepwater/Marine)
P=Preferred habitat
U=Utilized habitat

Note: Species were included only if special habitat needs exist nearby or are not specified in DeGraaf and Rudis (1986).

TABLE C-7. MAMMALS EXPECTED AT SITE 4A*

| Scientific Name | Common Name | Habitat and Suitability+ FO | SO | ES | CR | BO | Abundance in New England |
|---|---|---|---|---|---|---|---|
| Blarina brevicauda | Short-tailed Shrew | U | U | U | | | Common |
| Didelphis virginiana | Virginia Opossum | U | U | U | | | Common to uncommon |
| Eptesicus fuscus | Big Brown Bat | U | U | U | | | Common |
| Marmota monax | Woodchuck | P | U | | | | Common |
| Mephitis mephitis nigra | Striped Skunk | U | P | U | U | | Common |
| Microtus pennsylvanicus | Meadow Vole | P | U | U | U | | Abundant |
| Mus musculus | House Mouse | U | U | | | | Abundant |
| Odocoileus virginianus borealis | White-tailed Deer | U | U | U | U | | Common |
| Parascalops breweri | Hairy-tailed Mole | U | U | | | | Locally common |
| Peromyscus leucopus | White-footed Mouse | U | P | | U | | Common |
| Peromyscus maniculatus | Deer Mouse | | U | | | | Common |
| Procyon lotor | Raccoon | U | U | U | U | | Common |
| Rattus norvegicus | Norway Rat | U | U | U | U | | Abundant |
| Scalopus aquaticus aquaticus | Eastern Mole | U | U | | | | Locally common |
| Sylvilagus floridanus | Eastern Cottontail | P | P | U | | | Abundant |
| Sylvilagus transitionalis | New England Cottontail | U | P | U | | | Uncommon |
| Tamias striatus | Eastern Chipmunk | | U | | | | Common |
| Vulpes vulpes | Red Fox | U | U | U | U | | Common to uncommon |
| Zapus hudsonius | Meadow Jumping Mouse | U | U | U | | | Locally common |

*Based on a habitat assessment using DeGraaf and Rudis (1986)

+The following habitat types and suitability modifiers (specified in Degraaf and Rudis) were used in this habitat assessment:
FO=Forb (Terrestrial/Upland field)
SO=Shrub/Old Field (Terrestrial/Upland field)
ES=Estuary/Salt Marsh
BO=Bay/Ocean (Wetland or Deepwater/Marine)
CR=Coastal Beach/Rocks (Wetland or Deepwater/Marine)
P=Preferred habitat
U=Utilized habitat

Note: Species were included only if special habitat needs exist nearby or are not specified in DeGraaf and Rudis (1986).

TABLE C-8. REPTILES AND AMPHIBIANS EXPECTED AT SITE 4A*

| Scientific Name | Common Name | Habitat and Suitability+ | | | | | Abundance in New England |
|---|---|---|---|---|---|---|---|
| | | FO | SO | ES | CR | BO | |
| Coluber c. constrictor | Northern Black Racer | U | U | | | | Locally abundant |
| Opheodrys v. vernalis | Smooth Green Snake | U | U | | | | Common |
| Storeria d. dekayi | Northern Brown Snake | U | U | | | | Common |
| Thamnophis s. sirtalis | Eastern Garter Snake | U | U | | | | Very abundant |

*Based on a habitat assessment using DeGraaf and Rudis (1986)

+The following habitat types and suitability modifiers (specified in Degraaf and Rudis) were used in this habitat assessment:
- FO=Forb (Terrestrial/Upland field)
- SO=Shrub/Old Field (Terrestrial/Upland field)
- ES=Estuary/Salt marsh
- CR=Coastal Beach/Rocks (Wetland or Deepwater/Marine)
- BO=Bay/Ocean (Wetland or Deepwater/Marine)
- P=Preferred habitat
- U=Utilized habitat

Note: Species were included only if special habitat needs exist nearby or are not specified in DeGraaf and Rudis (1986).

TABLE C-9. PLANT SPECIES OBSERVED AT SITE 47

| Scientific Name | Common Name |
|---|---|
| Acer rubrum | Red maple |
| Alnus rugosa | Speckled alder |
| Aralia nudicaulis | Wild sarsparilla |
| Betula alleghaniensis | Yellow birch |
| Betula lenta | Black birch |
| Betula populifolia | Gray birch |
| Chamaedaphne calyculata | Leatherleaf |
| Clethra alnifolia | Sweet pepperbush |
| Dryopteris spinulosa | Spinulose woodfern |
| Fraxinus americana | White ash |
| Habenaria blephariaglottis | White-fringed orchid |
| Hamamelis virginiana | Witch hazel |
| Ilex opaca | American holly |
| Ilex verticillata | Winterberry |
| Juniperus virginiana | Red cedar |
| Kalmia angustifolia | Sheep laurel |
| Lindera Benzoin | Spicebush |
| Lycopodium sp. | Clubmoss |
| Myrica pensylvanica | Northern bayberry |
| Nyssa sylvatica | Black gum |
| Osmunda cinnamomea | Cinnamon fern |
| Osmunda regalis | Royal fern |
| Phragmites australis | Common reed |
| Pinus rigida | Pitch pine |
| Pinus strobus | White pine |
| Populus grandidentata | Bigtooth aspen |
| Populus tremuloides | Trembling aspen |
| Prunus serotina | Black cherry |
| Pteridium aquilinum | Bracken fern |
| Quercus alba | White oak |
| Quercus ilicifolia | Scrub oak |
| Quercus rubra | Red oak |
| Rhamnus caroliniana | Carolina buckthorn |
| Rubus idaeus | Red raspberry |
| Rubus sp. | Dewberry |
| Salix sp. | Willow |
| Sassafras albidum | Sassafras |
| Scirpus cyperinus | Woolly sedge |
| Smilax rotundifolia | Greenbriar |
| Sphagnum sp. | Sphagnum moss |
| Spiraea latifolia | Meadow-sweet |
| Tsuga canadensis | Eastern hemlock |
| Vaccinium corymbosum | Highbush blueberry |
| Vaccinium angustifolium | Lowbush blueberry |
| Viburnum lentago | Nannyberry |
| Viburnum recognitum | Northern arrowwood |

Sources: Wetlands Assessment by C-E Environmental;
CDM, Vol.II, 1989

TABLE C-10. BIRDS EXPECTED AT SITE 47*

| Scientific Name | Common Name | Habitat and Suitability+ RM | PR | EH | WM | SM | SS | Abundance in New England |
|---|---|---|---|---|---|---|---|---|
| Accipiter cooperii | Cooper's hawk | U | P | U | | | | Uncommon |
| Accipiter gentilis | Northern goshawk | U | U | U | | | | Uncommon |
| Accipiter striatus | Sharp-shinned hawk | U | P | U | | | | Uncommon |
| Aegolius acadicus | Northern saw-whet owl | P | P | P | | | | Uncommon |
| Agelaius phoeniceus | Red-winged blackbird | | | | U | P | U | Abundant |
| Archilochus colubris | Ruby-throated hummingbird | P | U | U | | | | Common |
| Asio otus | Long-eared owl | U | U | P | U | U | | Rare |
| Bombycilla cedrorum | Cedar waxwing | | | | | | U | Locally common/uncommon |
| Bonasa umbellus | Ruffed grouse | U | U | U | | | | Common to uncommon |
| Bubo virginianus | Great horned owl | P | U | P | U | | U | Locally common/uncommon |
| Buteo jamaicensis | Red-tailed hawk | P | P | U | | | | Common |
| Buteo lagopus | Rough-legged hawk | | | | U | U | U | Rare |
| Buteo lineatus | Red-shouldered hawk | P | U | U | | | P | Uncommon |
| Buteo platypterus | Broad-winged hawk | P | P | U | | | | Common to uncommon |
| Caprimulgus vociferus | Whip-poor-will | U | P | | | | | Locally common/uncommon |
| Cardinalis cardinalis | Northern cardinal | U | U | | | | U | Common |
| Carduelis pinus | Pine siskin | U | U | U | | | | Uncommon |
| Carpodacus mexicanus | House finch | | U | | | | | Common |
| Carpodacus purpureus | Purple finch | U | U | U | | | | Uncommon |
| Catharus fuscescens | Veery | P | U | U | | | | Common |
| Catharus guttatus | Hermit thrush | U | P | P | | | U | Uncommon |
| Certhia americana | Brown creeper | U | U | U | | | | Locally common/uncommon |
| Cistothorus platensis | Sedge wren | | | | P | | | Rare |
| Coccyzus americanus | Yellow-billed cuckoo | U | P | | | | | Uncommon |
| Coccyzus erythropthalmus | Black-billed cuckoo | | P | | | | U | Uncommon |
| Colaptes auratus | Northern flicker | U | P | U | | | | Common |
| Colinus virginianus | Northern Bobwhite | | P | | | | | Locally common/uncommon |
| Contopus virens | Easter wood-pewee | U | U | U | | | | Common |
| Corvus brachyrhynchos | American crow | U | P | U | | | | Common |
| Cyanocitta cristata | Blue jay | P | P | P | | | | Common |
| Dendroica caerulescens | Black-throated blue warbler | U | U | U | | | | Common |
| Dendroica virens | Black-throated green warbler | U | U | P | | | | Common |
| Dumetella carolinensis | Gray catbird | P | | | | | | Common |
| Empidonax alnorum | Alder flycatcher | | | | | | P | Uncommon |
| Empidonax minimus | Least flycatcher | P | P | | | | | Common |
| Euphagus carolinus | Rusty blackbird | U | | | | | U | Rare and local |
| Gallinago gallinago | Common snipe | | | | U | U | P | Common |
| Geothlypis trichas | Common yellowthroat | P | P | U | U | U | P | Common |
| Hylocichla mustelina | Wood thrush | U | P | U | | | | Common |
| Junco hyemalis | Dark-eyed junco | U | U | U | | | | Common to uncommon |
| Melanerpes carolinus | Red-bellied woodpecker | P | P | | | | | Locally common to rare |
| Melanerpes erythrocephalus | Red-headed woodpecker | P | P | | | | | Uncommon to rare |
| Melospiza melodia | Song sparrow | U | U | U | U | U | P | Abundant |
| Mniotilta varia | Black-and-white warbler | U | P | U | | | | Common |
| Molothrus ater | Brown-headed cowbird | U | U | U | U | U | | Common |

TABLE C-10. BIRDS EXPECTED AT SITE 47* (cont.)

| Scientific Name | Common Name | Habitat and Suitability+ RM | PR | EH | WM | SM | SS | Abundance in New England |
|---|---|---|---|---|---|---|---|---|
| Myiarchus crinitus | Great crested flycatcher | U | U | U | | | | Common |
| Otus asio | Eastern screech-owl | P | U | U | U | P | | Uncommon |
| Parus atricapillus | Black-capped chickadee | P | U | U | | | | Common |
| Parus bicolor | Tufted titmouse | U | P | | | | | Common |
| Pheucticus ludovicianus | Rose-breasted grosbeak | U | P | U | | | | Common |
| Picoides pubescens | Downy woodpecker | P | P | U | | | | Common |
| Picoides villosus | Hairy woodpecker | P | U | U | | | | Common |
| Pipilo erythrophthalmus | Rufous-sided towhee | U | P | | | | | Common |
| Piranga olivacea | Scarlet tanager | U | P | U | | | | Common |
| Polioptila caerulea | Blue-gray gnatcatcher | P | P | | | | U | Rare |
| Quiscalus quiscula | Common grackle | | | | U | U | P | Abundant |
| Rallus elegans | King rail | | | | U | P | | Uncommon to rare |
| Regulus calendula | Ruby-crowned kinglet | | U | U | | | | Common to uncommon |
| Regulus satrapa | Golden-crowned kinglet | U | U | U | | | | Common to uncommon |
| Scolopax minor | American woodcock | P | | | U | | U | Common |
| Seiuris aurocapillus | Ovenbird | U | P | U | | | | Common |
| Setophaga ruticilla | American redstart | U | U | U | | | | Common |
| Sitta canadensis | Red-breasted nuthatch | | U | P | | | | Common |
| Sitta carolinensis | White-breasted nuthatch | U | P | | | | | Common |
| Spizella arborea | American tree sparrow | | | | U | U | U | Common |
| Tachycineta bicolor | Tree swallow | P | | | U | P | U | Abundant |
| Troglodytes aedon | House wren | U | U | | | | | Common |
| Turdus migratorius | American robin | U | U | U | | | U | Abundant |
| Vireo flavifrons | Yellow-throated vireo | P | P | | | | | Rare |
| Vireo gilvus | Warbling vireo | P | U | | | | | Locally common/uncommon |
| Vireo griseus | White-eyed vireo | | | | | | P | Locally common |
| Vireo olivaceus | Red-eyed vireo | U | U | U | | | | Abundant |
| Zenaida macroura | Mourning dove | U | P | U | | | | Common |
| Zonotrichia albicollis | White-throated sparrow | U | U | U | | | | Uncommon |

*Based on a habitat assessment using DeGraaf and Rudis (1986)

+The following habitat types and suitability modifiers (specified in Degraaf and Rudis) were used in this habitat assessment:

RM=Red Maple (Forested)
PR=White Pine/Northern Red Oak/Red Maple (Forested)
EH=Eastern Hemlock (Forested)
WM=Wet Meadow (i.e., sedge meadow--Wetland or Deepwater/Palustrine)
SM=Shallow Marsh (Wetland or Deepwater/Palustrine)
SS=Shrub Swamp (Wetland or Deepwater/Palustrine)
P=Preferred habitat
U=Utilized habitat

Note: Species were included only if special habitat needs exist nearby or are not specified in DeGraaf and Rudis (1986).

TABLE C-11. MAMMALS EXPECTED AT SITE 47*

| Scientific Name | Common Name | Habitat and Suitability+ | | | | | | Abundance in New England |
|---|---|---|---|---|---|---|---|---|
| | | RM | PR | EH | WM | SM | SS | |
| Blarina brevicauda | Short-tailed Shrew | U | U | U | P | U | U | Common |
| Castor canadensis | Beaver | P | U | | | U | U | Common |
| Clethrionomys gapperi | Southern Red-backed Vole | U | P | P | | | U | Common |
| Condylura cristata | Star-nosed Mole | U | | | P | U | U | Common to uncommon |
| Didelphis virginiana | Virginia Opossum | P | P | | P | P | P | Common to uncommon |
| Glaucomys volans | Southern Flying Squirrel | U | P | | | | | Common to uncommon |
| Lasionycteris noctivagans | Silver-haired Bat | U | U | U | U | P | P | Uncommon to rare |
| Lasiurus borealis | Red Bat | U | U | | U | U | U | Uncommon to rare |
| Lasiurus cinereus | Hoary Bat | | U | U | U | U | U | Rare |
| Lepus americanus | Snowshoe Hare | U | U | U | | | P | Common |
| Mephitis mephitis nigra | Striped Skunk | U | U | U | U | U | U | Common |
| Microtus pennsylvanicus | Meadow Vole | | | | U | U | U | Abundant |
| Microtus pinetorum scalopsoides | Pine Vole | U | U | | | | | Common to uncommon |
| Mustela frenata | Long-tailed Weasel | U | U | U | U | U | U | Common to uncommon |
| Mustela vison | Mink | P | U | U | U | P | U | Common to uncommon |
| Odocoileus virginianus borealis | White-tailed Deer | U | U | P | U | U | U | Common |
| Ondatra zibethicus | Muskrat | | | | U | P | U | Common to uncommon |
| Parascalops breweri | Hairy-tailed Mole | U | U | U | | | | Locally common |
| Peromyscus leucopus | White-footed Mouse | U | P | U | U | | U | Common |
| Pipestrellus subflavus obscurus | Eastern Pipistrelle | U | U | U | U | P | P | Uncommon to rare |
| Procyon lotor | Raccoon | P | U | U | U | P | P | Common |
| Sciurus carolinensis pennsylvanicus | Gray Squirrel | U | P | | | | | Common to abundant |
| Sorex cinereus cinereus | Masked Shrew | U | U | U | U | U | U | Common to uncommon |
| Sylvilagus floridanus | Eastern Cottontail | U | U | | P | P | P | Abundant |
| Sylvilagus transitionalis | New England Cottontail | | | | U | U | P | Uncommon |
| Synaptomys cooperi | Southern Bog Lemming | U | U | | P | P | | Uncommon |
| Tamias striatus | Eastern Chipmunk | U | U | U | | | | Common |
| Tamiasciurus hudsonicus | Red Squirrel | U | U | P | | | | Common to uncommon |
| Urocyon cinereoargenteus | Gray Fox | P | P | | U | U | U | Common to uncommon |
| Vulpes vulpes | Red Fox | U | U | U | U | U | U | Common to uncommon |
| Zapus hudsonius | Meadow Jumping Mouse | U | U | U | P | P | U | Locally common |

*Based on a habitat assessment using DeGraaf and Rudis (1986)

+The following habitat types and suitability modifiers (specified in Degraaf and Rudis) were used in this habitat assessment:

RM=Red Maple (Forested)
PR=White Pine/Northern Red Oak/Red Maple (Forested)
EH=Eastern Hemlock (Forested)
WM=Wet Meadow (i.e., sedge meadow--Wetland or Deepwater/Palustrine)
SM=Shallow Marsh (Wetland or Deepwater/Palustrine)
SS=Shrub Swamp (Wetland or Deepwater/Palustrine)
P=Preferred habitat
U=Utilized habitat

Note: Species were included only if special habitat needs exist nearby or are not specified in DeGraaf and Rudis (1986).

TABLE C-12. REPTILES AND AMPHIBIANS EXPECTED AT SITE 47*

| Scientific Name | Common Name | Habitat and Suitability+ | | | | | | Abundance in New England |
|---|---|---|---|---|---|---|---|---|
| | | RM | PR | EH | WM | SM | SS | |
| Ambystoma maculatum | Spotted Salamander | P | U | U | U | U | U | Common |
| Ambystoma opacum | Marbled Salamander | P | U | | U | | U | Uncommon |
| Bufo a. americanus | American Toad | U | U | U | U | U | U | Common |
| Bufo woodhouseii fowleri | Fowler's Toad | U | U | | U | | | Uncommon |
| Chelydra s. serpentina | Snapping Turtle | U | U | | | U | | Common |
| Chrysemys p. picta | Painted Turtle | U | | | | | | Common to abundant |
| Clemmys guttata | Spotted Turtle | | | | P | P | U | Uncommon to rare |
| Coluber c. constrictor | Northern Black Racer | U | P | | | U | U | Locally abundant |
| Diadophis punctatus edwardsii | Northern Ringneck Snake | P | | U | | | | Common |
| Eurycea b. bislineata | Two-lined Salamander | U | U | U | | | | Common to abundant |
| Hemidactylium scutatum | Four-toed Salamander | P | U | U | U | U | | Uncommon to rare |
| Heterodon platyrhinos | Eastern Hognose Snake | | P | | | U | | Locally common |
| Hyla c. crucifer | Spring Peeper | U | U | U | U | P | U | Common to abundant |
| Hyla versicolor | Common Gray Treefrog | U | U | | | | U | Common |
| Lampropeltis t. triangulum | Eastern Milk Snake | U | U | | | | | Common |
| Nerodia s. sipedon | Northern Water Snake | U | | | U | | U | Abundant |
| Notophthalmus v. viridescens | Red-spotted newt | U | U | U | U | | U | Common |
| Plethodon cinereus | Red-backed Salamander | U | U | U | | | | Abundant |
| Rana clamitans melanota | Green Frog | U | | | U | U | U | Common |
| Rana palustris | Pickerel Frog | U | U | U | | | | Locally common |
| Rana pipiens | Northern Leopard Frog | U | | | P | P | | Common |
| Rana sylvatica | Wood Frog | U | U | U | U | U | U | Common |
| Scaphiopus h. holbrookii | Eastern Spadefoot | | U | | | | | Rare |
| Storeria d. dekayi | Northern Brown Snake | U | U | U | U | | U | Common |
| Storeria o. occipitomaculata | Red-bellied Snake | U | P | P | U | | U | Locally abundant |
| Terrapene c. carolina | Eastern Box Turtle | U | P | | U | | | Locally common |
| Thamnophis s. sauritus | Eastern Ribbon Snake | P | | | P | U | U | Common |
| Thamnophis s. sirtalis | Common Garter Snake | U | U | U | U | U | U | Very abundant |

*Based on a habitat assessment using DeGraaf and Rudis (1986)

+The following habitat types and suitability modifiers (specified in Degraaf and Rudis) were used in this habitat assessment:

RM=Red Maple (Forested)
PR=White Pine/Northern Red Oak/Red Maple (Forested)
EH=Eastern Hemlock (Forested)
WM=Wet Meadow (i.e., sedge meadow--Wetland or Deepwater/Palustrine)
SM=Shallow Marsh (Wetland or Deepwater/Palustrine)
SS=Shrub Swamp (Wetland or Deepwater/Palustrine)
P=Preferred habitat
U=Utilized habitat

Note: Species were included only if special habitat needs exist nearby or are not specified in DeGraaf and Rudis (1986).

TABLE C-13. PLANT SPECIES OBSERVED AT SITE 40

| Scientific Name | Common Name |
|---|---|
| Acer rubrum | Red maple |
| Chamaecyparis thyoides | Atlantic white cedar |
| Chamaedaphne calyculata | Leatherleaf |
| Clethra alnifolia | Sweet pepperbush |
| Drosera sp. | Sundew |
| Dryopteris spinulosa | Spinulose woodfern |
| Ilex opaca | American holly |
| Ilex verticillata | Winterberry |
| Kalmia angustifolia | Sheep laurel |
| Lindera Benzoin | Common spicebush |
| Mitchella repens | Partridgeberry |
| Nyssa sylvatica | Black gum |
| Osmunda regalis | Royal fern |
| Pinus strobus | White pine |
| Rhododendron viscosum | Swamp azalea |
| Sarracenia purpurea | Pitcher-plant |
| Sphagnum sp. | Sphagnum moss |
| Tsuga canadensis | Eastern hemlock |
| Utricularia sp. | Bladderwort |
| Vaccinium angustifolium | Lowbush blueberry |
| Vaccinium corymbosum | Highbush blueberry |
| Viburnum recognitum | Northern arrowwood |

Source: CDM, Vol. III, 1989

TABLE C-14. BIRDS EXPECTED AT SITE 40*

| Scientific Name | Common Name | Habitat and Suitability+ RM | PR | EH | WM | SM | SS | BG | Abundance in New England |
|---|---|---|---|---|---|---|---|---|---|
| Accipiter cooperii | Cooper's hawk | U | P | U | | | | | Uncommon |
| Accipiter gentilis | Northern goshawk | U | U | U | | | | | Uncommon |
| Accipiter striatus | Sharp-shinned hawk | U | P | U | | | | | Uncommon |
| Aegolius acadicus | Northern saw-whet owl | P | P | P | | | | | Uncommon |
| Agelaius phoeniceus | Red-winged blackbird | | | | U | P | U | U | Abundant |
| Archilochus colubris | Ruby-throated hummingbird | P | U | U | | | | | Common |
| Asio otus | Long-eared owl | U | U | P | U | U | | U | Rare |
| Bombycilla cedrorum | Cedar waxwing | | | | | | U | | Locally common/uncommon |
| Bonasa umbellus | Ruffed grouse | U | U | U | | | | | Common to uncommon |
| Bubo virginianus | Great horned owl | P | U | P | U | | U | | Locally common/uncommon |
| Buteo jamaicensis | Red-tailed hawk | P | P | U | | | | | Common |
| Buteo lagopus | Rough-legged hawk | | | | U | U | U | U | Rare |
| Buteo lineatus | Red-shouldered hawk | P | U | U | | | P | | Uncommon |
| Buteo platypterus | Broad-winged hawk | P | P | U | | | | | Common to uncommon |
| Caprimulgus vociferus | Whip-poor-will | U | P | | | | | | Locally common/uncommon |
| Cardinalis cardinalis | Northern cardinal | U | U | | | | U | | Common |
| Carduelis pinus | Pine siskin | U | U | U | | | | U | Uncommon |
| Carpodacus mexicanus | House finch | | U | | | | | | Common |
| Carpodacus purpureus | Purple finch | U | U | U | | | | | Uncommon |
| Catharus fuscescens | Veery | P | U | U | | | | | Common |
| Catharus guttatus | Hermit thrush | U | P | P | | | U | U | Uncommon |
| Certhia americana | Brown creeper | U | U | U | | | | U | Locally common/uncommon |
| Cistothorus platensis | Sedge wren | | | | P | | | | Rare |
| Coccyzus americanus | Yellow-billed cuckoo | U | P | | | | | | Uncommon |
| Coccyzus erythropthalmus | Black-billed cuckoo | | P | | | | U | | Uncommon |
| Colaptes auratus | Northern flicker | U | P | U | | | | | Common |
| Colinus virginianus | Northern Bobwhite | | P | | | | | | Locally common/uncommon |
| Contopus virens | Easter wood-pewee | U | U | U | | | | | Common |
| Corvus brachyrhynchos | American crow | U | P | U | | | | | Common |
| Cyanocitta cristata | Blue jay | P | P | P | | | | | Common |
| Dendroica caerulescens | Black-throated blue warbler | U | U | U | | | | | Common |
| Dendroica virens | Black-throated green warbler | U | U | P | | | | | Common |
| Dumetella carolinensis | Gray catbird | P | | | | | | U | Common |
| Empidonax alnorum | Alder flycatcher | | | | | | P | U | Uncommon |
| Empidonax minimus | Least flycatcher | P | P | | | | | | Common |
| Euphagus carolinus | Rusty blackbird | U | | | | | U | P | Rare and local |
| Gallinago gallinago | Common snipe | | | | U | U | P | U | Common |
| Geothlypis trichas | Common yellowthroat | P | P | U | U | U | P | U | Common |
| Hylocichla mustelina | Wood thrush | U | P | U | | | | | Common |
| Junco hyemalis | Dark-eyed junco | U | U | U | | | | | Common to uncommon |
| Melanerpes carolinus | Red-bellied woodpecker | P | P | | | | | | Locally common to rare |
| Melanerpes erythrocephalus | Red-headed woodpecker | P | P | | | | | | Uncommon to rare |
| Melospiza melodia | Song sparrow | U | U | U | U | U | P | | Abundant |
| Mniotilta varia | Black-and-white warbler | U | P | U | | | | U | Common |
| Molothrus ater | Brown-headed cowbird | U | U | U | U | U | | | Common |
| Myiarchus crinitus | Great crested flycatcher | U | U | U | | | | | Common |
| Otus asio | Eastern screech-owl | P | U | U | U | P | | | Uncommon |

TABLE C-14. BIRDS EXPECTED AT SITE 40* (cont.)

| Scientific Name | Common Name | Habitat and Suitability+ RM | PR | EH | WM | SM | SS | BG | Abundance in New England |
|---|---|---|---|---|---|---|---|---|---|
| Parus atricapillus | Black-capped chickadee | P | U | U | | | | | Common |
| Parus bicolor | Tufted titmouse | U | P | | | | | | Common |
| Pheucticus ludovicianus | Rose-breasted grosbeak | U | P | U | | | | | Common |
| Picoides pubescens | Downy woodpecker | P | P | U | | | | | Common |
| Picoides villosus | Hairy woodpecker | P | U | U | | | | | Common |
| Pipilo erythrophthalmus | Rufous-sided towhee | U | P | | | | | | Common |
| Piranga olivacea | Scarlet tanager | U | P | U | | | | | Common |
| Polioptila caerulea | Blue-gray gnatcatcher | P | P | | | | U | | Rare |
| Quiscalus quiscula | Common grackle | | | | U | U | P | U | Abundant |
| Rallus elegans | King rail | | | | U | P | | | Uncommon to rare |
| Regulus calendula | Ruby-crowned kinglet | | U | U | | | | | Common to uncommon |
| Regulus satrapa | Golden-crowned kinglet | U | U | U | | | | | Common to uncommon |
| Scolopax minor | American woodcock | P | | | U | | U | U | Common |
| Seiuris aurocapillus | Ovenbird | U | P | U | | | | | Common |
| Setophaga ruticilla | American redstart | U | U | U | | | | | Common |
| Sitta canadensis | Red-breasted nuthatch | | U | P | | | | U | Common |
| Sitta carolinensis | White-breasted nuthatch | U | P | | | | | | Common |
| Spizella arborea | American tree sparrow | | | | U | U | U | | Common |
| Tachycineta bicolor | Tree swallow | P | | | U | P | U | U | Abundant |
| Troglodytes aedon | House wren | U | U | | | | | | Common |
| Turdus migratorius | American robin | U | U | U | | | U | U | Abundant |
| Vireo flavifrons | Yellow-throated vireo | P | P | | | | | | Rare |
| Vireo gilvus | Warbling vireo | P | U | | | | | | Locally common/uncommon |
| Vireo griseus | White-eyed vireo | | | | | | P | | Locally common |
| Vireo olivaceus | Red-eyed vireo | U | U | U | | | | | Abundant |
| Zenaida macroura | Mourning dove | U | P | U | | | | | Common |
| Zonotrichia albicollis | White-throated sparrow | U | U | U | | | | | Uncommon |

*Based on a habitat assessment using DeGraaf and Rudis (1986)

+The following habitat types and suitability modifiers (specified in Degraaf and Rudis) were used in this habitat assessment:

RM=Red Maple (Forested)
PR=White Pine/Northern Red Oak/Red Maple (Forested)
EH=Eastern Hemlock (Forested)
WM=Wet Meadow (i.e., sedge meadow--Wetland or Deepwater/Palustrine)
SM=Shallow Marsh (Wetland or Deepwater/Palustrine)
SS=Shrub Swamp (Wetland or Deepwater/Palustrine)
BG=Bog (Wetland or Deepwater/Palustrine)
P=Preferred habitat
U=Utilized habitat

Note: Species were included only if special habitat needs exist nearby or are not specified in DeGraaf and Rudis (1986).

TABLE C-15. MAMMALS EXPECTED AT SITE 40*

| Scientific Name | Common Name | Habitat and Suitability+ RM | PR | EH | WM | SM | SS | BG | Abundance in New England |
|---|---|---|---|---|---|---|---|---|---|
| Blarina brevicauda | Short-tailed Shrew | U | U | U | P | U | U | U | Common |
| Castor canadensis | Beaver | P | U | | | U | U | U | Common |
| Clethrionomys gapperi | Southern Red-backed Vole | U | P | P | | | U | U | Common |
| Condylura cristata | Star-nosed Mole | U | | | P | U | U | U | Common to uncommon |
| Didelphis virginiana | Virginia Opossum | P | P | | P | P | P | | Common to uncommon |
| Glaucomys volans | Southern Flying Squirrel | U | P | | | | | | Common to uncommon |
| Lasionycteris noctivagans | Silver-haired Bat | U | U | U | U | P | P | P | Uncommon to rare |
| Lasiurus borealis | Red Bat | U | U | | U | U | U | U | Uncommon to rare |
| Lasiurus cinereus | Hoary Bat | | U | U | U | U | U | U | Rare |
| Lepus americanus | Snowshoe Hare | U | U | U | | | P | P | Common |
| Mephitis mephitis nigra | Striped Skunk | U | U | U | U | U | U | U | Common |
| Microtus pennsylvanicus | Meadow Vole | | | | U | U | U | U | Abundant |
| Microtus pinetorum scalopsoides | Pine Vole | U | U | | | | | | Common to uncommon |
| Mustela frenata | Long-tailed Weasel | U | U | U | U | U | U | U | Common to uncommon |
| Mustela vison | Mink | P | U | U | U | P | U | U | Common to uncommon |
| Odocoileus virginianus borealis | White-tailed Deer | U | U | P | U | U | U | U | Common |
| Ondatra zibethicus | Muskrat | | | | U | P | U | U | Common to uncommon |
| Parascalops breweri | Hairy-tailed Mole | U | U | U | | | | | Locally common |
| Peromyscus leucopus | White-footed Mouse | U | P | U | U | | U | U | Common |
| Pipestrellus subflavus obscurus | Eastern Pipistrelle | U | U | U | U | P | P | P | Uncommon to rare |
| Procyon lotor | Raccoon | P | U | U | U | P | P | P | Common |
| Sciurus carolinensis pennsylvanicus | Gray Squirrel | U | P | | | | | | Common to abundant |
| Sorex cinereus cinereus | Masked Shrew | U | U | U | U | U | U | P | Common to uncommon |
| Sylvilagus floridanus | Eastern Cottontail | U | U | | P | P | P | | Abundant |
| Sylvilagus transitionalis | New England Cottontail | | | | U | U | P | | Uncommon |
| Synaptomys cooperi | Southern Bog Lemming | U | U | | P | P | | U | Uncommon |
| Tamias striatus | Eastern Chipmunk | U | U | U | | | | | Common |
| Tamiasciurus hudsonicus | Red Squirrel | U | U | P | | | | | Common to uncommon |
| Urocyon cinereoargenteus | Gray Fox | P | P | | U | U | U | | Common to uncommon |
| Vulpes vulpes | Red Fox | U | U | U | U | U | U | U | Common to uncommon |
| Zapus hudsonius | Meadow Jumping Mouse | U | U | U | P | P | U | U | Locally common |

*Based on a habitat assessment using DeGraaf and Rudis (1986)

+The following habitat types and suitability modifiers (specified in Degraaf and Rudis) were used in this habitat assessment:
- RM=Red Maple (Forested)
- PR=White Pine/Northern Red Oak/Red Maple (Forested)
- EH=Eastern Hemlock (Forested)
- WM=Wet Meadow (i.e., sedge meadow--Wetland or Deepwater/Palustrine)
- SM=Shallow Marsh (Wetland or Deepwater/Palustrine)
- SS=Shrub Swamp (Wetland or Deepwater/Palustrine)
- BG=Bog (Wetland or Deepwater/Palustrine)
- P=Preferred habitat
- U=Utilized habitat

Note: Species were included only if special habitat needs exist nearby or are not specified in DeGraaf and Rudis (1986).

TABLE C-16. REPTILES AND AMPHIBIANS EXPECTED AT SITE 40*

| Scientific Name | Common Name | Habitat and Suitability+ RM | PR | EH | WM | SM | SS | BG | Abundance in New England |
|---|---|---|---|---|---|---|---|---|---|
| Ambystoma maculatum | Spotted Salamander | P | U | U | U | U | U | | Common |
| Ambystoma opacum | Marbled Salamander | P | U | | U | | U | | Uncommon |
| Bufo a. americanus | American Toad | U | U | U | U | U | U | | Common |
| Bufo woodhouseii fowleri | Fowler's Toad | U | U | | U | | | | Uncommon |
| Chelydra s. serpentina | Snapping Turtle | U | U | | | U | | U | Common |
| Chrysemys p. picta | Painted Turtle | U | | | | | | | Common to abundant |
| Clemmys guttata | Spotted Turtle | | | | P | P | U | U | Uncommon to rare |
| Coluber c. constrictor | Northern Black Racer | U | P | | | U | U | | Locally abundant |
| Diadophis punctatus edwardsii | Northern Ringneck Snake | P | | U | | | | | Common |
| Eurycea b. bislineata | Two-lined Salamander | U | U | U | | | | U | Common to abundant |
| Hemidactylium scutatum | Four-toed Salamander | P | U | U | U | U | | P | Uncommon to rare |
| Heterodon platyrhinos | Eastern Hognose Snake | | P | | | U | | | Locally common |
| Hyla c. crucifer | Spring Peeper | U | U | U | U | P | U | | Common to abundant |
| Hyla versicolor | Common Gray Treefrog | U | U | | | | U | U | Common |
| Lampropeltis t. triangulum | Eastern Milk Snake | U | U | | | | | U | Common |
| Nerodia s. sipedon | Northern Water Snake | U | | | U | | U | U | Abundant |
| Notophthalmus v. viridescens | Red-spotted newt | U | U | U | U | | U | | Common |
| Plethodon cinereus | Red-backed Salamander | U | U | U | | | | U | Abundant |
| Rana clamitans melanota | Green Frog | U | | | U | U | U | | Common |
| Rana palustris | Pickerel Frog | U | U | U | | | | P | Locally common |
| Rana pipiens | Northern Leopard Frog | U | | | P | P | | U | Common |
| Rana sylvatica | Wood Frog | U | U | U | U | U | U | U | Common |
| Scaphiopus h. holbrookii | Eastern Spadefoot | | U | | | | | | Rare |
| Storeria d. dekayi | Northern Brown Snake | U | U | U | U | | U | | Common |
| Storeria o. occipitomaculata | Red-bellied Snake | U | P | P | U | | U | U | Locally abundant |
| Terrapene c. carolina | Eastern Box Turtle | U | P | | U | | | U | Locally common |
| Thamnophis s. sauritus | Eastern Ribbon Snake | P | | | P | U | U | U | Common |
| Thamnophis s. sirtalis | Common Garter Snake | U | U | U | U | U | U | U | Very abundant |

*Based on a habitat assessment using DeGraaf and Rudis (1986)

+The following habitat types and suitability modifiers (specified in Degraaf and Rudis) were used in this habitat assessment:

RM=Red Maple (Forested)
PR=White Pine/Northern Red Oak/Red Maple (Forested)
EH=Eastern Hemlock (Forested)
WM=Wet Meadow (i.e., sedge meadow--Wetland or Deepwater/Palustrine)
SM=Shallow Marsh (Wetland or Deepwater/Palustrine)
SS=Shrub Swamp (Wetland or Deepwater/Palustrine)
BG=Bog (Wetland or Deepwater/Palustrine)
P=Preferred habitat
U=Utilized habitat

Note: Species were included only if special habitat needs exist nearby or are not specified in DeGraaf and Rudis (1986).

**Table C-17**

**FISH SPECIES COLLECTED FROM OTTER TRAWLS AT EXISTING AND 301(H) OUTFALL LOCATIONS**

| Fish | Outfall Location Existing | 301(h) |
|---|---|---|
| Alewife (Alosa pseudoharengus) | X | |
| American Eel (Anguilla rostrata) | X | |
| American Shad (Alosa sapidissima) | X | |
| Atlantic Herring (Clupea harengus harengus) | X | |
| Atlantic Silverside (Menidia menidia) | X | |
| Bay Anchovy (Anchoa mitchilli) | X | |
| Black Sea Bass (Centropristis striata) | X | X |
| Blueback Herring (Alosa aestivalis) | X | |
| Bluefish (Pomatomus saltatrix) | | X |
| Butterfish (Peprilus triacanthus) | X | X |
| Cunner (Tautogolabrus adspersus) | X | X |
| Fourbeard Rockling (Enchelyopus cimbrius) | X | X |
| Fluke (Paralichthys dentatus) | X | X |
| Gauguanche (Sphyraena gauchancho) | X | |
| Fourspot Flounder (Parlichthys oblongus) | X | X |
| Grubby (Myoxocephalus aeneaus) | X | |
| Little Skate (Raja erinacea) | X | X |
| Menhaden (Brevoortia tyrannus) | X | X |
| Northern Pipefish (Syngnathus fuscus) | X | |
| Ocean Pout (Macrozoarces americanus) | | X |
| Planehead filefish (Monacanthus hispidus) | | X |
| Pinfish (Lagodon rhomboides) | X | X |
| Northern Searobin (Prionotus carolinus) | X | X |
| Pollack (Pollachius virens) | X | |
| Red Hake (Urophycis chuss) | X | X |
| Scup (Stenotomus chrysops) | X | X |
| Seaboard Goby (Gobiosoma ginsburgi) | X | |
| Short Big Eye (Pristigenys alta) | | X |
| Silver Hake (Merluccius bilinearis) | | X |
| Smooth Dogfish (Mustelus canis) | X | X |
| Spiny Dogfish (Squalus acanthias) | X | X |
| Spotted Hake (Urophycis regia) | | X |
| Striped Anchovy (Anchoa hepsetus) | X | |
| Striped Sea Robin (Prionotus evolans) | X | X |
| Summer Flounder (Paralichthys dentatus) | X | |
| Tautog (Tautoga onitis) | X | X |
| Weak Fish (Cynoscion regalis) | X | X |
| White Hake (Urophycis tenuis) | X | X |
| Windowpane Flounder (Scophthalmus aquosus) | X | X |
| Winter Flounder (Pseudopleuronectes americanus) | X | X |

Sources: Massachusetts Department of Marine Fisheries, 1979-1983.
CDM, 1983.

**Table C-18**

**SUMMARY OF RESULTS FROM DEMERSAL AND PELAGIC CATCH SURVEY CONDUCTED IN AUGUST AND OCTOBER 1983**

| | Outfall Location | |
|---|---|---|
| Parameter | Existing | 301(h) |
| Number of demersal species | 12 | 4 |
| Demersal catch per unit effort[1] | 508 | 30 |
| Dominant species catch | | |
| Scup | 464 | 17 |
| Black seabass | 8 | 7 |
| Winter flounder | 14 | 0 |
| Number of pelagic species | 1 | 2 |
| Pelagic catch per unit effort[2] | 1 | 6 |
| Dominant species catch | | |
| Menhaden | 1 | 5 |

[1] per 10 minute tow, average of 2 tows
[2] per overnight set, average of 2 sets

Adapted from: CDM, 1983 (only Stations 3 and 13)

# APPENDIX D
# LOST OPPORTUNITY COST ANALYSIS

# NEW BEDFORD WASTE WATER TREATMENT PLANT EIS

# LOST OPPORTUNITY COST ANALYSIS

Prepared by
Wallace, Floyd, Associates Inc.

June 1989

## INTRODUCTION

Evaluating and comparing the potential siting alternatives for a facility such as a waste water treatment plant is a complex problem involving the analysis of a number of disparate factors and concerns. Cost, which plays a major role in determining the relative desirability of a particular site, can be measured both in terms of the actual dollar amount required to construct and operate the facility on a given site, and in less tangible terms such as impacts on surrounding neighborhoods, loss of valuable parkland, or loss of potential residential development sites.

One measure of the cost of developing the waste water treatment plant on a particular site is the "lost opportunity" to develop other uses on that site. The potential value of those other uses, both tangible and intangible, are "lost" to the community.

This report attempts to quantify and/or describe the potential lost opportunity costs for the three sites currently under consideration for the siting of the New Bedford Waste Water Treatment Plant.

## METHODOLOGY

The first step in this analysis was to define a set of feasible potential uses for each of the sites. Site visits and the constraint maps developed by CDM provided a basis for preparing an initial list of potential uses, incorporating information on site characteristics such as surrounding context, environmental suitability, location, access, parcel size and zoning regulations. Because the New Bedford Zoning Code has not been revised in many years, and it is possible for developers to obtain zoning variances, non-conforming uses were considered feasible in some cases.

This initial use list was then reviewed with the following local officials:

- Al Lima, Director of the New Bedford Planning Department;
- Jim Olivera, Director of the New Bedford Mayor's Office of Economic Development;
- Martin Manley, Executive Director of the New Bedford Harbor Development Commission; and
- Steve Smith, Executive Director of the Southeast Region Planning and Economic Development District.

Conversations with these individuals provided valuable information on community goals and concerns, the current development climate in New Bedford, and the likelihood of approval for specific zoning variances. Following these conversations, a set of development options for each site was prepared. This set, which was approved by each of the persons listed above, provided the framework for the remainder of the Lost Opportunity Cost Analysis.

For each of the sites, conceptual layouts were prepared for the various potential uses. These rough layouts were prepared to determine an estimate of the density or quantity of a specific use type which could be accommodated on the site (e.g., square feet of industrial building space). Site layouts did not include any of the land within the primary constraint areas as designated by the CDM constraint maps.

Total project market value was then estimated by totaling the following figures:

- 1988 land appraisal costs prepared for CDM. Appraisal costs were used rather than assessed values because they represent an estimate of the cost a developer would actually have to pay to acquire the property.

- Rough construction cost estimates which were made by using the site layouts and cost information based on commonly used industry standards and recent similar projects.

- An average rate of 20% of land and construction costs for miscellaneous expenses such as insurance, legal fees, permits, etc. This figure represents an industry standard commonly used for this type of calculation.

- 20% developer profit. As above, this figure represents an industry standard commonly used for this type of calculation.

Although based on the best available current information, these estimates do not represent actual specific development proposals or recommendations (with the exception of the Palmer's Cove proposal for Site 4A). The project market value refers to the project's value to the developer, not the value of the project to the community. The project market value does provide, however, the basis for estimating an order of magnitude annual tax assessment (based on New Bedford's tax assessment rate of .03599 for commercial and industrial property and .01909 for residential property).

The annual tax assessment associated with the project, together with less quantifiable benefits of that project (e.g., public access to the waterfront, parkland; affordable housing), also detailed in this analysis, constitute a fair representation of the value of the project to the community. Similarly, these factors represent the lost opportunity cost of developing the waste water treatment plant at that site.

This analysis does not attempt to estimate additional jobs or retail activity resulting from development. Development related jobs and spending may, in fact, be relocations from other jobs and/or commercial activities and are therefore not easily attributable to a specific project.

This analysis also does not attempt to quantify the cost of providing City services such as police, fire, and schools for these potential developments. These costs would differ between uses; in general, provision of municipal services is higher per square foot of development for residential than for commercial/industrial uses.

It should be noted that the time required to complete a development project, and thus the time required before the City will realize the financial and non-quantifiable benefits associated with that development, will differ both by site and by type of development. Factors which might affect the timing include required permits (e.g., dredging for marinas); the number of individual parcel owners; and the amount of building space which the developer is trying to sell and/or lease. Because, with the exception of the Palmer's Cove proposal for Site 4A, no actual development proposals currently exist for the sites, it is difficult to estimate when in fact a particular development might be completed. All of the uses analyzed in this report were determined to be feasible through the methodology described above. However, the relative likelihood of these developments actually occurring is difficult to predict. Factors such as changing economic and market conditions, which may differ with respect to type of use, will affect the likelihood of specific development projects occurring. Therefore, when comparing the potential lost opportunity costs for the three sites, it is important to remember that development of the waste water treatment plant on one site does not guarantee that the development projects described for the other sites will occur.

The remainder of this report details the uses analyzed for each site. There is also a discussion of those uses which were considered to be infeasible, and therefore were dropped from further consideration.

SITE 1A - FORT RODMAN

Site 1A is a 79.4 acre site at the southern tip of New Bedford, surrounded by water on three sides. The site currently comprises a wastewater treatment facility; Fort Rodman, a granite block Civil War fort; and a number of buildings housing educational and military office facilities. The area immediately to the north of Site 1A is a well-kept, attractive residential neighborhood. The site is several miles from the New Bedford business district and is zoned for residential use.

Discussions with local officials indicated that because of the site's scenic waterfront location, the City would be very interested in seeing at least a portion of the site developed for public park use. Also, the City wants to maintain control of the site, and would therefore offer a potential developer a long-term lease on the site, rather than actually sell the site. One use option is for the City to develop the entire site as a park.

Non-park uses which were considered for the site centered on those uses which would be compatible with park use and the adjacent residential neighborhood. Residential use, which is consistent with existing zoning and compatible with surrounding uses, was determined to be the most feasible and desirable non-park use. It was decided that the most desirable layout of the site for residential use would be a cluster development in which residential units were "clustered together" in a relatively dense grouping, leaving large areas of communal open space, rather than the more traditional single family housing on individual lots. Because of the large size of the site, it was decided to analyze the impacts of developing housing on half of the usable portion of the site, leaving the remaining half for parkland. (See Figure 1 for an illustrative site plan of residential use on Site 1A.) A developer would be provided with a long-term lease on the site, and would be allowed to develop housing in exchange for developing the other portion of the site for public open space. The layout used for cost estimation purposes comprised 468 residential units on approximately 25 acres. It was not considered reasonable or desirable to develop the entire site for residential use, as this would both preclude the development of public open space and result in a greater number of units on the site (over 900) than demanded by the market or desired by the City. The balance between land developed for housing and recreation could be modified; decreasing the amount of land in residential use would decrease the tax revenues, but would increase the amount of public open space.

Because of a marina's compatibility with the adjacent parkland, options were added which included a marina with both parkland and a combination of parkland and housing. As in the case of the residential developer described above, it was assumed that the marina developer would be required to develop the site for public park use in exchange for being given a long term lease on the site. The marina could also be developed by the City, in conjunction with a park, but such a project would preclude receipt of taxes on the site.

Other uses which were considered for the site include a mixed-use development similar to Palmer's Cove and a hotel/conference center. Although these uses would benefit from the waterfront location, they were dropped from further consideration because of the City's desire to concentrate commercial uses closer to the Downtown. Because of the site's limited access and proximity to a residential neighborhood, industrial development was not considered suitable.

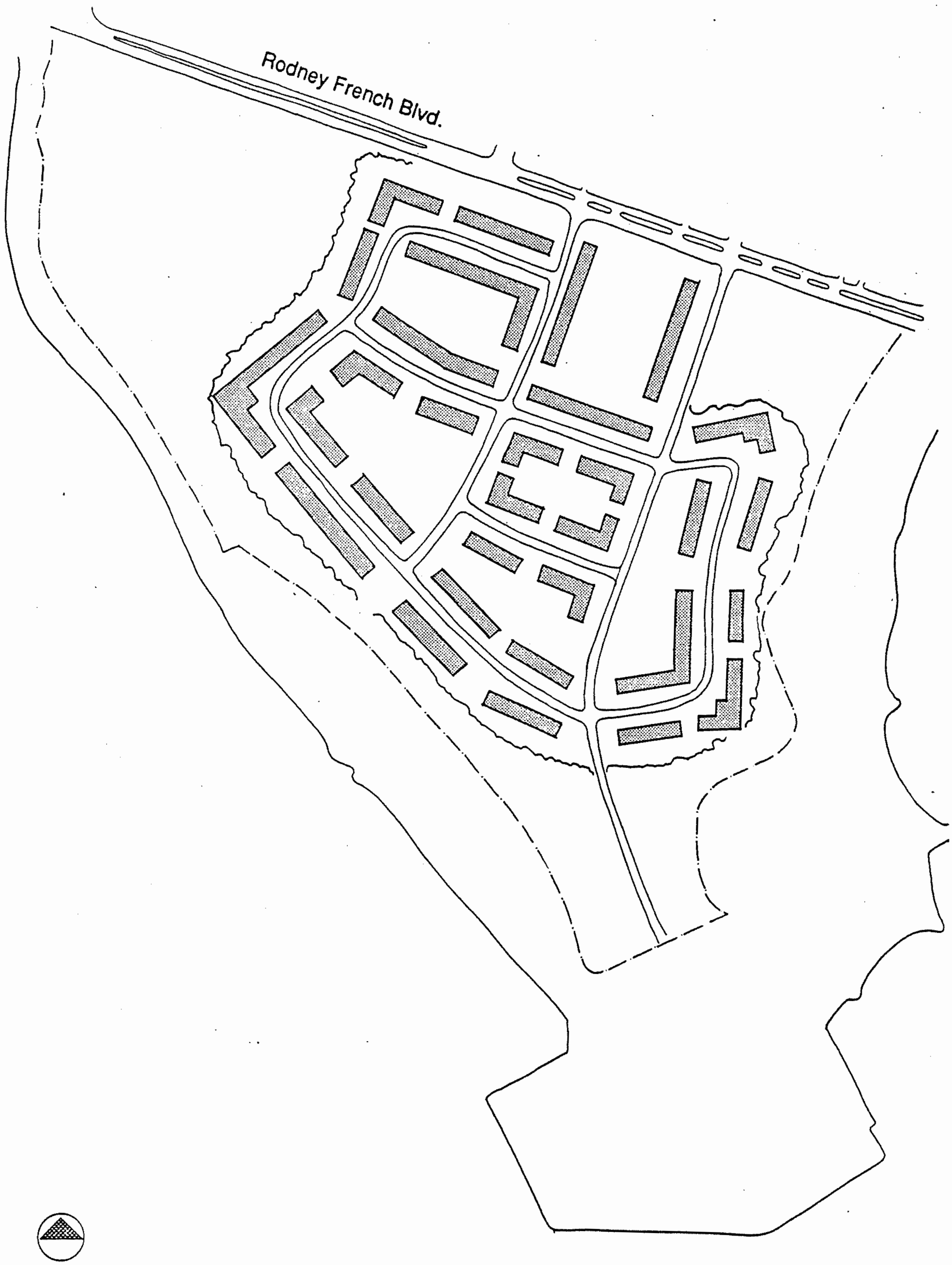


**Figure 1 : Illustrative Site Plan of Residential / Recreational Use on Site 1A**

SITE 1A - FORT RODMAN

| | Housing & Park[1,4] | Hsg/Park/Marina[1,2,4] | Park & Marina [3,4] |
|---|---|---|---|
| Appraised Land Value | (1,700,000) | (1,700,000) | (1,700,000) |
| Construction Cost | 54,500,000 | 56,900,000 | 20,800,000 |
| Subtotal | 54,500,000 | 56,900,000 | 20,800,000 |
| Indirect Costs @ 20% | 10,900,000 | 11,400,000 | 4,200,000 |
| Subtotal | 65,400,000 | 68,300,000 | 25,000,000 |
| Profit @ 20% | 13,100,000 | 13,700,000 | 5,000,000 |
| Total Market Value | $78,500,000 | $82,000,000 | $30,000,000 |
| Annual Tax Assessment @ .01909 | $1,500,000 | $1,600,000 | $1,100,000 |

Notes:

1. o Assumes long-term lease of site and development of 1/2 usable portion of site (approximately 25 acres) with housing, 1/2 site for recreation.

   o Housing designed as "cluster development" with two-floor, multi-unit buildings. 486 residential units @ 1200 square feet (SF) with $50/SF building construction cost; purchase price of $167,000/unit. 1200 SF units and $50/SF construction costs based on industry standards and recent project costs.

   o Other benefits from development of housing and park include:

   - 486 units of housing (may be affordable housing, but would result in lower property tax revenues).
   - 25 acres of developed parkland (plus land within primary constraint area).
   - Public access to waterfront.
   - Consistent with community desire for water-related use.
   - May induce some rehabilitation activity in adjacent neighborhood.

   o Municipal costs associated with development of housing and park include:

   - Provision of police and fire protection.
   - Provision of education for residents.
   - Park maintenance (could be maintained by developer).

2. o Assumes addition of 200 boat marina @ $12,000/boat to development described above in 1. $12,000/boat represents industry average for construction cost; possible additional cost for dredging is not included.

- o Other benefits from development of housing, park and marina include:

  - 480 units of housing (may be affordable housing, but would result in lower property tax revenues).
  - 25 acres of developed parkland (plus land within primary constraint area).
  - Public access to waterfront.
  - Consistent with community desire for water-related use.
  - May induce some rehabilitation activity in adjacent neighborhood.

- o Municipal costs associated with development of housing, park and marina include:

  - Provision of police and fire protection.
  - Provision of education for residents.
  - Park maintenance (could be maintained by developer).

3. o Assumes long-term lease and development of entire site with 200 boat marina @ $12,000/boat plus park. $12,000/boat represents industry average for construction cost; possible additional cost for dredging is not included.

- o Construction costs for park only are $18,400,000, and include extensive site improvements on 2/3 of the site, and limited site improvements on the remaining 1/3. (Construction costs for developing a park, leaving the existing educational buildings and surrounding area intact for educational purposes, are $14,800,000, with 1/2 of the park area extensively developed and the remaining park area with limited development.) It is assumed that if the site were developed for park use only, the City would be the developer and therefore there would be no tax revenues.

- o Other benefits from development of park or park with marina include:

  - Up to 49 acres of developed parkland (plus land within primary constraint area).
  - Public access to waterfront.
  - Consistent with community desire for water-related use.
  - May induce some rehabilitation activity in adjacent neighborhood.
  - Dock fees from marina (could go to City if partially City-owned or operated; public/private partnership would affect tax revenues).

- o Municipal costs associated with development of park or marina and park include:

  - Provision of police and fire protection.
  - Park maintenance (could be maintained by developer).

4. o Obstacles which might delay and/or prevent development:

   -Federally-owned property with a number of easements and uses requiring relocation.
   -Permits required for constructing marina in floodplain.
   -Large number of residential units would take several years for market absorption.

SITE 4A - STANDARD TIMES

Site 4A is a 38.9 acre site located on the eastern New Bedford waterfront, with primarily industrial uses to the north and south and a residential neighborhood to the west, separated from the site by a highway. It is approximately 1 mile from Downtown. The site currently comprises municipal ballfields and a radio tower. Adjacent uses include small industrial buildings to the north, south and west, and a Cape Verdean Social Club near the southwest corner. A residential neighborhood lies to the west, across a divided thoroughfare. The site is zoned for industrial use and is in the Waterfront Overlay District.

Because of the site's zoning and location within an industrial area, in addition to the City's desire for increased industrial development, industrial uses were considered to be appropriate for the site. Heavy and light industrial development were analyzed as two separate uses, although they are very similar and would result in virtually the same costs and benefits. Some combination of these two uses would also be appropriate for the site, but was not detailed separately because the results would be very similar to those shown already. The water is not deep enough in this part of the harbor to allow for waterborne shipments to the site. However, some marine-related industries such as ropeworks might be appropriate tenants of light industrial space. Conceptual layouts which were prepared to determine the capacity of the site for development as an industrial park resulted in 300,000 square feet of building space, along with parking, truck maneuvering areas, and some landscaping. (See Figure 2 for an illustrative site plan of industrial use on Site 4A.)

Because of the site's proximity to downtown, and its attractive waterfront location, a mixed-use development was also considered an appropriate use of the site. The existing Palmer's Cove proposal for the site, which has already received community support, was determined to be an appropriate model for mixed-use development; the density, mix of uses and construction costs used for the analysis of mixed-use development were taken directly from the Palmer's Cove Draft EIR. The use of the Palmer's Cove proposal as a model for mixed-use development on the site does not indicate EPA's endorsement of the size of the marina or other components of that proposal.

Conversations with City officials indicated that because of the site's location with respect to Downtown, and the desire for increased commercial/industrial activity, development of the entire site for park use was not considered to be desirable. Development of a strip along the waterfront for public access could be included as part of an industrial development. The site was not considered to be appropriate for the cogeneration plant proposed for the City because of its lack of both water and rail access.

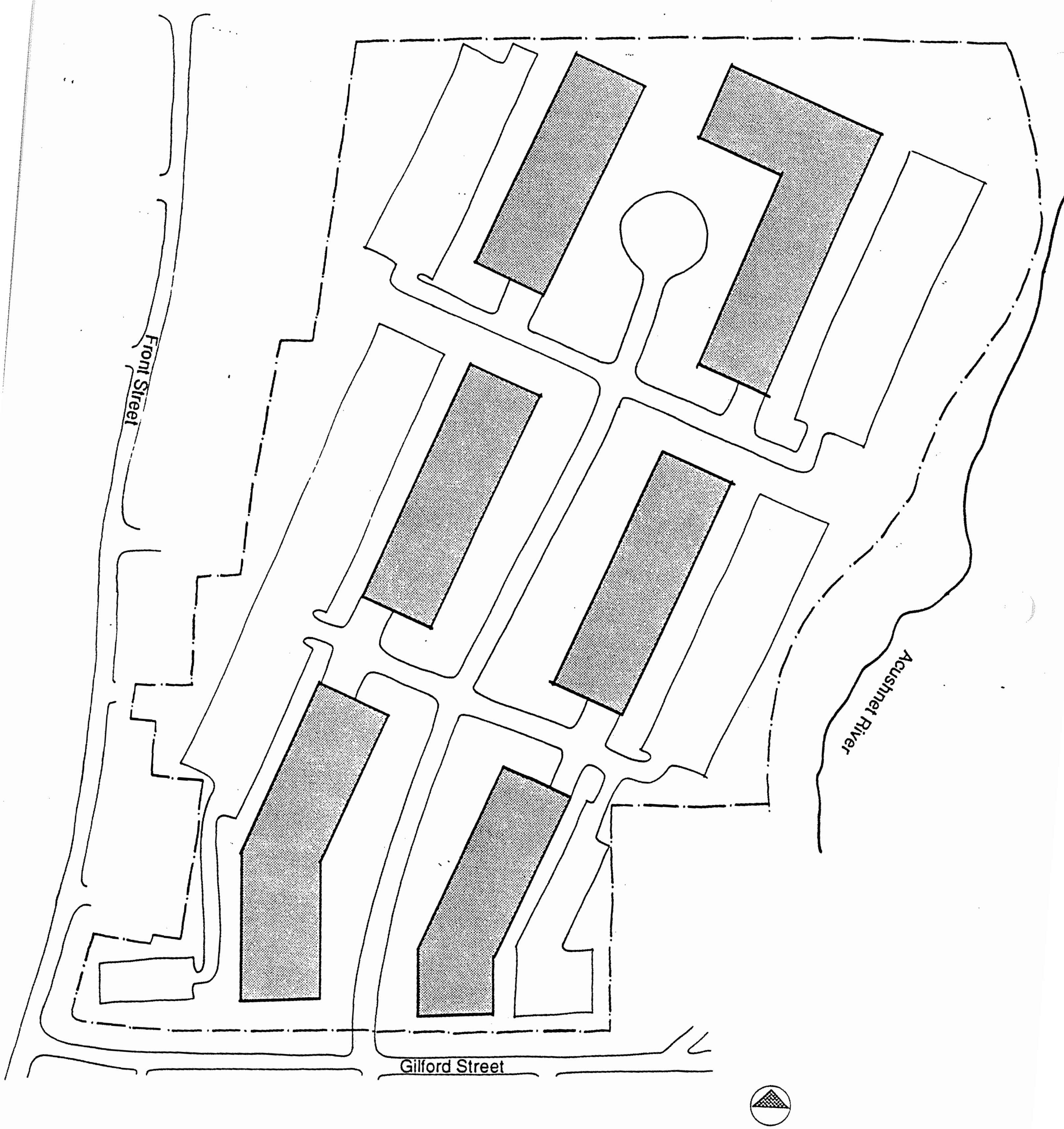


**Figure 2 : Illustrative Site Plan of Industrial Use on Site 4A**

SITE 4A - STANDARD TIMES

| | Light Industrial[1] | Heavy Industrial[1] | Mixed-Use[2] |
|---|---|---|---|
| Appraised Land Value | 5,800,000 | 5,800,000 | 5,800,000 |
| Construction Cost | 22,700,000 | 19,700,000 | 106,900,000 |
| Subtotal | 28,500,000 | 25,500,000 | 112,700,000 |
| Indirect Costs @ 20% | 5,700,000 | 5,100,000 | 22,500,000 |
| Subtotal | 34,200,000 | 30,600,000 | 135,200,000 |
| Profit @ 20% | 6,800,000 | 6,100,000 | 27,000,000 |
| Total Market Value | 41,000,000 | 36,700,000 | 162,200,000 |
| Annual Tax Assessment @ .03599 | 1,500,000 | 1,300,000 | 3,400,000* |

Notes:

1. o Assumes 300,000 SF industrial building space @ $60/SF for light industrial buildings and $50/SF for heavy industrial buildings, plus appropriate site improvements and parking. Building construction costs based on industry standards and recent projects.

   o Other benefits of industrial use include:

   - Improvements to underutilized site.
   - Supports Economic Development Commission's goal of increased industrial development.
   - Marine-related tenants would be consistent with desire for water-related use.

   o Municipal costs associated with industrial use include:

   - Provision of police and fire protection.

   o Obstacles which might delay and/or prevent industrial development:

   - The desire for water-related uses in this Waterfront Overlay District may complicate and/or lengthen the search for appropriate tenants.

2. o Assumes Palmer's Cove Mixed-Use Development as described in Draft EIR. Uses Palmer's Cove estimated construction cost, but total market value is determined based on same method used for other development options.

* o 88% of total project cost assumed to be for residential development (based on Palmer's Cove Draft EIR) and assessed at rate of .01909. (Palmer's Cove Draft EIR estimates annual tax assessment of $5,160,839 - $5,898,319; a rental income and sales-based income estimate was used as the the basis for establishing this assessed value.)

o Other benefits of mixed-use (Palmer's Cove) development include:

- 8.4 acre waterfront park with improved public access and site improvments to additional 19.5 acres of public-owned waterfront parkland including Palmer's Island.
- Consistent with community goals for water-related use.
- May induce rehabilitation activity in adjacent neighborhoods.
- Improvements to underutilized site.
- 968 units of housing (some may be affordable).
- Increased waterfront activity including restaurant, inn and retail space.

o Obstacles which might delay and/or prevent development:

- Requires zoning variance.
- Permits required for waterfront improvements and marina.
- Large number of residential units will require several years for market absorption.

SITE 47 - LANDFILL/AIRPORT

Site 47 is a 117.4 acre site located in central New Bedford, near the junction of Route 140 and Interstate Route 195. The site is bordered on the east by the New Bedford landfill, on the north and west by the New Bedford Regional Airport and on the south by a railroad track which separates the site from the New Bedford Municipal Golf Course. The site is zoned for industrial use.

The site's proximity to an airport and landfill limit its suitability for uses other than industrial development. Also, city officials indicated that they are very interested in locating potential sites for new industrial development, and sites of this large size are rare. The site is landlocked, and an easement across the land to the east would be required for provision of an access road to make this a feasible development location. As with Site 4A, light industrial and heavy industrial use were analyzed separately. A mix of the two would also be appropriate; the resulting costs and benefits would be very similar to those shown. Conceptual layouts which were prepared to determine the capacity of the site for development as an industrial park resulted in 650,000 square feet of building space, along with parking, an access road, truck maneuvering areas, and some landscaping. (See Figure 3 for an illustrative site plan of industrial use on Site 47.) The site was not considered to be appropriate for the cogeneration plant proposed for the City because of its lack of water access and the City's desire for increased industrial development activity.

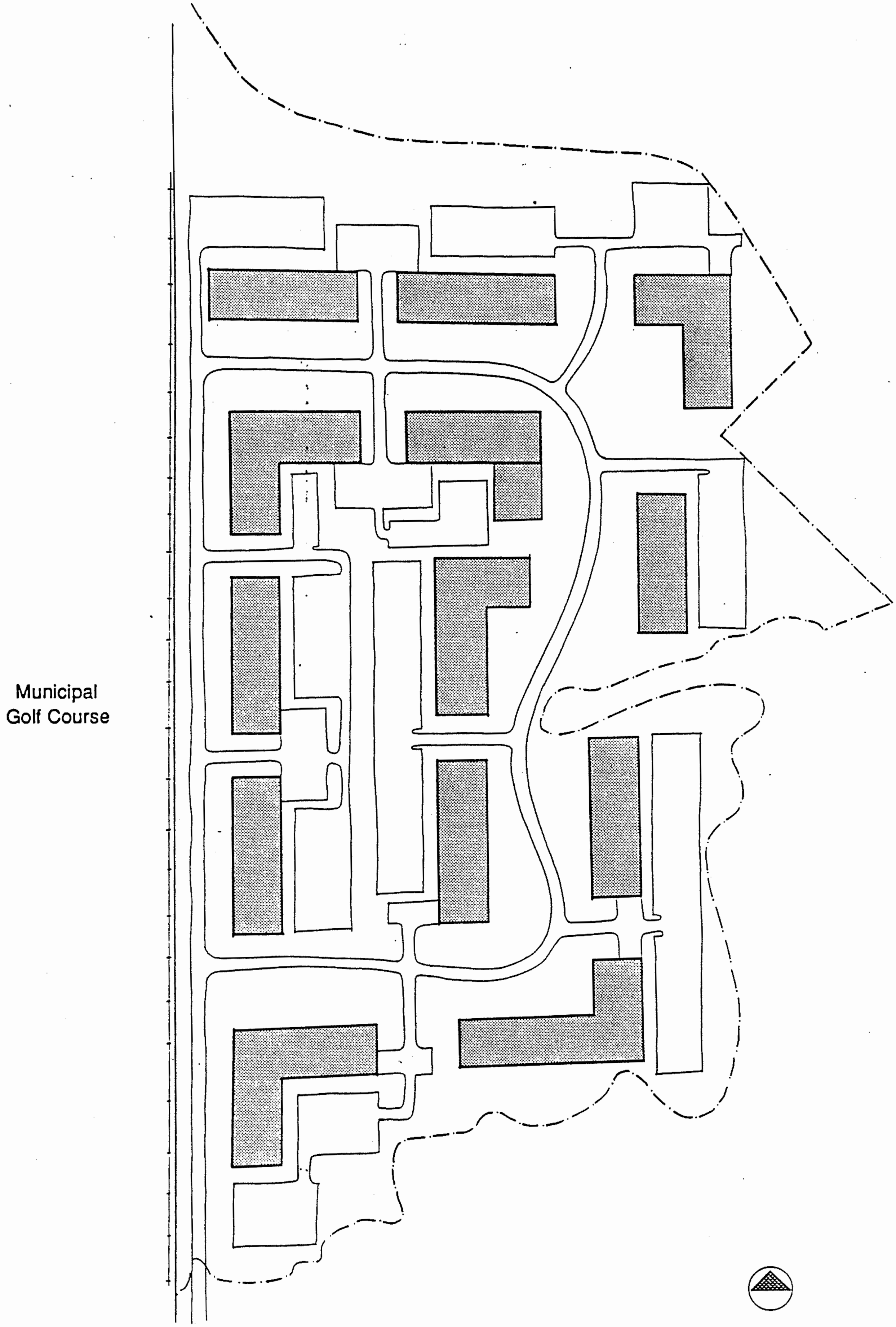


**Figure 3 : Illustrative Site Plan of Industrial Use on Site 47**

SITE 47 - LANDFILL/AIRPORT

| | Heavy Industrial[1] | Light Industrial[1] |
|---|---|---|
| Appraised Land Value | 3,700,000 | 3,700,000 |
| Construction Cost | 42,300,000 | 48,800,000 |
| Subtotal | 46,000,000 | 52,500,000 |
| Indirect Costs @ 20% | 9,200,000 | 10,500,000 |
| Subtotal | 55,200,000 | 63,000,000 |
| Profit @ 20% | 11,000,000 | 12,600,000 |
| Total Market Value | 66,200,000 | 75,600,000 |
| Annual Tax Assessment @ .03599 | 2,400,000 | 2,700,000 |

Notes:

1 o Assumes 650,000 SF industrial building space @ $50/SF for heavy industrial space and $60/SF for light industrial space, plus appropriate site improvements, access road and parking. Building construction cost based on industry standards and recent projects.

o Other benefits from industrial development include:

- Improvements to underutilized site.
- Supports Economic Development Commission's goal of increased industrial development.

o Municipal costs from industrial development include:

- Provision of police and fire protection.

o Obstacles which might delay and/or prevent development:

- Need for acquiring land or easement to construct access road.
- Large amount of industrial space will require several years for market absorption.

APPENDIX D-1
NEW BEDFORD WASTEWATER TREATMENT PLANT EIS
LOST OPPORTUNITY COST ANALYSIS
SUMMARY TABLE

SITE 1A: FORT RODMAN

| USE | Housing & Park | Hsg/Park/Marina | Park & Marina | Park |
|---|---|---|---|---|
| PARCEL SIZE | 79.4 acres | 79.4 acres | 79.4 acres | 79.4 acres |
| ZONING | Residential | Residential | Residential | Residential |
| DEVELOPED PARKLAND | 25 acres | 25 acres | 49 acres | 49 acres |
| HOUSING | 486 units | 486 units | none | none |
| INDUSTRIAL SPACE | none | none | none | none |
| MARINA SLIPS | none | 200 | 200 | none |
| TOTAL MARKET VALUE | $78,500,000 | $82,000,000 | $30,000,000 | $0 |
| ANNUAL TAX ASSESSMENT | $1,500,000 | $1,600,000 | $1,100,000 | $0 |
| PUBLIC WTRFRONT ACCESS | yes | yes | yes | yes |
| WATER-RELATED USE | yes | yes | yes | yes |
| COMPATIBLE WITH ZONING | yes | yes | yes | yes |
| COSTS FOR POLICE & FIRE | yes | yes | yes | yes |
| COSTS FOR EDUCATION | yes | yes | no | no |

APPENDIX D-1
NEW BEDFORD WASTEWATER TREATMENT PLANT EIS
LOST OPPORTUNITY COST ANALYSIS
SUMMARY TABLE (Continued)

| | SITE 4A: STANDARD TIMES | | | SITE 47: AIRPORT | |
|---|---|---|---|---|---|
| USE | Light Industrial | Heavy Industrial | Mixed Use | Light Industrial | Heavy Industrial |
| PARCEL SIZE | 38.9 acres | 38.9 acres | 38.9 acres | 117.4 acres | 117.4 acres |
| ZONING | Industrial | Industrial | Industrial | Industrial | Industrial |
| DEVELOPED PARKLAND | none | none | 8.4 acres | none | none |
| HOUSING | none | none | 968 units | none | none |
| INDUSTRIAL SPACE | 300,000 SF | 300,000 SF | none | 650,000 SF | 650,000 SF |
| MARINA SLIPS | none | none | 640 | none | none |
| TOTAL MARKET VALUE | $41,000,000 | $36,700,000 | $162,200,000 | $66,200,000 | $75,600,000 |
| ANNUAL TAX ASSESSMENT | $1,500,000 | $1,300,000 | $3,400,000 | $2,400,000 | $2,700,000 |
| PUBLIC WTRFRONT ACCESS | possible | possible | yes | no | no |
| WATER-RELATED USE | possible | possible | yes | not applicable | not applicable |
| COMPATIBLE WITH ZONING | yes | yes | no | yes | yes |
| COSTS FOR POLICE & FIRE | yes | yes | yes | yes | yes |
| COSTS FOR EDUCATION | no | no | yes | no | no |

# REFERENCES


Auer, A.H., 1978. Correlation of Land Use and Cover with Meteorological Anomalies. Journal of Applied Meteorology. Volume 17, pp. 636-643.

Baker, C., CDM, 1989. Personal Communication with Gwen Ruta, U.S. EPA. November, 1989.

Beach, D.W., NMFS, 1988. Letter to Gwen Ruta, U.S.EPA. June 7, 1988.

Beckett, G., USFWS, 1988. Letter to Gwen Ruta, U.S.EPA. June 21, 1988.

Bean, M.J., 1977. The Evolution of National Wildlife Law. Council on Environmental Quality. Washington, D.C.

Boesch, D.F. and R. Rosenberg, 1981. Response to Stress in Marine Benthic Communities. pp. 179-200 in G.W. Barrett and R. Rosenberg, eds. Stress effects on Natural Ecosystems. NY:G. Wiley.

Camp Dresser and McKee, Inc. See CDM.

CDM, 1971. City of New Bedford, Massachusetts, Report on Waterworks Improvements - Supply - Distribution - Financing. Prepared by Camp Dresser and McKee, Inc. Boston, Massachusetts.

CDM, 1979. Section 301(h) Application for Modification of Secondary Treatment Requirements for Discharges into Marine Waters, Volumes I and II. New Bedford, Massachusetts.

CDM, 1983a. Interim Summary Report on Combined Sewer Overflows: Phase I Draft. New Bedford, Massachusetts.

CDM, 1983b. Section 301(h) Application for Modification of Secondary Treatment Requirements for Discharges into Marine Waters, Volumes I and II. New Bedford, Massachusetts.

CDM, 1983c. Industrial Pretreatment Program: City of New Bedford. New Bedford, Massachusetts.

CDM, Volume I, 1989. City of New Bedford, Massachusetts. Phase 2 Facilities Plan. Volume I, Phase I Facilities Plan and Screening Studies. Prepared by Camp Dresser and McKee, Inc. Boston, Massachusetts.

## REFERENCES (CONTINUED)


CDM, Volume I, 1989. Appendices. City of New Bedford, Massachusetts. Phase 2 Facilities Plan. Volume I, Phase I Facilities Plan and Screening Studies. Prepared by Camp Dresser and McKee, Inc. Boston, Massachusetts.

CDM, Volume II, 1989. City of New Bedford, Massachusetts. Phase 2 Facilities Plan. Volume II, Site Evaluation for Wastewater Treatment Facilities. Prepared by Camp Dresser and McKee, Inc. Boston Massachusetts.

CDM, Volume III, 1989. City of New Bedford, Massachusetts. Phase 2 Facilities Plan. Volume III, Design Criteria Development and Process Evaluation. Prepared by Camp Dresser and McKee, Inc. Boston, Massachusetts.

CDM, Volume III, 1989. Appendices. City of New Bedford, Massachusetts. Phase 2 Facilities Plan. Prepared by Camp Dresser and McKee, Inc. Boston, Massachusetts.

CDM, Volume IV, 1989. City of New Bedford, Massachusetts. Phase 2 Facilities Plan. Volume IV, Effluent Outfall. Prepared by Camp Dresser and McKee, Inc. Boston, Massachusetts.

CDM, Volume IV, 1989. Appendices D-G. City of New Bedford, Massachusetts. Phase 2 Facilities Plan. Volume IV, Effluent Outfall. Prepared by Camp Dresser and McKee, Inc. Boston, Massachusetts.

CDM, Volume IV, 1989. Appendices H-K. City of New Bedford, Massachusetts. Phase 2 Facilities Plan. Volume IV, Effluent Outfall. Prepared by Camp Dresser and McKee, Inc. Boston, Massachusetts.

CDM, Volume IV, 1989. Appendices L-N. City of New Bedford, Massachusetts. Phase 2 Facilities Plan. Volume IV, Effluent Outfall. Prepared by Camp Dresser and McKee, Inc. Boston, Massachusetts.

CDM, Volume V, 1989. City of New Bedford, Massachusetts. Phase 2 Facilities Plan. Volume V, Development of the Recommended Plan. Prepared by Camp Dresser and McKee, Inc. Boston, Massachusetts.

CDM, Volume VI, 1989. City of New Bedford, Massachusetts. Phase 2 Facilities Plan. Volume VI, Public Participation Program. Prepared by Camp Dresser and McKee, Inc. Boston, Massachusetts.

Chen, K.Y. et al. 1974. Trace Metals in Wastewater Effluents. J. Water Pollution Control Federation, 46: 2663-2675.

City of New Bedford, 1972. New Bedford Planning Department. New Bedford's Draft Open Space Recreation Plan.

City of New Bedford, 1987. New Bedford Planning Department, New Bedford's Open Space and Recreation Plan. New Bedford, Massachusetts.

Clark, J.W., W. Viesmann, Jr., and M.J. Hammer, 1977. Water Supply and Pollution Control, 3rd Ed. Harper and Row Publishers. New York, New York.

Conservation Law Foundation of New England, 1988. Lost Harvest: Sewage, Shellfish, and Economic Losses in the New England Area. Boston, Massachusetts.

Copeland, 1989. Written Communication from Jay Copeland, Environmental Reviewer, Massachusetts Natural Heritage Program; to Joseph Freeman, Executive Office of Environmental Affairs, Boston, MA. October 30, 1989.

Dauer, D.M. and W.G. Connor, 1980. Effects of Moderate Sewage Input on Benthic Polychaete Populations. Est. and Mar. Sci. 10:335-346.

de Goeij, J.M., V.P. Quinn, D.R. Yound and A.J. Mearns, 1974. Neutron Activation Analysis Trace Element Studies of Dover Sole Liver and Marine Sediments. Comparative Studies of Food and Environmental Contamination. International Atomic Energy Agency, Vienna.

DeGraaf, R.M. and D.D. Rudis, 1986. New England Wildlife: Habitat, Natural History and Distribution. U.S. Department of Agriculture. Forest Service. Northeastern Forest Experiment Station. General Technical Report NE-108.

Dunstan, W.M. and D.W. Mehzel, 1971. Continuous Cultures of Natural Populations of Phytoplankton in Dilute, Treated, Sewage Effluent. Limnol. Oceanogr. 6: 623-632.

Elia, R.J., D.G. Jones, N.S. Seasholes, 1989. Intensive Archeological Survey of Site 1A, The Fort Rodman Military Reservation, New Bedford, Massachusetts. Submitted to Camp Dresser, and McKee, Inc. by Office of Public Archaeology. Boston University.

EPA, Levels Document, 1974. Information on the Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Washington, D.C.

EPA, 1976. PCBs in the United States, Industrial Use and Environmental Distribution, Task I, Final Report. USEPA-560/6-76-005, 1976.

EPA, 1986. Quality Criteria for Water. EPA 440/5-86-001.

EPA, 1988a. Final Scope of Work for the Preparation of the Draft EIS, New Bedford Wastewater Treatment Facilities and Solids Disposal. 14 pp.

EPA, 1988b. Boston Harbor Wastewater Conveyance System. Volume I, Draft Supplemental Environmental Impact Statement. U.S. EPA Region I Office.

EPA, 1988c. Interim Sediment Criteria Values for Nonpolar Hydrophobic Organic Contaminants. Office of Water Regulations and Standards. Criteria and Standards Division, Washington, D.C.

EPA, 1989a. Draft Supplemental Environmental Impact Statement, Long Term Residuals Management for Metropolitan Boston. Boston, Massachusetts.

EPA, 1989b. Federal Manual for Identifying and Delineating Jurisdictional Wetlands. U.S. EPA, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service and U.S.D.A. Soil Conservation Service. Publication No. 202 - 783 - 3238.

Fair, G.M. and J.C. Geyer, 1959. Water Supply and Wastewater Disposal. John Wiley and Sons, Inc. New York, New York.

Frithsen, J.B., A.A. Keller, and M.E. Pilson, 1985. Effects of Inorganic Nutrient Additions in Coastal Areas: A Mesocosm Experiment Data Report, Vol. I. Marine Ecosystems Research Laboratory, Graduate School of Oceanography, University of Rhode Island. MERL Series Report No. 3.

Geyer, W.R. and W.D. Grant, 1986. A Field Study of the Circulation and Dispersion in New Bedford Harbor: Final Report. Woods Hole, Massachusetts.

Geyer, W.R., 1987. Physical Oceanographic Measurements in New Bedford Outer Harbor: Research Related to Siting of Secondary Sewage Treatment Discharge. Woods Hole, Massachusetts.

Heinle, D.R., and M.S. Beaven, 1977. Effects of Chlorine on the Copepod Acartia tunsa. Chesapeake SA: 18:140.

Kolek, A., 1979. Personal Communication. Biologist, Division of Marine Fisheries. Sandwich, Massachusetts.

Lawson, P.S., R.M. Sterritt and J.N. Lester, 1984. The Speciation of Metals in Sewage and Activated Sludge Effluent. Water, Air, Soil Pollution 21: 384-402.

Laxen, D.P.H. and R.M. Harrison, 1981. The Physiological Speciation of Cd, Pb, Cu, Fe, and Mn in the Final Effluent of a Sewage Treatment Works and Its Impacts on Speciation in the Receiving Water. Water Research 15: 1053-1065.

Malone, T.C., 1982. Factors Influencing the Fate of Sewage - Derived Nutrients in Lower Hudson Estuary and New York Bight, In: Mayer, G.F. (ed.), Ecological Stress and the New York Bight: Science and Management. Estuarine Research Federation, South Carolina. Pp. 389-400.

Mearns, A.J., E. Haines, G.S. Kleppel, R.A. McGrath, J.J. McLaughlin, P.A. Eagar, J.H. Sharp, J.J. Walsh, J.Q. Word, D.K. Young, and M.W. Young, 1982. Effects of Nutrients and Carbon Loadings on Communities and Ecosystems, In: Mayer, G.F. (ed.), Ecological Stress and the New York Bight: Science and Management. Estuarine Research Federation, Columbia, South Carolina. Pp. 53-66.

Metcalf and Eddy, Inc., 1979. Wastewater Engineering: Treatment Disposal, Reuse. 2nd Ed. McGraw-Hill Book Company. New York, New York.

MHC, 1985. Public Planning and Environmental Review: Archaeology and Historic Preservation. Massachusetts Historical Commission (MHC). Boston, Massachusetts.

MWRA, STFP III, 1988. Secondary Treatment Facilities Plan. Volume III, Treatment Plant. Massachusetts Water Resources Authority (MWRA). Charlestown, Massachusetts.

NOAA, 1988. Local Climatological Data. Annual Summary with Comparative Data. National Oceanic and Atmospheric Administration. ISSN 0198-4594.

Old New Bedford Waterfront Corporation. See ONBWC.

ONBWC, 1988. Palmers Cove Draft Environmental Impact Report. Executive Office of Environmental Affairs (EOEA) No. 6722.

Oviatt, C.A., A.A. Keller, P.A. Sampou and L.L. Beatty, 1986. Patterns of Productivity During Eutrophication: A Mesocosm Experiment. Marine Ecology - Progress Series, 28: 69-80.

Oviatt, C.A., J.G. Quinn, J.T. Maughan, J.T. Ellis, B.K. Sullivan, J.N. Geasing, P.T. Gearing, C.D. Hunt, P.A. Sampou, and J.S. Latimer, 1987. Fate and Effects of Sewage Sludge in the Coastal Marine Environment: a mesocosm experiment. Mar. Ecol. Prog. Ser. 41: 187-203.

Pearson, T.H., and R. Rosenberg, 1978. Macrobenthic Success in Relation to Organic Enrichment and Pollution of the Marine Environment. Oceanog. and Mar. Biol. Ann. Rev. 16: 229-311.

Rand, G. and S. Petrocelli: Editors, 1985. Fundamentals of Aquatic Toxicology: Methods and Applications. Hemisphere Publishing Corporation. New York, NY.

Reback, K.E. and J.S. Dicarlo, 1970. Completion Report, Anadromous Fish Project. Massachusetts Division of Marine Fisheries. Boston, Massachusetts.

Roberts, M.H., Jr. and B.H. Gleeson, 1978. Acute Toxicity of Bromochlorinated Seawater to Selected Estuarine Species with a Comparison to Chlorinated Seawater Toxicity. Mar. Environ. Res. 1: 19-30.

Rosenfeld, L.K., R.P. Signell and G.G. Gawarkiewicz, 1984. Hydrographic Study of Buzzards Bay 1982-1983. Technical Report WHOI-84-5. Woods Hole Oceanographic Institution, Woods Hole Massachusetts.

Rossin, A.C., R.M. Sterritt and J.M. Lester, 1982. The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge. Water, Air, Soil Pollution 17: 185-198.

Sanders, H.L., 1958. Benthic Studies in Buzzard's Bay. I. Animal-Sediment Relationships. Limnol. Oceanog. 3: 245-258.

Summerhayes, C.P., J.P. Ellis, P. Stoffers, S.R. Briggs, and M.G. Fitzgerald, 1977. Fine-Grained Sediment and Industrial Waste Distribution and Dispersal in New Bedford Harbor and Western Buzzards Bay, Massachusetts. Woods Hole Oceanic Institution. Technical Report WHOI - 76 - 115, Woods Hole, Massachusetts.

Turner, J.T., 1989. Personal Communication with Phil Colarusso U.S. EPA.

Turner, J.T., D.G. Borkman, W. Lima, and R.W. Pierce, 1989. A Seasonal Study of Plankton, Larval Fish, and Water Quality in Buzzards Bay, Massachusetts. Interim Data Report, October 1987 through September 1988. Prepared for Tech. Serv. Branch, Massachusetts DWPC.

U.S. Environmental Protection Agency. See EPA.

Vince, S. and I. Valiela, 1973. The Effects of Ammonium and Phosphate Enrichments on Chlorophyll a Pigment Ratio, and Species Composition of Phytoplankton of Vineyard Sound. Mar. Biol. 19: 69-73.

Wallace, Floyd Associates, Inc., June 1989. New Bedford Wastewater Treatment Plant EIS Lost Opportunity Cost Analysis. Appendix D of this Draft EIS.

Wise, W., 1987. Summary of Research Findings on Brown Tide. Science Research Center. SUNY. Preliminary Report. September, 1987.

WPCF, 1976. Operation of Wastewater Treatment Plants, Manual of Practice No. 11. Subcommittee on Operation of Wastewater Treatment Plants, Water Pollution Control Federation (WPCF), Lancaster Press. Lancaster, Pennsylvania.

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| **AALs** | allowable ambient levels |
| **ACEC** | Area of Critical Environmental Concern |
| **ACHP** | Advisory Council on Historic Preservation |
| **ADT** | average daily traffic |
| **As** | arsenic |
| | |
| **BAT** | best available technology economically achievable |
| **BCT** | best conventional pollutant control technology |
| **BOD** | five-day biological oxygen demand |
| **BACT** | best available control technology |
| **BP** | before present |
| **Btu** | British thermal units |
| **BUAR** | Board of Underwater Archaeological Resources |
| **BVW** | bordering vegetated wetland |
| | |
| **CAA** | Clean Air Act |
| **CAC** | Citizen Advisory Committee |
| **CBRS** | Coastal Barrier Resources Act |
| **CCC** | criterion continuous concentration |
| **ccm** | cubic centimeter |
| **Cd** | cadmium |
| **CEQ** | Council on Environmental Quality |
| **CERCLA** | Comprehensive Environmental Response, Compensation and Liability Act |
| **cf** | cubic foot |
| **CFR** | Code of Federal Regulations |
| **Cl** | chlorine |
| **cm** | centimeter |
| **CMC** | criterion maximum concentration |
| **CMR** | Code of Massachusetts Regulations |
| **CO** | carbon monoxide |
| **Cr** | chromium |
| **CSO** | combined sewer overflow |
| **Cu** | copper |
| **CWA** | Clean Water Act |
| **cyd** | cubic yards per day |
| **CZM** | (Massachusetts) Coastal Zone Management |
| **°C** | degrees Centigrade |
| | |
| **DAQC** | Division of Air Quality Control |
| **dBA** | decibels on the A-weighted scale |
| **DEIR** | Draft Environmental Impact Report |
| **DEIS** | Draft Environmental Impact Statement |
| **DEM** | (Massachusetts) Department of Environmental Management |
| **DEP** | (Massachusetts) Department of Environmental Protection |
| **DEQE** | (Massachusetts) Department of Environment Quality Engineering |
| **DFW** | (Massachusetts) Division of Fisheries and Wildlife |
| **DMF** | (Massachusetts) Division of Marine Fisheries |
| **DO** | dissolved oxygen |
| **DPA** | Designated Port Area |
| **DPW** | (Massachusetts) Department of Public Works |

## ACRONYMS AND ABBREVIATIONS (CONTINUED)

dtpd — dry tons per day
dtpy — dry tons per year
DWPC — Division of Water Pollution Control
$d^{-1}$ — per day

EIR — Environmental Impact Report
EIS — Environmental Impact Statement
EOEA — (Massachusetts) Executive Office of Environmental Affairs
EPA — (United States) Environmental Protection Agency

FDA — Food and Drug Administration
Fe — iron
FEIS — Final Environmental Impact Statement
FEMA — Federal Emergency Management Agency
FHWA — Federal Highway Administration
FPCAC — Facilities Planning Citizens Advisory Committee
FPPA — Farmland Protection Policy Act
ft — foot, feet
FWPCA — Federal Water Pollution Control Act
$^{o}F$ — degrees Fahrenheit

g — gram
gpad — gallons per day per acre
gpcd — gallons per capita per day
gpd — gallons per day
gpm — gallons per minute

H — highest concentration
Hg — mercury
hr — hour
Hs — wave height

ISC — Industrial Source Complex (model)
ISCST — Industrial Source Complex Short-Term (model)

kg — kilogram
km — kilometer
kwh — kilowatt hours

l — liter
LAER — Lowest Achievable Emission Rate
lb — pound
$L_{DN}$ — day-night average sound level
LOS — level of service
$L_{EQ}$ — equivalent A-weighted sound level over a given time interval
$L_{90}$ — noise level exceeded 90 percent of the time

## ACRONYMS AND ABBREVIATIONS (CONTINUED)

| | |
|---|---|
| **m** | meter |
| **MAAQS** | Massachusetts Ambient Air Quality Standards |
| **MASN** | Massachusetts Air Surveillance Network |
| **MBtu** | million British thermal units |
| **MCI** | Massachusetts Correctional Institute |
| **MCL** | maximum contaminant level |
| **MCLG** | maximum contaminant level goal |
| **MCZM** | Massachusetts Coastal Zone Management |
| **MDC** | Metropolitan District Commission |
| **MEPA** | Massachusetts Environmental Policy Act |
| **mg** | milligram |
| **mgd** | million gallons per day |
| **MGL** | Massachusetts General Law |
| **mgy** | million gallons per year |
| **MHC** | Massachusetts Historical Commission |
| **MISER** | Massachusetts Institute for Social and Economic Research |
| **ml** | milliliter |
| **MLW** | mean low water |
| **mm** | millimeter |
| **Mn** | magnesium |
| **MNHP** | Massachusetts Natural Heritage Program |
| **MOA** | Memorandum of Agreement |
| **MOU** | Memorandum of Understanding |
| **mph** | miles per hour |
| **MPRSA** | Marine Protection Research and Sanctuaries Act |
| **MSC** | Massachusetts Shipbuilders Corporation |
| **MSL** | mean sea level |
| **MTR** | mechanical traffic recorder |
| **MUTCD** | manual on uniform traffic control devices |
| **MW** | megawatt |
| **MWRA** | Massachusetts Water Resources Authority |
| **mV** | millivolts |
| **u** | micron |
| **ug** | microgram |
| | |
| **NA** | not available or not applicable |
| **NAAQS** | National Ambient Air Quality Standards |
| **NAS** | National Academy of Sciences |
| **ND** | not detected |
| **NEPA** | National Environmental Policy Act |
| **NESHAPs** | National Emission Standards for Hazardous Air Pollutants |
| **NGVD** | National Geodetic Vertical Datum |
| **NHPA** | National Historic Preservation Act |
| **Ni** | nickel |
| **NMFS** | National Marine Fisheries Services |
| **NOAA** | National Oceanic and Atmospheric Administration |
| **NOI** | Notice of Intent |
| **NP** | not predicted |
| **NPDES** | National Pollutant Discharge Elimination System |
| **NRHP** | National Register of Historic Places |

## ACRONYMS AND ABBREVIATIONS (CONTINUED)

| | |
|---|---|
| **NSPS** | new source performance standards |
| **NTIS** | National Technical Information Service |
| **NWI** | National Wetlands Inventory |
| **NWS** | National Weather Service |
| | |
| **ONBWC** | Old New Bedford Waterfront Corporation |
| **OPA** | Office of Public Archaeology |
| **OSRP** | Open Space and Recreation Plan |
| | |
| **PAHs** | polycyclic aromatic hydrocarbons |
| **PAL** | Public Archaeology Laboratory |
| **Pb** | lead |
| **PCBs** | polychlorinated biphenyls |
| **pH** | acid/base value |
| **PICs** | products of incomplete combustion |
| **PM10** | particulate matter with a diameter under 10 microns |
| **POTW** | publicly owned treatment works |
| **ppb** | parts per billion |
| **ppm** | parts per million |
| **PPM** | priority pollutant metal |
| **PSD** | Prevention of Significant Deterioration |
| **psi** | pounds per square inch |
| | |
| **RCRA** | Resource Conservation and Recovery Act |
| **ROD** | Record of Decision |
| **R/T** | round trip |
| **RTF** | regional task force |
| | |
| **SARA** | Superfund Amendments and Reauthorization Act |
| **SCS** | Soil Conservation Service |
| **SDWA** | Safe Drinking Water Act |
| **sec** | second |
| **SEIS** | Supplemental Environmental Impact Statement |
| **SHPO** | (Massachusetts) State Historic Preservation Officer |
| **SIP** | (Massachusetts) State Implementation Plan |
| **SOD** | Sediment Oxygen Demand |
| **SQC** | Sediment Quality Criteria |
| **SS** | suspended solids |
| **SSA** | Sole-Source Aquifer |
| **SWDA** | Solid Waste Disposal Act |
| | |
| **TCE** | trichloroethylene |
| **TEL** | threshold effects exposure limit (24-hour AAL) |
| **THF** | tetrahydrofuran |
| **TOC** | total organic carbon |
| **TOX** | total organic halogens |
| **tpd** | tons per day |
| **tpy** | tons per year |
| **TSP** | total suspended particulates |
| **TSS** | total suspended solids |

## ACRONYMS AND ABBREVIATIONS (CONTINUED)

| | |
|---|---|
| **USACE** | United States Army Corps of Engineers |
| **USDA** | United States Department of Agriculture |
| **USDC** | United States District Court |
| **USEPA** | United States Environmental Protection Agency |
| **USFWS** | United States Fish and Wildlife Service |
| **USGS** | United States Geologic Survey |
| **VOC** | volatile organic compound |
| **VPH** | vehicles per hour |
| **WAS** | waste activated sludge |
| **WFA** | Wallace Floyd Associates |
| **WQI** | water quality index |
| **WWTP** | wastewater treatment plant |
| **yd** | yard |
| **yr** | year |
| **Zn** | zinc |

## GLOSSARY

**acute effects.** Lethal response resulting from short term exposure to toxicant(s). Ninety-six hours has been established as the generally accepted exposure time for bioassays determining acute toxicity.

**aeration.** The process which brings about contact between air and water by natural or mechanical means such as spray, bubbling, or agitation.

**allowable ambient limits.** AALs are state guidelines for the maximum ambient amounts of toxic pollutants allowable in the atmosphere.

**ambient.** Refers to conditions (e.g., concentration, temperature, and other parameters) at a specific location and resulting from activities in the surrounding environment.

**amphipod.** A small crustacean.

**anadromous.** Refers to species that migrate from marine waters to fresh waters to breed.

**anaerobic digestion.** The decomposition of organic and inorganic matter in the absence of molecular oxygen.

**anoxic.** An environment deficient in oxygen.

**Arochlor.** Mixture of polychlorinated biphenyls (PCBs).

**ash.** The solid residue that remains after incineration.

**attainment pollutant.** A pollutant that does not exceed a given standard.

**bank.** For coastal areas, the standard face or side of any elevated land form, other than a coastal dune, that lies at the landward edge of a coastal beach and is subject to tidal action, or other wetland. For inland areas, the portion of the land surface that normally abuts and confines a water body. It occurs between a water body and a vegetated bordering wetland and adjacent flood plain, or, in the absence of these, it occurs between a water body and an upland. See wetlands.

**beach (barrier).** A narrow low-lying strip of land generally consisting of coastal beaches and coastal dunes and extending roughly parallel to the trend of the coast. Beach (coastal) unconsolidated sediment subject to wave, tidal, and coastal storm action that forms the gently sloping shore of a body of salt water and includes tidal flats.

**bedrock.** The solid rock beneath soil and other unconsolidated material.

**benthic.** Of or pertaining to the ocean floor.

**benthic organisms.** Organisms that live in sediments or attached to rocks under water.

**bioaccumulation.** Accumulation of toxicants in tissues of organisms resulting from direct exposure or by ingestion.

**bioassay.** A test using organisms, typically to determine the toxicity of a substance.

**biological oxygen demand (BOD).** The amount of oxygen used during the biochemical oxidation of organic matter during a given time period and at a specific temperature.

**biota.** Refers to all plant and animal life in a geographic area.

**bordering wetlands.** Freshwater wetlands that border on creeks, rivers, streams, ponds, or lakes.

**buffer.** A physical barrier.

**carcinogen.** A substance that causes cancer.

**chronic effects.** Lethal reaction or prolonged debilitating damage to an organism resulting from prolonged exposure to a toxicant. Exposure time may be several days, weeks, months, or even years.

**coliforms.** A group of bacteria characteristic of the intestinal tract of warm blooded vertebrates, which are used as indicators of the presence of domestic wastes.

**compost.** Organic material that has undergone biological degradation to form a stable, humuslike material used as a soil conditioner.

**composting.** A method of stabilizing wastewater sludge by biological decomposition of putrescible organic matter to produce a material that can be used as a low-grade fertilizer and soil conditioner. The basic steps of composting are the combination of dewatered sludge with an amendment (sawdust, woodchips, recycled compost), and the aeration of this mixture during a "curing" period.

**corridor.** Access that leads to a given point or entity, such as for utilities or for a transportation route.

**cultural resource.** A resource of historical or archaeological importance.

**cumulative impacts.** Combined effects resulting from more than one action.

**decibel.** One tenth of a bel, where a bel is the log of the ratio of the intensity of two sounds in the watts/$cm^2$; a unit for expressing the relative intensity of sounds.

**deciduous.** Refers to trees or shrubs that lose their leaves in the fall.

**demersal.** Bottom dwelling.

**detection limit.** The smallest quantity that can be measured with certainty by a given analytical method.

**depuration.** A process of removing some contaminants from organisms.

**dewater.** The process of removing excess water from a substance.

**digested sludge.** The thickened mixture of sewage solids and water, that has been decomposed by anaerobic or aerobic bacteria.

**digester.** In a wastewater treatment plant, a closed tank that decreases the volume of solids and stabilizes raw sludge by bacterial action.

**dioxins.** Cyclic ethers frequently used as solvents and often produced during combustion.

**drumlin.** A hilly area caused by the deposition of glacial till.

**dry ton.** Two thousand pounds of material (sludge) with approximately 20 percent moisture content.

**dunes.** Any natural hill, mound, or ridge of sediment landward of a coastal beach deposited by wind action or storm overwash.

Dune also means sediment deposited by artificial means and serving the purpose of storm damage prevention or flood control.

**ecosystem.** Plant and animal communities in a specific environment, such as in a marine or pond environment.

**effluent.** The outflow of treated wastewater from a wastewater treatment plant.

**emergent wetlands.** Wetlands in which vegetation grows above the water. (See wetlands.)

**emissions estimates.** Estimated levels of pollutants or chemicals released into the environment from a particular process.

**estuary.** A coastal body of water, typically where salt and fresh water meet.

**exposure route.** The means by which a pollutant is introduced into the body such as by inhalation of gases and particles, ingestion of contaminated organisms or water, and dermal contact with contaminated water or leachate.

**facilities plan.** The conceptual design of a treatment system.

**farfield.** Zone removed from the discharge point where the effluent is affected by ambient transport, diffusion, and decay independently from the design of the discharge structure.

**floodplain.** The valley floor adjacent to a river, which may be inundated during high water.

**footprint.** The area over which a facility is to be built.

**fugitive dust.** Refers to particles not traceable to a single source but which enter the atmosphere as a result of a variety of physical activity or disturbance.

**grit.** A substance consisting of sand, gravel, cinders, and other heavy solid materials accumulated by the collection system of wastewater treatment plants, headworks, and at combined sewer overflow facilities requiring removal and disposal.

**groundwater.** Subsurface water that completely fills (saturates) all available space within an aquifer and the top of the zone of saturation.

**habitat.** The geographic area in which a plant or animal community exists.

**headworks.** A low point in a sewerage system where wastewater is collected and pumped to treatment works or to a continuation of the system at a higher elevation, and where grit and screenings are collected and removed. Also referred to as a wastewater pump station.

**histopathological.** Refers to animal tissue pathology or disease.

**hydrology.** The study of waters; their occurrence, circulation, and distribution; their chemical and physical properties; and their reaction with their environment.

**ichthyoplankton.** Young fish that are carried along in the water prior to developing into free-swimming creatures.

**infauna.** Animals living within the sediments of the ocean bottom.

**infiltration/inflow.** The entrance of water into a sewerage system as a result of factors such as wet weather, high groundwater conditions, leaking pipes, illegal connections, and combined sewer systems.

**influent.** Inflow to a wastewater treatment plant.

**infrastructure.** Refers to public water, sewer, gas, and other utilities serving a community or urban area.

**initial dilution.** Dilution which occurs in the effluent plume close to the diffuser by entrainment of ambient water.

**interceptor system.** A large sewer that meets a number of main or trunk sewers and conveys the wastewater from them to treatment facilities.

**intertidal.** Area affected by tides.

**invertebrate.** Animals without backbones.

**land application.** The direct disposal of sludge by land spreading.

**land use.** Refers to the ways in which a community or area makes use of its natural resources.

**leachate.** Water that percolates through the soil, a landfill, or compost, which may or may not contain contaminants.

**level of service (LOS).** A measurement that defines congestion as determined by vehicle operating speed, driver comfort and maneuvering ability, potential for queuing, and extent of traffic delay.

**listed species.** Plants or animals that appear on protected or special-concern lists published by federal or state agencies.

**marsh.** See wetlands.

**mean low water.** The average water elevation at low tide.

**mitigate.** To reduce or lessen.

**nearfield.** Area close to the discharge where the effluent is rapidly diluted by turbulent entrainment of ambient fluid.

**nuisance control.** The lessening of some action or condition that is unpleasant.

**nutrients.** Anything other than the elements carbon, hydrogen, and oxygen needed in the synthesis of organic matter. Common nutrients are nitrates and phosphates.

**outfall.** The pipe that conveys effluent from the wastewater treatment plant to its discharge location.

**oxygen demand.** Consumption of oxygen by bacteria to oxidize organic matter.

**particulate.** Small, separate particles.

**pathogen.** Any cause of disease, such as certain microorganisms.

**pH.** The negative logarithm of hydrogen ion concentration, used to measure acidity or alkalinity.

**phytoplankton.** Small floating waterborne plants.

**pond.** Any open body of water, either naturally occurring or man-made by impoundment, and which is never without standing water due to natural causes, except during periods of extended drought.

**primary productivity.** The rate at which organic matter is produced in photosynthesis.

**primary sludge.** The solids settled out by gravity from wastewater and removed from a treatment plant's primary clarifier after primary treatment.

**primary treatment.** Treatment of wastewater including pumping, screening, grit removal, and settling of heavy solids and floatable materials.

**priority pollutant.** A pollutant that is listed by the EPA as a pollutant of concern.

**process technology.** Combustion, heat drying, and composting.

**receptor.** A site, area, or population, including any sensitive populations, that would likely be affected by a particular impact or by a combination of impacts.

**redox potential.** Refers to oxidation-reduction, a chemical reaction in which a molecule or atom loses electrons to another molecule or atom.

**removal efficiency.** The effectiveness of a process in eliminating a pollutant.

**residuals.** Sludge, grit, screenings, combustion ash, and scum that are byproducts of the wastewater collection and treatment process.

**river.** A natural flowing body of water that empties to any ocean, lake, or other river and which flows throughout the year.

**runoff.** Rainfall that is not taken into the ground.

**screenings.** Refers to material collected and separated from wastewater during the treatment process including twigs, logs, and cloth. See also minor residuals.

**scum.** Floatable materials skimmed from the surface of wastewater primary and secondary settling tanks such as oil and grease.

**secondary sludge.** The solids that are a by-product of secondary wastewater treatment.

**secondary treatment.** Biological treatment of wastewater following primary treatment involving removal of dissolved organics.

**sediment.** Soil and organic particles that exist on the floor of a water body.

**sewerage/sewage.** Liquid or solid waste which is transported through drains and/or by sewers to a wastewater treatment plant for processing.

**sidestream.** Water circulated through a compost facility that collects condensate and leachate for odor control and removal.

**sludge.** The solid materials of high water content separated from wastewater during the treatment process.

**sludge cake.** Wastewater sludge from which excess water has been removed (i.e., dewatered).

**sole-source aquifer.** A groundwater aquifer that is considered the primary water supply for a geographic area.

**stormwater.** Precipitation which either runs off or enters a sewer system.

**stream.** A body of water, including brooks and creeks, that moves in a definite channel in the ground because of a hydraulic gradient.

**substation.** A division in a high-voltage electric line that reduces high-voltage electricity to a lower and more usable level.

**surficial geology.** Pertaining to the structural surface of the earth.

**suspended solids.** Solids that are present, but not dissolved, in a solution.

**swamp.** Area where groundwater is at or near the surface of the ground for a significant part of the growing season or where runoff water from surface drainage frequently collects above the soil surface. See wetlands.

## GLOSSARY (CONTINUED)

**taxon.** A category of biological classification, such as a genus or species.

**threshold.** A point or level beyond which certain effects would occur.

**tidal flat.** Any nearly level part of a coastal beach that usually extends from the mean low water line landward to the more steeply sloping coastal beach or that may be separated from the beach by land under the ocean.

**tideland.** Coastal land that is submerged under water at high tide.

**till.** Rock debris made of a combination of sand, gravel, clay, and boulders that has been deposited by a glacier or the running water from it.

**toxicity.** Degree to which an element or compound is capable of causing an adverse health effect when introduced into tissues.

**understory.** A lower height of plant growth (e.g., shrubs).

**upland communities.** Plant and animal groups found in a particular region on land of higher elevation.

**vertebrate.** An animal with a backbone.

**viewshed.** The area visible from a specific point.

**wastewater.** Liquid waste collected in a sewer system and transported to a wastewater treatment plant for processing.

**water column.** The water located vertically over a specific point or station.

**watershed.** The land from which water drains into a particular river, lake, or reservoir.

**wetlands.** An area characterized by a high degree of moisture in the soil. Also refers to areas defined as wetlands under state or federal regulations. For fresh water: wet meadows, marshes, swamps, bogs; areas where groundwater, flowing or standing surface water, or ice provide a significant part of the supporting substrate for a plant community for at least five months of the year; emergent or submergent plant communities in inland waters; that portion of any bank which touches any inland waters. For coastal areas: any bank, marsh, swamp, meadow, flat, or other lowland subject to tidal action or coastal storm flowage.