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USACE CONTRACT NO. DACW33-94-D-0002
TASK ORDER NO. 017
TOTAL ENVIRONMENTAL RESTORATION CONTRACT

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FINAL
BASIS OF DESIGN / DESIGN ANALYSIS REPORT REMEDIAL DESIGN FOR SAWYER STREET COMBINED SEWER OVERFLOW (CSO) RELOCATION AT CONFINED DISPOSAL FACILITY (CDF) C NEW BEDFORD HARBOR SUPERFUND SITE

New Bedford Harbor, Massachusetts

October 2000

Prepared for

U.S. Army Corps of Engineers
New England District
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Prepared by

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1.0 INTRODUCTION

Foster Wheeler Environmental Corporation (Foster Wheeler) has prepared this Basis of Design / Design Analysis (BD/DA) report for the design of the relocation of the combined sewer overflows (CSO), storm water discharge and utilities at Confined Disposal Facilities (CDF) at the New Bedford Harbor Superfund Site. The CSO relocation design is being performed under Task Order No. 17 of the U.S. Army Corps of Engineers (USACE) New England Total Environmental Restoration Contract (NE TERC) No. DACW33-94-D-0002 as part of the Remedial Design (RD) of Operable Unit #1 (OU#1), Upper and Lower Harbor, New Bedford Harbor Superfund Site, New Bedford, Massachusetts.

The U.S. Environmental Protection Agency (EPA) and USACE entered into an Inter-Agency Agreement in February 1998 which gives the USACE responsibility to provide technical assistance to EPA on New Bedford Harbor. In October 1998, EPA authorized the USACE to perform RD activities associated with the Upper and Lower New Bedford Harbor cleanup.

In the period December 1998 through April 1999, Foster Wheeler prepared a RD Work Plan and Cost Estimate for the design of the OU#1 remedial action for New Bedford Harbor. The USACE authorized Foster Wheeler to proceed with the RD work in January 1999. The Work Plan was finalized in April 1999.

Under the OU#1 RD Work Plan, a major group of design tasks involves the relocation of CSOs, storm drains (SD), and utilities in the shoreline locations where CDFs will be constructed to contain sediments contaminated with polychlorinated biphenyls (PCBs) and other chemicals dredged from the harbor. This BD/DA, consisting of introductory sections (the site description and ARARs analysis), has been developed to explain the specific purpose, design criteria, design analysis and supporting information for the CSO, storm drain and utility relocation for each of the four CDF areas A, B, C, and D. Specifics for each CDF will be prepared in sequence as the designs are performed. The planned sequence is CSO, storm drain and utility relocation for the CDF C area first followed by CDFs A, D, and B. In order to accomplish this, the BD/DA will be a dynamic document which has sections added as designs are performed.

Section 2.0 describes the CSO, storm drain and utility relocation for the CDF C area. Sections 3.0, 4.0, and 5.0 will be for the CSO, storm drain and utility relocation at CDFs A, D, and B and will be prepared later.

1.1 Site Description

The New Bedford Harbor Superfund Site (the site), located in Bristol County, Massachusetts, extends from the shallow northern reaches of the Acushnet River estuary south through the commercial port of New Bedford Harbor and adjacent areas of Buzzards Bay. The sediments in the harbor are contaminated with high concentrations of many pollutants, notably PCBs and heavy metals from the industrial and urban development surrounding the harbor.

The site has been divided into three areas - Upper, Lower, and Outer Harbor - based on geographical features and levels of contamination. OU#1 primarily covers the remediation of the Upper and Lower Harbor and a small area in the Outer Harbor as defined by cleanup goals in the Record of Decision (ROD). The Upper Harbor extends from an area slightly north of the Wood Street Bridge to the Coggeshall Street Bridge. The Lower Harbor extends from Coggeshall Street Bridge to the hurricane barrier. The Outer Harbor is the area between the hurricane barrier and an imaginary line drawn from Rock Point southwesterly to Negro Ledge and then southwesterly to Mishaum Point (see Figure 1-1).

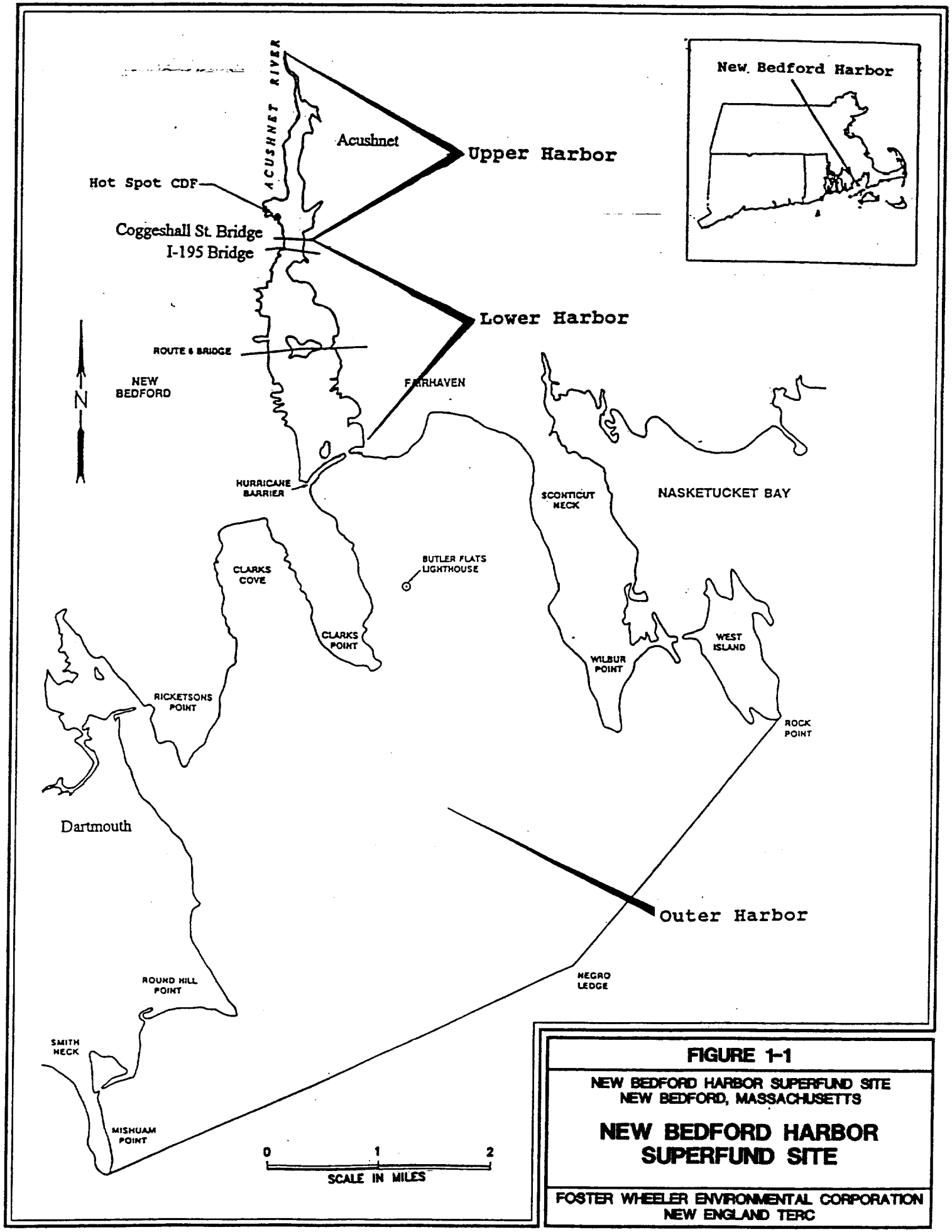

FIGURE 1-1

NEW BEDFORD HARBOR SUPERFUND SITE
NEW BEDFORD, MASSACHUSETTS

NEW BEDFORD HARBOR SUPERFUND SITE

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The approximate areas of contamination to be dredged in the Upper, Lower, and Outer Harbor are shown on Figure 1-2.

In September 1998, after years of study, public debate, and consensus building, EPA selected a cleanup remedy for the entire Upper and Lower Harbor areas as a solution to the widespread PCB contamination in and around New Bedford Harbor. The remedy involves the dredging of about 170 acres and containment of approximately 450,000 cubic yards of PCB contaminated sediment in CDFs.

Dredged sediments will be removed from the harbor and pumped to four CDFs to be constructed along the New Bedford Harbor shoreline. The CDFs will be used to permanently isolate the sediments from the public and the marine environment. The areas to be dredged and the approximate locations of the four CDFs are shown in Figure 1-2.

The CDFs in the Upper Harbor include A, B, and C with layouts as shown in Figure 1-3. The conceptual design for CDFs A, B, and C includes earthen embankments on the water side and sheet pile walls on the land side. The structures will isolate the sediments from the environment through a combination of sediments with inherently low permeability and flexible membrane liner (FML) material placed on the interior slopes of the CDFs. The largest CDF (CDF D) will be located in the Lower Harbor as shown in Figure 1-2, with a layout as depicted in Figure 1-4. The conceptual design for this facility includes sheet pile walls on each of four sides of the structure. A secondary long-term objective for this CDF is to facilitate economic development of the New Bedford Harbor waterfront.

At the locations where CDFs will be built, there are CSOs and stormwater drains which discharge to the Upper and Lower Harbor. These will need to be relocated to discharge outside the areas where the CDFs will be built. This BD/DA describes the design of the CSO, storm drain and utility relocations.

1.2 ARARs Analysis

The New Bedford Harbor Superfund Site is classified as a NPL site requiring remediation by the Environmental Protection Agency (EPA) under the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). An interagency agreement has been signed between EPA and the USACE granting regulatory authority to the USACE for administration of the selected remedy.

Table 1-1 identifies environmental ARARs that pertain to CSO relocation and how the requirements will be met. Other ARARs, such as the Preservation of Historical and Archeological Data Act of 1974 and the Endangered Species Act, were considered and do not appear to have requirements to be incorporated in this detailed design as specified in the ARARs table in the Foster Wheeler Regulatory Compliance Plan for Remedial Design, Operable Unit #1 (RCP). The CSO relocation construction will also be conducted in accordance with all other non-environmental laws, including Occupational Safety and Health Administration (OSHA) and Department of Transportation (DOT) rules and regulations.

Local requirements, such as City of New Bedford sewer construction specifications, have been obtained, discussed with city officials, and incorporated in the construction specifications. An example of the specifications incorporated are those for sewer bedding materials and manhole covers in the concrete structures connecting the new CSO conduit to the existing CSO.

During excavation of the trench for the new CSO conduit, there is a potential to encounter PCBs and other contaminated soils and debris. The construction specifications describe how this material is to be handled during stockpiling. Foster Wheeler will provide transportation and disposal consistent with the

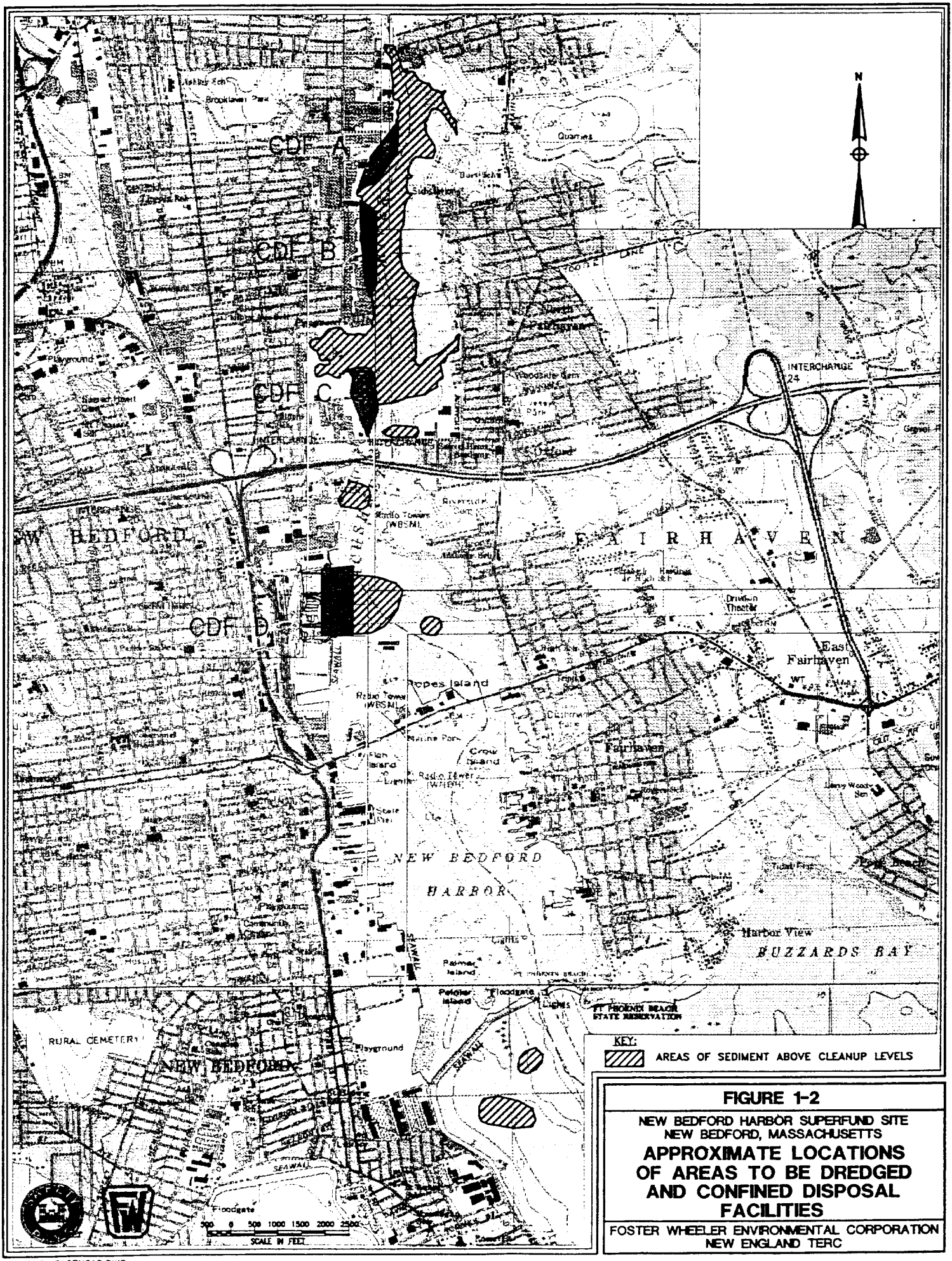

FIGURE 1-2

NEW BEDFORD HARBOR SUPERFUND SITE
NEW BEDFORD, MASSACHUSETTS

APPROXIMATE LOCATIONS OF AREAS TO BE DREDGED AND CONFINED DISPOSAL FACILITIES

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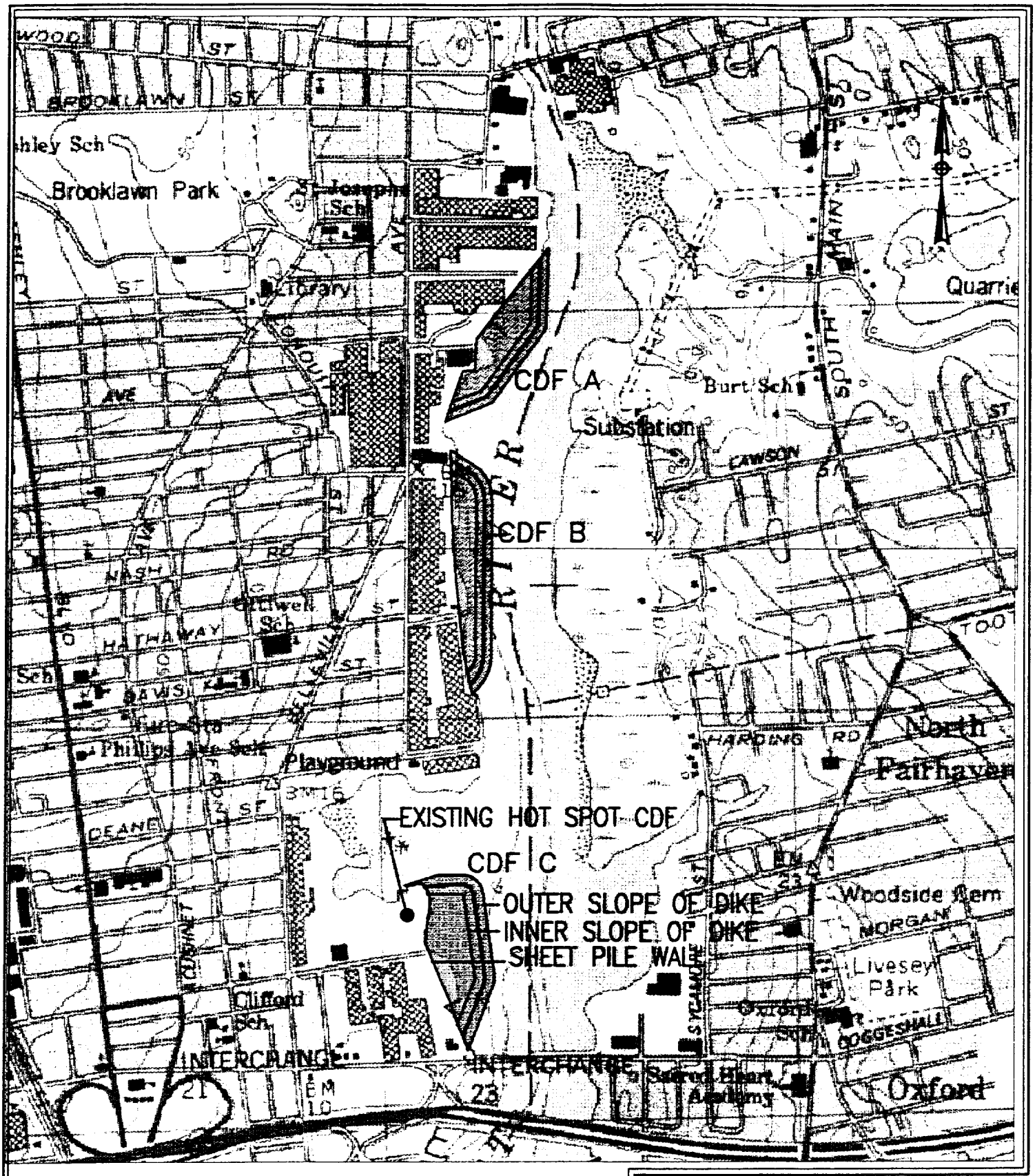

FIGURE 1-3

NEW BEDFORD HARBOR SUPERFUND SITE
NEW BEDFORD, MASSACHUSETTS

SITE LOCATION MAP OF UPPER HARBOR CDFs A, B, AND C

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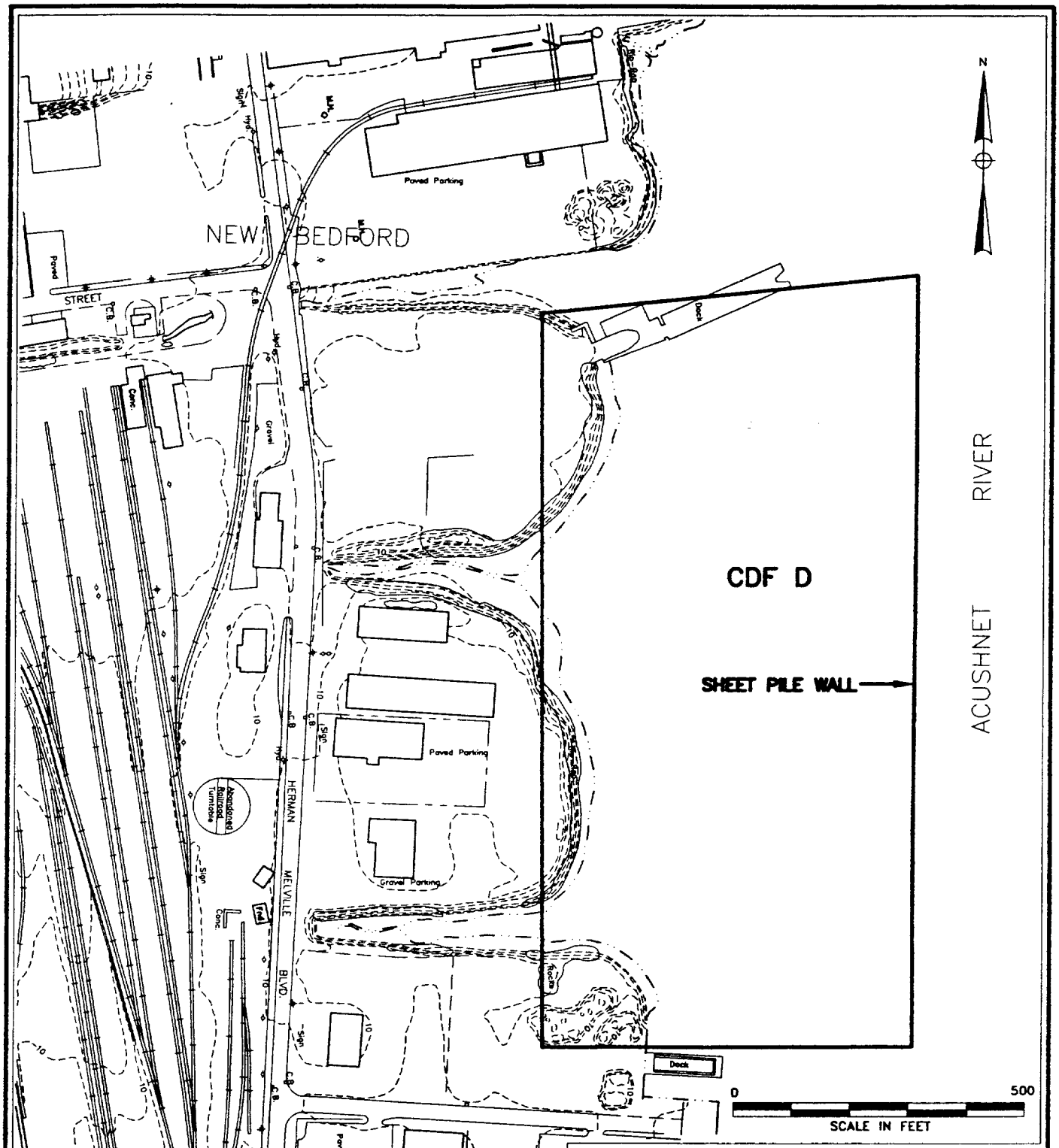

FIGURE 1-4

NEW BEDFORD HARBOR SUPERFUND SITE
NEW BEDFORD, MASSACHUSETTS

CONCEPTUAL LOCATION OF THE LOWER HARBOR CDF D

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Table 1-1
Applicable or Relevant and Appropriate Requirements

Requirement	Citation	Status	Synopsis	Actions to be Taken to Attain ARAR
Clean Water Act - Section 404 and Rivers & Harbors Act Requirements	40 CFR 230.70-76; 33 USC 401-426(m)	Applicable	Controls discharges of dredged or fill material in order to restore and maintain the chemical, physical, and biological integrity of waters of the U.S. Requires coordination and approval of USACE for construction of CSO outfall in navigable waters of the U.S.	EPA has found that the OU #1 remedy, including CSO relocation, is the least damaging alternative to remediating the harbor. The CSO outfall with riprap protection will be implemented so as to minimize the area where fill and riprap is placed. CSO design has been done following USACE guidelines for riprap size and apron area. The design is being done in coordination with USACE and with their review and approval.
National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Requirements for Construction Activities	40 CFR 122.26(a)(14)(x), 122.26(c)(1)(ii)(c) and (d); Federal Register, Vol. 63, No. 31, 9/17/98, Part IV, SWPP Requirements	Applicable	CSO relocation is part of the OU #1 Remedial Action, which has a total construction area exceeding 5 acres in size. Regulation requires best management practices to control pollutants in stormwater discharges during and after construction including erosion and sediment control.	The Erosion Control and Sedimentation Plan will include implementation of best management practices for control of pollutants in stormwaters and erosion and sediment control during CSO relocation construction. A Stormwater Management Plan will be prepared for CSO relocation for review and approval by USACE and EPA.
Floodplain Management - Executive Order 11988	40 CFR Part 6, Appendix A	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	The remedy will occur within the 100-year coastal floodplain as there is no practical acceptable alternative location. The CSO design incorporates flood protection measures for the affected shoreline and estuary subsurface.
Coastal Zone Management Act	16 USC Parts 1451 et seq.	Applicable	Requires that any actions must be conducted in a manner consistent with state approved management programs.	The entire site is located in a coastal zone management area. The remedy is consistent with the state coastal zone management program to the maximum extent possible.*
Wetland Protection - Executive Order 11990	40 CFR Part 6, Appendix A	Applicable	Federal agencies are required to avoid adversely impacting wetlands whenever possible, minimize wetland destruction, and preserve the value of wetlands.	The alternative of building shoreline CDFs including relocating CSO outfalls where CDFs will be built is the best practical alternative for remediating the harbor. At the CDF C area, the CSO outfall relocation will disturb only a small distance of shoreline comprised of some mudflat and cobble beach. The outfall area and adjacent shoreline will be protected from erosion by stone riprap. The outfall has been sized to accommodate CSO flows and to minimize any upstream overflows.

* Direct reference from Record of Decision, Upper and Lower Harbor Operable Unit, New Bedford Harbor Superfund Site, September 1998.

Table 1-1 (cont'd)
Applicable or Relevant and Appropriate Requirements

Requirement	Citation	Status	Synopsis	Actions to be Taken to Attain ARAR
Wetlands Protection Act - Sedimentation and Erosion Control Plan	131 MGL 40	Applicable	Standards regulate filling and altering of coastal and inland wetland resource areas and associated buffer zone of either 25 feet from riverfront, 100 feet inland of a coastal bank/beach or dune, or within Land Subject to Coastal Storm Flowage (from 100-year storm event).	Foster Wheeler will review and approve their CSO Subcontractor's Erosion Control and Sedimentation Plan. It will be prepared reflecting best management practices to minimize adverse impacts during construction, including preventing erosion and siltation of adjacent waterbodies and wetlands in accordance with USDA Soil Conservation Service methods. USACE and EPA will review and approve the plan. Comments will be requested from MADEP and City of New Bedford.
Massachusetts Surface Water Discharge Requirements	31 MGL 27; 314 CMR 3.000	Applicable	Outlines requirements for discharges to surface waters.	A Stormwater Management Plan will be prepared. The plan will be reviewed by USACE, EPA, MADEP, and City of New Bedford. Stormwater and ground-water pumped from CSO pipeline excavations will be discharged to the harbor or collected and treated in the on-site water treatment plant, depending upon contaminant levels as related to federal and Massachusetts surface water quality criteria. This will be done consistent with the substantive requirements of a Temporary NPDES Permit Exclusion. Collected water will be stored and transported if necessary, consistent with "on-site" and off-site requirements as described in the TTSP. The Remedial Action Work Plan for construction will define sampling and analytical requirements. Any new stormwater discharges will be designed consistent with requirements of the Stormwater Management Plan and the Erosion Control and Sedimentation Plan. CSO relocation is not considered to be a new discharge. The CSO relocation design has been reviewed by the City of New Bedford.
Certification for Dredging, Dredged Material Disposal, and Filling in Waters	21 MGL 26-53; 314 CMR 9.06(1-2)	Applicable	Establishes procedures and criteria for administration of Section 401 of the federal Clean Water Act for the discharge of dredged or fill material in waters of the U.S. within the Commonwealth.	Design and placement of fill and riprap for CSO outfall protection, sediment, and shoreline erosion will be done to minimize any adverse impacts and the area requiring filling.

* Direct reference from Record of Decision, Upper and Lower Harbor Operable Unit, New Bedford Harbor Superfund Site, September 1998.

Table 1-1 (cont'd)
Applicable or Relevant and Appropriate Requirements

Requirement	Citation	Status	Synopsis	Actions to be Taken to Attain ARAR
Administration of Waterways Licenses Law	91 MGL 1.00 et seq.; 310 CMR 9.00	Applicable	Criteria for work within flowed and filled tidelands. Focus on long term viability of marine uses and protecting public rights in tidelands. Applicable provisions are Restrictions on Fill and Structures 9.32(1)(a)(2,3)(b)(3,4); Preserving Water-Related Public Rights 9.35(1)(2)(a)(1 and 3)(a and b); Protecting Water Dependent Uses 9.36(2)(3)(4)(5)(a)(1,2)(5)(b); Engineering and Construction Standards 9.37(1)(c), (3)(a), (b)(4); and Dredging and Dredged Material Disposal 9.40(2), (3)(e).	Temporary unavoidable impacts to public access rights to water and to water dependent users will occur at CSO discharge location. Alternate access will be available at areas of new CDFs.
Surface Water Discharge	21 MGL 23(12) and 34; 314 CMR 3.10(3)(4-6); (9)(a); (19)(3-6), (10), (12)(a-b), (13)	Applicable	This section outlines the requirements for obtaining a NPDES permit in Massachusetts. The waters of New Bedford Harbor adjacent to the site are classified as SB.	Discharge from water treatment facilities will meet stringent effluent limitations. Discharges will be monitored in accordance with site monitoring plans. Plants shall be properly operated and maintained; discharge will be reduced or halted if plants fail to function properly while corrective action undertaken.*
Surface Water Quality Standards	27 MGL 27; 314 CMR 4.03(1)(3)(c); 4.04(1)(2)(4)(6); 4.05(4)(a-b), (5)	Applicable	MADEP surface water quality standards incorporate the federal ambient water quality criteria (AWQC) as standards for surface waters of the state. Standards establish acute and chronic effects on aquatic life for contaminants including PCBs, cadmium, chromium, copper, and lead.	Effluent discharged to the river from the CSO excavation dewatering will comply with ambient water quality criteria. Foster Wheeler will sample and analyze dewatering water and provide treatment, as required, prior to discharge to the Acushnet River.
Coastal Zone Management	301 CMR 21.00	Applicable	Requires that any actions must be conducted in a manner consistent with state approved management programs.	The entire site is located in a coastal zone management area. Actions taken will be consistent with substantive portions of identified policies of CZM.*

* Direct reference from Record of Decision, Upper and Lower Harbor Operable Unit, New Bedford Harbor Superfund Site, September 1998.

Table 1-1 (cont'd)
Applicable or Relevant and Appropriate Requirements

Requirement	Citation	Status	Synopsis	Actions to be Taken to Attain ARAR
Coastal Zone Management Policies	MCZM	To Be Considered	Statements of the state environmental policy for coastal zone areas which are implemented through identified ARARs, particularly the Wetlands Protection Act and the Waterways Law. Policies to be considered are Habitat 1; Water Quality 1; Coastal Hazard 2, 3; Ports 1, 2, 3; Ports Management Principle 1; Protected Areas 3; Public Access 1; Public Access Management Principle 2, 4; and Growth Management Principle 1.	These policies will be considered throughout construction, dredging, and operation and maintenance of the remedy. Compliance with the identified substantive portions of the state ARARs will meet the intent of these policies.* State ARARs and actions to attain them are incorporated within this Table 1-1.
Air Pollution Control	111 MGL 142A-J; 310 CMR 7.09(1-4); 7.10(1-2)	Applicable	Standards for, among other things, dust, odor, and noise at construction sites. Pollution abatement controls may be required.	CSO construction will be implemented so as to avoid air pollution. Engineering controls will be used as necessary.
Allowable Sound Emissions	DAQC Policy 90-001; 2/1/90	To Be Considered	Establishes guideline where source of new noise should not emit more than 10 decibels above the existing (background) level.	Site operations noise level will be minimized and will follow the suggested noise limit to the extent practicable.*
Ambient Air Quality Standards	111 MGL 142D; 310 CMR 6.04(2)	Applicable	Establishes ambient air level for contaminants and particulates.	Emissions during construction of CSOs will meet the particulate standard. Dust suppression will be used to reduce particulate emissions. Air monitoring is part of the site long term monitoring plan.
Massachusetts Stormwater Management Policy	131 MGL 40; 310 CMR 10	To Be Considered	Regulates work conducted within coastal and inland wetlands and riverfront areas. For CSO work, regulated area is 25 feet inland from the riverfront and land subject to coastal storm flowage.	The CSO relocation design will comply with the substantive requirements of this policy where possible and practicable. The Stormwater Management Plan and Erosion Control and Sedimentation Plan required by the construction specifications will be reviewed for consistency with the Policy requirements.

* Direct reference from Record of Decision, Upper and Lower Harbor Operable Unit, New Bedford Harbor Superfund Site, September 1998.

requirements in the Foster Wheeler Transportation and Temporary Storage Plan (TTSP) for the New Bedford Harbor Superfund Site, dated June 1999. This is described in more detail in Section 2.7.2, Excavation, Bedding, and Backfill, of this BD/DA.

1.2.1 Compliance with Project Decision Documents

Remediation activities will be conducted in accordance with the following:

- The U.S. EPA Record of Decision, dated September 1998,
- The USACE's October 14, 1998 Scope of Work,
- The November 13, 1998 Draft Engineering Guidance for the Scope of Work, and
- The Foster Wheeler Remedial Design Work Plan, dated April 1999.

All work conducted in areas deemed to be "on-site" will be conducted in accordance with these decision documents and the substantive requirements of the identified Applicable or Relevant and Appropriate Requirements (ARARs). ARARs for the OU #1 Remedial Action are listed in the RCP. Any work in areas deemed to be "off-site" will be conducted in accordance with both administrative and substantive requirements of applicable federal, state, and local regulations.

1.2.2 Regulatory Assumptions

Consistent with the National Contingency Plan (NCP), 40 CFR 300.5, "on-site" means the Acushnet River, the existing CDF and Sawyer Street facilities, and all areas in close proximity to the site contamination. Areas associated with the investigation and relocation of combined sewer overflows/storm drains are considered to be in close proximity to the site contamination.

Consistent with CERCLA Section 121(e)(1), it will not be necessary to obtain permits for on-site activities. However, all on-site activities must comply with all substantive requirements of the state and federal rules and regulations identified as ARARs in the Record of Decision (ROD).

2.0 CDF C - CSO RELOCATION

The first CSO relocation to be designed is located in the CDF C area (see Figure 2-1). It involves relocating CSO Outfall 022, which currently discharges at the shoreline end of Sawyer Street, to discharge at a location approximately 700 feet south of its present discharge point.

2.1 Purpose

The relocation of CSO C is part of the OU#1 remediation to place dredged sediment in shoreline CDFs for long term containment. The objective is to relocate the existing CSO discharge while maintaining its functionality, to allow CDF construction, and to accomplish the relocation consistent with EPA and City of New Bedford objectives.

A number of meetings have been held with EPA and the City of New Bedford which have defined the CSO relocation design objectives. The major objectives are:

- select a CSO routing or alignment which minimizes the number of properties requiring construction and permanent easements;

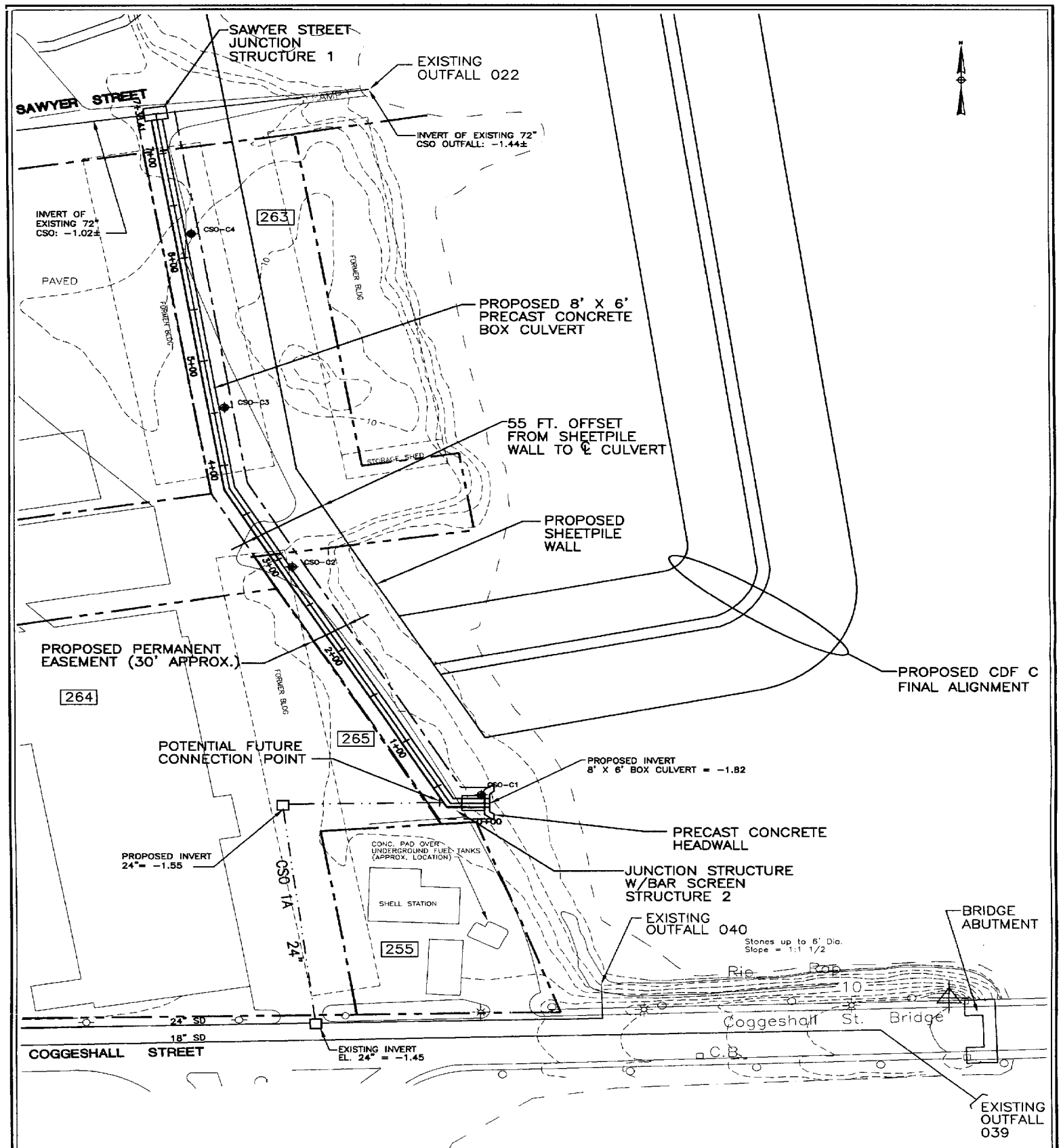

FIGURE 2-1

NEW BEDFORD HARBOR SUPERFUND SITE
NEW BEDFORD, MASSACHUSETTS

SELECTED ALTERNATIVE CSO RELOCATION CDF C

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TERC PROGRAM

CADDFILE: 519NB35a.DWG

- develop the CSO relocation design to be compatible with future City of New Bedford improvements to CSOs and potential collection and storage of CSO discharges;
- incorporate a structure within the relocated CSO Outfall 022 to reduce the visible floatable debris that will be discharged (this resulted from the planned recreational future use of the CDF and the decision to discharge the CSO between the southern limit of CDF C and the Coggeshall Street Bridge, a somewhat enclosed area); and
- size the CSO for a gravity flow capacity of approximately 200 cfs and keep the additional surcharge in the existing CSO upstream of the connection point to a minimum.

The BD/DA for the CSO C design presents the general conditions and parameters which have defined the relocation design. The two most significant parameters have been the route analysis which has involved extensive review and discussion of alternative alignments with USACE, EPA, and the City of New Bedford and determining the pipe size for the relocated CSO. Pipe sizing has been done in coordination with the City of New Bedford and their engineer Camp, Dresser, McKee (CDM).

Functional and technical aspects described in this BD/DA for the relocated CSO include an evaluation of alternative conveyance structures to provide the required discharge capacity given the existing site conditions (minimal slope and cover for the relocated pipeline). Other requirements included are consideration of alternative pipe materials, structural design for the anticipated site conditions, and incorporation of a bar screen to remove floatable debris and a connection point for a future additional CSO discharge by the City of New Bedford.

The design analysis also includes the impact on existing utilities in the area and the local traffic impacts during construction.

Sections 2.2 through 2.8 of this BD/DA present the detailed CSO C relocation design; Sections 2.9 and 2.10 describe existing utilities and traffic impacts, respectively; Section 2.11 presents the construction acquisition strategy; and Section 2.12 describes the drawings and specifications that are included in this submittal.

2.2 Design Criteria

Substantial input from several sources was utilized to establish the design criteria for the CSO relocation. Major input sources included the City of New Bedford, the City's engineer-CDM, EPA, and USACE. The design criteria for the project can be categorized into three groups based on specific design objectives. Table 2-1 presents the objectives and the associated design criteria.

The routing objectives are discussed in detail in Section 2.3. Hydraulic design concepts are discussed in Section 2.4 with supporting calculations in Appendix A. The structural and environmental objectives are described in Section 2.5, 2.6, 2.7 and 2.8.

2.3 Route Analysis

During the period from January to April, 1999 a series of meetings were held between Foster Wheeler, USACE, EPA, Massachusetts Department of Environmental Protection (MADEP), the City of New Bedford and the City's consulting engineer, CDM. The purpose of the meetings was to review various options for the relocation of the existing 72-inch Sawyer Street CSO. The goal of these discussions was to determine and agree upon the most cost effective route that would satisfy the requirements of the

Table 2-1
Design Criteria

Routing Objectives	1. To relocate the CSO outfall while maintaining as large a CDF C volume as possible. 2. To minimize the number of properties affected by CSO relocation. 3. To be consistent with CDF sheet pile wall location strategy. 4. To minimize easement and construction costs to the maximum extent practicable considering long term use and maintenance factors. 5. To facilitate future CSO abatement efforts by the City.
Hydraulic Objectives	1. To handle flow capacity equal to that of existing CSO-197.2 cfs* and provide capacity for future 24" connection - 9.5 cfs under gravity flow conditions. 2. To produce less than 0.40 ft.* of additional surcharge in the existing CSO at point of new connection under gravity flow conditions. 3. To produce minimal additional surcharge upstream during a 5-year storm event when the CSO is discharging a pressure flow of 335 cfs.*
Structural Objectives	1. To consider City of New Bedford objectives for future recreational use of the area when designing conveyance structures. 2. To design CSO for 70-100 year service life. (EM 1110-2-2902). 3. To facilitate future pipe connections at the conveyance structures by designing connection points in the side(s) of the structures.
Environmental Objectives	1. To reduce discharge of floatables (cups, bottles, cans, etc.) from the CSO.

* Values consistent with Camp, Dresser and McKee preliminary calculations.

project while also meeting the needs of the City relative to future use/maintenance and planned improvements to the City's sewer and storm drainage systems.

2.3.1 Initial Screening of Potential Route Alignments

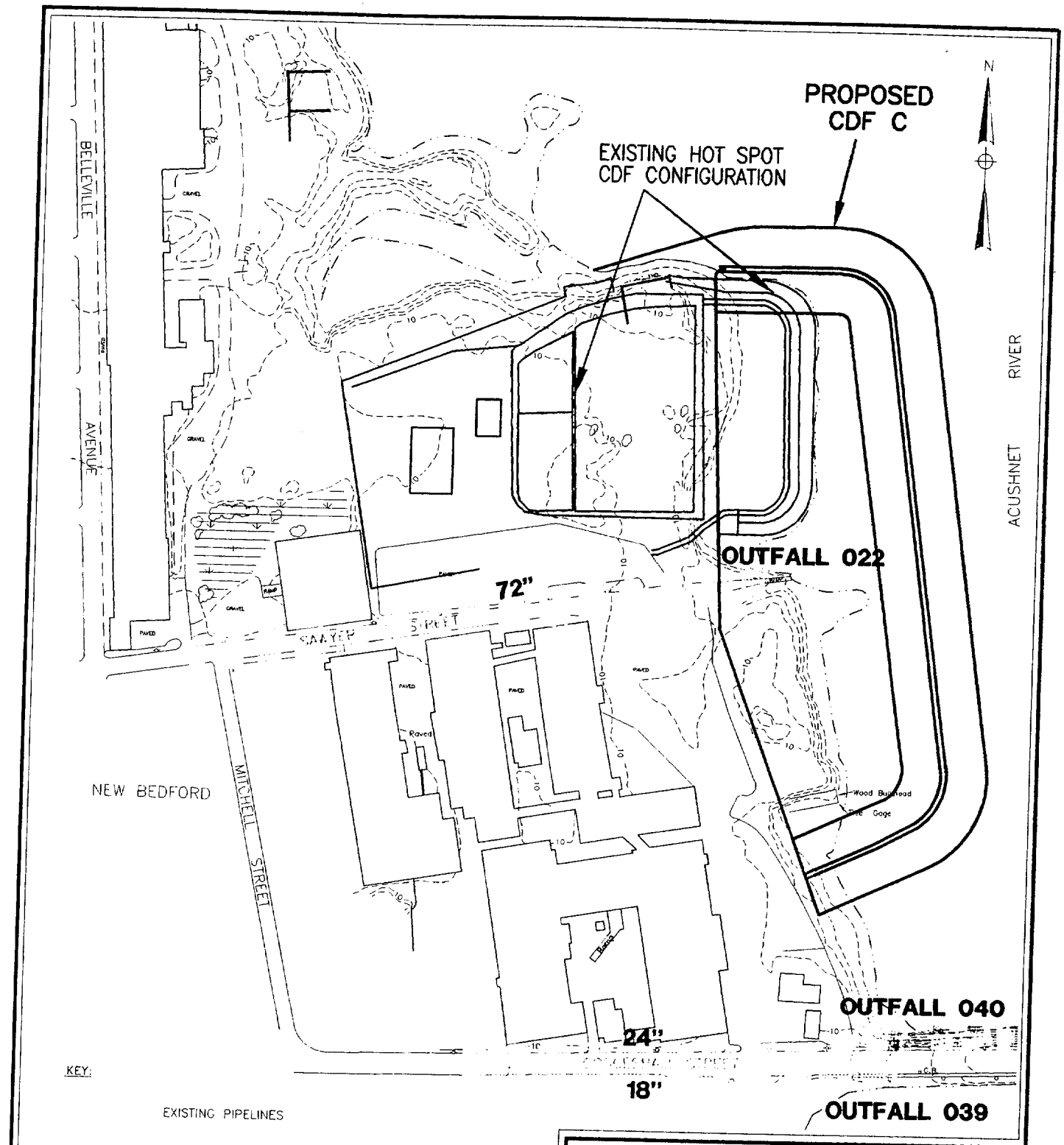
In general, from the above mentioned discussions, three general routes were identified for the relocation of the Sawyer Street CSO C (see Figure 2-2 for existing CSO and general site plan).

- A northern route around the proposed CDF C, running from Sawyer Street to the west of the Hot Spot CDF.
- An eastern route within a "clean corridor" through the proposed CDF C, and
- A southern route around the proposed CDF C, running south toward Coggeshall Street.

An initial review of these options revealed the northern route to be unacceptable due to the potential environmental impacts to the existing shallow cove and adjacent green space on the northern border of CDF C. The eastern route was also deemed unacceptable due to the technical concerns relative to the CDF C design with a CSO running through it and also potential CDF integrity concerns associated with the future City maintenance of the CSO pipeline. Given this initial review, various options for the relocation of the pipeline to the south of the proposed CDF C were discussed.

Three conceptual alternatives were then identified for routing the CSO to the south of the CDF C. These include:

- An inland route along Mitchell Street (proposed by the City),
- A shoreline route along the western edge of CDF C to discharge north of the Coggeshall Street Bridge, and
- A shoreline route similar to the above to discharge to the south of the Coggeshall Street Bridge.



NOTE:
BASE TOPOGRAPHY DOES NOT REFLECT EXISTING TOPOGRAPHY AT LOCATION OF EXISTING CONFINED DISPOSAL FACILITY AT NORTH END OF PROPOSED CDF C

0 500
SCALE IN FEET

CADDFILE: 5197NB05.DWG

FIGURE 2-2

NEW BEDFORD HARBOR SUPERFUND SITE
NEW BEDFORD, MASSACHUSETTS

CDF-C WITH EXISTING CSOs

FOSTER WHEELER ENVIRONMENTAL CORPORATION
NEW ENGLAND TERC

Originals in color.

The Mitchell Street route was deemed cost prohibitive due to the length of pipeline required. The remaining conceptual alternatives identified above were then selected for further evaluation.

The initial screening of the conceptual alternatives identified above resulted in a more detailed analysis of the various options available for constructing the new CSO pipeline along the shoreline to discharge at a point to the south of the proposed CDF C.

2.3.2 Detailed Route Analysis

In an effort to establish the most cost effective and mutually beneficial route, Foster Wheeler prepared a "Draft Technical Memorandum - Evaluation of Alternative CSO and CDF Alignments for Confined Disposal Facility C", dated March 1999. This document is included as Appendix B of this BD/DA.

Given that each of the CSO relocation options resulted in a corresponding impact to CDF C configuration (and in particular the available storage volume), the above evaluation included an analysis of the overall project benefits and disadvantages relative to both CSO and CDF construction.

Based upon the information presented in the Draft Technical Memorandum, and after numerous discussions between all parties relative to the benefits and disadvantages of various options, a final route alignment was selected. The selected route alignment was chosen primarily based upon overall cost considerations while also considering the following issues:

- Impact to the City's CSO Master Plan, specifically the potential for storage/pump-back facilities in the Coggeshall Street area,
- Minimizing the impact to adjacent properties, (i.e. land takings, permanent and temporary construction easements, access and egress),
- Impact to the CDF C design and storage volume,
- Future connection of a 24 inch CSO in Coggeshall Street by the City,
- Inclusion of a manually cleaned bar rack screen to remove floatable debris that could be discharged to the harbor.

This alignment - Alternative 1 - is included as Appendix C, Figure 1. (Note: Elliptical pipe was assumed for the initial alignments. Refer to Sections 2.5 and 2.6 for additional information relative to the evaluation of piping materials and configurations.)

2.3.3 The Selected Alternative

The selected alternative is graphically represented in Figure 2-1. The pipeline will be constructed as close as possible to the western limit of the CDF C (to be constructed as a sheetpile wall with an earthen berm if feasible).

Additional details regarding the design aspects of the pipeline and appurtenant structures are included in Section 2.4 through Section 2.8.

The preliminary location of the selected CSO alignment was determined based upon the following criteria, as shown in Figure 2-1:

1. A minimum separation distance of approximately 55 feet from the center of the proposed pipeline to the proposed sheetpile wall (western limit of CDF C) should be maintained;

2. An estimated permanent easement width of 30 feet, 15 feet either side of the pipe (culvert) centerline; and
3. Alignment of the permanent easement to be consistent with the existing property lines to minimize property impacts.

The 55 foot separation distance between the CSO and the sheetpile wall was calculated based upon a preliminary review of the proposed subsurface conditions. A section view of the CSO in proximity to the CDF C sheetpile wall is shown in Appendix C, Figure 2. (Note: An 84" circular pipeline was originally assumed for this calculation. The impact of the selected 8'x6' culvert configuration does not significantly impact the calculated separation.)

The approximate 55 foot separation distance allows for the future excavation and replacement of this pipeline without adversely impacting the integrity of the CDF. Moving the CSO pipeline closer to the sheetpile wall will result in the need for a deeper wall, or possibly a retaining wall, adding significantly to the cost of the wall. It should be noted that this is a preliminary calculation based upon an estimated sheetpile wall depth and conservative soil loading conditions. This distance may be reduced or increased based upon the design criteria ultimately determined for the CDF C construction.

The selected CSO alignment is shown and described in more detail on sheet C1, included in Appendix D.

2.4 Hydraulic Design

2.4.1 Background

The OU # 1 Remedial Design Work Plan approach for the design flow for the Sawyer Street CSO relocation extension was to have the City of New Bedford provide the design flow and required pipe sizes. At the beginning of the 30% design, the City's engineer, Camp, Dresser & Mckee, Inc. (CDM) provided Foster Wheeler a design flow of 199 cfs which is the full flow capacity of the Sawyer Street CSO under gravity flow conditions. To accommodate this flow without causing substantial additional surcharge at the CSO extension connection point in Sawyer Street, CDM selected a circular pipe of 96 inches. The proposed point of the extension connection in Sawyer Street is 100 feet upstream of the outfall. The CSO extension is 725 feet long with a connecting structure at Sawyer Street, two angled sections and the discharge and screen structure at the Acushnet River shoreline. CDM's approach was to design the CSO extension to convey and discharge an amount of flow equal to that which discharges from the existing CSO without significantly increasing (less than 0.4 ft.) surcharging in the upstream combined sewer.

2.4.2 Gravity Flow Conditions

Review of City of New Bedford records indicates that the final segment of the CSO consists of a 72" double ring brick sewer installed at a slope of 0.25%. Survey data collected in March 1999 verifies this information. The full flow capacity of the existing CSO is approximately 197.2cfs (Manning Equation). This value is consistent with preliminary calculations prepared by CDM, the City's engineer. Additionally, the new CSO must have the capacity to handle approximately 3.9 cfs from two future 12" local storm drains and 9.5 cfs from a potential 24" connection.

Three hydraulic designs were considered for the project:

1. 72" x 113" horizontal elliptical pipe (90" equivalent round).
2. Dual 66" round pipe, and
3. 8' x 6' box culvert.

A single round pipe configuration was not considered due to the shallow nature of the installation and the resulting cover limitations. The following table (Table 2-2) summarizes the results of the hydraulic analysis. Detailed calculations can be found in Appendix A.

Table 2-2
Summary of Hydraulic Analysis

Conveyance Structure	Minimum Slope (%)	Increase/Decrease in Hydraulic Grade Line at New Connection (ft.)	Velocity (ft/s)
72" x 113" Elliptical	0.064	0.21	4.78
Dual 66" Round	0.084	-0.14	4.45
8' x 6' Box	0.060	0.19	4.47

* Data based on conveyance of maximum flow of approximately 211 cfs.

From a hydraulic standpoint, each of the three designs meets the primary goal. Additional surcharging or increase in the hydraulic grade line in the upstream portion of the CSO can be kept below 0.40 ft. which is the desired surcharge limit as defined by the City's engineer, CDM.

2.4.3 Surcharged or Pressure Flow Conditions

In addition to sizing the CSO outfall extension to allow flow without substantial upstream surcharge under gravity flow conditions it was necessary to analyze the extension to ensure that increased surcharging does not occur under storm flow conditions when the pipe is under pressure. This occurs when surface runoff peaks during large storm events. The available storm flow information for the Outfall 022 area was obtained from the 1990 CSO Facilities Plan by CDM. The maximum peak flow available for the Outfall 022 area was for a 5-year return frequency storm. The flow was calculated to be 335 cfs. Since this was calculated, the sewer system has been modified. However, CDM explained that the changes to the system have reduced dry weather flows. These dry weather flow reductions mean the peak CSO discharge values are somewhat conservative.

To provide assurance of the adequacy of the CSO extension size relative to larger (greater than 5 year) flood events, Foster Wheeler and USACE reviewed the storm flow information provided and the sewer system plans in the Outfall 022 area. Since the largest flood evaluated by CDM in the 1990 Facilities Plan was the 5-year event, the following analysis of the existing CSO system upstream of the CSO extension connection point was performed.

The Sawyer Street CSO conduit originates at Sawyer and North Front Streets in a manhole where a weir controls flows to the conduit from the main interceptor sewer. Additional flow enters the conduit at Belleview Avenue where a 30 inch storm drain is connected. The peak flow from this storm drain was calculated to be 24 cfs based on a computed drainage area of 18 acres. With the peak flow of 335 cfs at the outfall, the pipe upstream of Belleview Avenue would flow at 311 cfs. This is the flow that would enter the conduit at the North Front Street structure. This is a very large flow for a conduit that originates as a 48 inch pipe leaving the North Front Street manhole. The surcharge conditions at the manhole at this flow were calculated to be about 5.2 feet above the top of the outflow pipe and found to reach an elevation of approximately 19.9 feet at North Front Street. The street elevation is about 20 feet at this location, indicating that at greater flows water overflows to the street. A review of available topographic mapping as well as field observations indicates that as levels rise, significant streetponding and possible overland flow would begin to occur. It is believed that under these rarer flood condition that the

additional surcharging at the North Front Street area would not be large enough to result in a significantly greater flow being conveyed in the 48 inch pipe leaving the North Front Street manhole. Therefore, it is not practicable to design the CSO extension for flows in excess of 335 cfs because stormwater overflows to the street (due to other hydraulic controls) at larger flood events.

Using a peak storm flow of 335 cfs, it was decided to analyze the system and evaluate the effect of the CSO extension compared to existing conditions. It was also decided to limit the analysis to the 8-foot by 6-foot box culvert extension since this alternative was deemed the most suitable (see Section 2.6 and Table 2-4). The analysis included:

- friction losses under pressure flow
- minor losses due to pipe structures, bends and the proposed trash rack at the outfall
- exit velocity losses under pressure flow
- backwater tidal effects

These analyses indicate the following:

- Accounting for friction losses, minor losses and the exit losses, the hydraulic grade line in the proposed 8-foot by 6-foot box culvert at the extension connection point in Sawyer Street during the peak storm flow of 335 cfs is approximately 7.6 feet NGVD. The calculated existing hydraulic grade line in the 72-inch CSO at the same location during the same storm event is approximately 7.5 feet NGVD.
- At peak storm flow of 335 cfs, the effects of the tide elevation at the discharge are negligible.

Note: The 7.6-feet hydraulic grade elevation in the extension is with a screening system 50% blinded by debris. A debris free screening system would result in a reduction in hydraulic grade line at the connection point. The existing 72" CSO does not have a screening system.

In summary, the 8'x6' box culvert is a hydraulically acceptable size for the Sawyer Street CSO extension for the following reasons:

1. Under gravity flow the additional surcharge is within an acceptable range of less than 0.4 feet at the connection point in Sawyer Street.
2. Under pressure flow, using a storm flow of 335 cfs, the hydraulic grade line elevation at the extension connection in Sawyer Street is essentially equivalent to the existing condition.

The hydraulic analysis, design flow, and surcharge with the 8'x6' box culvert CSO outfall extension have been reviewed by the City of New Bedford and their engineer, CDM. They concur with the criteria used for the hydraulic design and have no comments on the proposed design. This is documented in a letter dated November 9, 1999 from CDM to Foster Wheeler. The letter has been included in Appendix E.

2.5 Conveyance Structure Material

In order to select the appropriate conduit/culvert material for the proposed CSO, the engineering requirements including the long term performance of the project must be considered. Given the ramifications associated with repair and replacement of the CSO in proximity to the confined disposal facility, a design life of between 70 and 100 years would not be unreasonable. As stated in USACE publication EM 1110-2-2902, many USACE projects will likely remain in service indefinitely, and designers of major infrastructure projects should use a minimum project service life of 100 years when

considering life cycle design. With this in mind, the product service life of several conduit/culvert materials was considered. The following table (Table 2-3) summarizes information presented in EM 1110-2-2902.

Table 2-3
Summarized Information Presented in EM 1110-2-2902

Conduit/Culvert Material	Service Life
Concrete	70-100 years
Steel	At least 50 years for most environments
Aluminum	Not more than 50 years
Plastic	Not more than 50 years

Concrete conduits and culverts have been in use for over 100 years. Extensive research and performance surveys performed by the American Concrete Pipe Association and other agencies have firmly established the exceptional engineering qualities associated with concrete conduits and culverts. Based on the service life data presented and the known engineering performance, particularly in marine environments, it is recommended that the proposed CSO be a concrete conduit or culvert.

2.6 Conveyance Structure Alternatives

In addition to hydraulic performance, several other factors were considered to determine the most suitable CSO conveyance structure. The following matrix (Table 2-4) provides an evaluation of each of the three hydraulic designs relative to several key design elements.

Table 2-4
Evaluation of Each of Three Hydraulic Designs

Design Element	72" x 113" Horizontal Elliptical Pipe	Dual 66" Round Pipe	8' x 6' Box Culvert
Manufacturing	Elliptical pipe of this size is not commonly manufactured. The capability exists, but supplier would have to customize operations.	Pipe is commonly manufactured and readily available.	Box culvert of this size is commonly manufactured and readily available.
Quality	Quality could be suspect due to lack of recent experience manufacturing pipe of this size.	Higher quality expected due to level of production experience.	Higher quality expected due to level of production experience.
Joints	Gasket joints not available "Special" joints can be installed in field.	Gasket joints available.	Gasket joints available.
Trench Width (Impact on Easements)	Outside dimension of pipe is 130", translating to a potential trench width of 30 ft.	Outside dimension of pipes is approximately 170", translating to a potential trench width of 40 ft.	Outside dimensions of structure is 112", translating to a potential trench width of 25 ft.
Installation	Potential difficulty with centering pipe in trench due to elliptical geometry.	Common installation, but two lines to install instead of one.	Common installation.
Material Cost	Relative material cost approximately $368./ft.	Relative material cost approximately $236./ft.	Relative material cost approximately $287./ft.

Based on the evaluation, it would appear that the 72"x113" horizontal elliptical pipe is the least suitable conveyance structure. The dual 66" round pipes, despite having the lowest material cost would require a more labor intensive installation and would require a significantly large trench and/or easement width which could translate into higher overall costs. The 8'x6' box culvert remains as the most suitable conveyance structure for the project.

2.7 Structural Design

2.7.1 Subsurface Information

Subsurface conditions as indicated by the three on-shore test borings (CSO-C2 through CSO-C4) conducted along the proposed alignment of the box culvert generally consist of surface fill overlying naturally-deposited sand. The fill consists of loose to medium dense, fine to coarse sand with varying amounts of silt, gravel, brick fragments and glass. The fill thickness at these locations varied from 7 to 8.5 ft. The underlying sand deposit typically consists of loose to medium dense, fine to coarse sand with varying amounts of silt. The CSO borings which were drilled to depths of 25 ft. did not penetrate through the sand deposit. Test boring CSO-C1, conducted below mean high water at the proposed location of the outfall structure, encountered 7 ft. of fill overlying 4 ft. of soft organic clay. The sand deposit was encountered below the clay and was not completely penetrated within the exploration (drilled to a total depth of 27 ft.). Within the four CSO explorations in this area, the elevation of the top of the naturally-deposited sand varies from approximately El. –0.2 to –9.4. At test boring location FC-27, 7.5 ft. of organic clay was encountered, indicating that the organic clay strata generally increases in thickness with distance offshore within the area of the proposed riprap apron.

The explorations closest to the proposed location of Structure 1 (CSO-C4, FC-2, FC-3 and OW-C2) are inconsistent relative to encountering organic clay below the fill strata. The closest CSO exploration (CSO-C4) did not encounter organic clay material below the fill deposit, although no test borings were conducted within the Sawyer Street right of way. However, available design drawings for the existing CSO structure within Sawyer Street indicate that the existing brick structure was designed to be supported by a wood pile foundation, where required, based on subsurface conditions. Although as-built drawings are not available, wood piles would presumably have been required where organic clay strata were present below the proposed invert elevation of the structure. There is indication that the original CSO structure terminated to the west of the current outfall location, at what was then the shoreline. As the shoreline area was filled, the CSO was extended to the east, to its current location. It is therefore possible that organic clay is present below the alignment of the current CSO structure, and the existing structure may be supported by a pile foundation at the proposed structure 1 location.

Groundwater elevations, measured in adjacent observation and monitoring wells (OW-C2, -C3 and -C4, MW-C8 s and d), indicate that the groundwater elevation in the area of the proposed CSO structure varies from approximately El. 0.6 to El. 2.4. (Corresponding depths below ground surface vary between approximately 4 and 8 ft.). Due to proximity to the river, the groundwater elevations are likely tidally influenced. Groundwater elevations were measured in the observation and monitoring wells periodically during the month of October 1999, and as such, represent stabilized readings. However, groundwater elevations encountered in excavations at the time of construction should be expected to vary based on tide, season, and ongoing construction activities.

The waterfront area along the alignment of the proposed CSO is the former site of two large buildings. Although the test borings did not encounter large obstructions, it is likely that demolition debris, abandoned utilities, and possibly foundations and slabs will be encountered below grade in this area.

2.7.2 Excavation, Bedding, and Backfill

Based on the existing subsurface data, naturally-deposited sands will likely be encountered at the proposed bearing elevation (El. -1.3 to -1.8) of the box culvert. The naturally-deposited sands are considered suitable bearing material for the structure. It is possible that local areas of deeper fill and/or organic soils will be encountered at proposed bearing elevations. These soils are not suitable for support of the structure, and, where encountered, will be excavated and replaced with suitable off-site granular fill.

Bedding for the box culvert will consist of a minimum of 6 inches of aggregate base course compacted to 95% of the maximum laboratory dry weight as determined by American Association of State Highway and Transportation Officials (AASHTO) Specification T99.

Excavation depths on the order of 6 to 12 ft. below ground surface will be required for construction of the box culvert. It is likely that excavation can be accomplished by open cut, or with trench box or other excavation support systems as necessary, utilizing conventional excavation equipment. Sheeting and/or shoring will likely be necessary to facilitate construction of CSO Structures 1 and 2. Sediment and shoreline soils excavated during the construction of CSO Structure 2 are initially assumed to be PCB contaminated and will be stockpiled at the debris disposal area in the existing CDF. Materials excavated for the installation of the remaining portions of the CSO are assumed to be clean and will be stockpiled in a designated on-site area. If, however, contaminated soils are encountered as evidenced by heavy staining, noticeable odor, or readings above background on air monitoring instruments (e.g., organic vapor detector), these soils would be stockpiled separately on-site, sampled, and assessed for potential characterization under RCRA and Massachusetts hazardous waste requirements. Excess excavated material, or material not satisfactory for use as on site, will be characterized by Foster Wheeler and disposed of accordingly.

Control of groundwater will be required during excavation below approximately El. 3. Depending on the contractor's means and method for excavation and excavation support, groundwater control could likely be accomplished by pumping from open sumps, or shallow well point systems. Excavation and backfilling will be accomplished in-the-dry. Foster Wheeler will sample and analyze stormwater and groundwater pumped from excavations and provide storage and treatment as required prior to discharge to the Acushnet River. All effluent discharged to the river will meet ambient water quality criteria.

Backfill will consist of granular material placed and compacted over the top and on each side of the box sections. The backfill will be placed in lifts and compacted by means of mechanical tampers.

2.7.3 Future Use

The future use of the waterfront land along the CSO route is yet to be determined. In order to minimize any impacts that the proposed CSO might have on the future development of the area, the proposed CSO will be conservatively designed to structurally handle HS 20 highway loading.

2.7.4 Precast Concrete Box Culvert Structural Specifications

The precast concrete box culvert proposed for the CSO relocation will conform to American Society for Testing and Materials (ASTM) C850-95a. This specification covers precast reinforced concrete box sections with less than 2 feet of cover subjected to highway loadings and designed for the conveyance of stormwater, industrial wastes, or sewage. Dead load, live load, and impact allowances are in accordance with AASHTO specifications for HS20 highway loadings as published in AASHTO's "Standard

Specifications for Highway Bridges", Twelfth ed., 1977. A copy of ASTM C850-95a has been included in Appendix F.

2.8 Special Structures

2.8.1 Concrete Structures

A transition structure and a discharge structure are proposed along the realigned CSO route. The first structure will be a cast-in-place concrete box with approximate dimensions of 12'x14'. This structure (Structure 1) will be located approximately 100 feet west of the existing CSO discharge point within the Sawyer Street right-of-way at the junction between the existing CSO and the proposed CSO extension (refer to Figure 2-1). The structure will accept the existing 72" CSO conduit from the west and direct flow into the proposed 8'x6' box culvert CSO extension to the south. The structure will be channelized in order to redirect flow with minimal head loss and will have man-way access for maintenance.

The second structure (Structure 2) will be located at the outfall, approximately 740 feet from the first and will discharge flow to the river (refer to Figure 2-1). This structure will also be a cast-in-place concrete box and will have approximate dimensions of 16'x16'. This structure will be equipped with wing walls and a static stainless steel bar screen to prevent floatables from being discharged to the Acushnet River during CSO discharges. Floatables are defined as debris collecting on streets and sidewalks that washes into storm drains during periods of rainfall. Floatables entering the CSO will be trapped by the bar screen during storm events and will accumulate in a sump within the structure. Access doors will be installed to facilitate removal of accumulated debris from the sump using a "vactor" type truck and for regular maintenance.

The effectiveness of the bar screen in preventing floatables from reaching the river is dependent upon regular cleaning of the screen and sump after storm events. Without regular cleaning, debris could build up on the screen and cause partial blinding which would reduce the flow area and cause flow to pass over the top of the screen, thus reducing its effectiveness. The size of the structure and screening system has been conservatively designed to provide the same cross-sectional flow area as the 8'x6' box culvert with up to approximately 70% of the screen blinded with debris. The concept design for this screen was prepared by the City of New Bedford's engineer, CDM, as one option to meet their stated objective for screening of visible floatable debris from the CSO discharge. The first concept has been modified a number of times from review and discussion between CDM, City of New Bedford, USACE, and Foster Wheeler. The current design represents a consensus of the details of the structure. Detail of this structure is shown on sheets C5 and C6 included in Appendix D. The City will ultimately be responsible for the periodic cleaning of the sump and the regular maintenance of the structure.

Along the CSO Relocation Route, a 20° bend and a 60° bend will be custom made by the manufacturer with joints such that they will connect directly to the box culvert sections. In the box section just north of the 60° bend, provisions will be made for the future installation of a 24" conduit to the west. This will afford the City of New Bedford the opportunity to potentially reroute existing CSOs along Coggeshall Street through the new structure and to the harbor via a common discharge point.

Detailed structural calculations for Structures 1 and 2 are included in Appendix G.

2.8.2 Stone Outlet Protection

In order to prevent scour and erosion at the proposed CSO outlet, a stone outfall apron has been sized to dissipate energy and protect the shoreline (see detailed calculations in Appendix G). Construction of the

stone outfall apron will require placement of fill below mean low water, up to 140 ft east (outboard) of the proposed outfall. The fill will be placed directly over the very soft organic clay soils present at mudline. The organic clay thickness at this location is anticipated to vary from approximately 4 ft. at the outfall (based on boring CSO-C1) to greater than 7.5 ft. at the eastern end of the apron. A combination of bedding material and riprap will be required to achieve the proposed final elevation of the apron. Due to the low shear strength of the clay at mudline (as low as 25 psf) combined with the high compressibility of the clay, the clay will not provide adequate support for the proposed fill/stone design section. The large size of the apron, thickness of clay, and impact of construction below mean low water make it impractical to consider excavation of the soft clay and replacement with compacted suitable granular fill material for support of the stone. It may be possible to support the required fill/stone section above the clay by utilizing a high strength geomembrane fabric (similar to that used below the existing dike at Sawyer Street), however, use of such a fabric is costly and in our opinion not warranted for support of the proposed apron.

Instead it is proposed to place the fill required for the apron by pushing common fill incrementally out from the shoreline utilizing low ground pressure equipment to create a working pad above mean low water over the footprint of the apron. Placement of the fill to create a working pad will likely displace some thickness of the organic clay layer, depending on actual shear strength and thickness of the soft clay. In addition, organic clay remaining below the fill will undergo consolidation settlement due to the increased fill load. Uncertainties relative to clay thickness and shear strength make it difficult to estimate both the thickness of clay which will be displaced, as well as the magnitude of consolidation settlement anticipated due to the fill load. It is therefore impossible to estimate the required volume of fill to achieve design grade, since that will depend on the amount of displacement which occurs, combined with the amount of consolidation settlement resulting from the fill placement.

It is therefore proposed that common fill be placed to an initial elevation above mean low water (i.e., higher than final stone protection grade) to effectively function as a surcharge to accelerate consolidation settlement (thereby reducing post-construction settlement), as well as allowing equipment access. Settlement of the temporary pad will be monitored during construction, and additional common fill material added as required to maintain temporary grade. When adequate settlement has been achieved (based on monitoring magnitude and rate of settlement), the excess common fill material can be removed (working from east to west, toward the shoreline) and the final stone protection can be placed directly on the common fill bedding.

2.9 Impacts on Existing Utilities

Given the proposed CSO alignment (See Section 2.1 and associated appendices), few active utilities will be affected by the installation of the new CSO. The utilities that will be affected include an 8" waterline located on the south side of Sawyer Street in the Sawyer Street right-of-way, and a 6" waterline located approximately 300 feet south of Sawyer Street in Lot 262 (see Sheet C-1 in Appendix D). During construction of the proposed CSO, the eastern sections of these utilities will need to be taken out of service. However, this will not cause a disruption of service to any customers (except temporary disruption) since there are no service connections located east of the proposed junction between the existing CSO and the proposed CSO segment. The City of New Bedford has been consulted and the decision was made to install blind flanges on both waterlines and abandon service to the east. Fire protection needs will be evaluated prior to any temporary disruption of water service.

Other utilities identified include various waterlines traversing south from Sawyer Street which once served now demolished buildings near the shoreline, and a sea water intake structure and associated

appurtenances and piping. According to the best available information, these utilities are abandoned and will not require relocation or modification.

2.10 Traffic Impacts

The majority of the construction activities associated with the installation of the proposed CSO will occur on private land near the shoreline. The only public right-of-way directly affected by construction will be Sawyer Street, near its eastern terminus at the shoreline. The eastern 225 feet of Sawyer Street will be closed for the entire duration of the project. Only construction vehicles will be given access. This is not expected to cause any traffic problems since there are no residential or commercial facilities east of the proposed disruption that require vehicular access. However, curb side parking along Sawyer Street will likely be prohibited to allow for adequate ingress and egress to the site. During construction activities near Sawyer Street, barricades and "Road Closed" signs will be installed to restrict traffic from the eastern 225 feet of Sawyer Street. Access to the site from Coggeshall Street will be prohibited.

2.11 Construction Acquisition Strategy

In order for the design of the CSO Relocation at Area C to proceed in a cost effective manner it is necessary in the early stages of design to determine if the construction is to be self-performed by Foster Wheeler or issued for bid to local subcontractors with extensive experience in utility pipeline work of a similar nature. As indicated in the Work Plan (Section 3.5.1 Make/Buy Analysis), a set of guidelines has been developed to assist in determining the most cost-effective approach.

An analysis of the benefits and disadvantages of self-performing and subcontracting the work has been completed based upon the Make/Buy Analysis included in the Work Plan. A synopsis of this evaluation is included below.

In general, Foster Wheeler will opt to "buy" (subcontract the work) when:

- the project requirements are sufficiently well defined and measured, and there is minimal uncertainty or likelihood of change;
- when there is specialized training or skill beyond the capability of the Foster Wheeler team;
- where specialized expertise translates into a clear advantage in terms of cost, schedule or quality.

If the project should fit the above description the work will be performed under a fixed price or fixed unit rate arrangement with a detailed set of design plans and specifications prepared for bidding.

Conversely, Foster Wheeler prefers to "make" (self perform the work) when:

- work requirements are highly uncertain or subject to change;
- uniquely complex or highly hazardous work conditions exist;
- the task could potentially affect or interfere with other project activities; or
- the task is on the critical path of the project.

A meeting was held with key Foster Wheeler project team members to discuss the specific aspects of the project and to evaluate the merits of one acquisition strategy in comparison to the other. The key findings of this meeting were:

- The subsurface conditions will be reasonably well defined based upon previous work by the USACE in the area of the existing Hot Spot CDF at Sawyer Street; borings to be completed along the pipeline route; and documentation of previous land use in the area including approximate location of existing buried foundations.
- Utility construction, in particular large pipeline installation, is considered a specialty and there are numerous local subcontractors capable of performing the work cost effectively.
- The project is well defined and does not contain major components that are subject to significant change. If subcontracted under a fixed price/fixed unit rate arrangement, minor items that could change or increase (such as excavation below normal grade, disposal of excess unsuitable material, additional backfill, etc.) can be contained within unit rate items for bidding purposes.
- This work is not uniquely complex or highly hazardous and can be completed without interference with other project activities.

Based upon the above considerations it is recommended that all of the CSO work be described in a detailed set of plans and specifications and submitted to a group of pre-qualified subcontractors for competitive fixed price/fixed unit rate bidding. The proposed Bid Sheet is included in Appendix H. The pre-qualified subcontractors will be 40 CFR 1910.120 (OSHA) trained and capable of handling hazardous materials. A unit rate allowance for working in Level C will be provided within the bid form for use in the unlikely event elevated levels of personal protection are required. Foster Wheeler will provide oversight and construction quality control inspection, including review of submittals from the subcontractor and health and safety oversight. Due to the numerous uncertainties (refer to Section 2.8.2) relative to the required quantity of common fill as well as schedule uncertainties resulting from unknown duration of surcharging required, it is proposed that Foster Wheeler self-perform the stone outlet protection apron construction. Foster Wheeler's Remedial Action Work Plan (RAP) for CSO relocation will describe the means, methods, and construction sequence for construction of the apron.

The subcontractor will be required to place potentially contaminated soil and debris in roll off containers or otherwise stockpile the material for characterization. Characterization, transportation and disposal of any excavated soil and debris determined to be contaminated will be managed directly by Foster Wheeler.

In preparation for subcontracting for CSO construction, Foster Wheeler is now pre-qualifying potential subcontractors. A list of potential subcontractors has been prepared considering Small Disadvantaged Businesses and Small Businesses (SDB/SBs) that have performed this type of work in New Bedford, that have performed similar work for USACE-NAE, and that are from the New England area. Potential subcontractors will be screened for qualifications and experience, and the most qualified SDB/SB firms will receive bid packages.

2.12 Drawings and Specifications

The specifications included in this BD/DA report are included in Appendix I and are listed below:

The USACE based specifications were developed using Construction Criteria Base and SpecsIntact. They are structured with Foster Wheeler as the prime contractor and with a CSO construction subcontractor performing the work for Foster Wheeler. Following this process, subcontractor submittals are reviewed and approved by Foster Wheeler. The RAP for CSO construction and the CQCP will define the submittals for USACE review and approval.

Division 1 - General Requirements

01010 - Summary of Work
01320 - Project Schedule
01330 - Submittal Procedures
01356 - Storm Water Pollution Prevention Measures
01410 - Environmental Protection
01451 - Subcontractor Quality Control
01500 - Temporary Construction Facilities
01720 - Field Engineering
01780 - Closeout Submittals

Division 2 - Site Work

02160 - Earth Support System
02230 - Clearing and Grubbing
02300 - Earthwork
02316 - Excavation, Trenching, and Backfilling for Utilities Systems
02380 - Stone Protection and Gravel Bedding
02631 - Pre-Cast Reinforced Concrete Box Culvert
02713 - Bituminous Base Course
02769 - Protection and Modification of Existing Utilities
02821 - Fencing

Division 3 - Concrete

03200 - Concrete Reinforcement
03300 - Structural Concrete

Division 5 – Metals

05500 – Miscellaneous Metals

Division 6 – Wood & Plastics

06146 – Wood Stop Logs

Detailed Drawings are included in Appendix D and include the following sheets:

G-1 - Title Sheet
C-1 - Site Layout
C-2 - Plan and Profile
C-3 - Misc. Details
S-1 - Structural Details
S-2 - Structural Details
S-3 - Structural Details
S-4 - Structural Details