

1.0 INTRODUCTION

This Draft Environmental Impact Report (DEIR) evaluates the proposal by the Commonwealth of Massachusetts (Commonwealth) to designate the Buzzards Bay Disposal Site (BBDS) located off of Falmouth, Massachusetts. The purpose of the project is to provide a state-designated disposal site in Buzzards Bay for clean dredged material (CDM) determined to be suitable for such open-water disposal.

Designation of the BBDS is necessary to provide the full range of disposal alternatives for CDM to public and private interests in the region, particularly because upland disposal and beneficial use alternatives are limited. Based on extensive past use of the historic Cleveland Ledge Disposal Site (CLDS) and former BBDS in eastern Buzzards Bay for disposal of dredged material (Figures 1-1 and 1-2), the Commonwealth believes that designation of a new BBDS in this area should be considered before detailed investigations of other potential sites are undertaken.

This DEIR follows the scope specified in the Environmental Notification Form (ENF) Certificate issued by the Secretary of the Executive Office of Environmental Affairs (EOEA) on May 10, 1995 (See Appendix A), as well as additional requirements specified in the two NPC Certificates issued by the Secretary April 4, 1998 and May 23, 2005. State designation of the BBDS would result in the site being one of the feasible alternatives to be considered for disposal of CDM in the Buzzards Bay region. Designation of the BBDS would not constitute authorization to dispose of dredged material at the site. Rather, it establishes the BBDS as one possible solution for disposal of CDM to be considered in addition to other alternatives, such as upland disposal/reuse and beneficial use (e.g., beach nourishment, fill for development projects or landfill cover, and wetland creation or enhancement projects). Each proposed dredging project would be evaluated individually through the existing regulatory framework (summarized in Section 3.0 of this document) to determine whether open-water disposal is the least environmentally damaging practicable alternative (LEDPA).

Specific criteria are applied to the evaluation of an open-water site that would be designated for long-term disposal of dredged material. In this case, after screening a broad range of potential sites in the region, the Commonwealth is evaluating designation of a new BBDS partially within the boundary of the historically-used CLDS, and including an area south of the CLDS that also shows indications of historic dredged material disposal. Therefore, the evaluation criteria, presented in Section 3.8, were developed based on federal and state requirements relevant to historically used sites. A projected 20-year time period is being used for this evaluation. This DEIR uses detailed site characterization information from surveys conducted in the project area and also uses extensive experience gained from management and monitoring of existing open-water disposal sites throughout New England to reach a technically sound recommendation on whether designation of the new BBDS in the vicinity of the historically-used disposal sites is appropriate for the Buzzards Bay region.

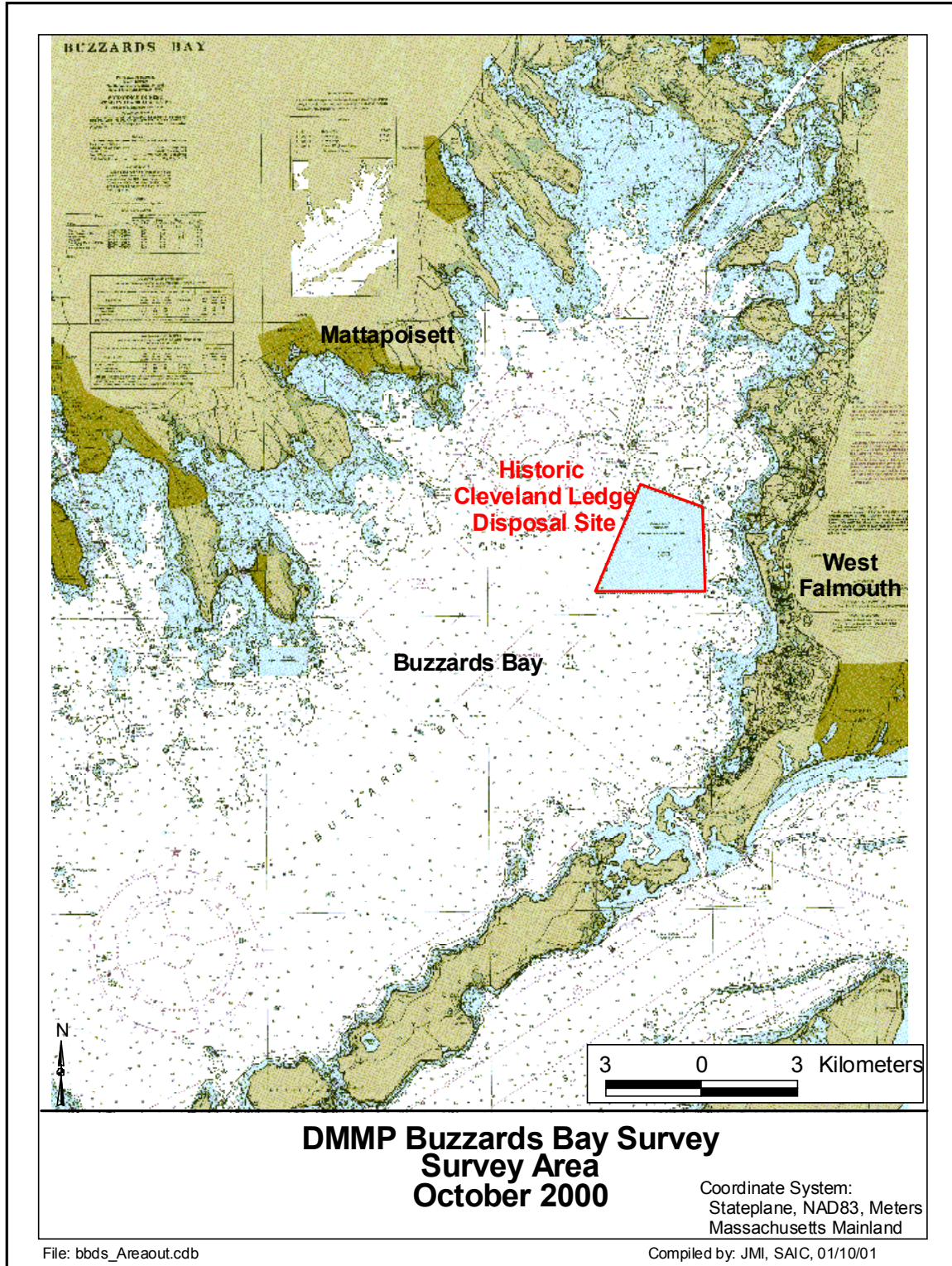


Figure 1-1. Map of Buzzards Bay showing the location of the historically-used CLDS off of West Falmouth (from NOAA Nautical Chart 13229).

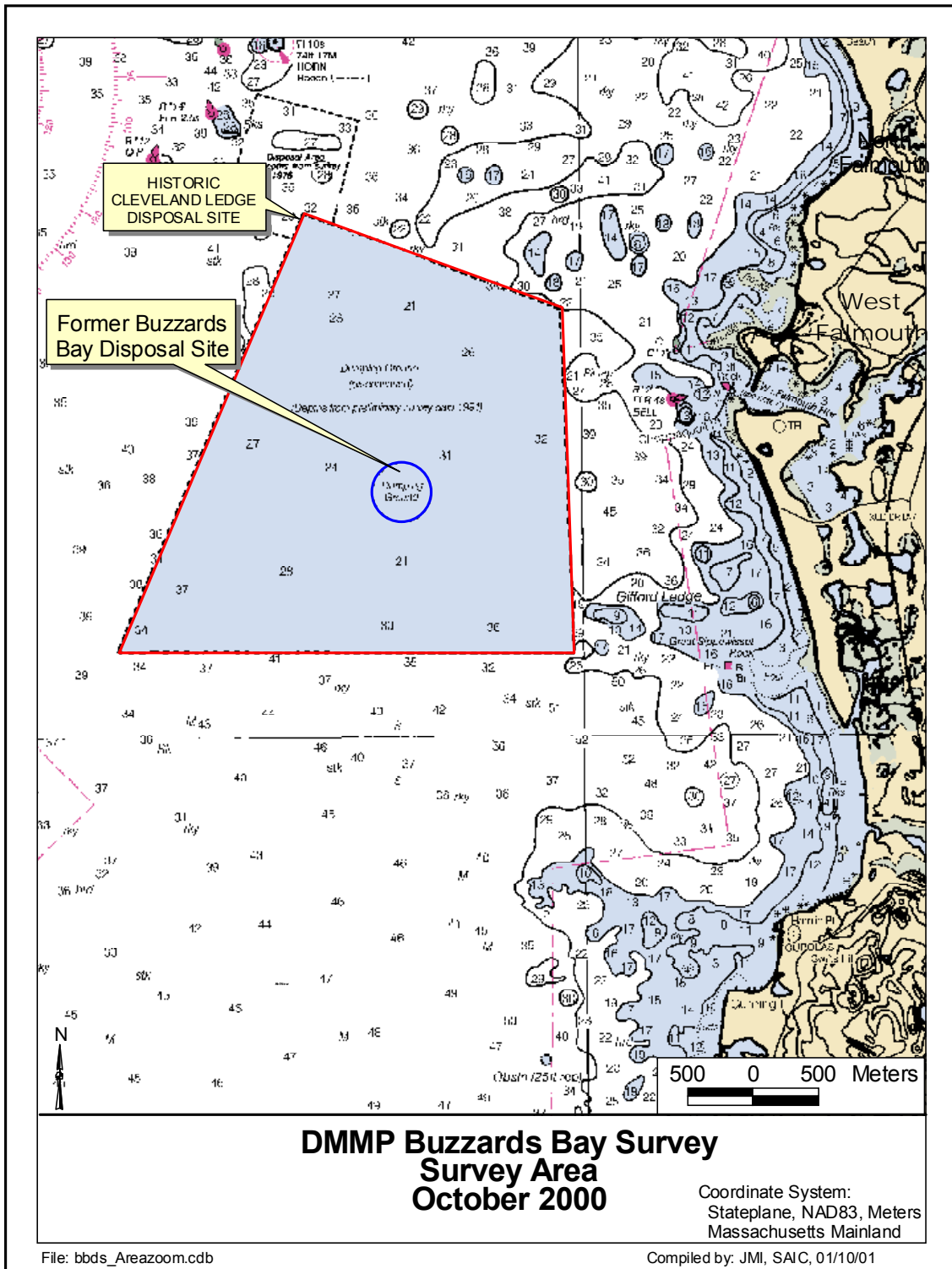


Figure 1-2. Map of the historic CLDS showing the location of the former BBDS.

1.1 Overview of the Massachusetts Dredged Material Management Plan

In an attempt to resolve impediments to shipping and economic development in the major Massachusetts port cities (Gloucester, Salem, New Bedford and Fall River), the Legislature, through the Seaport Bond Bill, directed Massachusetts Office of Coastal Zone Management (CZM) to develop a statewide dredged material management plan (DMMP). The primary goal of the DMMP is to identify disposal solutions for contaminated sediments so that the dredging of these urban harbors can be considered as a viable option for economic development of the ports. While the statewide DMMP is focused on identification of suitable disposal options for contaminated dredged material, the availability of adequate disposal options for CDM is a related issue.

First, there are extensive areas with clean sediments that require dredging by either public or private interests, and the lack of feasible disposal options hinders the economic benefits that would accrue from being able to dredge. Second, the range of solutions for disposing of contaminated dredged material includes construction of in-harbor confined aquatic disposal (CAD) cells, which are created by removing CDM from the harbor bottom to create a containment cell for disposal of contaminated sediments (Maguire 2002c). Thirdly cost-effective designated open-water disposal site alternatives are available for the clean material removed to create the CAD cells. The North Shore, Metro Boston, and the South Shore use Massachusetts Bay Disposal Site (MBDS). Cape Cod Bay dredging projects use Cape Cod Disposal Site (CCDS). No current cost-effective disposal site is designated for Buzzards Bay area CDM disposal. Designation of suitable disposal options for CDM, therefore, is one component of the comprehensive statewide plan to ensure that recreational and commercial use of the Commonwealth's waterways is maintained.

1.2 MEPA Scope for BBDS Designation

Pursuant to the advance disposal site identification provisions of the Clean Water Act (CWA) (40 CFR Part 230.80), CZM is the project proponent for site designation. The Massachusetts Department of Environmental Management (DEM), currently operating as the Department of Conservation and Recreation (DCR), the agency who was the original project proponent and who made the filings described below, will assume responsibility for maintenance and monitoring of the site following designation. The original ENF was filed on March 8, 1995, for re-designation of the former BBDS (Figure 1-2) for the disposal of clean, coarse-grained dredged material (20% or less fine-grained silt/clay fraction). The project was posted in the Environmental Monitor on March 22, 1995, with file number 10284. Following regulatory response and public comment, a Certificate from the Secretary of Environmental Affairs was issued on May 10, 1995, requiring the preparation of an Environmental Impact Report (EIR) pursuant to the Massachusetts Environmental Policy Act (MEPA). The scope for the EIR (referred to as the MEPA Scope in this document) was described in the Certificate and is transcribed below.

In response to the ENF, several agencies expressed concerns over the use of the proposed area for the disposal of dredged material. The primary concern raised was potential impacts on the marine fisheries resources in Buzzards Bay, particularly spawning habitat for winter flounder. In addition, the potential resuspension of material by bottom currents was cited as a major concern.

The Cape Cod Commission raised concerns that the proposed site does not address the long-term needs of the region, and that the designation of such a site may hinder beneficial environmental goals if open-water disposal costs are cheaper in comparison. This DEIR has been written with the intent of including sufficient information to address these concerns, as directed by the MEPA scope.

The original ENF indicated that the dredged material to be disposed at the BBDS would be restricted to coarse-grained sediment. The restriction was included because clean, coarse-grained sediment was generally considered to have limited impacts on the marine environment, and DEM was requesting a waiver for the EIR requirement. Following public and regulatory comment, the waiver was denied. Consequently, CZM assumed the role of project proponent and filed a Notice of Project Change in March 1998, proposing to designate the site for all physical categories of material suitable for unconfined open-water disposal, from fine- to coarse-grained, subject to all applicable state and federal chemical and biological testing protocols. This document, therefore, addresses use of the site for all physical categories of clean material.

Initial field data collected for the former BBDS indicated that more appropriate locations for dredged material disposal existed adjacent to the site. A full suite of field investigations, presented in this DEIR, were undertaken at these locations. As a result, an additional NPC also proposed a change from the original BBDS (the circular area located inside the boundary of the former CLDS as shown in Figure 1-2), to designation of either of two larger, rectangular areas near the former BBDS and within and adjacent to the boundary of the historic CLDS. As described in greater detail in Section 3.8, these two rectangular areas possess greater water depths and therefore have increased capacity to accept dredged material; they have been designated as Candidate sites 1 and 2 (Figure 1-3). It is these two sites that are being evaluated in this document for designation as the new BBDS.

The Secretary of Environmental Affairs identified the following MEPA Scope in the ENF Certificate (presented here as it appears in the ENF Certificate dated May 10, 1995):

- I. Preliminary Needs Analysis - Evaluate the regional need for the disposal site and the types and quantities of dredged material likely to be disposed of at the site. Include a discussion of local, regional and state dredge material use/disposal policies.
- II. Alternatives - The EIR must evaluate the potential environmental benefits/drawbacks of opening an historic disposal site versus identifying a new site. Also, discuss why the two existing designated disposal sites, the Massachusetts Bay Disposal Site (MBDS) and the CCDS [Cape Cod Disposal Site] cannot be used.
- III. Physical Site Characteristics - For the site and reference sites, provide at least the following data and analyses:
 - a) A detailed bathymetry study to determine bottom contours;
 - b) Grain size analysis;

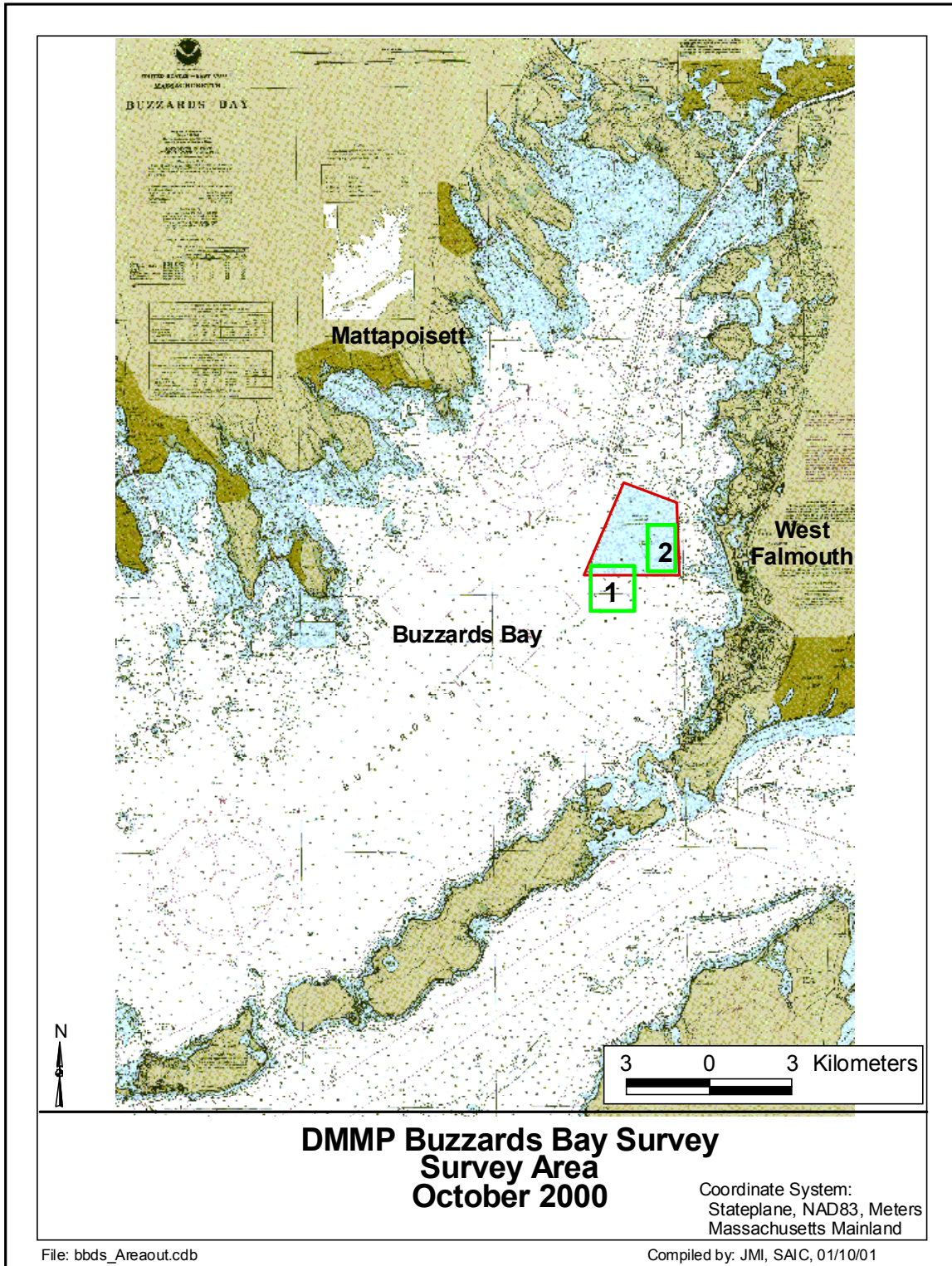


Figure 1-3. Map showing the location of candidate sites 1 and 2 in relation to the historic CLDS and former BBDS.

- c) Chemical analysis of sediment samples at three locations within each site, to establish baseline chemical conditions. The analysis should include an evaluation of the level of contaminants listed in the New England Guidance document at Table IA (heavy metals, total polychlorinated biphenols (PCBs), pesticides, polycyclic aromatic hydrocarbons (PAHs) and total organic carbon) and the 16 aromatic hydrocarbons listed at Table IB;
- d) A bottom current study which evaluates the impact of currents and storm events on the site. The study should evaluate the depositional/erosional character of the area to determine how sediment is likely to be contained or dispersed at the site; and
- e) Basic water column chemistry including conductivity, temperature and depth.

IV. Habitat Analysis – For the site and reference sites, evaluate the following:

- a) the benthic community; and
- b) the fisheries communities.

V. Biological Assessment – The EIR must also assess the significance of the site in terms of use by any rare or endangered species. This analysis must be consistent with the format required by the National Marine Fisheries Service (NMFS). Consultation with NMFS during preparation of the EIR should assure that the analysis will satisfy the State’s obligation under Section 7 of the Federal Endangered Species Act.

VI. Competing Site Use – Evaluate the impacts on recreational and commercial fishing and lobstering use of the site.

VII. Disposal Site Impacts – Evaluate the physical/chemical behavior and biological fate of disposal material and potential impacts the material may have on the biological resources found at the site and the surrounding area.

VIII. Project Mitigation – Evaluate mitigation opportunities for identified impacts which cannot be avoided. Identify the specific measures and strategies to be implemented and the parties responsible for funding and implementation.

IX. Permitting Requirements – The EIR must identify all local, state and federal permits or approvals required for the site designation and its use. Identify the requirements for each of the permits or approvals and show how the project by its siting, design and management will meet those requirements.

X. Site Management/Monitoring Plan – A management/monitoring plan must be prepared for the site which includes provisions for periodic reporting on the use and condition of the site.

- XI. Section 61 Finding – A draft Section 61 Finding must be included in the FEIR.

The Secretary’s Certificate also indicated that the EIR should provide a response to comments received in eight comment letters received in response to the ENF. The Secretary’s Certificates for the 1998 and 2005 NPCs reaffirmed the original scope, and the 2005 certificate restated the need to “investigate potential options for upland use or disposal of the dredged material,” and also directed the DEIR to investigate, “the impacts on the archaeological resources and proposed mitigation.”

1.3 Purpose and Organization of this Document

The purpose of this DEIR is to conduct a full-scale assessment of the potential impacts of designation of the BBDS before any future disposal activity is permitted. While the basic project purpose is to consider designation of the BBDS, this DEIR includes an evaluation of alternative disposal options to justify the need for an open-water disposal site. It also includes an inventory of historical open-water disposal sites in the Buzzards Bay region to catalogue and screen potential open-water alternatives. If it is determined that designation of a new BBDS in the vicinity of the former CLDS and BBDS is not feasible, the Commonwealth may perform additional studies to identify a new site. This approach is consistent with the terms of the MEPA Scope for the EIR and with the U.S. Environmental Protection Agency’s (USEPA) site designation process for the MBDS.

The organization of this DEIR follows the MEPA regulation 11.07 as modified by the Secretary of the EOEAs project scope listed above, and is organized into the following sections.

Section 1.0 - Introduction summarizes how the project facilitates the Commonwealth’s goals for management of dredged material disposal, and discusses the MEPA framework for the project and the scope and organization of the DEIR.

Section 2.0 – Need for the Buzzards Bay Disposal Site presents documentation of the regional need for an open-water disposal site, a general description of the site and its historic use, estimates of the type and quantities of dredged material that may require open-water disposal.

Section 3.0 - Alternatives Analysis discusses the approach to the analysis of BBDS by the state and federal authorities, presents an evaluation of alternatives to open-water disposal, an evaluation on the feasibility of using either of the two existing Massachusetts open-water disposal sites for the Buzzards Bay region, benefits and drawbacks of designating an historic disposal site, specific evaluation of potential alternative historic sites in Buzzards Bay, justification for selection of candidate sites 1 and 2, and presentation of the evaluation criteria to be applied to sites 1 and 2.

Section 4.0 – Physical and Chemical Characteristics of the Candidate Sites presents detailed information on the bathymetry and capacity, sediment grain size and chemistry, bottom currents and sediment resuspension potential, and water column chemistry of the candidate sites.

Section 5.0 – Biological Characteristics of the Candidate Sites presents detailed descriptions of the benthic community, fisheries resource (including finfish, shellfish, and lobster), and presence of any rare or endangered species at the candidate sites.

Section 6.0 – Human Use Characteristics of the Candidate Sites presents detailed information on the human uses and cultural resources of the candidate sites. This section includes an evaluation of commercial and recreational fisheries harvests, historical and archaeological resources, navigation and shipping, land use, air quality and noise considerations, recreational resources, economic environment, and environmental justice considerations.

Section 7.0 – Disposal Site Impacts presents an evaluation of the potential impacts from disposal on bathymetry, water quality, sediment quality, benthic communities, fishery resources, wetlands, wildlife, historical and archaeological resources, navigation and shipping, land use, air quality and noise, recreational resources, economic environment, and environmental justice.

Section 8.0 – Summary Evaluation of Candidate Disposal Site Suitability is a summary of the environmental and socioeconomic evaluations of the candidate sites based on the criteria with recommendations on the preferred alternative.

Section 9.0 – Minimization and Mitigation of Impacts presents potential mitigative measures to compensate for adverse impacts at the disposal site that are identified through monitoring.

Section 10.0 – Compliance with Regulatory Standards and Requirements for Site Users presents an overview of the current regulatory framework within which open-water disposal of CDM is evaluated. This section describes the applicable regulations associated with implementing the preferred alternatives and discusses compliance with the regulatory standards.

Section 11.0 – BBDS Management and Monitoring Plan outlines the management measures to ensure that dredged material placed at the BBDS satisfies the tiered testing protocol for classification as clean material and that disposal activities will not result in unacceptable impacts to the environmental and human use characteristics of the site. The monitoring plan specifies how the site will be monitored for physical and biological impacts following disposal events, including details of the type of monitoring to be conducted and the frequency and conditions under which monitoring requirements may be changed. The plan includes provisions for periodic reporting of use and conditions of the site.

Section 12.0 – Draft Section 61 Findings are included as required by MEPA, to outline whether the implementation of the preferred alternatives are likely to cause either direct or indirect damage to the environment. This section confirms that all practicable measures have been taken to avoid or minimize potential damage to the environment.

Section 13.0 – Response to Comments provides responses to correspondence received by MEPA in response to the BBDS ENF.

This DEIR outline ensures that the requirements of the state’s environmental policies are met as modified by the specific project Scope provided in the EOE ENF Certificate.

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2.0 NEED FOR THE BBDS

In accordance with MEPA Scope Item I, this section of the DEIR presents information to justify the need for an open-water disposal site in the Buzzards Bay region and information on whether site designation and its use is consistent with current policies and regional plans. Section 2 includes the following:

Section 2.1: Background information on Buzzards Bay water plane uses;

Section 2.2: A description of the historical dredged material data resources referred to in this study;

Section 2.3: Dredging needs by town;

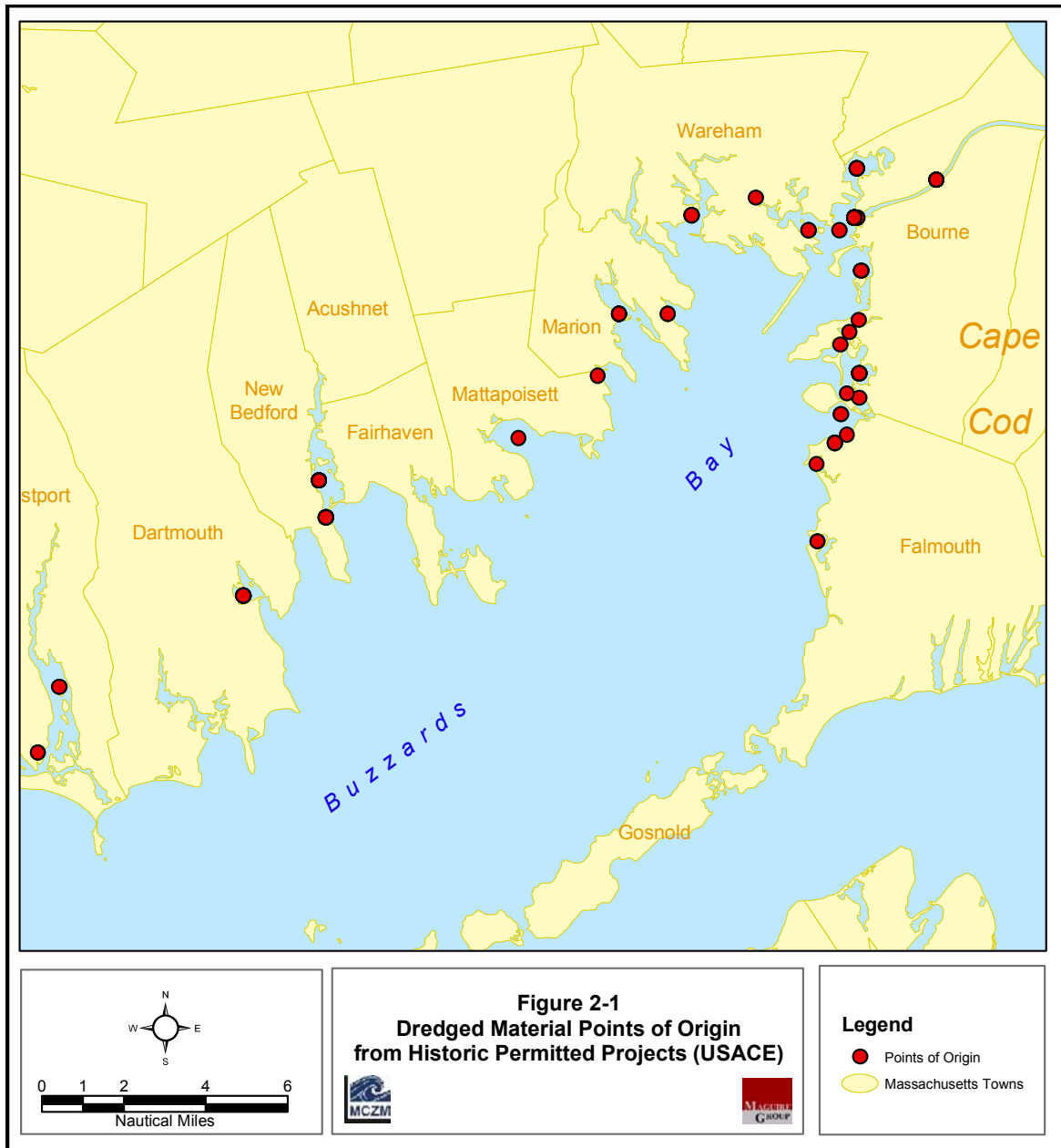
Section 2.4: Dredging needs by region; and

Section 2.5: Estimated 20-year dredging need for the Buzzards Bay region

2.1 Background

Buzzards Bay and its surrounding harbors and waterways support numerous and diverse boating uses. As the gateway to the Cape Cod Canal (the Canal) for industrial traffic to and from ports north of Cape Cod, the bay serves as a corridor for barges, tankers, and freighters. With the proximity of commercial and recreational fishing grounds, the harbors of New Bedford, Fairhaven, Westport and Woods Hole support significant commercial fishing fleets. Additionally, the region's 17 coastal and non-coastal towns and 27 major embayments serve a large recreational maritime community (Maguire 1997a). Many of these waterways require periodic dredging to remove material that accumulates over time and causes shoal conditions. The loss of adequate water depth in ports, harbors, and channels can reduce the availability of moorings and subject recreational and commercial boats to tidal delays in accessing moorings, boat ramps, or docks and piers. In extreme cases, shoaling can cause vessel groundings or, in larger ports like New Bedford, impose constraints on the ability to attract and maintain marine-related industries because of the lack of adequate depths. Shoaling is the result of the transport of upland material through a river or runoff, the resuspension and redistribution of marine sediments, or a combination of both. It is a natural process that characterizes waterways everywhere. As illustrated in Figure 2-1, all of the communities around Buzzards Bay have dredged their waterways in the past. A list of the historic projects developed by the US Army Corps of Engineers New England District (NAE) from permitting and construction records is included in this DEIR as Appendix B.

The purpose of the needs analysis is to determine whether there is a demonstrated need for an aquatic disposal site to accommodate clean material dredged from waterways in the Buzzards Bay region. CZM has surveyed local waterways officials and determined that the lack of a cost-effective environmentally responsible aquatic disposal site currently prevents the dredging of a number of Buzzards Bay region waterways. The results of our conversations with these officials are described in Section 2.2 below.



In addition, to try to understand how much dredging has occurred in the past around Buzzards Bay and to see if that information is helpful in quantifying the projected future need for a disposal site, the DEIR incorporates the material and results of an analysis performed for CZM that used historical records as the basis for future projections. The results, while generally informative, were subject to a range of factors that affect their utility:

- Accuracy of records;
- Extent of database (from early 1900s) meant the project history included volumes from construction or significant improvements made to most waterways through the mid-1900s;
- The Canal skewed results for both volumes and type of material;

- Earlier projects were not subject to environmental review and more stringent environmental permitting has been in place only since the early 1970s. This exaggerated the frequency of earlier dredging when the data was used to project future volumes; and
- The records did not consistently identify the type of material dredged or the location of its disposal. Because some assumptions must be made about percentages of sandy versus silty material and the location of disposal, projections could only be estimates.

Therefore, while we have provided the results of that analysis below, estimates of future need based on historical information were extremely imprecise. The final volume estimate of approximately 2 million cubic yards (cy) over 20 years used as the basis for this site designation was based on best professional judgment that incorporated the projections based on historic use, the current survey of local officials, and conversations with state officials who fund and construct dredging projects. The actual volume of material proposed for disposal at the site will be a function of the number of dredging projects that seek permits over time.

An additional factor that complicated the development of historically based projections was that these records did not always indicate whether the material was fine or coarse-grained. While there will continue to be projects, both at the Canal and in some channel mouths that need to dredge sand, sand can be beneficially and economically reused as beach nourishment. Therefore, as discussed in greater detail below, the Commonwealth discourages the aquatic disposal of sand as the waste of a valuable resource; moreover, the economics of dredging sand for all projects except the Canal generally work to ensure that aquatic disposal does not occur. Note that in the communications from Buzzards Bay area waterways officials, the areas that have not been dredged are areas of silty material. Use of sand on local beaches is considered both practical and economical. If designated, the site may be used for some volume of sand dredged from the Canal (particularly if the need arises for emergency dredging in the western half of the Canal), but the Commonwealth has initiated a sand-management study with the NAE, and expects that the volume of Canal sand placed on local beaches will increase dramatically with time. Therefore, the needs analysis anticipated that the primary need is for an aquatic disposal site to accommodate fine-grained sediments unsuitable for beach nourishment.

As described in greater detail in Section 11.0, below, the site management plan is designed to provide a disposal alternative that meets a demonstrated, but imperfectly defined, need while ensuring that actual site use is controlled and managed to minimize impacts. Site use, and the volumes actually disposed of at the site, will be controlled by the management plan. Because capacity is initially established at 2 million cy, and because estimates of site use will become more definite when the site is designated and projects have access to a feasible alternative, the management plan is designed to:

- 1) Cap the site capacity at 2 million cy, subject to reassessment based on the results of environmental monitoring, site use, and continued demonstration of need;
- 2) Designate the entire site boundary, but restrict disposal to sub-areas that can be expanded within the overall site in response to demonstrated future need; and
- 3) Formally reassess overall site capacity based on post-designation site use when 500,000 cy (25% of initial designation capacity) has been disposed of at the site.

Taken together, these measures will support an ongoing site management approach sensitive to both need and the minimization of impacts.

2.2 Data Resources

Several resources were used to compile the information summarized in this report. For historical information in specific towns, data compiled by the DEM (1995) were drawn from extensively, as well as information gathered during DMMP Phase I (Maguire 1997b). Regional historical information for Buzzards Bay and New Bedford were collected from DEM (1995), and two compilations from the New England District of the NAE (USACE-NAE 1995, 1996). For historical disposal records at the BBDS, the DEM reference and reports specific to BBDS (SAIC 1989; SAIC 1991; Maguire 1997b) were utilized.

For baseline projected volumes, the results of a needs assessment conducted in 1985 for the following decade (SAIC 1985c), as well as the DEM (1995) reference, were used. The data compilations and needs analysis conducted by NAE (1995, 1996) were useful for the major contributors of dredged material (Cape Cod Canal and New Bedford region). Much of the data for Bourne was compiled from the dredging needs study specific for that town (Bourne 1995). For the final estimates, the projections based on historical use were used as a guide to establish potential future volumes. These figures were amended based on a survey of local waterways officials who provided qualitative information about current dredging needs in their waterways.

There are some caveats to consider in the data collected for the needs analysis. Dredged material estimates for both historical and predicted volumes were averaged over the period of time summarized in order to provide an annual average that could be referenced and compared. The two most comprehensive historical references were averaged over 50 years (USACE-NAE 1995; DEM 1995). Although the DEM data (1995) were provided for the years 1920 to 1992, they were averaged over a period of 50 years, as the information prior to the 1940s was relatively unreliable (USACE-NAE 1995). Several other references provided data for a much shorter period of time, including ten years spanning 1985 to 1995 (SAIC 1985), 20 years spanning 1996 to 2016 (USACE-NAE 1996), and a "few" years for Bourne, interpreted here as 1995 to 2000 (Appendix B). The result is that the annual averages were generally smaller for data averaged over a longer time frame.

The values summarized for the historical annual average volumes were often smaller than the projected needs, except for the larger projects (Canal, New Bedford, and Westport). Higher reported values for projected needs were partially a result of shorter periods over which the annual data were averaged, as discussed above. Additionally, the projected needs information often represented projects that may have been delayed for some time and therefore reflected an accumulation of material that had a relatively larger volume but a shorter-term need. Finally, the historical volumes reported for the three largest project areas (Canal, New Bedford, and Westport) included large volumes of new and improvement material, and therefore skewed the analysis of maintenance dredging needs for the region. These factors were taken into account when assessing overall dredging needs for the region.

2.3 Dredging Needs by Town

All of the volumes discussed below, unless otherwise noted, are annual averages, in units of cy per year. The information for the towns in the Buzzards Bay region is summarized on Table 2-1. This table does not include the towns of New Bedford/Fairhaven and Westport because of the large volumes from those regions. They are included in a discussion of the major regions within Buzzards Bay (Section 2.4). A compilation of both town and region data is provided in Section 2.5. Material types are referenced here; a more complete discussion is provided in Sections 3.0 and 4.0.

Note that the projected figures do not always correspond with the town summary figures. Not all project referenced by local sources were identified in the initial needs analysis, and vice versa.

Bourne. In all of the areas of Bourne (Table 2-1), the historical data were compiled from estimated and actual projects (i.e., Buttermilk Bay) and the annual historical average summed over all the individual projects was over 6,000 cy (DEM 1995; Maguire 1997b). This summary included the actual volume dredged from Buttermilk Bay in 1983, but averaged over a 50 year time frame. The projected need included many more areas primarily derived from the Bourne (1985) summary report, and ranged from 15,000 to 21,000 cy per year over the next few years. The annualized regional estimate of dredging need over the period 1985 to 95 for Bourne was 61,000 cy (SAIC 1985). To estimate the total annual volumes required for dredging from the Bourne area, the minimum estimated value was used (15,493 cy per year), primarily because the higher volumes represent the accumulation of immediate dredging needs, whereas the longer term requirements will probably be closer to the derived historical value (6,096 cy). Most of the reported Bourne material was sand with a secondary component of gravel and fine-grained sediment and one description of "muck" from Queen Sewell Cove.

Last report – Bourne has “many small projects and several large projects” that include small to medium quantities of fine-grained material that would benefit from an aquatic disposal site (Town Engineer, personal communication, 2004). Red Brook Harbor, Hens Cove, Hospital Cove area requires 15,000 to 20,000 cy dredging; 4,000 cy of silty material that needed dredging in Buttermilk Bay was left in place for lack of a disposal option (Superintendent of Cape Cod County Dredge Program, personal communication, 2004).

Dartmouth. Two areas of Dartmouth were identified as potential dredged material sources. Historical information (DEM 1995) from Allen's Harbor resulted in an average of 3,921 cy per year, averaged over a period of 50 years. Projected needs for individual projects in Dartmouth were only available for South Dartmouth. The regional projected need predicted over the period 1985 to 1995 was only slightly greater than the historical estimate (5,000 cy per year; SAIC 1985). This value was used for the annual estimated predicted needs for this town. The physical sediment in the Dartmouth harbors was reported as a combination of sand and mud.

Last report – There are “several areas” in Dartmouth that need to be dredged in the future (Selectman and Town Administrator, personal communication, 2003).

Table 2-1. Annual average dredged material volume summary by town (excluding New Bedford/Fairhaven and Westport).

Town	User	Historical			Projected			Material Type	Reference
		Volume (cy)	Time Period	Annual Average (cy)	Volume (cy)	Time Period	Annual Average (cy)		
Bourne									
User estimates	Buttermilk Bay (historical)	74,100	'20-'92 (*)		10,600	'95-'00 (**)	2,120	sand	DEM 1995, Bourne
	Buttermilk Bay (actual)		1983						1995 Maguire 1997b
	Total Buttermilk Bay	84,154	'20-'92	1,683					
	Buzzards Bay	72,441	'20-'92	1,449				sand, silt, clay	DEM 1995
	Phinney's Harbor	1,270	'20-'92	25	10,000	'95-'00	2,000	sand	DEM 1995, Bourne 1995
	Red Brook Harbor	146,918	'20-'92	2,938				sand, gravel	DEM 1995
	boatyard, marina				1400 – 2,000+	'95-'00	80 – 200+	sand, silt	Bourne 1995
	Gray Gables Cove				15,000	'95-'00	3,000	fine sand w/some silt	Bourne 1995
	Hospital Cove Channel (bouy 6 to can 1)				25,000 – 50,000	'95-'00	5,000 – 10,000	sand	Bourne 1995
	Monk's Park				200 – 500	'95-'00	40 – 100		Bourne 1995
	Current River	395	1984		5,213	'95-'00	1,043	mud	Maguire 1997, Bourne1995
	Queen Sewell Cove				10,000	'95-'00	2,000	muck	Bourne 1995
	South Channel (bouy 14 to bouy 6)				50 – 100	'95-'00	10 – 20	gravel, rocks	Bourne 1995
<i>Annual total, user estimates</i>		305,178		6,096			15,493 – 20,683		Summary of above
<i>Regional estimate</i>					610,470	'85-'95	61,047	sand	SAIC 1985
Town Annual Average				6,096			15,493		
Dartmouth									
User estimates	Allen's Harbor	196,072	'20-'92	3,921	2,200	'85-'95	220	sand	DEM 1995
	S. Dartmouth							silt, mud	SAIC 1985
<i>Annual total, user estimates</i>				3,921					
<i>Regional estimate</i>					50,000	'85-'95	5,000		SAIC 1985
Town Annual Average				3,921			5,000		
Falmouth									
User estimates	Falmouth Harbor	168,840	'20-'92	3,377	102,150	'85-'95	10,215	sand, gravel	DEM 1995, SAIC 1985
	E. Falmouth				5,000	'85-'95	500	sand, silt, clay, gravel	SAIC 1985
	N. Falmouth				400	'85-'95	40	sand	SAIC 1985
	Woods Hole Ferry Terminal	800	1989						Maguire 1997b
	Little Harbor	1,733	'20-'92	35					DEM 1995
	Cataumet				200	'85-'95	20		SAIC 1985
Town Annual Average				3,411			10,775		
Marion									
User estimates	Wing's Cove	9,995	'20-'92	200					DEM 1995
	Sippican Harbor	65,635	'20-'92	1,313				sand, silt, gravel	DEM 1995
	Aucoot Cove	1,800	'20-'92	36				sand, gravel	DEM 1995
<i>Annual total, user estimates</i>				1,549					
<i>Regional estimate</i>					10,080	'85-'95	1,008		SAIC 1985
Town Annual Average				1,549			1,008		
Mattapoisett									
User estimates	Mattapoisett Harbor	600	'20-'92	12					DEM 1995
<i>Regional estimate</i>					200	'85-'95	20		SAIC 1985
Town Annual Average				12			20		
Wareham									
User estimates	Onset	8,300	'20-'92	166	1,000	'85-'95	100	sand	DEM 1995, SAIC 1985
<i>Regional estimate</i>					6,000	'85-'95	600		SAIC 1985
Town Annual Average				166			350		
Annual Total by Town				15,155			32,646		

*For the DEM (1995) reference, the historical values (1920-1992) were averaged over a period of 50 years.

**The Bourne (1995) reference indicates that the needs are for a "few years." For the purpose of annual averages, a time frame of five years was used.

For references, see text.

Falmouth. The annual average for historical dredged material volumes in the Town of Falmouth was 3,411 cy per year, which was dominated by the volumes dredged from Falmouth Harbor. The projected future need, again with the majority from Falmouth Harbor, was about three times higher than the historical estimate (10,775 cy), averaged over the period 1985 to 1995 (SAIC 1985). This value was used for the project annual need for the town, although it is likely overestimated, again due to the short time frame (ten years) over which the estimate was derived. The grain size information provided for Falmouth indicated dominance by coarse grain size (sand and gravel). There was no overall regional estimate available for Falmouth.

Last report – Falmouth Inner Harbor (small/medium size project), West Falmouth Harbor (small/medium), Child’s River (potentially large) require dredging. Due to lack of a feasible disposal option for these projects, more specific estimates of volumes have not been developed. (Harbormaster, personal communication, May 2004)

Marion. Historical data available for the Town of Marion were limited to the DEM (1995) report. The annual average calculated for the three areas requiring dredging (Wing’s Cove, Sippican Harbor, and Aucoot Cove) resulted in an annual average of 1,549 cy per year, which was slightly higher than the value estimated for Marion in the 1985 needs analysis (1,008 cy, SAIC 1985). This value (1,008 cy per year) was used for the town annual summary of dredging needs for Marion. The reported grain sizes were sand, gravel, and silt.

Last report – One undefined project will require dredging (Harbormaster, personal communication, 2004). The town denied a recent request by a marina to place dredged material at the town landfill (Town Administrator, personal communication, 2003).

Mattapoisett. Mattapoisett Harbor requires dredging of small volumes. As in Marion, historical data (12 cy averaged over 50 years) were consistent with the projected need over a ten year period (20 cy per year), which was used for the total town annual projected needs estimate. No grain size data was reported in the needs analysis for Mattapoisett.

Last report – No need. Most dredging needed is around piers and can be removed by excavator and disposed of at the town disposal site (Harbormaster, personal communication, 2003).

Wareham. Historical information from DEM suggested that Onset Harbor is the major area in Wareham that requires occasional dredging. The historical value summarized for Onset averaged over 50 years was 166 cy. Two sources of information for projected needs ranged from 100 cy annually for Onset, to 600 cy for the Wareham region. The summary value used for Wareham was taken from the average of the two predicted estimates (350 cy per year), which was only about twice that of the historical estimate. Again, sand was the major grain size from Onset Harbor.

Last report – “Long list” of potential projects (Harbormaster and Town Planner, personal communication, 2003). Formal applications for state dredging assistance under the Rivers and Harbors Program have been submitted for Shell Point, Wareham River and Onset Bay (Design Engineer, Waterways Office of Division of Conservation and Recreation, personal communication, 2004).

Summary by Town. Excluding the towns of New Bedford/Fairhaven and Westport, the total annual estimated volume needs for the Buzzards Bay region was 32,646 cy per year. This value was approximately twice the historical summary of dredged volumes (15,155 cy per year). The value of 32,646 cy per year was incorporated into the Buzzards Bay regional needs assessment (Section 2.5).

2.4 Dredging Needs by Region

All of the volumes discussed below, unless otherwise noted, are annual averages, in units of cy per year. The information for the regions of Buzzards Bay, and the towns of New Bedford/Fairhaven and Westport, is provided on Table 2-1. A compilation of both town (Section 2.3) and region data is provided in Section 2.5. Material types are referenced here and a more complete discussion is provided in Sections 3.0 and 4.0.

The Canal. Two types of dredging volume estimates were identified for the Canal: individual project information and total summary volumes. Because much of the material from the Canal has historically gone to alternate disposal sites (including the CCDS), an estimate of 50% of the material was used for an estimate of material designated for disposal at BBDS. All of the material from the Canal was assumed to consist of sand.

Three individual dredging projects were summarized in Table 2-2: two projects in the 1980s and one project (announced in April 1998) in the 1990s. The project information, averaged over the ten-year period of those two decades, resulted in a consistent 10,000 to 11,000 cy per year estimate for dredging of the Canal. This value was also consistent with the needs analysis survey conducted in 1985 for the ten-year period between 1985 and 1995 (SAIC 1985).

The value of 10,000 cy per year obtained from individual project information was one to two orders of magnitude smaller than the regional estimates provided by the DEM (1995) and NAE (1995). For historical dredged material volumes from the Canal, an average of 1.4 million cy per year was calculated based on DEM and NAE estimates. These 50-year estimates included the material dredged from the excavation of the Canal; therefore, they were less representative of maintenance dredging needs than the project information. The projected need, however, was reported by NAE to be 692,700 cy per year over the period of 1995 to 2045. This value did not include material dredged from the east end. The NAE value was selected for inclusion in the Buzzards Bay regional needs database, indicating that the project information summed over the decades of 1980 and 1990 was not representative of the actual future needs. A final value for the annual volume projected to be dredged from the Canal and disposed of at BBDS, assuming 50%, was 346,350 cy per year.

Mashpee. Mashpee River (24,000 cy) and Ockway Bay (26,000 cy) both require dredging silty material (Waterways Committee, personal communication, 2004).

Cape Cod Islands. Two harbors in the Cape Cod Islands region were considered to be potential sources of material to the BBDS: Cuttyhunk and Nantucket. For Cuttyhunk, an historical annual estimate of 8,115 cy was reported by DEM (1995), and 15,000 cy for Nantucket was reported by NAE (1995) for a total regional historical estimate of 23,115 cy per year. The projected needs for Cuttyhunk (20,000 cy per year; SAIC 1985) and Nantucket (12,980 cy per year; NAE 1995)

Table 2-2. Annual average dredged material volume summary by region.

Region	User	Historical			Projected			Material Type	Reference
		Volume (cy)	Time Period	Annual Average (cy)	Volume (cy)	Time Period	Annual Average (cy)		
Canal									
Project estimates	Canal	37,151	1980						Maguire 1997b
	Mass Maritime Academy	72,448	1985						SAIC 1989
	Canal, east/west mooring basins	2,200	1986						Maguire 1997
	<i>Project Summary, 1980s</i>	111,799	1980's	11,180					
Region estimates	Hog Island Channel/East Mooring Basin				100,000	1990's	10,000	sand/gravel	Bid# DACW33-98-B-0008(4/98)
	<i>Project Summary, 1990s</i>								
	Canal, all	69,432,000	Past 50 years	1,388,640	34,635,000	'95-'45	692,700	sand	NAE 1995
	Canal, all	71,310,198	'20-'92 (*)	1,426,204	100,000	'85-'95	10,000	sand	DEM 1995, SAIC 1985
Region Annual Average Estimate to BBDS**		70,371,099		1,407,422			692,700		
				703,711			346,350		
Cape Cod Islands									
	Cuttyhunk	405,748	'20-'92	8,115	200,000	'85-'95	20,000	sand	DEM 1995, SAIC 1985
	Nantucket	750,000	Past 50 years	15,000	649,000	'95-'45	12,980		NAE 1995
	<i>Annual user estimates</i>	1,155,748		23,115			32,980		
	<i>Region estimate</i>				500,000	13 years	38,462		DEM 1995
Region Annual Average		1,155,748		23,115			35,721		
New Bedford-Fairhaven									
New Bedford	New Bedford (DEM 1995)	4,371,819	'20-'92	87,436	200,000	'85-'95	20,000	sand, clay, gravel	DEM 1995, SAIC 1985
	New Bedford (USACE-NAE 1995)	6,431,000	Past 50 years	128,620	5,072,000	'95-'45	101,440		NAE 1995
	<i>Average, New Bedford</i>	5,401,410		108,028			60,720		
	Fairhaven				9,000	'85-'95	900	sand, silt, clay, gravel	SAIC 1985
	Acushnet River (DEM 1995)	1,168,500	'20-'92	23,370				Sand, silt, clay, gravel	DEM 1995
	Acushnet River (USACE-NAE 1995)	1,123,000	Past 50 years	22,460	9,000	'95-'45	180		NAE 1995
	<i>Average, Acushnet River</i>	1,145,750		22,915			180		
Annual, user estimates		6,547,160		130,943			61,800		
	<i>Region estimate</i>				1,767,664	'96-'16	88,383		NAE 1996, Maguire 1997b, SAIC 1989
Region Annual Average Estimate to BBDS**		6,547,160		130,943			75,092		
				26,189			15,018		
Westport									
	Westport Harbor	42,042,850	'20-'92	840,857					DEM 1995
	Westport River	66,440	'20-'92	1,329				sand	DEM 1995
Annual user estimates				842,186					
Annual Total by Region				1,595,200			397,089		
Annual Total by Town***				15,155			32,646		
Annual Total to BBDS				1,610,356			429,735		
Buzzards Bay Region									
	<i>Regional estimates</i>	77,800,000	Past 50 years	1,556,000	41,000,000	'95-'45	820,000		NAE 1995
					1,000,000	16 yr.	62,500		DEM 1995
Regional Annual Total		77,800,000		1,556,000			441,250		
Historical Deposition at BBDS									
		112,500	'79-'84	22,500					SAIC 1989
		120,336	'79-'90	10,940					SAIC 1991

*For the DEM (1995) reference, the historical values (1920-1992) were averaged over a period of 50 years.

**The Bourne (1995) reference indicates that the needs are for a "few years." For the purpose of annual averages, a time frame of five years was used. For references, see text.

resulted in a total future volume estimate of 32,980 cy per year. DEM (1995) estimated a regional need of 38,462 cy per year for Cape Cod Islands, which was consistent with the summary of the Cuttyhunk and Nantucket estimates. The final estimated volume from this region for disposal at BBDS was calculated as an average of these two values (35,721 cy per year). All of the material from Cape Cod Islands was assumed to be sand.

New Bedford-Fairhaven. Extensive data were available for total volumes of material requiring dredging from the Acushnet River and New Bedford Harbor (Table 2-2). The volumes that would potentially be suitable for open-ocean disposal at BBDS, however, were unknown at the time of this report. Sampling from the DMMP program is currently planned for New Bedford Harbor. As the volume estimates are classified as to suitability, these data will be included in the needs assessment. For the purposes of this report, total volumes are provided, and an estimate of 20% of the material was included for as potentially contributing to the regional need for an open-water disposal site (estimates include improvement material).

Two primary sources of information were available for assessing the historical volumes of material dredged from New Bedford Harbor and the Acushnet River (Table 2-2). Estimates for New Bedford Harbor ranged from 4.4 million to 6.4 million cy (DEM 1995; NAE 1995). These estimates were averaged over 50 years and an average annual historical volume was calculated from the two estimates, resulting in 108,028 cy per year dredged annually from New Bedford Harbor alone. In the same way, an average of 22,915 cy was calculated for an average volume dredged from the Acushnet River. No historical information was available for Fairhaven, so that the sum of annual average of historical dredging volumes in the New Bedford region was 130,943 cy. The estimated historical volume that was suitable for open-ocean disposal, assuming 20% of the total volume, was 26,189 cy per year.

Several references were available for projected volumes requiring dredging from the New Bedford region (SAIC 1985, 1989c; DEM 1995; USACE-NAE 1995, 1996; Maguire 1997b). The estimates for New Bedford Harbor ranged from 20,000 cy (SAIC 1985) to 100,440 cy (USACE-NAE 1995). An average value of 60,720 cy was used for the annual average value summary (Table 2-2). The survey conducted in 1985 resulted in a predicted 900 cy per year requiring dredging from Fairhaven (SAIC 1985). For the Acushnet River, NAE (1995) estimated an annual average of 900 cy. The sum of estimates for the New Bedford region project needs was 61,800 cy per year. This value was consistent with the value predicted over the next 20 years, as referenced by the DMMP Phase I needs document (Maguire 1997b), of 88,383 cy per year. Averaging these two estimates, the total average of projected dredging volumes for the future in the New Bedford region resulted in 75,092 cy per year; the value potentially suitable for disposal at BBDS (assuming 20%) was 15,018 cy. This value was slightly more than half of the historical value (26,189 cy), which is not surprising considering the historical records include improvement dredging of New Bedford Harbor.

Last Report – CAD cells have been designated by the state as an approved disposal site for contaminated materials. The city is currently planning upcoming dredging work. An application for state dredging assistance under the Rivers and Harbors Program has been submitted for West Island Channel in Fairhaven (Design Engineer, Waterways Office of Division of Conservation and Recreation, personal communication, 2004).

Westport. The only dredging information located for Westport indicated that a large volume was dredged historically (42 million cy), resulting in an average of 840,000 cy per year. No projection data were available to assess the dredging cycle; therefore, the regional needs assessment value does not incorporate any information from Westport.

Last report – Most projects are sand and the town will use the material on Horseneck Beach or other sections of the barrier. Where material may be silty, town would look to BBDS (Town Dredging Committee member, personal communication, 2003).

Summary by Region. Including the towns of New Bedford/Fairhaven and Westport, the total annual estimated volume needs for the larger regions within Buzzards Bay was 397,089 cy per year. This value was four times less than the historical summary of dredged volumes (1.6 million cy per year). This was consistent with the historical values reflecting improvement projects. The volume estimates are considered to be fairly robust over the available data sources. The highest source of error will be in the estimates of the actual volumes disposed of at BBDS because of the assumptions for the Canal and New Bedford Harbor. The value of 397,089 cy per year was incorporated into the Buzzards Bay regional needs assessment (Section 2.5).

2.5 Estimated 20-Year Dredging Need for the Buzzards Bay Region

Combining the projected annual volume to be dredged from the towns of Buzzards Bay, excluding New Bedford/Fairhaven and Westport (32,646 cy per year), and from the larger regions within Buzzards Bay (397,089 cy per year), resulted in a total estimate of 429,735 cy per year to be dredged and disposed of at the BBDS in the next 20 to 50 years (Table 2-2). The database indicated that 80% of this volume was from the estimate developed for the Canal, which was slightly less than the estimate of the NAE (84%; 1995). This discrepancy was partially due to the fact that the NAE estimate for the Canal did not include the east end (most likely deposited in Cape Cod Bay). The large volume dredged from the Canal obviously will dominate the potential need for the BBDS. The estimate summarized for the Canal is considered to be a minimum estimate, considering that only 50% of the material was assumed to be disposed of at the BBDS. The next highest volume was calculated from the Cape Cod Islands (35,721 cy per year), followed by the Bourne (15,493 cy per year) and the New Bedford (15,018 cy per year, again assuming 20% suitability) regions.

The total annual volume calculated for the Buzzards Bay needs assessment from the individual towns and regions were next compared with regional estimates calculated by the DEM and NAE. The BBDS regional estimates varied widely, from an estimate of 1 million cy over the next 16 years (62,500 cy per year; DEM 1995) to an estimate of 41 million cy over the next 50 years (820,000 cy per year; NAE 1995). Calculating an average of these estimates, however, resulted in a value extremely consistent (441,250 cy per year) with the value estimated using the method of summing over the individual towns and projects (429,735 cy per year). The two values were within 5%.

Finally, the historical information of material disposed at the BBDS was summarized for comparison to the regional needs information. The estimates ranged from an average of 22,500 cy from 1979 to 1984 going to the BBDS annually from "various small harbors and river channels throughout the Buzzards Bay region" (SAIC 1989) to 10,940 cy per year estimated

between 1979 and 1990 (SAIC 1991). These values are consistent with both the historical estimate of material from the small towns in the Buzzards Bay region (15,155 cy per year) and the predicted future volumes (32,646 cy per year).

Estimates of future dredging needs were derived from historical records of dredging projects for the region. The historical dredging database was obtained from the NAE and included quantities of material dredged by town and/or region for the period 1920 to 1993. The total volumes of material dredged during that period were used to calculate annual average volumes of material dredged. Annual average volumes were computed for each town in the region, miscellaneous projects from the Buzzards Bay region (i.e., not specified by town), and the Cape Cod Islands (Cuttyhunk and Nantucket). These values were multiplied by a factor of 20 to calculate the 20-year projected dredge material disposal volume. The estimate for the Canal was derived from the NAE estimate of maintenance dredging volumes, which consisted of 200,000 cy dredged once every six years, and takes into account that approximately one third of the material would likely be transported east for disposal at the CCDS. Most of the sediment requiring dredging in New Bedford Harbor is likely to be classified as unsuitable for open-water disposal due to elevated contaminant levels. However, the subsurface sediment to be dredged in constructing the proposed CAD cells within this harbor was assumed to be suitable for open-water disposal. The volume of this material requiring disposal at the BBDS over a 10-year time frame was estimated to be 960,000 cy (Maguire 2002c).

The NAE historical dredging records provided a rough estimate of the percentage of dredged material that may be used for upland disposal and/or beach nourishment. Based on a review of the records for the Buzzards Bay region from 1920 to 1993, for projects where both the disposal location and the grain size were indicated, roughly 93% of the material dredged consisted of sand, roughly 25% of all material dredged was disposed in an upland location and/or used for beach nourishment, and 75% of all material was disposed of at an open-water site. Using all records for which the disposal site was reported (i.e., including records that did not specify the grain size), roughly 35% of all material dredged was disposed at an upland location and/or used for beach nourishment, and 65% was disposed at an open-water site. Based on past practices, it would be reasonable to assume that roughly 25% to 35% of all material dredged in the Buzzards Bay region may be disposed in an upland location or used for beach nourishment. However, as discussed above, the quantity of sandy material that may actually be disposed of in the future is likely to be significantly less than a projection extrapolated from historical use.

Table 2-3 shows the historical disposal volumes from 1920 to 1993, the annual average disposal volumes calculated from that historical total, and the projected 20-year volumes. The NAE database used for historical records presents the volumes in cy; projected volumes are also calculated in cubic meters to facilitate comparisons with disposal site capacity in Sections 3.0 and 4.0.

Table 2-3. Estimated 20-year dredging need for the Buzzards Bay region.

Municipality/ Area	1920-1993 Historical Total (yd ³)	Historical Annual Average (yd ³)	20-Year Projection (yd ³)	20-Year Projection (m ³)
Bourne	65,800	901	18,020	13,777
Dartmouth	11,652	160	3200	2447
Fairhaven	75,700	1037	20,740	15,857
Falmouth	404,955	5547	110,940	84,820
Marion	76,330	1046	20,920	15,994
Mattapoisett	600	9	160	122
Wareham	51,083	700	14,000	10,704
Westport	147,290	2018	40,360	30,857
Buzzards Bay region	(73,292)	1004	20,080	15,352
Cape Cod Islands	(1,687,395)	23,115	462,300	353,454
Canal		200,000 every 6 years	440,000	336,404
New Bedford CAD Cell Construction		960,000 for the 10 year life of the project	960,000	733,973
Total			2,110,720	1,613,761

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