NEW ENGLAND

REGIONAL IMPLEMENTATION MANUAL

Framework for the Evaluation of Dredged Material Proposed for Disposal in New England Waters

Prepared by:

U.S. EPA
Region 1

US Army Corps of Engineers.

U.S. ARMY
CORPS OF ENGINEERS,
NEW ENGLAND
DISTRICT

INTERIM GUIDANCE

December 2025

This New England Regional Implementation Manual (NERIM) provides a framework for the evaluation of dredged material proposed for disposal in New England Waters. It has been developed to comply with Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) (33 U.S.C. 1401, et seq.) and Section 404 of the Clean Water Act (CWA) (33 U.S.C. 1344, et seq.). Consistent with our efforts to ensure coordination and consistency with other applicable federal and state laws and regulations, policies, requirements, and environmental practices, the NERIM has also been reviewed by regional offices of the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, environmental resource agencies of the five coastal New England states, and has been approved by the following officials of the U.S. Environmental Protection Agency (USEPA) Region 1 and the U.S. Army Corps of Engineers (USACE), New England District (CENAE).

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Record of Revision

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2004	Full revision to reflect advances in scientific methodologies and environmental evaluation	USEPA / USACE
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List of Acronyms

ADDAMS Automated Dredging and Disposal Alternatives Management System
ASTM American Society for Testing and Materials
CAD Confined Aquatic Disposal
CENAE New England District, U.S. Army Corps of Engineers
CFR Code of Federal Regulations
CLP Contract Laboratory Program
cm centimeter
COC Contaminant of Concern
CRM Certified Reference Material
CSM Conceptual Site Model
CWA Clean Water Act
DAMOS Disposal Area Monitoring System
DDD dichlorodiphenyldichloroethane
DDE dichlorodiphenyldichloroethylene
DDT dichlorodiphenyltrichloroethane
DDx sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT
DMMT Dredged Material Management Team
DO Dissolved Oxygen
DQM Dredging Quality Management
EDD Electronic Data Deliverable
ERDC U.S. Army Engineering Research and Development Center
ERL Effects Range Low
ERM Effects Range Median
ESA Endangered Species Act
FDA Food and Drug Administration
FNP Federal Navigation Project
ft foot
g gram
GNSS Global Navigation Satellite System
GPS Global Positioning System
IP Individual Permit
ITM Inland Testing Manual
LCS Laboratory Control Sample
LOP Letter of Permission
LPC Limiting Permissible Concentration
LQAP Laboratory Quality Assurance Plan
MDL Method Detection Limit
mg/L milligrams per Liter
MLLW Mean Lower Low Water
mm millimeter
MPRSA Marine Protection Research and Sanctuaries Act
NAD North American Datum
NEDMMP New England Dredged Material Management Program
NEPA National Environmental Policy Act
NERDT New England Regional Dredging Team
NERIM New England Regional Implementation Manual
NFG National Functional Guidelines
NMFS National Marine Fisheries Service
NMI Nautical Mile
NOAA National Oceanic and Atmospheric Administration
NWP Nationwide Permit
ODMDS Ocean Dredged Material Disposal Site
PAH Polycyclic Aromatic Hydrocarbon
PCBs Polychlorinated Biphenyls
ppb parts per billion
ppm parts per million
ppt parts per thousand (used for salinity measurements)
QA/QC Quality Assurance/Quality Control
RGP Regional General Permit
RHA Rivers and Harbors Act
RL Reporting Limit
RPD Relative Percent Difference
RPM Reasonable and Prudent Measure
SAP Sampling and Analysis Plan
SD Suitability Determination
SMMP Site Management and Monitoring Plan
SQG Sediment Quality Guidelines
SRM Standard Reference Material
STFATE Short-Term Fate and Transport Evaluation
TOC Total Organic Carbon
USACE U.S. Army Corps of Engineers
USEPA U.S. Environmental Protection Agency
USFWS U.S. Fish and Wildlife Service
WQC Water Quality Criteria

1.0 Introduction

1.1 Overview

The U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA) share federal responsibility for regulating dredged material disposed within waters of the United States under Section 404 of the Clean Water Act (CWA) and for regulating dredged material disposed in ocean waters under Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA). In New England, the USACE New England District (CENAE) and USEPA Region 1 together lead the regional New England Dredged Material Management Program (NEDMMP) that also receives input from agencies of the states bounding New England waters (Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and New York). This *New England Regional Implementation Manual* (NERIM) was developed by the NEDMMP to provide a framework for characterizing and assessing sediment to determine the suitability of dredged material for unconfined, aquatic disposal in New England waters.

1.2 Applicability and Limitations

The procedures detailed in the NERIM apply expressly to the evaluation of sediment proposed for disposal in New England waters, extending from the Maine-Canadian border to the western end of Long Island Sound, including the Long Island Sound itself (Figure 1-1). The boundary defining which set of regulations apply to a given disposal site (CWA or MPRSA) can be confusing along the New England coastline and is described in detail in Section 2 of this manual.

The regional guidance in the NERIM draws from the two national testing manuals:

- Evaluation of Dredged Material Proposed for Ocean Disposal (Ocean Testing Manual or Green Book), which satisfies MPRSA testing requirements (USEPA/USACE 1991)
- Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual (Inland Testing Manual), which satisfies CWA sediment testing requirements (USEPA/USACE 1998)

The procedures described in the NERIM for evaluating potential contaminant-related environmental impacts resulting from aquatic disposal of sediment are primarily used for navigation-related dredging projects. This user manual and data generated through the NEDMMP may also be useful for the evaluation of discharges of dredged material for other in-water and shoreline beneficial use projects such as ecosystem restoration or coastal protection. However, decisions regarding beneficial use of dredged sediment frequently involve additional resource agencies and/or cleanup programs that are outside of the purview of the NEDMMP.

Freshwater dredging and disposal projects are not common in the New England region and are therefore not covered in this manual. The NEDMMP will provide guidance for the evaluation of

freshwater projects on a case-by-case basis. General guidance on the procedures for freshwater projects can be found in the Inland Testing Manual (USEPA/USACE 1998).

As a regional guidance manual, the NERIM does not alter the statutory and regulatory framework for permitting decisions as presented in Section 2.2.

1.3 New England Dredged Material Management Program

The NEDMMP is composed of representatives from CENAE and USEPA Region 1 with expertise in sediment evaluation procedures, CWA/MPRSA regulations and permitting procedures, marine survey and sediment sampling methodologies, and dredging equipment and operations.

The CENAE Navigation Section manages federal navigation projects (FNPs) by maintaining authorized channels, anchorages, and turning basins for safe navigation in New England coastal waters. Non-federal navigation projects coordinate with the CENAE Regulatory Division for their permitting process. Common to both types of projects is the need to develop sampling and analysis plans (SAPs) to characterize sediment proposed for dredging and suitability determinations (SDs) to assess the potential suitability of dredged sediment for unconfined aquatic disposal. Preparation of SAPs and SDs is performed by the Dredged Material Management Team (DMMT), a technical group within CENAE's Planning Division. The DMMT also draws on subject matter experts in the fields of chemistry, toxicology, biology, oceanography, geology, and engineering from other Divisions within CENAE.

At USEPA Region 1 the Regional Ocean Disposal Coordinator and support staff within the Ocean and Coastal Protection Section provide review of all SAPs and SDs prepared by the DMMT. USEPA Region 1 and CENAE staff meet regularly to review data from proposed projects, to track compliance with specified permit conditions of ongoing dredging projects, and to inform management decisions regarding dredged material disposal sites within New England waters.

The NEDMMP receives technical and regulatory support from additional federal agencies as well as agencies from each of the states bordering New England waters. Collectively known as the New England Regional Dredging Team (NERDT), this group typically meets three times a year to discuss and recommend resolution of technical and policy issues related to dredging and dredged material disposal in New England waters with the overall goal of improving dredged material management (and increasing the beneficial use of dredged material) by

fostering communication. To that end, the group maintains a website at www.nerdt.org providing a forum for information exchange and a record of meetings and decisions/projects of note.

A partial listing of NERDT members is provided in Table 1-1 along with their roles contributing to the NEDMMP. Depending on the specific location of a dredging project and associated dredged material disposal, multiple agencies from this list may be involved in the review of SAPs and SDs and the resulting permit/contract conditions.

1.4 Organization of the NERIM

This NERIM provides a risk-based sediment assessment framework that describes methods and procedures to evaluate potential environmental impacts from the aquatic discharge of dredged material, and to inform sediment management decisions made by regulatory authorities. As presented in the national testing guidance, this manual follows a four-tiered evaluation procedure to assess the suitability of project sediments for unconfined aquatic disposal (USEPA/USACE 1991; USEPA/USACE 1998). The four tiers are presented sequentially in separate sections (Sections 3 through 6) for clarity, as most applicants need only proceed partially through the tiers. Flow charts have been included to further clarify the stepwise decision processes.

Although there is significant overlap in the requirements for evaluation of sediment for disposal in waters of the United States (under Section 404 of CWA) and in ocean waters (under Section 103 of MPRSA), there are some important differences. For clarity, these differences have been noted in boxed callouts or in separate subsections within the text and detailed in separate flow charts as necessary.

1.5 Revisions of the NERIM

Given the continual advancements in sediment sampling and testing procedures, as well as updated information on the types and concentrations of chemicals that pose environmental concerns, the NERIM is expected to be revised on a periodic basis. Coupled with the goal of accurate, up-to-date sampling and testing procedures, this manual is intended to provide an easy-to-use guide to applicants desiring to pursue evaluation of sediment for open-water disposal. To that end, users with suggestions for improvement of this manual are encouraged to contact DMMT staff as noted below.

1.6 How to Contact Us

DMMT staff are available to answer questions regarding the SAP/SD process and provide technical guidance during sediment sampling and testing. Any questions, problems, or issues related to dredged material management should be directed to the DMMT at:

Dredged Material Management Team
US Army Corps of Engineers
New England District

696 Virginia Road
Concord, MA 01742
E-mail/Phone: CENAE_DMMT@usace.army.mil

Table 1-1. NEDMMP Roles and Responsibilities

Agency	Primary NEDMMP Role(s)	Secondary Role(s)
CENAE Dredged Material Management Team (DMMT)	- Development of sampling and analysis plans (SAPs) - Development of suitability determinations (SDs)	- Develop NERIM
CENAE Disposal Area Monitoring System (DAMOS) Program	- Management and monitoring of dredged material disposal sites - Disposal compliance monitoring for all projects - Selection of new ocean disposal sites	- Co-chair NERDT - Support identification/designation of new disposal and beneficial use sites - Manage and maintain CENAE Beneficial Use Planning Tool
CENAE Regulatory Division	- Issuance of permits for private applicants and non-USACE projects - Project review and NEPA compliance	- Support identification of disposal and beneficial use sites
USEPA Region 1	- Provide independent review of SAPs and SDs, and concurrence on MPRSA permits and contract specifications - Designation, management, and monitoring of ocean dredged material disposal sites	- Co-chair NERDT - Support identification and management of non-ocean disposal sites - Develop NERIM
NOAA	Endangered Species Act compliance	Support identification of disposal and beneficial use sites
USFWS	Endangered Species Act compliance	Support identification of disposal and beneficial use sites
Maine -Dept. of Environmental Protection -Coastal Program	- Review of SAPs and SDs - Water quality certification	Support identification of disposal and beneficial use sites in state waters
New Hampshire -Dept. of Environmental Services -Coastal Program	- Review of SAPs and SDs - Water quality certification	Support identification of disposal and beneficial use sites in state waters
Massachusetts -Dept. of Environmental Protection -Coastal Zone Management	- Review of SAPs and SDs - Water quality certification	Support identification of disposal and beneficial use sites in state waters
Rhode Island -Dept. of Environmental Management -Coastal Resources Management Council	- Review of SAPs and SDs - Water quality certification	Support identification of disposal and beneficial use sites in state waters
Connecticut -Dept. of Energy & Environmental Protection	- Review of SAPs and SDs - Water quality certification	Support identification of disposal and beneficial use sites in state waters
New York -Dept. of State -Dept. of Environmental Conservation	- Review of SAPs and SDs - Water quality certification	Support identification of disposal and beneficial use sites in state waters
All NEDMMP Agencies	Identify sites and projects to promote beneficial use of dredged material	

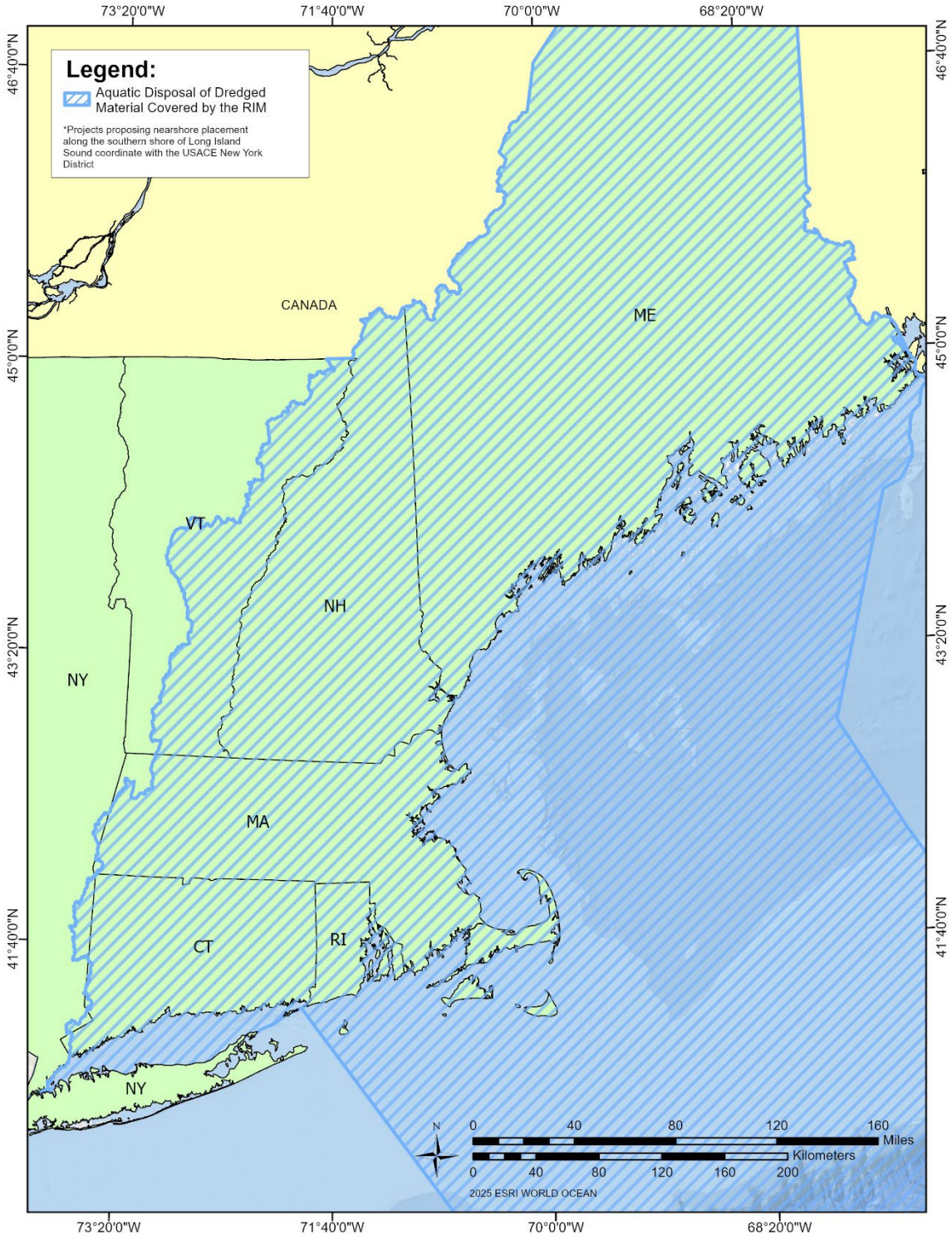


Figure 1-1 Geographic Coverage of the NERIM

2.0 Dredging Project Permit Process

2.1 Overview

The regulation of dredged sediment management is a shared responsibility of the USACE and USEPA, and a summary of the major regulations covering this topic is provided in Section 2.3. When a private, state, or federal entity other than the USACE proposes dredging activities with associated sediment placement into waters of the United States or ocean waters they must seek a permit from the USACE. In New England that process begins with the CENAE Regulatory Division. The stepwise process for such a dredging project is presented in Figure 2-1, highlighting the steps that are covered by this NERIM. Additional permits, licenses, or approvals may be required from federal, tribal, state, county, city, and/or local jurisdictions based on the location, scope, and complexity of the project.

USACE civil works projects, such as dredging of federal channels and anchorages, are subject to the same substantive requirements as dredging conducted by other entities. However, rather than issue itself a permit, the USACE evaluates the project (using the same procedures described in this NERIM and highlighted in Figure 2-1) and prepares a “statement of findings” prior to authorizing the work.

2.2 Geographic Jurisdiction of Regulations

For purposes of both international and domestic law, the territorial sea baseline is the boundary between land (and internal waters) and ocean waters. In the United States, the baseline is defined in 33 CFR 329.12(a)(1) as the line on the shore reached by the ordinary low tides. The baseline is drawn across river mouths, bay openings, and along the outer points of complex coastlines. Waters located inside the baseline are defined as internal waters, and waters beyond the baseline are defined as ocean waters. The territorial sea of the United States extends seaward 3 miles from the baseline. The boundary of the territorial sea is quite irregular along the complex New England coastline (Figure 2-2).

The physical location of the planned disposal of dredged material from a proposed project drives which of the two the major regulations covering the evaluation of the dredged material applies. Discharge of dredged materials into inland waters lying landward of the baseline are governed fully by CWA regulations. Discharge of dredged material into ocean waters lying seaward of the territorial sea boundary are governed fully by MPRSA regulations. Within the territorial sea there is overlap in the CWA and MPRSA jurisdiction. In this zone, discharges of dredged material are generally evaluated under the MPRSA. However, if the discharge of dredged material into the territorial sea is for the primary purpose of fill (including the beneficial use of dredged material for beach nourishment, island creation, or the construction of nearshore berms) it will be evaluated under the CWA (33 CFR § 336.0). An exception to these rules applies in the waters of Long Island Sound, as described below under the Ambro Amendment to MPRSA (33 USC § 1416(f)). These regulations are summarized below in Section 2.3, and a

decision diagram for identifying the applicable regulations for a given project is presented in Figure 2-3.

2.3 Regulatory Basis for Sediment Evaluation

2.3.1 Clean Water Act

Section 404

The Federal Water Pollution Control Act of 1972 (amended and renamed the Clean Water Act of 1977) governs the discharge of dredged or fill material into waters of the United States (inland of and including the territorial sea). The geographical limits of jurisdiction under the CWA include all waters of the United States as defined at 33 CFR § 328.3.

Section 404(b)(1) of the CWA requires the USEPA, in conjunction with the USACE, to promulgate guidelines for the discharge of dredged or fill material (the "404(b)(1) guidelines") to ensure that such proposed discharge will not result in unacceptable adverse environmental impacts--either individually or in combination--to waters of the United States. The USACE and USEPA also have authority under the Section 404(b)(1) guidelines to identify, in advance, sites that are either generally suitable or generally unsuitable for the discharge of dredged or fill material into waters of the United States. Section 404 assigns to the USACE the responsibility for authorizing all such proposed discharges and requires application of the 404(b)(1) guidelines in assessing whether there is a practicable alternative to a proposed discharge which would have less adverse impact on the aquatic ecosystem, including alternatives to disposal into waters of the United States.

Subpart B of the 404(b)(1) guidelines (40 CFR § 230.10-230.11) identifies restrictions on the discharges of dredged or fill material into waters of the United States and the factual determinations that must be made in accordance with the restrictions. Subpart G of the 404(b)(1) guidelines (40 CFR § 230.60-230.61) identifies regulatory procedures for the general evaluation of discharges; Subpart G also identifies procedures for chemical, biological, and physical evaluation and testing of dredged and fill materials. As specified in 40 CFR § 230.60 and 230.61, USEPA and USACE developed the national manual "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual" (commonly known as the "Inland Testing Manual", or ITM) (USEPA/USACE 1998).

Section 401

CWA Section 401 allows states to issue water quality certifications with or without conditions, deny certification, or waive certification for any activity that may result in a discharge to a water of the United States and requires a federal permit or license.. A water quality certification documents that the activity complies with all applicable federal and state water quality standards, limitations, and restrictions. No license or permit may be issued by a federal agency until the water quality certification required by Section 401 has been granted or waived. Further, no license or permit may be issued if certification has been denied. In many cases, water quality

certifications have been issued programmatically for general permits (including nationwide permits), and additional review may or may not be required by states or the USEPA.

2.3.2 Marine Protection Research and Sanctuaries Act

The MPRSA of 1972 (also called the Ocean Dumping Act, 33 U.S.C. 1401 *et seq*.) governs the transportation and disposal of dredged material in ocean waters, i.e. seaward of the baseline. In accordance with Section 103 of MPRSA, the USACE is the permitting authority for the transportation and disposal of dredged material. The USACE is required to consider navigation, economic and industrial development, and domestic and foreign commerce, as well as the need for and availability of alternatives to ocean disposal as part of its evaluation. Review and concurrence by the USEPA are required, where USEPA has an environmental management role in reviewing the USACE determination with the ocean disposal criteria relating to the environmental impact of the Section 103 permit.

The USEPA has authority under Section 102 of MPRSA to designate ocean dredged material disposal sites (ODMDSs). Currently, there are seven designated ODMDSs in New England coastal waters extending from western Long Island Sound to southern Maine (Table 2-1; Figure 2-2). In addition, the USACE has the authority under Section 103 to select alternative dredged material disposal sites to be used for a period of five years.

The MPRSA requires that operations involving the transportation and discharge of dredged materials in ocean waters are to be evaluated to determine their potential impact to the marine environment. The proposed disposal must be evaluated through the use of criteria published by the USEPA in 40 CFR § 220-228. In accordance with Subsection 227.27(b) of the regulations, USEPA and USACE developed a national testing manual to define procedures for evaluating the suitability of dredged material for ocean disposal that are based upon the testing requirements in the regulations. This national testing manual is entitled "Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual" and is commonly known as the "Green Book" (USEPA/USACE 1991).

Ambro Amendment

Based on the geographic jurisdiction described above in Section 2.2, the waters of Long Island Sound fall inside the baseline drawn across the mouth of the Sound and dredged material disposal in the Sound would be governed solely by the CWA. However, in 1980 the MPRSA was amended (Section 106(f)) to require that all federal dredging projects and any non-federal dredging project exceeding 25,000 cubic yards comply with the environmental criteria for ocean disposal under the MPRSA in addition to CWA requirements, including use of MPRSA designated ODMDSs. This amendment received its name from Jerome A. Ambro, the U.S. Representative from New York who authored it.

2.3.3 Rivers and Harbors Act

The Rivers and Harbors Act (RHA) of 1899 was designed to ensure the free flow of interstate commerce on the nation's aquatic "highways." Under Section 10 of the RHA, any project proponent who wishes to build a structure, or perform work in, above, or under navigable waters must receive a permit from the USACE.

Waters are considered navigable if they are: 1) subject to the ebb and flow of the tide, or 2) if they are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. (33 CFR Part 329). Navigable waters under the RHA are defined differently than Traditional Navigable Waters under the CWA, though in many cases they overlap.

In most cases if a CWA 404 permit is needed for a discharge of dredged or fill material in waters of the United States, the work will also be reviewed under Section 10 for potential impacts to navigation.

2.3.4 Other Applicable Laws and Regulations

Numerous other federal and state laws may pertain directly or peripherally to dredging operations and dredged material disposal in New England waters, some of which vary by individual state. Coordination with CENAE Regulatory and state agencies will determine which laws and regulations apply to a specific dredging project. Additional federal laws are summarized in Table 2-2.

2.4 Permit Types

The primary federal permit for in-water work is the Department of the Army permit. In New England, the CENAE Regulatory Division can permit dredging projects under two types of permits:

- Individual Permit – includes standard Individual Permits (IP) and Letters of Permission (LOP)

- General Permit – includes regional General Permits (GPs) and the Nationwide Permit (NWP) Program

IPs are issued for specific projects whereas GPs can authorize many projects of a similar nature over a specified region. Typically, IPs undergo the greatest amount of analysis. Standard IPs require a public notice comment period as well as consideration for cumulative effects and an alternatives analysis if the project would result in a discharge of dredged or fill material. LOPs, a type of streamlined individual permit, can also be issued for minor projects that would not have significant individual or cumulative impacts on environmental values and should encounter no appreciable opposition.

General permits are streamlined for projects that will result in no more than minimal adverse environmental effects; compliance with NEPA, cumulative impacts considerations, and alternatives analysis are completed programmatically. NWPs are a type of general permit issued across the entirely of the United States that authorize work with minimal environmental effects. NWPs are not currently utilized in New England; however, CENAE plans to adopt applicable NWPs by the year 2026. CENAE plans to supplement additional regional GPs to complement the NWPs..

The CENAE Regulatory Division determines the type of permit and level of analysis appropriate for a given project after reviewing its scope and potential for impact. Prior to or concurrent with the CENAE Regulatory permit process, dredging proponents are required to obtain permits/approvals from state agencies and or local jurisdictions such as Section 401 Water Quality Certification or Coastal Zone Management Consistency Review.

2.5 Dredged Material Evaluation Process

A detailed presentation of the dredged material evaluation process, shown as one of the initial steps in Figure 2-1, comprises the bulk of the remainder of this NERIM with the overall objective of determining if the dredged material from a proposed project is suitable for unconfined open-water disposal. Specific information and documents required or developed for the evaluation include the following:

- **Proposed Project Initial Submittal** (Section 3) – At a minimum, project proponents must submit a detailed description of the proposed dredging project, including scaled drawings and recent bathymetry. Additional supporting information can also be submitted and may reduce the time required for development of the SAP by the DMMT.

- **Conceptual Site Model and Risk Ranking** (Section 3.5) – Based on the project description, along with historic and recent data from the proposed project and surrounding area, the DMMT prepares a Conceptual Site Model (CSM) of potential existing or historical sources of contamination that could impact the project sediment proposed for dredging. The CSM in turn is used to develop a risk ranking for the project sediment.

- **Sampling and Analysis Plan** (SAP, Sections 4, 5, and 6) – With the CSM and risk ranking as a basis, the DMMT determines the need for additional data collection and develops a project-specific SAP. The SAP details the number and locations of required sediment samples and the types of analyses and refers to specific procedures included in this NERIM. The SAP is reviewed by USEPA Region 1 as well as the state(s) where the project and dredged material disposal are proposed.

- **Sampling and Analysis Data Submittal** (Sections 4, 5, and 6) – Specifics are provided on the required format for delivery of data along with the checks and validation required to ensure data quality in order to streamline its review and use by the DMMT.

- **Suitability Determination** (SD, Section 7) – This is the standard type of decision document for dredging projects seeking open-water disposal and is generally the endpoint of the process described in this NERIM. Based on an analysis of the collected data, the DMMT assesses the suitability of the dredged material from the proposed project for unconfined, open-water disposal at a particular disposal site. USEPA Region 1 performs an independent assessment of the data and reviews the SD along with the state agency where the dredging/disposal is occurring.

2.5.1 Tiered Approach to Sediment Characterization

The collection of required information and data to support preparation of the SD follows a tiered approach to characterize the sediment proposed for dredging as outlined in the Green Book and the ITM. The tiered approach to testing consists of successive levels of investigation, each with increasing effort and complexity, based on the potential risk of adverse impacts associated with an individual dredging project. This approach generates the information necessary to evaluate the proposed disposal of dredged material at an open water site.

- Tier 1: Integration of the Proposed Project and Existing Information (Section 3)
- Tier 2: Physical and Chemical Testing of Sediment and/or Elutriates (Section 4)
- Tier 3: Biological Testing of the Sediment and/or Elutriates (Section 5)
- Tier 4: Special Studies (Section 6)

For projects governed under Section 404 of CWA, the testing proceeds only to the highest tier required to make an informed decision on the suitability of the proposed dredged material for unconfined, open-water disposal. For projects with proposed disposal at a site in ocean waters under Section 103 of MPRSA, testing is required to proceed through Tier 3 unless the material has been determined to meet exclusionary criteria as described in Section 3.6.

2.5.2 Time to Complete the Dredged Material Evaluation Process

The time required for the NEDMMP's sediment quality evaluation can vary significantly depending on the complexity of the proposed dredging project, the amount and type of testing that is triggered, and seasonal constraints associated with field sampling and some of the laboratory analyses. A smaller project that requires minimal sediment characterization may require 4 to 6 months to complete all of the steps (initial project submittal, SAP development, field sampling, laboratory analysis and reporting, and preparation of the SD). This timeline may be extended if there are delays in supplying the required project information or delays in the field sampling and laboratory analyses. A larger, more complex project may require a year or more to complete the evaluation process given the requirement for a second phase of fieldwork

to collect additional sample material for biological testing and the extended analytical time for completing those tests.

Table 2-1. Ocean Dredged Material Disposal Sites (ODMDS) in New England

Site Name	Description	Area (nmi^2)	Water Depth (ft)
Western Long Island Sound Disposal Site	WLDS is located in Long Island Sound approximately 2.7 nmi south of Long Neck Point, Noroton, CT.	2.0	75-115
Central Long Island Sound Disposal Site	CLDS is located in Long Island Sound approximately 5.6 nmi south of South End Point, East Haven, CT.	2.4	60-75
Eastern Long Island Sound Disposal Site	ELDS is located in Long Island Sound approximately 2.5 nmi southwest of Eastern Point, Groton, CT.	1.3	46-98
Rhode Island Sound Disposal Site	RISDS is located approximately 9.0 nmi south of Point Judith, RI, within the separation zone for the Narragansett Bay shipping lanes.	1	110-128
Massachusetts Bay Disposal Site	MBDS is located approximately 10.8 nmi southeast of Manchester, MA, centrally located within Massachusetts Bay and situated adjacent to the Stellwagen Bank National Marine Sanctuary.	4.6	240-300
Isles of Shoals North Disposal Site	IOSN is located approximately 15 nmi east of Portsmouth, NH, in the Gulf of Maine.	0.75	250-340
Portland Disposal Site	PDS is located approximately 7.1 nmi east of Dyer Point, Cape Elizabeth, ME.	1	120-230

Additional resources on ODMDS monitoring and management in New England can be found at:

- CENAE's DAMOS Program: https://www.nae.usace.army.mil/Missions/Disposal-Area-Monitoring-System-DAMOS/
- USEPA Region 1 Ocean Dumping Program: https://www.epa.gov/ocean-dumping/managing-ocean-dumping-epa-region-1#odmds

Table 2-2. Summary of Additional Federal and State Laws that May Pertain to Dredging Projects

Authority (Agency)	Regulated Activities/Actions	Jurisdiction
Federal		
National Environmental Policy Act (NEPA)	Actions undertaken by the federal government	All federal actions, including applications for federal permits or other forms of authorization that are not otherwise exempted from NEPA
Endangered Species Act	Any activity that may affect ESA listed species or habitat	ESA listed species or habitat
Fish and Wildlife Coordination Act	Land, water, and interests may be acquired by federal construction agencies for wildlife conservation and development	Where waters or channel of a water body are modified by a department or agency of the U. S.
Magnuson-Stevens Fishery Conservation and Management Act	Actions affecting commercial fisheries	Federally managed species with designated essential fish habitat
Marine Mammal Protection Act	Actions resulting in the lethal take, nonlethal take, or incidental harassment of marine mammals	All species of whales, dolphins, porpoises, and seals; marine mammal habitat
Coastal Zone Management Act	Effective management, beneficial use, protection, and development of coastal zone; federal agency activities or permits that affect the coastal zone must be consistent with the enforceable policies of the approved state management program	See state programs below
National Historic Preservation Act Section 106	Federal actions affecting cultural resources; federal actions affection tribal cultural resources, treaty fishing access sites, usual and accustomed areas, traditional cultural properties, and/or other resources important to the respective tribes	Cultural and tribal resources; federal action agency coordinates with State Historic and Tribal Preservation Offices and attempts to avoid or minimize impacts to cultural and/or tribal resources and mitigate unavoidable impacts; federal action agency makes final determination of project effect

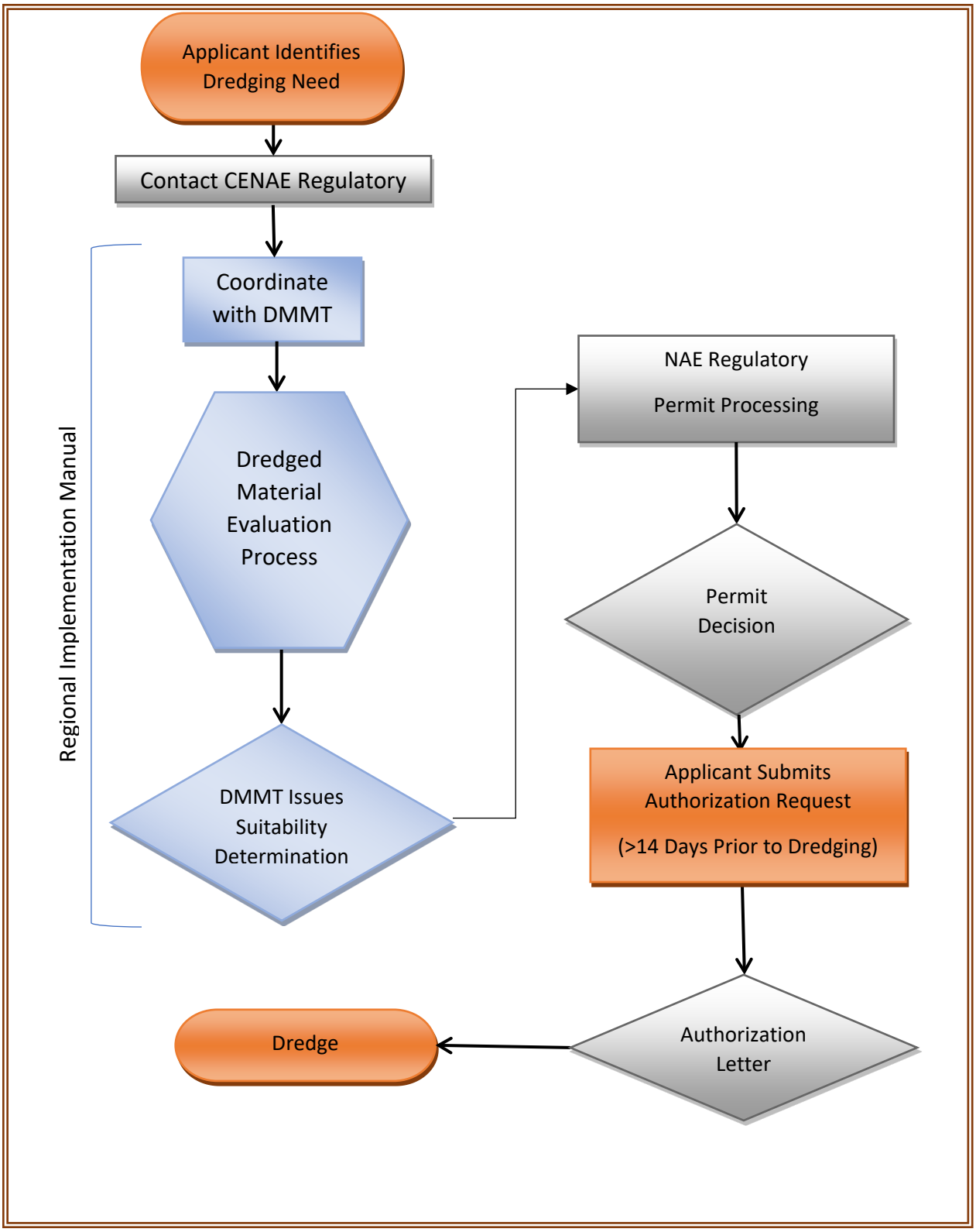


Figure 2-1. Dredging Project Stepwise Summary

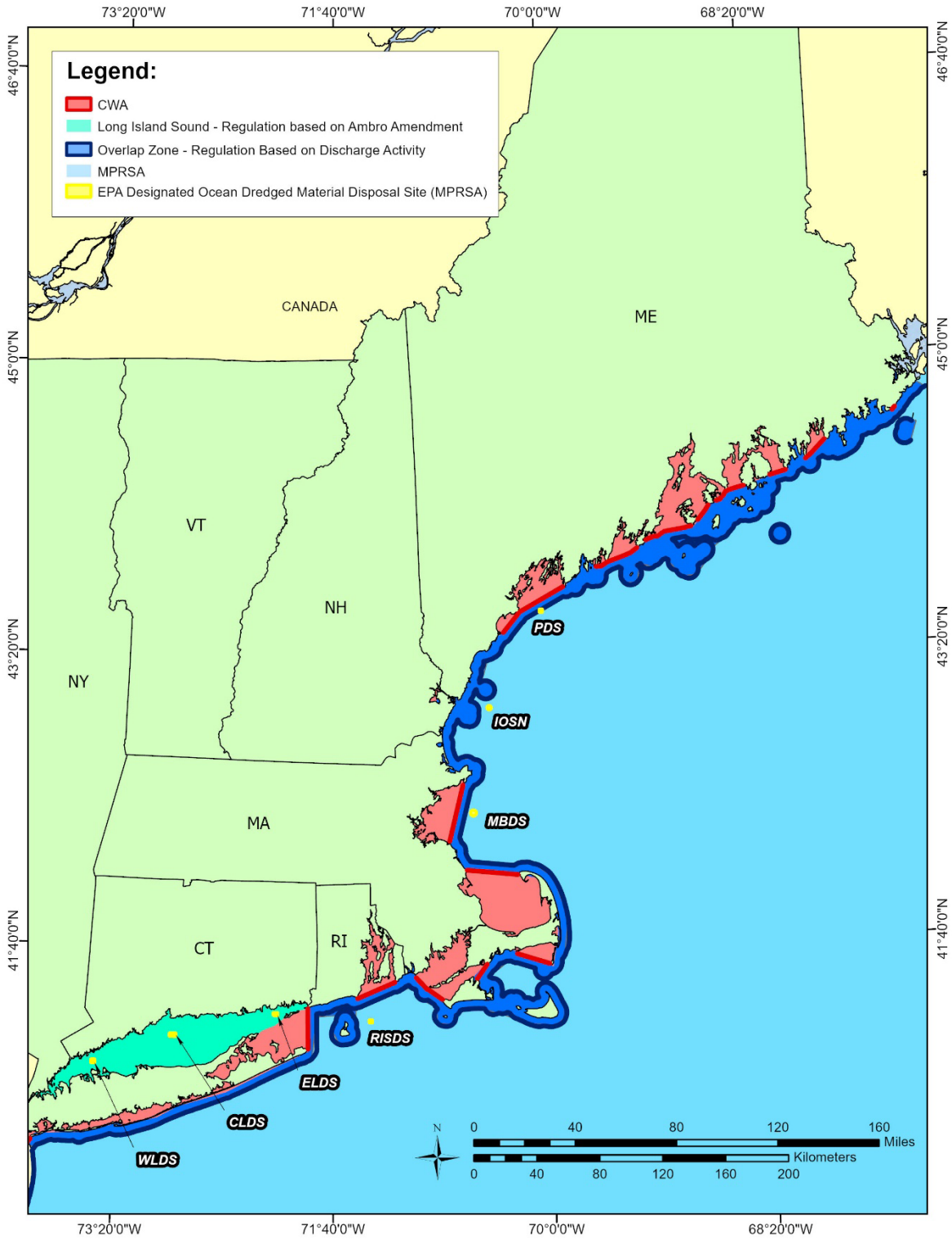


Figure 2-2. Map of CWA versus MPRSA Jurisdiction and ODMDS in New England

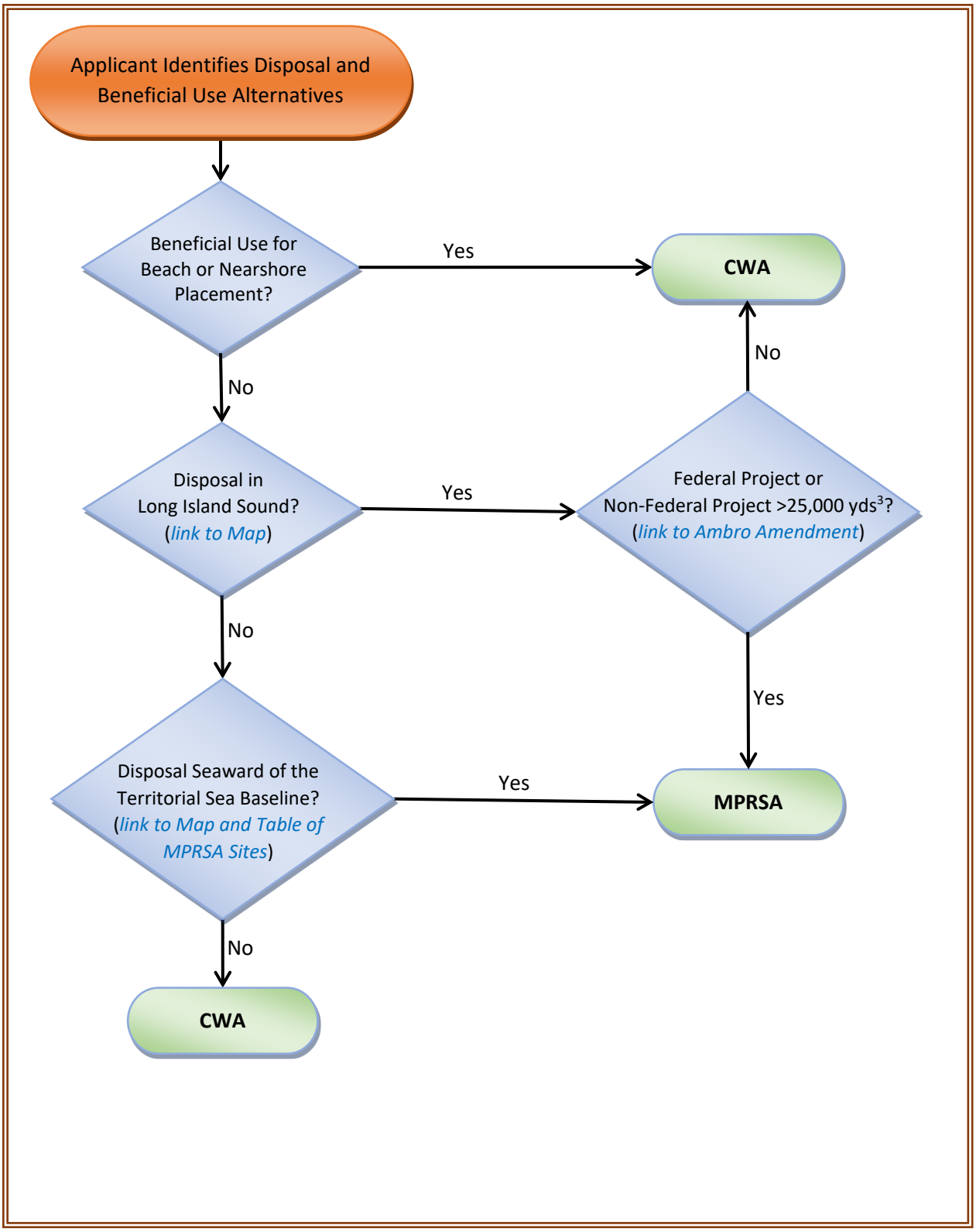


Figure 2-3. Is My Project Governed by CWA or MPRSA?

3.0 Tier 1: Integration of the Proposed Project and Existing Information

3.1 Overview

Tier 1 is a comprehensive analysis of all readily available existing information on the proposed dredging project and the overall setting of the area where the proposed project is located. In addition to specific details on the proposed project, the Tier 1 review includes a relevant site history and all previously collected physical, chemical, and biological data for the project site and surrounding area. The type and amount of information required for a Tier 1 evaluation will vary according to the size and complexity of the project and the environment in which it is located. The Tier 1 evaluation is necessary to inform the entire sediment evaluation process. ***Although the project proponent is only required to provide the information detailed in Section 3.2, providing an organized presentation of the information described in Sections 3.3 and 3.4 can help expedite the Tier 1 review and preparation of a SAP.***

3.2 Project Description and Site History

The minimum information required for the DMMT to begin a Tier 1 review for a proposed project falls into three general areas as described below. A detailed listing of these requirements is provided in Appendix A along with the required file format for each type of information or data.

Dredging Project

- Dredging footprint overlaid over current bathymetry
- Calculated dredge area, dredge cut depths, planned allowed overdepth, side slopes/technique, estimated dredge volume
- Planned dredge type and supporting equipment (e.g. scow size)
- Estimated project timeline
- Alternatives analysis for beneficial use of dredged material
- Target site if in-water disposal is approved

Project Site

- Current site use with identification of land-based and in-water structures
- Specific activities that have the potential to disturb the sediment bed, e.g. maneuvering/docking powerboats
- Current site use of neighboring properties
- Identification and location of outfalls along the shoreline

- General site drainage

Site History

- History of the use of the site and neighboring properties
- Summary of previous dredging or in-water/shoreline work at the site including any sampling locations and data
- History of recorded spills and remediation at the site and neighboring properties

3.3 Overall Setting of the Project Area

Understanding the sediment dynamics of a given project site and designing an adequate field sampling program requires looking beyond the boundaries of the project itself. General information that is reviewed in developing the Tier 1 evaluation and subsequent SAP includes:

- Tidal range and tidal excursion
- Exposure to open-water fetch and recorded wave climate
- Discharge records for watershed affecting the project site
- State water quality classification for the surrounding waterbody
- Studies or past dredging records providing insight on sediment deposition rates

3.4 Potential Sources of Contamination

Understanding the potential sources of contamination to sediment at the dredging project site also requires looking well beyond the site boundaries. General information that is reviewed in developing the Tier 1 evaluation and subsequent SAP includes:

- Listing of Superfund and other hazardous waste site cleanups within the watershed noting that contaminant sources downriver of a proposed dredging project site can affect the project site’s sediment quality due to transport on the flood tide.
- Review of sampling data from previous dredging projects in the adjacent waterway.
- Review of historical aerial imagery to better understand changes in land use along the watershed.

3.5 Conceptual Site Model and Risk Ranking

The DMMT uses the information described above in Sections 3.2-3.4 to develop a CSM of sediment dynamics and potential contaminant sources for the proposed project site. The CSM is a written description and/or visual representation that succinctly conveys project-specific conditions and identifies the potential sources of sediment contamination that could ultimately contribute to environmental or human health risk if dredged sediment were disposed in an unconfined, open-water setting. Using the CSM, the DMMT assigns a risk ranking to the proposed project's sediment using the five categories presented in Table 3-1. This step completes the Tier 1 evaluation, allowing for a decision on whether sufficient information already exists to complete a suitability determination or if there is a requirement to move forward to Tier 2 with development of a SAP (Figure 3-1). If development of a SAP is required, the CSM and risk ranking inform the number and location of sampling stations as well as the types of analyses required.

An example CSM and risk ranking for a recent New England project is provided in Appendix B.

3.6 Testing Exclusions Based on Tier 1 Analysis

Both the CWA (40 CFR § 230.60) and MPRSA (40 CFR § 227.13(b)) provide for exclusion from testing requirements based on the composition and location of the proposed dredged material. The exclusionary criteria vary slightly between the two regulations but is typically limited to coarse grained dredged material (sand, gravel, rock) that is demonstrated through the CSM to be isolated from potential sources of contamination.

Under certain circumstances, native material, glacial sediments deposited in pre-industrial times, may also meet the exclusionary criteria. For CWA projects this definition is explained in Chapter 4 of the ITM as sediments that are "from depths deposited in pre-industrial times and not exposed to modern sources of pollution." Similar exemptions apply under 40 CFR § 227.13(b)(3) of the MPRSA for material that is far removed from known existing and historical sources of pollution.

The DMMT can provide guidance on exclusionary criteria as part of the Tier 1 coordination process.

The DMMT may issue an SD based on the Tier 1 evaluation alone or based on limited additional testing to confirm that the proposed project material meets the exclusionary criteria (see Section 4.4).

Table 3-1. Risk Ranking Descriptions

Rank	Guidelines
Low	Few or no sources of contamination exist. Data are available to verify no significant potential for adverse biological effects.
Low-Moderate	Few or no sources of contamination are identified, but existing data is insufficient to confirm ranking.
Moderate	Known sources of contamination exist within the vicinity of the project with the potential to produce chemical concentrations that may cause adverse biological effects.
High	Known sources of contamination within the project area and/or project(s) in the vicinity were previously unsuitable for unconfined open water placement.

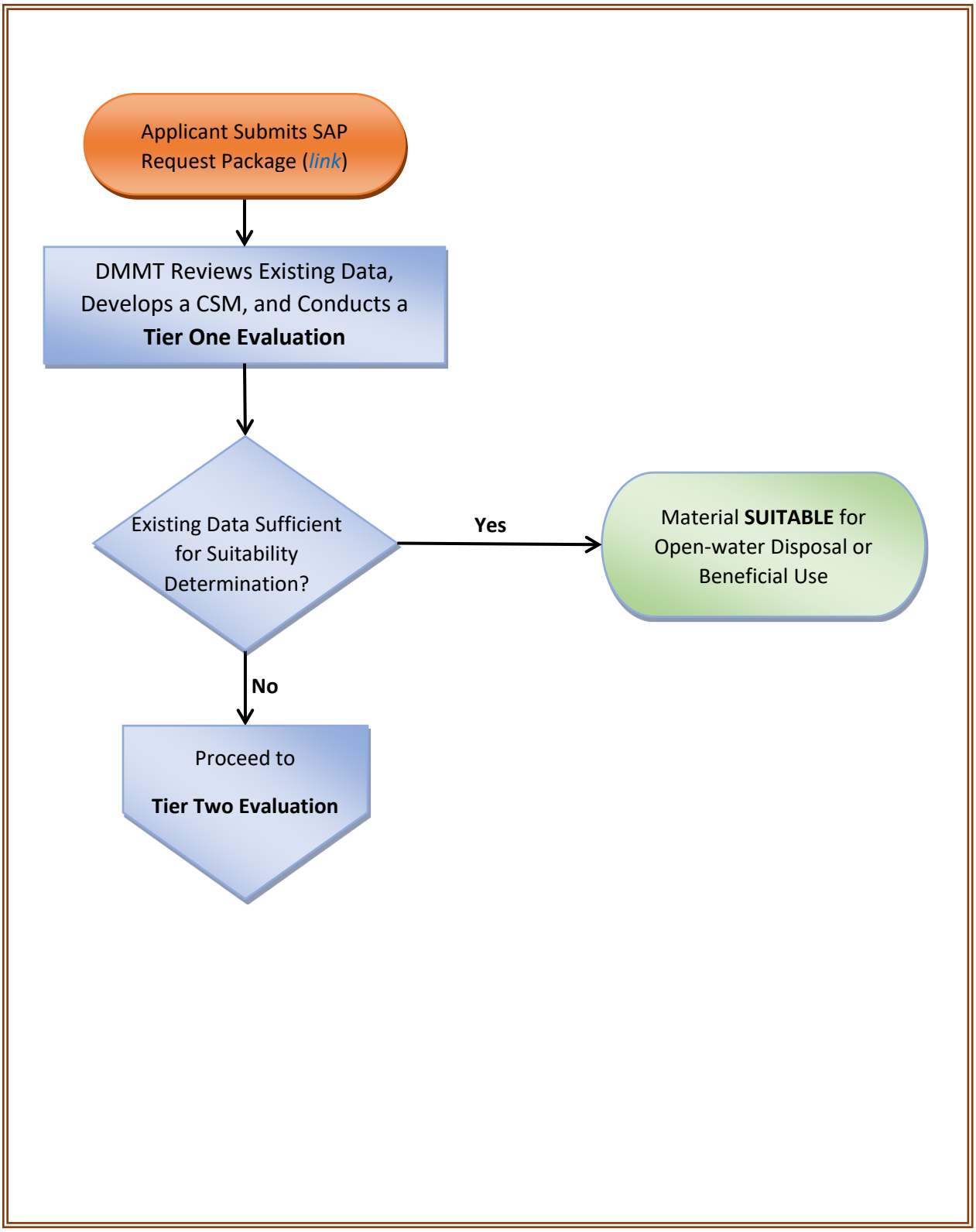


Figure 3-1. Tier One Evaluation (CWA and MPRSA)

4.0 Tier 2: Physical and Chemical Analysis of Dredged Material

If existing information is not sufficient to determine the suitability of proposed dredged material, additional testing is necessary to evaluate a project for open water disposal under Tier 2. Tier 2 builds upon the information collected in Tier 1 and consists of an evaluation of compliance with water quality criteria (WQC), and an evaluation of potential benthic toxicity and bioaccumulation based on sediment and elutriate chemistry data. Using the information gathered in Tier 1, the DMMT develops a SAP to collect this physical and chemical data.

The importance of a well-designed sampling program is underscored by the fact that an evaluation of the potential impacts of a proposed dredging project is only as complete and reliable as the sampling upon which it is based. The quality of information gathered through the tiered testing process is affected by the following sampling-related factors:

- Collecting representative samples;
- Using appropriate sampling techniques; and
- Protecting or preserving the samples until they are tested.

It is the responsibility of the applicant to ensure that samples taken for a proposed project meet the Quality Assurance/Quality Control (QA/QC) requirements presented below and discussed in Chapter 8 of the Green Book and the ITM, and the QA/QC manual (USEPA/USACE 1995). Failure to meet these requirements or follow specified procedures without prior DMMT approval will likely cause rejection of the testing results. ***Applicants should always consult with the DMMT to obtain a project specific SAP prior to initiating any sampling efforts****.*

4.1 Overview and CWA/MPRSA Differences

When the need to move on to Tier 2 is identified, the DMMT will use the information obtained in Tier 1 to prepare a SAP for the chosen disposal alternative(s). The conceptual site model and project risk ranking, explained in Section 3.5, inform the sampling design including the number of samples, sample locations, and the basis for compositing or sub-sampling requirements. The applicant will collect data per the project SAP, submit the data to the DMMT, and the DMMT will subsequently evaluate the submitted data.

For projects evaluated under the CWA, the SAP will include information on collecting and analyzing sediment samples for grain size and bulk chemistry and, depending on these results, elutriate chemistry and additional Tier 3 testing may be required (Figure 4-1). For projects evaluated under MPRSA, the chemical and physical information gathered in Tier 2 will inform the additional sampling required in Tier 3 (Figure 4-2).

The following sections describe the components of a Tier 2 evaluation.

4.2 Sampling and Analysis Plan

Applicants must have a project SAP prepared by the DMMT which, together with the Laboratory Quality Assurance Plan (LQAP) discussed in Section 4.7.4, make up the Quality Assurance Project Plan. Applicants should initiate the SAP planning process with the DMMT as early as possible to ensure there is adequate time to perform the required sampling, analysis, and evaluation prior to the planned dredging project (see Section 2.5.2 for the estimated time to complete the overall process). The SAP will outline the components necessary to characterize the sediment chemistry and potential water column, benthic, and bioaccumulation effects from the proposed discharge of dredged sediment.

The applicant must provide the following information to the DMMT in order to receive a SAP:

- Project summary (the volume proposed to be dredged, the proposed dredge and overdepth elevations in feet relative to MLLW, the area of the proposed dredge footprint, and the proposed disposal site[s])
- Project dredge plans/figures that display the dredging footprint, side slopes, recent bathymetry in feet relative to MLLW, and relevant information to the project site's usage (docks, fuel dock, travel lift, boat launch, bulkheads, etc.)
- Geospatial data that includes all files displayed in the project's dredge plans/figures
- Potential sources of sediment contamination directly adjacent to the proposed dredge area (storm drains, outfalls, catch basins, etc.) and adjacent/nearby sites that could contribute contaminants to the waterway (remediation sites, wastewater treatment plants, industrial facilities, etc.)
- Reported spills in the area with a citation for the source of the spill data
- A summary of previous dredging events at the project site including the years, volume removed, and disposal location
- A summary of previous testing data (physical, chemical, and biological test results, as available) with the dates testing occurred

The DMMT determines the number of samples and sample locations based on the conceptual site model, project risk ranking, shoaling, and proximity to potential contamination sources. The SAP includes figures displaying required sample locations with the dredge footprint and recent bathymetric data. The SAP will also list required physical and chemical analyses for sediment (Table 4-1), elutriates if necessary (Table 4-2), and their associated holding times (Table 4-3). Depending on the conceptual site model for the proposed project, other analyses may be required in addition to those listed in Tables 4-1 and 4-2. Appendix C includes an example list of potential analytes that could be added to a project specific SAP.

The DMMT coordinates all SAPs with USEPA Region 1 and the appropriate state environmental agency/agencies. Upon concurrence from these agencies, the DMMT will provide the final SAP to the project applicant so that field sampling and laboratory testing may commence.

General information on sample collection and analysis is provided in the following sections.

4.3 Field/Lab Instructions

Instructions for field sampling are explained in Sections 4.3.1 through 4.3.3; these may be amended or updated in the project specific SAP provided by the DMMT.

4.3.1 Core Collection

Vessel positioning shall be achieved using a Global Navigation Satellite System (GNSS) that has been calibrated on site using a known reference point. The required horizontal accuracy of the system shall be 10 feet or less unless otherwise noted in the project SAP. Sediment surface elevations at each location are to be determined with an accuracy of ±0.1 feet (relative to MLLW). All core samples shall be collected to the proposed dredge depth plus allowable overdepth using inert core liners. Required core lengths based on the provided bathymetry and dredging plan will be included in the SAP; however, the actual required core lengths shall be determined at the time of sampling using measured sediment surface elevations at each location.

In order to ensure that the core samples adequately represent the dredge interval (dredge depth plus allowable overdepth interval) at each location, all cores must have a recovered length that is within 75% of the core penetration depth. Any cores that display significant disturbance such as compaction or washout should not be used. If the cores from any location do not meet the acceptability criteria after multiple attempts (minimum six attempts are required), then the applicant should retain the best core from that location and contact the DMMT for further guidance prior to finishing sample collection. Upon collection, all cores shall be measured and maintained in an upright position for a minimum of 15 minutes to allow any fine-grained material to settle. After a core has settled, it shall be remeasured, taking care to not include overlying water with sediment flocculant in the measurement before any overlying water is drained.

4.3.2 Core Processing and Sampling

All cores shall be split lengthwise (taking care to not disturb or contaminate the sediment sample), photographed with a stadia rod for scale with zero indicating the sediment/water interface (with a resolution that makes the photos useful for zoomed in inspection), and described in accordance with ASTM D2488 (Standard Practice for Description and Identification of Soils). Samples shall be collected from the dredge interval within each core for grain size and bulk chemical analysis. If the dredge interval within a core is homogenous, then the entire length may be composited as a single sample for chemistry and grain size analysis unless specific subsampling requirements are provided in the project SAP.

If a core shows significant stratification or obvious signs of contamination, then subsamples shall be collected from each discrete layer and noted on the sampling log, and the applicant shall consult the DMMT for guidance prior to the start of laboratory analysis. The term "significant stratification" includes any distinct change in sediment composition that could represent a change in depositional history or waterway usage such as a change in color or lithology. ***Compositing of dissimilar sediment layers without prior approval from the DMMT may result in the rejection of any resulting data products***.

Typically, each core or core layer from the dredge area shall be individually analyzed for grain size and bulk chemical analysis. Any compositing of samples or sub-samples must be coordinated with the DMMT. All sample data including date, time, latitude, longitude, Global Positioning System (GPS) accuracy at the sample station, sediment surface elevation, tidal correction, core penetration and recovery, and chemistry/grain size sample interval(s) shall be recorded in a sampling log (Figure 4-3 or equivalent) and provided to the DMMT with the applicant's core descriptions and photographs. All coordinate data shall be reported in geographic North American Datum (NAD) 83 decimal degree format to six decimal places. All depth/elevation data shall be reported in tenths of feet referenced to MLLW. The penetration and recovery for the core used for the chemistry and grain size samples should be recorded on the sample log. All core logs from the dredge area shall be submitted to the DMMT prior to performing physical and chemical analysis. All sediments held for testing shall be stored in accordance with the requirements in Table 4-3.

4.3.3 Water Sampling

If elutriate analysis is required in the project SAP, then the applicant shall collect dredge site water using either a non-contaminating pump or a discrete water sampler from a central location within the proposed project area, avoiding any outfalls or other potential sources of pollution, unless specific sampling requirements are provided in the project SAP. For dredging sites less than 30 feet deep, all water samples shall be collected from the middle of the water column. For sites greater than 30 feet deep, the sample should be a composite of near-surface (3 feet below the surface), mid-depth, and near bottom samples (3 feet above the bottom). All water samples held for testing shall be stored in accordance with the requirements in Table 4-3. For information on elutriate preparation see Section 4.7.2.

4.3.4 Reference Area Sampling

The DMMT and the CENAE Disposal Area Monitoring System (DAMOS) Program maintain a sediment chemistry database from established reference areas at most of the commonly used disposal sites in New England. The applicant does not need to collect and analyze reference area sediment for their chosen disposal site if the DMMT has current reference data available. The applicant will be informed in their project specific SAP whether reference area sampling is needed. If reference area sampling is required, then the project SAP will provide sampling instructions.

4.3.5 Field Quality Control

If required in the project specific SAP, a field duplicate sample shall be collected for bulk chemistry and grain size analysis. An equipment blank for chemical analysis shall be collected for each field effort by exposing deionized water to any non-dedicated equipment used in the sampling process. All samples held for testing shall be stored in accordance with the requirements in Table 4-3. Sample chain of custody forms are typically provided by the analytical laboratory and shall be maintained by the applicant and submitted to the DMMT with the data package. The chain of custody form should include the following information:

- Project name and location
- Unique identification for each sample (sample ID) that corresponds to the SAP
- Sample matrix
- Analyses to be performed on each sample
- Date and time of sample collection
- Name or initials of the sampler
- Signature of sampler and the lab recipient with date and time
- Preservation
- Any comments or additional information required by the lab

4.4 Physical Properties and Grain Size Analysis

Sediment proposed for dredging must be analyzed for grain size distribution, total organic carbon (TOC), total solids, and percent moisture according to the methods listed in Table 4-1. Examples of additional physical properties that may be necessary on a project specific basis are specific gravity, bulk density, and Atterberg limits (see Appendix C). Grain size analysis must be reported as percentages retained by weight in the size classes listed below.

- Total Gravel
- Coarse Sand
- Medium Sand
- Fine Sand
- Total Fines (silt/clay)

Gravel and sand fractions should be separated using the standard sieve sizes listed in Table 4-1. In addition to reporting the percentages of each size class, the applicant must graph the cumulative frequency percentages. The DMMT will provide guidance, on a project specific basis, on whether silt and clay fractions need to be distinguished. Further analysis of other size classes may also be required to evaluate suitability for beneficial use or other purposes. If so, instructions will be provided in the project specific SAP.

Note that the results of the above physical analyses may be used to support compliance with one or more of the exclusionary criteria for open water disposal under the MPRSA or the CWA explained in Section 3.6. If physical analyses show that the dredged material meets one or more of the exclusionary criteria and if other pertinent, historical, site-specific information evaluated in Tier 1 support the criteria, the material may be approved for open water disposal without further testing.

4.5 Bulk Chemical Analysis of Sediments and Elutriates

Instructions for the chemical analysis of project sediment and elutriate samples are provided in the sections below.

4.5.1 Contaminants of Concern

The contaminants of concern (COCs) that are required analytes on all projects undergoing sediment and elutriate chemical testing, appropriate analytical methods, and required reporting limits are listed in Tables 4-1 and 4-2. These metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and pesticides were chosen based on their toxicity, persistence in the environment, ability to bioaccumulate, and their widespread and consistent occurrence in New England estuarine and marine sediments and organisms. If additional project specific contaminants of concern are identified, then information will be provided to the applicant in the project specific SAP on appropriate methods and reporting requirements. Appendix C includes a list of example additional COCs.

4.5.2 Quality Control Samples

Certain quality control samples are required with each analysis to assure the quality of the analytical results. These include matrix spikes, laboratory duplicates, method blanks, laboratory control samples, standard reference materials, and surrogates. These QC samples are assessed in the data validation process and compared to acceptance criteria. The required quality control samples and their frequency are provided in Table 4-4.

4.5.3 Reporting Requirements

A reporting limit (RL) is the lowest concentration that the lab can measure with confidence in the quantitative accuracy of the data. RLs are affected by several factors including sample moisture and dilution. Method detection limits (MDLs) are the minimum concentration of a substance which can be identified, measured, and reported with confidence that the analyte is present. MDLs are typically several times less than RLs. The RLs listed in Tables 4-1 and 4-2 have been set to provide meaningful results when compared to the relevant reference data and screening criteria during dredged material evaluations. Results reported between the MDL and RL must be qualified as estimated with a "J". Non-detect results should be reported as half the MDL. The analytical laboratory must provide a report in an easy-to-read format (e.g., PDF, MS Word) that includes the information listed below. Please note this includes the Chemistry Data Validation Worksheet (provided in Appendix D) with the appropriate column filled out, showing whether the criteria were met.

- The reporting limit and the method detection limit for every analyte
- Title sheet identifying laboratory name, location, contact information
- Authorization statement and dated signature
- Analytical case narrative (i.e., data quality report)
- Sample identification table
- Method summary
- QC results and acceptance criteria
- Completed Chemistry Data Validation Worksheet (Appendix D)
- Signed chain of custody forms

All sediment testing data must also be submitted electronically in the electronic data deliverable (EDD) format available on the CENAE website:

https://www.nae.usace.army.mil/Missions/Disposal-Area-Monitoring-System-DAMOS/Electronic-Data-Deliverables.aspx.

The concentration, reporting limit, and method detection limit should be reported as parts per million (ppm) for metals and parts per billion (ppb) for organics on a dry weight basis. Total organic carbon and percent moisture, used to calculate dry weight concentrations, must also be reported. Total organic carbon samples must be analyzed in duplicate and shall include a laboratory control sample (LCS) with each batch.

4.5.4 Total Calculations

Total PCBs are calculated using the National Oceanic and Atmospheric Administration (NOAA) 18 method, which sums the 18 PCB congeners noted in Table 4-1 multiplied by two. Total chlordane is the sum of alpha and gamma chlordane, cis and trans nonachlor, and oxychlordane. Total DDx is the sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT. Total low molecular weight PAHs is the sum of acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. Total high molecular weight PAHs is the sum of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene.

For these mixtures of chemicals, non-detect results are included in the summation as one half of the analyte's MDL. Estimated values between the MDL and the laboratory RL (i.e., J-flagged values) are included in the summation at face value. Values that are J-flagged due to minor quality control deviations are also handled in this way.

4.5.5 Benthic Effects Evaluation and CWA/MPRSA Differences

The DMMT uses multiple lines of evidence to evaluate potential benthic effects based on the data generated through Tier 2. One consideration is a comparison of dredged material chemical concentrations to sediment chemistry concentrations at disposal site reference areas. The CENAE DAMOS Program maintains a database of reference area sediment chemistry for all commonly used dredged material disposal sites in New England. The DMMT compares concentrations of COCs in the dredged material to the reference area concentrations to determine which contaminants are elevated above background and require further evaluation.

An additional line of evidence the DMMT uses to evaluate potential benthic effects is a comparison of dredged material chemical concentrations to sediment quality guidelines (SQGs). Applicable SQGs for marine and estuarine sediments are the NOAA effects-range low (ERL) and effects-range median (ERM). It is important to understand that these values were not derived as pass-fail thresholds. Rather, ERL and ERM values are empirically derived guidelines based on a large number of studies nationwide that identify contaminant levels that indicate probability of toxic effects to inform decision making (Long et al. 1998). Effects are considered unlikely at concentrations below the ERL with an increased probability of toxic effects as concentrations increase. At concentrations above the ERM, toxic effects are considered likely. For sediment concentrations that fall between the ERL and ERM values, the DMMT considers both the number of contaminants that exceed the ERL and where those concentrations fall in the range between the ERL and the ERM in assessing the probability of benthic effects and the need for additional tiers of testing.

For projects evaluated under the CWA, the weight of evidence from the review of Tier 2 data could lead to a factual determination on benthic effects from the proposed dredging project. If the DMMT determines that Tier 2 data are insufficient to evaluate benthic effects, then additional benthic toxicity and/or bioaccumulation testing is required under Tier 3. For projects evaluated under the MPRSA, the Tier 2 benthic effects evaluation will inform the subsequent toxicity and bioaccumulation analysis required under Tier 3.

The DMMT also considers available physical, chemical, toxicological, and bioaccumulation testing data from recent, nearby dredging projects and from previous evaluations of the proposed dredging site. The DMMT reviews these data for quality, recency, and applicability with respect to the current conceptual site model for the proposed dredging project prior to incorporating these data into the benthic effects evaluation.

4.6 Water Column Evaluation and Modeling

The discharge of dredged material at an open water disposal site may introduce sediment contaminants into the water column. As required in 40 CFR § 227.6(c)(1), discharges in ocean waters must be in compliance with marine WQC after allowance for mixing. The federal criteria are shown in Table 4-2. Similarly, as required in 40 CFR § 230.10(b)(1), the discharge must be in compliance with state water quality standards for discharges in waters of the United States. Each appropriate state environmental regulatory agency, in coordination with the DMMT, will assess compliance with applicable state standards using the data described below.

The Tier 2 evaluation for water column compliance is a two-step process. If WQC have not been established for all contaminants of concern or if synergistic effects are suspected, additional testing in Tier 3 is required to determine water column compliance (Section 5.3).

4.6.1 Step 1: Evaluation for compliance with Water Quality Criteria

As the first step in evaluating compliance the DMMT models the discharge using the dry weight sediment concentrations of COCs, which assumes a total release from the sediments to the water column, as described in Section 5.1 of the Green Book and the ITM. This is a conservative assumption since in most scenarios, particularly within the relatively shallow open water disposal sites of New England, most of the contaminants remain within the dredged material (bound to particulates and within the pore water) that quickly reaches the seafloor. The model used is described below in Section 4.7.3. If the modeled discharge meets the WQC (Table 4-2 or applicable state WQC), then no further analysis is needed. If the modeled discharge exceeds the WQC, then the standard elutriate test, described below in Step 2, must be performed. Disposal site water quality values are used in the calculation to determine WQC compliance, or existing data (provided by the DMMT) in the vicinity of the disposal site may be substituted.

4.6.2 Step 2: Standard Elutriate Analysis

If the model results from Step 1 fail to meet the WQC, then further evaluation is required under Tier 2, which involves analyzing dredged material elutriate samples that are prepared in accordance with the methods presented in Section 10.1.2.1 of the ITM (“Standard Elutriate Preparation"). By using elutriate analysis results, the modeling performed in Step 2 more accurately represents the contaminant concentrations that will be present in the water column when the dredged material is discharged at the disposal site.

The elutriate is prepared with approximately one liter of homogenized dredged material mixed with overlying water from the dredged material site in a 1 to 4 volumetric ratio. To evaluate WQC in the liquid phase, the supernatant must be siphoned off without disturbing the settled material and centrifuged prior to chemical analysis to remove particulates. The chemical analysis of the elutriate and disposal site water is discussed in Section 9.4 of the ITM (“Chemical Analysis of Water”). Disposal site water quality values are used in the calculation to determine WQC compliance, or existing data (provided by the DMMT) in the vicinity of the disposal site may be substituted.

At a minimum, chemical analysis must be conducted for the inorganic and organic analytes shown in Table 4-2. Additional contaminants of concern may be requested for specific projects. Table 4-2 also provides the recommended methods and required RLs for each contaminant of concern.

4.6.3 Numerical Model for Mixing Evaluations

This section describes the DMMT use of numerical models to evaluate water column mixing during the discharge of dredged material at an open water disposal site. Initial-mixing evaluations for compliance with WQC, and toxicity if applicable, are performed by the DMMT as part of their assessment of each project; applicants or their agents do not need to run the models. The following information supplements the national guidance in Appendix B of the Green Book and in the ITM Appendix C: Evaluation of Mixing.

Numerical models are components of both Tier 2 and Tier 3 water column evaluations. The model used, STFATE (Short-Term Fate and Transport evaluation), is contained in the Automated Dredging and Disposal Alternatives Management System (ADDAMS) from the ITM. The model is available for unrestricted distribution from the U.S. Army Engineer Research and Development Center (ERDC). Other USACE or USEPA approved models may be used in place of STFATE if appropriate.

STFATE is run only for the contaminant of concern that requires the greatest dilution. If this contaminant is shown to be in compliance with the appropriate criteria, discussed in Sections 4.6.1, 4.6.2, and later in 5.3.1, then all other contaminants that require less dilution will also be in compliance.

STFATE computes the movement of dredged material from an instantaneous discharge from a split-hulled scow or from a hopper dredge as it falls through the water column. To properly apply this model, the total time required for the dredged material to leave the disposal vessel should not be greater than the time required for the material to reach the bottom. The model applies to both split-hull barge and hopper disposal.

This model accounts for the physical processes that determine the short-term fate of dredged material in the water column as it is disposed at open water sites. The model assumes that the dredged material behaves as a dense liquid and simulates the movement of the disposed material as it falls as a hemispherical cloud through the water column and spreads over the bottom. It does not account for resuspension or other long-term post-disposal phenomena in the water column or benthic environment.

Input data for the model are grouped into the following general areas:

- Description of the disposal operation
- Description of the disposal site
- Description of the dredged materials
- Model coefficients
- Controls for input, execution, and output

Table C-2 in the ITM (Appendix C: Evaluation of Mixing) lists the necessary input parameters and their corresponding units. In addition to the physical and chemical properties of the dredged material generated through the Tier 2 evaluation, applicants must also provide the following parameters: volume of dredged material in barge, barge hopper length and width, and post-disposal draft of barge. Additional descriptions and guidance for selection of values for many of the model parameters are also provided in Appendix C of the ITM.

4.6.4 CWA/MPRSA Differences

General guidelines for compliance with WQC under the CWA are explained in Section 10.1 and Appendix C of the ITM. The applicable state environmental regulatory agency will be consulted to determine the mixing requirements for compliance with the WQC in that state. If the numerical model predicts that the concentration of all contaminants of concern at the edge of the mixing zone is less than the available, applicable WQC, the dredged material is in compliance. Otherwise, it is not, and reductions in discharge volume or other controls may be considered. Water column impact must also be evaluated by toxicity testing in Tier 3 when there are contaminants of concern for which applicable WQC are not available or where synergistic effects are of concern.

General guidelines for compliance with WQC under the MPRSA are explained in Section 5.1 and Appendix A of the Green Book. As a rule, under the MPRSA, synergistic effects are to be suspected whenever there is more than one contaminant present in the sediment (USEPA/USACE 1998). Consequently, there is not currently a procedure to assess compliance for water column impacts at Tier 2 under the MPRSA, and determinations for these scenarios must include bioassay testing at Tier 3.

4.7 Data Validation

The DMMT will review the quality of all submitted data to ensure it meets acceptance criteria for use in suitability determinations. This section provides quality assurance (QA) guidelines for both field and chemical data.

4.7.1 Data Package Submittal

The first step in the data validation process is a review of the data package submitted by the applicant to ensure it is complete. The submittals necessary for a complete data package are listed below.

- Data submittal checklist (Appendix D)
- Core logs which include all the information required in Section 4.3.2.
- Field sampling data table (part of the EDD, see below) and the relevant Field Data Review Worksheet (Appendix D).
- Laboratory report which includes the information required in Section 4.5.3.
- An EDD in the format specified on the CENAE website: http://www.nae.usace.army.mil/Missions/Disposal-Area- Monitoring-System DAMOS/Electronic-Data-Deliverables.aspx.
- *OPTIONAL (if the applicant chooses to perform the data validation by utilizing a data validation professional):* Data validation report and EDD with all data validation qualifiers applied.

4.7.2 Field Data Validation

After the DMMT receives a complete data package, the next step in the data validation process is confirming that the field sampling effort was performed in accordance with the requirements outlined in Section 4 and the project specific SAP. As-sampled coordinates are checked to make sure they are within the required distance from the planned target locations. Sediment surface elevations reported in feet MLLW are compared to the project depth plus overdepth elevation (feet MLLW) to verify the required core length at the time of sampling. The core penetration and recovery are compared to the required core length to ensure that each core

encompasses the full dredge plus overdepth interval. Core recovery is compared to penetration to ensure that each core had a recovery of at least 75%. Sample intervals are then compared to the required core length, core photos, and descriptions to ensure that the full dredge interval was sampled correctly and that, if appropriate, subsampling was completed based on sediment stratification or instructions from the DMMT. The number of coring attempts is also checked to ensure that, if necessary, a sufficient number of attempts were made to recover a core that meets the above criteria.

If a project's field data submittal does not meet these requirements, or any additional requirements stated in the SAP, then samples may be rejected and re-sampling may be required. The Field Data Review worksheets can be found in Appendix D and the field sampling data table is provided as part of the EDD on the CENAE website.

4.7.3 Chemistry Data Validation

In order to assess the usability of chemistry data for dredged material characterization and suitability determinations, certain QA/QC samples must be analyzed including method blanks, matrix spikes, laboratory duplicates, surrogates, and standard reference materials. The required QA/QC samples and the frequency at which they must be analyzed are summarized in Table 4-4.

Laboratories performing chemical analyses must follow the standard quality control procedures published in the respective method and/or laboratory standard operating procedure and must have CENAE LQAP accreditation for each method (see Section 4.7.4).

All chemistry data submitted for dredging projects must undergo data validation. The DMMT can perform the necessary data validation once a complete data package has been received (see section 4.7.1). However, applicants also have the option to perform the data validation by utilizing a professional data validation firm or competent individual with relevant data validation experience. Submitting data with the validation completed can help reduce the time needed for the DMMT to complete the data review and subsequent evaluation.

If the applicant chooses to perform the data validation by utilizing a professional data validation firm or competent individual with relevant data validation experience, then a data validation report which follows the guidance specified below must be submitted as part of the data submittal package. The report must list each instance of an analyte that is outside QA/QC criteria with the associated action taken, and the submitted EDD must have the validation qualifiers applied. The DMMT will review the submitted data validation report and, if the DMMT finds that the applicant's data validation was not done in accordance with the guidelines below, may require the applicant to revise the data validation report or the DMMT may elect to perform their own data validation.

All sediment and elutriate chemistry data must undergo data validation to a modified Tier 1 Stage 2A (USEPA 2020a) level to ensure that all chemistry QA/QC requirements are met and to

assign appropriate final data validation flags consistent with the NERIM Data Validation Reference Sheets in Appendix D. As defined by USEPA Region 1, a Tier 1 Stage 2A data validation consists of verification and validation based on completeness and compliance checks of sample receipt conditions and sample-related QC results (USEPA 2020a). In addition to the Tier 1 Stage 2A requirements, field duplicates and equipment blanks will be assessed. Higher stages of data validation may be required if data quality issues are present.

For data submittal and validation requirements for tissue chemistry results submitted for bioaccumulation assays see sections 5.5.3 and 5.7.

Data validation is conducted using the NERIM Data Validation Reference Sheets and worksheets in Appendix D, which are based on USEPA Contract Laboratory Program (CLP) National Functional Guidelines (NFG) (USEPA 2020b; 2020c) and USEPA Region 1 requirements (USEPA 2018). These guidelines are regularly updated, and DMMT validation guidelines may change to reflect any updates.

Measurement performance criteria must be provided for each analytical method. Completed Chemistry Data Validation Worksheets (Appendix D) must be submitted with each laboratory report with the appropriate column filled out, showing whether the criteria were met. These worksheets are used to complete data validation for each project. The data validator (either the DMMT or applicants chosen data validation professional) must fill out the appropriate column, showing any necessary actions taken (e.g. data qualifiers applied) or explain why an action was not needed.

4.7.4 Laboratory Accreditation

All laboratories must have an approved LQAP on file with the DMMT. Any data produced from a lab without an approved LQAP will not be accepted. A current list of laboratories with approved LQAPs may be found at: http://www.nae.usace.army.mil/Missions/Regulatory/Dredged-Material-Program/.

4.7.5 Sample Detection Limits and Reporting Limits

All RLs must be at or below the NERIM required RLs specified in Tables 4-1 and 4-2 when submitting chemical data for bulk chemistry and elutriate testing. Higher reporting limits are acceptable if dilution is required due to the sample matrix or interference and the analyte is detected above the resulting RL. If the NERIM RLs cannot be achieved for non-detect results due to matrix interference and/or necessary dilution, then it is imperative that the MDL be below the required RL. Failure to achieve the NERIM required RLs for non-detect results could lead to data rejection and the need for re-analysis, which may require resampling if applicable holding times are exceeded (see Table 4-3). Holding times for sediment can be extended by freezing samples. If RLs cannot be met under Tier 2, additional testing under Tier 3 may also be required to verify the suitability of sediments for open-water disposal.

To avoid potential problems, and have the option for retesting, it is recommended that archived sediments or extracts be retained under proper storage conditions until the chemistry data are deemed acceptable by the DMMT.

4.7.6 Data Quality Objectives

Data quality objectives are the quantitative and qualitative requirements that must be met in order to achieve the project's objectives. Typical data quality objectives include precision, accuracy, and representativeness.

Precision: Precision is evaluated using the Relative Percent Difference (RPD) values between duplicate sample results and/or matrix spike duplicates.

$$\mathrm{RPD} = \frac{\mathrm{ABS}(\mathrm{R1} - \mathrm{R2})}{\left(\frac{\mathrm{R1} + \mathrm{R2}}{2}\right)} \times 100$$

R1 = Recovery for MS or duplicate 1

R2 = Recovery for MSD or duplicate 2

Accuracy: For parameters analyzed in the laboratory, accuracy will be evaluated using percent recovery (%R) of the target analyte in spiked samples and, where applicable, also the recoveries of the surrogates in all samples and QC samples.

$$\%\mathrm{Recovery} = \frac{\mathrm{SSR} - \mathrm{SR}}{\mathrm{SA}} \times 100$$

SSR = Spiked Sample Result

SR = Sample Result

SA = Spike Added

Representativeness: The degree to which data from the project accurately represent a particular characteristic of the environmental matrix which is being tested. Representativeness of samples is ensured by adherence to standard field sampling protocols and standard laboratory protocols. The SAP provided by the DMMT is designed to provide representativeness of each matrix being sampled.

Completeness: The percentage of valid results obtained compared to the total number of samples taken for a parameter. Percent completeness is calculated using the following formula:

$$\%\mathrm{Completeness} = \frac{\text{number of valid results}}{\text{number of samples taken}} \times 100$$

4.8 Potential Outcomes from Tier 2 and CWA/MPRSA Differences

For projects evaluated under the CWA, if the Tier 2 evaluation shows compliance with the water column, benthic, and bioaccumulation criteria, then the dredged material may be found suitable for open water disposal at this point (Figure 4-1). If the Tier 2 evaluation does not provide enough information to determine compliance with these criteria, then additional testing of toxicity and/or bioaccumulation may be required under Tier 3. Under the CWA, adverse effects of the dredged material discharge may be controlled, as described in 40 CFR § 230.72, in order to potentially reduce or eliminate the need for additional Tier 3 testing.

For projects evaluated under the MPRSA, the chemical and physical information gathered in Tier 2 will inform the additional sampling and analysis required in Tier 3 (Figure 4-2).

Table 4-1. Bulk Sediment Testing Parameters

Parameter	Units	Analytical Method	Reporting Limit
Physical			
Total organic carbon	%	USEPA 9060A	0.1%
Percent Moisture	%	ASTM D2216, SM 2540	1.0%
Percent Solids	%	ASTM D2216 SM 2540	1.0%
Grain Size	%	ASTMD 6913 (Sieves #4, 10, 40, 200)	1.0%
Silt/Clay (Hydrometer)		ASTM D7928	1.0%
Metals			
Arsenic	mg/kg	USEPA 6010D, 6020B	0.4
Cadmium	mg/kg	USEPA 6010D, 6020B	0.07
Chromium	mg/kg	USEPA 6010D, 6020B	0.5
Copper	mg/kg	USEPA 6010D, 6020B	0.5
Lead	mg/kg	USEPA 6010D, 6020B	0.5
Mercury	mg/kg	USEPA 7471B, 7474	0.02
Nickel	mg/kg	USEPA 6010D, 6020B	0.5
Zinc	mg/kg	USEPA 6010D, 6020B	1
PAHs			
Acenaphthene	ug/kg	8270E	10
Acenaphthylene	ug/kg	8270E	10
Anthracene	ug/kg	8270E	10
Fluorene	ug/kg	8270E	10
Naphthalene	ug/kg	8270E	10
Phenanthrene	ug/kg	8270E	10
Benzo(a)anthracene	ug/kg	8270E	10
Benzo(a)pyrene	ug/kg	8270E	10
Benzo(b)fluoranthene	ug/kg	8270E	10
Benzo(g,h,i)perylene	ug/kg	8270E	10
Benzo(k)fluoranthene	ug/kg	8270E	10
Chrysene	ug/kg	8270E	10
Dibenz(a,h)anthracene	ug/kg	8270E	10
Fluoranthene	ug/kg	8270E	10
Indeno(1,2,3-cd)pyrene	ug/kg	8270E	10
Pyrene	ug/kg	8270E	10

mg/kg=milligrams per kilograms
ug/kg=micrograms per kilograms

Table 4-1 (continued). Bulk Sediment Testing Parameters

Parameter	Units	Analytical Method	Reporting Limit
Pesticides			
4,4`-DDD	ug/kg	8081B	1
4,4`-DDE	ug/kg	8081B	1
4,4`-DDT	ug/kg	8081B	1
Aldrin	ug/kg	8081B	1
Alpha-Chlordane (cis)	ug/kg	8081B	1
cis-Nonachlor	ug/kg	8081B	1
Dieldrin	ug/kg	8081B	1
Endosulfan I	ug/kg	8081B	1
Endosulfan II	ug/kg	8081B	1
Endrin	ug/kg	8081B	1
Gamma-Chlordane (trans)	ug/kg	8081B	1
Heptachlor	ug/kg	8081B	1
Heptachlor epoxide	ug/kg	8081B	1
Hexachlorobenzene	ug/kg	8081B	1
Lindane (gamma-BHC)	ug/kg	8081B	1
Methoxychlor	ug/kg	8081B	1
Oxychlordane	ug/kg	8081B	1
Toxaphene	ug/kg	8081B	25
trans-Nonachlor	ug/kg	8081B	1
PCBs			
PCB 008	ug/kg	8082A, 8270E	1
PCB 018	ug/kg	8082A, 8270E	1
PCB 028	ug/kg	8082A, 8270E	1
PCB 044	ug/kg	8082A, 8270E	1
PCB 052	ug/kg	8082A, 8270E	1
PCB 066	ug/kg	8082A, 8270E	1
PCB 101	ug/kg	8082A, 8270E	1
PCB 105	ug/kg	8082A, 8270E	1
PCB 118	ug/kg	8082A, 8270E	1
PCB 128	ug/kg	8082A, 8270E	1
PCB 138	ug/kg	8082A, 8270E	1
PCB 153	ug/kg	8082A, 8270E	1
PCB 170	ug/kg	8082A, 8270E	1
PCB 180	ug/kg	8082A, 8270E	1
PCB 187	ug/kg	8082A, 8270E	1
PCB 195	ug/kg	8082A, 8270E	1
PCB 206	ug/kg	8082A, 8270E	1
PCB 209	ug/kg	8082A, 8270E	1

ug/kg=micrograms per kilograms

The specified methods are recommendations only. Other acceptable methodologies capable of meeting the Reporting Limits can be used. Sample preparation methodologies (e.g. extraction and cleanup) and sample size may need to be modified to achieve the required Reporting Limits.

Table 4-2. Elutriate Testing Parameters

Parameter	Units	Analytical Method	Reporting Limit	Federal WQC
Metals				
Arsenic	ug/L	6020B, 200.9, 1632A	10	69
Cadmium	ug/L	6020B, 200.9, 1637	10	33
Hexavalent Chromium	ug/L	7196A, 218.6, 1636	10	1100
Copper	ug/L	6020B, 200.9, 1639	2	4.8
Lead	ug/L	6020B, 200.9, 1639	10	210
Mercury	ug/L	7474, 245.7, 1631	0.4	1.8
Nickel	ug/L	6020B, 200.9, 1639	10	74
Selenium	ug/L	6020B, 200.9, 1639	10	290
Silver	ug/L	6020B, 200.9	1	1.9
Zinc	ug/L	6020B, 200.9, 1639	10	90
Industrial Chemicals				
Pentachlorophenol	ug/L	8270E	2.6	13
Pesticides				
4,4`-DDT	ug/L	8081B	0.03	0.13
Aldrin	ug/L	8081B	0.26	1.3
Alpha-Chlordane (cis)	ug/L	8081B	0.02	
Dieldrin	ug/L	8081B	0.14	0.71
Chlorpyrifos	ug/L	8081B	0.002	0.011
Endosulfan I (alpha)	ug/L	8081B	0.007	0.034
Endosulfan II (beta)	ug/L	8081B	0.007	0.034
Endrin	ug/L	8081B	0.007	0.037
Gamma-Chlordane (trans)	ug/L	8081B	0.02	
Heptachlor	ug/L	8081B	0.01	0.053
Heptachlor epoxide	ug/L	8081B	0.01	0.053
Lindane (gamma-bhc)	ug/L	8081B	0.03	0.16
Toxaphene	ug/L	8081B	0.04	0.21
Total Chlordane (alpha + gamma)[1]	ug/L			*0.09*

Notes:

[1] Total chlordane is the sum of alpha and gamma chlordane, USEPA WQC only available for total chlordane.

[2] No federal saltwater acute WQC available for PCBs, chronic criteria shown.

ug/L=micrograms per liter

The specified methods are recommendations only. Other acceptable methodologies capable of meeting the Reporting Limits can be used. Sample preparation methodologies (e.g. extraction and cleanup) and sample size may need to be modified to achieve the required Reporting Limits.

Table 4-2 (continued). Elutriate Testing Parameters

Parameter	Units	Analytical Method	Reporting Limit	Federal WQC
PCBs				
PCB 008	ug/L	8082A, 8270E	0.006	
PCB 018	ug/L	8082A, 8270E	0.006	
PCB 028	ug/L	8082A, 8270E	0.006	
PCB 044	ug/L	8082A, 8270E	0.006	
PCB 052	ug/L	8082A, 8270E	0.006	
PCB 066	ug/L	8082A, 8270E	0.006	
PCB 101	ug/L	8082A, 8270E	0.006	
PCB 105	ug/L	8082A, 8270E	0.006	
PCB 118	ug/L	8082A, 8270E	0.006	
PCB 128	ug/L	8082A, 8270E	0.006	
PCB 138	ug/L	8082A, 8270E	0.006	
PCB 153	ug/L	8082A, 8270E	0.006	
PCB 170	ug/L	8082A, 8270E	0.006	
PCB 180	ug/L	8082A, 8270E	0.006	
PCB 187	ug/L	8082A, 8270E	0.006	
PCB 195	ug/L	8082A, 8270E	0.006	
PCB 206	ug/L	8082A, 8270E	0.006	
PCB 209	ug/L	8082A, 8270E	0.006	
Total PCBs[2]	*ug/L*			*0.03*

Notes:

[1] Total chlordane is the sum of alpha and gamma chlordane, USEPA WQC only available for total chlordane.

[2] No federal saltwater acute WQC available for PCBs, chronic criteria shown.

ug/L=micrograms per liter

The specified methods are recommendations only. Other acceptable methodologies capable of meeting the Reporting Limits can be used. Sample preparation methodologies (e.g. extraction and cleanup) and sample size may need to be modified to achieve the required Reporting Limits.

Table 4-3. Recommended Procedures for Sediment and Aqueous Sample Collection, Preservation, and Storage

Analyses	Collection Method	Suggested Quantity[a]	Container[a]	Preservation Technique[a]	Storage Conditions[a]	Holding Time[a]
Sediment						
Metals	Grab/ corer	4 oz	Glass jar	Refrigerate. Dry ice or freezer storage is recommended for extended holding times.	4° C ± 2° C	180 Days[b], Hg 28 Days[b]
Volatile Organic Compounds	Grab/ corer	5 g	High Level: 40 mL VOA vial Low Level: (2) 40 mL VOA vials	High Level: 5 mL MeOH Low Level: 5 mL Water	4° C ± 2° C	High Level: 14 Days Low Level: 48 Hrs freeze, 14 Days analysis
PAHs	Grab/ corer	4 oz	Glass jar	Refrigerate. Dry ice or freezer storage is recommended for extended holding times.	4° C ± 2° C	14 Days[b] (Extraction)
Pesticides	Grab/ corer	4 oz	Glass jar	Refrigerate. Dry ice or freezer storage is recommended for extended holding times.	4° C ± 2° C	14 Days[b] (Extraction)
PCBs	Grab/ corer	4 oz	Glass jar	Refrigerate. Dry ice or freezer storage is recommended for extended holding times.	4° C ± 2° C	1 Year[b] (Extraction)
Grain Size	Grab/ corer	1 quart	Zipper lock bag	None	NA	NA
Total Organic Carbon	Grab/ corer	4 oz	Glass jar	Refrigerate. Dry ice or freezer storage is recommended for extended holding times.	4° C ± 2° C	28 Days[b] (Extraction)

Notes:

[a] This table contains only a summary of recommended collection, preservation, and storage procedures for samples. The applicant should consult with their laboratory for required sample volumes, containers, preservation, and holding times.

[b] Sample may be held for up to one year if maintained frozen ≤-20°C.

oz=ounce

g=gram

mL=milliliter

VOA=volatile organic analysis

Table 4-3 (continued). Recommended Procedures for Sediment and Aqueous Sample Collection, Preservation, and Storage

Analyses	Collection Method	Suggested Quantity[a]	Container[a]	Preservation Technique[a]	Storage Conditions[a]	Holding Time[a]
Water and Elutriate						
Metals	Discrete sampler or pump	500 mL	Polyethylene bottle	pH <2 with HNO_3	4° C ± 2° C	180 Days, Hg 28 Days
Hexavalent Chromium	Discrete sampler or pump	500 mL	Polyethylene bottle	Airtight seal; refrigerate	4° C ± 2° C	24 Hrs
Volatile Organic Compounds	Discrete sampler or pump	(2) 40 mL VOA vials	(2) Amber 40 mL VOA Vials	pH <2 with HCl, zero headspace	4° C ± 2° C	14 Days
Semivolatile Organic Compounds	Discrete sampler or pump	(2) 1000 mL	Amber Glass Teflon Lined	Airtight seal; refrigerate	4° C ± 2° C	7 Days (Extraction)
Pesticides	Discrete sampler or pump	(2) 1000 mL	Amber Glass Teflon Lined	Airtight seal; refrigerate	4° C ± 2° C	7 Days (Extraction)
PCBs	Discrete sampler or pump	(2) 1000 mL	Amber Glass Teflon Lined	Airtight seal; refrigerate	4° C ± 2° C	1 Year (Extraction)

Notes:

[a] This table contains only a summary of recommended collection, preservation, and storage procedures for samples. The applicant should consult with their laboratory for required sample volumes, containers, preservation, and holding times.

[b] Sample may be held for up to one year if maintained frozen ≤-20°C.

mL=milliliter

VOA=volatile organic analysis

Table 4-4. Analytical QA/QC Requirements

Analysis Type	Methods Blank[1]	Laboratory Duplicate[1]	MS/ MSD[1]	Surrogates[2]	CRM/ SRM[3]	LCS/ LCSD[1]	Field Duplicate[1]	Field Equipment Blank[4]
Organics (e.g., PAHs, pesticides, PCBs)	X	X	X	X	X	X	X	X
Metals	X	X	X		X	X	X	X
Total Organic Carbon[5]	X	X	X			X	X	
Grain Size		X					X	
Total Moisture/Solids		X					X	

Notes:

CRM=Certified Reference Material; SRM=Standard Reference Material
MS/MSD=matrix spike/matrix spike duplicate
LCS/LCSD=laboratory control sample/ laboratory control sample duplicate.
[1] Frequency of Analysis=1 for every 20 samples or 1 per batch, whichever is more frequent.
[2] Surrogate spikes required for every sample, including matrix spiked samples, blanks, and reference materials.
[3] One CRM/SRM should be analyzed per project sampling event.
[4] Equipment blanks are necessary only for non-dedicated sampling equipment that comes into contact with samples.
[5] TOC run in duplicate for every sample.

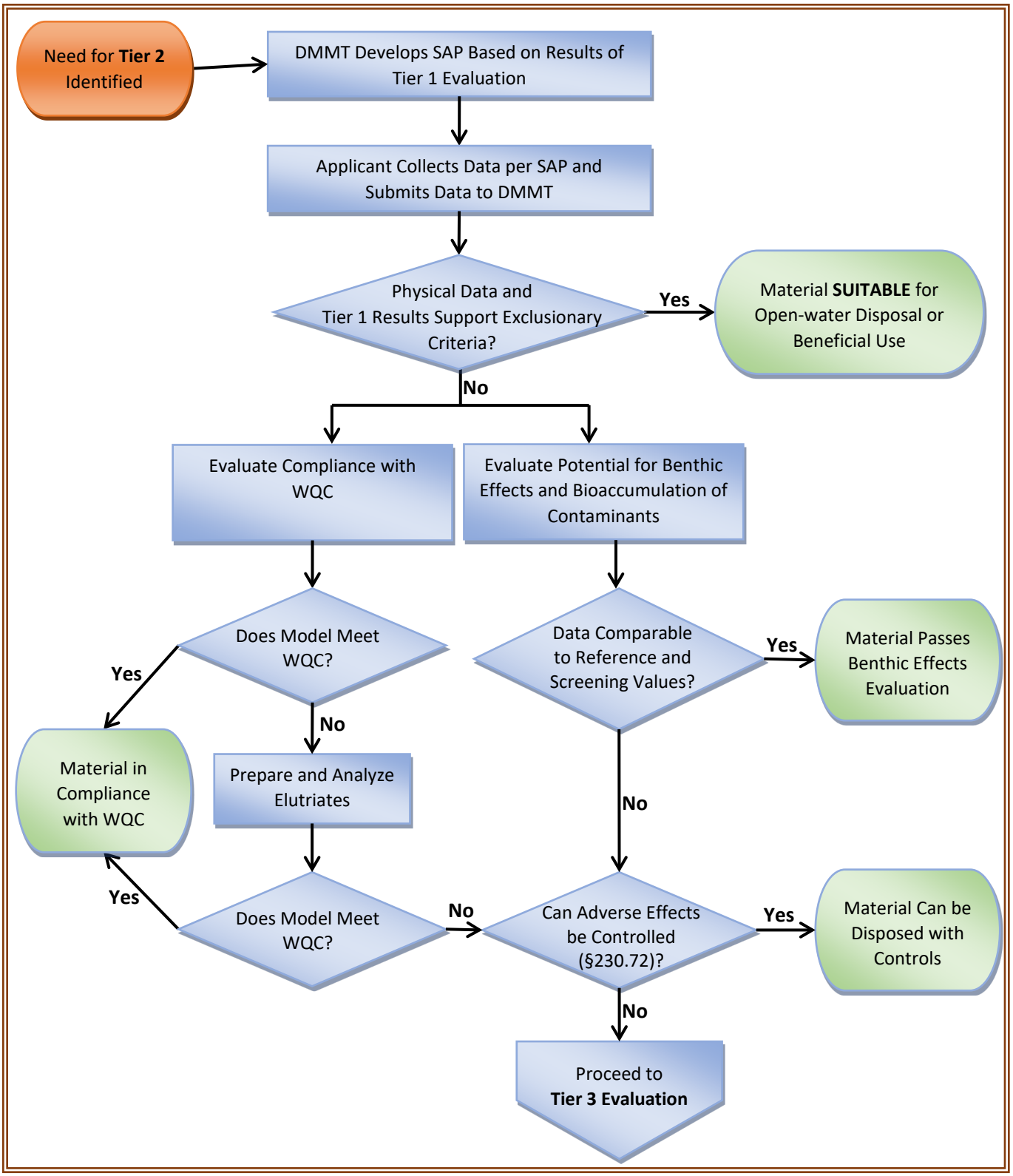


Figure 4-1. Tier Two Evaluation (CWA)

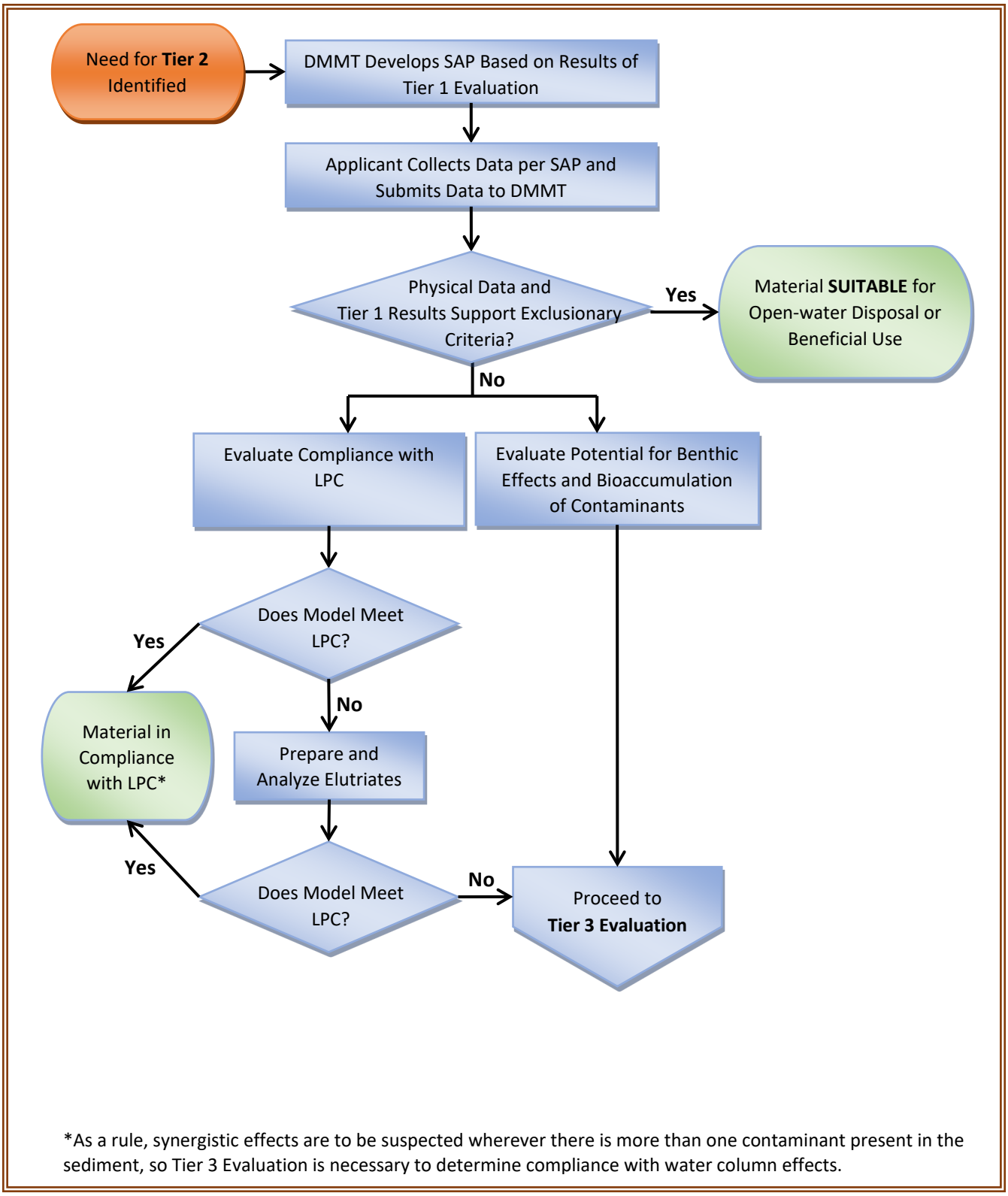


Figure 4-2. Tier Two Evaluation (MPRSA)

PROJECT NAME: _____ DATE: _____

PROJECT LOCATION: _____ SEA STATE: _____

VESSEL: _____ POSITIONING EQUIPMENT: _____

SAMPLING EQUIPMENT (MAKE/MODEL): _____

SAMPLING PERSONNEL: _____ LOGGED BY: _____

CORE ID: _____ ATTEMPT NO: _____ TIME: _____

LATITUDE: _____ LONGITUDE: _____ POSITION ACCURACY: _____

MEASURED WATER DEPTH (FT): _____ CORRECTED WATER DEPTH (FT MLLW): _____

TARGET PENETRATION (FT): _____ ACTUAL PENETRATION (FT): _____ RECOVERY (FT): _____

COMMENTS: _____

SAMPLE INTERVAL(S): _____

CORE PHOTO:	CORE DESCRIPTION:
Insert core photograph with scale	*Insert field notes and ASTM description of core*

Figure 4-3. Example Core Log Template

5.0 Tier 3: Bioassays and Bioaccumulation Testing

Tier 3 biological testing is required for all dredged material evaluated under MPRSA and when the suitability of dredged material cannot be determined with the information collected through Tier 2, or if the effects of the discharge cannot be controlled under 40 CFR 230.72, for material evaluated under CWA.

Biological testing under Tier 3 may include:

- Whole sediment bioassays – used to evaluate potential toxicity to benthic invertebrates (Section 5.2)
- Water column bioassays – used to evaluate potential toxicity to aquatic organisms (Section 5.3)
- Bioaccumulation tests – used to evaluate the bioavailability of contaminants that are known or suspected to accumulate in the tissues of benthic marine organisms and cause ecological or human health risk (Section 5.4)

Results of bioassay tests are considered to be more informative of potential resource impacts than evaluations based solely on chemical testing; therefore, bioassay results generally take precedence over chemical results.

5.1 CWA/MPRSA Differences and Supplemental SAPs

Under the CWA, Tier 3 testing may include whole sediment toxicity, water column toxicity, bioaccumulation testing, or a subset of these tests based on the project specific risk determined through the Tier 1 and Tier 2 evaluations. Under the MPRSA Tier 3 testing is required for all dredged material that does not meet exclusionary criteria (explained in Section 3.6) and must include whole sediment toxicity, water column toxicity, and bioaccumulation testing for all projects.

When Tier 3 testing is required, the DMMT will consider the conceptual site model, project risk, and results of the Tier 2 evaluation to develop a supplemental sampling and analysis plan for biological testing. This supplemental SAP will include a revised sampling scheme that may involve compositing samples for biological testing based on location, physical characteristics, and chemical concentrations. The supplemental SAP will also identify which components of Tier 3 testing are required for projects evaluated under the CWA. Recommended procedures for sediment, water, and tissue sample collection for biological testing (including sample volumes, preservation, storage, and holding times) are provided in Table 5-1.

5.2 Whole Sediment Toxicity

Whole sediment toxicity is determined through a 10-day bioassay as described in Section 11.2 of the Green Book and the ITM. The purpose of the 10-day sediment toxicity test is to determine

whether the sum of the sediment contaminants measured in Tier 2, in combination with the physical characteristics of the dredged material, will elicit a toxic response to exposed organisms after the material is deposited into the marine environment.

For projects proposing marine and estuarine disposal, two test species of those listed in the Toxicity section of Table 5-2 are required – one of the three marine amphipod species (depending on disposal site conditions, i.e. salinity and grain size), and the mysid shrimp. Species-specific test conditions and procedures are listed in Appendix E and in the ITM. Details are provided in American Society of Standards and Materials (ASTM) (ASTM 2023a) for estuarine/marine amphipods and in USEPA (2002) for mysid shrimp. All tests are static non-renewal, with the exception that renewal is allowed to control for ammonia toxicity (see below).

General guidance for the collection, handling, and storage of sediments for biological testing are described in Chapter 8 of the Green Book and the ITM. Refer to ASTM guides, “Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing and for Selection of Samplers Used to Collect Benthic Invertebrates” (ASTM 2023b) and “Measuring the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Invertebrates” (ASTM 2023a) for specific guidance related to amphipod sediment toxicity testing. The DMMT will determine whether compositing of sediment samples for biological testing is permissible based on the project conceptual site model and the physical and chemical results of the Tier 2 analysis.

The minimum sediment depth in the test beakers should be 2 centimeters (cm). Sediments tested may be press-sieved (determined on a case-by-case basis by visual observation) with a 1 or 2 millimeters (mm) sieve to remove unwanted debris and predators before being added to the test chambers. All data should be reported on the forms supplied in USEPA (1994; Appendix A, Figures A1-A5) or a close facsimile. In addition to the parameters on the forms, all observations on mortality, the formation of tubes or burrows, amphipod emergence from sediment, and any physical or behavioral abnormalities must be recorded.

Sediment chemistry for the project specific contaminants of concern, TOC, and grain size analyses may be required by the DMMT on subsamples of the sediments that are used for biological testing. The DMMT may require subsamples of the dredged material, reference, and control sediments used in the test to be archived for possible future chemical or physical analysis.

The DMMT maintains a reference database of whole sediment toxicity results for preferred species at most dredged material disposal sites in New England for statistical comparison with dredged material test results. Depending on species selection, these results may be used in place of project specific whole sediment toxicity testing of disposal site reference areas. The DMMT can provide guidance on preferred species and availability of reference data for specific disposal sites.

5.2.1 Whole Sediment Toxicity Evaluations

The DMMT will evaluate the results of the whole sediment toxicity tests to determine the potential for benthic effects from disposal of the dredged material. The approach is outlined in Section 6 of the ITM and the Green Book and involves a statistical comparison of mortality in the dredged material versus mortality in the reference sediment. If mortality in the dredged sediment is statistically greater than in the reference sediment and exceeds the mortality in the reference sediment by at least 10%, the dredged material is considered to be acutely toxic to benthic organisms and not in compliance with the benthic criteria (Figure 5-1). The 10% value will be used for all organisms, except amphipods, which will be evaluated with a 20% value based on recommendations in the ITM and Green Book.

5.2.2 Ammonia Mitigation

Amphipods and mysid shrimp are sensitive to ammonia; therefore, excessive ammonia concentrations in test sediments may cause mortalities in these species that confound the mortality endpoint of interest for the Tier 3 evaluation, which focuses on more persistent contaminants. Ammonia toxicity changes with ephemeral environmental conditions, such as temperature, salinity, and pH. To mitigate for this scenario, the USEPA and USACE have developed methods to reduce ammonia toxicity potential before the whole sediment toxicity test begins as described in Sections 11.4.5 -11.4.5.3 of the USEPA amphipod manual (USEPA 1994) and summarized in the ASTM (2023a). The applicant must seek approval from the DMMT on project-specific procedures for any sediments requiring treatment for ammonia toxicity.

To avoid toxicity from ammonia in the amphipod tests, the laboratory must ensure that the sediment pore water total ammonia and unionized ammonia concentrations are below 30 milligrams per liter (mg/L) and 0.4 mg/L, respectively, for 24 hours before amphipods are added to the test chambers, as well as for the duration of the test (USEPA/USACE 1998). Ammonia levels can be reduced by sufficiently aerating the sample and replacing two volumes of water per day (USEPA 1994). Ammonia measurements should be made in surrogate test chambers set up specifically for pore water collection. Recommended procedures to set up the surrogate chambers, collect pore water, and analyze for ammonia are described in Appendix F Total ammonia levels must be monitored in the pore water on days 1, 3 (or 5) and 10 during the test. Unionized ammonia can be calculated from total ammonia based on additional measurements of pH, temperature, and salinity.

For the mysid shrimp test, the concern is unionized ammonia in the overlying water (1 cm above the sediments). The laboratory must ensure that the water concentrations are below 0.6 mg/L in tests run at pH of 7.9-8.0, or 0.3 mg/L at lower pHs before any animals are added to the test chambers. In this case, overlying water is monitored each day and should be replaced two times per day until the levels are below the acceptable thresholds.

An alternative approach to remove ammonia is to perform a thin layer purging technique as conducted by the USEPA Region 2 Environmental Laboratory (Ferretti et al. 2000). Contact the DMMT for further information on this approach.

5.3 Water Column Toxicity

Tier 3 water column tests evaluate the potential for toxicity of the dissolved and suspended portions of the dredged material that remain in the water column after discharge of the dredged material. The water column bioassays are required under MPRSA, and they are run under CWA if the Tier 2 evaluations are inconclusive: i.e., there are no water quality criteria for all contaminants of concern or there is reason to suspect additive or synergistic effects among the contaminants. The Tier 3 water column tests involve exposing fish, pelagic crustaceans, and planktonic invertebrate larvae to a dilution series containing dissolved and suspended components of the proposed dredged material. Disposal site water, clean seawater, or aged artificial seawater (see below) is used as the dilution water for the tests. An overview of the Tier 3 water column evaluation is presented in Section 6.1 of the Green Book and the ITM.

Technical guidance for performing the tests is provided in Section 11.1 of the ITM. Three series of tests are necessary; tests must be run using a fish (silversides or minnow), a crustacean (mysid shrimp), and a planktonic larva (bivalve or echinoderm) as specified in Table 5-3 of this manual. Species-specific test conditions are listed in Appendix E. The mysids and fish should be fed as prescribed by USEPA (2002). Planktonic larvae must not be fed (ASTM 2021a; 2021b). Test duration is generally 96 hours, except for planktonic larvae, which is typically 48 hours.

Samples for the standard elutriate test and the water column toxicity test can be prepared from the same sediment-water mixture. The procedure for preparing the water column toxicity test samples is given in Section 11.1.4 of the ITM with certain modifications. In cases where the salinity of the disposal site water is detrimental to the health of the test organism (too low), all the toxicity water samples must be prepared using clean seawater. The necessary dilutions may be made using water collected from clean seawater or aged artificial seawater. Each series should include 100%, 50%, and 10% treatments in addition to a 0% treatment (=100% dilution-water treatment). Clean seawater in which the organisms were held prior to testing must be run as a control. If the diluent is the same water the organisms are held in prior to testing, then the control and 0% treatment are one and the same. Some fine-grained sediments can create turbidity in the test water even after settling. In this circumstance, the ITM Section 11.1.4 allows “mild centrifugation” until the suspension is clear enough at the first observation time for the organisms to be visible in the testing chamber.

For the fish and mysid shrimp bioassays, a minimum of five replicates per treatment concentration and a minimum of 10 organisms per replicate are required. The lab should ensure that organisms are not overcrowded in the test chambers, as this can cause stress to the organisms and falsely influence the results. The number of surviving fish and mysid shrimp for

each replicate must be recorded at 0, 1 to 2 hours, 24, 48, 72 and 96 hours. Dead or unresponsive organisms may be removed and replaced at the first observation period, but not at any subsequent observations. Dead organisms should be counted and removed daily. Observations of organism behavior and activity must be recorded daily during the test.

For the planktonic larvae bioassays, a minimum of five replicates per treatment is also required. A suspension of fertilized eggs is used in the preparation of the test solutions. The suspensions containing bivalve larvae should contain 15 to 30 embryos/mL, whereas the suspensions containing sea urchin larvae should also contain 15 to 30 embryos/mL, but up to 50 embryos/mL is acceptable for the test. For the bivalve water column toxicity test, the ASTM (2021a) protocol should be followed. For the sea urchin larvae test, the ASTM (2021b) protocol should be followed. A light box or dissecting microscope may be used to record the number of live animals; use of an image analyzer as discussed in this procedure is not required. For the planktonic larval test, centrifugation of a turbid supernatant is not necessary and should not be performed. The test is terminated in 48 to 72 hours when at least 70% (oysters and urchins) or 90% (mussels) of the larvae in the test chambers have reached the acceptable stage of development for the test organism - in the bivalve embryos, normally developed prodissoconch I larvae, and in urchin embryos, normal pluteus larvae.

For all test organisms any sublethal effects such as physical or behavioral anomalies must also be reported along with the percent of larvae that reached the appropriate stage of development (prodissoconch larvae bivalves and plutei for the sea urchin) in the 0% treatment. Daily water quality records must be kept for salinity, temperature, dissolved oxygen (DO) and pH for each test dilution. See Section 5.3.2 for additional recording requirements for ammonia.

5.3.1 Water Column Evaluation, Mixing Models, and CWA/MPRSA Differences

The DMMT uses the numerical mixing model STFATE, described in Section 4.6.3 of this manual, to determine water column effects in a Tier 3 evaluation.

General guidelines to determine compliance of dredged material discharges under the CWA are explained in Section 11.1 and Appendix C of the ITM. The maximum allowable concentration outside of the defined mixing zone, typically the disposal site boundary, is 1% of the lowest calculated median lethal concentration (LC_{50}) from the suspended phase toxicity test results (USEPA/USACE 1998). If the model predicts that the concentration beyond the boundaries of the mixing zone will not exceed 1% of the lowest LC_{50} then the dredged material discharge is not predicted to be acutely toxic to water column organisms (Figure 5-2).

To evaluate discharges of dredged material under the MPRSA the DMMT uses the results of the suspended phase toxicity test to determine compliance with the Limiting Permissible Concentration (LPC). The LPC for the dredged material is 1% of the lowest calculated LC_{50} (40 CFR § 227.27(a)(2)). If the numerical mixing model predicts that the concentration of dredged material in the water column will not exceed 1% of the LC_{50} concentration at any time outside the disposal site, or within the disposal site boundaries after allowance for 4 hours of mixing, the

proposed discharge of dredged material meets the water column LPC. If either of these criteria are not met, the dredged material does not meet the water column LPC (Figure 5-2).

5.3.2 Ammonia Mitigation and Protocol

As explained in Section 5.2.2, ammonia is a naturally occurring non-persistent contaminant that is considered a confounding factor in marine sediment toxicity evaluations and generally not a contaminant of concern at open water disposal sites (USEPA/USACE 1998). To account for this potential interference the NEDMMP developed a protocol to determine if ammonia is contributing to observed toxicity in the suspended phase test. In cases where ammonia is identified as a confounding influence, alternate application factors (other than the 1% presented in the previous section) can be used to determine compliance in water column evaluations under both the MPRSA (40 CFR § 227.27(a)(3)) and the CWA.

To determine if naturally occurring ammonia in the sediment has the potential to cause a toxic response in the suspended phase test the DMMT advises applicants to measure total ammonia in the undiluted (100%) elutriate samples prior to test initiation and then calculate the unionized ammonia concentration based on additional measurements of pH, temperature, and salinity. If calculated unionized ammonia concentrations are greater than the applicable WQC, the applicant should notify the DMMT within 24 hours for guidance on project-specific procedures for preparation of additional elutriate samples requiring treatment for ammonia reduction and additional suspended phase acute toxicity testing. The general procedure is described below and outlined on Figure 5-3.

If the ammonia concentration in the undiluted elutriate sample exceeds the WQC, immediately consult the DMMT for guidance to perform a second, paired suspended phase toxicity test with ammonia purged sediment. The sediment used to prepare the elutriates for the paired water column toxicity test shall be assessed for ammonia content in sediment pore water according to the method outlined in Appendix F. The sediment is purged following the same technique described in Section 5.2.1 until the sediment pore water total ammonia and unionized ammonia concentrations are below 30 mg/L and 0.4 mg/L, respectively, for 24 hours before using this sediment to create elutriates. Once ammonia pore water concentrations reach acceptable levels, the applicant shall create a second set of ammonia reduced elutriates and follow the same procedure described in Section 5.3 for water column toxicity testing.

An alternative approach to remove ammonia is to perform a thin layer purging technique as conducted by the USEPA Region 2 Environmental Laboratory (Ferretti et al. 2000). Contact the DMMT for further information on this approach.

Total ammonia and calculated unionized ammonia concentrations must be recorded for all elutriate dilutions, original and ammonia purged, at the start and end of each test. If complete mortality is observed prior to the full test duration, total ammonia and calculated unionized ammonia must be recorded when the test is terminated.

The DMMT will use the reported ammonia concentrations, and the toxicity results from the original and the ammonia purged elutriates, to determine if ammonia is the driver of toxicity. If the DMMT determines that ammonia is the driver of toxicity, then an alternate application factor of 5% will be used to evaluate water column compliance (Kennedy et al. 2015).

Note that ammonia purging, creating a second set of elutriates, and running a second suspended phase toxicity test requires considerable time and additional sample volume. Applicants should consider holding time implications and the required sample volumes when conducting suspended phase toxicity tests where elevated ammonia concentrations may be present.

5.4 Bioaccumulation Testing

Bioaccumulation refers to the accumulation of contaminants in the tissues of organisms through any route, including respiration, ingestion, or direct contact with contaminated sediment or water. The regulations require that bioaccumulation be considered as part of the environmental evaluation of dredged material proposed for open water disposal. The bioaccumulation tests in this manual provide a measure of uptake in deposit-feeding marine animals to bioavailable sediment contaminants that may accumulate up the food chain and potentially lead to risk to human health. In this case, representatives of a bivalve and a polychaete worm species are exposed for a 28-day period to dredging site, reference, and control sediments. General technical guidance on the test is provided in Section 12.1 of the ITM and the Green Book.

The two required species for marine/estuarine disposal are listed in Table 5-2: the clam worm, *Alitta virens* (formerly *Nereis virens*), and the bivalve, *Macoma nasuta* or *Macoma balthica.* Species-specific test conditions are listed in Appendix E. Each species must be exposed in separate aquaria because of the predatory behavior of *Alitta virens*. It should be noted that use of another set of aquaria will require a proportionally greater amount of sediments to be collected and processed. The DMMT is aware of availability issues with wild harvested specimens, particularly *Macoma nasuta*, and is actively researching alternate species to be added to the required species list.

All aquaria must have a sediment depth of at least 5 cm. At least 20 specimens of each species are required in each test chamber, although more may be necessary to conduct the prescribed tissue analyses at the end of the test exposure. It is the applicant's responsibility to ensure that the laboratory provides enough animal tissue (size and number) to run subsequent chemical analyses. Generally, it is desirable to produce 50 grams (g) (wet weight) for each replicate and species. The number of animals and the size of the aquarium will vary with the size of individual animals acquired for the test. For the species in Table 5-2, tissue/sediment loading should not exceed 1 g tissue (wet weight minus shell) to 50 g sediment (wet weight) (H. Lee, USEPA Newport Lab, personal communication). If dioxin/furan analysis is required, then a separate set of aquaria may be required to provide adequate tissue for analyses to achieve the required RLs.

The typical suite of contaminants of concern that are required to be analyzed on most projects undergoing bioaccumulation testing, appropriate methods, and required reporting limits are listed in Table 5-4. Additional analytes may be required on a project specific basis, as determined by the project Tier I review and/or chemical testing of the sediments. The final decision on which project-specific contaminants are required is made by the DMMT in consultation with other federal and state regulatory agencies. Recommended tissue extraction and analytical methods are provided in NOAA (1993), USEPA/USACE (1995) and USEPA (1993). The applicant must ensure the contracted laboratory can reasonably achieve the required RLs listed in Table 5-4 and Appendix C, if applicable. The sample preparation methods for animal tissue described in USEPA (1993) and USEPA/USACE (1995) are highly recommended. As mentioned above, 50 g of tissue (wet weight) per replicate is recommended (or enough to obtain acceptable RLs). In addition to the contaminants of concern, the lipids of each clam and worm tissue replicate should be analyzed using a modified Bligh and Dyer (1959) method developed by the USEPA Narragansett Laboratory (USEPA/AED 1995). Percent water, solids, and lipids must be reported for each species and replicate.

All appropriate QA/QC measures listed in Chapters 9 and 12 of the ITM and the QA/QC manual must be followed. Tissues of organisms randomly selected prior to initiation of bioaccumulation testing (pre-test) must be analyzed and reported for all contaminants analyzed in the exposed organisms. A subsample of these pre-test tissue samples from each species must be archived as the applicant may be required to perform additional analyses on this tissue at a later date for specified contaminants.

As with toxicity tests, daily records must be kept of salinity, temperature, DO, pH, flow rate, obvious mortalities and any sublethal effects. Failure of organisms to burrow into the sediment or any other physical or behavioral abnormalities must also be recorded. All organisms (whether pre- or post-test) must be depurated for 24 hours in clean seawater prior to freezing.

5.4.1 Bioaccumulation Evaluations

The DMMT evaluates the tissue concentrations in the test organisms to determine compliance with bioaccumulation criteria in the MPRSA and the CWA. This includes a comparison to Food and Drug Administration (FDA) Action Levels, and a statistical comparison between the tissue concentrations in organisms exposed to the dredged sediment and organisms exposed to reference sediment (Figure 5-4).

Tissue concentrations of contaminants of concern in the test organisms are initially compared against applicable FDA Action Levels for Poisonous or Deleterious Substances in Fish and Shellfish for Human Food. The levels, which are based on human-health as well as economic considerations, are revised according to the criteria specified in 21 CFR § 109 and § 509. They do not include the potential for environmental impact on the contaminated organisms or on their nonhuman predators. If test tissue concentrations of one or more contaminants exceed FDA

Action Levels the dredged material is expected to result in unacceptable benthic bioaccumulation of contaminants and is not in compliance with the bioaccumulation criteria.

If tissue concentrations do not exceed FDA Action levels, the laboratory then performs a statistical comparison between the test tissue concentrations and reference tissue concentrations. When dredged material tissue concentrations statistically exceed that in the reference material tests, the DMMT considers a number of factors to determine compliance with the bioaccumulation criteria as outlined in the ITM and the Green Book, including:

- Number of species in which bioaccumulation from the dredged material is statistically greater than bioaccumulation from the reference material;
- Number of contaminants for which bioaccumulation from the dredged material is
- statistically greater than bioaccumulation from the reference material;
- Magnitude by which bioaccumulation from the dredged material exceeds bioaccumulation from the reference material;
- Toxicological importance of the contaminants whose bioaccumulation from the dredged material statistically exceeds that from the reference material;
- Phylogenetic diversity of the species in which bioaccumulation from the dredged material statistically exceeds bioaccumulation from the reference material;
- Propensity for the contaminants with statistically significant bioaccumulation to biomagnify within aquatic food webs;
- Magnitude of toxicity and number and phylogenetic diversity of species exhibiting greater mortality in the dredged material than in the reference material; and
- Magnitude by which contaminants whose bioaccumulation from the dredged material exceeds that from the reference material also exceed the concentrations found in comparable species living in the vicinity of the proposed disposal site.

To facilitate the evaluation of these factors, the DMMT uses available USACE and USEPA bioaccumulation models, disposal site reference datasets from the CENAE's DAMOS Program, and national datasets such as the NOAA National Mussel Watch Program.

5.5 Quality Control Measures

The applicant must submit documentation of all quality control measures performed during bioassay testing and analysis of the tissue samples and complete the Biological Testing Data Review Worksheet in Appendix D. If any of the quality control criteria are exceeded, the data

may be rejected. Required analytical QC measures for Tier 3 testing are provided in the sections below.

5.5.1 Whole Sediment Toxicity Tests

All marine/estuarine bioassays must be performed under the conditions specified in each of the test species sheets in Appendix E using either natural seawater or a synthetic seawater adjusted to salinity appropriate for the test species and disposal site (generally 25 to 30 parts per thousand (ppt)). Adherence with the applicable test acceptability requirements must be documented for *Ampelisca abdita, Eohaustorius estuarius*, and *Leptocheirus plumulosus* (ASTM 2023a).

The mean mortality of five replicates in the control sediments must be less than or equal to 10% for the test to be valid. If the control mortality is greater than 10%, the test should be repeated, or the applicant should contact the DMMT for further guidance.

5.5.2 Water Column Toxicity Tests

All bioassays must be performed under the conditions specified in each of the test species sheets in Appendix E using either natural seawater or a synthetic seawater adjusted to salinity appropriate for the test species and disposal site (generally 25 to 30 ppt).

The survival rate requirements in the Control treatments must be achieved. Failure to meet the applicable requirements below will likely invalidate the testing procedures and require retesting of the control and test samples.

Control mortality requirements:
≤10% mean of replicates

Control abnormality requirements:
≤30% for oyster and mussel larvae
≤40% for clam larvae
≤30% for sea urchin larvae

5.5.3 Bioaccumulation Tests

The QA/QC procedures cited in the ITM must be followed and documented for bioaccumulation testing.

Where control mortality is greater than 10% for sediment bioaccumulation samples, the applicant should contact the DMMT and determine whether the following conditions exist:

- adequate number of replicates to obtain statistical power;
- stressed organisms;

- contaminated control sediment;
- contamination of test system;
- quality control problems; and
- adequate tissue for chemical analyses.

Certain quality control samples are required with each tissue chemistry analysis to assure the quality of the analytical results. These include matrix spikes, laboratory duplicates, method blanks, laboratory control samples, standard reference materials, and surrogates. The required quality control samples and their frequency are provided in Table 5-5.

All tissue chemistry data submitted as part of bioaccumulation assays must undergo a Tier 1 Stage 1 evaluation (USEPA 2020a), which consists of completeness and compliance checks of sample receipt conditions. In addition, the Chemistry Data Validation Worksheets (Appendix D) must be provided in the tissue chemistry laboratory report, with the appropriate column filled out, showing whether the criteria were met.

All QA/QC for Dioxin/Furan analyses (listed in Appendix C) must be documented according to the methods described in USEPA Method 1613.

5.6 Statistical Analysis

Toxicity and bioaccumulation data should be analyzed as indicated in Appendix C of the ITM. As discussed in Appendix C, these methods are described in many popular general statistics texts such as Winer (1971), Steel and Torrie (1980), Sokal and Rohlf (1981), Dixon and Massey (1983), Zar (1984) and Snedecor and Cochrane (1989). In addition, Conover (1980) is recommended for nonparametric tests. Most of these tests are included in commercially available statistics software packages. All non-detected analytes must be reported as one half the MDL. Results between the MDL and RL should be reported in full as estimated and qualified with a “J”. Statistical analysis is not needed only if ***all*** the replicates in a site composite sample are non-detect. Note that even if all the replicates in the reference site sample are non-detect, statistical analysis is still required if any of the site composite replicates have a detected result. Data qualifiers required for the statistical analysis are provided in the bioaccumulation EDD found on the CENAE website: http://www.nae.usace.army.mil/Missions/Disposal-Area-Monitoring-System DAMOS/Electronic-Data-Deliverables.aspx.

5.7 Data Reporting

All toxicity data and tissue chemistry lab reports must be submitted electronically to the DMMT in an easy-to-read format (e.g. PDF, MS Word). The applicant must include the results of the QC analyses, the Field Data Review Worksheet (Elutriate/Biological Testing), the Biological Testing Data Submittal Checklist, the Biological Testing Data Review Worksheet, and in

addition, for tissue chemistry the applicant must provide Chemistry Data Validation Worksheets (Appendix D) with the appropriate column filled out, showing whether the criteria were met. Bioaccumulation tissue chemistry data and the results of the statistical analysis must also be submitted in the EDD format available on the CENAE website (http://www.nae.usace.army.mil/Missions/Disposal-Area- Monitoring-System DAMOS/Electronic-Data-Deliverables.aspx). This format is necessary to facilitate the project review process and to ensure completeness of the submittal. Project data not submitted in the described formats will be considered incomplete and a resubmittal will be required.

5.8 Possible Outcomes of Tier 3

The information collected through Tier 3 is generally sufficient to determine compliance with the water column, benthic effects, and bioaccumulation criteria for open water disposal under the MPRSA and the CWA. Under certain unique circumstances the DMMT may determine that additional testing is necessary for a particular project and an evaluation under Tier 4 may be required.

Table 5-1. Recommended Procedures for Sediment, Water, and Tissue Sample Collection for Biological Assays, Preservation, and Storage

Analyses	Collection Method	Suggested Quantity[a]	Container[a]	Preservation Technique[a]	Storage Conditions[a]	Holding Time[a]
Sediment						
Dredged Material	Grab/corer	12-15 L per sample	Plastic bag or container	Completely fill and refrigerate; sieve	4° C ± 2° C	14 Days[b]
Reference Sediment	Grab/corer	45-50 L per test	Plastic bag or container	Completely fill and refrigerate; sieve	4° C ± 2° C	14 Days[b]
Control Sediment	Grab/corer	21-25 L per test	Plastic bag or container	Completely fill and refrigerate; sieve	4° C ± 2° C	14 Days[b]
Elutriate						
Water Column Toxicity	Grab	6 L per sample	Plastic carboy	Completely fill and refrigerate	4° C ± 2° C	14 Days
Tissues						
Metals	Trawl/ Teflon coated grab	4 oz	Glass jar	Frozen	≤-20° C	1 Year
Lipids	Trawl/ Teflon coated grab	4 oz	Glass jar	Frozen	≤-20° C	1 Year
Semivolatile Organic Compounds	Trawl/ Teflon coated grab	4 oz	Glass jar	Frozen	≤-20° C	1 Year
Pesticides	Trawl/ Teflon coated grab	4 oz	Glass jar	Frozen	≤-20° C	1 Year
PCBs	Trawl/ Teflon coated grab	4 oz	Glass jar	Frozen	≤-20° C	1 Year

Notes:
a This table contains only a summary of recommended collection, preservation, and storage procedures for samples. The applicant should consult with their laboratory for required sample volumes, containers, preservation, and holding times.

b Two weeks is recommended; sediments must not be held for longer than 8 weeks prior to biological testing.

Table 5-2. Organisms Required for Whole Sediment Toxicity and Bioaccumulation Testing

Group/Taxa	Habitat	Scientific Name
Toxicity - 10 Days		
Amphipods*	Marine/Estuarine and fine grain	*Ampelisca abdita*
	Estuarine	*Leptocheirus plumulosus*
	Marine/Estuarine and coarse grain	*Eohaustorius estuarius*
Non-amphipods - Mysid shrimp	Marine/Estuarine	*Americamysis bahia*
Bioaccumulation - 28 days		
Bivalve	Marine/Estuarine	*Macoma nasuta* or *M. balthica*
Polychaete	Marine/Estuarine	*Alitta virens*

Notes:

*One amphipod species is required and should be selected based on disposal site conditions.

Alternate species listed on Tables 11-2 and 12-1 of the ITM and Green Book may also be acceptable with prior approval from the DMMT.

Freshwater species selection will be determined based on consultation with the DMMT.

Table 5-3. Organisms Required for Water Column Toxicity Testing

Group*	Organism	Scientific Name	Typical Test Duration
1	**Fish**		
	Silverside	*Menidia menidia* or *M. beryllina*	96 hours
	Sheepshead minnow	*Cyprinodon variegatus*	
2	**Crustacean**		
	Mysid shrimp	*Americamysis bahia*	96 hours
3	**Planktonic larvae**		
	Blue mussel	*Mytilus edulis*	48 to 72 hours
	American oyster	*Crassostrea virginica*	
	Hard clam	*Mercenaria mercenaria*	
	Coot clam	*Mulinia lateralis*	
	Sea urchin	*Arbacia punctulata*	

Notes:

* One type of organism must be tested from each group.

Alternate species listed on Table 11-1 of the ITM and Green Book may also be acceptable with prior approval from the DMMT.

Freshwater species selection will be determined based on consultation with the DMMT.

Table 5-4. Tissue Testing Parameters

Parameter	Units (wet weight)	Analytical Method	Reporting Limit
Physical			
Total Lipids	%	USEPA/AED, 1995; NOAA, 1998	0.1%
Total Moisture	%	SM 2540	0.1%
Metals			
Arsenic	ppm	USEPA 6010D, 6020B	0.5
Cadmium	ppm	USEPA 6010D, 6020B	0.1
Chromium	ppm	USEPA 6010D, 6020B	1
Copper	ppm	USEPA 6010D, 6020B	1
Lead	ppm	USEPA 6010D, 6020B	1
Mercury	ppm	USEPA 7471B, 7474	0.02
Nickel	ppm	USEPA 6010D, 6020B	1
Zinc	ppm	USEPA 6010D, 6020B	1
PAHs			
Acenaphthene	ppb	8270E	20
Acenaphthylene	ppb	8270E	20
Anthracene	ppb	8270E	20
Fluorene	ppb	8270E	20
Naphthalene	ppb	8270E	20
Phenanthrene	ppb	8270E	20
Benzo(a)anthracene	ppb	8270E	20
Benzo(a)pyrene	ppb	8270E	20
Benzo(b)fluoranthene	ppb	8270E	20
Benzo(g,h,i)perylene	ppb	8270E	20
Benzo(k)fluoranthene	ppb	8270E	20
Chrysene	ppb	8270E	20
Dibenz(a,h)anthracene	ppb	8270E	20
Fluoranthene	ppb	8270E	20
Indeno(1,2,3-cd)pyrene	ppb	8270E	20
Pyrene	ppb	8270E	20

The specified methods are recommendations only. Other acceptable methodologies capable of meeting the Reporting Limits can be used. Sample preparation methodologies (e.g. extraction and cleanup) and sample size may need to be modified to achieve the required Reporting Limits.

Table 5-4 (continued). Tissue Testing Parameters

Parameter	Units (wet weight)	Analytical Method	Reporting Limit
Pesticides			
4,4`-DDD	ppb	8081B	1
4,4`-DDE	ppb	8081B	1
4,4`-DDT	ppb	8081B	1
Aldrin	ppb	8081B	1
Alpha-Chlordane (cis)	ppb	8081B	1
cis-Nonachlor	ppb	8081B	1
Dieldrin	ppb	8081B	1
Endosulfan I	ppb	8081B	1
Endosulfan II	ppb	8081B	1
Endrin	ppb	8081B	1
Gamma-Chlordane (trans)	ppb	8081B	1
Heptachlor	ppb	8081B	1
Heptachlor epoxide	ppb	8081B	1
Hexachlorobenzene	ppb	8081B	1
Lindane (gamma-BHC)	ppb	8081B	1
Methoxychlor	ppb	8081B	1
Oxychlordane	ppb	8081B	1
Toxaphene	ppb	8081B	50
trans-Nonachlor	ppb	8081B	1
PCBs			
PCB 008	ppb	8082A, 8270E	0.5
PCB 018	ppb	8082A, 8270E	0.5
PCB 028	ppb	8082A, 8270E	0.5
PCB 044	ppb	8082A, 8270E	0.5
PCB 052	ppb	8082A, 8270E	0.5
PCB 066	ppb	8082A, 8270E	0.5
PCB 101	ppb	8082A, 8270E	0.5
PCB 105	ppb	8082A, 8270E	0.5
PCB 118	ppb	8082A, 8270E	0.5
PCB 128	ppb	8082A, 8270E	0.5
PCB 138	ppb	8082A, 8270E	0.5
PCB 153	ppb	8082A, 8270E	0.5
PCB 170	ppb	8082A, 8270E	0.5
PCB 180	ppb	8082A, 8270E	0.5
PCB 187	ppb	8082A, 8270E	0.5
PCB 195	ppb	8082A, 8270E	0.5
PCB 206	ppb	8082A, 8270E	0.5
PCB 209	ppb	8082A, 8270E	0.5

The specified methods are recommendations only. Other acceptable methodologies capable of meeting the Reporting Limits can be used. Sample preparation methodologies (e.g. extraction and cleanup) and sample size may need to be modified to achieve the required Reporting Limits.

Table 5-5. Tissue Analytical QA/QC Requirements

Analysis Type	Methods Blank[1]	Laboratory Duplicate[1]	MS/ MSD[1]	Surrogates[2]	CRM/ SRM[3]	LCS/ LCSD[1]
Organics (e.g. PAHs, pesticides, PCBs)	X	X	X	X	X	X
Metals	X	X	X		X	X
Total Moisture		X				
Percent Lipids	X	X				

Notes:
CRM=Certified Reference Material
SRM=Standard Reference Material
MS/MSD=matrix spike/matrix spike duplicate
LCS/LCSD=laboratory control sample/laboratory control sample duplicate

1 Frequency of Analysis=1 for every 20 samples or 1 per batch, whichever is more frequent.
2 Surrogate spikes required for every sample, including matrix spiked samples, blanks, and reference materials.
3 One CRM/SRM should be analyzed per project sampling event.

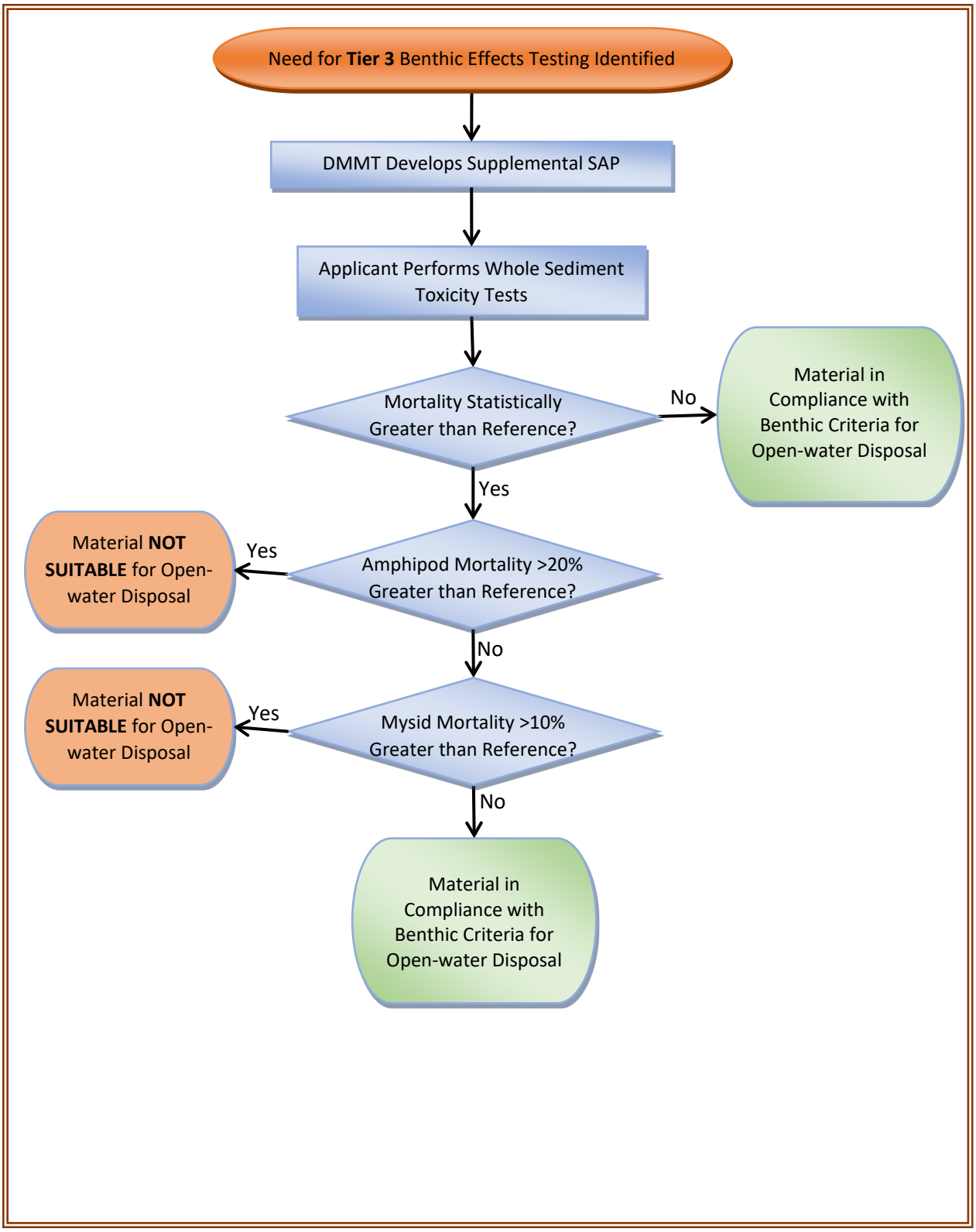


Figure 5-1. Tier Three Benthic Effects Evaluation (MPRSA and CWA)

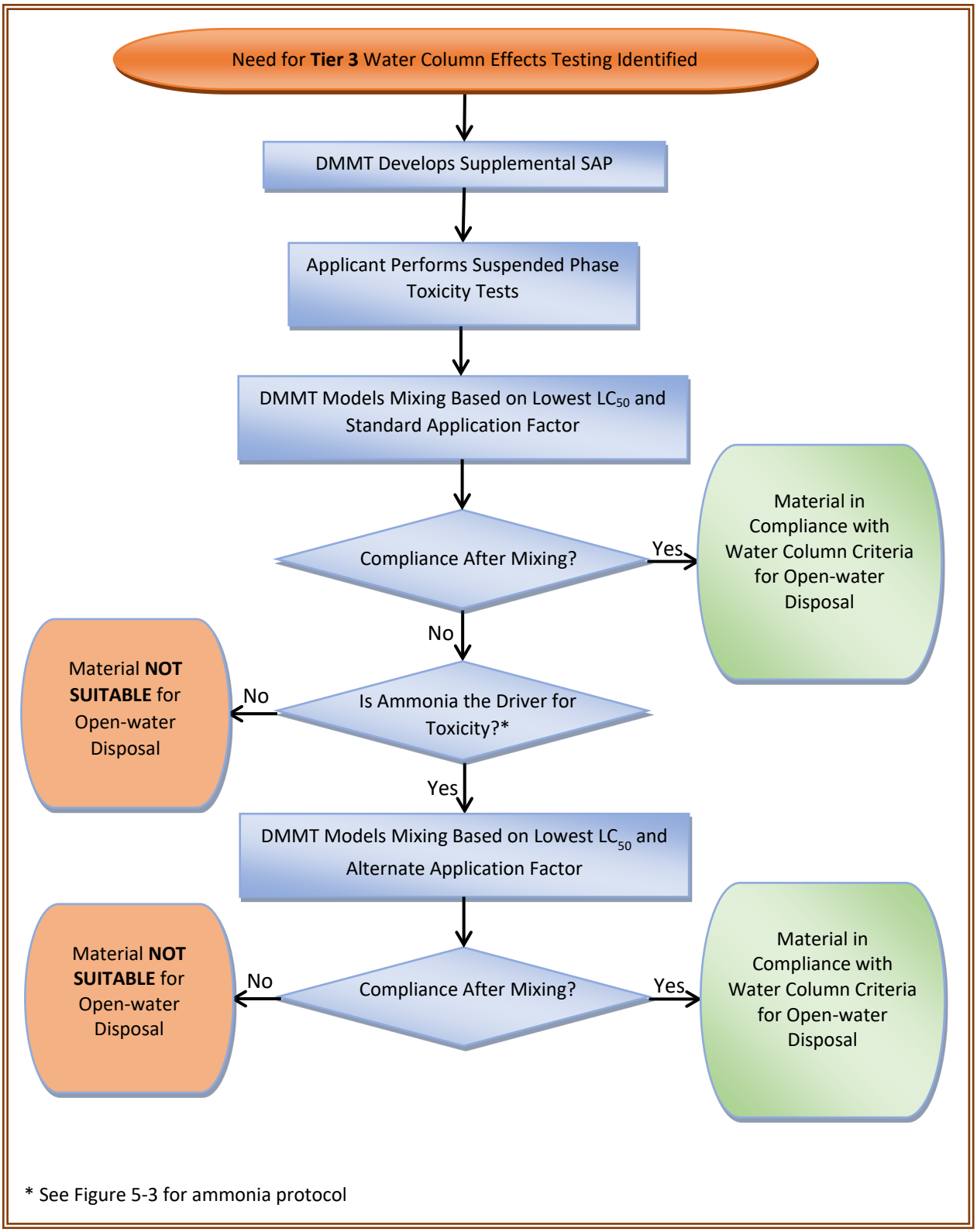


Figure 5-2. Tier Three Water Column Evaluation (MPRSA and CWA)

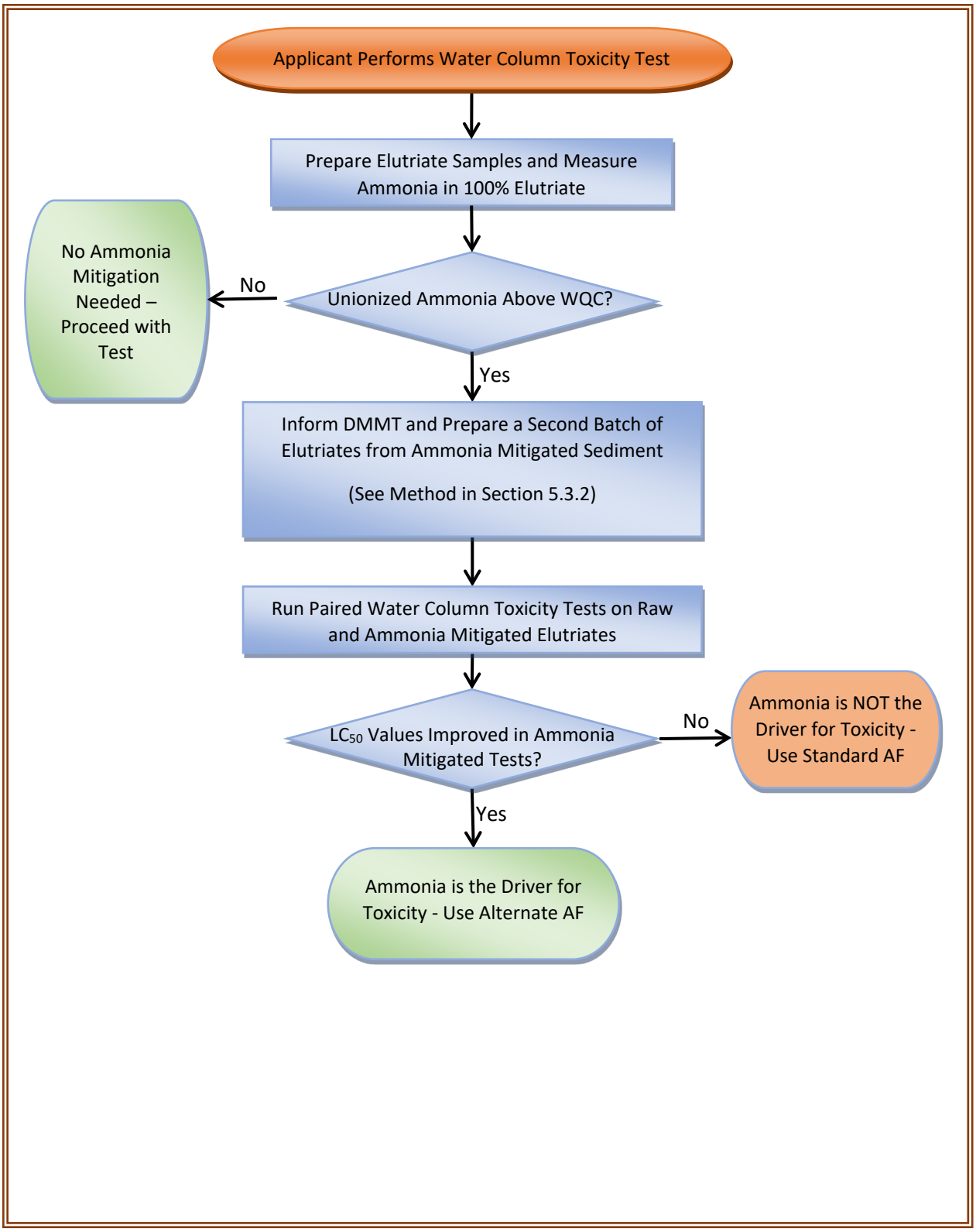


Figure 5-3. Ammonia Mitigation Protocol for Water Column Toxicity Tests

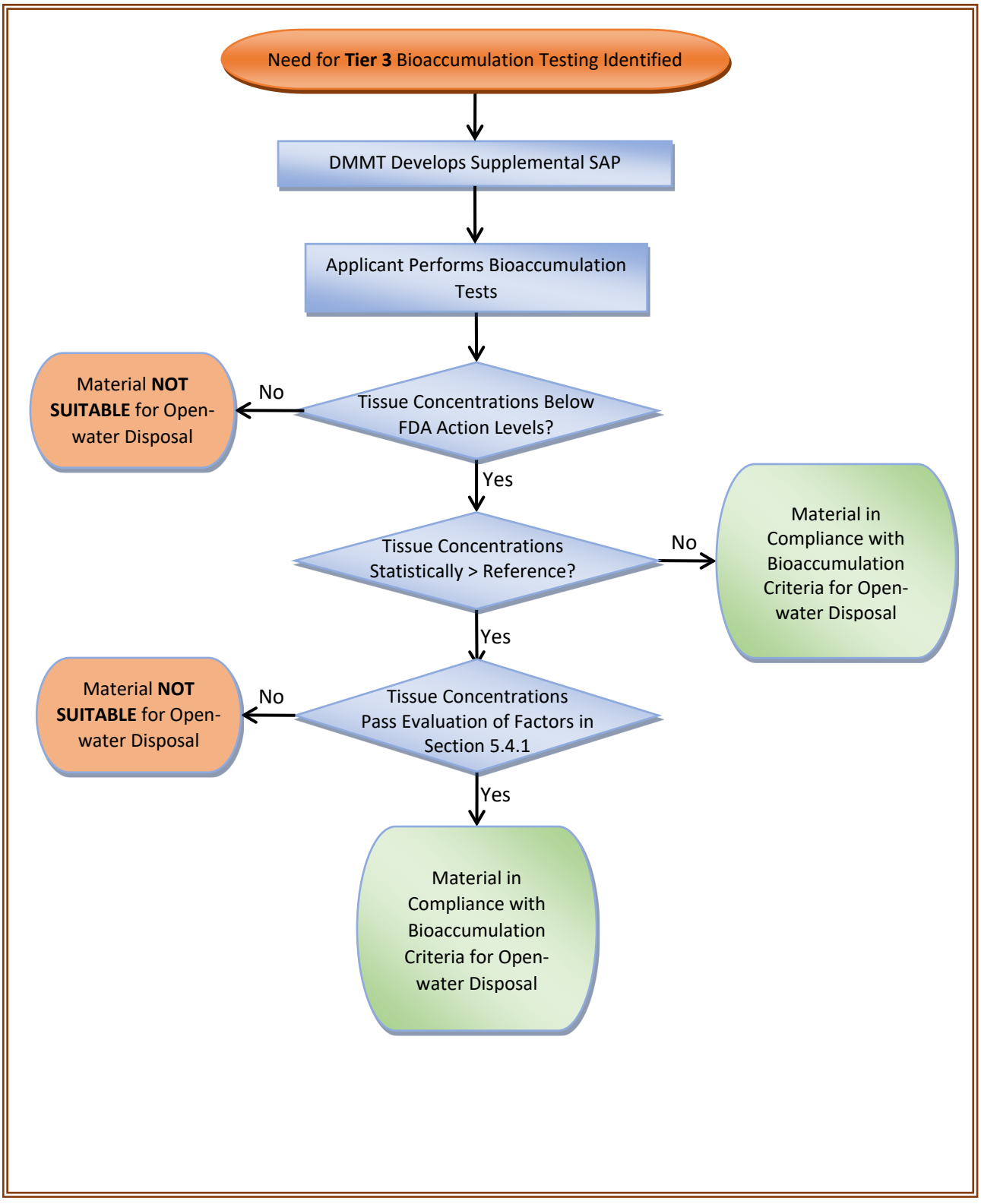


Figure 5-4. Tier Three Bioaccumulation Evaluation (MPRSA and CWA)

6.0 Tier 4: Special Studies

Tier 4 involves additional chemistry, toxicity, and/or bioaccumulation testing on a project specific basis when a complete determination cannot be made at a lower tier. This may include chemical testing for emerging contaminants identified in the conceptual site model, or evaluation of long-term effects for a unique resource or resource area. In particular circumstances the DMMT may also require chemical or toxicological testing of the new sediment surface layer that will be exposed through the proposed dredging operation to determine compliance with applicable anti-degradation policies. A Tier 4 assessment is considered a special, non-routine evaluation that will require discussions among the NEDMMP to determine the specific testing or assessment requirements. Due to the complexity and uniqueness of these studies, extremely close coordination with the DMMT is required throughout the Tier 4 testing process.

7.0 Project Evaluation and Suitability Determinations

The DMMT evaluates the information and data collected through the tiered testing process to issue a decision document on the suitability of dredged material for the proposed disposal alternative(s). Permits for dredging and disposal are tied to the DMMT decision document prepared for a given project. Major changes in volume, dredge prism, dredge method, or disposal site subsequent to DMMT evaluation may result in delayed permitting, additional sediment testing requirements, or permit enforcement actions. Taking the time to plan a project carefully before proceeding to sediment characterization can save considerable time and expense.

For most projects, the DMMT decision document is a suitability determination consistent with the regulations for the particular type of project and disposal site under either the CWA or MPRSA. For some projects with existing and valid testing data a Tier 1 evaluation may be sufficient for the DMMT to determine the suitability of the material to be dredged. The two major types of decision documents prepared by the DMMT are as follows:

7.1 Tier 1 Memorandum

A Tier 1 memo is written for projects where sufficient information is available for the DMMT to make a determination based on existing valid data. This is typically limited to projects requesting an extension of testing data age restrictions (see Section 9) where sampling and testing were performed but the project was not dredged within the allowable timeframe. A Tier 1 memo may also be issued by the DMMT to review minor changes in project conditions (design volume or footprint) after a suitability determination was issued. More information on Tier 1 evaluations is provided in Section 3.

7.2 Suitability Determinations

The primary decision document issued by the DMMT is a suitability determination. This is the standard type of decision document and is intended for projects with aquatic disposal alternatives where some level of Tier 2 and/or higher tiers of testing was performed. This document also addresses project-specific restrictions on the discharge, including limitations on scow size, discharge rate, or containment (as appropriate for CWA projects). Detailed information regarding the evaluation procedures necessary for a suitability determination are included throughout this manual.

7.2.1 Exclusionary Criteria

Both the CWA and MPRSA provide for an exclusion from testing requirements based on the composition and location of the proposed dredged material. The DMMT may issue a suitability determination under the exclusionary criteria based on a Tier 1 evaluation alone or based on limited additional testing to confirm that the proposed project material meets the exclusionary criteria (see Section 4.4).

7.2.2 Weight of Evidence

The DMMT uses a risk-based approach to evaluate whether the placement of dredged material in the aquatic environment will have unacceptable impacts. Multiple lines of evidence are compiled and evaluated through the tiered testing process and may include previous testing data, the conceptual site model, physical characteristics of the dredged material, chemical testing data, bioassay results, and/or modeling. Under the CWA the weight of evidence necessary for the DMMT to make a determination may be sufficient at Tier 2, while determinations under the MPRSA require additional lines of evidence from Tier 3. For CWA projects where the weight of evidence is inconclusive at Tier 2, the DMMT will coordinate with the applicant to determine if a suitability determination to document that a decision cannot be made without additional testing is appropriate or if a sampling plan addendum to collect Tier 3 data should be prepared.

For projects evaluated under the CWA, the weight of evidence from the review of Tier 2 data could lead to a factual determination. For projects evaluated under the MPRSA, the regulations require that the assessment proceeds through Tier 3 before a determination is made.

7.2.3 Suitable and Unsuitable Delineations

For projects with a mix of suitable and unsuitable material the DMMT will conservatively delineate boundaries to identify each type of sediment and document them within the suitability determination. The delineation is based on a number of factors including the conceptual site model, site bathymetry, dredging considerations, and sediment chemistry concentrations, distribution, and variation. In cases where vertical subsampling was performed, the delineation may be vertical as well as horizontal. The applicant can coordinate with the DMMT to collect additional samples along boundary areas to further refine the delineation between suitable and unsuitable material. Any additional sampling will require a sampling plan addendum from the DMMT.

7.3 Decision Document Coordination

The DMMT will coordinate the draft decision document with appropriate members of the NEDMMP including USEPA Region 1 and the relevant state agencies. Comments and input from the NEDMMP members will be incorporated into the final decision document before distribution to the project applicant. USEPA Region 1 will perform an independent evaluation of the project based on the data collected through the tiered testing process and will document their findings in a separate memo.

8.0 Dredging and Disposal

8.1 Disposal Alternatives

Disposal options for dredged material depend upon project location, dredging method, material type, volume, and the results of the suitability determination.

8.1.1 Open Water Disposal

There are seven USEPA designated ODMDS in New England for disposals authorized under MPRSA (see Table 2-1 and Figure 2-2) and multiple disposal sites for disposals authorized under Section 404 of the CWA. The DMMT evaluates the suitability of dredged material for disposal at these sites in accordance with the MPRSA and/or CWA as described throughout this manual. In New England, USEPA Region 1 and CENAE's DAMOS Program share responsibility for the monitoring and management of each ODMDS while the DAMOS Program leads the monitoring and management of CWA sites with support from other NEDMMP members.

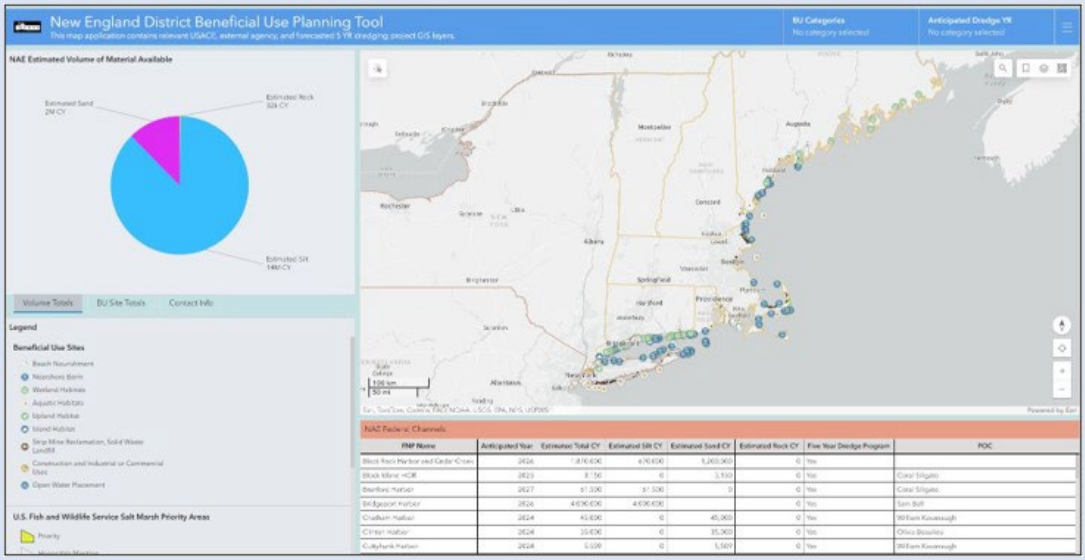
Figure 8-1. Loaded dredged material disposal scow

Management approaches at open water sites are site specific and intended to maximize capacity and minimize adverse impacts to the environment. CENAE's DAMOS Program and USEPA Region 1 develop and maintain Site Management and Monitoring Plans (SMMPs) for each ODMDS in New England. Management goals for disposal sites located in state waters are presented in CENAE's DAMOS Program publications. Typical disposal strategies include point disposals to form discrete mounds to minimize benthic impacts, limiting buildup of dredge material deposits to avoid impacts to navigation, or targeted placement for habitat creation or restoration goals. CENAE's DAMOS Program will provide applicants with project specific disposal targets, or a complete disposal plan for larger projects, in the Dredge and Disposal Approval Letter (see Section 8.3.1).

8.1.2 Beneficial Use

Beneficial use is defined as the productive use of dredged material for some purpose rather than disposing of the material at open water or upland disposal sites. A wide range of benefits are possible - shoreline protection and beach nourishment, habitat enhancement and wetland restoration, buildup of shoreline elevation for coastal resilience, and upland uses as grading and cover material. The Water Resources Development Act of 2024 (Public Law 118-272) established the national goal within USACE of using 70% of dredged material for beneficial purposes. The NEDMMP also encourages the beneficial use of dredged material and, to ensure a beneficial use project's viability, evaluation of the proposed dredged material by the DMMT is required for beneficial use sites within CWA or MPRSA jurisdiction.

In order to promote beneficial use of dredged material in New England, CENAE's DAMOS Program developed an online tool to help permit applicants identify potential beneficial use opportunities near their dredging projects.



The planning tool is publicly accessible and available at: https://www.nae.usace.army.mil/missions/disposal-area-monitoring-system-damos/beneficial-use-of-dredged-material/beneficial-use-planning-map/.

Figure 8-2. CENAE Beneficial Use Planning Tool

Standard DMMT characterization for disposal may or may not be sufficient for the proposed beneficial use, so early coordination with the DMMT is highly recommended when a beneficial use alternative is considered. Other permitting agencies may also require additional testing to ensure the material is suitable for the proposed use. The DMMT can provide applicants with

recommended testing criteria for beneficial use evaluations which may include additional physical parameters, specific chemical analysis, or bench-scale testing.

Beach Nourishment

Placement of sandy sediments directly on a beach is an effective beneficial use of dredged material to stabilize eroding beaches, protect shorelines, and preserve recreational opportunities. Placement options include hydraulic dredging and pumping directly onto the beach or utilizing pump-out barges to transport the sand from a scow to the beach. Additional information on approaches, considerations, and limitations on beach nourishment can be found in the USACE Dredging and Dredged Material Management Engineering Manual (USACE 2015) and various state publications (MassDEP 2007; MaineDEP 2018; CTDEEP 2024).

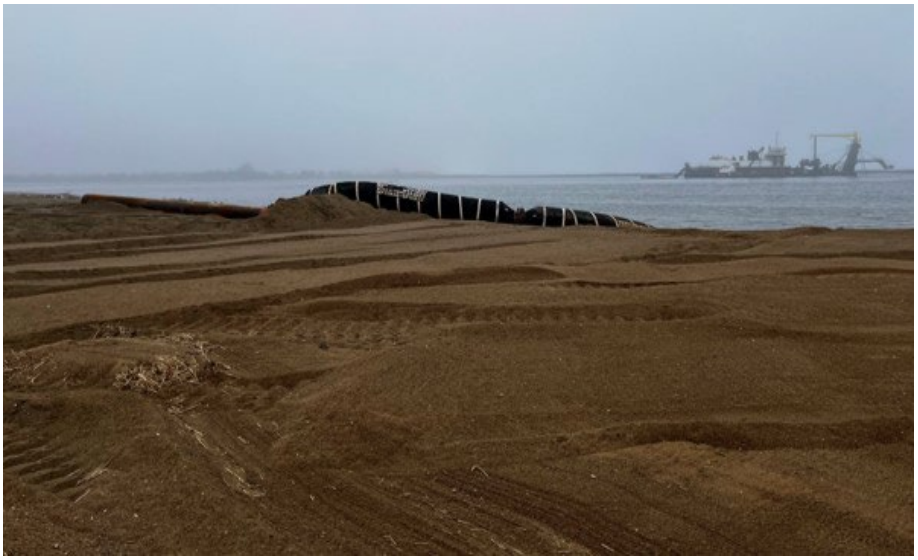


Figure 8-3. Hydraulic dredging and beach nourishment in Newburyport, Massachusetts

DMMT evaluation for beach nourishment projects will include physical analysis of the dredged material and of the placement area beach to ensure compatibility of the sediments. Beach placement is generally limited to projects with less than 10% fine-grained material (silt and clay), but evaluations will be made on a case-by-case basis. Projects that do not meet exclusionary criteria (see Section 3.6) will also be required to undergo sediment chemistry testing as appropriate under Tier 2. State agencies may have additional testing requirements and/or limitations on beach placement.

Evaluation for beach nourishment projects by the DMMT is limited to the jurisdiction of the Clean Water Act (Section 2.2) and does not include placement areas above the high tide line.

Nearshore Placement

Targeted placement of dredged material in a nearshore area can be a cost-effective method to keep sandy material in the littoral system to feed nearby beaches and shorelines. Nearshore placement has advantages over direct beach nourishment by utilizing bottom dump disposal scows or hopper dredges instead of requiring hydraulic dredging or secondary pump-out. Nearshore sites need to be carefully selected to ensure that placed dredged material will be transported through natural processes towards the target beach and not toward sensitive marine resources. CENAE has investigated and identified multiple nearshore placement sites around New England and catalogued these sites in the Beneficial Use Planning Tool (Section 8.1.2).

DMMT evaluation for nearshore placement sites is similar to direct beach placement but a higher fraction of fine-grained material is allowable due to the natural sediment transport processes that will winnow silts and clays from the sandy material.

Saltmarsh Restoration and Augmentation

Dredged material can be beneficially used to restore saltmarshes that have been impacted by historic ditching or have degraded over time due to loss of sediment input, erosion, or subsidence. Additionally, some areas may require periodic sediment input to keep up with the effects of sea level rise. Strategic placement of dredged material can raise saltmarsh elevations or restore subsided marshes to historic footprints. Dredged material is typically cast (sprayed) in a thin layer over the marsh to raise the surface to match high or low marsh elevations or targeted to specific areas of the marsh in need of sediment.

DMMT evaluation of dredged material for saltmarsh placement follows the tiered approach for open water disposal with additional components to assess the intertidal receptors associated with a saltmarsh site. Early coordination with the DMMT is recommended for saltmarsh placement as there may also be a requirement for additional analytical parameters to evaluate the potential formation of acid sulfate soils (VanZomeren 2020). Several NEDMMP agencies have completed pilot-scale saltmarsh restoration projects with dredged material and may be able to provide technical guidance.

Other Aquatic and Upland Beneficial Uses

Other potential aquatic beneficial uses for dredged material include habitat restoration or enhancement (such as increasing elevation to promote shellfish or eelgrass habitat) and island creation. Coarse-grained dredged material may be able to be used directly for upland construction or commercial uses. Fine-grained material may be used directly (such as landfill cover) or augmented with a stabilizing agent and used in grading and construction. These uses are described in the USACE Dredging and Dredged Material Management Engineering Manual (USACE 2015) and will require site specific evaluations by the DMMT and other regulatory

agencies. Upland beneficial uses (above the high tide line) are outside the jurisdiction of the Clean Water Act and not covered in this guidance document.

8.1.3 Unsuitable Dredged material

Dredged material that is determined to be unsuitable for open water disposal has more limited alternatives for both upland and aquatic disposal.

Upland Disposal

Upland disposal of dredged material (above the high tide line) is outside the jurisdiction of the Clean Water Act and not covered in this guidance document. Applicants should coordinate with the CENAE Regulatory Division and appropriate state agencies for dredging projects with upland disposal.

Confined Aquatic Disposal

Capping contaminated dredged material with a layer of sediment that is suitable for open water disposal can be an effective containment strategy to control the benthic effects of a discharge under the Clean Water Act (40 CFR § 230.72). This can be achieved through level-bottom capping at an open water disposal site within CWA jurisdiction or through the construction of a confined aquatic disposal (CAD) cell.

Confined aquatic disposal is only allowed for discharges of dredged material evaluated under the CWA.

Level-bottom capping entails placing unsuitable material directly on the seafloor and then covering it with a layer of material that is suitable for open water disposal, resulting in sequestration of the unsuitable material from the environment. While this is a cost-effective option that has been demonstrated to be environmentally protective at multiple sites in New England (SAIC 1995, USACE 2022), it also presents several significant challenges. Level-bottom capping in harbors is generally not feasible because of the need to maintain navigational depth requirements above the disposal mound. This depth requirement also increases the potential for water column effects from the discharge of the unsuitable dredged material, which are not controlled through capping and are evaluated separately from benthic effects (Sections 4.6 and 5.3). Due to the natural spread of the unsuitable material on the seafloor, level-bottom capping requires a large volume of suitable dredged material to construct the cap layer which may not be available within the schedule requirements of the dredging project. Given these constraints, level-bottom capping at open water sites can also face significant challenges in obtaining regulatory approval.

For these reasons, CAD cells are often selected as the preferred disposal option for a growing number of contaminated dredging projects throughout the world and have been used in New England since the 1980's as a practical alternative for the disposal of unsuitable dredged material (USACE 2012). The technique involves placing the unsuitable sediment within existing seafloor depressions or in cells excavated into the seafloor for containment. Depending on the characteristics of the unsuitable material and the deposition regime of the cell location, a cap of suitable dredged material or an engineered cap may be required to further sequester the unsuitable material within the cell.

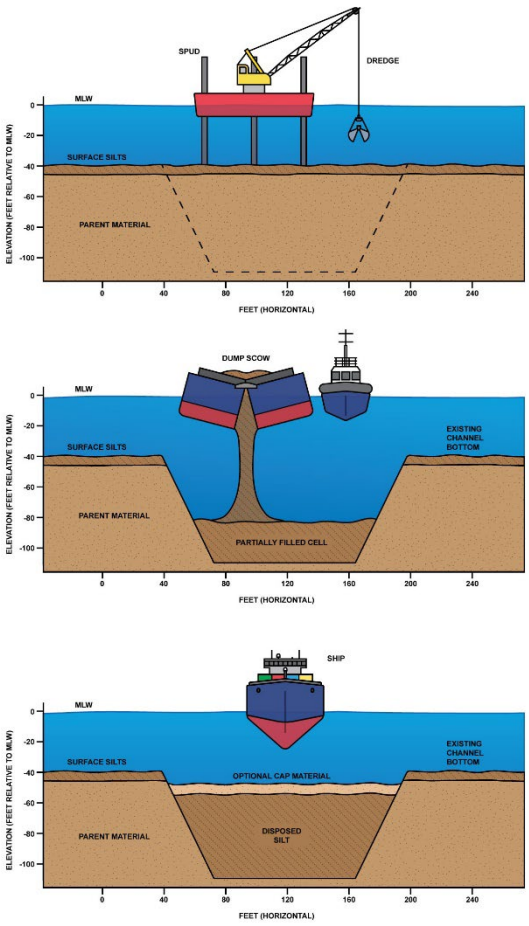


Figure 8-4. CAD Cell Construction Sequence

Factors that favor CAD cells over other options include regulatory considerations, public perception, relative ecological and human health risk, and cost (Fredette 2006). CAD cells can often be located in the same harbor as the dredging project, limiting the area of impact and minimizing transportation costs for a project. CAD cells also can reduce the potential for human health and ecological risk presented from unsuitable material by confining the material to a smaller footprint and further sequestering it from the environment (Fredette 2006).

Since benthic effects are controlled through the confined disposal technique, the DMMT evaluation for these projects focuses on the water column effects. This evaluation follows the process explained in Section 4.6 and requires the collection of sediment chemistry samples, and may require elutriate chemistry samples, to determine if the discharge complies with the CWA guidelines. CAD cell projects may also have additional requirements including the development of a management plan to detail the filling, capping, and monitoring of the cell.

Innovative Technology

Finding beneficial uses for unsuitable dredged material is challenging but has gained some momentum in recent years, and the NEDMMP is aware of innovative technologies that are being developed to increase options for upland use of this material (Integral Consulting 2023; Barr Engineering, et al. 2024). Development of these technologies is particularly advantageous

as the need for shoreside fill grows in response to sea level rise. Evaluations for these alternatives will inherently be project specific, dependent on the ultimate disposition of the material, and may or may not fall within the scope of this manual.

8.2 Dredging Quality Management Program Monitoring

Dredging Quality Management (DQM) Program monitoring is a permit requirement for all dredging projects with aquatic transport or disposal that allows for assessment of compliance with permit conditions. For more information on the DQM Program and project requirements contact the CENAE Regulatory Division at cenae-r@usace.army.mil.

8.3 Project Coordination

Once a suitability determination and all necessary permits (Section 2) are obtained, planning for dredging and disposal can proceed. Applicants, or their dredging contractor, are responsible for regular coordination with the CENAE Regulatory Division and the DMMT throughout the life of their dredging project. The following project coordination requirements will generally apply. However, some permits may have additional requirements or earlier submission deadlines and applicants should carefully read all conditions of their permit to determine if additional coordination or submittals are required. All work authorized by USACE must comply with the conditions of the permit authorizing the work.

8.3.1 Prior to Dredging

- At least 14 days prior to the anticipated start of work, notify the CENAE Regulatory Division by submitting a completed Dredge and Disposal Request Form to cenae-r@usace.army.mil.
- Submit current DQM Program certifications for all disposal scows to be used on the project to the CENAE Regulatory Division at cenae-r@usace.army.mil.

At this point, CENAE Regulatory will issue a Dredge and Disposal Approval Letter to the applicant with the following components:

- Authorization to proceed
- A list of DQM certified scows approved for use on the project
- Permitted volume and date range for dredging and disposal operations
- Project specific disposal coordinates provided by CENAE's DAMOS Program

8.3.2 During Dredging and Disposal Operations

- Respond promptly to any requests for information from the DMMT or the CENAE Regulatory Division on dredging progress or DQM compliance questions.
- Notify the CENAE Regulatory Division of any potential dredging or disposal non-compliance issues within 24 hours.
- Notify the CENAE Regulatory Division of any pause in dredging operations anticipated to last more than 14 days.
- Submit a Weekly Summary Report Form to the CENAE Regulatory Division at cenae-r@usace.army.mil.

8.3.3 After Completion of Dredging

- Submit a Dredging Completion Summary Report to the CENAE Regulatory Division at cenae-r@usace.army.mil. A Dredging Completion Summary Report is also required at the end of each dredging season if the project will continue over multiple seasons.
- Submit a post-dredging bathymetric survey to the CENAE Regulatory Division at cenae-r@usace.army.mil.

9.0 Administrative Considerations

Decisions made by the NEDMMP reflect the current conditions of the project site based on an evaluation of the most recent available data. Site conditions in coastal and riverine systems are inherently dynamic and a project's sediment quality is directly affected by continual deposition/erosion processes and episodic events from storms. Nearby dredging, waterfront construction projects, and spills can also influence sediment quality. For these reasons, the DMMT has set age limitations on the data used to support suitability determinations.

Note: For most projects, dredging must be completed within five years of sediment sampling before a Tier One review is required. If a project is not dredged within five years of sampling, the applicant should alert CENAE Regulatory to initiate a Tier One review (Section 7.1). At this point the DMMT will evaluate the conceptual site model, testing data, and any changes to project conditions (recent shoaling, spills, storm events, etc.) and determine if the existing suitability determination is valid or if additional sampling and testing is required. Projects with a higher risk ranking (Section 3.5) have an increased potential for contamination and may have a shorter age restriction specified in the suitability determination. Likewise, projects with a low risk ranking, or were found to meet exclusionary criteria, may have an extended age restriction specified in the suitability determination. Additionally, an event in the surrounding area that could affect the sediment quality of a project (e.g. large spill, adjacent dredging, etc.) may trigger the need for a Tier One review some level of confirmatory re-assessment.

In addition to age of data considerations, permits issued for the transport of dredged material for the purpose of disposing of it in ocean waters must specify a completion date for the disposal not to exceed three years from the date of permit issuance (33 CFR 325.6(c). Applicants should contact CENAE Regulatory to request a permit extension if needed.

Applicants should carefully consider these timeframe restrictions in the context of their proposed dredging schedule to avoid the need for costly resampling or potential delays from additional DMMT evaluations or permit modifications.

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