THE MANAGEMENT AND REGULATION OF DREDGING ACTIVITIES AND DREDGED MATERIAL IN NEW JERSEY'S TIDAL WATERS

DRAFT - MARCH 1996

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION

EXECUTIVE SUMMARY

This document has been prepared by the New Jersey Department of Environmental Protection Dredging Task Force in order to establish clear and comprehensive policies and procedures for reviewing proposed dredging activities, and the management of the dredged material. It has been developed in response to Governor Christine Whitman's Dredged Material Management Team and Departmental commitments included in the New York-New Jersey Harbor and Delaware Estuary Program Comprehensive Conservation and Management Plans. This document provides Departmental staff and project applicants with guidance and criteria for the required sampling, testing, and permitting of proposed dredging projects and various dredged material management alternatives.

The regulatory review of permit applications for dredging operations and/or the management of dredged material will be coordinated by the Department's Land Use Regulation Program.

Section III of the guidance document identifies the background information which must be submitted in support of all permit applications for dredging and dredged material management activities. Testing of dredged material for contaminants will not always be necessary. These testing exclusions are discussed in Section III-B, and Figure 1 is a schematic diagram of the required test procedures. In general, small dredging projects along the State's Atlantic Ocean coast, projects in which the dredged material is greater than 90% sand, and other projects where the Department has determined that the potential for sediment contamination is unlikely, will be excluded from extensive testing requirements. The development of a sampling plan for sediments to be dredged is also discussed.

Section IV-B discusses the Department's program for managing and regulating dredging operations, including the use of Best Management Practices. In most cases, dredging projects in New Jersey's navigable tidal waters will require a Waterfront Development Permit and a Water Quality Certificate (pursuant to Section 401 of the federal Clean Water Act). Any discharge of dredged material will also require a permit from the U.S. Army Corps of Engineers pursuant to Section 404 of the federal Clean Water Act. Dredging activities are also regulated by the federal government pursuant to Section 10 of the Rivers and Harbors Act of 1899. Federally-conducted, funded, or permitted activities which have a direct impact on New Jersey's Coastal Zone, will also require a federal consistency determination from the Department, pursuant to the Coastal Zone Management Act.

A variety of potential alternatives exist for the management and/or beneficial use of dredged material. These include open water (including ocean) disposal sites, upland confined disposal facilities (CDFs), subaqueous disposal pits, and containment areas. Table 2 identifies the potential sediment testing and permitting requirements for these options.

Section IV-C of the document discusses Open Water disposal alternatives. Disposal of dredged material in ocean waters is regulated by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency. The Department will coordinate its review of proposed ocean disposal operations with these federal agencies.

Section IV-D discusses the design, construction, operation, closure, and permitting of upland confined disposal facilities (CDFs). Regulation of upland CDFs will be administered by the Department's Land Use Regulation Program, pursuant to the Waterfront Development Law and the State and federal Water Pollution Control Acts. In New Jersey's designated Coastal Zone, siting of a proposed upland CDF will be evaluated using the Rules on Coastal Zone Management. The Department will require the owner and/or operator of an upland CDF to submit an annual report to the Department, summarizing the past year's activities at the facility. In addition, Final (and Interim, if needed) Closure Plans must be developed and approved by the Department for each proposed upland CDF.

The major potential adverse environmental impacts associated with upland CDFs are surface and ground water contamination. Dredged material dewatering effluent returning to the same water body from which the material was originally dredged will require a Water Quality Certificate. A New Jersey Pollutant Discharge Elimination System (NJPDES) Discharge to Surface Water permit will be required for discharges from upland CDFs accepting material from single or multiple dredging sites located in a different surface water body. The NJPDES-Discharge to Ground Water permitting process for upland CDFs will consider the source and degree of contamination of the dredged material, as well as the use(s) and value(s) (i.e. classification) of the underlying aquifer. This process may include the following components: (1) preliminary determination of leachate quality from dredged sediments, (2) Ground Water Protection Plans, and (3) a NJPDES-Discharge to Ground Water Permit. A NJPDES-DGW Permit will only be required where the maximum leachate quality of any contaminant is predicted to violate the Ground Water Quality Criteria applicable to the underlying aquifer, thus potentially adversely impacting the designated use(s) and value(s) of the aquifer.

Section IV-E discusses the use of subaqueous disposal pits for contaminated dredged material. Use of such pits will be evaluated by the Land Use Regulation Program using the Rules on Coastal Zone Management. Designing a pit to be properly capped, and maintaining the integrity of the cap, is essential. Thus, long-term monitoring of the subaqueous disposal pit, its final cap, and the surrounding environment will be required.

Section IV-F discusses the construction and use of in-water/aquatic containment areas for dredged material. Permitting requirements are generally similar to those associated with upland CDFs.

Dredged material can be considered a resource, and the Department strongly supports its beneficial use, wherever possible, as opposed to exclusive reliance on disposal facilities. Beneficial use alternatives for dredged material are discussed in Section V. These include beach nourishment, habitat development, construction material, landfill cover, agricultural uses, and capping open water disposal sites. The suitability of dredged material for any of these uses will depend on its characteristics, particularly grain size and degree of contamination.

TABLE OF CONTENTS

List of Figures

List of Tables

Draft - March 1996

THE MANAGEMENT AND REGULATION OF DREDGING ACTIVITIES AND DREDGED MATERIAL IN NEW JERSEY'S TIDAL WATERS

Chapter I - Purpose of Document

This document establishes the policies and procedures under which the New Jersey Department of Environmental Protection will conduct regulatory reviews of dredging activities in tidal waters of the State of New Jersey and the management of the dredged material. This document also provides Departmental staff and project applicants with general guidance and criteria for the required sampling, testing, and permitting of dredged material for various identified management alternatives, including potential beneficial use options. These policies and procedures have been developed to ensure that proposed dredging projects and the management of dredged material are conducted so as to minimize the potential for adverse impacts to the environment and public health. This document has been developed by the Department under the requirements of the Environmental Management Accountability Plan (P.L. 1991, Chapter 422) with the goal of making the permit application process more consistent and predictable.

Chapter II - Overview

A - Given the shallow natural depths of many tidal waterbodies and high rates of sedimentation/shoaling, dredging is needed to provide safe navigation conditions and to maintain vessel berthing areas. Many components of New Jersey's economy including marine commerce, commercial and recreational fishing, boating, and tourism are dependent on dredging for continued operations.

In many areas of the state sediments have become contaminanted with a variety of toxic substances, including dioxin, polychlorinated biphenyls (PCBs), heavy metals, pesticides, polycyclic aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs). Sediments in tidal water bodies may be contaminated as a result of discharges from industrial, municipal, and storm sewer sources, marina and boating operations, and atmospheric desposition. The dredging and subsequent disposal of these sediments, if not properly managed and regulated, could result in adverse impacts to the environment and public health.

In contrast, tidal waters in some areas of New Jersey (particularly along the Atlantic Ocean coast) have been impacted to a lesser degree by pollutant discharges. As a result, sediments in these water bodies have a lower potential to be contaminated at levels warranting a high degree of regulatory concern. Likewise, coarser-grained sediments do not bind contaminants as strongly as finer-grained and organic sediments. Finally, all else being equal, the potential for adverse impacts from smaller dredging and dredged material management projects can be comparatively lower than that from larger projects.

<u>B</u> - The New Jersey Department of Environmental Protection (NJDEP) is responsible for the evaluation and permitting of all dredging-related activities that occur in the waters of the State of New Jersey. As part of that review the Department evaluates the proposed dredged material management option. Existing management options include in-water disposal, upland containment/disposal, and/or beneficial use of the dredged material. The objectives of the Department's regulatory programs overseeing dredged material management activities include:

(1) the identification of potential adverse impacts to the environment and public health which could result from a proposed activity;

(2) the regulation/management of a proposed activity to ensure that any potential adverse impacts are minimized;

(3) the development of appropriate programs to monitor for the potential adverse impacts.

The authority to regulate proposed dredging activities and the management of dredged material is derived from the following statutes:

Waterfront Development Law (N.J.S.A. 12:5-3 et seq.)
Rules on Coastal Zone Management (N.J.A.C. 7:7E)
Riparian Interests (N.J.S.A. 12:3-1 et seq. & 18:56-1 et seq.)
New Jersey Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.)
Federal Water Pollution Control Act (Clean Water Act Amendments of 1977; 33 U.S.C. 1251, Section 401)
Federal Coastal Zone Management Act (16 U.S.C. 1451 et seq.)

The siting of upland confined disposal facilities may also be regulated by the following:

Flood Hazard Area Control Act (N.J.S.A. 58:16A-50 et seq.)
Freshwater Wetlands Protection Act (N.J.S.A. 13:9B-1 et seq.)
Wetlands Act of 1970 (N.J.S.A. 13:9A-1 et seq.)
Coastal Area Facility Review Act (N.J.S.A. 13:19-1 et seq.)

<u>C</u> - The regulatory review of permit applications for dredging operations and the management of dredged material will be coordinated by the Department's Land Use Regulation Program. **It is strongly recommended that a pre-application meeting be held with the Land Use Regulation Program, prior to the actual submittal of a permit application, to discuss the proposed project, required permits, sampling and testing protocols, and other information needed to evaluate the application.**

In most cases, dredging projects in New Jersey's navigable tidal waters will require a Waterfront Development Permit and a Water Quality Certificate (WQC; pursuant to Section 401 of the Clean Water Act Amendments of 1977). The WQC is issued jointly with the Waterfront Development Permit. While a WQC is not required for the actual dredging operation, it is required for any discharge of dredged material into waters of the United States associated with the dredging operation. Any such discharge will also require a permit from the US Army Corps of Engineers pursuant to Section 404 of the federal Clean Water Act; the Section 404 Permit triggers the requirement for a WQC. Federally-conducted, funded, or permitted activities, including federal navigation projects, which have a direct impact on New Jersey's Coastal Zone, will require a federal consistency determination from the Department, pursuant to the Coastal Zone Management Act. The U.S. Army Corps of Engineers also has authority over dredging activities conducted in Waters of the United States, and federal permits are also required pursuant to Section 10 of the Rivers and Harbors Act of 1899.

Disposal of dredged material in ocean waters is regulated by the U.S. Army Corps of Engineers (USACE) and the U.S. Environmental Protection Agency (USEPA) pursuant to the Marine Protection, Research, and Sanctuaries Act. The State of New Jersey has discretionary authority to review disposal activities at ocean disposal sites pursuant to the Federal Coastal Zone Management Act. The review of proposed ocean disposal operations at currently designated ocean disposal sites will be coordinated with the USACE and USEPA.

D - Solid Waste Issues

The Department has carefully reviewed the issue of whether dredged material constitutes "solid waste" and whether dredging activities/disposal should be regulated under the provisions of the New Jersey Solid Waste Management Act (NJSWMA). The term "solid waste" is defined broadly to include "garbage, refuse and other discarded materials resulting from industrial, commercial and agricultural operations, and from domestic and community activities...". Based upon its review, and following consultation with other states and USEPA, it is clear that dredged material could be considered a solid waste.

In order to address the appropriateness of regulating dredging activities and dredged material under the solid waste regulatory program at N.J.S.A. 13:1E-1 et seq. and N.J.A.C. 7:26-1 et seq., the Department carefully evaluated the implications of such a decision. Historically, as a result of Adminstrative Order No. 36, issued in 1983 by former NJDEP Commissioner Robert E. Hughey, permitting and regulatory control of dredging activities and associated in-water and upland disposal of dredged material has been managed under the provisions of the New Jersey Water Pollution Control Act. Dredging has not been regulated under solid waste law for over 12 years and has never been a component of the NJSWMA district planning process.

Following a careful review of solid waste regulatory issues, the Department has concluded that the NJSWMA should not apply, and it should continue to regulate upland containment/disposal/use of dredged material under the provisions of the New Jersey Water Pollution Control Act, Waterfront Development Law, and the other relevant statutory and regulatory authorities listed in Section II-B.

Chapter III - Information Required of All Projects

A - Background Information

In order for the Land Use Regulation Program to determine what specific sampling and testing is required for a proposed dredging project and the management of the dredged material, background information must be submitted to the Department. It is strongly encouraged that potential applicants schedule a pre-application meeting with the Department once this background information has been gathered. The following information shall be submitted to the Land Use Regulation Program with the preapplication request:

1. A USGS quadrangle or county map identifying the dredging project area.

2. The proposed dredging method, project depth and areal extent of project.

3. A bathymetric survey of the dredging site taken within the past 6 months. All hydrographic surveys shall be performed by an ACSM (American Congress of Surveying and Mapping) certified hydrographer, a licensed land surveyor with 5 years hydrographic experience, or a professional engineer.

4. The location of the proposed disposal area and method of transporting material to the disposal area.

5. The estimated volume of dredged material and length of time necessary to conduct the dredging project, including approximate number of barge trips, if applicable.

6. An inventory of aquatic resources in the area to be dredged such as shellfish beds, eel grass beds, migratory pathways for finfish, and other aquatic organisms. Mapping of many resources is available from the Land Use Regulation Program. The Program may require surveys if insufficient data is available.

7. The location and type of all existing outfalls to surface waters on site and within 500 feet of the site.

8. Where available, a ten year history and summary of past dredging events, including grain size, Total Organic Carbon, percentage moisture, and bulk sediment chemistry analysis data.

9. The past history of on-site and adjacent land uses, and documented spills either on land or into surface waters.

10. An inventory of known and suspected historic upstream and downstream spills and unauthorized discharges of pollutants.

11. The location of any potable water intakes within one mile of the disposal site.

The above information will be utilized by the Department to determine the potential of sediments in the dredging project area to contain contaminants, in an effort to minimize the testing requirements for applicants, and to develop a sampling plan. Any additional available information related to potential contamination or non-contamination of the sediments should also be submitted.

B - Testing Exclusions

Testing of dredged material for contaminants will not always be necessary. Based on the volume of dredged material, the potential for contaminants to be present, and the proposed management/disposal alternative, the Department has developed the following four cases in which dredged material will be excluded from bulk sediment chemistry and modified elutriate testing (see Figure 1). For exclusions from testing for evaluation of ground water impacts, see Section IV-C(4).

Case 1:

No further testing will be required if: (1) the material to be dredged is more than 90% sand (grain size >0.0625 mm) and (2) the percent moisture, Total Organic Carbon or other background information do not lead the Department to believe the material may be contaminanted.

Case 2:

Projects where less than 1,000 cubic yards of dredged material will be removed over the 5-year life of the Waterfront Development Permit and disposal will occur in a Subaqueous Disposal Pit approved by the Department.

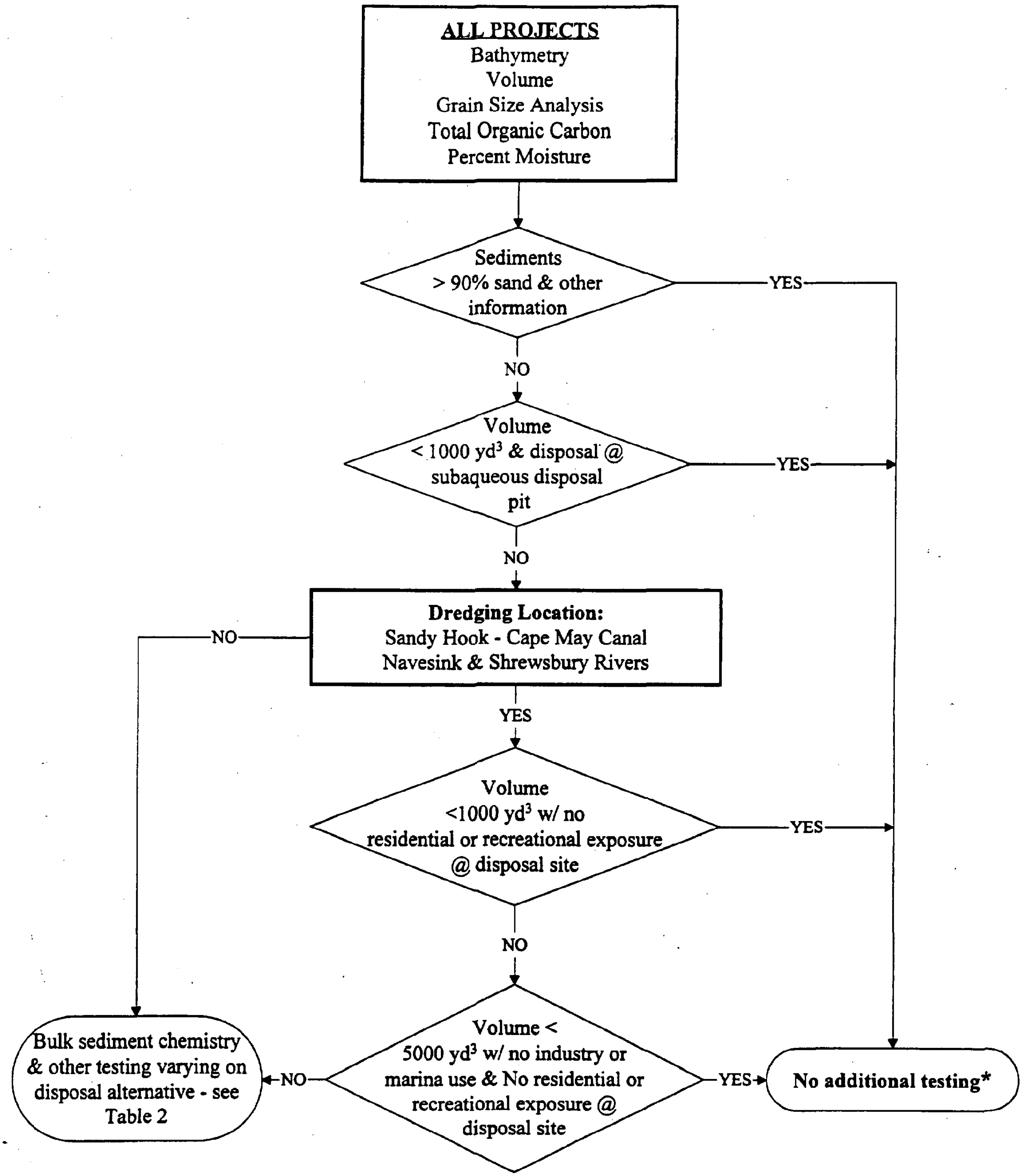
Case 3:

For dredging sites south of the Atlantic Ocean side of Sandy Hook to the western entrance of the Cape May Canal, including the Navesink and Shrewsbury Rivers, no testing of dredged material will be required if all of the following requirements are met.

a. less than 1,000 cubic yards of dredged material will be removed over the 5-year life of the Waterfront Development permit, and

b. disposal is proposed in an area which will not be subject to residential or recreational use.

Figure 1: Dredged Material Guidance Document Testing Schematic



*Note: Additional testing will be required for ocean disposal and may be required for beneficial use.

Case 4:

For dredging sites south of the Atlantic Ocean side of Sandy Hook to the western entrance of the Cape May Canal, including the Navesink and Shrewsbury Rivers, no testing of dredged material will be required if all of the following requirements are met.

a. less than 5,000 cubic yards of dredged material will be removed over the 5-year life of the Waterfront Development permit, and

b. there has not been an historic or current upland industrial use and the site is not now or previously occupied by a marina/marine basin of 25 or more boat slips, and

c. disposal is proposed in an area which will not be subject to residential or recreational use.

If none of the above four exclusions are met, the Department will consider reducing the testing requirements. This decision will be based on a review of the historical testing data (including the detection limit and methodology used, and parameters tested for) as well as the Department's knowledge of the area (including the occurrence of spills or unauthorized discharges of pollutants, and the location of nearby outfalls).

C - Sampling of Sediments

The proposed sampling plan must be presented to the Land Use Regulation Program for review and approval prior to samples being taken. The sampling plan must include the following information:

(1) Sampling locations:

a. Sample locations should be chosen so as to provide representative information on grain size, Total Organic Carbon, and percentage moisture of the sediments to be dredged.

b. In order to evaluate contamination of the sediments by pollutants, the sampling locations must be biased toward the positions of any outfalls, tributaries, other industrial sources, historical spill areas, and depositional (shoaling) zones. Previous test data for maintenance dredging projects must also be taken into account when choosing sampling locations.

For general guidance, especially for approximate number of samples to be taken per volume of sediment to be removed, refer to Table 1. However, each project will be assessed on a site-specific basis.

Table 1: General Sampling Guidance for Proposed Dredging Projects

Project Size (cubic yards)

Greater than but	Less than or Equal to	Number of Samples	Yards per Sample
1,300	3,600	2	1,800
3,600	6,000	3	3,000
6,000	8,400	4	2,100
8,400	10,700	5	2,140
10,700	13,000	6	2,166
13,000	21,800	7	3,114
21,800	30,500	8	3,750
30,500	39,000	9	4,333
39,000	48,000	10	4,800
48,000	56,500	11	5,136
56,500	65,000	12	5,416
65,000	76,000	13	5,846
76,000	87,000	14	6,214
87,000	98,000	15	6,533
98,000	109,000	16	6,812
109,000	120,000	17	7,058
120,000	131,000	18	7,277
131,000	184,000	19	9,684
184,000	238,000	20	11,333
238,000	281,000	21	13,857
281,000	345,000	22	15,681
345,000	398,000	23	17,304
398,000	452,000	24	18,833
452,000	505,000	25	20,200
505,000	559,000	26	21,500
559,000	612,000	27	22,666
612,000	666,000	28	23,785
666,000	719,000	29	24,793
719,000	773,000	30	25,766
773,000	803,000	31	25,903
803,000	880,000	32	27,500
880,000	933,000	33	28,272
933,000	987,000	34	29,029
987,000	1,040,000	35	29,714

Source: "Guidance for the Collection and Preparation of Sediments for Physico-chemical Characterization and Biological Assessment", Environment Canada.

c. Where ocean disposal is proposed, the Department will accept the sampling plan and analysis of results submitted to the federal agencies in accordance with the U.S. Army Corps of Engineers and U.S. Environmental Protection Agency February 1991 Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Manual and the December 1992 Regional Guidance Manual for USEPA Region II entitled "Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal", and any subsequent revisions thereto. However, the Department will coordinate with the U.S. Army Corps of Engineers in the approval of sampling plans and testing for ocean disposal projects in New Jersey waters to address surface water quality concerns at the dredging site.

(2). Method of sampling

a. In order for the data to be valid, all sediment core samples must be taken in accordance with the guidance specified in this Section and in Appendix A. Table 1 specifies the approximate number of sediment core samples to be taken per the volume of sediment to be dredged, excerpted from an Environment Canada draft document "Guidance for the Collection and Preparation of Sediments for Physico-chemical Characterization and Biological Assessment". This guidance must be used for the total number of core samples which will be necessary to fully characterize the dredging project. In most cases, individual core samples may be composited for analytical purposes, following the guidance in 2(d).

b. Core samples are to be taken to the proposed project depth plus allowable overdredge (2 feet).

c. Each core shall be described. Grain size analysis shall be required, using the method of R.L. Folk, 1969 (cited in Section VI - References). A core may be homogenized unless there are distinct strata in grain size and composition which are at least 2 feet in depth. The Department shall be notified of any cores that show grain size stratification prior to homogenizing. For cores that show grain size stratification, each strata with a depth of 2 feet or greater must be tested for grain size, Total Organic Carbon and percentage moisture.

d. Samples may be composited using the following general guidelines. The Department must be contacted prior to compositing:

1. Separate cores may be composited only if the grain size and likelihood of contamination is uniform based on depositional characteristics, spill history, location of outfalls, etc.

2. The number of cores to be composited should be kept to a minimum and not exceed 3 cores. Minimal compositing will serve to fully characterize the sediments proposed for dredging and disposal.

3. At least three analytical samples must be taken per reach. A reach is a continuous stretch of waterway not separated by any structure and subject to similar hydrodynamic and depositional features as well as similar upland inputs. Reach boundaries must be approved by the Department.

e. In those cases in which there is a potential for the uncovering of more contaminated sediment, such as new work dredging projects in shoaling zones and maintenance dredging projects which proposed a deeper depth, the bottom 6 inches of each core will be separated from the remainder of the core and reserved. The material shall be visually inspected to determine if it is predominantly sand, gravel, silt or clay. The bottom 6 inches is considered representative of the material that will be exposed as a result of dredging. If the 6 inches sample is less than 90% sand, as determined by grain size analysis, bulk sediment chemistry analysis will be required.

Chapter IV - Management of Dredging Activities and Dredged Material

A - Overview

Section IV-B discusses the Department's program for managing and regulating dredging operations and activities, including the use of Best Management Practices.

A variety of potential alternatives exist for the management and/or beneficial use of dredged material. These include open water (including ocean) disposal sites, upland confined disposal facilities (CDFs), subaqueous disposal pits, and containment areas. Beneficial use alternatives include beach nourishment, habitat development, construction material, landfill cover, agricultural uses and capping open water disposal sites.

These dredged material management alternatives and applicable regulatory requirements and procedures are discussed in detail in this section and Section V. Figure 2 is a schematic diagram of potential dredged material disposal alternatives. Table 2 summarizes the potential sediment testing and permitting requirements for these alternatives.

Permit application procedures for dredging operations and the dredged material management alternatives, including sediment sampling and testing protocols, were discussed in Section III.

(Note: the construction and operation of dredged material containment islands and the use of decontamination technologies are currently under investigation by the State of New Jersey, in cooperation with various federal agencies. As these dredged material management alternatives are not currently available, they are not discussed in this guidance document.)

B - Management of Dredging Activities

(1) Authority/Permitting Process: refer to Sections II-B,C for a discussion of relevant statutes, regulations, and an overview of the permitting process. The Department's Land Use Regulation Program will review proposed dredging operations under the Rules on Coastal Zone Management (N.J.A.C. 7:7E), as amended to July 19, 1994. These Rules provide the basis for the Department's review, including an evaluation of the locational requirements for the issuance of permits for maintenance and new dredging projects.

The riparian statutes contained within Titles 18A (N.J.S.A. 18A:56-1 et seq.) and 12 (NJSA 12:3-1 et seq.) may also apply to a dredging project. Tidelands conveyances are not required when dredged material is removed from tidelands and placed in a different tidelands location. This would include ocean disposal operations, reprofiling, or disposal into subaqueous disposal pits. It would also include placement on upland sites which are State-owned tidelands.

Figure 2: Schematic Diagram of Potential Dredge Material Disposal Alternatives

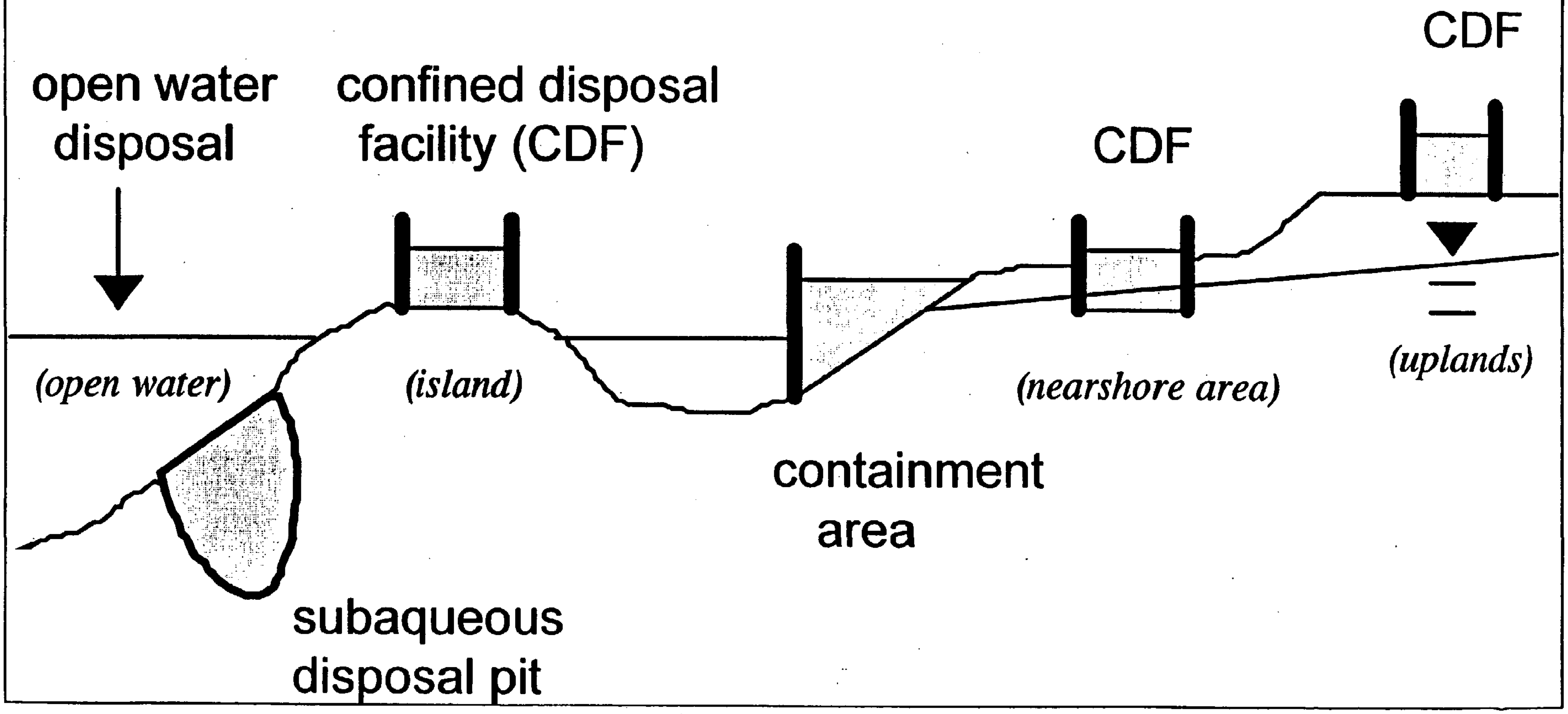


Table 2: Potential Sediment Testing and Permitting Requirements for Various Dredged Material Disposal Alternatives

Management Alternative:	Open Water	SAD Pits	Containment Area	Upland CDF
Tests:				
Physical Analysis	R	R	R	R
Bulk Sediment Chemistry	R*	R*	R*	R*
Modified Elutriate	(1)	(1)	R*	R*
SBLT	-	-	(2)	(2)
Bioassay	?	-	-	?
Permits:				
Waterfront Dev.	R	R	R	PR
Tidelands Instr.	R	R	R	PR
Water Quality Cert.	R	R	R	R
NJPDES-DSW	-	-	(1)	(1)
NJPDES-DGW	-	-	(2)	(2)
Stream Encroach.	-	-	PR	PR
CAFRA	-	-	PR	PR
Freshwater Wet.	-	-	PR	PR
Coastal Wetlands	-	-	PR	PR

Key: R - required in all cases
R* - required except where sediments meet applicable testing exclusion criteria (see Section III-B)
? - may be required depending on Bulk Sediment Chemistry data
(1) may be required when dredged material originates in a waterbody different from that in which the disposal site is located
(2) may be required depending upon the results of site specific groundwater impact evaluations and/or sediment characteristics
PR - potentially required if facility is to be located in an area regulated by the listed program

Construction of a subaqueous disposal pit by the removal of material may require a tidelands conveyance. If the dredged material is placed in an upland location which is not State-owned tidelands by an entity other than the State or federal government, a tidelands conveyance or agreement, approved by all the required officials (including the Tidelands Resource Council, the Commissioner of the NJDEP, the Attorney General, and the Governor), is required.

[Note: In addition to required State permits, permits will be required from the USACE pursuant to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the federal Clean Water Act.]

(2) Potential Impacts/Regulatory Objectives: potential adverse environmental impacts associated with dredging operations arise from (1) the destruction of benthic habitat as a direct result of the operation, and (2) the dispersal of sediments and associated contaminants away from the dredging area. The Department's objectives in regulating dredging operations are to minimize the potential for such impacts to occur.

In general, benthic organisms will rapidly recolonize areas that have been dredged. However, new dredging should avoid impacting areas of ecological importance. The Rules on Coastal Zone Management provide the basis for the Department's review of proposed dredging projects and evaluation of the potential impact of dredging projects. In its review of the location and need for any dredging operation, the Land Use Regulation Program will consider direct and indirect impacts to sensitive areas, such as shellfish beds and finfish migratory pathways.

The dispersal of sediments away from the dredging area may result in adverse impacts. Impacts could result from the direct physical settlement of the dispersed sediments onto sensitive benthic areas. Dispersal of contaminants associated with these sediments could have impacts to both benthic and water column food webs. The Department has developed a list of Best Management Practices which should be used to minimize the creation and dispersal of suspended sediments during dredging operations.

The Department is also concerned about the potential long-term and cumulative impacts of dredging operations. The potential for such impacts will be evaluated as part of the Land Use Regulation Program's review of proposed dredging projects.

(3) Best Management Practices (BMPs): the Department has identified a number of BMPs which should be used to minimize the potential for, and magnitude of, adverse environmental impacts that could result from dredging operations. The need for any BMPs will be determined by the Department and will be included as permit conditions. The applicability of the use of a particular BMP for a dredging project will be evaluated by the Department in consultation with the permit applicant.

The effectiveness of a particular BMP to minimize potential adverse impacts will vary with the conditions present at a particular dredging operation. Thus, the Department will consider this list of BMPs as a "menu", from which those practices anticipated to be most effective and implementable for a particular dredging project can be selected. The use of these BMPs would then be incorporated as conditions into the permits issued by the Department for the dredging operation.

The following BMPs have been identified by the Department. This list is not intended to be all inclusive, and additional BMPs will be considered by the Department.

*Hydraulic Dredging - this method can be used when the channel or berthing area configuration, the type of sediments to be dredged, and the volume of dredged material allows it. Hydraulic dredging is preferable when an acceptable upland confined disposal facility (CDF) is available within pumping distance of the dredging area. It reduces the generation of suspended sediments at the dredging site. However, this method results in the production of large volumes of a high percent water content dredged material slurry. Thus, the proposed upland CDF must be designed and operated to accept such material.

*Closed Clamshell - the use of a closed, watertight clamshell reduces the production of suspended solids at the dredging site. A closed clamshell will be required by the Department when the sediments to be dredged are contaminated at levels warranting concern. A closed clamshell would also be required by the Department whenever a no-barge-overflow permit condition is in effect.

*Dredging Practices - a number of procedures can be employed by the dredging contractor to minimize the creation and dispersal of suspended sediments when using a clamshell dredge. These include:

(1) maximizing the size of the "bite" taken by the clamshell. This also results in a minimization of the number of "bites" needed to dredge a particular volume of sediment;

(2) slowly withdrawing the clamshell through the water column;

(3) not hosing down or rinsing sediments off the sides and gunwales of the barge.

*No-Barge-Overflow - this BMP reduces the creation and dispersal of suspended sediments when finer-grained sediments are dredged. It will be required by the Department when the dredged material is contaminated at levels warranting concern. Except as noted below, this condition will always apply to dredging operations in Newark Bay, the Passaic River and its tidal tributaries from Newark Bay to Dundee Dam, the Hackensack River and its tidal tributaries from Newark Bay to Oradell Dam, the Kill Van Kull, the Arthur Kill, Elizabeth Channel, City Channel, and Upper New York Bay. This condition will also apply when the dredged material is to be rehydrated as part of its disposal/management.

However, in most cases, barge-overflow will be permitted when the dredged material will be taken to a designated ocean disposal site. Use of barge overflow in such projects will tend to produce a more consolidated dredged material. This will result in less dispersal of dredged material at the ocean disposal site. Thus, while impacts may be greater at the dredging site, the impacts of disposal will be reduced.

*Shunting - this BMP involves the active pumping of free water in a barge to the bottom of the water column at the dredging site. It may act to reduce turbidity in the upper water column. The discharge end of the shunting system must include a diffuser in order to minimize the potential for additional disruption of benthic sediments. Additionally, the pumping rate and location of the discharge must not result in the disruption of in-place sediments. This BMP could be used as an alternative to barge-overflow in reducing the volume of water in the barge.

*Seasonal/Migratory Periods - depending on the location of the dredging area, the Department may prohibit operations during certain times of the year to minimize potential adverse impacts to anadromous or other migratory finfish, nesting shorebirds, etc.

*In certain semi-enclosed water bodies, dredging only on the incoming tide may provide additional time for suspended sediments to settle, thus minimizing the dispersal of contaminated sediments out of the water body.

*Dredging contractors may be required to employ independent, on-board dredging inspectors certified by the USACE. These inspectors will observe the dredging and disposal operations to ensure compliance with all permit conditions.

*Silt curtains may be practical for use in areas where the water current is less than one (1) knot. The use of silt curtains may minimize the upper water column dispersal of sediments from the dredging area. This BMP can also be used to protect tidal creeks, etc. adjacent to the dredging area.

*Split-hull barges should only be used in dredging projects which will use open water disposal methods.

(4) Testing Requirements: Section III discusses the sampling and testing required for all proposed dredging projects. Sediments which do not qualify for a testing exclusion, as described in Section III-B, may require additional bulk sediment and/or modified elutriate testing. This will be determined by the Department on a case-by-case basis. To evaluate potential impacts to estuarine benthic communities as a result of the dispersal of contaminated suspended sediments, the Department will compare the bulk sediment chemistry data with the guideline values developed by Long et al. (1995), on a case-by-case basis.

C - Open Water Alternatives

(1) Authority: refer to Sections II-B, C for a listing of relevant statutes and regulations.

All Open Water disposal operations in State waters require a Water Quality Certificate (this is required in conjunction with the permit issued by the USACE pursuant to Section 404 of the Clean Water Act). Non-federal projects also require a Waterfront Development permit (which is a federal consistency determination). Federally-conducted or funded projects require only a federal consistency determination (i.e. a Waterfront Development permit is not required). All of these permits are issued by the Land Use Regulation Program.

(2) Ocean Disposal:

(a) Overview. There are currently 6 federally authorized ocean disposal sites in proximity to New Jersey. They are the Mud Dump site (approximately six miles offshore of Sea Bright), sites at Shark River Inlet, Manasquan Inlet, Cold Spring/Cape May Inlet, and Absecon Inlet (the Inlet sites may only be used for the disposal of sand dredged from each inlet), and Buoy 10 in Delaware Bay (the Buoy 10 site may only be used for disposal of dredged material from specific reaches on the Delaware River). The expansion of any of these sites or the designation of new sites will require a federal consistency determination from the Land Use Regulation Program. In addition, individual disposal operations will require a federal consistency determination.

(b) Testing Requirements. Disposal of dredged material in ocean waters is regulated by the U.S. Army Corps of Engineers (USACE) and the U.S. Environmental Protection Agency (USEPA) pursuant to the Marine Protection, Research, and Sanctuaries Act. The State of New Jersey has discretionary authority to review disposal activities at ocean disposal sites pursuant to the Federal Coastal Zone Management Act. The review of proposed ocean disposal operations at currently designated ocean disposal sites will be coordinated with the USACE and USEPA. Through the Dredged Material Management Forum of the NY-NJ Harbor Estuary Program, the Department, USACE and USEPA are working to develop coordinated sampling, testing and criteria for ocean disposal.

(3) Other Open Water Disposal Areas:

(a) Overview. Dredged material can be placed in nearshore waters through sidecasting, reprofiling, interpier disposal or other means. If the material will be contained by a bulkhead, berm, subaqueous pit, etc., it will not be considered Open Water disposal, but will be regulated as a Containment Area (see Section IV-F).

The following open water disposal sites have been approved by the Department and used repeatedly for disposal of sand dredged from the Intracoastal Waterway. Proposals for Open Water disposal at these sites (or new proposed sites) will be reviewed by the Department on a case-by-case basis: North of Gull Island in Great Sound, West of Pullen Island in Great Bay.

(b) Permitting Process. Open Water disposal is suitable only in the designated areas and where the dredged material is at least 90% sand. Further, practicable upland disposal alternatives must not be available. Disposal at a designated Open Water site requires a Waterfront Development permit (with the exception of federal projects), a Water Quality Certificate, and a federal consistency determination. (Note: a Clean Water Act Section 404 Permit will also be required from the USACE.)

(c) Potential Impacts/Regulatory Objectives. Disposal at an Open Water site requires a demonstration that no practicable alternative site exists, federal and State Water Quality Standards will be met, and potential adverse environmental impacts will be minimized. An evaluation of the proposed disposal operation will be made using the Rules on Coastal Zone Management (N.J.A.C. 7:7E) to ensure that sensitive areas will not be adversely affected. Sensitive areas include but are not limited to shellfish habitat, prime fishing areas, submerged vegetation, shallow water habitat, and threatened and endangered species habitat. Open Water disposal is prohibited in tidal guts, man-made harbors, medium rivers, streams, and creeks due to the inability of smaller waterways to assimilate many pollutants (refer to the Rules on Coastal Zone Management for definition/identification of these types of water bodies). Disposal is discouraged in all other waterways, except the ocean and bays greater than 6 feet deep.

(d) Testing Requirements. Required testing of dredged material to be disposed of at an Open Water Site includes an analysis of sediment cores for grain size, Total Organic Carbon and percent moisture to demonstrate that the criterion of greater than 90% sand is met. See Section III-C for sampling procedures.

D - Upland Confined Disposal Facilities

(1) Overview: Sediments in New Jersey's tidal waters may be impacted to varying degrees by a number of pollutants. Not all sediments are considered to be "contaminated". When sediments are contaminated, it is generally believed that the degree of contamination is such that placement of the sediments in appropriately managed upland confined disposal facilities (CDFs) would not result in significant adverse impacts to terrestrial ecosystems or pose risks to public health. However, the presence of these same sediments in an aquatic environment could result in significant adverse impacts to the aquatic ecosystem. Thus, in most cases, it is preferable that contaminanted sediments be removed from the aquatic environment and contained in appropriate upland facilities (or decontaminanted when appropriate technologies are available and practicable.)

The Department's regulatory programs are designed to identify and minimize potential adverse environmental impacts resulting from proposed activities. For dredged material upland CDFs the magnitude of these impacts are dependent upon the:

(a) location of the facility and site-specific conditions (including compatibility with adjacent and nearby land uses);

(b) characteristics of the dredged material proposed for placement at the facility;

(c) design and construction of the facility;

(d) operation of the facility;

(e) final closure and use of the facility site.

These five factors will be considered collectively, as regulatory decisions will be based on a comprehensive review of a proposed upland CDF. With proper design and operation of the upland CDF, the potential for adverse impacts can be reduced significantly. Upland CDFs will be designed, permitted, and operated on a case-by-case basis.

Siting of a proposed upland CDF will be addressed by the Department's Land Use Regulation Program. In New Jersey's designated Coastal Zone, the Rules on Coastal Zone Management will be applied to proposed sites. These Rules include constraints on the types of activities which can occur in various types of coastal areas. In addition, a number of regulatory programs, such as the Freshwater Wetlands Protection Act and the Flood Hazard Area Control Act, may restrict the use of a particular site.

The major potential adverse environmental impacts associated with the upland containment of dredged material are surface and ground water contamination. Testing of dredged material for upland containment is driven, in large part, by the potential for contamination of surface and groundwaters. The discharge of contaminants from upland CDFs to surface water must be controlled to minimize potential adverse impacts to the aquatic ecosystem. The Department's testing requirements and evaluation protocols for surface and groundwater discharges are discussed in detail in Sections IV-D(3) and IV-D(4), respectively.

Potential adverse impacts could result from the dispersal of contaminants into terrestrial ecosystems and subsequent effects on receptor organisms. The upland CDF must be designed and operated to minimize the dispersal of contaminants. A number of management techniques are available to address this concern. This topic is discussed in more detail in Section IV-C(5).

Potential adverse impacts to public health could result from human exposure to dredged material contaminated at levels which have been identified as being of concern. Potential exposure pathways with contaminanted dredged material must be identified and controlled. This topic is discussed in more detail in Section IV-C(6).

End-use(s) and final closure of the upland CDF site must also be addressed in the regulatory process. Long-term impacts of the facility will be evaluated and appropriate management actions to minimize such impacts required. These concerns are discussed in more detail in Section IV-C(2).

(2) Design, Construction, Operation, and Closure:

(a) Authority. The Department will regulate the design, construction, operation, and closure of upland CDFs pursuant to the Waterfront Development statute. The New Jersey Flood Hazard Regulations and the Coastal Area Facilities Review Act may also be applicable. The Division of Solid and Hazardous Waste will conduct the technical/engineering review of proposed facilities.

(b) Potential Impacts/Regulatory Objectives). Potential adverse impacts which could result from the operation and interim/final closure of an upland CDF would be caused by the unintended dispersal of contaminants out of the upland CDF into the environment. These potential impacts are discussed in detail in Sections IV-D(1), (3), (4), (5), and (6). Potential contaminant migration pathways and exposure hazards can be minimized and controlled through oversight of the design, construction, operation, and interim/final closure of the upland CDF.

i. Design and Construction - an upland CDF is not fundamentally different in the structural aspects of its design from any earthen berm. It must be capable of resisting the forces exerted by the weight of the dredged material placed within it and the hydraulic forces exerted by adjoining surface water bodies, underlying ground water, stormwater discharges, and dewatering effluent. The containment structure must be able to withstand the effects of erosion, provide a stable platform for the operation of equipment, and allow for the potential vertical expansion of the containment structure.

The USACE has considerable experience in the design of upland CDFs. The Department will use the technical standards in the following documents as the basis for its engineering review of the design and construction of proposed upland CDFs:

Confined Disposal of Dredged Material - Engineer Manual (EM 1110-5027), September 1987.

Confined Disposal Guidance for Small Hydraulic Maintenance Dredging Projects - Design Procedures, Environmental Effects of Dredging Technical Note EEDP-02-8, December, 1988.

Where circumstances, as described in Section IV-C(4)(c), require the use of liners and leachate collection systems within the design of an upland CDF to control discharges to groundwater, the Department's regulatory standards for the design, construction, and quality control of landfill liners and leachate collection systems (N.J.A.C. 7:26-2A.7) will be used for technical guidance. The Department does not anticipate that the multiple liner system required for certain landfills will be needed in the design of upland CDFs.

Erosion control of all external surfaces of an upland CDF will be necessary to prevent undermining of the containment berms and to control sediment transport to adjoining surface waters. Erosion may be caused by wave activity, stormwater runoff, discharge of dewatering effluent, and infiltration of water through the containment berm. The New Jersey Standards for Soil Erosion and Sediment Control (N.J.A.C. 2:90) shall be applied to the design and construction of a proposed upland CDF. If required by the appropriate regional office of the Soil Conservation Service, a Certified Soil Erosion and Sediment Control Plan shall be obtained for the upland CDF.

The importance of following all aspects of the approved engineering design for an upland CDF must be emphasized. Accordingly, the Department will require the filing of "as built" plans, with a certification by a professional engineer licensed to practice in New Jersey that the approved engineering design plans have been adhered to.

ii. Operation - it will be necessary for the Department to have adequate operational oversight of an upland CDF in order to ensure that the stability and integrity of the containment structure is maintained, and to prevent the uncontrolled release of dredged material, ponded water, and associated contaminants. Additional oversight and/or monitoring may be needed to control the rate at which the upland CDF is filled, the manner in which it is filled, and how dewatering occurs in order to address potential requirements relating to surface water (Section IV-D[3]) and ground water (Section IV-D[4]) discharges. Additional oversight may be needed to address potential human and terrestrial ecosystem exposure concerns as they may arise on a case-by-case basis (see Sections IV-D[5] and [6]).

To maintain oversight, the Department will require the owner and/or operator of an upland CDF to submit an annual report to the Department. The report will summarize the past year's activities at the upland CDF. Projected activities for the next five (5) years shall also be identified. The report shall document the following information:

(1) Condition of containment berms, dewatering and stormwater discharge weirs, and other engineering structures critical to the operation of the upland CDF. Any significant changes to the upland CDF must be first approved by the Department and revised "as built" plans documenting such changes submitted.

(2) Summary of disposal operations at the upland CDF, including a listing of all dredging projects and their volumes.

(3) Summary of maintenance and management activities conducted at the upland CDF, including regrading, ditching, crust management, etc.

(4) Summary of any dredged material removed from the upland CDF and its final use/destination.

(5) An analysis of available disposal capacity in the upland CDF. This will be compared with the projected disposal activities for the next five (5) years and a running total of available capacity for the next five years estimated.

(6) Summary of surface and ground water discharge monitoring programs for all required parameters.

(7) Any additional monitoring or certifications required pursuant to Sections IV-D(5) and (6) of this guidance document.

The USACE Engineer Manual EM 1110-2-5027, Confined Disposal of Dredged Material includes discussions of a variety of concerns critical to the proper operation and maintenance of an upland CDF.

iii. Closure - it is expected that most of the dredged material placed in upland CDFs will be contaminated by organic and inorganic pollutants at various levels of concern. Without assuring long-term containment of the dredged material, these contaminants may disperse into the environment. Potential human health exposure pathways include direct contact and inhalation (particulate transport via dust) routes (refer to Section IV-D[6]). Potential uptake of contaminants by plants and animals which colonize or use the upland CDF is also of concern (see Section IV-D[5]). Upland CDFs may erode, resulting in the transport of contaminants into surface waters. Infiltration will also continue to occur, with the resulting generation of leachate and surface water runoff, which may impact ground or surface water resources.

This section discusses the closure requirements for those upland CDFs which accept any dredged material which does not meet the testing exclusion criteria listed in Sections IV-D(4) and III-C. The Department will consider exceptions to these closure requirements on a case-by-case basis.

To control or mitigate these potential adverse impacts, the Department will require interim/final closure of the upland CDF. Final closure refers to the implementation of practices after the cessation of dredged material disposal operations at the upland CDF. Interim closure practices may be needed if there will be a large (generally greater than 6 months) interval between disposal or management activities at the upland CDF.

Interim Closure

Interim closure procedures are largely concerned with minimizing the potential for direct human and plant/animal exposure to contaminated dredged material. These are discussed in Sections IV-D(5) and (6).

The need for interim closure procedures will be determined by the Department on a case-by-case basis. The Department will require the submittal and approval of a formal plan to address interim closure requirements. Such a determination will be based on the testing data available for the dredged material; alternatively, additional testing of the exposed dredged material may be needed (see Section [d] below).

Interim closure procedures include the implementation of measures to control the generation of dust. Site access controls (for example, fencing) shall be maintained. The need for capping of exposed dredged material with clean fill will be determined by the Department on a case-by-case basis. The requirements of any Water Quality Certificate (WQC) or New Jersey Pollutant Discharge Elimination System (NJPDES) permits for discharges to surface or ground water from the upland CDF must be maintained during the interim closure period. Likewise, required soil erosion and sediment control measures must be maintained.

An annual report on the status of the upland CDF, similar to that discussed in Section ii, shall be submitted to the Department, during the interim closure period. An interim closure period will not last longer than five (5) years; implementation of final closure procedures will be required for such situations.

Final Closure

Upland CDFs are expected to contain dredged material contaminated with pollutants at various levels of concern. Thus, long-term containment of these contaminants must be assured. The owner of record of the property on which the upland CDF is constructed is ultimately responsible for the final closure of the facility and any required post-closure monitoring.

The Department will require the submittal and approval of formal plans that address final closure, post-closure maintenance and monitoring, and site development or use for all upland CDFs. This requirement does not apply to those upland CDFs permitted and used solely for the disposal of dredged material which meets the exclusion criteria listed in Sections IV-D(4) and III-C. A preliminary final closure plan should be submitted with the permit application to construct and operate the upland CDF. A Final Closure Plan shall be submitted to the Department no later than 60 days following the issuance of Departmental approval to construct and operate the upland CDF. The Final Closure Plan must propose all engineering controls designed to contain the contaminated dredged material and prevent direct contact with, and off-site transport of, contaminants of concern. The Final Closure Plan must also include provisions for post-closure monitoring of the upland CDF and a Financial Plan. The Financial Plan shall be prepared following the general guidance in the Department's landfill closure regulations (N.J.A.C. 7:26-2A.9), adapted to the specific design and closure features of the upland CDF. In the event of a proposed transfer of ownership of property containing an upland CDF, a new Final Closure Plan (including a Financial Plan), to be implemented by the prospective purchaser, shall be submitted to the Department for approval prior to the final change of Title.

A major component of the Final Closure Plan will relate to the cap design for the upland CDF. The exact nature of the cap construction must be included in the Final Closure Plan. Cap requirements will be determined on a case-by-case basis by the Department, in consultation with the owner/operator of the upland CDF. In general, a minimum thickness of two feet of cover, consisting of 18 inches of clean fill overlain by 6 inches of topsoil, with a complete vegetative cover, will be required. In situations where relatively clean dredged material (i.e. meets the Interim State Direct Contact Soil Cleanup Criteria) has been emplaced entirely, or used as a substantial top cover on the upland CDF, reduced cap design criteria may be warranted.

The Final Closure Plan shall include restrictions on site access via fencing and future site use via a Declaration of Environmental Restrictions, Deed Restrictions, or other site use restriction documentation. It is possible that at some point following final closure of the upland CDF, reuse of the property may be proposed (the potential for such reuse should be identified in the Final Closure Plan, and continually investigated during the operational lifetime of the facility). If a final reuse (other than the creation of habitat via natural succession processes) is proposed, the owner of the property will be required to submit a modified Final Closure Plan to the Department. The contents of this plan will vary with the upland CDF and the proposed final reuse, and will be determined on a case-by-case basis by the Department, in consultation with the owner of the property. The main objective of the Final Closure Plan is to ensure that the proposed project design will not in any way reduce the effectiveness of the dredged material containment provided by the upland CDF.

Additional components of the Final Closure Plan could include provisions for the maintenance and monitoring of the following parameters:

(1) surface and/or ground water discharge monitoring required pursuant to any WQC or NJPDES permits issued for the upland CDF;

(2) erosion, stormwater run-off, and drainage controls;

(3) stabilization and vegetation of the final cover;

(4) weir and other outlet structures;

(5) security and access restrictions;

(6) leachate collection and/or control (if required).

The submission of an annual Post-Closure Maintenance Report, summarizing the status of the upland CDF and activities associated with its final closure, and updating the Financial Plan, may be required by the Department.

(c) Permitting Process. Applications to construct, operate, and close upland CDFs will be reviewed by the Department's Land Use Regulation Program pursuant to the Waterfront Development statute, the Coastal Area Facilities Review Act, and the New Jersey Flood Hazard Regulations, as applicable. The Division of Solid and Hazardous Waste will conduct the technical/engineering review of proposed upland CDFs and will develop appropriate conditions to be placed on the Waterfront Development Permit. The review conducted by the Land Use Regulation Program will be coordinated with other Departmental programs, as needed, to address the concerns discussed in Sections IV-D(3), (4), (5), and (6).

(d) Testing Requirements. Design of the upland CDF containment structures must consider the engineering properties (for example, soil density, grain size, percent compaction) of the material to be used. In those cases where dredged material is to be used to construct, or enlarge, containment berms, the material must meet the Interim State Direct Contact Soil Cleanup Criteria. Additional bulk sediment analyses of any dredged material proposed for such use may be required, as determined by the Department on a case-by-case basis.

Upon final closure of the upland CDF, the Department presumes that the dredged material may represent an unacceptable risk. With prompt capping of the exposed dredged material, no sampling other than that required to ensure the use of "clean fill" or soil cover in the cap, will be required. If a reduction in the design cap criteria are proposed by the owner and/or operator based upon site-specific conditions, then sampling and testing of the exposed dredged material will be required. In general, a minimum sampling frequency of one sample per two acres will be required. Analysis must include all the target compounds listed in Appendix A of this guidance document.

If final closure of the upland CDF will not be completed within two years of the cessation of dredged material disposal operations, or should off-site transport of dredged material or its contaminants become evident, the sampling of the media (including surface waters, sediments, and soils) surrounding the facility shall be required. Such sampling would require analysis for all of the target compounds listed in Appendix A of this guidance document.

(3) Surface Water Discharges:

(a) Authority. The authority to issue permits for direct point source surface water discharges is derived from both the federal and state Water Pollution Control Acts, also known as the Clean Water Act(s). The New Jersey Pollutant Discharge Elimination System (NJPDES) regulations (N.J.A.C. 7:14A) are the operating regulations that implement the State Clean Water Act.

Additionally, authority for the permitting of the effluent from dewatering dredged material to surface waters of the State can be found in Section 401 of the federal Clean Water Act for the issuance of Water Quality Certificates (WQCs).

(b) Potential Impacts/Regulatory Objectives. The objectives of any regulatory oversight document (i.e. NJPDES permit or WQC) for the point source discharge of effluent from the dewatered dredged material is to prevent any adverse impacts of the discharge on the receiving water body. Adverse impacts to the receiving water body may include toxic effects or bioaccumulation of contaminants in aquatic organisms, as well as adverse effects in humans through fish consumption or water exposure. The best way to ensure that no adverse impacts occur is to regulate the amount and type of potential pollutants (as defined by N.J.S.A. 58:10A-3) that could be discharged to the receiving water body. The two most important methods of controlling the amount and type of potential pollutants that could be discharged are by having either technology based discharge criteria or water quality based discharge criteria in the form of permit limitations in either the NJPDES permit or the WQC. Either of these two methods of developing permit limitations will serve to protect the water quality of the receiving water body.

i. Technology Based Discharge Limits - The rationale for technology based numbers is that compliance with either NJPDES permit or WQC discharge limits can be demonstrated through the use of engineering solutions such as retention basins, flocculents, and other innovative methods. Any particular type of treatment that will achieve pollutant reduction to a defined and/or acceptable level(s) may meet this criteria. These limits may be utilized when the source dredged material is from a waterbody other than the discharge receiving water body. The effluent from the dewatered dredged material must meet these NJPDES permit or WQC limits at all times.

ii. Water Quality Based Limits - These types of limits are based on the existing water quality of the receiving water body as well as the ability of the receiving water body to assimilate any additional loading(s) of pollutants without any adverse effects. The rationale for this method of permit (limit) development for the effluent from the dewatered dredged material is to set the discharge limit(s) of the effluent to ambient levels of the receiving water. In this way no additional loading(s) of potential pollutants will be discharged to the receiving water body in excess of what is already presumably present in the receiving water body. The procedures to establish ambient conditions can be found in the following three reference documents:

(1) Guidance for Preparation of Combined Work/Quality Assurance Project Plans for Environmental Monitoring. (OWRS QA-1), Office of Water Regulations and Standards, USEPA.

(2) Field Sampling Procedures Manual. NJDEPE, 1992.

(3) USEPA Handbook - Stream Sampling for Waste Load Allocation Applications.

Additionally, this method can utilize indicator parameters such as Total Suspended Solids (TSS) as action levels in the permit or WQC. Indicator parameters are indicative of groups of individual pollutants. The limiting or regulating of an indicator parameter should serve to limit the indicator group of pollutants. The use of indicator parameters will allow for more rapid data generation for compliance purposes. It is expected that this method will be sufficiently protective of the receiving water body.

The setting of action levels as permit limits is consistent with the Department's direction of emphasizing compliance with permit conditions instead of monetary penalties for numerical permit violations. Exceedances of action levels trigger corrective action measures such as additional treatment of the effluent or increased retention time prior to effluent discharge. The permit and WQC will contain language that reflects the action level concept so that permission to discharge is contingent upon compliance with either action levels or corrective action measures. This is the method of choice when the dredged material originates in the same water body to which the effluent from the dewatered dredged material is being discharged.

(c) <u>Permitting Process</u>. The point source discharge of the dewatered dredged material to surface waters of the state will fall into one of two categories:

(1) dredged material dewatering effluent returning to the same water body from which the material was originally dredged will require a WQC. This WQC will have discharge conditions similar, if not identical, to those which would be found in a NJPDES/DSW permit.

(2) a NJPDES/Discharge to Surface Water (DSW) permit will be required for discharges from facilities accepting material from single or multiple dredging sites located in a different surface water body, or from "unidentified" sites.

(d) Testing Requirements. Exclusionary criteria for the testing requirements are described in Section III-B. Any project which does not qualify for a testing exemption as described in Section III-B will be subject to the following requirements.

Initially, the background information submitted for a dredging project proposing upland disposal/containment will be evaluated to determine the testing necessary to characterize potential adverse impacts of the dewatering discharge to the receiving waterbody. A list of the required background information is provided in Section III-A. The most important information used to assess potential surface water impacts are previous and current bulk chemical analyses of site sediments (both bulk chemistry and aqueous fractions).

If deemed necessary, the Modified Elutriate Test will be required to predict pollutant concentrations in the discharge, both soluble and particulate-bound. Modified Elutriate Test results will be considered valid only if:

(1) the Standard Operating Procedure (SOP) found in the U.S. Army Corps of Engineers Waterways Experimental Station Environmental Effects of Dredging Technical Note, EEDP-04-2 (June 1985) is followed, in conjunction with the Department-approved use of a site-specific field retention time, analysis of both dissolved and suspended fractions, and

(2) sediment core sampling, homogenizing, and compositing follows Section III-C, and

(3) the discharge total suspended solids value required for the final calculation in the Modified Elutriate Test data analysis does not exceed either ambient TSS concentrations for the receiving waterbody or state Surface Water Quality Standards for TSS for the receiving waterbody.

As described in Section IV-C(3)(b)ii, the applicant, in pre-application consultation with the Land Use Regulation Program, may choose to determine ambient pollutant/parameter concentrations in the receiving waterbody for setting discharge limits; the methods required for this determination are referenced in this section. Ambient condition determinations will be reviewed by the Department on a case-by-case basis. Should existing information lead the Department to believe that surface water discharges from an upland CDF will not result in adverse impacts, the Modified Elutriate Test may not be required.

(4) Ground Water Discharges:

(a) Authority. The New Jersey Water Pollution Control (WPC) Act includes "dredge spoils" in its definition of a "pollutant". Because the upland placement of dredged material represents a potential discharge of pollutants, the activity is subject to regulation pursuant to the authority of the New Jersey Pollutant Discharge Elimination System (NJPDES) regulations (N.J.A.C. 7:14A-1) and the Ground Water Quality Standards (GWQS; N.J.A.C. 7:9-6).

(b) Potential Impacts/Regulatory Objectives. When dredged material is placed at upland locations, contaminants may become soluble and be transported into the subsurface terrestrial environment by leachate generation and seepage. The introduction of contaminants into the subsurface terrestrial environment may degrade ground water quality and potentially threaten potable water supplies. The susceptibility of ground water to contamination and the degree to which it can be degraded is dependent upon the hydrogeologic characteristics of ground water resource and the designated use. The impact of upland confined disposal facilities (CDFs) on ground water resources can be limited through an integrated approach of ground water resource classification, engineering of upland CDFs, dredged material testing and leachate analysis, and site-specific geotechnical evaluation. Through this approach, ground water resources can be protected at an appropriate level relative to their sensitivity and use, and the objectives of the NJPDES regulations and the GWQS can be achieved.

(c) Permitting Process. The degree to which the discharge to ground water (DGW) emanating from the upland disposal of dredged material will be regulated pursuant to the NJPDES regulations and the GWQS is dependent upon the following characteristics:

- the classification of the ground water;
- the nature of the upland CDF;
- the source and quality of the dredged material; and
- the management of the dredged material.

The NJPDES-DGW permitting process involving the upland disposal of dredged material will include any or all of the following components:

- Preliminary determination of leachate quality from dredged sediments;
- Ground Water Protection Plans; and/or
- NJPDES-DGW permit.

In order to determine which components of the NJPDES-DGW permitting process apply, it must be determined whether the project involves a Type A or Type B upland CDF as defined below:

Type A upland CDFs involve projects where the specific location(s) from which sediments are to be dredged is known prior to preceding with the development of a Ground Water Protection Plan and issuance of a NJPDES-DGW permit. In these cases, leachate quality from the sediments to be dredged can be evaluated on a preliminary basis allowing for a wider variety of management and/or permitting alternatives.

Type B upland CDFs are constructed independent of any specific dredging project(s). As such, the leachate quality of all sediments to be placed within the upland CDF cannot be determined prior to development of a Ground Water Protection Plan and issuance of a NJPDES-DGW permit. Therefore, the only regulatory options available are those detailed below at IV-C(4)(c)ii and iii.

i. Preliminary Determination of Leachate Quality from Dredged Sediments - because Type A upland CDFs allow for preliminary evaluation of the quality of the leachate from the dredged material, the quality of the discharge emanating from the upland CDF can be predicted prior to proceeding with the development of a Ground Water Protection Plan and issuance of a NJPDES-DGW permit. Leachate quality shall be evaluated according to the procedure outlined in IV-C(4)(d).

Where the maximum leachate quality for any parameter exceeds the Ground Water Quality Criteria in Table 3, a Ground Water Protection Plan will have to be developed and implemented through a NJPDES-DGW permit.

Where the maximum leachate quality for all parameters, does not exceed the Ground Water Quality Criteria in Table 3, the project will be exempt from both the requirement to develop a Ground Water Protection Plan and to obtain an individual NJPDES-DGW permit.

ii. Ground Water Protection Plans - a Ground Water Protection Plan shall be developed for:

(1) all Type B upland CDFs; and

(2) all Type A upland CDFs where the anticipated quality of the leachate, determined as per IV-C(4)(c)i and in accordance with IV-C(4)(d), exceeds the Ground Water Quality Criteria in Table 3 for any parameter.

Table 3: Ground Water Quality Criteria

Aquifer Classification	Ground Water Quality Criteria
Class I: Ground Water of Special Ecological Significance	Site specific ground water constituent standards determined as per NJAC 7:9-6.8
Class II: Ground Water for Potable Water Supply	Worst Case IIA Ground Water Constituent Standards (see Appendix A, Table XIV) or site specific criteria based upon ground water constituent standards determined as per NJAC 7:9-6.8
Class III: Ground Water with Uses Other Than Potable Water Supply	Worst Case IIA Ground Water Constituent Standards (see Appendix A, Table XIV) or site specific criteria based upon ground water constituent standards determined as per NJAC 7:9-6.8

Note: the determination of site specific criteria per NJAC 7:9-6.8 shall be done in accordance with a ground water sampling plan approved by the Department.

The Ground Water Protection Plan for any upland CDF must demonstrate that the annual discharge of contaminants from the facility will not result in a contravention of the Ground Water Quality Standards. This report must include at a minimum:

(1) an engineering design and construction plan of the proposed CDF;

(2) an operation and maintenance plan which details the use of the proposed CDF;

(3) detailed evaluation of potential contaminant migration pathways which considers at a minimum the following:

- Regional physiography
- Site specific geology and hydrogeology and
- Regional ground water use and receptors

(4) a contaminant transport model which simulates ground water contaminant migration pathways on site as follows:

- For Type A upland CDFs, each parameter analyzed from Appendix A, Table XIV which exceeds the Ground Water Quality Criteria in Table 3 shall be modeled.

- For Type B upland CDFs, the parameters listed in Appendix A, Table XIV shall be modeled, using trial simulations in order to assess the maximum assimilative capacity of the aquifer and to assign maximum leachate concentrations for all dredged material to be placed on site.

The model shall simulate annual leachate discharge and contaminant loading into the ground water for the duration of the active use of the facility, closure, and post-closure periods.

iii. NJPDES-DGW Permitting - A NJPDES-DGW permit will be issued for every facility which must develop a Ground Water Protection Plan according to IV-C(4)(c)ii. Dependent upon the results of the Ground Water Protection Plan, a NJPDES-DGW permit may require any or all of the following:

(1) installation and periodic sampling of ground water monitoring wells;

(2) in-situ leachate monitoring through lysimetry;

(3) liner and/or leachate collection system monitoring;

(4) leachate quality analysis of dredged material.

iv. Exclusions - Projects which qualify and meet the criteria listed below are exempt from the requirements outlined in IV-C(4)(c)i-iii above. These exclusions only apply to upland CDFs which do not discharge into Class I ground waters or wellhead protection areas as delineated by the Department.

(1) Projects south of the Atlantic Ocean side of Sandy Hook to the western entrance of the Cape May Canal, including the Navesink and Shrewsbury Rivers where:

(a) less than 5,000 cubic yards (yd^3) of dredged material will be placed in an upland CDF over the five (5) year life of the associated Waterfront Development Permit; and

(b) the sediments are dredged from a waterway(s) where there has not been an historic or current upland industrial use and the site is not currently or previously occupied by a marina of 25 or more boat slips.

(2) Any project where:

(a) less than 1,000 cubic yards (yd^3) of dredged material will be placed within an upland CDF over the five (5) year life of the associated Waterfront Development Permit; and

(b) the sediments are placed over impervious soils, or are underlain by a liner that has a hydraulic conductivity less rapid then 10E-7 centimeters per second (cm/sec)

(3) Any project where:

(a) the dredged material to be placed in the upland CDF is >90% sand (grain size >62.5 um); and

(b) the percent moisture content, Total Organic Carbon, or other background information do not lead the Department to believe the material is contaminated.

(d) <u>Testing Requirements.</u> Leachate quality shall be determined using the Sequential Batch Leaching Test (SBLT) procedure developed by the United States Army Corps of Engineers, Waterways Experiment Station, or other tests as approved by the Department in advance. When used, the SBLT shall be conducted in accordance with the procedure outlined in Brannon et. al., April 1994 (cited in Section VI - References) under conditions (anaerobic or aerobic) which reflect how the dredged material is to be managed. All samples of dredged material to be analyzed for leachate quality shall also include determinations of hydraulic conductivity and porosity.

For Type A upland CDFs leachate quality shall be determined for a representative number of samples for the parameters listed in Appendix A, Table XIV in each location to be dredged prior to proceeding with the development of a Ground Water Protection Plan and issuance of a NJPDES-DGW permit. For Type B upland CDFs, leachate quality shall be determined for a representative number of samples for the parameters listed in Appendix A, Table XIV on all sediments to be received as a condition of the NJPDES-DGW permit. A representative number of samples shall be determined according to the guidance in Section III-C.

(5) Terrestrial Ecosystem Impacts:

(a) Authority. The Department's authority to regulate terrestrial ecosystem impacts which may occur during the operation of an upland CDF depend on the location of the facility. The Department may have regulatory authorities pursuant to the Flood Hazard Area Control Act, the Freshwater Wetlands Protection Act, the Wetlands Act of 1970, the Waterfront Development Act, and the Rules on Coastal Zone Management (N.J.A.C. 7:7E). Additional Department authority may also be derived from both the federal and State Water Pollution Control Acts.

(b) Potential Impacts/Regulatory Objectives and the Management/Regulatory Process. The regulatory objectives of the Department are to identify and minimize the potential for contaminant mobility and transport into terrestrial ecosystems resulting from the upland disposal of contaminated dredged material. Potential adverse impacts will be evaluated on a case-by-case basis, initially considering the bulk sediment chemistry analyses of the dredged material placed in the upland CDF and the proposed schedule for future disposal and management operations at the facility. Additional discussions of potential impacts to the terrestrial ecosystem can be found in Section IV-D(2).

When dredged material is allowed to dry in an upland CDF, there is potential for dust generation. This potential is greater when the dredged material consists of fine silt and has not revegetated. Dust generation could facilitate the dispersal of contaminants into the terrestrial ecosystem. Management techniques will be required, as necessary, to control the generation and dispersal of dust from an upland CDF. Potential management techniques include interim/final capping of contaminated and exposed dredged material and the use of erosion control mats.

The potential impacts to terrestrial ecosystems associated with the upland disposal of contaminated dredged material also include the possibility of increased contaminant mobility through uptake by colonizing plants and animals. This potential is enhanced by the physicochemical changes which occur when dredged material is disposed of in an upland setting. Such chemical changes include the oxidation associated with drying, and a decrease in pH, both resulting in increased availability of metal contaminants.

The Department has identified a number of possible scenarios for the operation of upland CDFs. These scenarios, described in the following sections, have different potentials to produce adverse impacts to the terrestrial ecosystem. During the operation of an upland CDF, management techniques can be utilized to minimize potential adverse impacts. Appropriate management techniques, summarized and briefly discussed in the following sections, will be evaluated as part of the project-specific review and permitting of an upland CDF. In general, potential impacts to the terrestrial ecosystem as a result of the upland disposal of contaminated dredged material will be evaluated on a case-by-case basis.

i. Upland CDFs Maintained in Continuous Operation

For most large upland CDFs, it is expected that the facility will be operated in a continuous active mode during its operational lifetime. This would involve the continual placement of dredged material in the upland CDF, followed by periods of dewatering, drying, crust management, etc. - with subsequent repetitions of this cycle. This active mode of operation, in which the dredged material placed in an upland CDF remains in a disturbed condition, should effectively limit the ability of plants and animals to recolonize or use the site. For such facilities, the permittee will be required to submit an annual report (see Section IV-D(2)(b)ii) to the Department, summarizing the disposal and management operations at the upland CDF, and further certifying that the site has not been recolonized or used by terrestrial plants or animals for extended periods of time (generally considered to be 6 months or longer).

ii. Upland CDFs Operated Intermittently

Upland CDFs which are operated intermittently, such that the dredged material placed on the site is allowed to dry out for a period of time exceeding 6 months in an undisturbed condition, will be more available for use and/or recolonization by plants and animals. Such upland CDFs therefore have the potential to result in increased contaminant mobility and transport into terrestrial ecosystems.

a. Maintaining an upland CDF in a ponded condition would serve to minimize the potential for increased contaminant mobility through plant and animal colonization. This may be practicable in situations where the upland CDF will be used infrequently, with long periods of time between disposal operations. However, there is a concern that birds may use a ponded CDF. If this occurs, methods could be employed to discourage such use. For such facilities, the permittee will be required to submit an annual report (see Section IV-D(2)(b)ii) to the Department, summarizing the disposal and management operations at the upland CDF, and further certifying that the site has not been recolonized or used by terrestrial plants or animals for an extended period of time.

b. In those cases where an upland CDF will be used only intermittently and allowed to dry out and remain undisturbed for time periods exceeding 6 months between disposal operations, the potential exists for the site to be recolonized and/or used by plants and animals. The greater the contamination of the dredged material, and the longer the site remains undisturbed (and thus available for recolonization and use), the greater the potential for adverse terrestrial ecosystem impacts to occur.

Potential adverse impacts will be evaluated on a case-by-case basis, initially considering the bulk sediment chemistry analyses of the dredged material placed in the upland CDF and the proposed schedule for future disposal and management operations at the facility. The permittee will be required to submit an annual report (see Section IV-D(2)(b)ii) to the Department, summarizing the anticipated disposal and proposed management operations at the upland CDF. Interim management operations (between disposal operations) may be required to minimize potential adverse terrestrial ecosystem impacts. These could include interim capping measures to isolate contaminated dredged material (see Section IV-D[2]).

(c) Testing Requirements. Section III-B of this document identifies those sediments which are excluded from the Department's testing or reporting requirements; these exclusions also apply to any additional testing required for an evaluation of potential terrestrial ecosystem impacts. Any dredged material which does not qualify for a testing exemption as described in Section III-B may be subject to additional testing.

Section (b)-ii discusses "Upland CDFs Operated Intermittently". If recolonization and/or use of such CDFs by plants or animals occurs, there is potential for increased contaminant mobility and transport into the terrestrial ecosystem. To evaluate the potential for such impacts, predictive animal and plant uptake bioassays may be required. The Department will determine the need for such additional testing on a case-by-case basis.

[Note: the Department is currently further investigating the potential impacts of contaminated dredged material disposal at upland CDFs on the terrestrial ecosystem. Additional and more detailed guidance may be developed and incorporated into this guidance document at some future date.]

(6) Public Health Impacts:

(a) Authority. The Department's authority to control potential public health impacts which may be associated with the disposal of dredged material at an upland confined disposal facility is derived from the federal and State Water Pollution Control Acts, the New Jersey Waterfront Development Law, and the Federal Coastal Zone Management Act.

(b) Potential Impacts/Regulatory Objectives. The potential impacts to public health associated with the upland disposal of dredged material include the potential for direct human contact with contaminated dredged material, dust generation from drying dredged material with a potential inhalation exposure pathway, and surface and ground water impacts. The frameworks for regulating potential surface and ground water impacts are described in Sections IV-C(3) and IV-C(4), respectively.

The regulatory objectives of the Department are to identify and control public health impacts originating from the upland disposal of contaminated dredged material.

(c) Management/Regulatory Process. The Department will use the Rules on Coastal Zone Management in evaluating the siting of upland confined disposal facilities (CDFs). These rules serve to minimize potential public health impacts. The potential impacts of human inhalation of dust from drying dredged material are minimal when upland CDFs are sited in locations which are removed from areas subject to extensive human use, such as residential and recreational properties.

During the operation of an upland CDF, management techniques can be applied to control and minimize potential public health impacts. Management techniques will be required, as necessary, to control the generation and dispersal of dust. This will further serve to minimize the inhalation pathway for human exposure. Direct human contact will be controlled through access restrictions to the upland CDF. Facility personnel will be required to use the appropriate precautionary measures to avoid direct contact with contaminated dredged material.

(d) Testing Requirements. Section III-B of this document identifies those sediments which are excluded from the Department's testing requirements. Any dredged material which does not qualify for a testing exemption as described in Section III-B will be subject to the following requirements.

Bulk chemical analysis of the sediments to be dredged will be required as per Section III-A. Potential public health impacts will be evaluated by comparison to the NJDEP Residential Direct Contact or Non-Residential Direct Contact Soil Clean-up Criteria, as applicable. These analyses will be conducted to determine if the dredged material to be disposed of requires precautions to avoid direct human exposure pathways during and after disposal in an upland CDF. Where access to the upland CDF will not be restricted by adequate fencing, the NJDEP Residential Direct Contact Clean-up Criteria will be applied.

Results of the bulk sediment chemistry analyses will be considered valid only if:

(1) the bulk sediment chemistry analysis includes all target analytes for which Interim New Jersey Soil Clean-up Criteria exist (which is included in the Target Compound List in Appendix A), and

(2) sediment core sampling, homogenizing, and compositing follows Section III-C sampling procedures.

E - Subaqueous Disposal Pits

(1) Overview: Subaqueous disposal pits are submarine trenches or pits excavated below the ocean/bay bottom for the specific purpose of containing contaminated dredged material. Existing subaqueous borrow pits created as a result of past sandmining activities, or natural pits and depressions, could also be used as subaqueous disposal pits. Such sites usually refer to nearshore pits in estuarine bays and harbors, including those proposed by the Governor's Dredged Material Management Team in its Final Report (February 1995) to be constructed in Newark Bay. The effective function of a subaqueous disposal pit is predicated upon its ability to contain the contaminated dredged material which will be placed in it.

Subaqueous disposal pits are considered distinct from open water disposal sites (see Section IV-C).

(2) Authority: Refer to Section II-B for a listing of relevant statutes and regulations.

(3) Potential Impacts: The potential adverse environmental impacts of a subaqueous disposal pit depend directly upon the location and existing ecological functions of the pit site. Potential impacts which may require evaluation include physical disruptions during construction and disposal operations (resulting in, for example, temporary interference with existing benthos, fisheries, or anadromous fish migrations), short-term benthic and water column toxicity impacts as a result of the disposal of contaminated dredged material, and water column impacts associated with the resuspension of sediment. In addition, long-term impacts to biota and the ecosystem may result if the contaminated dredged material placed in a subaqueous disposal pit is not adequately contained and isolated from the marine environment.

(4) Regulatory Objectives/Management Process: Short-term regulatory concerns lie primarily with minimizing the potential adverse environmental impacts associated with the construction of a subaqueous disposal pit and dredged material disposal operations. Submarine excavation of bay/ocean bottom or the use of existing pits/depressions to create a subaqueous disposal pit will be evaluated using the Rules on Coastal Zone Management. It is preferable that subaqueous disposal pits be located in areas impacted by similar levels of existing sediment contamination as the dredged material proposed for disposal in the pit.

Short-term impacts can result from the dispersal of dredged material during disposal operations. Such impacts include physical disruption of benthos surrounding the subaqueous disposal pit, and water column and benthic toxicity and contamination. With proper design and management of the subaqueous disposal pit, these impacts can be limited. The use of Best Management Practices (BMPs) during disposal operations will be required and permit conditions will be applied to ensure these impacts are minimized.

The filling of a subaqueous disposal pit with contaminated dredged material will employ BMPs which reduce suspension and dispersal of the dredged material during the disposal operation. These include adherence to strict navigation requirements to ensure point disposal of the dredged material. Additionally, restrictions on conducting disposal operations during severe weather/tidal conditions may also serve to minimize the dispersal of dredged material. The use of geotextile containers or the direct shunting of dredged material into the pit should be considered.

Potential long-term impacts can be minimized, and mitigated upon closure of the subaqueous disposal pit. Designing the pit to be properly capped, and maintaining the integrity of the cap, is an essential regulatory goal to ensure the long-term isolation of contaminants. In general, one meter of suitable clean material (as defined in Section V-I) will be required as a final cap. The placement of interim caps may also be required between dredged material disposal operations. Long-term monitoring of the subaqueous disposal pit, its final cap, and the surrounding environment will be required to ensure cap integrity is maintained. For additional discussion of generally applicable capping requirements, see Section V-I. In addition, restoration of the natural bathymetry of the subaqueous disposal pit site using appropriate clean material as a final cap will serve as de facto mitigation for the temporary loss of benthic habitat resulting from the construction of the pit.

Some of the techniques and designs which should be considered when constructing a subaqueous disposal pit are:

(a) Level Bottom Capping - involves locating a subaqueous disposal pit in a natural bottom depression or existing subaqueous borrow pit. This reduces the need to excavate. Dredged material is placed in the pit up to a predetermined level. The site is then capped with clean material up to the level of the surrounding bay/ocean bottom.

(b) Contained Subaqueous Disposal - involves constructing a berm opposite an existing subaqueous ledge or wall. The cavity formed between these features is then filled and capped with clean material.

(c) New Excavation - entails the construction of a new subaqueous disposal pit, designed specifically for the containment of contaminated dredged material. In theory, such a pit would provide for better containment compared to that offered by existing borrow pits or natural depressions.

(5) Testing Requirements: Section III-B discusses general testing exclusions. Where the dredged material originates in the same waterbody as the subaqueous disposal pit, required testing will consist of grain size analysis and bulk sediment chemistry. The bulk sediment chemistry data will be used to ensure that only contaminated dredged material is placed in the subaqueous disposal pit. It will also be used in the development of the monitoring and management plan for the pit.

If the dredged material originates in a waterbody different from that of the subaqueous disposal pit, testing requirements will be determined on a case-by-case basis. Testing may include bulk sediment chemistry and modified elutriate testing (with retention time to be specified; ambient water quality testing of the subaqueous disposal pit site may also be needed), depending on the dredging site, subaqueous disposal pit site characteristics, and the volume of dredged material to be placed in the pit. Section III-C includes general guidance on sampling the dredged material.

Precision bathmetry (accuracy to 6 inches or better) of the subaqueous disposal pit site will be required prior to initial site disturbance/pit construction, upon the completion of the construction of the pit, and may be required prior to and after any dredged material disposal operation. This will provide information on existing subaqueous disposal pit capacity and help ensure the dredged material is contained within the pit.

F - Containment Areas

(1) Overview: Dredged material containment areas are features artificially created in open water or wetlands and include any structure which, upon the completion of its filling with dredged material, would result in an extension of existing upland into open waters (i.e. the creation of "fastland"). They are usually created by constructing a retaining structure (berm or bulkhead) in an open water area and filling the enclosed area with dredged material.

(2) Authority: The near-shore disposal of dredged material into a containment area is subject to the Waterfront Development Act, the Rules on Coastal Zone Management (N.J.A.C. 7:7E), federal consistency determinations pursuant to the Federal Coastal Zone Management Act, Water Quality Certification pursuant to Section 401 of the Clean Water Act, and Riparian Interests. In addition, the Coastal Area Facility Review Act (CAFRA; N.J.S.A. 13:19-1 et seq.) may be applicable. Disposal into open waters or wetlands is also regulated by the federal government pursuant to Section 404 of the federal Clean Water Act.

In all cases, either a Water Quality Certificate (WQC) or NJPDES-Discharge to Surface Water permit will be required for a containment area. A NJPDES Discharge to Surface Water permit may be required for the effluent from the dewatering dredged material if the dredged material is not from the same waterbody as the containment area. A WQC will be required for the effluent from a containment area which only accepts dredged material from the waterbody in which it is located.

A NJPDES Discharge to Groundwater Permit may be required pursuant to N.J.A.C. 7:14A-1, subject to a determination by the Department's Bureau of Operational Ground Water Permits.

(3) Potential Impacts: The potential adverse environmental impacts of a dredged material containment area depend directly upon the location and existing ecological functions of the site. Potential impacts which require evaluation include the destruction and permanent loss of benthic,

open water, or wetlands habitats, and temporary physical disruptions during construction of the containment area (resulting in, for example, interference with existing benthos, fisheries, or anadromous fish migrations). Potential short-term surface water quality and benthic toxicity impacts may result from the dispersal of sediments and associated contaminants due to the construction of the containment area.

Potential impacts to surface water quality during the filling of the containment area with contaminated dredged material resulting from the discharge of effluent from the dewatering dredged material, are similar to those for upland confined disposal facilities [CDFs; see Section IV-D(3)]. In addition, potential water quality impacts resulting from the permeability of the berm/bulkhead will be considered on a case-by-case basis.

Potential long term impacts to ground water quality are also similar to those for upland CDFs, and are discussed in Section IV-D(4). Long term impacts to aquatic biota and the marine ecosystem may result if contaminated dredged material placed in a containment area is not adequately contained and isolated. In addition, filling of the containment area ultimately results in the creation of additional upland. Potential impacts to the terrestrial environment are essentially the same as those associated with upland CDFs [see Sections IV-D(2), (5), and (6)].

(4) Regulatory Objectives/Management Process: The creation of upland areas by filling open water/wetland environments is a regulatory concern. Based upon the Rules on Coastal Zone Management at N.J.A.C. 7:7E-4.2(j) filling in natural water areas is discouraged and filling wetlands areas is prohibited. Such activity requires a demonstration that there is no practicable or feasible land alternative. In addition, minimal interference to Special Areas enumerated at Subchapter 3 of the Rules on Coastal Zone Management (such as Intertidal Shallows, Finfish Migratory Pathways, and Submerged Vegetation Habitats) must be demonstrated.

Short-term regulatory concerns lie primarily with minimizing the potential adverse environmental impacts associated with the construction of the containment area and dredged material disposal operations. It is preferable that containment areas be located in areas impacted by similar levels of existing sediment contamination as the dredged material proposed for disposal in the area. Locating a dredged material containment area site will be evaluated using the Rules on Coastal Zone Management.

Short-term impacts can result from the dispersal of contaminated dredged material during disposal operations. Such impacts include physical disruption of benthos surrounding the containment area, and water column and benthic toxicity and contamination. With proper design and management of the containment area, these impacts can be minimized. The use of best management practices (BMPs) during disposal operations will be required and permit conditions will be applied to ensure these impacts are minimized. Such BMPs could include controlling the rate of dredged material placement in the containment area to allow for adequate settling of suspended solids. The use of geotextile containers or liners, and the pumping of free water to upland water quality basins to provide settling of suspended solids prior to discharge, could also be used.

Potential long-term impacts could result if the containment area does not adequately isolate contaminated dredged material from the surrounding aquatic and terrestrial environments. The containment area berm/bulkhead must be designed and constructed to ensure maximum isolation of contaminants. If the containment area is filled with contaminated dredged material, final capping of the created upland area is required to ensure the long-term isolation of contaminants from the terrestrial environment. Potential impacts to the terrestrial environment and public health are similar to those for upland CDFs, and are discussed in Sections IV-D(5) and (6). In addition, site closure/final use considerations are discussed for upland CDFs in Section IV-D(2). Long-term monitoring of the containment area site and the surrounding environment may be required to ensure that contaminated dredged material has been adequately isolated.

Construction of the containment area will result in the loss of open water habitat and/or wetlands. In some cases, mitigation for this loss by means of in-kind replacement will not be possible. Thus, construction and operation of a dredged material containment area may result in the permanent loss of aquatic habitat. Proposals for out-of-kind mitigation may be considered by the Department during the regulatory review of proposed containment areas.

(4) Testing Requirements: Section III-B discusses general testing exclusions. Regulatory concerns with potential impacts to surface and ground water quality, the terrestrial ecosystem, public health, and site closure/final use are essentially similar to those for uplands CDFs; see Sections IV-D(2), (3), (4), (5) and (6) for applicable guidance.

Chapter V - Beneficial Use Alternatives

A - Overview

Dredged material can be considered a resource, and the Department strongly supports its beneficial use, wherever possible, as opposed to exclusive reliance on disposal facilities. While new dredged material disposal facilities are needed, it is essential to test and cultivate emerging beneficial use strategies to ensure a multi-faceted and integrated long-term program for the management of dredged material.

The concept of beneficial use was first applied in the area of sludge management, where, depending on its quality, sludge has been applied directly to the land or mixed to create soil enhancement products. Many additional materials have been approved for beneficial use applications including coal ash from power plants, contaminated soils, wastewater treatment plant residuals, and other industrial/commercial by-products.

Depending on its characteristics, particularly grain size and degree of contamination, dredged material may be suitable for use in beach nourishment projects, as construction material or fill, as landfill cover, in habitat development projects, to cap open water disposal areas, or in a variety of other uses. The USACE Engineer Manual No. 1110-2-5026, Beneficial Uses of Dredged Material (30 June 1987), provides guidance for planning, designing, developing, and managing dredged material for beneficial uses.

In many cases, dredged material proposed for beneficial use would first have to be dewatered. This would most likely occur at an upland confined disposal facility (CDF). The regulatory process for placing dredged material in an upland CDF is discussed in Section IV-D.

B - Authority

Requests to beneficially use a variety of materials have been handled on a case-by-case basis through various Departmental programs. In many cases, beneficial use applications have been authorized as pilot or demonstration projects or have been exempted from regulation under the broad authority of the non-hazardous waste regulations at N.J.A.C. 7:26-1.1, et seq. Under these authorizations, the Department has required a series of steps to be followed in order to demonstrate that the beneficial use option is environmentally sound and consistent with current law in New Jersey or in the state where the material is to be used. In addition, the applicant must demonstrate that markets will accept the material and maintain suitable records of the weight and/or volume of material beneficially used. Although dredged material will not be regulated as a solid waste, a similar process will be used by the Department to evaluate proposed beneficial uses of dredged material.

The Department is currently in the process of finalizing "Beneficial Use Determination Rules" to be found at N.J.A.C. 7:26-1.6. These rules will formally establish a regulatory program to exempt qualifying materials, including dredged material, from other NJDEP permitting programs. The process is intended to streamline the approval of beneficial use activities through a minimal submission/review process.

The above noted "Beneficial Use Determination Rules" will not be applicable to beneficial use options involving beach nourishment, habitat development, or the capping of open water dredged material disposal sites (see Sections V-D, E, and I). Authority to regulate these beneficial uses of dredged material is available pursuant to the State and federal Clean Water Acts, the Waterfront Development Law, the Flood Hazard Area Control Act, and the federal Coastal Zone Management Act. The Rules on Coastal Zone Management are also applicable to these beneficial use options.

C - Linkages with Other Management Alternatives

The beneficial use options discussed in Sections V-D through V-I can be divided into three general categories. These categories reflect the degree to which the dredged material must be rehandled/treated prior to its beneficial use, or the use of dredged material to support another dredged material management alternative (discussed in Section IV of this document):

(1) beneficial use options supporting other dredged material management alternatives - capping open water disposal sites;

(2) beneficial use options requiring minimal rehandling of the dredged material - beach nourishment, aquatic and wetland habitat development.

(3) beneficial use options requiring substantial rehandling/treatment of the dredged material - construction material, landfill cover, agricultural use, terrestrial habitat development.

For uses 1 and 2, the dredged material would have to meet applicable testing requirements to verify its suitability for the proposed use. Suitability criteria would include grain size and contaminant concerns. Rehandling of this material would be limited to its transport to the use site and its placement in accordance with the applicable engineering design and regulatory requirements.

In almost all cases, dredged material proposed for the beneficial use 3 options would first have to be dewatered. This would most likely occur at an upland confined disposal facility (CDF). A "beneficial use train", involving sequential placement of dredged material in an upland CDF, dewatering over a period of time, and then removal from the upland CDF for beneficial use purposes, could be developed. Such activities would not only provide a useable product, but would enable an upland CDF to remain in operation for a longer period of time before it reached its design capacity. Dredged material contaminated to various degrees could be suitable for these beneficial use options; testing requirements and evaluation criteria are discussed in the appropriate Sections of this document.

D - Beach Nourishment

(1) Authority: the Department's authority to regulate the use of dredged material for beach nourishment is derived from the Waterfront Development Act, the Coastal Area Facilities Review Act, the federal Coastal Zone Management Act, and the Water Quality Certification provisions (Section 401) of the Clean Water Act.

(2) Potential Impacts/Regulatory Objectives: The Department encourages the placement of clean sand on beaches.

Beach nourishment operations usually involve the borrowing of sand from inshore or offshore locations and transporting it by truck or hydraulic pipeline to an eroding beach for the purpose of restoration. This can result in displacement of existing substrate, the destruction of non-motile benthic communities, and changes in the topography of both the placement and borrow areas. However, a beach nourishment operation also creates new habitat which is usually rapidly recolonized by benthic organisms. Significant impacts to offshore organisms can be minimized by selecting borrow areas to avoid important benthic habitats, not creating deep/anoxic borrow pits, and maintaining substrate quality in the borrow area.

Potential adverse impacts could also result from the placement of dredged material with excessive organic content on beaches. This would be aesthetically unpleasant, but temporary in duration. In addition, placement of dredged material contaminated by chemical or biological pollutants may affect nearby benthic and open water habitats, and may pose a public health concern. The Department's objectives in regulating the placement of dredged material on beaches are to prevent any adverse impacts to the beach area, be they aesthetic (human interest), public health, or to nearby benthic and open water communities.

(3) Permitting Process: permitting for this use of dredged material will be conducted by the Land Use Regulation Program. The Rules on Coastal Zone Management will govern beach nourishment and dune construction activities.

In terms of grain size, suitable material must be comprised of 75% or greater sand (grain size larger than 0.0625mm) with a grain size compatible with that of the receiving beach. (Note: material less than 90% sand will require bulk sediment chemistry analyses and additional testing - see Section III.) Material with a grain size smaller than the "compatible grain size" for the beach, but still greater than 75% sand, could be utilized in dune construction, provided that effective erosion controls were utilized until vegetative cover can be established.

(4) Testing Requirements: exclusionary criteria for testing requirements are described in Section III-B. For dredged material which does not meet these criteria, bulk sediment chemistry analyses will be required. This data will be compared with the NJDEP Residential Direct Contact Soil Clean-up Criteria to evaluate potential impacts to public health. To evaluate potential impacts to estuarine benthic communities, the Department will compare this data with the guidelines values developed by Long et al. (1995), on a case-by-case basis.

All dredged material proposed for beach nourishment must be characerized by grain size analyses. In addition, grain size analyses of the sand on the proposed receiving beach must also be completed. Sampling guidance for these required analyses will be provided by the Department on a case-by-case basis.

E - Habitat Development

(1) Overview: A wide range of habitat types can be developed (created, restored, or enhanced) using dredged material. The development of upland and wetlands habitats will be discussed in this Section of the guidance document.

The construction of islands using dredged material, on which wetlands as well as upland habitat types could develop, is considered to be a special case. Islands will not be addressed in this guidance document, but will be considered by the Department on a project-specific basis.

Aquatic habitats (including tidal flats, seagrass meadows, and other benthic habitats) could be developed as a result of the Open Water Disposal of dredged material (see Section IV-C). Development of aquatic habitat in association with such disposal operations will be considered on a case-by-case basis. A special case of aquatic habitat development is the use of dredged rock to create artificial reefs, jetties, etc.

The USACE Engineer Manual EM 1110-2-5026 (30 June 1987), Beneficial Uses of Dredged Material, includes detailed discussions and a listing of references concerning habitat development using dredged material.

(2) Authority: The Department's authority to regulate the beneficial use of dredged material for habitat development depends on the location of the project site. The Department may have regulatory authority pursuant to the Flood Hazard Area Control Act, the Waterfront Development Act, the Freshwater Wetlands Protection Act, the Wetlands Act of 1970, the Coastal Zone Management Act, and the Rules on Coastal Zone Management (N.J.A.C. 7:7E). Additional Departmental authority may also be derived from both the federal and State Water Pollution Control Acts. Dredged material could also be used in restoration or mitigation activities required pursuant to permits issued for other projects.

(3) Potential Impacts/Regulatory Objectives:

(a) Upland Habitats. Habitats will develop on upland dredged material disposal sites regardless of human intervention. However, the use of a variety of management techniques can improve the habitat that develops, or foster the development of specific habitat types. Although the level of effort needed to develop upland habitat could essentily be limited to that necessary to provide erosion control, additional effort and long-term management may be needed to create specific and more productive habitats.

Some of the potential impacts and regulatory objectives associated with habitat creation at upland Confined Disposal Facilities (CDFs) are discussed in Section IV-D(5). In addition, the use of dredged material in mine reclamation activities to create habitat is breifly discussed in Secton V-F.

Dredged material used for upland habitat development must be suitable in terms of physical (particularly grain size) and chemical (salinity, nutrients, contaminants) characteristics. The main concern of the Department is the potential dispersal of contaminants from the dredged material into the terrestrial environment and food webs. Refer to Section IV-D(2) for information concerning the development of habitat as part of the final closure process on upland CDFs. (In general, placement of a clean cap at least 2 feet thick will serve to isolate the underlying contaminated dredged material and eliminate many of the concerns with the dispersal of contaminants into the terrestrial ecosystem.)

When placed in an upland environment, dredged material will dry, tend to oxidize, and decrease in pH. Thus, soil amendments (including lime, manure, sand, and limestone gravel) may be needed to provide a suitable medium for the recolonization and growth of plants. In addition, the salt content of material dredged from estuarine areas may inhibit the development of upland habitat. For additional information and guidance, refer to the USACE Waterways Experiment Station Environmental Effects of Dredging Information Exchange Bulletin D-92-4 (September 1992).

Section V-D of this guidance document briefly discusses the beneficial use of dredged material to create dunes on beaches.

(b) Wetlands. As discussed in this section, the beneficial use of dredged material to create wetlands will be considered by the Department only under exceptional conditions.

The Department has two major concerns with the use of dredged material to create (non-open water, emergent) wetland habitats: (1) the loss of other habitats coincident with the creation of wetlands, and (2) the potential release of contaminants from the dredged material.

Development of emergent wetlands habitats is usually accomplished by the placement of dredged material in open water areas to create substrate elevations conducive to the development of such wetlands. While wetlands are recognized as important and productive components of the aquatic ecosystem, creation of such habitat could result in the loss of important open water and benthic habitat. The Department will consider such wetland creation proposals on a case-by-case basis, consistent with the Rules on Coastal Zone Management. In general, sites proposed for wetland creation should avoid areas of productive open water and benthic habitat.

Dispersal of contaminants from dredged material used for wetland development can occur through two major routes: (1) resuspension of dredged material due to waves and currents, and (2) uptake by plants and animals colonizing or using the created wetland. In order to prevent the physical dispersal of the placed dredged material, low wave/current energy, shallow water sites should be used for wetland creation projects. Temporary (and possibly permanent) protective/retaining structures may be needed to contain the dredged material. Additional design and management factors which must be considered to create a productive wetland, while minimizing the potential for contaminant dispersal, include salinity, tidal range, and weir operation.

Uptake of contaminants by plants and animals will be minimized by restricting the contaminant levels allowable in dredged material proposed for wetland creation. To evaluate potential impacts to benthic communities, the Department will compare bulk sediment chemistry data with the guidelines values developed by Long et al. (1995).

(4) Permitting Process: The development of wetlands using dredged material will be regulated by the Department's Land Use Regulation Program pursuant to the Rules on Coastal Zone Management and other applicable authorities.

Long-term maintenance and monitoring of both upland and wetlands habitat development projects may be required.

(5) Testing Requirements: Section III-B of this document identifies those sediments which are excluded from the Department's testing or reporting requirements for the purpose of disposal. These exclusions may not apply to the testing required for an evaluation of potential impacts resulting from the use of the dredged material for habitat development. The testing needed to evaluate the suitability of the dredged material for the proposed habitat development project include considerations of salinity, nutrients, and degree of contamination.

The use of dredged material to develop wetlands habitats may require project-specific permits with specific conditions. Additional testing of the dredged material may be required, irrespective of the testing and reporting exclusions listed in Section III-B, pursuant to these permits. This could include bulk sediment analyses, modified elutriate testing, and predictive animal and plant bioassays. The Department will determine the need for such additional testing on a case-by-case basis.

F - Construction Material

Over the past several years, the Department has authorized the use of contaminated soils and other residual materials in construction related activities. Most notably, the use of nonhazardous petroleum contaminated soil as a raw material in the asphalt, concrete or brick production process has been formally recognized in the recylcing regulations at N.J.A.C. 7:26A-1.3. Consistent with applicable regulations, contaminated soils have also been washed and blended with leaf compost to make a topsoil product. In addition, remediated petroleum contaminated soil is marketable as a fill product. Through contacts with asphalt manufacturers, the New Jersey Asphalt Pavement Association and other industry representatives, it appears that the potential exists to utilize dredged material in similiar types of applications.

From the manufacturer's perspective, the key to wide utilization of such beneficial uses will be revised construction specifications to establish the parameters under which dredged material can be used without the need for case-by-case permits. Such a development would be especially beneficial in terms of using dredged material as landfill cover or as general fill. In terms of using dredged material in road construction applications, it should be noted that current New Jersey Department of Transportation (NJDOT) specifications do not allow for the use of contaminated soils in asphalt pavements under NJDOT purview. While the NJDOT is presently examining such pavements, the lack of a specification for remediated soil asphalt pavements is a major obstacle to the use of this material and is indicative of the obstacles that marketers of dredged material would face.

An additional construction related activity with potential for the use of dredged material or dredge/soil blends is in surface mine reclamation. For example, the Commonwealth of Pennsylvania has a substantial number of coal mines; existing Pennsylvania legislation requires mine reclamation. Over the past several years, New Jersey-generated coal ash has been authorized for beneficial use in Pennsylvania coal mine reclamation. Some sludge derived products have been approved historically for strip mine reclamation in Pennsylvania and dredge/soil blends may provide similar potential.

G - Landfill Cover

(1) Authority/Management Process: in recent years, the Department has received numerous requests for the utilization of residual materials as landfill cover throughout the state. Contaminated soils, auto shredder residue, sludge derived products and other materials have been authorized for direct cover application or in blends with other soil to produce a suitable product. Since landfill operators would otherwise have to purchase soil for cover, the acceptance of residual materials for approved applications has been considered an exempt activity pursuant to N.J.A.C. 7:26-1.1.

The Department's regulations at N.J.A.C. 7:26-2A.8-13 address landfill cover requirements. In general, three different classifications of cover are addressed - daily, intermediate and final cover. All exposed surfaces of solid waste must be covered at the close of each operating day with a minimum of 6 inches of daily cover. Areas outside the immediate landfill working face which will be exposed for any period exceeding 24 hours must contain at least 12 inches of intermediate cover. Finally, the federal government adopted amendments to the Resource Conservation and Recovery Act in 1993 at 40 CFR 258.60 which address landfill closure requirements. Under these rules, an infiltration layer of at least 18 inches of earthen material with a permeability less than or equal to the bottom liner and an erosion layer of at least 6 inches of earthen material capable of sustaining plant growth must be provided as part of a final landfill cover system.

The need for landfill cover across New Jersey is substantial. Currently, 25 landfills remain in operation in New Jersey. Fourteen of these facilities are large county-wide or regional landfills which utilize substantial quantities of daily and intermediate cover. The balance consists of 9 small sole source construction and demolition debris or company landfills, and 2 very small municipal landfills. In addition, the Department has identified a total of 578 sites which may require final closure and remediation.

From the sizable number of operating and closed landfills, and the State and federal regulatory requirements for daily, intermediate and final cover, it is clear that enormous quantites of earthen material will be needed. Dredged material or blends of dredged material and other soils or residual materials may be suitable for these applications. However, such applications will have to be carefully evaluated, particularly from a structural perspective. The very nature of most dredged material and its fine silty/clay properties may greatly limit its usefulness for cover applications.

(2) Testing Requirements: The purpose of a good landfill cover is to (1) impede rodents and vectors from entering the waste fill, (2) control malodorous emissions, (3) provide a firebreak, (4) have limited erosion potential, (5) not be easily windblown, and (6) provide control of windblown litter. Given these purposes, the physical properties of dredged material (which tend to be low cohesion fine-grained material) must be evaluated to ascertain its suitablity for use as cover material. For example, excessively fine-grained material is generally prohibited due to its susceptibility to wind blown dust, erosion, and potentially limiting hydraulic conductivity (preventing good drainage capability which consequently can cause leachate seeps on side slopes). The moisture content of the material must also be evaluated to ascertain its workability. If the moisture content is too high, then the material must be dewatered, which will require additional processing. The Department will evaluate the suitability of dredged material proposed for use as landfill cover on a case-by-case basis.

H - Agricultural Use

An additional area in which dredged material may have potential for beneficial use applications is in agricultural/horticultural use. As an example of this type of a beneficial use of a material similar to dredged material, New Jersey potable water treatment plant residuals have been approved by the Department for several uses. These include blending with other materials to create soil products for rehabilitating barren sites and as soil for nursery use as potting and field growing media. In some cases, the residuals also have qualified for use directly as clean fill on review by the Department on a case-by-case basis.

While the chemical and physical qualities of specific dredged material would have to be evaluated, it is likely that cleaner materials would also qualify for many types of similar agricultural/horticultural beneficial uses in New Jersey, and other states as well. For example, dredged material could be used to amend marginal soils, thus increasing crop production. However, salinity problems will occur with the use of dredged material from estuarine waters.

I - Capping Open Water Disposal Sites

(1) Overview: depending upon its degree of contamination, dredged material proposed for disposal at an Open Water Site (see Section IV-C) may only be suitable for disposal if management techniques are used to isolate the contaminated dredged material from the surrounding environment. The principal method used to isolate contaminated dredged material placed at an Open Water Disposal Site is to cap it with a layer of clean material. Capping could be required as both an interim and final dredged material management method.

The use of suitable clean dredged material for capping purposes involves a number of engineering and design considerations beyond those associated solely with the open water disposal of dredged material. In addition, capping may be required for the disposal of contaminated dredged material. Thus, the Department considers capping to be a beneficial use of clean dredged material.

Capping may also be required at Subaqueous Pits (Section IV-E) and Containment Areas (Section IV-F) in which contaminated dredged material is disposed. The following discussion of Capping Open Water Disposal Sites is also generally applicable to these two dredged material management alternatives.

(2) Authority: capping may be required for contaminated dredged material placed at an Open Water Disposal Site, in a Subaqueous Pit, or in a Containment Area. The Department's authority to regulate dredged material disposal activities at these areas has been discussed in Sections IV-C, IV-E, and IV-F, respectively.

Disposal of dredged material in ocean waters (and thus any required capping of such material) is regulated by the USACE and USEPA. The State of New Jersey has discretionary authority to review disposal activities at ocean disposal sites pursuant to the Federal Coastal Zone Management Act. The review of proposed ocean disposal (and capping) operations at currently designated ocean disposal sites will be coordinated with the USACE and USEPA.

(3) Potential Impacts/Regulatory Objectives: the primary purpose of capping an Open Water Disposal Site is to isolate contaminated dredged material placed at the site from the surrounding environment. This will serve to minimize potential adverse impacts to the benthic community as a result of exposure to the contaminants.

It must be emphasized that the use of capping must be considered throughout the development and implementation of the open water dredged material disposal alternative. This begins with the process used to select the disposal site. The USACE Waterways Experiment Station Dredging Research Technical Notes DRP-5-03 (February 1991) and DRP-5-04 (November 1991) provide discussions of design, engineering, and construction considerations for the capping of dredged material disposal sites. The USACE emphasizes that a capping project must be considered as an engineered structure, with specific design and construction requirements that must be implemented, monitored, and maintained.

Any cap placed on contaminated dredged material must be of a thickness to ensure the long-term isolation of the contaminants from the surrounding environment. The required thickness will be dependent on the following factors:

(a) the physical and chemical properties of the contaminated dredged material and the clean material to be used for capping;

(b) the potential for bioturbation by recolonizing benthic organisms to disturb the cap and expose the underlying contaminated dredged material;

(c) the potential for consolidation and erosion of the cap material.

In general, a required final cap will be 3 to 4 feet thick, plus allowances for consolidation and erosion.

Interim capping, between disposal operations at Open Water Disposal Sites or in Subaqueous Pits, may also be required. The need for and thickness of an interim cap will be determined on a case-by-case basis. Factors that will be considered in making such a determination include the grain size of the last-placed dredged material, its degree of contamination, the anticipated schedule of future disposal operations at the site, and the physical conditions (particularly currents) at the disposal site. In general, contaminated dredged material should be capped (or otherwise covered by a subsequent disposal operation) within 14 days of its disposal.

The Department notes that the use of geotextile bags/containers for the disposal of contaminated dredged material is currently under investigation. It is anticipated that final (but not interim) capping of such bags/containers placed at Open Water Disposal Sites or in Subaqueous Pits will be required. Capping requirements when geotextile bags/containers are used will be determined on a case-by-case basis.

Only clean material of suitable grain size, which would otherwise be acceptable for unrestricted open water disposal, can be used for capping purposes. Both fine grain and sandy material may be suitable for capping. However, in order to avoid mixing or displacing the contaminated dredged material during capping operations, the cap material should generally be of a lower density than the contaminated dredged material. In addition, the cap material should be of a grain size which will be resistant to erosion and thus stable over the long-term. The USACE Waterways Experiment Station Dredging Research Technical Note DRP-5-05 (November 1991) discusses a variety of techniques which can be used to construct a cap.

When selecting material to be used for capping purposes, its suitability (particularly grain size) for recolonization by benthic organisms must be considered. The cap must be thick enough to ensure that recolonizing organisms cannot penetrate down to the underlying contaminated dredged material and that bioturbation will not expose the contaminated material. However, the cap may also serve to mitigate the original loss of habitat resulting from the disposal of the contaminated dredged material.

(4) Management Process: monitoring of capped Open Water Disposal Sites will be required to ensure that contaminated dredged material is isolated from the environment. Refer to the USACE Waterway Experiment Station Dredging Research Technical Note DRP-5-07 (June 1992) for general guidance on designing an appropriate monitoring program.

A precision bathymetric survey (accuracy to 6 inches or better) of the disposal site will be required prior to any interim or final capping operation. Immediately after the capping operation is completed, additional monitoring will be required to verify that a cap of the required thicknesss has been placed as intended. This would include a precision bathymetric survey and the collection of core samples. The placement of additional cap material will be required if the specified cap design parameters have not been met.

Long-term monitoring of the Open Water Disposal Site and its cap will be required to ensure that (1) the stability and required thickness of the cap is maintained, and (2) the cap is effective in isolating the contaminated dredged material. This will consist of precision bathymetric surveys, the collection of core samples and the chemical analysis of sediment and body burden analyses of benthic organisms in the disposal area. Appropriate management actions will be required to ensure that the contaminated dredged material is isolated from the environment. This will usually involve the placement of additional suitable cap material.

(5) Testing Requirements: only clean dredged material which will ensure the long-term isolation of the underlying contaminated dredged material is suitable for use in capping Open Water Disposal Sites. This involves a consideration of the physical and chemical characteristics of the capping material in relation to both the disposal site and the underlying contaminated dredged material. Such considerations must be evaluated as part of the process of selecting/siting the Open Water Disposal Site. Grain size analyses will be required to evaluate the potential long-term stability of the cap when subjected to the current and other erosive forces in the disposal area. The grain size data will also be used to ensure that the contaminated dredged material is not dispersed as a result of the capping operation. In addition, this information will be considered as part of the evaluation of the potential recolonization of the cap by benthic organisms.

Chemical analyses of the proposed capping material will also be required to ensure it is acceptable for unrestricted open water disposal. Refer to Section IV-C-(3)(d) for applicable testing requirements (note: any dredged material that meets the Testing Exclusion criteria listed in Section III-B does not need to undergo bulk sediment chemistry testing). This information, together with the chemical data for the underlying contaminated dredged material, will be used in the development of a monitoring program for the Open Water Disposal Site and its cap.

Given the interdependent and complex evaluations needed, the suitability of any material for use in the capping of an Open Water Disposal Site will be made on a case-by-case basis.

Chapter VI - References

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Chapter VII - Glossary

ambient conditions: those physical, chemical, and biological conditions present in the immediate vicinity of the project site.

anadromous fish: marine or estuarine species of finfish that spawn in freshwater (CZM Rules Glossary); fish that migrate from oceanic to coastal waters, or from salt water to fresh water.

benthic: occurring or living on or in the bottom of a water body (CZM Rules Glossary); the bottom of a water body, with particular reference to sediments.

benthos: see **benthic**; the organisms living on the bottom of a water body.

best management practices (BMPs): methods and measures employed to reduce the adverse environmental impacts resulting from a dredging or dredged material management/disposal activity.

bioaccumulation: the accumulation of contaminants in the tissues of organisms through any route, including respiration, ingestion, or direct contact with sediment or water; indicates the biological availability of contaminants.

bioassay (test): acute toxicity tests using organisms representative of the water column, benthic, and terrestrial environment(s) at the dredging or dredged material disposal site.

borrow pit: a deep hole in a bay or near-shore area remaining after borrow material has been removed.

bulk (sediment) chemical analysis: the determination of the concentration of **target analytes** present in the sediments to be dredged.

clamshell dredge: a dredging bucket comprised of two hinged jaws; a boat or barge equipped with such a machine.

containment area: any site used for the permanent disposal or temporary confinement of dredged material, and which may or may not have a permanent retaining structure, located in an open water or wetland area directly adjacent to an upland area.

dewatering: the practice of actively or passively removing water from dredged material, usually occurring in a barge or upland confined disposal facility.

dioxin: commonly refers to polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF), in particular 2,3,7,8-TCDD (tetrachlorodibenzo-p-dioxin).

dredged material: the sediments under a body of water removed during a dredging operation and displaced or removed to a disposal location.

dredging:

maintenance dredging: the removal of accumulated sediment from previously authorized navigation and access channels, marinas, lagoons, canals, or boat moorings, for the purpose of maintaining an authorized water depth and width for safe navigation (CZM Rules N.J.A.C. 7:7E-4.11[f]).

new dredging: the removal of sediment from the bottom of a water body that has not been previously dredged, for the purpose of increasing water depth, or the widening or deepening of navigable channels to a newly authorized depth or width (CZM Rules N.J.A.C. 7:7E-4.11[g]).

effluent: a discharge of pollutants into the environment, whether untreated, partially treated, or completely treated (CZM Rules Glossary); particular reference to the quality of water coming over a weir from a dredged material upland confined disposal facility during and after a disposal operation.

elutriate (test): involves mixing dredged material with dredging-site water and allowing the mixture to settle - the potential release of dissolved chemical constituents from the dredged material is determined by chemical analysis of the supernatant (elutriate) remaining after undisturbed settling.

flocculents: substances which, when added to dredged material, result in the aggregation of finer particles into larger particles, thus enhancing the settling properties of the suspended particles and lowering the **Total Suspended Solids** in the dewatering effluent.

furans: see **dioxin**.

geotextile bag/container: tubes, bags, and other containers costructed of woven and non-woven water permeable synthetic fabrics which can be filled with dredged material.

heavy metals: metals which have proven to be hazardous to living organisms ingesting them in sufficient quantities; generally, cadmium, nickel, lead, zinc, copper, mercury, and chromium.

hopper dredge: self-propelled seagoing ships equipped with sediment containers (hoppers), dredge pumps, and other special equipment. Dredged material is raised by dredge pumps through drag arms in contact with the bay/ocean bottom and discharged into hoppers built in the vessel.

hydraulic conductivity: ratio of the velocity to driving force for viscous flow under saturated conditions of a specified liquid in a porous medium.

hydraulic dredging: use of suction equipment to remove a sediment/water slurry from the bay/ocean bottom.

hydrogeology: the study of those factors that deal with subsurface waters and related geologic aspects of subsurface waters.

impervious: impassable, applies to strata such as clays, shales, etc., which will not permit the penetration of water, petroleum, or natural gas.

leachate: a solution obtained by leaching, as in the downward peneration of water through soil or solid waste, and containing soluble substances.

lysimeter: a structure containing a mass of soil and so designed as to permit the measurement of water drainage through the soil.

mitigation: a measure or system of measures taken to lessen the adverse impacts of development (CZM Rules Glossary); the replacement or substitution of a habitat in repayment for habitat that has been degraded or destroyed.

modified elutriate test: used to predict the quality of dewatering effluent discharged from upland confined disposal facilities and similar operations; see elutriate (test).

New Jersey Coastal Zone: the Coastal Area under the jurisdiction of the Coastal Area Facility Review Act (N.J.S.A. 13:19-4), all other areas now or formerly flowed by the tide, shorelands subject to the Waterfront Development Law, regulated wetlands listed at N.J.A.C. 7:7-2.2, and the Hackensack Meadowlands Development Commission District as defined by N.J.S.A. 13:17-4 (CZM Rules N.J.A.C. 7:7E-1.1[b]).

ocean: those waters of the open seas lying seaward of the baseline from which the territorial sea is measured.

ocean disposal: the practice of dredged material disposal via oceangoing barge into a designated disposal site in deep, open water, often miles from shore; particular reference to the use of the Mud Dump site located offshore of Sandy Hook, New Jersey.

open water disposal: the practice of dredged material disposal anywhere into open water.

permit(s): an authorization, license, or equivalent control document issued by the U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, or approved State agency to implement the requirements of an environmental regulation.

physiography: the physical geography of the general region/area in the vicinity of a project site; the study of the genesis and evolution of land forms.

pollutants: any gaseous, chemical, or organic waste (natural or man-made) that contaminates air, soil, sediment, or water, and has the potential for harm to human health, to any aspect of human or natural ecosystems, or to environmental aesthetics or vitality.

polychlorinated biphenyls (PCBs): nonflammable liquids formerly used in heat exchangers, electrical condensers, hydraulic and lubricating fluids, etc. with demonstrated chronic toxicity effects.

polynuclear aromatic hydrocarbons (PAHs): although present in some natural products (eg. crude oil), they are generally associated with the incomplete combustion of organic materials; some have demonstrated carcinogenic effects.

reprofiling: the levelling of sediments within a berth or reach, essentially removing small mounds on the bay bottom, by redistributing the sediments within the boundaries of the berth or reach.

sample compositing: mixing distinct samples, or sediment layers from distinct samples, (see **stratification**) collected in a berth or reach proposed to be dredged.

sample homogenizing: mixing an entire sediment core sample which is not stratified (see **stratification**).

sand: loose, granular particles of worn or disintegrated rock, finer than gravel, and coarser than dust; the fraction of dredged material whose grain size distribution is 2.00 to 0.05 mm, generally referred to as coarse grained.

sidecasting: the pumping of dredged material and the discharge of the material to the side of the dredge, out of the channel or berth area.

stratification (of sediments): the formation of distinct layers of sediments having the same general composition (grain size, quality), arranged one on top of another.

target analyte/compound: a hazardous substance, hazardous waste, or pollutant for which a specific analytical method is designed to detect that potential contaminant both qualitatively and quantitatively (N.J.A.C. 7:26E-1.8).

terrestrial ecosystem: of, pertaining to, or composed of land as distinct from air or water.

total suspended solids (TSS): the mass per unit volume (usually expressed in units of milligrams per liter - mg/L) of solid material obtained by filtering a known volume of liquid.

toxic/toxicity: a condition or substance that is harmful, destructive, poisonous, or deadly; the limit of intolerance of organisms to survive lethal chronic or short-term (acute) subjection to certain chemical and contaminating substances, or physical and environmental conditions.

upland confined disposal facility: a disposal site/structure located above the mean high tide level built to hold dredged material in a totally confined condition. Upland CDFs are usually built to permanently hold contaminated sediments, but this term also refers to those facilities which will only contain dredged material for dewatering purposes prior to some future beneficial use or decontamination management alternative.

APPENDIX A - Quality Assurance/Quality Control Procedures

I. Required Target Analyte Lists

Required bulk sediment chemistry and modified elutriate tests must include analysis for all target analytes listed in Tables I-XIII, excepting the volatiles compound list, which will be required on a case-by-case basis. Required sequential batch leaching tests must include analysis for all target analytes listed in Table XIV. Tables I-XIII also include the required analytical methods for each analyte, and the contract required quantitation limits (CRQLs). These required analytical methods apply to all analytes listed in Tavle XIV as well.

II. Reporting Requirements

All bulk sediment chemistry results must be reported in both wet and dry weight concentrations.

All polychlorinated dibenzo(p)dioxin and polychlorinated dibenzofuran congener results, in both sediment and water matrices, must be reported in both individual congener concentrations and summarized as 2,3,7,8-tetrachlorodibenzo(p)dioxin toxic equivalents, using the International '88 method of toxic equivalency factors. Calculations should include the use of 1/2 the detection limit for all reported nondetects, and for those values reported as Estimated Maximum Possible Concentrations (EMPCs), the full EMPC value should be used.

All PCB congener results must be reported in both individual congener concentrations and summarized using the sum of the PCB congeners multiplied by a factor of 2, to equate the 22 individual congeners to a total PCB value (T. O'Connor, NOS, NOAA, in a July 20, 1994 memorandum to USEPA, Region II, S. Ausubel).

III. Grain Size Analysis and Total Organic Carbon

The grain size analysis must be conducted according to the methods described by R.L. Folk, Petrology of Sedimentary Rocks (Hemphill Publishing Co., Texas, 1980).

Results must be reported as percentages within the general size classes:

Sand:	>0.625 mm diameter
Silt:	<0.625 mm diameter and >0.0039 mm diameter
Clay:	<0.0039 mm diameter

Total Organic Carbon analysis must be conducted according to the USEPA 1986 method, excerpted from the December 1992 regional manual for USEPA Region II and the New York District Corps of Engineers, entitled "Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal," included as Attachment 1.

IV. Sampling Methodology

The sampling methodology described below has been drawn from Section 8.2.6 of the "Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Manual"," February 1991, US Army Corps of Engineers, and the USEPA "QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations," Office of Water (EPA 823-B-95-001, April 1995).

The data reports submitted to the Department for testing and analysis of material proposed for dredging must include descriptions of the procedures used for sample handling, preservation, and storage. These procedures must conform to the following guidance.

(a) Sediment:

The recommended storage and preservation procedures for sediment samples are summarized in Attachment 2. The specified holding times by analyte group for sediment samples must be adhered to or the laboratory must contact the Department with any proposed alterations to the specified holding times.

Sediment samples are subject to chemical, biological, and physical changes as soon as they are collected, and therefore the handling, preservation, and storage techniques should minimize any changes in sample composition by retarding chemical and/or biological activity and by avoiding contamination.

A vibra corer (or piston corer for lesser depths) should be used for sediment sample collection. To avoid cross-contamination of sediment cores, inert plastic core liners which have been steamcleaned prior to use must be utilized for individual sediment cores; these liners cannot then be reused. The vibra corer barrel must be rinsed between each sampling event. Cross-contamination of collected sediment and water samples via personnel must also be avoided.

Generally, samples to be analyzed for metals should not come into contact with metals, and samples to be analyzed for organics should not come into contact with plastics. All sample containers should be appropriately cleaned: acid-rinsed (10% nitric acid) for metal analysis, and solvent-rinsed (methanol) for organic analysis. When equipment will be used to take samples for both metal and organic analysis, the acid rinse must be conducted first, and the solvent rinse second. Samples should completely fill the storage container, leaving no headspace, except for expansion area needed for potential freezing. Since the first few hours after collection are the most critical for potential changes to the sediment, preservation should begin immediately upon sediment collection onboard the collecting vessel. This would include refrigeration or freezing with dry ice. The elapsed time between sample collection and analyses must be as short as possible, and not exceed the recommended holding times listed in Attachment 2.

(b) Water:

The recommended storage and preservation procedures for water samples are summarized in Attachment 2. The specified holding times by analyte group for water samples must be adhered to, or the laboratory must contact the Department with any proposed alterations to the specified holding times.

Water samples are subject to chemical, biological, and physical changes as soon as they are collected, and therefore the handling, preservation, and storage techniques should minimize any changes in sample composition by retarding chemical and/or biological activity and by avoiding contamination.

Water samples should be collected with either a noncontaminating pump (peristaltic or magnetically coupled impeller-design pump) or a discrete water sampler. The pump system should be flushed with 10 times the volume of the collection tubing. The discrete water sampler should be made of stainless steel or acrylic plastic, of the close/open/close type. Seals should be Teflon-coated. All water sampling devices should be acid-rinsed (10% nitric acid) for metal analysis, and solvent-rinsed (methanol) for organic analysis. When equipment will be used to take samples for both metal and organic analysis, the acid rinse must be conducted first, and the solvent rinse second.

V. Quality Assurance/Quality Control Guidance

This guidance has been drawn from both the December 1992 regional manual for USEPA Region II and the New York District Corps of Engineers, entitled "Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal," and the USEPA "QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations," Office of Water (EPA 823-B-95-001, April 1995).

The data reports submitted to the Department for testing and analysis of material proposed for dredging must include a description of all methods and procedures used in the field and laboratory, referencing established protocols or guidance, for the following:

1. Sample collection
2. Sample preparation (including homogenizing and compositing)
3. Sample preservation methods and holding times (before and after extraction)
4. Chain-of-custody tracking documents
5. Sample transport, storage, and disposal
6. Sample analysis
7. Data entry and data reduction
8. Deviations from standard methods or prescribed procedures
9. Narrative of analytical problems, corrective actions taken, effects on data interpretation.

The following quality control samples or procedures will be required for both sediment and water matrices:

1. Field blanks: One with every batch of 1-20 samples
2. Method blanks: One with every batch of 1-20 samples (except for volatile organic analysis: One with every batch of 1-20 samples or every 12 hours, whichever is less)
3. Matrix spike and Matrix spike duplicate: One set with every batch of 1-20 samples
4. Surrogate spike recovery: each sample, organics only
5. Standard Reference Materials (SRMs): One set with every batch of 1-20 samples, if available, see the sources of SRMs listed below
6. MDL verification within last 6 months for marine sediments and salt water matrices, to be submitted to the Department

Standard reference materials (SRMs) may be obtained from the following organizations:

<u>Organic Constituents</u>

U.S. Department of Commerce
National Institute for Standards & Technology
Office of Stardard Reference Materials
Room B3111 Chemistry Building
Gaithersburg, Maryland 20899
Telephone: (301) 975-6776

Marine Analytical Chemistry Standards Program
National Research Council of Canada
Atlantic Research Laboratory
1411 Oxford Street
Halifax, Nova Scotia, Canada B3H 3Z1
Telephone: (902) 426-8280

<u>Inorganic Constituents</u>

U.S. Department of Commerce
National Institute for Standards & Technology
Office of Standard Reference Materials
Room B3111 Chemistry Building
Gaithersburg, Maryland 20899
Telephone: (301) 975-6776

Marine Analytical Chemistry Standards Program
National Research Council of Canada
Division of Chemistry
Montreal Road
Ottawa, Ontario, Canada K1A 0R9
Telephone: (613) 993-2359

DETERMINATION OF TOTAL ORGANIC CARBON

1.0 APPLICATION AND SCOPE

This method, developed by the U.S. Environmental Protection Agency, Region II, Environmental Services Division laboratory in Edison, New Jersey, describes protocols for the determination of organic carbon in ocean sediments. Although the detection limit may vary with procedure or instrument, a minimum reporting value of 100 mg/kg will be required for the ocean dumping/dredging program. Several types of determinations, which are considered equivalent, are presented in this procedure. However, wet combustion methods are not considered to be equivalent to the pyrolytic methods described.

In this method, inorganic carbon from carbonates and bicarbonates is removed by acid treatment. The organic compounds are decomposed by pyrolysis in the presence of oxygen or air. The carbon dioxide that is formed is determined by direct nondispersive infrared detection, flame ionization gas chromatography after catalytic conversion of the carbon dioxide to methane; thermal conductivity gas chromatography, differential thermal conductivity detection by sequential removal of water and carbon dioxide; or thermal conductivity detection following removal of vater with magnesium perchlorate.

Water content is determined on a separate portion of sediment and data are reported in mg/kg on a dry weight basis.

2.0 DEFINITIONS

The following terms and acronyms are associated with this procedure:

LRB	Laboratory record book
TOC	Total organic carbon

3.0 PROCEDURE

3.1 Sample collection

Collect sediments in glass jars with lids lined with Teflon or aluminum foil. Cool samples and maintain at 4°C. Analyze samples within 14 days. If unrepresentative material is to be removed from the sample, it should be removed in the field under the supervision of the chief scientist and noted in the LRB on the field log sheet.

3.2 Apparatus and Reagents

- Drying oven maintained at 103° to 105°C.
- Analytical instrument. No specific TOC analyzer is recommended as superior. The following listing is for information on instrument options only, and is not intended to restrict the use of other unlisted instruments capable of analyzing TOC. The instrument to be used must meet the following specifications:
  - A combustion boat that is heated in a stream of oxygen or air in a resistance or induction-type furnace to completely convert organic substances to CO_2 and water.
  - A means to physically or by measurement technique to separate water and other interferants from CO_2.
  - A means to quantitatively determine CO_2 with adequate sensitivity (100 mg/kg), and precision (25% at the 95% confidence level as demonstrated by repetitive measurements of a well-mixed ocean sediment sample).
  - A strip chart or other permanent recording device to document the analysis.

  (1.) <u>Perkin Elmer Model 240C Elemental Analyzer or equivalent.</u> In this instrument, the sample from Section 3.5 is pyrolyzed under pure oxygen, vater is removed by magnesium perchlorate and the carbon dioxide is removed by ascarite. The decrease in signal obtained by differential thermal conductivity detectors placed between the combustion gas stream before and after the ascarite tube is a measure of the organic carbon content.

  (2.) <u>Carlo Erba Model 1106 CHN Analyzer, or equivalent.</u> In this apparatus, the sample is pyrolyzed in an induction-type furnace, and the resultant carbon dioxide is chromatographically separated and analyzed by a differential thermal conductivity detector.

(3.) LECO Models WR12, WR112, or CR-12 carbon determinators, or Models 600 or 800 CHN analyzers. In the LECO WR-12, the sample is burned in high frequency induction furnace, and the carbon dioxide is selectively absorbed at room temperature in a molecular sieve. It is subsequently released by heating and is measured by a thermal conductivity detector. The WR-112 is an upgraded WR-12 employing microprocessor electronics and a printer to replace the electronic digital voltmeter.

In the LECO CR-12 carbon determinator, the sample is combusted in oxygen, moisture and dust are removed by appropriate traps, and the carbon dioxide is measured by a selective, solid state, infrared detector. The signal from the detector is then processed by a microprocessor and the carbon content is displayed on a digital readout and recorded on an integral printer.

In the LECO CHN-600 and CHN-800 elemental analyzers, the sample is burned under oxygen in a resistance furnace and the carbon dioxide is measured by a selective infrared detector.

(4.) Dohrman Model DC85 Digital High Temperature TOC Analyzer. In this instrument, the sample is burned in resistance furnace under oxygen, the interfering gases are removed by a sparger/scrubber system, and the carbon dioxide is measured by a non-dispersive infrared detector and shown on a digital display in concentration units.

- Reagents

(1.) Distilled water used in preparation of standards and for dilution of samples should be ultrapure to reduce the carbon concentration of the blank.

(2.) Potassium hydrogen phthalate, stock solution, 1000 mg carbon/L: Dissolve 0.2128 g of potassium hydrogen phthalate (Primary Standard Grade) in distilled water and dilute to 100.0 mL.

NOTE: Sodium oxalate and acetic acid are not recommended as stock solutions.

(3.) Potassium hydrogen phthalate, standard solutions: Prepare standard solutions from the stock solution by dilution with distilled water.

(4.) Phosphoric acid solution, 1:1 by volume.

3.3 Interferences

3.3.1 Volatile organics in the sediments may be lost in the decarbonation step resulting in a low bias.

3.3.2 Bacterial decomposition and volatilization of the organic compounds are minimized by maintaining the sample at 4 °C, analyzing within the specified holding time, and analyzing the wet sample.

3.4 Sample Preparation

3.4.1 Allow frozen samples to warm to room temperature. Homogenize each sample mechanically, incorporating any overlying water.

3.4.2 Weigh the well-mixed sample (up to 500 mg) into the combustion boat or cup. Add 1:1 phosphoric acid dropwise until effervescence stops. Heat to 75°C.

NOTE: This procedure will convert inorganic carbonates and bicarbonates to carbon dioxide and eliminate it from the sample.

3.5 Sample Analysis

Analyze the residue according to the instrument manufacturer's instructions.

3.6 Percent Residue Determination

Determine percent residue on a separate sample aliquot as follows:

3.6.1 Heat a clean 25-mL beaker at 103° to 105°C for 1 h. Cool in a desiccator, weigh to the nearest mg, and store in desiccator until use.

3.6.2 Add 1 g, weighed to the nearest mg, of an aliquot of the well-mixed sample .

3.6.3 Dry and heat in the 103° to 105°C oven for 1 h. Cool in a desiccator. Weigh to the nearest mg.

3.7 Calibration

Follow instrument manufacturer's instructions for calibration. Prepare a calibration curve by plotting mg carbon vs. instrument response using four standards and a blank, covering the analytical range of interest.

3.8 Data Recording

Record all data and sample information in LRBs or on project-specific data forms.

All transfers of data to forms and data reductions (e.g., concentration calculations, means, standard deviations) should be checked by the analyst and approved by a lab manager, project manager, or principal investigator. Hard copies of sample data and spreadsheet reports should be kept in the testing laboratory's central files.

3.9 QA/QC Procedures

3.9.1 **Precision and Accuracy** The precision and accuracy will differ with the various instruments and matrices, and must be determined by the laboratories reporting data. A representative sample of well-mixed, meshed, sediment should be analyzed in quadruplicate for 4 days to determine the analytical precision.

3.9.2 It is critical that each sample be thoroughly homogenized in the laboratory before a subsample is taken for analysis. Laboratory homogenization should be conducted even if samples were homogenized in the field.

3.9.3 Dried samples should be cooled in a desiccator and held there until they are weighed. If a desiccator is not used, the sediment will accumulate ambient moisture and the sample weight will be overestimated. A color-indicating desiccant is recommended so that spent desiccant can be detected easily. Also, the seal on the desiccator should be checked periodically and, if necessary, the ground glass rims should be greased or the "O" rings replaced.

4.0 DATA REDUCTION, DOCUMENTATION, AND REPORTING

4.1 Data Reduction

Data analysis and calculations will be performed whenever possible on computers using commercial spreadsheet software such as Lotus 1-2-3, Quattro Pro, or Microsoft Excel.

4.2 Documentation

Keep all laboratory records, test results, measurements, other and supporting documentation for each sediment test in a LRB or project file dedicated to that purpose.

4.3 Reporting

A report should be prepared including, but not limited to, the following information:

- Sources of samples
- Description of methods
- Summary of sample analysis results
- Summary of any deviations from the project test plan
- Copies raw data, observations, or data forms

Total organic carbon should be reported as a percentage of the dry weight of the unacidified sample to the nearest 0.1 unit. The laboratory should report the results of all samples (including QC replicates, method blanks, and standard reference measurements) and should note any problems that may have influenced sample quality. The laboratory should also provide a summary of the calibration procedure and results (e.g., range covered, regression equation, coefficient of determination).

Source: U.S. Army Corps of Engineers - New York District and Environmental Protection Agency -Region II, 1992, "Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal," Draft-18 Dec 1992.

ATTACHMENT 2

SUMMARY OF RECOMMENDED PROCEDURES FOR SAMPLE COLLECTION, PRESERVATION, AND STORAGE

Analyses	Collection Method[a]	Sample Volume[b]	Container[c]	Preservation Technique	Storage Conditions	Holding Times[d]
Sediment						
Chemical/Physical Analyses						
Metals	Grab/corer	100 g	Precleaned polyethylene jar[e]	Dry ice[f] or freezer storage for extended storages; otherwise refrigerate	≤ 4°C	Hg - 28 days Others - 6 months[g]
Organic compounds (e.g., PCBs, pesticides, polycyclic aromatic hydrocarbons)	Grab/corer	250 g	Solvent-rinsed glass jar with Teflon® lid[e]	Dry ice[f] or freezer storage for extended storage; otherwise refrigerate	≤ 4°C[h]/dark[i]	14 days[g]
Particle size	Grab/corer	100 g	Whirl-pac bag[e]	Refrigerate	< 4°C	Undetermined
Total organic carbon	Grab/corer	50 g	Heat treated glass vial with Teflon®-lined lid[e]	Dry ice[f] or freezer storage for extended storages; otherwise refrigerate	≤ 4°C[h]	14 days
Total solids/specific gravity	Grab/corer	50 g	Whirl-pac bag	Refrigerate	< 4°C	Undetermined
Miscellaneous	Grab/corer	≥ 50 g	Whirl-pac bag	Refrigerate	< 4°C	Undetermined
Sediment from which elutriate is prepared	Grab/corer	Depends on tests being performed	Glass with Teflon®-lined lid	Completely fill and refrigerate	4°C/dark/airtight	14 days

Excerpted from pp. 54-57 of the USEPA "QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations," Office of Water (EPA 823-B-95-001, April 1995).

Analyses	Collection Method[a]	Sample Volume[b]	Container[c]	Preservation Technique	Storage Conditions	Holding Times[d]
Water and Elutriate						
Chemical/Physical Analyses						
Particulate analysis	Discrete sampler or pump	500–2,000 mL	Plastic or glass	Lugols solution and refrigerate	4°C	Undetermined
Metals	Discrete sampler or pump	1 L	Acid-rinsed polyethylene or glass jar[i]	pH < 2 with HNO_3; refrigerate[i]	4°C 2°C[i]	Hg - 14 days Others - 6 months[h]
Total Kjeldahl nitrogen	Discrete sampler or pump	100–200 mL	Plastic or glass[h]	H_2SO_4 to pH < 2; refrigerate	4°C[h]	24 h[h]
Chemical oxygen demand	Discrete sampler or pump	200 mL	Plastic or glass[h]	H_2SO_4 to pH < 2; refrigerate	4°C[h]	7 days[h]
Total organic carbon	Discrete sampler or pump	100 mL	Plastic or glass[h]	H_2SO_4 to pH < 2; refrigerate	4°C[h]	<48 hours[h]
Total inorganic carbon	Discrete sampler or pump	100 mL	Plastic or glass[h]	Airtight seal; refrigerate[h]	4°C[h]	6 months[h]
Phenolic compounds	Discrete sampler or pump	1 L	Glass[h]	0.1–1.0 g $CuSO_4$; H_2SO_4 to pH < 2; refrigerate	4°C[h]	24 hours[h]
Soluble reactive phosphates	Discrete sampler or pump	--	Plastic or glass[h]	Filter; refrigerate[h]	4°C[h]	24 hours[h]
Extractable organic compounds (e.g., semi-volatile compounds)	Discrete sampler or pump	4 L	Amber glass bottle[j]	pH < 2, 6N HCl; airtight seal; refrigerate	4°C[j]	7 days for extraction; 40 days for sample extract analyses[j]
Volatile organic compounds	Discrete sampler or pump	80 mL	Glass vial[f]	pH < 2 with 1:1 HCL; refrigerate in airtight, completely filled container[j]	4°C[j]	14 days for sample analysis, if preserved[f]
Total phosphorus	Discrete sampler or pump	--	Plastic or glass[h]	H_2SO_4 to pH < 2; refrigerate	4°C[h]	7 days[h]

Analyses	Collection Method[a]	Sample Volume[b]	Container[c]	Preservation Technique	Storage Conditions	Holding Times[d]
Total solids	Discrete sampler or pump	200 mL	Plastic or glass[h]	Refrigerate	4°C[h]	7 days[h]
Volatile solids	Discrete sampler or pump	200 mL	Plastic or glass[h]	Refrigerate	4°C[h]	7 days[h]
Sulfides	Discrete sampler or pump	–	Plastic or glass[h]	pH > 9 NaOH (ZnAc); refrigerate[h]	4°C[h]	24 hours[h]

PCB - polychlorinated biphenyl

[a] Collection method should include appropriate liners.

[b] Amount of sample required by the laboratory to perform the analysis (wet weight or volume provided, as appropriate). Miscellaneous sample size for sediment should be increased if auxiliary analytes that cannot be included as part of the organic or metal analyses are added to the list. The amounts shown are not intended as firm values; more or less tissue may be required depending on the analytes, matrices, detection limits, and particular analytical laboratory.

[c] All containers should be certified as clean according to U.S. EPA (1990c).

[d] These holding times are for sediment, water, and tissue based on guidance that is sometimes administrative rather than technical in nature. There are no promulgated, scientifically based holding time criteria for sediments, tissues, or elutriates. References should be consulted if holding times for sample extracts are desired. Holding times are from the time of sample collection.

[e] NOAA (1989).

[f] Tetra Tech (1986a).

[g] Sample may be held for up to 1 year if $\leq -20°C$.

[h] Polypropylene should be used if phthalate bioaccumulation is of concern.

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

[j] U.S. EPA (1987a); 40 CFR Part 136, Table III.

[k] Plumb (1981).

[l] If samples are not preserved to $pH < 2$, then aromatic compounds must be analyzed within 7 days.

[m] Tetra Tech (1986b).

The required analytes have been grouped according to type in the following tables. Analytes in each group can be analyzed by the same preparative and analytical methods. A choice of a GC or a GC/MS method is given where applicable. A GC/MS method is preferable to insure more positive identification of components. However, GC/MS methods are generally somewhat less sensitive thereby causing CRQLs to be higher. Soil CRQLs are applicable to sediments. Listed methods are from SW-846, Third Edition unless otherwise indicated.

Table I - Volatile Halogenated Organics

Methods: Preparative, 5030A (purge and trap for water and soils)

Analytical, GC, 8010B
GC/MS, 8260A

Analyte	Water CRQL(ug/L) GC	GC/MS	Soil CRQL[ug/Kg(wet wt.)] GC	GC/MS
Chloromethane	1	3	5	10
Bromomethane	1	3	5	10
Vinyl chloride	1	3	5	10
Methylene chloride	1	3	5	10
1,1-Dichloroethene	1	3	5	10
1,1-Dichloroethane	1	3	5	10
1,2-Dichloroethene(total)	1	3	5	10
Chloroform	1	3	5	10
1,2-Dichloroethane	1	3	5	10
1,1,1-Trichloroethane	1	3	5	10
Carbon tetrachloride	1	3	5	10
Bromodichloromethane	1	3	5	10
1,2-Dichloropropane	1	3	5	10
cis-1,3-Dichloropropene	3	5	10	15
Trichloroethene	3	5	10	15
Dibromochloromethane	1	3	5	10
1,1,2-Trichloroethane	1	3	5	10
trans-1,3-Dichloropropene	3	5	10	15
Bromoform	1	3	5	10
1,1,2,2-Tetrachloroethane	1	3	5	10

Table II - Volatile Aromatic Organics

Methods: Preparative, 5030A (purge and trap for water and soils)

Analytical, GC, 8020A
GC/MS, 8260A

Analyte	Water CRQL(ug/L) GC	GC/MS	Soil CRQL[ug/Kg(wet wt.)] GC	GC/MS
Benzene	1	2	5	10
Toluene	1	2	5	10
Chlorobenzene	1	2	5	10
Ethylbenzene	1	2	5	10
Styrene	1	2	5	10
Xylenes (total)	1	2	5	10
Naphthalene	1	2	5	10

Table III - Volatile Nonpurgeable Water Soluble Organics by Azeotropic Distillation

Methods: Preparative, 5031 (new method proposed in Update III to SW-846)

Analytical, GC, 8015B
GC/MS, 8260B

Analyte	Water CRQL(ug/L) GC	GC/MS	Soil CRQL[ug/Kg(wet wt.)] GC	GC/MS
Acetone	80		240	
2-Butanone	30		90	
4-Methyl-2-Pentanone	10		30	

Table IV - Phenols

Methods: Preparative, Water-3510B
Soil-3540B

Analysis, GC, 8040A
GC/MS, 8270B

Analyte	Water CRQL(ug/L) GC	GC/MS	Soil CRQL[ug/Kg(wet wt.)] GC	GC/MS
Phenol	5	10	50	330
2-Chlorophenol	5	10	50	330
2-Methylphenol	5	10	50	330
4-Methylphenol	5	10	50	330
2,4-Dimethylphenol	5	10	50	330
2,4-Dichlorophenol	5	10	50	330
2,4,5-Trichlorophenol	5	10	50	330
2,4,6-Trichlorophenol	5	10	50	330
2,4-Dinitrophenol	10	20	100	660
Pentachlorophenol	10	20	100	660
4-Chloro-3-methyl-phenol	5	10	50	330

Table V - Phthalate Esters

Methods: Preparative, Water-3510B
Soil-3540B

Analytical, GC, 8061A
GC/MS, 8270B

Analyte	Water CRQL(ug/L) GC	GC/MS	Soil CRQL[ug/Kg(wet wt.)] GC	GC/MS
Dimethylphthalate	5	10	50	100
Diethylphthalate	5	10	50	100
Di-n-butylphthalate	5	10	50	100
Butylbenzylphthalate	5	10	50	100
bis-(2Ethylhexyl)phthalate	10	20	100	200
Di-n-octylphthalate	10	20	100	200

Table VI - N-Nitrosoamines

Methods: Preparative, Water-3510B/3520
Soil-3540B/3550A

Analytical, GC, 8070
GC/MS, 8270B

Analyte	Water CRQL(ug/L) GC	GC/MS	Soil CRQL[ug/Kg(wet wt.)] GC	GC/MS
N-Nitrosodinpropylamine	1	10	50	100
N-Nitrosodiphenylamine	1	10	50	100

Table VII - Polynuclear Aromatic Hydrocarbons

Methods: Preparative, Water-3510B/3250
Soil-3540B/3550A

Analytical, GC, 8100
GC/MS, 8270B

Analyte	Water CRQL(ug/L) GC	Water CRQL(ug/L) GC/MS	Soil CRQL[ug/Kg(wet wt.)] GC	Soil CRQL[ug/Kg(wet wt.)] GC/MS
Acenaphthene	5	10	50	100
Fluorene	5	10	50	100
Anthracene	5	10	50	100
Fluoranthene	5	10	50	100
Pyrene	5	10	50	100
Benzo(a)anthracene	5	10	50	100
Chrysene	5	10	50	100
Benzo(b)fluoranthene	5	10	50	100
Benzo(k)fluoranthene	5	10	50	100
Benzo(a)pyrene	5	10	50	100
Indeno(1,2,3,-cd)pyrene	5	10	50	100
Dibenzo(a,h)anthracene	5	10	50	100
Benzo(g,h,i)perylene	5	10	50	100

Table VIII - Haloethers

Methods: Preparative, Water/Soil, See analytical methods

Analytical, GC, 8110
GC/MS, 8270B

Analyte	Water CRQL(ug/L) GC	Water CRQL(ug/L) GC/MS	Soil CRQL[ug/Kg(wet wt.)] GC	Soil CRQL[ug/Kg(wet wt.)] GC/MS
bis-(2-chloroethyl)ether	5	10	50	100
bis-(2-chloroisopropyl) ether	10	20	50	100

Table IX - Chlorinated Hydrocarbons

Methods: Preparative, Water/Soil, See analytical methods

Analytical, GC, 8121
GC/MS, 8270B

Analyte	Water CRQL(ug/L) GC	GC/MS	Soil CRQL[ug/Kg(wet wt.)] GC	GC/MS
1,2-Dichlorobenzene	5	10	50	100
1,3-Dichlorobenzene	5	10	50	100
1,4-Dichlorobenzene	10	20	100	200
Hexachloroethane	1	3	20	100
Hexachlorobutadiene	1	3	20	100
Hexachlorocyclopentadiene	5	10	50	100
Hexachlorobenzene	1	3	20	100
1,2,4-Trichlorobenzene	5	10	50	100

Table X - Nitroaromatics and Isophorone

Methods: Preparative, Water/Soil, See analytical methods

Analytical, GC, 8090
GC/MS, 8270B

Analyte	Water CRQL(ug/L) GC	GC/MS	Soil CRQL[ug/Kg(wet wt.)] GC	GC/MS
Isophorone	10	10	100	200
Nitrobenzene	10	10	100	200
2,4-Dinitrotoluene	5	10	100	200
2,6-Dinitrotoluene	5	10	100	200

Table XI - Miscellaneous

Analytical Methods (See method listed with analyte)

Analyte	Water CRQL(ug/L GC/MS	Soil CRQL[ug/Kg(wet wt.)] GC/MS
4-Chloroaniline (8270B)	20	500
3,3'-Dichlorobenzidene (8270B)	20	500

Seventeen (17) 2,3,7,8 substituted CDD and CDF congeners (1613). The required congeners and related isotopes used for analysis are shown in Attachment 1. CRQLs for each congener should range from 5X the minimum level for water to 10X the minimum level for solids.

PCB congener and Aroclors (Sloan method, NOAA Technical Memorandum NOS ORCA-71). This method was selected because it provides detailed cleanup procedures and quantitates all congeners of interest. The New York District Army Corps of Engineers uses this method for its analysis of sediments for PCB congeners. There is some concern about this method in that no performance statistics such as method detection limits, percent recovery, and precision are presented. The recommended MDLs for all individual PCB congeners are 1 ug/kg dry weight (sediment), and 0.0005 ug/L (water).

Table 2. Retention Time References, Quantitation References, Relative Retention Times, and Minimum Levels for CDDs and CDFs

Compound	Retention Time and Quantitation Reference	Relative Retention Time	Minimum Level[1] Water (pg/L; ppq)	Solid (ng/kg; ppt)	Extract (pg/μL; ppb)
Compounds using $^{13}C_{12}$-1,2,3,4-TCDD as the injection internal standard					
2,3,7,8-TCDF	$^{13}C_{12}$-2,3,7,8-TCDF	0.999–1.003	10	1	0.5
2,3,7,8-TCDD	$^{13}C_{12}$-2,3,7,8-TCDD	0.999–1.002	10	1	0.5
1,2,3,7,8-PeCDF	$^{13}C_{12}$-1,2,3,7,8-PeCDF	0.999–1.002	50	5	2.5
2,3,4,7,8-PeCDF	$^{13}C_{12}$-2,3,4,7,8-PeCDF	0.999–1.002	50	5	2.5
1,2,3,7,8-PeCDD	$^{13}C_{12}$-1,2,3,7,8-PeCDD	0.999–1.002	50	5	2.5
$^{13}C_{12}$-2,3,7,8-TCDF	$^{13}C_{12}$-1,2,3,4-TCDD	0.923–1.103			
$^{13}C_{12}$-2,3,7,8-TCDD	$^{13}C_{12}$-1,2,3,4-TCDD	0.976–1.043			
$^{37}Cl_4$-2,3,7,8-TCDD	$^{13}C_{12}$-1,2,3,4-TCDD	0.989–1.052			
$^{13}C_{12}$-1,2,3,7,8-PeCDF	$^{13}C_{12}$-1,2,3,4-TCDD	1.000–1.425			
$^{13}C_{12}$-2,3,4,7,8-PeCDF	$^{13}C_{12}$-1,2,3,4-TCDD	1.011–1.526			
$^{13}C_{12}$-1,2,3,7,8-PeCDD	$^{13}C_{12}$-1,2,3,4-TCDD	1.000–1.567			
Compounds using $^{13}C_{12}$-1,2,3,7,8,9-HxCDD as the injection internal standard					
1,2,3,4,7,8-HxCDF	$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	0.999–1.001	50	5	2.5
1,2,3,6,7,8-HxCDF	$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	0.997–1.005	50	5	2.5
1,2,3,7,8,9-HxCDF	$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	0.999–1.001	50	5	2.5
2,3,4,6,7,8-HxCDF	$^{13}C_{12}$-2,3,4,6,7,8,-HxCDF	0.999–1.001	50	5	2.5
1,2,3,4,7,8-HxCDD	$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	0.999–1.001	50	5	2.5
1,2,3,6,7,8-HxCDD	$^{13}C_{12}$-1,2,3,6,7,8,-HxCDD	0.998–1.004	50	5	2.5
1,2,3,7,8,9-HxCDD	–[2]	1.000–1.019	50	5	2.5
1,2,3,4,6,7,8-HpCDF	$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	0.999–1.001	50	5	2.5
1,2,3,4,7,8,9-HpCDF	$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	0.999–1.001	50	5	2.5
1,2,3,4,6,7,8-HpCDD	$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	0.999–1.001	50	5	2.5
OCDF	$^{13}C_{12}$-OCDD	0.999–1.008	100	10	5.0
OCDD	$^{13}C_{12}$-OCDD	0.999–1.001	100	10	5.0
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	0.944–0.970			
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	0.949–0.975			
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	0.977–1.047			
$^{13}C_{12}$-2,3,4,6,7,8,-HxCDF	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	0.959–1.021			
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	0.977–1.000			
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	0.981–1.003			
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.043–1.085			
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.057–1.151			
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.086–1.110			
$^{13}C_{12}$-OCDD	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.032–1.311			

1. The Minimum Level (ML) for each analyte is defined as the level at which the entire analytical system must give a recognizable signal and acceptable calibration point. It is equivalent to the concentration of the lowest calibration standard, assuming that all method-specified sample weights, volumes, and cleanup procedures have been employed.
2. The retention time reference for 1,2 3,7,8,9-HxCDD is $^{13}C_{12}$-1,2,3,6,7,8-HxCDD, and 1,2,3,7,8,9-HxCDD is quantified using the averaged responses for $^{13}C_{12}$-1,2,3,4,7,8-HxCDD and $^{13}C_{12}$-1,2,3,6,7,8-HxCDD.

ATTACHMENT I

ATTACHMENT 2
REQUIRED PCB CONGENERS

PCB Congener	IUPAC #
2,4'-Dichlorobiphenyl	8
2,2',5-Trichlorobiphenyl	18
2,4,4'-Trichlorobiphenyl	28
2,2',3,5'-Tetrachlorobiphenyl	44
2,2',5,5'-Tetrachlorobiphenyl	52
2,3',4,4'-Tetrachlorobiphenyl	66
2,2',3,4',5-Pentachlorobiphenyl	49
2,2',3,4,5'-Pentachlorobinphenyl	87
2,2',4,5,5'-Pentachlorobiphenyl	101
2,3,3',4,4'-Pentachlorobiphenyl	105
2,3',4,4',5-Pentachlorobiphenyl	118
2,2',3,3',4,4'-Hexachlorobiphenyl	128
2,2',3,4,4',5'-Hexachlorobiphenyl	138
2,2',4,4',5,5'-Hexachlorobiphenyl	153
2,2',3,3',4,4',5-Heptachlorobiphenyl	170
2,2',3,4,4',5,5'-Heptachlorobiphenyl	180
2,2',3,4,4',5',6-Heptachlorobiphenyl	183
2,2',3,4,4',6,6'-Heptachlorobiphenyl	184
2,2',3,4',5,5',6-Heptachlorobiphenyl	187
2,2',3,3',4,4',5,6-Octachlorobiphenyl	195
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	206
2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl	209

The recommended MDLs for all individual PCB congeners are 1 ug/kg dry weight (sediment), and 0.0005 ug/L (water).

Table XII - Pesticides

Methods: Preparative, Water/Soil, See analytical methods

Analytical, GC, 8080
GC/MS, 8270B

Analyte	Water CRQL(ug/L) GC	GC/MS	Soil CRQL[ug/Kg(wet wt.)] GC	GC/MS
alpha-BHC	0.1	1	5	50
beta-BHC	0.1	1	5	50
delta-BHC	0.1	1	5	50
gammma-BHC	0.1	1	5	50
Heptachlor	0.1	1	5	50
Aldrin	0.1	1	5	50
Heptachlor epoxide	0.1	1	5	50
Endosulfan I	0.1	1	5	50
Dieldrin	0.1	1	5	50
4,4'DDE	0.1	1	5	50
Endrin	0.1	1	5	50
Endosulfan II	0.1	1	5	50
4,4'DDD	0.1	1	5	50
Endosulfan sulfate	0.1	1	5	50
4,4'DDT	0.1	1	5	50
Methoxychlor	0.5	5	50	300
Endrin ketone	0.1	1	5	50
Endrin aldehyde	0.1	1	5	50
alpha-Chlordane	0.1	1	5	50
gamma-Chlorodane	0.1	1	5	50
Toxaphene	1	10	400	600

Table XIII - Inorganics

Methods: Preparative for Water/Soil, See analytical method for specific analyte

Analytical, See specific analyte below. The direct aspiration method is listed first and the furnace method second. The furnance method has lower detection limits.

Analyte	Water(ug/L)	CRQL Soil(ug/Kg)wet wt.
Antimony (7040, 7041, 7062)	3	2500
Arsenic (7060A, 7062)	3	2500
Barium (7080A, 7081)	1	100
Beryllium (7090, 7091)	0.2	2500
Cadmium (7130, 7131A)	1	300
Chromium (7190, 7191)	5	2500
Copper (7210, 7211)	5	2500
Lead (7420, 7421)	5	2500
Manganese (7460, 7461)	1	2500
Mercury (7470A-water, 7471A-soil)	1	200
Nickel (7520, 7521)	5	2500
Selenium(___, 7740)	5	2500
Silver (7760A, 7761)	2	200
Thallium (7840, 7841)	5	200
Vanadium (7910, 7911)	8	2500
Zinc (7950, 7951)	0.5	2500
Cyanide (9010)	40	2500

<u>TABLE XIV. Worst Case IIA Ground Water Constituent Standards</u>

Constituent Groups	CASRN	Ground Water Quality Criteria (uG/L)	PQL (uG/L)	Worst Case IIA Ground Water Constituent Standard (uG/L)
TARGET COMPOUND LIST				
VOLATILE ORGANIC COMPOUNDS				
Chloromethane	74-87-3	30.00	2.00	16.00
Bromomethane	74-83-9	10.00	2.00	6.00
Vinyl Chloride	75-01-4	0.08	5.00	5.00
Methylene Chloride	75-09-2	2.00	2.00	2.00
Acetone	67-64-1	700.00	700.00	700.00
~~Carbon Disulfide~~	~~75-15-0~~	~~700.00~~	~~N/A~~	~~N/A~~
1,1-Dichloroethene	73-35-4	1.00	2.00	2.00
~~1,1-Dichloroethane~~	~~75-34-3~~	~~50.00~~	~~N/A~~	~~N/A~~
Chloroform	67-66-3	6.00	1.00	3.50
1,2-Dichloroethane	107-06-2	0.30	2.00	2.00
~~2-Butanone~~	~~78-93-3~~	~~300.00~~	~~N/A~~	~~N/A~~
1,1,1-Trichloroethane	71-55-6	30.00	1.00	15.50
Carbon Tetrachloride	56-23-5	0.40	2.00	2.00
Bromodichloromethane	75-27-4	0.30	1.00	1.00
1,2-Dichloropropane	78-87-5	0.50	1.00	1.00
Trichloroethene	79-01-6	1.00	1.00	1.00
Dibromochloromethane	124-48-1	10.00	1.00	5.50
1,1,2-Trichloroethane	79-00-5	3.00	2.00	2.50
Benzene	71-43-2	0.20	1.00	1.00
Bromoform	75-25-2	4.00	0.60	2.30
~~4-Methyl-2-pentanone~~	~~108-10-1~~	~~400.00~~	~~N/A~~	~~N/A~~
Tetrachloroethene	127-18-4	0.40	1.00	1.00
1,1,2,2-Tetrachloroethane	79-34-5	1.00	1.00	1.00
Toluene	108-88-3	1000.00	5.00	502.50
Chlorobenzene	108-90-7	4.00	2.00	3.00
Ethylbenzene	100-41-4	700.00	5.00	352.50
Styrene	100-42-5	100.00	5.00	52.50
Xylenes (total)	1330-20-7	40.00	2.00	21.00
SEMIVOLATILE ORGANIC COMPOUNDS				
Phenol	108-95-2	4000.00	10.00	2005.00
bis-(2-Chloroethyl) ether	111-44-4	0.03	10.00	10.00
2-Chlorophenol	95-57-8	40.00	20.00	30.00
1,3-Dichlorobenzene	541-73-1	600.00	5.00	302.50
1,4-Dichlorobenzene	106-46-7	75.00	5.00	40.00
1,2-Dichlorobenzene	95-50-1	600.00	5.00	302.50
~~2-Methylphenol~~	~~95-48-7~~	~~400.00~~	~~N/A~~	~~N/A~~
2,2'-oxybis (1-Chloropropane)	108-60-1	300.00	10.00	155.00
~~4-Methylphenol~~	~~106-44-5~~	~~350.00~~	~~N/A~~	~~N/A~~
N-Nitroso-di-n-dipropylamine	621-64-7	0.005	20.00	20.00
Hexachloroethene	67-72-1	0.70	10.00	10.00
Nitrobenzene	98-95-3	3.00	10.00	10.00
Isophorone	78-95-1	100.00	10.00	55.00
2,4-Dimethylphenol	105-67-9	100.00	20.00	60.00
2,4-Dichlorophenol	120-83-2	20.00	10.00	15.00
1,2,4-Trichlorobenzene	120-82-1	9.00	1.00	5.00
~~Naphthalene~~	~~91-20-3~~	~~300.00~~	~~N/A~~	~~N/A~~

Hexachlorobutadiene	87-68-3	1.00	1.00	1.00
4-Chloro-3-methylphenol	59-50-7	100.00	20.00	60.00
Hexachlorocyclopentadiene	77-47-4	50.00	10.00	30.00
2,4,6-Trichlorophenol	88-06-2	3.00	20.00	20.00
2,4,5-Trochlorophenol	95-95-4	700.00	10.00	355.00
Acenaphthene	83-32-9	400.00	10.00	205.00
2,4-Dinitrophenol	51-28-5	10.00	40.00	40.00
2,4-Dinitrotoluene	121-14-2	.05	10.00	5.03
Diethylphthalate	84-66-2	5000.00	10.00	2505.00
Flourene	86-73-7	300.00	10.00	155.00
N-Nitroso-diphenylamine	86-30-6	7.00	20.00	20.00
Hexachlorobenzene	118-74-1	0.02	10.00	10.00
Pentachlorophenol	87-86-5	0.30	1.00	1.00
Phenanthrene	85-01-8	100.00	10.00	55.00
Anthracene	120-12-7	2000.00	10.00	1005.00
Di-n-butylphthalate	84-74-2	900.00	20.00	460.00
Flouranthene	206-44-0	300.00	10.00	155.00
Pyrene	129-00-0	200.00	20.00	110.00
Butylbenzylphthalate	85-68-7	100.00	20.00	60.00
3,3-Dichlorobenzidine	91-94-1	0.08	60.00	60.00
Benzo(a)anthracene	56-55-3	0.05	10.00	10.00
Chrysene	218-01-9	0.5	20.00	20.00
Bis(2-Ethylhexyl)phthalate	117-81-7	3.00	30.00	30.00
Benzo(b)flouranthene	205-99-2	0.05	10.00	10.00
Benzo(k)flouranthene	207-08-9	0.5	2.00	2.00
Benzo(a)pyrene	50-32-8	0.005	20.00	20.00
Indeno(1,2,3-cd)pyrene	193-39-5	0.05	20.00	20.00
Dibenzo(a,h)anthracene	53-70-3	0.005	20.00	20.00
Benzo(g,h,i)perylene	191-24-2	100.00	20.00	60.00
PESTICIDES/PCBS				
alpha-BHC	319-84-6	0.006	0.02	0.02
beta-BHC	319-85-7	0.20	0.04	0.12
~~delta-BHC~~	~~319-86-8~~	~~5.00~~	~~N/A~~	~~N/A~~
gamma-BHC (Lindane)	58-89-9	0.20	0.20	0.20
Heptachlor	76-44-8	0.008	0.04	0.04
Aldrin	309-00-2	0.002	0.04	0.04
Heptachlor epoxide	1024-57-3	0.004	0.20	0.20
Endosulfan I	959-98-8	0.40	0.02	0.21
Dieldrin	60-57-1	0.002	0.03	0.03
4,4'-DDE	72-55-9	0.10	0.04	0.07
Endrin	72-20-8	2.00	0.04	1.02
Endosulfan II	33213-65-9	0.40	0.04	0.22
4,4'-DDD	72-54-8	0.10	0.04	0.07
Endosulfan sulfate	1031-07-8	0.40	0.08	0.24
4,4'-DDT	50-29-3	0.10	0.06	0.08
Methoxychlor	72-43-5	40.00	10.00	25.00
Toxaphene	8001-35-2	0.03	3.00	3.00
PCBs (Polychlorinated Biphenyls)	1336-36-3	0.02	0.5	0.50

TARGET ANALYTE LIST

INORGANICS				
Antimony	7440-36-0	2.00	20.00	20.00
Arsenic	7440-38-2	0.02	8.00	8.00
Barium	7440-39-3	2000.00	200.00	1100.00
Beryllium	7440-41-7	0.008	20.00	20.00
Cadmium	7440-43-9	4.00	2.00	3.00
Chromium	7440-47-3	100.00	10.00	55.00

Copper	7440-50-8	1000.00	1000.00	1000.00
Iron	7439-89-6	300.00	100.00	200.00
Lead	7439-92-1	5.00	10.00	10.00
Manganeese	7439-96-5	50.00	6.00	28.00
Mercury	7439-97-6	2.00	0.50	1.25
Nickel	7440-02-0	100.00	10.00	55.00
Selenium	7782-49-2	50.00	10.00	30.00
Silver	7440-22-4	40.00	2.00	21.00
Sodium	7440-23-5	50000.00	400.00	25200.00
Thallium	7440-28-0	0.50	10.00	10.00
Zinc	7440-66-6	5000.00	30.00	2515.00
Cyanide	57-12-5	200.00	40.00	120.00
DIOXIN				
TCDD (2,3,7,8-Tetrachlorodibenzo-p-dioxin)	1746-01-6	0.0000002	0.01	0.01