Chapter 10 Dredged Material Disposal and Post-Dredge Surface Management

Under this guidance, a management decision can be made for the dredged material and the post-dredge surface (PDS) at one of three stages (Figure 10-1):

- Sediment is determined suitable for unconfined, aquatic disposal/exposure after the Level 1 site history review (per Chapter 3)
- Sediment is determined suitable (or unsuitable) for unconfined, aquatic disposal/exposure after the Level 2A physical and chemical characterization (per Chapters 4, 5, and 6)
- Sediment is determined suitable (or unsuitable) for unconfined, aquatic disposal/exposure after the Level 2B biological testing and/or special evaluations are completed (Chapters 7, 8, and 9)

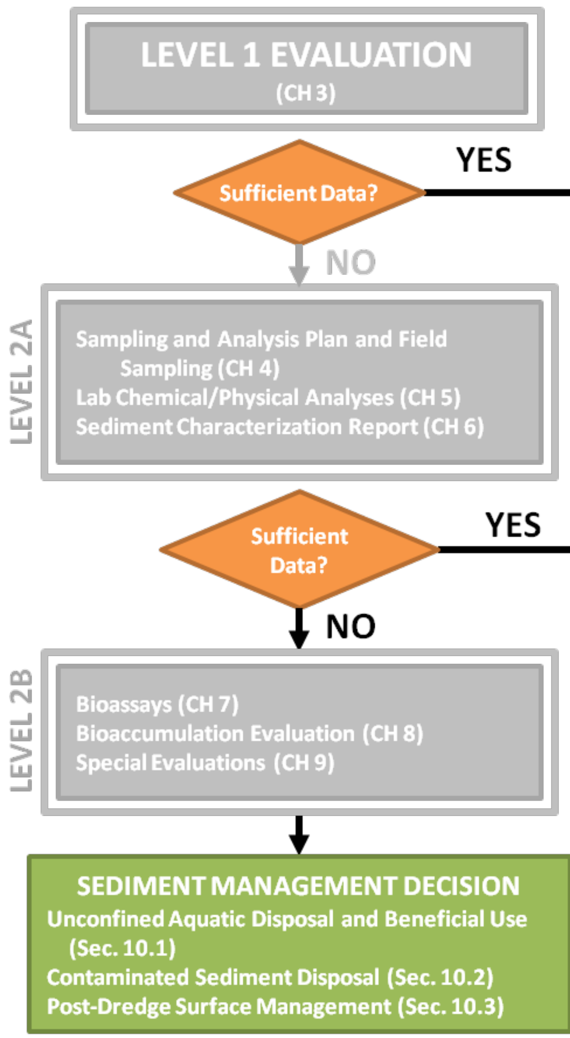

Figure 10-1. The sediment evaluation process culminates in a management decision for the dredged material and post-dredge surface.

The local review team documents the suitability of the dredged material for unconfined, aquatic disposal. The project proponent must identify their preferred dredged material disposal location as part of the Level 1 information submittal. However, depending on the project location and the suitability of the dredged material, the project proponent's range of possible disposal sites may be limited. In some cases only one disposal option may be available. Additionally, if the dredged material contains debris, the project proponent may be required to remove the debris prior to disposal. The local review team will work with the project proponent and the Regulatory or civil works project manager to identify applicable dredged material disposal and debris management options consistent with the suitability determination.

The local review team also documents the suitability of the PDS for unconfined, aquatic exposure. If the post-dredge surface is unsuitable, the project proponent's range of possible PDS management options may be limited. In some cases only one PDS management option may be available. The local review team will work with the project proponent to identify PDS management options that are consistent with the suitability determination.

This chapter describes the types of disposal options for suitable or unsuitable dredged material and identifies potential management strategies for contaminated post-dredge surfaces. Detailed guidelines for environmental dredging can also be found in *Technical Guidelines for Environmental Dredging of Contaminated Sediments (ERDC/EL TR-08-29)* (ERDC, 2008).

10.1 Unconfined Aquatic Disposal and Beneficial Use

Options for unconfined, aquatic disposal and beneficial use of suitable dredged material are described in this section. All aquatic disposal options must be coordinated with the local review team.

As a part of the permit review (or compliance), the Regulatory Project Manager must coordinate with the appropriate Corps Navigation Project Manager for in-water disposal planned in or adjacent to Corps federal navigation channels on the Columbia River and the Oregon Coast. Similarly, the Regulatory Project Manager must coordinate with the appropriate Corps Navigation Project Manager for dredged material disposal at sites selected by the Corps (under the CWA[1]) at the mouth of the Columbia River or along the Oregon Coast. In order to use a multiuser site in Puget Sound, Grays Harbor or Willapa Bay (managed by the Washington DMMP), the proponent must obtain a "site use authorization" from the Washington Department of Natural Resources.

Coordination with the EPA and Corps Ocean Dumping Coordinators is required to use ocean dredged material disposal sites (ODMDSs) designated by EPA under section 102 of the MPRSA or selected by the Corps under section 103 of the MPRSA. Concurrence by the EPA Regional Administrator is required for all projects (both Corps and non-Corps) proposing transport to and disposal of dredged material at an ODMDS.

10.1.1 Dispersive Disposal

Dredged material placed at dispersive sites does not stay on site, but is rapidly dispersed with the tides or river current. Examples of dispersive sites include:

[1] 33CFR335.2

- Puget Sound dispersive disposal sites at Port Angeles, Port Townsend, and Rosario Strait, in Washington
- In-bay, estuarine sites (e.g., Point Chehalis in Grays Harbor; Site G in Coos Bay)
- Nearshore CWA or MPRSA disposal sites in the Pacific Ocean (e.g., the North Jetty Site at the mouth of the Columbia River and the shoreward half of ODMDS-F at Coos Bay, Oregon)
- Flow lane disposal in the Columbia River
- Dispersive beneficial use sites/projects throughout the states of Idaho, Oregon, and Washington

Because the material moves offsite, disposal actions planned at dispersive sites may be subject to more stringent sediment management guidelines (e.g., thresholds for dioxins/furans concentrations in the Puget Sound). Monitoring at these sites is not be possible, because the disposed material is rapidly transported off site.

10.1.2 Non-Dispersive Disposal

Dredged material placed at non-dispersive sites stays on site, and sequential disposal events result in a combination of mixing with, and burial of, previously-placed dredged material. These sites are subject to post-disposal monitoring and management. Examples of non-dispersive sites include:

- Puget Sound non-dispersive disposal sites at Anderson/Ketron Island, Bellingham Bay, Commencement Bay, Elliott Bay, and Port Gardner, in Washington
- Offshore ODMDSs in the Pacific Ocean (e.g., the Deep Water Site off the mouth of the Columbia River and Yaquina Bay North ODMDS at Newport, Oregon)
- Non-dispersive beneficial use sites/projects throughout the states of Idaho, Oregon, and Washington

10.1.3 Beneficial Use of Dredged Material

"Beneficial use" is the placement or use of dredged material for some productive purpose. While the term "beneficial" indicates some "benefit" is gained by a particular use, the term has come to generally mean any "reuse" of dredged material. As part of regional sediment management goals, the RSET agencies support the productive reuse of dredged material. There are numerous resources and case studies available regarding the beneficial uses of dredged material. Two federal guidance documents provide general information and planning considerations:

- *Identifying, Planning, and Financing Beneficial Use Projects Using Dredged Material* (Beneficial Use Planning Manual) (USEPA and USACE, 2007)
- Corps Engineer Manual No. 1110-2-5026, *Beneficial Uses of Dredged Material* (USACE, 1987)

Depending on its characteristics, particularly grain size and sediment chemistry, dredged material may be suitable for beach nourishment projects, structural or non-structural fill, landfill cover(s), habitat development projects, wetland enhancement/restoration projects, capping contaminated-sediment sites, or a variety of other uses. The use of suitable dredged material in habitat and wetland creation, enhancement, and restoration offers a unique opportunity to use sediments as a resource and, at the same time, restore, and improve degraded habitats in ocean, riverine, estuarine, and adjacent uplands.

Degraded lands such as active and inactive landfills, brownfield sites, and quarry sites can offer another unique opportunity to combine the use of dredged material with the environmental and economic restoration of otherwise unproductive or contaminated properties. All of these sites have disturbed environments and limited natural resource value in their present condition. Many of these sites also generate leachate and surface water runoff that contaminate surrounding soils, aquifers, and surface water. The beneficial use of dredged sediment for land remediation under properly controlled conditions and in conjunction with engineering and institutional controls can provide a safe and economical way of remediating these sites.

Project proponents considering beneficial-use of dredged material should bring these projects to the attention of the local review team early in the evaluation process. The proponent will be asked to provide either a brief written project description, or provide a presentation of the proposed project. Early coordination is critical, especially if the state claims ownership of the dredged material desired for reuse. If the dredged material is not state-owned, the project proponent should approach the material owner and negotiate for its use.

Materials proposed for unconfined, aquatic beneficial use must be tested per the methods described in this guidance. Additional chemicals may need to be analyzed, or alternative screening levels may be requested by another agency. Detected chemicals of concern must fall below the applicable screening levels (presented in Chapter 6); if necessary, bioassays must pass the interpretive criteria presented in Chapter 7. The local review team's suitability determination memorandum will document the sediment quality of project sediments relative to the SEF SLs. Material that has concentrations of chemicals greater than the SL1 but lower than the SL2 (i.e., the cleanup screening level) may be allowed for beneficial use on a case-by-case basis after consideration of site-specific factors and coordination with landowners and/or resource agencies. However, physical and chemical compatibility of the sediments for a particular in-water beneficial use must be approved by appropriate regulatory agencies, and in some cases more stringent screening levels may apply (e.g., habitat creation projects).

10.1.4 Debris Management

Both CWA[2] and MPRSA[3] prohibit the discharge of debris at disposal sites, where its discharge may 1) create a navigation hazard, 2) result in negative habitat alterations, or 3) be otherwise contrary to the public interest. Debris originates from both anthropogenic and non-anthropogenic sources, and includes (but is not limited to): rock, semi-consolidated dredged material, rip rap, logs/fallen trees, pilings and treated wood, scrap wood, concrete fragments, tires, marketable spilled products (aggregate, wood chips, scrap metal, etc.), discarded large metal and plastic objects (shopping carts, appliances, cables, rebar, wiring, chains, pipes, etc.), and other trash.

In coordination with civil works project managers, Regulatory project managers, and the regulated public, the local review teams are responsible for establishing district/state-specific procedures to manage debris. The need to manage debris is informed by:

[2] 40CFR230, CWA 404(b)(1) Guidelines, Subparts A, B, and H
[3] 40CFR227.5 (MPRSA, Prohibited materials)

Empirical Evidence Dredging records, sediment sampling, and other types of surveys (trawls, remotely operated vehicles, video sleds, etc.) indicate debris is either present or absent.

Proposed Dredging Method Hydraulic dredging methods (pipeline and hopper dredges) typically exclude debris from the dredged material. Mechanical dredging, with either an open or closed bucket, indiscriminately excavates the sediment and the debris interspersed therein.

Dredging Frequency Projects that are frequently maintained are less likely to contain debris than projects that are dredged once per decade.

Proximity to Debris Sources (Reason to Believe) Projects in urban settings or rural projects that receive natural debris inputs (branches and logs from fallen trees) are more likely to contain debris than projects that are removed from debris sources.

If debris management is deemed to be necessary by the local review team, they will coordinate with the civil works or Regulatory project manager (and project proponent) to develop a debris management plan. The plan may require that a debris screen (aka “grizzly”) placed over the receiving barge/scow or other satisfactory method for removal and isolation of debris until it can be disposed at an appropriate upland facility.

10.2 Contaminated Sediment Disposal

Identification of reasonable disposal sites for contaminated sediments must take into account multiple criteria, including ecologic, geologic, hydrogeologic, economic, social, and other factors. This section identifies potential disposal options for contaminated sediments. Depending on the acceptance criteria of the receiving facility, debris management may be required (as described in the section above).

10.2.1 Confined Aquatic Disposal

In confined aquatic disposal (CAD) facilities, contaminated sediments are placed in an existing or constructed subaquatic pit and capped with a thick cap. See Section 10.3.3 for general information and considerations on thick cap installation. The primary design components of a CAD facility are the physical (i.e., thickness and gradation) and chemical quality of the cap, depth, topography, and currents at the site. A CAD can be built without a net loss of habitat and in some instances, result in a net gain.

10.2.2 Nearshore Confined Disposal Facility

In a nearshore confined disposal facility (CDF) contaminated sediments are placed behind an engineered structure (berm or dike) in the shallow, nearshore environment for containment of dredged material. The confinement dikes or structures in a nearshore CDF enclose the disposal area, isolating the dredged material from adjacent waters during placement. In this document, nearshore confined disposal does not refer to subaqueous capping or CAD.

Nearshore confined disposal facilities provide an opportunity to confine the dredged material and incorporate development of upland areas. Potential effects to groundwater flow and existing structures in the adjacent upland area must be considered during the engineering of these facilities. Nearshore confined disposal facilities may result in a net loss of aquatic habitat that could require mitigation.

10.2.3 Upland Disposal

Upland disposal facilities can include either existing municipal landfills (mixed), or on-site fills dedicated solely to the sediment remediation project. For either type of landfill, materials require dewatering, and effluent from the material may require testing (see Chapter 9, Special Evaluations) if it is discharged back into the adjacent water body.

Solid Waste Landfills Existing solid waste landfills may accept contaminated sediments, as long as those sediments are not designated as hazardous waste. Sediments that are hazardous waste must be sent to a Subtitle C landfill. Each landfill has acceptance criteria for waste materials, and the landfill operator should be contacted to determine additional sampling, testing, and reporting requirements (which are different from those presented in this document).

Upland Confined Disposal Facilities Upland CDFs are developed adjacent to the dredge location or offsite where the project proponent has responsibility for the development and management of the facility. In the state of Washington, upland disposal is regulated by the local municipality, although return water from such sites may be regulated by Ecology, either through an existing industrial stormwater NPDES permit or as part of the dredging project individual 401. Upland disposal of dredged material in Oregon is regulated by ODEQ's Solid Waste Program and requires a solid waste letter of authorization or exemption for disposal or placement of dredged sediment at an upland site. Similarly, upland disposal of dredged material in Idaho is regulated by IDEQ's Solid Waste Program.

CDFs must be designed to eliminate contaminant transport pathways. Sediment and site water must be intensively managed in cells to ensure that the contaminated materials are retained and do not pose a risk to humans and other receptors. When the upland CDF is full, it can be capped and beneficially used for commercial or industrial development.

10.3 Post-Dredge Surface Management

If the local review team determines that the post-dredge surface is unsuitable for unconfined, aquatic exposure, then the proponent must identify how the post-dredge surface will be managed to reduce or eliminate exposure of the dredging residuals to the environment. Management strategies can be implemented during dredging to reduce generated residuals and after dredging to manage both undisturbed residuals and generated residuals. The management strategies identified by the project proponent should be developed collaboratively with local review team involvement. To ensure the efficacy of the selected management option(s), the local review team and/or the permitting agencies may also require a monitoring component.

10.3.1 Reducing Generated Residuals during Dredging

Methods for characterizing dredging residuals (i.e., generated residuals + undisturbed residuals) are briefly discussed in Chapters 4 and 9. Generated residuals will occur in every dredging project, but the degree of their formation is a function of a number of factors including:

- Sediment properties such as in situ dry bulk density (solids concentration, solids content or water content), organic content, particle-size distribution, and mineralogy.
- Site conditions such as water depth, currents, waves, and presence of hardpan or bedrock.

- Nature and extent of impediments, such as debris, loose cobbles, boulders, and obstructions.
- Operational considerations such as the thickness of dredge cuts, dredging equipment type, method of operation, and skill of the operator.

Operational Controls If dredge prism sediments are contaminated, the local review team may require that generated residuals be minimized through the application of operational control measures. Operational controls to manage generated residuals may include changes in dredging methods and/or in operation of the equipment. Examples of operational controls to reduce generated residuals include:

- Reducing the dredging rate, especially as the bucket approaches the sediment surface and extraction of the bucket from the sediment surface after closing
- Reducing bucket over-penetration, which can cause sediment to be expelled from the vents in the bucket or cause excess sediment to be piled on top of the bucket and fall back during bucket retrieval
- Eliminating overflow from barges during dredging or transport or managing/treating return water
- For pipeline dredging, modifying the depth of the cutterhead, rate of swing of the ladder and of the rotating cutterhead, and reducing the speed of advance of the dredge
- Sequencing the dredging by moving upstream to downstream
- Varying the number of dredging passes (vertical cuts) to increase sediment capture
- Using properly sized tugs and support equipment
- Using an environmental bucket

If generated residuals are a concern, the local review team should work collaboratively with the proponent to identify operational controls (ERDC, 2008).

Engineered Controls Engineered controls may also be used on a limited basis to keep suspended sediments from migrating offsite. However, these can be very costly and are typically used for cleanup dredging. Examples of engineered controls include silt curtains and screens, cofferdams, and sheet-pile enclosures. Before an engineered control is selected, the following questions should be asked:

- Are there more cost-effective operational controls that would reduce generated residuals?
- Is deployment of the engineering control feasible given site conditions?
- What is the function and purpose of the engineering control?
- What is known about the effectiveness of the engineering control on similar projects?
- What information is available on selection, design, specification, and deployment of engineering controls on similar projects?
- What is the risk to federally protected species in the dredge area if the engineering control is implemented (entrainment)?

Silt curtains and silt screens (typically referred to as curtains) are the most commonly required engineered controls. Curtains are made of impervious materials, such as coated nylon, and primarily redirect all water flow around the enclosed area; screens are made from synthetic geotextile fabrics, which allow some water flow, but retain a large fraction of the suspended solids inside the screened area.

The effectiveness of silt curtain installation is primarily determined by the hydrodynamic conditions at the site. Silt curtains are most effective in relatively shallow, quiescent water (currents <2.5 ft/s), without significant tidal fluctuations. As water depth increases and turbulence caused by currents and waves increases, it becomes increasingly difficult to isolate the dredging operation from the ambient water effectively. Conditions that will reduce the effectiveness of the silt curtain include:

- Strong currents
- High winds.
- Changing water levels.
- Excessive wave height (including ship wakes).
- Drifting ice and debris.
- Continual movement of equipment into or out of the curtained area.

The effectiveness of silt curtains is also influenced by the quantity and type of suspended solids, the mooring method, and the characteristics of the barrier. A cleanup dredging pass may be necessary to remove residuals that are redeposited within the silt curtain, or other containment barrier (ERDC, 2008).

10.3.2 Monitored Natural Recovery

Monitored natural recovery (MNR) refers to a remedial approach in which natural processes such as sedimentation, sediment mixing, and chemical degradation, reduce contaminant concentrations over time. MNR is a potential approach for managing post-dredging residuals if the layer thickness and concentrations of the residuals would allow for MNR within acceptable time frames (as determined by the resource agencies). The following project-specific parameters should be evaluated to determine if MNR is an acceptable management strategy for contaminated post-dredge surfaces:

- Contaminant type(s) and concentration(s)
- Sedimentation rate (calculated across the dredge area, using historical bathymetry)
- Quality of the shoaling material
- Currents and stability of the shoaling material
- Mudline slope

If MNR is accepted, post-dredge sampling and analysis of the contaminant(s) must be conducted to verify that the site is, in fact, recovering. At a minimum, post-dredge samples should be collected at two points:

- Within one week after the dredging project is completed (if the project is large and multi-phased, then post-dredge sampling must be conducted after the completion of each phase of dredging)
- Approximately halfway through the estimated recovery period, to verify the efficacy of MNR

10.3.3 Capping

Capping is one method to isolate contaminated sediment from the surrounding aquatic environment. Capping is typically used in conjunction with cleanup projects, not maintenance dredging projects, and caps typically require long-term monitoring to ensure the cap is functioning as desired. Over time, and coupled with successful source control, waterways can be expected to recover and constitute much-improved habitat for invertebrates, fish, and birds. Capping may be considered as an option when the costs of removal are deemed greater than the benefit, and navigation depths are not a concern. There are two types of caps:

Thin Cap (Residuals Cover/Enhanced Natural Recovery) A thin cap is less than 3 feet thick and composed of unconsolidated, clean sands/silts, placed without armoring materials, in low-energy environments. A thin cap can be used for dredged materials with lower contaminant concentrations in which hazards to human health and the environment are low. Thin capping improves the chemical or physical properties of the upper sediment bed, which constitute the biologically active zone. Note that most dredging projects use what regulatory agencies refer to as "cover," not a cap; sand cover typically consists of a nominal 1-ft layer and post-project monitoring is typically not required.

Thick Cap (Engineered Isolation Cap) A thick cap is greater than 3 feet thick and composed of clean sands/silts with armoring to protect from scouring in high-energy environments. A thick cap is engineered to manage dredged material with higher contaminant concentrations, and it is typically permanent. As such, capping is best implemented in off-channel areas or within deep areas of the waterway that are well below the current maximum dredging depth (or future planned dredging depth).

A properly installed thick cap can be placed over contaminated dredged materials to effectively contain and isolate them from the benthos and overlying water column and habitat. A thick cap must be designed to resist:

- Mechanical scour from vessel traffic (bow thrusters; prop wash)
- Natural scour from wave action or strong river current
- Penetration by burrowing organisms
- Contaminant migration through the cap (upward or laterally) into the surrounding water body

10.4 References

DMMP. 2014. Dredged Material Evaluation and Disposal Procedures: User Manual (December 2014). *Prepared by* the Seattle District Dredged Material Management Office.

ERDC. 2008. Technical Guidelines for Environmental Dredging of Contaminated Sediments. ERDC Environmental Laboratory Technical Report No.: ERDC/EL TR-08-29, *prepared by* M.R. Palermo, P.R. Schroeder, T. Estes and N.R. Francingues.

USACE. 1987. Beneficial Uses of Dredged Material (EM 1110-2-5026). 30 June 1987.

USEPA and USACE. 2007. Identifying, Planning, and Financing Beneficial Use Projects Using Dredged Material. October 2007.