INTERNATIONAL ASSESSMENT OF THE USE OF CONFINED AQUATIC DISPOSAL FACILITIES FOR CONTAMINATED DREDGED MATERIAL

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ABSTRACT

This assessment reviewed the use of confined aquatic disposal facilities and associated policies by countries world-wide to manage and monitor the disposal of contaminated dredged material into ocean and estuarine waters. The assessment emphasized environmental, financial, and legal risks and liabilities and what procedures are used to manage and minimize risks and liabilities to government permit authorities.

INTRODUCTION

Recent modifications to the international treaty on disposal of wastes into ocean waters (i.e., London Convention 1972 and the 1996 Protocol) recognize that the appropriate use of management techniques for disposal of contaminated dredged material in ocean waters is an acceptable approach for management of dredged material.

Requests for information on these issues were sent to a total of 13 countries and information from 10 of those countries is summarized in this paper. Information on the internet was also an excellence source.

WHAT MANAGEMENT TECHNIQUES ARE USED FOR DISPOSAL OF CONTAMINATED DREDGED MATERIAL IN ESTUARINE AND OCEAN WATERS?

"Management techniques" include carefully designed and constructed confined aquatic disposal facilities. Four types of confined aquatic disposal facilities (Figure 1) are in use:

1. Confined aquatic disposal (CAD) cells and capping
   The objective of confined aquatic disposal into CAD cells is to isolate the contaminated dredged material by disposal of the contaminated dredged material at a specific aquatic site and capping. The disposal can be in natural depressions in the seafloor, in borrow pits in the seafloor from mining operations (e.g., beach nourishment), or in specifically designed and constructed cells to contain the contaminated dredged material. Capping is the controlled placement of clean material over the CDM to effectively isolate it from the surrounding environment.

2. Level bottom capping
   Confined aquatic disposal can be accomplished via disposal of the contaminated dredged material on the seafloor, creating a mound, and capping it with clean material.

3. Nearshore confined disposal facilities
   A nearshore confined disposal facility (CDF) is a constructed in-water disposal site with containment structures or constructed dikes in the water, taking advantage of the shoreline as a dike. Numbers of nearshore CDFs have been constructed such that new land has been created for alternate uses, such as airports or port facilities.

4. Island confined disposal facilities
   Simply stated, an island CDF is a containment facility for dredged material in open water and is the same as a nearshore CDF except the island does not use the shoreline as a containment dike. Island CDFs can be

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created in such a manner to have multiple objectives, including habitat restoration and recreational opportunities.

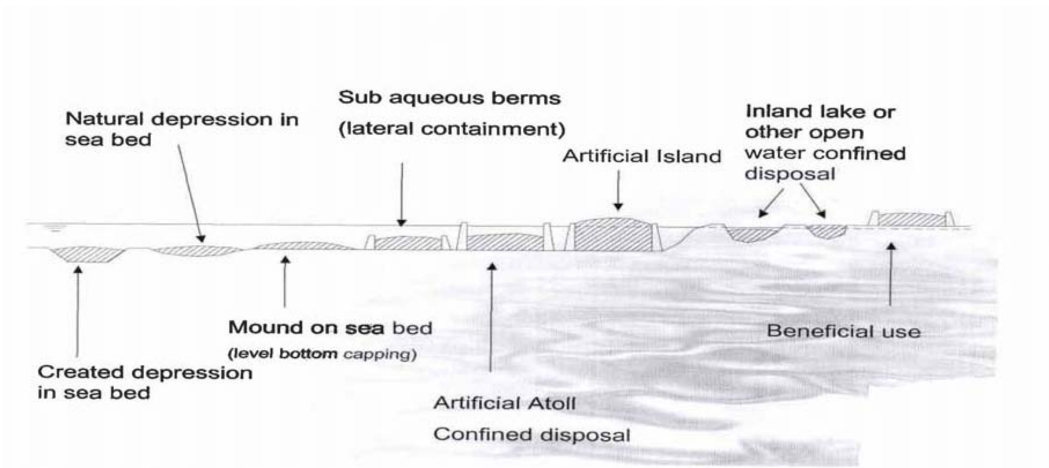

Figure 1. Confined aquatic disposal facilities (Vivian 2007)

A confined aquatic disposal facility including capping should be treated as an engineered project with carefully considered design, construction, and monitoring to ensure that the design is adequate. There are several factors which therefore must be carefully considered prior to approval of a confined aquatic disposal facility. These include potential water column impacts during disposal, efficacy of cap placement, and long term cap integrity for CAD cells and level bottom capping. For nearshore and island CDFs, important design factors include containment dikes, transport and disposal of material, site geometry and size, contaminant pathways, and dewatering and long term management.

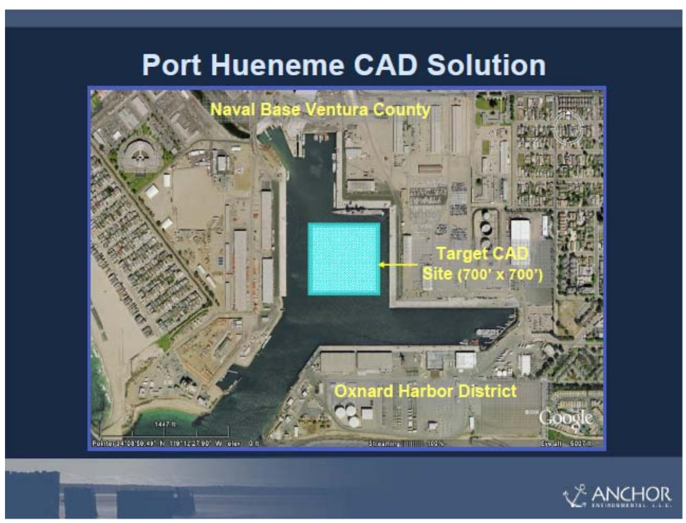

Figure 2. Use of CAD cell at Port Hueneme (Credit: Anchor Environmental)

WHAT COUNTRIES ARE USING CAD CELLS, NEARSHORE CDFS, OR ISLAND CDFS?

A wealth of experience from around the world demonstrates successful use of confined aquatic disposal facilities for isolation of contaminated dredged material. *This is an important point*, addressing one portion of the concerns regarding potential risks and liabilities.

The authors believe that most industrialized countries have used nearshore CDFs for disposal of contaminated dredged material, although a number of these CDFs were created well before current definitions of what constitutes contaminated dredged material were in place. Less information is available on nearshore CDFs as an explicit management technique for disposal of contaminated dredged material; disposal of dredged material as fill material into nearshore CDFs to create new land has been a common practice for decades. A comprehensive survey would likely identify hundreds of projects that placed dredged material into nearshore CDFs to create new land.

From those countries surveyed for this report, countries that have used (or are in final stages of planning) CAD cells for disposal of contaminated dredged material include: Netherlands, Hong Kong China,, Norway, United Kingdom, Australia, and USA. Germany, Japan, and Korea stated that they do not dispose of contaminated dredged material in ocean waters. There are a number of island CDFs in use today, including the Netherlands and the USA. A total of 34 confined aquatic disposal facilities (CAD cells) were identified in the survey of countries.

A sample listing of countries and locations where CAD cells have been used for disposal of contaminated dredged material (see Figures 2-5) is provided below.

1981 - Rotterdam, Netherlands, 840,000 cubic meters
1981 - Norwalk Harbor, ~ 2,500 cubic meters
1984 - Seattle, Washington, USA, Duwamish, 840 cubic meters
1987 – One Tree Island Marina, Washington, USA
1992 - Hong Kong, China, Airport 10 million cubic meters
1992 - Ross Island, Portland, Oregon, USA, 122,000 cubic meters
1997 - Newark Bay, New Jersey, USA, 1.5 million cubic meters
1997-2000 – Boston Harbor, 1,200,000 cubic meters
2000 - Puget Sound Naval Shipyard, Washington, USA, 290,000 cubic meters
2001 - Los Angeles, California, USA, Energy Island, 765,000 cubic meters
2003 - Providence Harbor, 700,000 cubic meters
2006 - Oslofjord, Norway, 670,000 cubic meters
2007 - Port of Tyne, United Kingdom, 160,000 cubic meters
2008 - Port Hueneme, California, USA, 250,000 cubic meters
2008 - Melbourne, Australia, 18 million cubic meters
2008-2010 – Boston Harbor, Massachusetts, USA
2010 - New London Harbor, Connecticut, USA

Figure 3. Nearshore CDF----Slufter in the Netherlands

WHAT ARE THE ADVANTAGES AND DISADVANTAGES OF CAD CELLS, ISLAND CDFS, AND NEARSHORE CDFS?

Confined aquatic disposal facilities represent an acceptable compromise when costs, regulatory acceptance, environmental risk, and public perception and acceptance are considered, and have a number of advantages over upland CDF disposal of contaminated dredged materials.

- Environmental and human health risk of confined aquatic disposal has been shown to be one of the lowest risk options, compared to upland disposal.

- The cost of island, nearshore, and upland CDFs can be 5-100 times higher than level bottom capping and CAD cells.

- Regulatory permitting agencies and natural resource agencies appear to find the case for use of confined aquatic disposal facilities compelling for isolation of the contaminants; however, nearshore and island CDFs consume bay or ocean bottom for disposal, resulting in less aquatic habitat on the bay or ocean floor. Regulatory agencies are not always all that keen to take bottom habitat out of service.

- When completed, island or nearshore CDFs may eventually be used for habitat or other uses such as recreational boating facilities.

- Experience to date has been that initial public concerns about disposal of contaminated dredged material in confined aquatic disposal facilities have been overcome through excellent analyses of the disposal alternatives and good communications. One of the concerns expressed by NGOs is that use of confined aquatic disposal facilities will result in insufficient attention placed upon preventing the contamination of sediments.

The advantages of confined aquatic disposal facilities as stated by the Port of Boston (USA):

> *"Cost effective. Environmentally sound. Confines impact of disposal to dredging footprint (the way we did it - not true for all projects). Acceptable (and strongly supported) by permitting agencies and NGOs."*

WHAT PRACTICES/POLICIES ARE GOVERNMENTS USING TO ISSUE PERMITS FOR DISPOSAL OF CONTAMINATED DREDGED MATERIAL IN ESTUARINE AND OCEAN WATERS?

Analysis of the information found on the internet and from the country responses shows striking similarities in practices and policies that are used in the overall approach to permit issuance and in the specific permit conditions. The general processes for ensuring that contaminated dredged material is disposed of properly minimizing environmental risk, and thereby government liability, include:

- <u>Preparation of environmental impact assessments</u>-- Environmental impact assessments provide the basic foundation for predicting the potential harm to the bays, estuaries, or ocean water resources of proposed dredging and dredged material disposal projects. Key parts of an environmental impact assessment:
  - Baseline monitoring of the bay or estuary
  - Site selection
  - Engineering design of the confined aquatic disposal facility
  - Risk assessment

- <u>Establishment of an organization, setting procedures, and development of environmental management plans</u>--This area includes the government's initiation of the overall management structure to oversee the project, the development of management and operational criteria, the issuance of the permit itself including technical and public review, and the communication mechanisms with stakeholders

- <u>Specific conditions in permits</u>-- The specific conditions in permits are critical to minimizing the risks of environmental problems and government liabilities.

- <u>Monitoring programs pre-, during-, post-dredging and disposal</u>-- Requirements for monitoring programs are included in permits but are emphasized here, given their importance in the overall project to ensure that the environment is protected and that the integrity of the confined aquatic disposal facility is maintained.

A great deal of effort was dedicated to assessing the practices and policies used by various countries when issuing permits for disposal of contaminated dredged material disposal in confined aquatic disposal facilities. *This is the second important point.* There are important lessons in the level of attention and detail provided by those countries; the reader is encouraged to understand that risks and liabilities can be minimized through management actions by application of planning and operational considerations, similar to those followed by the reporting countries.

WHAT ARE THE RISKS AND LIABILITIES OF CONFINED AQUATIC DISPOSAL?

The environmental risk is fairly straight-forward: contaminants could be distributed into the surrounding aquatic environments, including groundwater. The failure of the confined aquatic disposal facility could be the result of poor design or operation of the CAD cell or level bottom capping, the island CDF, or the nearshore CDF. Each of these facilities is designed based upon specific parameters, such as a containing structure/dikes, low energy environments, potential exposure pathways, or storm events.

The potential liabilities include simply: (1) negligent issuance of a permit that has inadequate conditions, and (2) responsibility to fix the problem with the confined aquatic disposal facility (e.g., repair a dike) (3) responsibility to clean-up the environmental problem resulting from the project (e.g., clean-up contaminants in the bay that leaked from the broken dike). The precise liability *depends* on a number of factors, including, but not necessarily limited to, existing legislation, regulations, permit conditions, and agreements between the permit issuing authority and dredging project sponsors.

Figure 4. Malmøykalven, Norway, CAD cell at 70 m water depth (Jorgensen 2008)

Liabilities can be limited for the permit issuing authority through permit requirements and agreements with permittees. *This is the third important point.* Potential approaches for consideration by Environment Canada include the following as reported by the surveyed countries.

- The Netherlands stated that the federal government is responsible.
- The United Kingdom uses an informal approach with permittees to share liability.
- Hong Kong China said that the government is the owner of the CAD cells and that their approach to limit risk and liability was to do a good upfront environmental impact assessment and apply management procedures and operational controls.
- The USA has several models depending upon the locality of the dredging project. In the USA, maintenance of federal channels into ports is the responsibility of the U.S. Army Corps of Engineers who is also the permit authority.

1. For federal channels, the Corps authorizes (equivalent of a permit) itself to conduct the dredging and disposal (with review by other federal agencies and state agencies). In these cases, the Corps is carries the liability for the dredging and disposal.

2. For dredging projects sponsored by port authorities, permits are issued to the port authority with boilerplate language which states that the U.S. government accepts no liability for the permitted action. In the case of the Newark Bay CAD cell, the permit required the Port of New York/New Jersey to procure an Owner Controlled Environmental Insurance Policy with a limit of $20,000,000 and a deductible of $100,000 relating to the construction, operation, management, and eventual closure of the Newark Bay CAD cell.

   For private parties (e.g., an oil and gas terminal) to use the Newark Bay CAD cell, they were/are required to sign an extensive agreement with the Port of New York/New Jersey which ensures that the full risk and liabilities of using the site for disposal of contaminated dredged material was carried by the users. The Port of New York/New Jersey allows private sponsors to use the CAD cell through a signed agreement. The agreement requires extensive insurance for private users of the site.

3. In one case, the Corps of Engineers delegated responsibility for operation and maintenance of the CAD cells to the State of Rhode Island, which then issued permits for private users, charging fees depending upon the amount of contaminated dredged material disposed in the CAD cells.

ARE FEES CHARGED TO PERMIT APPLICANTS FOR DISPOSAL OF CONTAMINATED DREDGED MATERIAL?

In short, all countries collect fees for the issuance of a dredging and disposal permit. Fees vary by country.

- Only one country (i.e., the Netherlands) stated that it collected fees for permit administration and for insurance objectives, to address future liability issues associated with maintenance of the confined aquatic disposal facilities or clean-up; however, the fees are only 1 to 2 Euros per cubic meter of dredged material disposed. It was noted that the amount of fees are low relative to the potential long term scenarios, are more symbolic than realistic, and go into the government treasury.

- Hong Kong China, collect fees but they do not serve any type of insurance purpose.

- The Corps of Engineers permit fee in the USA is $100. Thus, no funds are provided for insurance objectives for the federal government. In the case of the Providence River CAD cell, the State of Rhode Island is responsible for management and monitoring. The state charges fees for use of the site on a sliding scale from $15.7 to $32.7 per cubic meter ($12 to $25 per cubic yard) of dredged material placed in the CAD cell. The state collected fees are used by the state program primarily for management and monitoring the Providence River CAD cell, and also for coastal resources management.

Figure 5. Newark Bay, New Jersey, CAD cell site

WHAT ARE THE LESSONS LEARNED?

In terms of lessons learned, the following quotes are instructive:

Netherlands: Regarding liability, the representative of the Netherlands stated:

> *"If anything goes wrong. the government pays. The amount of money is about 1 to 2 euro per cubic meter. We have disposal sites for 20 to 30 years now. And never anything went wrong."*

USA: The representative of the State of Rhode Island who is manager of the CAD cells in Providence River responded to the inquiry on liability with a statement of confidence in well designed CAD cells that there is not much that can go wrong:

> *"…..not much to break…...not many moving parts."*

When asked for lessons learned and suggestions to consider, the representative of the Port of Boston said:

> *"We thought it worked great and have used our initial project as a model for a maintenance dredging/disposal project that we completed last summer. Make sure you conduct borings in advance to fully understand subsurface conditions and CAD cell capacity (i.e. slope of side walls and depth to bedrock or other hard bottom will greatly affect cell capacity.)"*

WHAT ARE THE FINDINGS AND CONCLUSIONS?

The simple message resulting from this international assessment of practices and policies:

- A wealth of international experience demonstrates that contaminated dredged material can be effectively disposed in ocean and estuarine waters by applying management techniques, which include four types of confined aquatic disposal facilities.

- Application of the specific practices and policies will minimize environmental, financial, and legal risks and liabilities to the government permit issuing authority.

- Specific approaches used by several countries may be useful as models in assigning liability for short and long term responsibility for confined aquatic disposal facilities.

- While isolation of contaminated dredged material via confined aquatic disposal facilities is effective, government programs should continue working to prevent further contamination of sediments.

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