APPENDIX E2

DREDGED MATERIAL MANAGEMENT PLAN

BAYOU CASOTTE ENERGY LLC

CASOTTE LANDING NATURAL GAS IMPORT TERMINAL PROJECT

DREDGED MATERIAL MANAGEMENT PLAN

JULY, 2006

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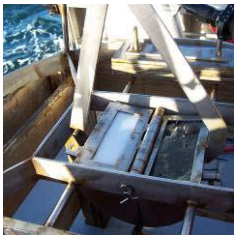

Dredged Material Management Plan

ENSR Corporation
July, 2006
Document No.: 01231-021-0041

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LIST OF ACRONYMS AND ABBREVIATIONS

BCDMMS	Bayou Casotte Dredged Material Management Site
Bgs	Below ground surface
BU	Beneficial Use
CDF	Confined Disposal Facility
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
DM	Dredged material
DMMP	Dredged Material Management Plan
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Environmental Site Assessment
FERC	Federal Energy Regulatory Commission
FSP	Field Sampling Plan
GPS	Global positioning system
LNG	Liquefied natural gas
mcy	Million cubic yards
ODMDS	Ocean Dredged Material Disposal Site
MCP	Mississippi Coastal Program
MLLW	Mean Lower Low Water
MDEQ	Mississippi Department of Environmental Quality
MDMR	Mississippi Department of Marine Resources
MPRSA	Marine Protection Research and Sanctuaries Act
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
SMA	Special Management Area
TSS	Total suspended solids
USACE	U.S. Army Corps of Engineers
WRDA	Water Resources Development Act

Executive summary

This Dredged Material Management Plan (DMMP) describes the dredging requirements, dredged material, operations, and recommended placement plan for the proposed onshore liquefied natural gas (LNG) import terminal and associated facilities located south of the existing Chevron, USA (CUSA) Pascagoula Refinery on Bayou Casotte, just east of Pascagoula, Mississippi in Jackson County. The proposed Casotte Landing Natural Gas Import Terminal Project includes construction of a slip and berth for offloading LNG carriers, relocation of existing Refinery Berths 6 and 7, and construction of facilities to receive and regasify LNG for transport into the nearby existing United States natural gas transmission grid. This project is described in detail in the Draft Environmental Impact Statement (DEIS) prepared by the Federal Energy Regulatory Commission, May 2006. This DMMP serves as supporting information for permitting by federal and state agencies.

Construction of the proposed slip will require dry excavation of approximately 1 Million cubic yards of material, to be used for site development and dredging of approximately 3.5 Million cubic yards of material to a depth of 46 feet below MLLW (42 feet required plus 2 feet advanced maintenance plus 2 feet allowable overdepth). The dredged material is composed of layers of sand and clay. Dredging also includes deepening Bayou Casotte between the existing federal navigation channel and the slip.

Placement alternatives for the dredged material were evaluated in the DEIS. The preferred placement site is the Pascagoula Ocean Dredged Material Disposal Site (ODMDS) located approximately 11 nautical miles offshore in the Gulf of Mexico. Dredged material sampling and characterization was recently completed to determine its suitability for disposal at the ODMDS. Material will be removed using mechanical dredging methods and transported via scows to the ODMDS. Beneficial use of the dredged material, including shoreline and wetland restoration, has been investigated extensively by the Corps of Engineers and the Mississippi Department of Marine Resources. The known beneficial use sites have limited capacity and will be considered for placement of a portion of the material if they are available at the time of project construction. It is estimated that dredging and placement operations will take 4 to 6 months.

After completion of the project, the slip area will shoal in at a rate of approximately 250,000 cubic yards per year which will require periodic removal to maintain the required 42-foot depth. Experience gained after the initial project is completed will determine the frequency of maintenance dredging. The preferred placement site for maintenance material is the ODMDS. As is the case with the slip construction, placement at beneficial reuse sites will be investigated when needed.

At this time there are no seasonal restrictions on dredging or placement. Model studies have shown that resuspension of material from dredging operations did not result in water column TSS concentrations significantly higher than those observed in Bayou Casotte. Dredging plans and specifications will incorporate any permit requirements and conditions and include contingency plans to ensure compliance.

1.0 Introduction

Bayou Casotte Energy LLC (Bayou Casotte Energy), a subsidiary of Chevron U.S.A. Inc. (CUSA), proposes to build and operate an onshore liquefied natural gas (LNG) import terminal and associated facilities (Terminal) south of the existing CUSA Pascagoula Refinery (Pascagoula Refinery) on Bayou Casotte, just east of Pascagoula, Mississippi in Jackson County. The proposed Casotte Landing Natural Gas Import Terminal Project (Casotte Landing, Project, or Terminal) includes construction of a slip and berth for offloading LNG carriers (LNGCs), relocation of existing Refinery Berths 6 and 7, and construction of facilities to receive and regasify LNG for transport into the nearby existing United States (U.S.) natural gas transmission grid. The Project is designed to process a nominal rate of 1.3 billion standard cubic feet per day (BSCFD). An overview of the proposed slip and berth can be seen in Figure 1-1. A more detailed project description is included in Draft Environmental Impact Statement (FERC, 2006)

Figure 1-1 Overview of the proposed facility

1.1 Scope

The Dredged Material Management Plan (DMMP) supplements the Draft Environmental Impact Statement (DEIS) for the Casotte Landing Natural Gas Import Terminal Project, prepared by the Federal Energy Regulatory Commission (FERC), May 2006, which describes alternative slip construction, excavation, and dredging methods for the Project slip. An initial draft DMMP was included in the Environmental Reports that served as the basis for the DEIS. Information from the DEIS is summarized in the DMMP where needed for clarity.

As a marine terminal, the construction and maintenance of this facility will require a significant amount of dredging. The DMMP provides information pertaining to the dredging and placement of dredged material associated with the Project. The DMMP describes the volume, and other characteristics of the dredged material removed in connection with the initial construction (new work dredging) of the Project as well as the dredged material requiring removal as a result of sedimentation (maintenance dredging) that may occur over the course of the project life (MNI, 2005).

The DMMP focuses on the dredging and material placement operations needed to complete the Project following the current preferred placement plan as described in the DEIS (Sect. 3.7).

This DMMP updates the draft DMMP dated January 2006 (ENSR, 2006a) and will serve as supporting documentation for the Joint Application and Notification process, in particular, the Individual Permit issued by the U. S. Army Corps of Engineers (USACE) to comply with Section 10 of the Rivers and Harbors Act of 1899 (33U.S.C. 403); Section 404 of the Clean Water Act (33 U.S.C. 1344; and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA), as amended) and associated requirements of

the Mississippi Department of Marine Resources (MDMR) and the Mississippi Department of Environmental Quality (MDEQ).

1.2 Project dredging requirement

The Project includes the construction of a new double-berth slip for accommodation of an LNG Berth and the relocation of an existing refinery berth for the Pascagoula Refinery along the eastern shore of Bayou Casotte (Figure 1-2). The upper 10 to 14 feet of material (approximately 1 million cubic yards [mcy]) will be excavated via traditional earth moving equipment and will be used on-site for construction purposes. The remaining material below the water table will be mechanically dredged (approximately 3.5 mcy) and the material placed at a suitable site(s).

1.3 History of site

Before industry moved into the area around 1960, the proposed slip area was largely aquatic as depicted in Figure 1-3. During the 1950's the slip area was filled, apparently with material dredged from Bayou Casotte as a way to establish what was then the largest industrial site in the state (Goodwin and Associates, 2005; C. Sullivan, 1985). The slip area and larger LNG terminal site were initially occupied by Corning Glass works (formerly Cohart Refractory), where high temperature brick was manufactured at the site until 1989 using a magnesite refractory process.

1.4 Prior studies and reports

A number of reports have been prepared by USACE and others to address dredging and its impacts on the area. Listed below are a few of the more significant reports that were used in the preparation of the DEIS and the DMMP for this project.

Draft Environmental Impact Statement for Casotte Landing Natural Gas Import Terminal Project, Federal Energy Regulatory Commission, May 2006. FERC is the lead Federal agency for preparing the Environmental Impact Statement for the Casotte Landing Natural Gas Terminal project. Included in the Draft EIS (DEIS) are alternative analyses for the project including dredged material placement. The DEIS was issued on May 19, 2006 by the FERC, with the public comment period scheduled through July 10, 2006.

Casotte Landing Slip Sediment Evaluation Report, ODMDS Suitability, ENSR Corporation, June 2006. This report summarizes the field investigations and chemical and biological test results performed on the dredged material to be removed to create the project slip. This data and sediment characterization provides the basis for Corps and EPA decision making for placement at the Pascagoula Ocean Dredged Material Disposal Site (ODMDS).

Special Management Area Plan for the Port of Pascagoula, Jackson County, Mississippi, Ralph M. Field Associates, Inc., November 1985. The Mississippi Coastal Program (MCP) was developed to implement the Mississippi Coastal Wetlands Protection Law which was passed in 1973. The MCP designed the Special Management Area (SMA) Plan for the Port of Pascagoula as a result of a three-year-long planning process initiated in 1982 and which included numerous discussion and negotiation sessions, as well as field reconnaissance and technical studies by a SMA Task Force. The SMA was established to adopt management plans through cooperative and voluntary processes involving local, state, and federal agencies. The objective of this plan was to establish a balance among competing interests in coastal areas, taking into consideration the diverse ecological values of the wetlands, the need for maintaining industrial requirements, the importance of wetlands to the fisheries industries, and other factors.

Environmental Impact Statement for the Designation of an Ocean Dredged Material Disposal Site Located Offshore Pascagoula, Mississippi, Robert Howard, July 1991. The Environmental Protection Agency (EPA) was the lead Federal agency for preparing the Environmental Impact Statement (EIS) for designation of a new Ocean Dredged Material Disposal Site (ODMDS) in the Gulf of Mexico south of Pascagoula, Mississippi. This report discusses the reasons why an Ocean Disposal site is needed outside of Pascagoula and the environmental requirements for placement of material at the ODMDS.

Dredged Material Management Plan, Pascagoula River Harbor, U.S. Army Corps of Engineers Mobile District, June 2003. This report addresses the disposal of material from the Pascagoula River Inner Harbor and a portion of the Upper Pascagoula Channel. The purpose of this report was to determine the best location for dredged material associated with the Pascagoula Channel.

Dredged Material Management Plan for Maintenance of Bayou Casotte Inner Harbor Pascagoula Harbor, Mississippi, U.S. Army Corps of Engineers Mobile District, January 2000. The dredged material management site for the Bayou Casotte Inner Harbor was at Greenwood Island. This site had been used for disposal of dredged material from the Bayou Casotte Inner Harbor since 1979. In the early 1990's it was found to have elevated lead levels in the soil. The U. S. Army Corps of Engineers, Mobile District, determined that Greenwood Island was no longer a suitable disposal area. The replacement site is the Bayou Casotte Dredged Material Management Site (BCDMMS). This report constitutes the decision document justifying the construction of the BCDMMS.

Chevron Products Company Pascagoula Refinery, Inland Testing Manual Tier I, Brown and Caldwell, December 2000. The Bayou Casotte Channel was proposed to be deepened from 38 feet to 42 feet and widened from 225 feet to 300 feet. The maintenance sediment from the Inner Bayou Casotte would be placed in a USACE permitted Confined Disposal Facility (CDF) to be constructed on the east shore of the Bayou Casotte mouth. This document has generated physical and chemical information about the sediment and surface water conditions in the Inner Bayou Casotte Harbor.

Chevron Products Company Pascagoula Refinery, Sampling and Analysis Plan Tier II, Brown and Caldwell, December 2000. This document outlines the Sampling and Analysis Plan (SAP) efforts that will be followed in order to evaluate the quality of effluent from the Chevron Products Company – Pascagoula, MS Refinery's 85-acre upland Confined Disposal Facility (CDF) during active dredging operations. The evaluation provides information that is used to determine potential impacts associated with effluent water discharge from Chevron's CDF to the receiving water during active dredge operations.

Joint Application and Notification for New Work and Maintenance Dredging at Refinery Marine Terminal Bayou Casotte, Mississippi, Brown and Caldwell, 2001. This report discusses Chevron's Products Company – Pascagoula, MS Refinery's need to modify the dimensions of the approach to its refinery marine terminal facilities and to deepen the approaches. The proposed new work and maintenance sediment was hydraulically placed in the 85-acre upland Confined Disposal Facility (CDF) that Chevron Products Company – Pascagoula, MS Refinery has operated and maintained.

Long-Term Comprehensive Master Plan for Beneficial Uses of Dredged Material Along Coastal Mississippi, U.S. Army Corps of Engineers, Mobile District, September 2002. The Corps coordinated with state and local agencies to establish links between dredging projects and projects along three Mississippi coastal counties (Hancock, Harrison, and Jackson) that may be able to beneficially use the dredged materials to enhance or restore coastal habitats.

Project Management Plan, Implementation of Comprehensive Master Plan for Beneficial Uses of Dredged Material Along Coastal Mississippi, U.S. Army Corps of Engineers, Mobile District, March 2003. This is the second phase of the Long-Term Comprehensive Master Plan. The objective of this plan is to prioritize the beneficial use sites and consider new sites not investigated previously. The report focuses on three of the most favorable projects for each of the three coastal counties.

Reconnaissance Geotechnical Investigation Report – Phase I. Casotte Landing LNG Terminal, Pascagoula, MS. Draft Report. URS Corporation, 2005 This report provided information used to determine the general physical characteristics of site soils and sediments and estimates of the volumes of each type of material to be excavated and dredged from the project slip area.

Figure 1-2 Project slip and Bayou Casotte Channel

Figure 1-3 Historic shoreline

2.0 Navigational requirements

Navigation to and from the Project will use the existing Federal navigation channels through the Mississippi Sound to the Bayou Casotte Channel. Figure 2-1 shows the federal channel system beginning at the Horn Island Pass Channel, through the Pascagoula Channel into the Bayou Casotte Channel to the Project slip. A detailed description of the LNG carrier transit in the Port of Pascagoula is included in the DEIS (Sect. 4.12.5). Ship simulation studies performed for the Project design have shown that modification to the Federal channels, including the existing turning basin adjacent to the Project, is not needed.

Figure 2-1 Federal channel system

2.1 Federal channels

The existing Bayou Casotte channel project depths were authorized in 1986 by Section 202 (a) of the Water Resources Act of 1986 (WRDA86) (Public Law 99-662) which include modifications to the Federal navigation project for Pascagoula Harbor. The authorized dimensions are: Deepening and widening the Gulf Entrance Channel to 44 feet by 550 feet from the 44-foot depth contour in the Gulf of Mexico to the bend at the southern end of Horn Island Pass; and deepening and widening Horn Island Pass to 44 feet by 600 feet between the bends at the southern and northern ends of that pass, for a total distance of about 4-1/2 miles, and relocating the Horn Island Pass reach about 500 feet westward; Reconfiguring the impoundment basin in Horn Island Pass to provide a section within the channel limits 1,500 feet long with a total depth of 56 feet to facilitate maintenance, and allowing for future realignment of Horn Island Pass reach as natural conditions warrant; Deepening the Lower Pascagoula Channel to 42 feet from the bend at the northern end of Horn Island Pass, through Mississippi Sound; Widening and deepening the Bayou Casotte Channel to 42 feet by 350 feet from the junction with the main channel to the mouth of Bayou Casotte, a distance of about 3-1/2 miles; A turning basin 42 feet deep at the mouth of Bayou Casotte with a total turning diameter of 1,150 feet, including the channel width; Widening and deepening the Bayou Casotte Inner Harbor Channel above the turning basin to 42 feet by 350 feet for a distance of about 1,200 feet; Bend easing and widening; and Mitigation for the

unavoidable loss of four acres of emergent wetlands by restoring six acres of disturbed wetland habitat south of the Greenwood Island DMMS to a more natural emergent nature.

Records show that USACE began maintenance dredging of the Bayou Casotte channel in 1974. Disposal was not recorded but apparently was in open water in Mississippi Sound. Prior to the last improvement to bring the channel to its authorized dimensions, the maintenance dredging frequency of once every 36 months (3 years) was estimated. This would amount to about 310,000 cubic yards (cy) every 36 months. The maintenance dredging for the turning basin was estimated to be 209,300 cy every 36 months. (USACE, 2000)

2.2 Project slip

The Project slip will provide a double berth (a crude tanker berth for the refinery and a berth for the Project's LNG tanker) and berthing for tugs (Figure 1-2). Because of its angled alignment with the Bayou Casotte Channel, the length of the slip varies from 1,450 to 2,150 feet (at a reference depth of -40 ft MLLW). The width will be approximately 900 feet. The side slopes of the slip will be 5:1 which is the angle of repose for the bank material. The final slopes will be protected from scour with riprap.

3.0 Description of dredged material

This section summarizes the volume and other characteristics of the material to be dredged from the Project slip. These characteristics are important to the selection of dredging equipment and the placement of the dredged material.

USACE currently defines dredging projects by two categories: initial (new work) and maintenance projects. New work projects are defined by projects that are original construction or deepening of existing projects. Maintenance dredging is work that takes place on a regular time frame to maintain the authorized depths of active projects.

The initial dredging will be considered new work dredging by USACE. Construction of the proposed slip would involve excavation of the upper material and dredging of the underlying materials present at the site. The Project slip will be dredged to a depth of -46 ft MLLW (-42 ft required Project depth plus 2 ft advanced maintenance plus 2 ft overdepth) for the entrance to the LNG berth and ship slip area.

Shoaling occurs naturally as suspended sediments within the channel settle into the berthing area. Periodic maintenance dredging would be required to maintain the navigable depth of the dredged slip of -42 ft MLLW.

3.1 Initial dredging

3.1.1 Physical description

Based on the current slip design, dredged material volumes were estimated using geometric analysis. The volume estimates were based on average surface elevations taken from bathymetric and topographic surveys. The estimates do not take into account variations in the surface elevation throughout the dredge prism. The volumes are based on a dredged depth of 46 ft MLLW (-42 ft Project depth plus 2 ft advanced maintenance plus 2 ft allowable overdepth). Table 3-1 provides a summary of the generalized soil conditions.

Table 3-1 Generalized Dredge Material Types by Elevation (URS, 2005)

Soil Classification	Elevation Range (ft MLLW)
Fill and Surficial Sand	+10 to 0
Surficial Sand	0 to -7
Upper clay	-7 to -30
Sandy Clay with Sand Seams	-30 to -54

A total volume of 4.5 million cubic yards (mcy) of excavated and dredged material has been estimated. The soil above 0 ft MLLW, about 1 mcy, will be excavated by traditional earthmoving equipment in the dry and used for facility construction purposes. The excavation and handling of this material is not covered in this DMMP. The remaining material, about 3.5 mcy, will be dredged and is described in this DMMP.

The type of material being dredged has a significant impact on the dredging techniques selected, placement options, and cost of dredging. The material proposed for dredging and placement is primarily comprised of upper clay. Sandy clay with sand seams comprises the rest of the dredged material. (URS, 2005)

3.1.2 Suitability characterization

A full study has been completed to characterize the dredged material in order to determine its suitability for the placement options under consideration (see Section 4). The study was designed in coordination with the relevant agencies (USACE, EPA and MDMR), who will make the final suitability determination. To determine suitability for placement at an offshore site, a full suite of testing was conducted as required by Marine Protection, Research and Sanctuaries Act (MPRSA) and specified in the Green Book (EPA/USACE, 1991). Sediment quality is currently being evaluated based on sediment chemistry and biological testing, including toxicity and bioaccumulation testing. Furthermore, water quality modeling has been conducted using the regulatory model STFATE (ENSR, 2006b)

3.2 Maintenance dredging

Upon completion of the initial (new work) dredging, a maintenance dredging program will need to commence to keep the slip at the required depth. Dredging will need to be performed on a regular basis to remove sediment that will be deposited in the slip by shoaling (sedimentation). The shoaling of the slip may be caused by upland runoff and shoreline erosion as well as large ships plowing sediments up the channel. The rate of shoaling is highly variable and depends largely on facility layout, marine storm events, and flows in the adjacent waterway from upland runoff.

The preliminary volumetric sedimentation rates for the slip are estimated to be up to 250,000 cy/yr. The sedimentation in the slip is subject to a high degree of uncertainty and a more detailed sedimentation analysis is recommended to better plan for expected maintenance dredging needs. Annual condition surveys in the slip will determine the need for maintenance dredging before berthing is adversely impacted. With ongoing annual surveys, the maintenance cycle can be projected more accurately.

4.0 Recommended dredging and placement plan

4.1 Dredging Equipment Options

There are three main types of dredges: mechanical dredges, hopper dredges, and hydraulic dredges. Selection of the appropriate type of dredge is based on the properties of the material to be dredged and the logistics of dredged material placement for the Project. Generally the hopper dredge is used for offshore dredging, hydraulic dredge for nearshore, mechanical dredge for new work, and hydraulic/hopper dredge for maintenance (MNI, 2005).

Mechanical and hydraulic dredging methods were considered and evaluated based on Project needs including placement requirements. Those methods suitable for use in the recommended plan for initial work and maintenance are described in more detail in Section 5. Hopper dredges are large, usually self propelled, and typically used for open ocean channel dredging. Due to the limited dimensions of the slip and potential adverse impacts to marine turtles, the Project will not use hopper dredges.

4.2 Dredged material placement options

Initially, the Project team researched work by others, primarily USACE and MDMR, to prepare a wide range of placement options to consider for the initial construction and for future maintenance needs. This list was then evaluated using a multi-tiered screening process. The results of the screening process and evaluation are described in the DEIS (Sect. 3.7).

There are a number of placement options near the Bayou Casotte Harbor that consist of confined, upland confined, partially confined, and unconfined sites. Some of these sites are still actively used for placement of maintenance dredged material while others are currently out of use and even in private ownership. Some sites that may reuse the dredged material to create salt marsh, protect shorelines from erosion and other beneficial uses, are included (MNI, 2005). The placement sites within the Project vicinity are shown in Figure 4-1.

The Project continues to evaluate potential beneficial uses of the dredged material. Several studies, jointly prepared by USACE and MDMR (USACE, 2002 and USACE, 2003), have evaluated numerous opportunities for beneficial use of dredged material. The availability of these sites has changed over the recent past and new sites may be added. Testing has been completed by Chevron that will support beneficial use placement suitability if sites become available prior to Project dredging.

The following alternative plans for the initial dredging requirement of 3.5 mcy and expected maintenance dredging are described in more detail in the DEIS (Sect. 3.7). As described in Sect. 3.1.1 an additional 1 mcy of material above the water table, will be excavated from the surface of the slip area and used for on-site construction. The following alternative placement sites are shown on Figures 4-1 and 4-2.

<u>Preferred Option - Offshore placement and Beneficial Use</u> – Approximately 3.5 mcy will be mechanically dredged, placed on disposal scows or barges and transported to the EPA's designated Pascagoula Ocean Dredged Material Disposal Site (ODMDS) located approximately 11 nautical miles offshore in the Gulf of Mexico. A portion of the material would be available for beneficial use that may include the existing Round Island and Greenwood Island Restoration projects and the proposed South Wetlands Restoration project and/or future Beneficial Use projects that may become available prior to Project construction. This alternative may also serve as an option for future maintenance. This plan is described in more detail in Section 4.3 of this report.

<u>Alternative 1 – New Upland Confined Disposal Facility</u> – Two options were investigated: the North Woods site and a new property purchase. Detailed evaluation of these alternatives has been suspended and would be pursued only if the preferred plan, placement at ODMDS, is not permitted.

Figure 4-1 Dredged material placement alternatives

Figure 4-2 Conceptual beneficial use projects

This alternative is described in more detail in the DEIS (Sect. 3.7) and MNI, 2005.

Alternative 2 – Permitted On-shore Disposal (Existing Landfills) - This alternative was considered for both initial construction and maintenance and was dropped from further consideration. This alternative is described in more detail in the DEIS (Sect. 3.7) and MNI, 2005.

4.3 Initial (new work) dredging

4.3.1 Ocean Dredged Material Disposal Site

Based on an evaluation of advantages and disadvantages as described in the DEIS (Sect. 3.7), the Pascagoula ODMDS is considered to be the best alternative for placement of the initial (new work) dredged material from the proposed Project. In its EIS for designation of the ODMDS, the EPA concluded that impacts associated with placement of dredged materials in the site would be localized to the vicinity of the placement site and would not result in significant adverse effects to the environment (FERC, 2006).

4.3.2 Beneficial use sites

Opportunities may exist for placement of a portion of the material at a beneficial use site which would reduce the volume to be placed at ODMDS. At this time, the sites considered are: Round Island and Greenwood Island restoration projects and the proposed South Wetlands Restoration project. The combined total capacity of these three beneficial use sites is very limited (less than 1 mcy). The capacity of these sites is based on studies completed prior to hurricane Katrina. It is likely that the sites listed here will require additional material and new coastal or barrier island sites requiring protection will emerge as post-Katrina conditions are evaluated.

4.3.2.1 Round Island restoration

Round Island was identified by the MDMR (USACE, 2002 and USACE, 2003) as a possible placement site (Figure 4-2 insert). In the 1850's the original island was approximately 150 acres. The shoreline has been eroded and only about 34 – 40 acres still exist. The project's goal is to restore the island to its 1850's configuration; therefore, the project is considered a "restoration," not "creation" project. The portion of the restoration that is currently funded will require approximately 20,000 cy of material. This site is located approximately 6 miles from the Project site (MNI, 2005). Construction at this site cannot proceed until adjacent fish habitat is clarified.

4.3.2.2 Greenwood Island restoration

Greenwood Island covers approximately 190 acres and is located on the west side of the mouth of Bayou Casotte. The diked disposal area contains about 101 acres with dike elevations in 1985 of 18 to 19 feet. The Greenwood Island disposal area is about 0.7 miles from the Project site and has generally accommodated maintenance dredged material from the mouth of the Bayou Casotte Harbor to the inland terminus of the channel. Greenwood Island was originally an island and the deposition of dredged material is responsible for its current attachment to the mainland. The disposal area at Greenwood Island has been determined to be unsuitable for continued use due to site contamination. The entire island, including the existing disposal site, is owned by the Jackson County Port Authority. The Mississippi Coastal Program includes Greenwood Island in a list of waterfront erosion and accretion areas, and states that the Greenwood Island area of Bayou Casotte bears the brunt of waves generated over a long fetch from the southeast through Petit Bois Pass. The Coastal Wetlands Use Plan designates the area as S-4 (Special Use – dredged material disposal and disposal island). Hurricane George hit Greenwood Island in 1998 and further eroded the island. In order to restore the island dredged material consisting of rubble and fill material would be used to stop shoreline erosion.

The expansion of Greenwood Island consists of tying into the existing dikes at Greenwood Island and creating a confined disposal area that extends into the Mississippi Sound. The area is bordered on the east by the Bayou Casotte Channel and on the west by a recreation channel that leads to Pascagoula's yacht club. Port Authority plans include a barge fleeting area and terminal development. The area, approximately 65 acres, includes a proposed rail spur from the airport site to the east side of Greenwood Island. To provide adequate area for disposal a long peninsula-shaped disposal area would have to be constructed.

Currently the disposal site consists of open water and marsh. The site is inactive and a permit status has not been coordinated. A levee and weir would have to be constructed before any dredged material could be disposed. (MNI, 2005)

4.3.2.3 South wetland restoration

The South Wetland Restoration alternative is a new site at the conceptual stage of development and was not included in the previous beneficial use studies by USACE and MDMR (USACE, 2002 and USACE, 2003). This site is located approximately one mile south of the Project site along the south facing coastline (Figure 4-2). The objective would be to restore the shoreline to a historic location, either 1850 or 1950. Figure 4-2 shows the current and historic shorelines. Restoration will require construction of a containment dike approximately 8,800 feet long to establish a shoreline and protect the marsh to be created. If the 1850 shoreline is restored, the total area of marsh would be over 100 acres. The volume of dredged material that could be placed would be between 0.5 mcy and 1 mcy. This site will require extensive coordination with USACE, MDMR and the property owners before further analyses is done.

4.4 Maintenance dredging

The ODMDS is also considered to be the best alternative for placement of the maintenance dredged material from the proposed LNG terminal. The permit for the new work dredging with placement at ODMDS also covers any maintenance dredging within the first three years after construction. Maintenance material removed after the first three years would have to be tested and characterized as part of the permitting process. However, it should be noted that Bayou Casotte Energy may reduce environmental impacts by coordinating their maintenance dredging with USACE maintenance dredging of the Bayou Casotte channel. This would in effect necessitate using the same placement area as USACE. Use of one or more beneficial use sites will also be considered based on timing and availability. At this time the same three sites recommended for the initial Project and any new sites will be evaluated for future maintenance material placement.

5.0 Dredging operations

This section describes the general requirements needed to implement the recommended dredging and placement plan including equipment, operational logistics and timing. Prior to construction, conditions deemed to be necessary to minimize impacts from dredging and placement operations will be included in the plans and specifications for the Project. Anticipated requirements by resource agencies are outlined in the following sections.

5.1 Dredging equipment

Based on the recommended plan for initial work and future maintenance of the Project, two types of dredges will likely be used: mechanical and hydraulic.

5.1.1 Mechanical dredges

Mechanical dredges are typically used where the area to be dredged has restricted access or operating space and/or when the placement site is a significant distance from the dredging site. Mechanical dredging is often required when the soil is very hard or compacted. Typically a clamshell (Figure 5-1)), backhoe (excavator) (Figure 5-2), or ladder dredge is used. Each type of mechanical dredge uses some sort of bucket to excavate the material. Backhoe and ladder dredges are often required to excavate dense material due to the positive digging force they can exert. Because the material to be dredged from the slip does not contain hard material it is unlikely that the backhoe or ladder type dredge will be used. Clamshell buckets are also capable of removing large debris that hydraulic dredges can not remove. Generally the dredged material is loaded onto a separate barge or scow which is used to transport material to the placement site. Closed hull barges and scows need to be discharged by either mechanical or hydraulic means. Open-hull barges including split-hull scows, have the ability to release the sediment from the bottom of the vessel, allowing for a faster turn-around time in offshore placement sites. (MNI, 2005)

Figure 5-1 Typical clamshell dredge with disposal scow (MNI, 2005)

Figure 5-2 Typical backhoe (excavator) dredged (MNI, 2005)

5.1.2 Hydraulic dredges

Hydraulic dredging is used to remove softer materials using a pump to discharge a slurry mix. Hydraulic dredges can excavate a variety of materials including stiff clays and dense sands. Several variants of hydraulic dredges exist including plain suction, cutterhead, dustpan, and water injection dredges. The cutterhead dredge (Figure 5-3) uses rotating cutting apparatus around the intake of a suction pipe to allow suction of harder materials. Hydraulic dredging is generally much faster than mechanical dredging, so it is typically preferred when dredge material properties are suitable. The dredged material is pumped through a pipeline which can be placed on land, floating, submerged on the seabed, or even buried. The dredged material slurry is typically pumped directly to a placement area, but can be pumped into scows which are then transported to the placement site and emptied similar to mechanical dredging methods. In a typical application dredged material is pumped up to 25,000 ft; in-line booster pumps can be added to increase the pumping distance to 50,000 ft or greater. However, adding booster pumps increases pumping cost and typically decreases productivity. Booster pumps can be located on land, on jack-up type rigs, or on moored barges. Hydraulic dredges are generally rated based on the size of the discharge pipe, ranging from 6 in. to 30 in. Smaller dredges can be used for smaller, shallower dredge cuts and some small dredges are even trailer-able. Larger dredges have higher production rates and are typically more cost effective for large projects and can pump dredged material longer distances without booster pumps. A typical 30” dredge is capable of placing up to 1,800 to 2,000 cy per hour of material (28,000 to 30,000 cy per day).

Figure 5-3 Typical cutterhead hydraulic dredge

5.2 Initial Project dredging

Dredging of the slip will be conducted using mechanical dredging equipment, such as clamshell or dragline dredges mounted on barges. Use of mechanical dredging methods is required for material placed at ODMDS. Oversight of all operations will be provided to assure that contract plans and specifications, including permit conditions, are followed.

5.2.1 Slip dredging sequence

The operation will begin with installation of sheet pile along the shoreline behind Refinery Berth 7 to protect the shoreline and the berth structures. Prior to dredging, the contractor will mobilize the necessary equipment to perform dredging and placement operations. In addition to a barge mounted mechanical dredge, equipment would typically include several barges (scows), a crew boat, a tug for transporting scows to the placement site, survey boat and equipment and other vessels or barges needed to support the operation. Detailed pre-dredge bathymetric surveys will be completed and approved. Dredging will begin at the southwest corner of the new slip, at the edge of the existing shipping channel, and continue counterclockwise around the slip. As dredging progresses around the slip, it will be immediately followed by installation of stone riprap as scour protection for the side slopes. Relocation of Refinery Berth 7 will be performed in such a way as to minimize the out-of-service time. The pilings for the new berths will be installed in the newly dredged slip and the new Refinery Berth #7 will be completed and commissioned. Then the old Refinery Berth #7 will be removed, the sheet pile wall will be removed and the remaining material in the mouth of the slip will be dredged. The contractor will perform periodic progress surveys to assure that that required depths are being met without excessive overdredging.

5.2.2 Timing

The timing of the dredging operations will depend on the capacity of the equipment that will be used, including the dredge size, bucket capacity and scow size, as well as other factors including permit conditions and potential seasonal windows that may affect the cycle time at the dredge and transit to ODMDS. It is anticipated that only one dredge will be mobilized for the Project. Because the material to be dredged does not contain any hard material the production rate should be consistently high. The dredge is not self propelled and requires assistance each time it has to move to a new location within the slip. Once set up it can use its spud system to make minor moves forward and backward. Once set up at a location, the depth of material to be dredged is significant (up to 46 feet) and will likely result in full or almost full buckets during most dredging cycles. Dredging is typically done full time, 24 hours per day, 7 days per week. Breaks in this cycle may occur due to weather, equipment maintenance, dredge moves within the slip and unforeseen reasons. Resource agencies consulted during the preparation of the DEIS have not required any seasonal constraints on dredging or placement operations at this time.

Material removed via the mechanical dredge will be placed on scows for transport and placement at the ODMDS or beneficial use sites. Scow sizes typically range from 1,000 cy to over 7,000 cy. Material that will be placed at the beneficial use sites may need to be transported in smaller scows that can navigate shallow waters. It is anticipated that the dredging contractor will have at least three scows on site. This allows for one scow to be loaded while one is in transit to the placement site and one empty scow standing by. Assuming that the average 3,000 cy scow will be used, it is estimated that approximately 10 scow loads will be towed to the ODMDS daily using existing shipping channels. If larger scows are used, fewer trips to the ODMDS would be required. Scows will be inspected regularly to assure that they are seaworthy, that their bottom release mechanisms operate properly and the bottom doors seal properly.

It is estimated that about 4 to 6 months would be needed to dredge and place the full 3.5 mcy at the ODMDS.

5.2.3 Placement

The placement location(s) at the ODMDS will be specified by the USACE. To assure accurate placement, inspectors and/or an automated monitoring system will be on-board for each scow trip to record the time and exact location of the placement event. As indicated in the previous section, placement events at ODMDS will be continuous over a 4 – 6 month period at an average rate of between 5 and 10 events per day. During adverse weather and/or sea conditions, placement operations may be reduced or suspended until safe conditions exist to proceed.

Use of dredged material at beneficial use sites is subject to further study to determine the type of material needed and the timing. The Round Island and Greenwood Island Restoration projects have undergone feasibility studies but will need engineering and design and construction of containment structures before placement of dredged material can take place. The Round Island project is not likely to fit the timing for the initial Project. The Greenwood Island Shoreline Erosion Abatement project is considered a beneficial add-on to the overall solution by others and will require close coordination with all those involved. The South Wetlands Restoration project has been studied only to determine potential capacity. The feasibility of creating the South Wetlands has to be evaluated further before detailed engineering and design is initiated and may not be available for the initial Project placement. As described elsewhere, the beneficial use sites may change before the Project is initiated. The Project will maintain close coordination with USACE and MDMR, who evaluate and permit these sites, to assure the best use of Project materials. Because mechanical dredging is required for placement at ODMDS, this method would be used to dredge material for placement at the beneficial use sites. Small scows may be used to place material at these sites if there is adequate access and sufficient depth. It is more likely that scows will be used to transport the material to a location near the placement site where hydraulic pumping may then be used to place the material where needed if practical.

5.2.4 Mitigation measures

There are no known measures required for mitigating the impacts from dredging operations. Model studies were performed for both mechanical and hydraulic dredging methods. The predicted total suspended solids resuspended from the dredging operations did not result in water column TSS concentrations significantly different from those historically observed in Bayou Casotte (see DEIS, Section 4.3.2.2).

5.2.5 Environmental Protection

The contractor will be required to comply with the terms, and conditions of the permits for the dredging and dredged material placement operations of the project. The contractor will be required to submit plans, for approval, to outline the measures they will take to ensure permit conditions are not exceeded. Plans that are part of dredging or dredged material management may include but are not limited to: trash and debris removal; spill prevention and response; fish and wildlife encounters; turbidity monitoring to prevent exceedances; and other potential extraordinary factors. Contingency plans to ensure compliance and address permit conditions will be required and followed. Additionally, the Project will employ environmental Inspectors to provide further oversight to ensure operational compliance with all conditions.

5.3 Maintenance dredging

Operations required for maintenance of the slip would be governed by the placement option selected. As described in Sect. 4.2, the primary option is continued use of the ODMDS for maintenance material. Other placement options may be available in the future and would require review and approval prior to permitting and implementation. It is possible that some beneficial use options will no longer be available but that others may become available prior to future maintenance cycles. As described in Sect. 4.4, the quantity and frequency of maintenance dredging will be based on surveys. If maintenance dredged material is placed at the ODMDS it is expected that mechanical methods will be used. Use of hydraulic dredging methods would be feasible for use on other placement options that are in closer geographic proximity to the Project.

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