REVIEW OF

MISSISSIPPI RIVER SEDIMENT DELIVERY SYSTEM

BAYOU DUPONT (BA - 39)

Jefferson and Plaquemines Parishes, Louisiana
(DNR Contract No. 2503-05-34)

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Introduction

This is a review of a plan being developed by the Department of Natural Resources, State of Louisiana, for creating marsh using Mississippi River sediment. The project is located in Plaquemines and Jefferson Parishes approximately two miles northwest of Myrtle Grove and 1.4 miles west of Ironton.

This project is funded through the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA). It is an approved project in the engineering and design phase of project formulation. It will utilize the renewable resource of Mississippi River sediment to create marsh in a rapidly eroding and subsiding section of the Barataria land-bridge. The goals of this project is to create over four hundred acres of inter-tidal marsh using Mississippi River sediment and to establish Mississippi River sediment mining as an effective coastal restoration tool.

Purpose and Scope

This review of the proposed dredging will provide recommendations for utilizing sediment from the Mississippi River between River Miles 60.0 and 61.4 and between River Miles 63.4 and 65.0 in terms of the effect that such dredging will have on the morphology of the Mississippi River. A recommendation will be made concerning the need for hydrodynamic modeling.

Geotechnical data from Borrow Area 1, which was provided by LDNR, will be evaluated to determine if they are representative of both borrow areas or if borings should also be obtained from Borrow Area 2. The silt content will be reviewed to determine if special considerations are needed for dredging and dewatering.

This review does not address the ecosystem considerations for building marsh, the volume in the proposed borrow areas, the details of dredging or the delivery of sediment to the marsh area.

Characteristics of Mississippi River.

The Bayou Dupont project is located on the west side of the Mississippi River near River Mile 60 Above Head of Passes. In this reach, the Mississippi River is maintained for deep and shallow draft navigation and for flood protection. Hydrographic survey maps show levees along both banks of the channel, and no floodplain exists on either side. (USACE, 1991-1992) The plan view for a short reach of the river channel upstream and downstream of this project is shown in Figure 1. The solid lines are the Low Water Reference Plain (LWRP). The dash lines are the -50 elevation contours. The circle points are river mile markers moved from their normal position along the center of the channel over to the location of the thalweg. These features were

digitized from pp 55 through 59 of the hydrographic survey book referenced above. The alignments of these features indicate the river is highly controlled in the vicinity of the Bayou Dupont project.

Proposed Borrow Areas.

The proposed borrow areas were delineated by DNR as Borrow Area 1, as west of the navigation channel between river miles 60.0 and 61.4, and Borrow Area 2 west of the navigation channel between river miles 63.4 and 65.0. They noted, "Bathymetric data from 1992 and 2003 has been evaluated. The river bathymetry in this area does not significantly change between these years. Each proposed borrow area has been designed to meet all USACE restrictions. LDNR anticipates mining a maximum of 6.2 million cubic yards *from* these borrow areas."

The objective of Figure 1 is to reveal the alignment of the thalweg with respect to the general alignment of the channel in the vicinity of the borrow areas. It shows both borrow areas to be located on alternate bar features. In addition, the upstream site is in an expanding reach of the river. Computational studies reported by Copeland and Thomas (1992) show the river to be strongly depositional between River Miles 30 and 85.

> "The calculated cumulative volumes through 1989 are shown in Figure 14. When the 1976 - 82 sediment inflow curves were used for the entire simulation, sediment accumulation of about 48 million cubic yards occurred in the study reach between 1984 and 1989. Almost all of the material was deposited between river miles 30 and 85. ... Using the reported 1983-89 sediment inflow curves resulted in 45 million cubic yards of degradation in the 300 mile reach for the five-year period. This is a 93-million-cubic yard difference from the results using the 1976 - 82 sediment inflow curves. Even with calculated net degradation, using the 1983 - 89 sediment inflow curves, aggradation of about 40 million cubic yards was calculated between river miles 30 and 85."

The proposed borrow areas are in locations where the bed sediment will be replenishment naturally by the river.

Applying the samples from the downstream borrow to the upstream borrow area, also, is not satisfactory. It is important to collect samples from both borrow areas. The analysis of the borrow material to determine if special requirements are needed for dredging or the delivery of the dredged material must wait on the availability of the complete set of bed samples.

During the course of this study, the following two specific questions were raised.

There is a submerged pipeline, at approximate elevation -80 NAVD88, in the southern part the northern borrow area. Therefore, the southernmost 1500' has been removed from the proposed borrow area. Excavation will be prohibited within 500' of this pipeline. Is there a problem with this approach?

Answer. In my opinion, there is not a problem with that approach. The 500 foot distance that you propose is adequate to insure that your dredging will not cause significant erosion at the pipeline. The following details support my position.

First of all, this question involves more than the morphological issue that I investigated. It is a design issue. Design questions differ from river morphology principles in level of detail. River morphology principles deal with questions that can be answered with the one dimensional approximation of the hydrodynamic equations. HEC-6/6T is an example. Design questions require either a physical model study or a computational model that contains the fully three-dimensional equations of flow and sediment processes. The reasons that I do not propose such a design investigation in this case are as follows.

Dredging Area 2, RM 63.4 to 65.0, is in a morphological feature that I classify as an alternate bar. An alternate bar feature is an area where deposition occurs naturally. Bank stabilization in this vicinity has fixed the plan-form of the Mississippi River, and that makes this alternate bar relatively stationary. I understand your question to say that the pipeline in question is located in the same dredging area which means it is also in a single morphological feature. It is located about 500 feet downstream from the revised limits of dredging. Therefore, I do not expect degradation between the lower end of the borrow area and the pipeline. I do expect the bed material load that the river transports into this dredging area, those particles of essentially the same size as will be dredged from the bed, to rapidly deposit out of the water column and refill the borrow pit. Cases of degradation can be cited where trapping of the bed material load resulted in erosion from the bed downstream. However, the present case is different because it involves deposition along a single bar feature.

In the general case, there is the possibility of local scour, rather than bed degradation, at the downstream end of a dredging area. However, at this site I do not believe it is very likely. Local scour results when the natural pattern made by the velocity vectors is upset. In the case we are evaluating, the bar is formed by and aligned with the current, and the alignment that is proposed for the dredging area is along the bar. I know of no reason the velocity pattern should be upset by the proposed dredging plan.

Local scour is not something for which we have a simple equation. It is the result of the 3-dimensional current pattern, and it will vary with discharge. Therefore, I cannot compute the extent of local scour - or even the likelihood of such occurring. However, I cannot conceive of how the dredging in the proposed plan could cause local scour at a pipeline located 500 feet downstream from it. Therefore, I do not believe that it is necessary to perform a detailed hydrodynamic study to prove there is no problem. Rather, I propose that you discuss the distance question with your dredging firm and use their experience to confirm that 500 feet is a safe distance.

The second question has to do with the depth of dredging. "If a capable dredge is the low bidder, would it be a problem to dredge deeper than -70' NAVD88?"

Answer. In terms of the capability of the dredge, I cannot answer that question. Please contact the dredging company. The size of the borrow pit relative to the total size of the river channel is an important consideration and my reply above took that into account. However, I recommend that you not dredge deeper than the pipeline is buried without performing a detailed hydrodynamic and sediment analysis.

References

Copeland, Ronald R. and William A. Thomas. June 1992. "Lower Mississippi River Tarbert Landing to East Jetty Sedimentation Model." Technical Report HL-92-6. Hydraulics Laboratory, US Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

US Army Corps of Engineers. June 1993. Mississippi River Hydrographic Survey, 1991-1992, "Black Hawk, LA to Head of Passes, LA. Mile 0 to Mile 324 (A.H.P.). Prepared under the direction of the President, Mississippi River Commission. Prepared by the US Army Engineers District, New Orleans, Louisiana.

Figure 1. Mississippi River Channel
in the Vicinity of Bayou Dupont, Louisiana