Appendix H: Construction Impacts

H-5 Dredged Materials Management Alternatives Analysis

A. INTRODUCTION

The Tappan Zee Hudson River Crossing Project proposes to replace the existing Tappan Zee Bridge with two new bridge structures to the north of its existing location. The replacement alternative includes two options for the approach spans (short span and long span options) which differ in terms of the type of structure as well as the number of and distance between bridge piers.

In either option, the proposed bridge alignment would span extensive shallows in the Hudson River. Therefore, to facilitate construction and to prevent significant resuspension of sediments during construction, a channel must be dredged to provide access for tugboats and barges to the construction zone during construction of the approach spans. Over the entire construction period, a total of approximately 1.78 and 1.87 million cubic yards of sediment would be dredged for the short and long span options, respectively.

Transport by ocean scow and placement of the dredged material at the Historic Area Remediation Site (HARS) in the New York Bight would be most beneficial to the project for a number of reasons, including cost, schedule, and the avoidance of impacts to surrounding residential communities. In accordance with federal regulations, the U.S. Environmental Protection Agency (USEPA) must concur that there are no practicable alternative locations and methods of disposal or recycling available before a permit can be issued by U.S. Army Corps of Engineers (USACE) for placement of dredged materials at the HARS. This document evaluates the alternatives available for placement of the dredged materials from the Tappan Zee Hudson River Crossing project.

B. REGULATORY PROCESS AND COMPLIANCE

The Tappan Zee Hudson River Crossing Project proposes placement of dredged materials from the Hudson River at the HARS in the New York Bight. Placement of dredged materials at the HARS is subject to the Marine Protection, Research, and Sanctuaries Act of 1972, also known as the Ocean Dumping Act. Section 103 of the Ocean Dumping Act states that USEPA must ensure that the disposal will not "unreasonably degrade or endanger human health, welfare, or the marine environment." In accordance with implementing regulations (40 CFR § 227), the USEPA must evaluate alternative disposal options before the USACE can issue permits for placement of dredge spoils in the HARS. The USEPA must concur that there are no practicable alternative locations and methods of disposal or recycling available. 40 CFR § 227.16 (b) outlines the test for practicability of alternatives by stating that "…alternative methods of disposal are practicable when they are available at reasonable incremental cost and energy expenditures, which need not be competitive with the costs of ocean dumping, taking into account the environmental benefits derived from such activity, including the relative adverse environmental impacts associated with the use of alternatives to ocean dumping…."

While ocean disposal of dredged materials is the proposed disposal method for the Tappan Zee Hudson River Crossing Project, this analysis also evaluates upland disposal options. Dredged

materials destined for upland disposal are considered a solid waste by the New York State Department of Environmental Conservation (NYSDEC) and are subject to regulation under 6 NYCRR Part 360 Solid Waste Management Facility Regulations. Wastes regulated under Part 360 must be disposed of at an authorized solid waste management facility. In addition to the extensive application requirements (i.e., engineering reports, facility plans, and equipment specifications) prescribed under Part 360, waste management facility permits are subject to the New York State Environmental Quality Review Act (SEQRA) and the Uniform Procedures Act, Article 70 of the New York State Environmental Conservation Law, which provides timeframes for application review and procedures for public noticing and hearings.

Certain waste materials, normally classified as solid waste under the Part 360 Solid Waste Management Facility regulations, may be determined by NYSDEC to be appropriate for beneficial reuse. While a Beneficial Use Determination (BUD) is not subject to SEQRA or 6 NYCRR Part 621 Uniform Procedures, the determination process may become complex and time consuming. NYSDEC BUD regulations identify 16 pre-approved BUDs in 6 NYCRR Part 360-1.15. For other situations where the proposed reuse is not specifically identified in the Part 360 regulations, a case-specific BUD petition must be submitted to NYSDEC in accordance with 6 NYCRR Part 360-1.15(d). The petition must include a variety of information about the material and proposed beneficial use such as, but not limited to, the chemical and physical characteristics of the solid waste, a demonstration of a known or probable market for the waste, and a solid waste control plan. Dredged materials that are determined to be uncontaminated can be used as fill material in accordance with a pre-approved BUD. Dredged materials that are found to be moderately contaminated require a case-specific BUD.

In New Jersey, processing or transferring dredged materials requires an Acceptable Use Determination (AUD) from the New Jersey Department of Environmental Protection (NJDEP). Each AUD proposal is evaluated by NJDEP on an individual basis and an AUD is issued if the applicant can prove that the placement destination is designed and managed in accordance with all relevant statutes, such as the Water Pollution Control Act (N.J.S.A. 58:10A-1), the Waterfront Development Act (N.J.S.A. 12:5-3), the Spill Compensation and Control Act (N.J.S.A. 58:10-23.11), and the Solid Waste Management Act (N.J.S.A. 13:1E-1). An AUD will only be issued to projects that use dredged material from tidal waters of New Jersey, which include adjacent interstate waters. Dredged material cannot be a hazardous waste, as defined in the New Jersey Hazardous Waste Regulations (N.J.A.C. 7:26G).

C. TAPPAN ZEE HUDSON RIVER CROSSING PROJECT DREDGING PROGRAM

Dredging for the construction of the Tappan Zee Hudson River Crossing Project would be conducted in three stages over a four-year period, with a duration of approximately three months each year. Each of these three-month spans would occur during the limited window for such dredging, from August 1st to November 1st. This is the period when dredging activities would have the minimum effect on anadromous species and other aquatic resources.

Table 1 presents the estimated total and daily volumes of materials to be removed for each dredging stage for the two replacement bridge alternatives. As shown in the table, during the busiest dredging stage, Stage 1, over 17,000 cubic yards of material would be dredged and removed from the site each day, using the methodology described below. Over the entire construction period, a total of approximately 1.78 and 1.87 million cubic yards of sediment would be dredged for the short and long span options, respectively.

Table 1
Dredged Material Removal by Stage

Construction Stage	Total Volume (cubic yards)*		Average Daily Volume (cubic yards)
	Short Span	Long Span	Either Span
Stage 1	1.07 million	1.16 million	17,059
Stage 2	0.43 million	0.43 million	6,324
Stage 3	0.28 million	0.28 million	4,118
Total	1.78 million	1.87 million	n/a

Note: * includes dredging overdepth allowance (1ft) for each stage

To determine the suitability of the dredged material for the HARS, a Sediment Sampling and Analysis Program of material to be dredged during Stages 1 and 2 was completed. Sediment testing results show that this sediment meets the criteria for disposal at the HARS and placement in HARS has been approved by USEPA and USACE. Material to be dredged during Stage 3 will be sampled at a point in the future closer to dredging; if this material is found to be eligible, disposal at HARS will also be pursued. The dredged material removed from the river bottom would consist of sand and silt. Although some materials—in particular materials removed from the top layer—may contain some contaminants, it is anticipated that most of the dredged material would be suitable for beneficial re-use at another location rather than disposal in a landfill.

Dredged material would be collected from the bottom of the river using a clamshell dredge with an environmental bucket and placed into hopper scows, which are boats with a capacity of approximately 2,500 cubic yards. To ensure that the scows do not exceed the maximum allowable draft of the river work zone, they would be limited to 80 percent of their maximum load, or 2,000 cubic yards per load.

After placement in the hopper scows, the next step in the dredge materials handling would depend on the dredge placement option selected, as discussed below.

D. DREDGED MATERIAL MANAGEMENT ISSUES

To address a lack of management options for dredge spoils from various projects in the Port of New York and New Jersey, and the high cost of the limited number of management options that are available, the USACE New York District has prepared a Dredged Material Management Plan (DMMP), last updated in August 2008. The DMMP identified a wide array of both primary and contingency management options needed to meet the dredging requirements of the Port in the long term, through the year 2065. Special emphasis was given in the plan to beneficial uses of dredged material, specifically for land remediation and habitat creation, enhancement, and restoration. The DMMP also considered the possibility of establishing a public dredge spoils processing/storing facility, as an additional option to existing privately funded facilities, to be used primarily by public agencies. The interest in developing such a facility arose not only because of the high cost of processing at private facilities, but also in an attempt to better correlate the availability of dredge spoils to the availability of processing capacity or land at a potential beneficial re-use site. The DMMP noted that once individual dredging projects are complete or when a large real estate development project has exhausted its capacity for dredged material (e.g., as fill material), private processing facilities become no longer economically viable. To protect against the risk associated with the variability in the volumes of incoming dredged materials, private processors maintain low throughputs, restricting capacity. Timing the availability of a beneficial re-use site is similarly challenging since such sites often require

additional studies, funding, or permits. According to the DMMP, providing a space to process and store spoils until they are needed would stabilize costs of private processing and would encourage greater beneficial re-use placement of spoils. The DMMP commits to studying various siting, ownership, and management options of such a facility as a way to address the harbor's long term dredge disposal needs.

While the public processing/storage facility and other options described in the DMMP are being evaluated by the USACE for long-term resolution, the Tappan Zee Bridge Hudson River Crossing Project is investigating many of the same dredge placement options, with the same near-term limitations and difficulties identified in the DMMP.

E. DREDGE PLACEMENT ALTERNATIVES

The range of options potentially available for placement/disposal of material removed during dredging of the access channel for the Tappan Zee Bridge Hudson River Crossing Project is as follows:

- Placement in the Historic Area Remediation Site (HARS) in the New York Bight.
- Upland disposal using processed dredge material:
    - Upland placement as landfill or brownfield remediation;
    - Upland placement at a to-be-permitted facility
    - Beneficial reuse for habitat creation, enhancement, and restoration;

All of the placement options discussed in this analysis assume that the resulting dredge spoils are transported from the project site by water. The option to remove the dredge spoils by truck is not practicable, given the large number of truck trips required and the environmental implications. To implement this option, dredged materials would have to be transported to a shoreline site, where they would be dewatered and stockpiled. The site selected for these operations would have to be large enough to accommodate a large volume of material, and located on roadways that can accommodate the daily volumes of trucks, estimated at 853 trucks per day inbound and 853 trucks outbound, that would be required to transport dredge material in Stage 1 of the dredging program, and the approximately 95,000 outbound and 95,000 inbound total truck trips over all stages of the dredging program. Due to the large number of estimated truck trips that would be required, and the potential for adverse traffic, air quality and noise impacts on the local community, the bridge contractor would not be allowed to transport the dredged material by truck from the waterfront staging areas.

All of the disposal alternatives presented below therefore involve the transfer of dredge spoils directly by barge to a processing facility in New York/New Jersey. Dredged materials could also be transported by larger vessel to a waterfront site outside of New York or New Jersey; however, it is expected that the cost for transporting dredged materials by barge to a more distant site would likely exceed even the alternatives presented below and therefore would not meet the practicability test outlined in 40 CFR §227.16 (b).

PLACEMENT IN THE HISTORIC AREA REMEDIATION SITE (HARS)

In this option, the dredged materials would be transported to the HARS, a site in the Atlantic Ocean approximately 3.5 miles east of Sandy Hook, NJ. The HARS is overseen by the USACE and the USEPA. This site was historically used for ocean disposal of dredged material. Today, the site is being remediated through a program to cap those historic sediments with cleaner sediments dredged from New York Harbor that meet certain criteria established EPA Region 2. To receive the Section 103 permit for placement in the HARS, the materials must be suitable for remediation, in that they meet certain criteria related to contaminants based on sediment toxicity

and bioaccumulation tests. After the Section 103 permitting process is complete, HARS would be available for disposal at any time. The availability of the site could only be affected by weather which would prohibit ocean scows from traveling to the site.

The transport of material from the project site would be dependent on the scows and other equipment available to any given dredging sub-contractor working on the project. Typical ocean-going dump scows have drafts up to 18 feet, and are too large to be accommodated in the dredge construction channel. Therefore, it is likely that the dredged material would have to be collected into hopper barges and then transferred to ocean-going scows for transport to HARS. At the time of this document, it is assumed that dredged materials from the Tappan Zee Hudson River Crossing Project would be loaded onto 2,500 cubic yard hopper barges, filled to 80 percent capacity (i.e. 2,000 cubic yards of dredged material per hopper barge). When full, these hopper barges would be towed to a temporary mooring in deeper water, where the dredged material would decant to reduce the volume of material requiring disposal. The dredged material would then be transferred to ocean-going dump scows for transport and placement at the HARS. The transfer would be accomplished by positioning a hopper barge tightly along one side of a spud barge supporting an excavator; an ocean-going dump scow would be positioned on the opposite side and the material would be transferred via the excavator. A perimeter containment and treatment system would be fitted on the spud barge to prevent the loss of spoils and residual water during the transfer. The ocean-going dump scows would then travel to the HARS, where materials would be placed at the site in accordance with the permit conditions for that placement.

The base cost for placement of material at the HARS is estimated at approximately $10 to 20 per cubic yard. This cost reflects the experience of the project team and USACE with projects where the additional transfer of materials from hopper to ocean scows is not required. The project team estimates that approximately $7 per cubic yard should be added to this cost range to reflect the double handling of the material as described above. Therefore, the cost for the HARS disposal alternative for all three stages of the dredging program is estimated at $17 to $27 per cubic yard, or between $30 million and $50 million, depending on the chosen span option.

UPLAND DISPOSAL USING PROCESSED DREDGED MATERIAL

In a 2007 study[1], the USACE identified five private facilities, in and around the Port of New York and New Jersey, that could process and temporarily store dredged material. Four of the facilities were contacted as part of this analysis; one of the facilities identified in the DMMP is not actively operating:

- Clean Earth Dredging Technologies, Inc
- Donjon Marine Company, Inc.
- Jay Cashman, Inc
- Great Lakes Dredge and Dock, Inc.

Private companies, such as Clean Earth Dredging Technologies, could dewater and amend the dredged material, identify suitable disposal locations for the materials, and arrange to have materials placed there. Other companies, such as Donjon Marine and Great Lakes Dredge and Dock provide dredging and transport services, as well as amendment. Overall, these facilities operate at rates ranging from 4,000 and 8,000 cubic yards/day. Therefore, no single processing

[1] Alternative Scenarios for the Realization of a Dredged Material Public Processing or Storage Facility, USACE, August 2007.

and/or dredging facility would be able to accept all of the dredged material generated by the Tappan Zee Hudson River Crossing Project during the three months required for Stage 1 of the dredging program. The large volume of material that will result from the Tappan Zee Hudson River Crossing Project would comprise a significant portion of dredge processing capacity throughout New York Harbor since during the peak of its dredging program the project would generate over 17,000 cubic yards/day.

Based on the information provided by the facilities that responded to inquiries from this project, the cost for this disposal alternative may range widely, from $75 to $150 per cubic yard for dredging, processing, transport, and disposal, plus additional costs to mobilize and demobilize equipment during each dredging stage (up to $1 million per dredging stage). To allow for maximum cost effectiveness and contractor flexibility, it is assumed that under the upland placement alternative the dredged material will also be transferred from hopper barges to larger dump scows since transport of material in larger vessels is more economical. Therefore, as with the HARS Placement Alternative, it is assumed that a factor of approximately $7 per cubic yard should be added to account for the double handling of material. The cost for disposal for this alternative is estimated at $82 to $157 per cubic yard, or between $146 million and $294 million, depending on the chosen span option.

UPLAND PLACEMENT FOR LAND REMEDIATION

One type of beneficial re-use of dredged material is land remediation, where dredged material can be utilized as structural fill, grading material, landfill cover, etc., to remediate sites such as active and inactive landfills, former industrial (brownfield) sites, quarry sites, and abandoned mines. Prior to use, the dredged material is typically processed with binding agents, such as Portland cement. The stabilized dredged material can be manufactured to meet the material and engineering specifications of a specified use by adjusting the proportions and types of mixing agents.

The range of upland sites that may be available to receive dredged material as a beneficial re-use is discussed immediately below, however, as discussed in the DMMP, timing the availability of dredged material to available capacity at a remediation site for a project of this size could be challenging. In addition to the sites noted below, any new proposed upland site would need to go through design, environmental review, and permitting before it can be ready to accept processed dredged material delivery, which would have to be timed precisely to be available at the site in an appropriate quantity to comply with the conditions of any beneficial re-use. For the Tappan Zee Bridge construction, with a limited window of August 1st through November 1st dredging, an imminent construction schedule, and large volumes of dredged material, identifying a practicable beneficial re-use option that can be used at the times when it is needed would prove difficult.

New York Placement Sites

GATX Site

One potential site identified by USACE for beneficial re-use of dredged materials is the site in northwestern Staten Island along the Arthur Kill waterfront known as the "GATX site." This 440-acre site was historically occupied by industrial uses, including bulk oil storage and liquefied natural gas storage facilities. In 1998, the New York State Department of Environmental Conservation (NYSDEC) issued a Consent Order that required the property owner, GATX Terminals Corporation, to remediate contamination at the site and to restore wetland areas affected by the contamination and remediation work. A modification of the 1998 Consent Order is currently being proposed by NYSDEC; the public comment period on the modification ended in April 2011 and a Modified Consent Order was expected to be signed in

late January 2012, at which time it was anticipated that a new owner will take over the site and begin to remediate the site in accordance with an Engineering Work Plan. As of this document, the Consent Order has not been signed.

Fill materials permitted on the site would have to meet specified chemical and physical standards, as set forth in the Modified Order. The fill would include the use of dredged material that meets those standards and has qualified for and received a BUD from the NYSDEC. Overall, it is expected that 4.5 million cubic yards of fill would be required to cap the site and to raise the overall elevation, since the majority of the site is only a few feet above sea level. One potential owner/operator expects that an additional capacity of up to approximately 3.5 million cubic feet exists on the site, yielding a total capacity of 8 million cubic feet of fill. That potential owner/operator anticipated that after the execution of the Modified Consent Order, the site would begin accepting fill material in the first quarter of 2012, however, as mentioned previously, the Consent Order has not been signed.

As with other beneficial reuse options, the dredged Tappan Zee Hudson River Crossing Project material would have to be amended before being placed at the site. This processing could happen in several ways. The project's contractor could utilize a private dredge processor, as described previously; the processor could then dispose of the material at the GATX site. Alternatively, the Tappan Zee Hudson River Project may compensate the prospective site owner/operator for establishing a dedicated processing facility on the GATX site.

The prospective owner/operator contacted by the project team has declined to provide an estimate of costs associated with placing the Tappan Zee Hudson River Crossing Project dredged material on the site. Even assuming there would be no charge for disposal of material at this site, however, it is expected that this disposal option would cost significantly more than disposal at HARS due to the costs associated with the amendment and stabilization required prior to placement. In addition, the exact terms and conditions of placing Tappan Zee Hudson River Crossing Project dredged material (such as the logistics of offload and placement, and required treatment or processing) would also have to be negotiated once a new owner begins managing the site and the Modified Consent Order is executed.

New Jersey Placement Sites

As of February 2012, the most recent data available from NJDEP at the time of this analysis, eight potential placement sites in New Jersey were available, or were soon to become available, to receive processed dredged material. The permitted capacity of these sites ranged from 210,000 cubic yards to 1,400,000 cubic yards, for a total combined permitted capacity of approximately 5,000,000 cubic yards. Approximately 3,000,000 cubic yards of this capacity remained at the time of this analysis.

PLACEMENT AT A TO-BE-PERMITTED LANDFILL FACILITY IN NEW YORK

In this alternative, it is assumed that the ultimate disposal site is not yet permitted to accept any material, but instead would be adapted specifically to accept dredged material from the Tappan Zee Bridge Hudson River Crossing Project. The site would need to receive all relevant permits, including a Part 360 permit from NYSDEC, to operate as waste management facility before the project's dredging program begins. This alternative would therefore require enough time to receive all required approvals for the landfill site and to develop the facilities to accept waste once approvals are in place. For the Tappan Zee Bridge construction, obtaining the required permits and developing the necessary facilities in time to meet the project's imminent construction schedule would prove difficult.

In undertaking this analysis, the three sites discussed below were suggested by USACE as potential sites to establish a facility specifically for the disposal of material dredged for the construction of the Tappan Zee Bridge Hudson River Crossing Project. These facilities could also be considered options under the Beneficial Reuse for Land Remediation alternative; they are grouped here because all three sites are currently operational and would be closed and converted specifically to accept materials from the project.

Tilcon sites

The sites suggested are located in New York State and owned by Tilcon New York Incorporated: the Tompkins Cove Quarry near Stony Point, approximately 13 miles north of the construction zone; the West Nyack Quarry, approximately 3 miles from the project site, and the Kingston Quarry, approximately 70 miles from the project site. To accept fill material, the sites' owner would have to obtain a Part 360 permit and would have to implement all needed capital improvements to accept and process dredged material prior to receipt of any dredged material from the Tappan Zee Bridge Hudson River Crossing Project. Such improvements may include additional infrastructure to transfer the delivered and processed dredge material, dewatering facilities, engineering controls for groundwater protection and leachate control, etc. In addition, converting to a waste management facility would require that the site's owner forego any residual value associated with mining the site and any associated potential revenue, which would increase the cost for this disposal option for the project.

Discussions with Tilcon regarding the various quarry sites they own and operate indicated that the only potential site for developing a landfill facility is at Stony Point. However, Tilcon has indicated that they are not prepared to discuss this option at this time. Because of the imminent project construction schedule, it is unlikely that this option would be available when it is needed for the project and therefore is not considered at this time as a disposal alternative.

BENEFICIAL RE-USE FOR HABITAT RESTORATION

Another beneficial re-use option involves using dredged material for habitat creation, enhancement, and restoration, e.g., creation of wetlands, bird and shellfish habitat, and restoration of degraded aquatic sites such as borrow pits[1]. This option also requires that the dredged materials are of an appropriate consistency (i.e., sand, silt/clay) for placement.

According to the USACE DMMP, several steps must be accomplished to implement most habitat restoration applications. For example, many applications would require a demonstration project before a full-scale implementation.[2] Demonstration projects are reviewed by an interagency team of experts and undergo extensive public review. Most habitat restoration projects would involve the identification of a site, design of a placement program appropriate for the site, environmental review (including a public input phase) and permitting. Given the likely duration of these steps, it is unlikely that this option would be available when dredging occurs for the Tappan Zee Bridge Hudson River Crossing Project, unless the resulting dredged material can be incorporated into a restoration project already designed and permitted by USACE; no such sites are known at this time. Moreover, the dredged materials from the Tappan Zee Bridge Hudson River Crossing Project would not be of an appropriate consistency for restoration of a

[1] http://www.nan.usace.army.mil/harbor/dmmp/index.php?benefic. Last accessed 17 May 2012.

[2] Dredged Material Management Plan for The Port of New York and the State of New Jersey, *Beneficial Uses of Dredged Material.* http://www.nan.usace.army.mil/harbor/dmmp/index.php?benefic.

habitat where sand is required. For these reasons, use of Tappan Zee Bridge dredged materials for habitat restoration is not considered practicable.

F. CONCLUSION

Based on the foregoing it is concluded that there is no practicable alternative at this time to disposal of the project dredged material at HARS. The HARS disposal alternative is identified at this time as being the most cost effective, as the best fit to the Tappan Zee Bridge Hudson River Crossing Project's dredging program schedule, and as being the most reliable and available, given the imminent need for the project and constraints on other potential sites. No upland placement sites are currently available in New York. With respect to options involving disposal at the Tilcon and GATX sites, in view of the uncertainties indicated above, these sites are not considered practicable alternatives at this time. While the option of processing the dredged material and placing it an existing upland site in New Jersey may provide a level of schedule fit and reliability, this option could cost nearly ten times the cost for disposal at HARS, which can add up to $264 million to the cost of the project, making the cost of upland disposal an unreasonable incremental cost to this publicly funded project. ✷