COAST & HARBOR ENGINEERING
A Division of Mott MacDonald

Technical Memorandum – Executive Summary

Port of Ilwaco and Port of Chinook Engineering Study/Solutions In Support of Maintenance Dredging

1. Introduction

The Port of Ilwaco and Port of Chinook have regularly conducted dredging in the marinas to maintain minimal required navigation depths to provide safe berthing and maneuvering operations for pleasure and commercial fishing vessels. For the last several decades, dredging at the marinas was conducted by hydraulic pipeline with placement of dredged material at the upland disposal sites. Currently, the upland disposal sites at the Port of Ilwaco and at Port of Chinook are at the limit of their capacity and likely may be available for only 2-3 more dredging cycles.

This study was conducted by Coast & Harbor Engineering, A Division of Mott MacDonald, to develop engineering solutions and cost estimates for feasible and cost-effective measures to provide long-term sustainable and navigable depths in the Port of Ilwaco and Port of Chinook marinas. The study determined the required dredging depths at both the Port of Ilwaco and Port of Chinook marinas, estimated maintenance dredging requirements, identified and evaluated dredged material disposal alternatives, selected the preferred alternative, and developed engineering cost estimates.

The current document presents a summary of the study. For more details of the study, the reader is referred to the study report: Port of Ilwaco and Port of Chinook Engineering Study/Solutions In Support of Maintenance Dredging, June 2019.

2. Dredging Depths and Dredging Requirements

For the purposes of dredging, the Port of Ilwaco Marina area is defined by two areas with navigable depths[1] at 10 ft. MLLW and 16 ft. MLLW. Figure 1a shows these areas overlayered on a 2013 bathymetric survey. Similarly, for dredging purposes, the Port of Chinook Marina is defined by three distinct areas with navigable depths at 10 ft. and 8 ft. MLLW. Figure 1b shows these areas overlayered on the 2016 depth measurements data.

The volumes of dredging for the Port of Ilwaco and Port of Chinook marinas were computed using the alignment and design depths of the areas delineated in Figure 1, and are shown in Table 1.

[1] Please note that the navigation depth does not include 1 ft. of allowable over-dredge and/or advanced maintenance dredging clearance.

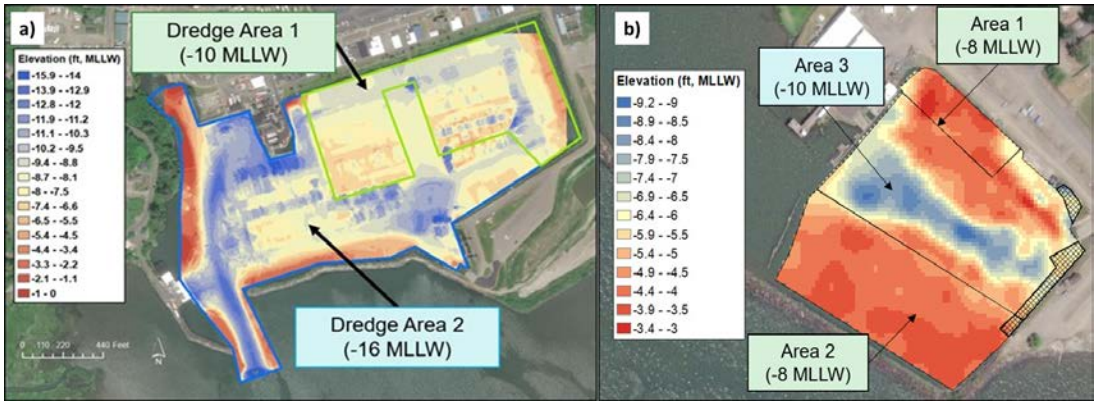

Figure 1. Dredging depths for a) Port of Ilwaco and b) Port of Chinook

Table 1. Dredging Volumes Estimates, Port of Ilwaco and Port of Chinook Marinas

	Dredging to Navigable Depths (CY)	Dredging to Navigable Depths + 1 ft OD (CY)
Port of Ilwaco Marina	400,000	450,000
Port of Chinook Marina	56,000	67,000

Analysis of sedimentation was conducted, and the average yearly rates of sediment deposition[2] for both the Port of Ilwaco and Port of Chinook Marinas were estimated. Using these rates, the volumes of yearly sediment deposition in the marinas were computed and are depicted in Table 2.

Table 2. Averaged per Year Rates of Sedimentation and Volumes of Sediment Deposution Estimates at Port of Ilwaco and Port of Chinook Marinas

	Rate of sedimentation (ft/year)	Volume of Deposition (CY/year)
Port of Ilwaco Marina	0.4	29,000
Port of Chinook Marina	0.3	9,000

Table 3 summarizes the volumes of dredging for the Port of Ilwaco and Port of Chinook Marinas to achieve the designed depths (also referenced as Capital Dredging) and maintenance dredging requirements for a 10-year period[3].

[2] Rate of sediment deposition is the thickness of accumulated sediment layer, averaged over the entire area of the marina.

[3] The table considers that the Port of Ilwaco Marina maintenance dredging will remove 58,000 cy of sediment once every two years, and the Port of Chinook Marina maintenance dredging will remove 27,000 cy of sediment once every three years.

Table 3. Summary of Dredging Volumes

Port	Capital Dredging (CY)	Yearly Maintenance (CY/yr)	Total Volume for 10 Years (CY)
Ilwaco	450,000	29,000	740,000
Chinook	67,000	9,000	157,000

3. Dredging and Dredge Material Disposal Alternatives

Analysis and development of the dredging and dredged material disposal alternatives was conducted to identify feasible and cost-effective measures that will provide long-term sustainable and navigable depths in the Port of Ilwaco and Port of Chinook Marinas. As a result, a total of five dredging and dredged material disposal alternatives for the Port of Ilwaco and three dredging and dredged material disposal alternatives for the Port of Chinook were developed and conceptually evaluated to select the preferred option(s). The evaluation was based on the following 7 (seven) criteria: performance, constructability (dredgeability), capital cost, maintenance cost, risks and uncertainties associated with environmental permitting process, use of dredged sediment for shoreline protection, and use of dredged sediment to maintain sediment budget in LCR Estuary. Initial feedback from Portland District USACE dredging experts was also considered in the evaluation of alternatives.

Based on evaluation of the analysis results and coordination with the Port of Ilwaco and Port of Chinook, two preferred alternatives[4] were selected for the Port of Ilwaco and one preferred alternative was selected for the Port of Chinook.

The preferred alternatives for the Port of Ilwaco are: Most preferred – Dredging with a small hydraulic dredge and placement of sediment into nearshore beneficial use disposal sites; and Preferred – Clamshell and bottom dump barges with open water disposal and restoration of existing upland disposal site capacity.

Port of Ilwaco Most Preferred Alternative: Dredging with a small hydraulic dredge and placement of sediment into nearshore beneficial use disposal sites. The objective of this alternative is to develop an unlimited capacity nearshore disposal site with several beneficial uses including: a) minimizing shoreline erosion; and b) restoring historical levels of suspended sediment concentration in the Lower Columbia River Estuary that has apparently been depleted during the last century. Upon implementation of this alternative, no need for an upland disposal site would exist in the future. The concept of the Most Preferred alternative is described in Figure 2 (a and b).

[4] Two alternatives (instead of one) was selected due to the risks associated with obtaining environmental permits for the most preferred, cost-effective alternative. However, during the next phase of the project it may occur that this alternative will require a complex and lengthy process of permitting that may eventually transform this alternative into a more expensive and less preferred alternative. Thus, the funds are secured for a second preferred alternative that should be used to implement it.

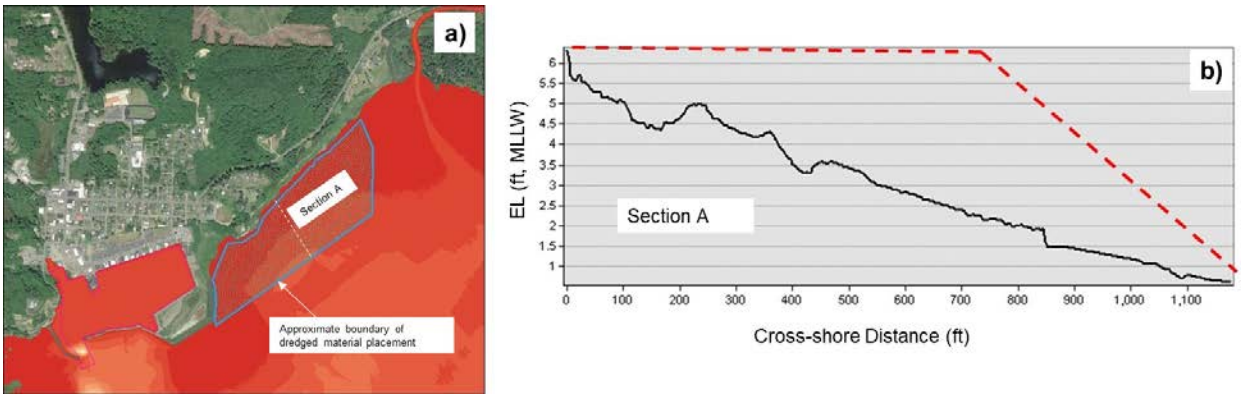

Figure 2. Port of Ilwaco Dredge Material Disposal - Most Preferred Alternative Concept

Plate "a" of Figure 2 shows the boundary of the proposed nearshore and beneficial use dredged material placement area overlaid on the bathymetric survey data. The boundary of the landward part of the proposed placement site is aligned along the eroding shoreline and armor rock revetment that was placed at some locations to stop the shoreline erosion. Plate "b" of Figure 2 shows, in black, the existing depths (elevations) along Section A and proposed vertical limits (red-dashed line) of the dredged material placement. The geometric volume confined by the boundaries of the proposed site and existing configuration of the bed is estimated to be in excess of 600,000 cy, which would be sufficient for first-time placement and long-term maintenance dredging requirements. Please note that a steep drop of existing elevations at the landward part of the section indicates the presence of armor rock and concrete slabs that were built and maintained historically to stop shoreline erosion.

With this Most Preferred alternative, the marina would be dredged by a small hydraulic dredge with placement of sediment through a hydraulic pipeline directly at the nearshore disposal area. No confinement for placement of dredged sediment is assumed at this time[5]. Once placed, the dredged material will be subject to erosion from energy produced by waves and tidal currents. However, by eroding and absorbing wave and tidal current energy, the dredged sediment provides protection from shoreline erosion.

Port of Ilwaco Preferred Alternative: Clamshell and bottom dump barges with open water disposal and restoration of existing upland disposal site capacity. This alternative includes maintenance of the existing upland disposal site, but periodically (once every 10-15 years) emptying the site using the operations discussed below. The frequency of emptying the upland disposal site would be reduced (more time between re-empty events) if there are opportunities for beneficial use of dredged material[6]. The concept of this alternative is illustrated in Figure 3 (plates "a" and "b").

[5] A final decision on the need for a confinement berm would be made during the permitting process and through consultation with the agencies and USACE.

[6] Based on information from the Port of Ilwaco, there was one example of using a limited amount dredged material (approximately 12,000 cy) from the upland disposal site of the Port for a habitat restoration project. However, long-term and regular users of the dredged material have not yet been identified.

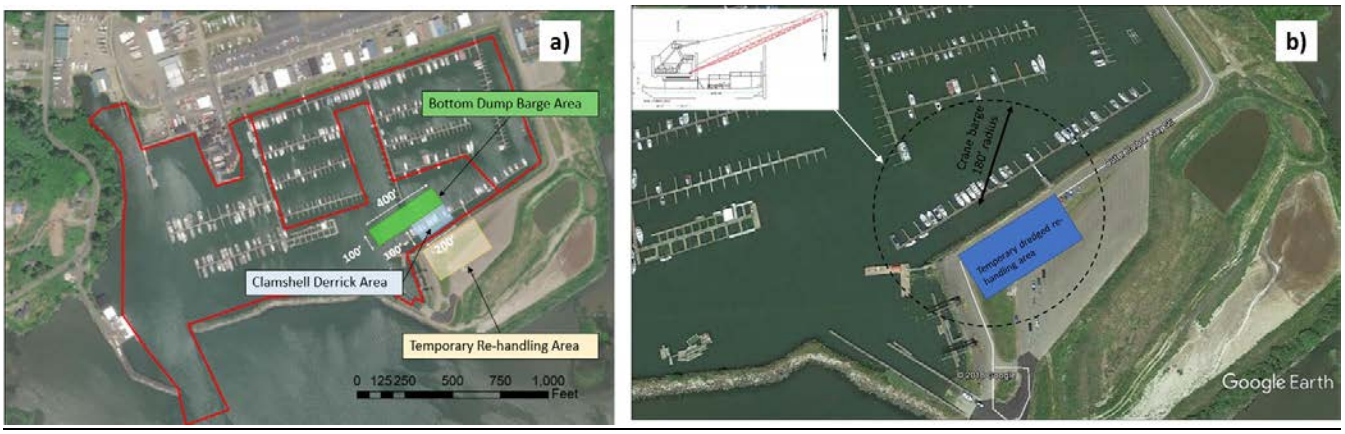

Figure 3. Port of Ilwaco Disposal Alternative 1 schematics

Plate A shows the overall view of the Port of Ilwaco Marina with the existing upland site. With Alternative 1, dredged material from this upland disposal site will be periodically mechanically excavated and placed at the temporary re-handling area, also shown in the figure. It should be noted that the specific location of the re-handling facility may change due to possible remodeling of the adjacent upland area[7], but still will be within reach of the clamshell, shown schematically in Plate B. The clamshell will be able to reach the temporary re-handling facility and load the excavated sediment to the bottom dump barge, stationed at the temporary offloading facilities (Bottom Dump Barge Area), as shown in Plate A.

This alternative assumes using a clamshell and bottom dump barge with a capacity of 4,000 – 6,000 cy, with a loaded draft of 12-17 ft. that will be moored at the temporary loading facility. Additional dredging may be required at this loading facility to accommodate barge loading operations without grounding. The volume of this dredging as well as specific locations of temporary loading and re-handling facilities shall be determined upon preliminary and final design of the dredging operations, if this alternative is implemented.

Once loaded with excavated sediment, the bottom dump barge will be towed to the designated open water disposal site where sediment will be disposed. The specific open water disposal site for placement of excavated sediment shall be determined upon preliminary and final design, but likely would be one of the USACE's Columbia River Mouth sites.

Port of Chinook Preferred Alternative: Dredging with a hydraulic dredge and placement of sediment at the nearshore beneficial use disposal sites. The objective of this alternative is to develop an unlimited capacity nearshore open water disposal site, restore the eroded bottom slope, and abandon the existing upland disposal site. Also, it is believed that this alternative would beneficially contribute to restoration of historical levels of suspended sediment concentration in the Lower Columbia River Estuary that, apparently, have been depleted during the last century. The concept of the alternative is described in Figure 4.

[7] For example, as informed by the Port, the marina restroom facilities may be relocated in the vicinity of the proposed project area. Thus, if this occurs, the location of the re-handling area shown in the figure would shift appropriately.

Figure 4. Port of Chinook Preferred Dredging and Dredged Disposal Alternative

The proposed nearshore disposal area is preliminarily identified with dimensions at approximately 3,000 ft. long (along the shore) and 500 ft. wide (perpendicular to the shore), as shown in Figure 4 The location of the disposal area was selected along the nearshore bottom slope that recently has been subjected to scour and deepening (trenching), apparently from landward migration of the tidal channel. Formation of the trench at the nearshore area has contributed to acceleration of shoreline erosion; thus, several shoreline erosion measures have been undertaken at this area recently.

Under this alternative, dredging in the marina would be conducted by a hydraulic dredge. The dredged sediment would be pumped through a short length of pipeline and discharged directly at the proposed nearshore placement area, shown in the figure. The type and dimensions of the hydraulic dredge as well as detailed alignment of the pipeline should be determined during preliminary and final design. Preliminarily, it is expected that a portable hydraulic dredge of a minimum 10” and maximum 16” discharge pipe diameter would be used for the project. The length of pipeline would not exceed 4,000 ft.; thus, no need for a booster pump is assumed.

Placement of dredged material at the proposed placement site would minimize scour effects and preclude further formation of a trench. The placement area would be sufficient for placement of sediment from capital and the following maintenance dredging events.

4. Dredging and Dredged Material Disposal Alternatives Preliminary Cost Estimates

Cost estimates for implementation of each of the preferred dredging and dredged material placement alternatives were developed at the preliminary level[8] based on the general assumptions as follows:

- All dredged and excavated sediment are suitable for open water disposal.
- Open water disposal sites at the Mouth of Columbia River with be available for placement of sediment from the Port of Chinook and the Port of Ilwaco.
- Costs for permitting and related mitigation measures (if required) are not included.
- Costs for acquiring land or leases of nearshore areas (if required) are not included.
- All dredging work will be performed by the Contractor.
- All costs are in 2018 money values.
- Dredging cost estimates for hydraulic dredging work were computed using the Corps of Engineering Dredging Software (Dredging Cost Spreadsheet).

In addition to the general, the explicit assumptions are described in more detail in the study report. The results of the cost estimates are presented below in Table 4.

Table 4. Port of Ilwaco and Port of Chinook Recommended Dredging and Disposal Alternative Preliminary Cost Estimates

Port	Alternative	First-Time Dredging Costs	Design Maintenance Dredging Event Costs[9]
Ilwaco	Most Preferred Alternative	$2,800,000	$420,000
	Preferred Alternative	$11,000,000	$460,000
Chinook	Preferred Alternative	$3,000,000	$270,000

5. Recommendations

1. Port Ilwaco
   a. Proceed with design, permitting, and implementation for the Most Preferred Alternative of dredging and dredged material disposal.
   b. Secure the funds for Preferred Alternative ($11,000,000) in case the permitting process for Most Preferred Alternative requires unreasonable amounts of time and resources.
2. Port of Chinook
   a. Proceed with obtaining funds for design, permitting, and implementation of the recommended Preferred Alternative of dredging and dredged material disposal.

[8] The level of accuracy of the preliminary cost estimates corresponds to the opinion on the order of magnitude and is used herein for comparison analysis and selection of the preferred alternative. More accurate cost estimates would be developed during the next phases of the project; preliminary and final design.
[9] Maintenance dredging event for the Port of Ilwaco Marina is assumed once every 2 years with a volume of 58,000 cy.