Final Independent External Peer Review Report Columbia River at the Mouth, Oregon and Washington Major Rehabilitation Evaluation Report

Prepared by
Battelle Memorial Institute

Prepared for
Department of the Army
U.S. Army Corps of Engineers
Deep Draft Navigation Planning Center of Expertise
Mobile District

Contract No. W912HQ-10-D-0002
Task Order: 0007

March 9, 2011

Final Independent External Peer Review Report
Columbia River at the Mouth, Oregon and Washington
Major Rehabilitation Evaluation Report

by

Battelle
505 King Avenue
Columbus, OH 43201

for

Department of the Army
U.S. Army Corps of Engineers
Deep Draft Navigation Planning Center of Expertise
Mobile District

March 9, 2011

Contract Number W912HQ-10-D-0002
Task Order Number: 0007

This page is intentionally left blank.

FINAL
INDEPENDENT EXTERNAL PEER REVIEW REPORT
for the

Columbia River at the Mouth, Oregon and Washington
Major Rehabilitation Evaluation Report

EXECUTIVE SUMMARY

Project Background and Purpose

The Mouth of the Columbia River (MCR) navigation project is located at the confluence of the Columbia River with the Pacific Ocean on the border between Washington and Oregon. Navigation is maintained by three primary navigation structures, North Jetty, South Jetty, and Jetty A. The North Jetty and Jetty A are located in Pacific County, Washington, near Ilwaco and Long Beach on the Long Beach Peninsula. The North Jetty was completed in 1917. Jetty A, positioned on the south side of the North Jetty, was constructed in 1939 to a length of 1.1 miles. Jetty A was constructed to direct river and tidal currents away from the North Jetty foundation. The South Jetty is located in Clatsop County, Oregon near Warrenton/Hammond and Astoria. The initial 4.5-mile section of the South Jetty was completed in 1895, with a 2.4-mile extension completed in 1913. Jetty construction realigned the ocean entrance to the Columbia River, established a consistent navigation channel that was 40 feet below MLLW across the bar, and significantly improved navigation through the MCR. Improvements made from 1930 to 1942 (including addition of Jetty A and Sand Island pile dikes) produced the present entrance configuration. Each year, ocean-going vessels on the Columbia River carry about 40 million tons of cargo with an estimated value of $17 billion on an annual basis. More than 12,000 commercial vessels and 100,000 recreational/charter vessels navigate through the MCR annually.

Prior to improvement in 1885, the tidal channels through the MCR shifted north and south between Fort Stevens and Cape Disappointment, a distance of about 5.5 miles. The controlling depth of dominant channel through the ebb tidal delta varied between 18 to 25 feet deep below MLLW. The ebb and flood tidal deltas at MCR entrance were distributed over a large area immediately seaward and upstream of the river mouth. Ships often had difficulty traversing the Columbia River bar, the area in which the flow of the estuary rushes headlong into towering ocean waves. On many occasions, outbound ships had to wait a month or more until bar conditions were favorable for crossing. To make navigating through the MCR even worse, sailing ships had to approach either of the two natural channels abeam to the wind and waves. The natural channels often shifted widely within the course of several tidal cycles. At best, crossing the bar was dangerous. At worst, it was not possible. Offshore of the MCR lies the vast expanse of the northeast Pacific Ocean. Inshore of the MCR lies the Columbia River and estuary, the coastal outlet for a drainage basin of 250,000 square miles.

Despite intermittent repair and partial rehabilitation efforts, all of the MCR jetties are currently in an unacceptably deteriorated condition. This project was undertaken to address problems related to the structural stability of the MCR jetty system in order to extend the functional life of the jetties and maintain deep-draft navigation.

Independent External Peer Review Process

USACE is conducting an Independent External Peer Review (IEPR) of the Columbia River at the Mouth, Oregon and Washington Major Rehabilitation Evaluation Report (hereinafter Mouth of Columbia River IEPR). Battelle, as a 501(c)(3) non-profit science and technology organization with experience in establishing and administering peer review panels for USACE, was engaged to coordinate the IEPR of the Mouth of Columbia River Major Rehabilitation Evaluation Report. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2010), USACE (2007), and OMB (2004). This final report describes the IEPR process, describes the panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel (the Panel).

Five panel members were selected for the IEPR from more than 28 identified candidates. Based on the technical content of the Mouth of Columbia River Major Rehabilitation Evaluation Report and the overall scope of the project, the final panel members were selected for their technical expertise in the following key areas: design and construction engineering (coastal engineering), plan formulation, biology NEPA, hydrology and hydraulics engineering/coastal engineering, geomorphology, and economics. USACE was given the list of candidate panel members, but Battelle made the final selection of the Panel.

The Panel received electronic versions of the Mouth of Columbia River IEPR documents, totaling more than 1,000 pages, along with a charge that solicited comments on specific sections of the documents to be reviewed. The charge was prepared by USACE according to guidance provided in USACE (2010) and OMB (2004). Charge questions were provided by USACE and included in the draft and final Work Plans.

The USACE Project Delivery Team briefed the Panel and Battelle during a kick-off meeting held via teleconference prior to the start of the review. In addition to this initial teleconference, a second teleconference with USACE, the Panel, and Battelle was conducted halfway through the review period to provide the Panel an opportunity to ask questions of USACE and clarify uncertainties. The Panel produced more than 500 individual comments in response to the 78 charge questions.

IEPR panel members reviewed the Mouth of Columbia River IEPR documents individually. The panel members then met via teleconference with Battelle to review key technical comments, discuss charge questions for which there were conflicting responses, and reach agreement on the Final Panel Comments to be provided to USACE. Each Final Panel Comment was documented using a four-part format consisting of: (1) a comment statement; (2) the basis for the comment; (3) the significance of the comment (high, medium, or low); and (4) recommendations on how to resolve the comment. Overall, 25 Final Panel Comments were developed. Of these, 8 were identified as having high significance, 14 had medium significance, and 3 had low significance.

Results of the Independent External Peer Review

The panel members agreed among one another on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2010; p. D-4) in the Mouth of Columbia River IEPR document. Of primary significance, and as discussed in several of the Final Panel Comments, the Panel has serious concern with the SRB model and the potentially over-emphasized role it played in the evaluation of alternatives, engineering design, and economic analyses. Table ES-1 lists the Final Panel Comments statements by level of significance. The full text of the Final Panel Comments is presented in Appendix A of this report. The following statements summarize the Panel's findings.

Plan Formulation Rationale: From a planning perspective, the Major Rehabilitation Evaluation Report is well done and in compliance with all of the typical formulation steps; however, it was never clearly explained that the scope of work was limited to the repair and rehabilitation within the present configuration, nor why it was limited in this manner. Undefined risk thresholds may serve to undermine the logic of the cost and maintenance predictions and, to a lesser extent, the alternatives selected. The Panel agreed that the SRB model is not a substitute for conventional engineering and economic analyses and should not be a stand-alone analysis for selecting a recommended plan.

Economics: The Panel identified three major issues in the economic analysis: (1) inconsistencies in the Major Rehabilitation Evaluation Report and economic spreadsheet models; (2) the assumption that navigation would not be impacted; and (3) the formulation of the base condition. Inconsistencies in the report and economic spreadsheet models pertaining to the calculation of NPVs and AACs prevented the Panel from validating the economic analysis. Based on the assumption that navigation will not be impacted, a least cost analysis was used in lieu of a transportation cost savings analysis to calculate NED benefits. Conflicting assumptions concerning the ability to maintain navigation invalidate the logic behind calculating NED benefits using a least cost analysis. As the project is currently formulated, the base condition maintenance strategy for the MCR jetties conforms most closely with the fix-as-fails strategy, while the base condition life-cycle costs are the basis for estimating project benefits for all action alternatives. Inaccurate formulation of the base condition may increase life cycle costs, and may erroneously escalate project benefits. Each of these issues could impact the selection of the NED plan, which was selected as the recommended plan.

Engineering: There are serious technical difficulties with the Major Rehabilitation Evaluation Report and analyses. The report lacks a set of design criteria, including project life, standards of performance to be met, and environmental conditions with return period events. All are part of conventional coastal engineering design practice. The SRB model cannot be verified and does not include important processes. Major questions remain that have not been adequately investigated for this level of study, including subsurface geotechnical properties, feasibility of proposed barge offloading/material re-handling facilities, and the long term stability of the jetty foundations assuming continued erosion and loss of nearshore sediment. The report indicates that large volumes of sediment will move into the navigation channel after a breach event. However, the data and analysis do not support this conclusion. Additionally, is no clear discussion of the role of maintenance or emergency dredging, especially under extreme winter conditions. Detailed construction cost estimates also need to be provided in order for the cost analysis to be complete and verifiable. Although there is a good description of historical failures and repair actions for each jetty, there is no discussion or documentation of current jetty condition or detailed condition assessments of structure and functional condition.

Environmental: There is no discussion in the main report of sea level rise and potential wave height increases and its impact on this project over the 50+ year project timeline, given that the regional wave climate has been documented as more severe in the last 10 years. This has potential impacts to the project and in designing a project with lower long-term maintenance costs. Potential environmental impacts on sensitive species, upland habitats, and water quality as well as potential impacts to recreational use during project construction are not comprehensive nor adequately described in the mitigation plan. Finally, the alternatives are limited to armoring the existing configuration of the jetties and may not satisfy NEPA directive for alternative analysis.

Table ES-1. Overview of 25 Final Panel Comments Identified by the Mouth of Columbia River IEPR Panel

Significance – High	
1	The economic analysis used to select the National Economic Development (NED) plan cannot be validated, nor can it be determined if assumptions were applied correctly in the economic spreadsheet models.
2	The analysis of the sediment transport process is not comprehensive, and the data and analysis do not support the conclusions concerning large movement of sediment during a breach event.
3	The underlying assumption that navigational impacts will not occur is not substantiated.
4	The SRB model by itself has very limited value for analyzing alternatives and is not a substitute for conventional economic and engineering analysis.
5	The base condition, as formulated, does not represent the current O&M practice.
6	The reported analysis and design to mitigate a potential breach of the foreshore dune at the South Jetty root is not adequate.
7	The basis of design and design environmental criteria are vague, not consistent within the report, and not consistent with conventional coastal engineering design practice.
8	The models and analyses of jetty failure do not include all significant processes.
Significance – Medium	
9	The alternative selection process may fail to meet the requirements of NEPA Section 1502.14.
10	A failure analysis for the original structure design and past trends of Operation and Maintenance (O&M) costs has not been provided.
11	Sea level rise and potential increases in wave height have not been examined sufficiently under different model scenarios.

Table ES–1. Overview of 25 Final Panel Comments Identified by the Mouth of Columbia River IEPR Panel, continued

Significance – Medium	
12	Construction cost estimates cannot be evaluated because the assumptions and details have not been provided.
13	Potential environmental impacts on sensitive species, upland habitats, and water quality have not been thoroughly discussed or specifically mitigated in the document.
14	Potential impacts to recreational use during project construction, as identified in public comments, are not adequately discussed or mitigated.
15	There is not sufficient information on the evaluation of barge offloading and material re-handling facilities to ensure these sites can operate as intended and to ensure the construction costs are adequately represented.
16	The requirements, costs, and history associated with emergency dredging compared to scheduled maintenance dredging activities have not been specified.
17	The current jetty structure condition is not well described, making it difficult to confirm the confidence of the SRB model analysis and selection of a recommended plan.
18	The mechanisms causing jetty head scour have not been sufficiently analyzed to allow selection of the appropriate jetty head repair measure.
19	Risk thresholds for selected alternatives are not clearly defined.
20	It is not clear how uncertainty and derived risk analyses were considered in the structure and application of the model.
21	The model output parameters and wave height components are not clearly explained and supported.
22	The culvert installation details, as well as potential impacts, need further clarification.
Significance – Low	
23	The various base years cited in the report and the difference between project life and period of analysis require additional explanation.
24	Cargo tonnage and vessel trip statistics presented throughout the report are inconsistent.
25	Terminology related to jetty rehabilitation and failure is defined inconsistently or vaguely in some places.

This page is intentionally left blank.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ACRONYMS

AAC	Average annual cost
ATR	Agency Technical Review
CEDER	Center for Economic Development and Research
CE/ICA	Cost effectiveness/incremental cost analysis
CHL	Coastal and Hydraulic Laboratory
CMS	Coastal Modeling System
COI	Conflict of Interest
DEC	Design Environmental Conditions
DrChecks	Design Review and Checking System
EA	Environmental Assessment
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionary significant unit
IEPR	Independent External Peer Review
LCR	Lower Columbia River
MCR	Mouth of Columbia River
MLLW	Mean lower low water
NED	National Economic Development
NEPA	National Environmental Policy Act
NPV	Net present value
NTP	Notice to Proceed
O&M	Operation and Maintenance
OMB	Office of Management and Budget
PNWA	Pacific Northwest Waterways Association
SWS	Shallow water site
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WRDA	Water Resources Development Act

1. INTRODUCTION

The Mouth of the Columbia River (MCR) navigation project is located at the confluence of the Columbia River with the Pacific Ocean, on the border between Washington and Oregon. Navigation is enabled by three primary navigation structures, North Jetty, South Jetty, and Jetty A, plus maintenance dredging of about 4 million cubic yards per year from the entrance channel. The North Jetty and Jetty A are located in Pacific County, Washington, near Ilwaco and Long Beach on the Long Beach Peninsula. The North Jetty was completed in 1917. Jetty A, positioned on the south side of the North Jetty, was constructed in 1939 to a length of 1.1 miles. Jetty A was constructed to direct river and tidal currents away from the North Jetty foundation. The South Jetty is located in Clatsop County, Oregon near Warrenton/Hammond and Astoria. The initial 4.5-mile section of the South Jetty was completed in 1895, with a 2.4-mile extension completed in 1913. Jetty construction realigned the ocean entrance to the Columbia River, established a consistent navigation channel that was 40 feet below mean lower low water (MLLW) across the bar, and significantly improved navigation through the MCR. Improvements made from 1930 to 1942 (including addition of Jetty A and Sand Island pile dikes) produced the present entrance configuration.

Prior to improvement in 1885, the tidal channels through the MCR shifted north and south between Fort Stevens and Cape Disappointment, a distance of about 5.5 miles. The controlling depth of dominant channel through the ebb tidal delta varied between 18 to 25 feet deep below MLLW. The ebb and flood tidal deltas at MCR entrance were distributed over a large area immediately seaward and upstream of the river mouth. Ships often had difficulty traversing the Columbia River bar, the area in which the flow of the estuary rushes headlong into towering ocean waves. On many occasions, outbound ships had to wait a month or more until bar conditions were favorable for crossing. To make navigating through the MCR even worse, sailing ships had to approach either of the two natural channels abeam to the wind and waves. The natural channels often shifted widely within the course of several tidal cycles. At best, crossing the bar was dangerous. At worst, it was not possible. Offshore of the MCR lies the vast expanse of the northeast Pacific Ocean. Inshore of the MCR lies the Columbia River and estuary, the coastal outlet for a drainage basin of 250,000 square miles.

The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the Mouth of Columbia River Major Rehabilitation Evaluation Report in accordance with procedures described in the Department of the Army, U.S. Army Corps of Engineers (USACE) Engineer Circular *Civil Works Review Policy* (EC No. 1165-2-209) (USACE, 2010), USACE CECW-CP memorandum *Peer Review Process* (USACE, 2007), and Office of Management and Budget (OMB) bulletin *Final Information Quality Bulletin for Peer Review* (OMB, 2004). Battelle, as a 501(c)(3) non-profit science and technology organization with experience in establishing and administering peer review panels, was engaged to coordinate the IEPR of the Mouth of Columbia River Major Rehabilitation Evaluation Report. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses.

This final report details the IEPR process, describes the IEPR panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel on the existing environmental, economic, and engineering analyses contained in the Mouth of Columbia River Major Rehabilitation Evaluation Report. The full text of the Final Panel Comments is presented in Appendix A.

2. PURPOSE OF THE IEPR

To ensure that USACE documents are supported by the best scientific and technical information, USACE has implemented a peer review process that uses IEPR to complement the Agency Technical Review (ATR), as described in USACE (2010) and USACE (2007).

In general, the purpose of peer review is to strengthen the quality and credibility of the USACE decision documents in support of its Civil Works program. IEPR provides an independent assessment of the economic, plan formulation, engineering, and environmental analysis of the project study. In particular, the IEPR addresses the technical soundness of the project study's assumptions, methods, analyses, and calculations and identifies the need for additional data or analyses to make a good decision regarding implementation of alternatives and recommendations.

In this case, the IEPR of the Mouth of Columbia River Major Rehabilitation Evaluation Report was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization under Section 501(c)(3) of the U.S. Internal Revenue Code with experience conducting IEPRs for USACE.

3. METHODS

This section describes the method followed in selecting the members for the IEPR Panel (the Panel) and in planning and conducting the IEPR. The IEPR was conducted following procedures described by USACE (2010) and in accordance with USACE (2007) and OMB (2004) guidance. Supplemental guidance on evaluation for conflicts of interest (COIs) was obtained from the *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports* (The National Academies, 2003).

3.1 Planning and Schedule

After receiving the notice to proceed (NTP), Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan.

Table 1 defines the schedule followed in executing the IEPR. Due dates for milestones and deliverables are based on the NTP date of December 6, 2010. Note that the work items listed in Task 7 occur after the submission of this report. Battelle will enter the 25 Final Panel Comments developed by the Panel into USACE's Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports and design documents, so that USACE can review and respond to them. USACE will provide responses (Evaluator Responses) to the Final Panel Comments, and the Panel will respond (BackCheck Responses) to the Evaluator Responses. All USACE and Panel responses will be documented by Battelle.

Table 1. Mouth of Columbia River IEPR Schedule

TASK	ACTION	DUE DATE
1	**NTP**	12/6/2010
	Review documents available	12/7/2010
	[a]Battelle submits draft Work Plan	12/15/2010
	USACE provides comments on draft Work Plan	12/20/2010
	[a]Battelle submits final Work Plan	12/28/2010
2	Battelle requests input from USACE on the conflict of interest (COI) questionnaire	12/8/2010
	USACE provides comments on COI questionnaire	12/9/2010
	[a]Battelle submits list of selected panel members	12/16/2010
	USACE provides comments on selected panel members	12/17/2010
	Battelle completes subcontracts for panel members	1/5/2011
3	[a]Battelle receives final charge from USACE (to be included in Work Plan)	12/10/2010
4	USACE/Battelle kick-off meeting	12/13/2010
	Battelle sends review documents to IEPR Panel	1/6/2011
	USACE/Battelle/Panel kick-off meeting	1/7/2011
	Battelle convenes mid-review teleconference for panel to ask clarifying questions of USACE	1/19/2011
5	Panel members complete their individual reviews	1/31/2011
	Battelle convenes panel review teleconference with IEPR Panel	2/10-2/11/2011
	Panel members provide draft Final Panel Comments to Battelle	2/21/2011
6	[a]Battelle submits Final IEPR Report to USACE	3/9/2011
7[b]	Battelle inputs Final Panel Comments to DrChecks; Battelle provides Final Panel Comment response template to USACE	3/10/2011
	Battelle convenes teleconference with USACE to review the requirements of the Evaluator Response process.	3/11/2011
	USACE provides draft Evaluator Responses and clarifying questions to Battelle	3/16/2011
	Battelle convenes teleconference between Battelle, Panel, and USACE to discuss Final Panel Comments, draft responses, and clarifying questions	3/23/2011
	USACE inputs final Evaluator Responses in DrChecks	3/30/2011
	Battelle inputs the Panel's BackCheck Responses in DrChecks	4/7/2011
	[a]Battelle submits pdf printout of DrChecks project file	4/8/2011
	Project Closeout	6/13/2011

[a] Deliverable

[b] Task 7 occurs after the submission of this report.

3.2 Identification and Selection of IEPR Panel Members

The candidates for the Panel were evaluated based on their technical expertise in the following key areas: design and construction engineering (coastal engineering), plan formulation, biology/ National Environmental Policy Act (NEPA), hydrology and hydraulics engineering/coastal engineering, geomorphology, and economics. These areas correspond to the technical content of the Mouth of Columbia River IEPR and overall scope of the Columbia River at the Mouth, Oregon and Washington Major Rehabilitation Evaluation Report project.

To identify candidate panel members, Battelle reviewed the credentials of the experts in Battelle's Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Battelle initially identified more than 28 candidates for the Panel, evaluated their technical expertise, and inquired about potential COIs. Of these, Battelle chose seven of the most qualified candidates and confirmed their interest and availability. Of the seven candidates, five were proposed for the final Panel and two were proposed as backup reviewers. Information about the candidate panel members, including brief biographical information, highest level of education attained, and years of experience, was provided to USACE for feedback. Battelle made the final selection of panel members according to the selection criteria described in the Work Plan.

The five proposed primary reviewers constituted the final Panel. The remaining candidates were not proposed for a variety of reasons, including lack of availability, disclosed COIs, or lack of the precise technical expertise required.

The candidates were screened for the following potential exclusion criteria or COIs.[1] These COI questions were intended to serve as a means of disclosure and to better characterize a candidate's employment history and background. Providing a positive response to a COI screening question did not automatically preclude a candidate from serving on the Panel. For example, participation in previous USACE technical peer review committees and other technical review panel experience was included as a COI screening question. A positive response to this question could be considered a benefit.

- Involvement by you or your firm[2] in the Major Rehabilitation of the Jetty System at the Mouth of the Columbia River, Major Rehabilitation Evaluation Report and technical appendices.
- Involvement by you or your firm[2] in any work related to deep draft navigation studies on the Columbia River.

[1] Battelle evaluated whether scientists in universities and consulting firms that are receiving USACE-funding have sufficient independence from USACE to be appropriate peer reviewers. See OMB (2004, p. 18), "….when a scientist is awarded a government research grant through an investigator-initiated, peer-reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects. This contrasts, for example, to a situation in which a scientist has a consulting or contractual arrangement with the agency or office sponsoring a peer review. Likewise, when the agency and a researcher work together (e.g., through a cooperative agreement) to design or implement a study, there is less independence from the agency. Furthermore, if a scientist has repeatedly served as a reviewer for the same agency, some may question whether that scientist is sufficiently independent from the agency to be employed as a peer reviewer on agency-sponsored projects."

- Involvement by you or your firm[2] in projects related to the Major Rehabilitation of the Jetty System at the Mouth of the Columbia River, Major Rehabilitation Evaluation Report and technical appendices.
- Involvement by you or your firm[2] in the conceptual or actual design, construction, or O&M of any projects related to the Major Rehabilitation of the Jetty System at the Mouth of the Columbia River, Major Rehabilitation Evaluation Report and technical appendices.
- Current employment by the U.S. Army Corps of Engineers (USACE).
- Involvement with paid or unpaid expert testimony related to the Major Rehabilitation of the Jetty System at the Mouth of the Columbia River, Major Rehabilitation Evaluation Report and technical appendices.
- Current or previous employment or affiliation with members of any of the following cooperating Federal, State, County, local and regional agencies, environmental organizations, and interested groups: National Marine Fisheries Service, U.S. Fish and Wildlife Service, U.S. Geological Survey, Washington Department of Ecology, Oregon Department of Environmental Quality, Oregon Department of Land Conservation and Development, or Portland State University (for pay or pro bono).
- Past, current or future interests or involvements (financial or otherwise) by you, your spouse or children related to the mouth of the Columbia River.
- Current personal involvement with other USACE projects, including whether involvement was to author any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the Portland District.
- Current firm[2] involvement with other USACE projects, specifically those projects/contracts that are with the Portland District. If yes, provide title/description, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role.
- Any previous employment by the USACE as a direct employee or contractor (either as an individual or through your firm[2]) within the last 10 years, notably if those projects/contracts are with the Portland District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning deep draft navigation or coastal engineering, and include the client/agency and duration of review (approximate dates).
- Pending, current or future financial interests in contracts/awards from USACE related to the Major Rehabilitation of the Jetty System at the Mouth of the Columbia River, Major Rehabilitation Evaluation Report and technical appendices.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years came from USACE contracts.
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to Major Rehabilitation of the Jetty System at the Mouth of the Columbia River, Major Rehabilitation Evaluation Report and technical appendices.

- Participation in relevant prior Federal studies relevant to this project, including:
  - U.S. Army Corps of Engineers. 1983. Columbia River at the Mouth Navigation Channel Improvement, Final Environmental Impact Statement, Oregon-Washington. Portland, Oregon.
  - Earth Sciences Associates and Geo Recon International. 1985. Geologic and Seismic Investigation of Columbia River Mouth Study Area, Report for U.S. Army Corps of Engineers, Portland District, Portland, Oregon.
  - Northwest Geophysical Associates, Inc. 1996. 1996 Columbia River Offshore Disposal Site Study, Sidescan Sonar Investigation, Report for U.S. Army Corps of Engineers, Portland District, Portland, Oregon.
  - U.S. Army Corps of Engineers. 1999. Integrated Feasibility Report for Channel Improvements and Environmental Impact Statement, Columbia and Lower Willamette River Federal Navigation Channel. Portland, Oregon.
  - NMFS. 2004. Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery and Conservation Management Act Essential Fish Habitat Consultation for the Columbia River North and South Jetties Rehabilitation, Columbia River Basin, Clatsop County, Oregon.
  - USACE. 2005. Interim Repair Decision Document for North and South Jetties at the Mouth of the Columbia River, Oregon and Washington. U.S. Army Corps of Engineers-Portland District, Portland, Oregon.
  - Global Remote Sensing. 2005. Mouth of the Columbia River Offshore Disposal Site Study, Multibeam Investigations, Report for U.S. Army Corps of Engineers, Portland District, Portland, Oregon.
  - Tetra Tech, Inc. April 2007. Wetland and Waters of the U.S. Delineation Revised Final Report: North Jetty, Mouth of the Columbia River, Pacific County, Washington. Prepared for U.S. Army Corps of Engineers, Portland, Oregon.
  - Tetra Tech, Inc. April 2007. Clatsop Spit Plant Communities Investigation and Mapping, Final Report: South Jetty, Mouth of the Columbia River, Clatsop County, Oregon. Prepared for U.S. Army Corps of Engineers, Portland, Oregon.
  - Ward, D. L., Melby, J.A., Myrick, G.B., and Henderson, W.G. 2007. Physical Model Study of Jetties at the Mouth of the Columbia River, Oregon and Washington. ERDC/CHL TR-07-XX. U.S. Army Corps of Engineers. Engineer Research and Development Center-Coastal and Hydraulics Laboratory. Vicksburg, Mississippi.
  - Demirbilik, Z., Lin, L, and Nwogu, O.G. 2008. Wave Modeling for Jetty Rehabilitation at the Mouth of the Columbia River, Oregon and Washington. ERDC/CHL TR-08-3. U.S. Army Corps of Engineers. Engineer Research and Development Center-Coastal and Hydraulics Laboratory. Vicksburg, Mississippi.
  - Moritz, H.R. and Moritz, H. P. 2009. Stochastic Risk-Based Life Cycle Simulation of Century Old Jetties at the Mouth of the Columbia River, USA. International Conference on Coasts, Marine Structures, and Breakwaters 2009. Proceedings of the Institution of Civil Engineers. Presented in Edinburgh, Scotland, September 2009.
- Participation in prior non-Federal studies relevant to this project.

- Is there any past, present or future activity, relationship or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project? If so, please describe:

In selecting the final members of the Panel from the list of candidates, Battelle chose experts who best fit the expertise areas and had no COIs. The five final reviewers were either affiliated with academic institutions or consulting companies or were independent engineering consultants. Battelle established subcontracts with the panel members when they indicated their willingness to participate and confirmed the absence of COIs through a signed COI form. USACE was given the list of candidate panel members, but Battelle made the final selections of the Panel. Section 4 of this report provides names and biographical information on the panel members.

Prior to beginning their review and within 2 days of their subcontracts being finalized, all members of the Panel attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication procedures, and other pertinent information for the Panel.

3.3 Preparation of the Charge and Conduct of the IEPR

Shortly after Battelle received NTP, USACE provided the following documents and reference materials. The documents and files in bold font were provided for review and the other documents were provided for reference or supplemental information only.

- **Columbia River at the Mouth, Oregon and Washington Major Rehabilitation Evaluation Report**
  - **Appendix A1: Coastal Engineering**
  - **Appendix A2: Reliability Analysis, Event Tree Formulation and Life-Cycle Simulation**
  - **Appendix B: Geotechnical**
  - **Appendix C: Economics**
  - **Appendix D: Environmental Documentation**
  - **Appendix E: M-CACES Cost Estimate for Recommended Plan**
  - Appendix F: Project Management Plan
  - Appendix G: Schedule of Fully Funded Project Costs
- USACE guidance *Civil Works Review Policy* (EC 1165-2-209) dated January 31, 2010
- CECW-CP Memorandum dated March 31, 2007
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

In addition, throughout the review period, USACE provided additional documents at the request of panel members. These additional documents were provided as supplemental information only and were not part of the official review:

- Jetty Rehab, Mouth of the Columbia River, USGS Draft v01 Appendix Figures, Edwin Elias and Guy Gelfenbaum 2007
- Jetty Rehab, Mouth of the Columbia River, USGS Draft v02, Edwin Elias and Guy Gelfenbaum 2007

- Analysis of Jetty Rehabilitation at the Mouth of the Columbia River, Washington/Oregon, USA Part: 2 Regional Circulation, Sediment Transport, and Morphology Change June 2007 ERDC/CHL Kenneth J. Connell and Julie Dean Rosati
- 2009 MCR Jetty inspection reports and supporting documentation
- Summary of the Jetty heads and the physical model
- Model Documentation Report
- Additional documentation on design criteria
- Appendix b geotechnical studies (as listed in the file name)
- Exhibit M Economic Analysis of the Columbia River Channel Improvement Project, Final Supplemental Integrated Feasibility Report and Environmental Impact Statement
- Economic spreadsheet models for each jetty
- Three AVIs and videos showing the velocity vectors at the MCR
- a summary of the Jetty heads and the physical model
- Mouth of the Columbia River North Jetty, South Jetty, and Jetty A Rehabilitation Template Examples
- Documentation sent to USACE Headquarters to obtain model approval for use.

Charge questions were provided by USACE and included in the draft and final Work Plans. In addition to a list of 78 charge questions/discussion points, the final charge included general guidance for the Panel on the conduct of the peer review (provided in Appendix B of this final report).

Battelle planned and facilitated a final kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meeting, the IEPR Panel received an electronic version of the Mouth of Columbia River IEPR documents and the final charge. A full list of the documents reviewed by the Panel is provided in Appendix B of this report. The Panel was instructed to address the charge questions/discussion points within a comment-response form provided by Battelle.

3.4 Review of Individual Comments

Prior to completion of the review of the Mouth of Columbia River IEPR documents, a teleconference with USACE, the Panel, and Battelle was held halfway through the review period to provide the Panel an opportunity to ask questions of USACE regarding uncertainties requiring clarification. At the end of the review period, the Panel produced approximately 500 individual comments in response to the charge questions/discussion points. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other overall impressions. As a result of the review, Battelle summarized the 500 comments into a preliminary list of 44 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

3.5 IEPR Panel Teleconference

Due to the number of comments and the complexity of the issues, Battelle facilitated two 3-hour teleconferences with the Panel so that the panel members, many of whom are from diverse scientific backgrounds, could exchange technical information. The main goal of the teleconferences was to identify which issues should be carried forward as Final Panel Comments in the IEPR report and decide which panel member would serve as the lead author for the development of each Final Panel Comment. This information exchange ensured that the Final IEPR Report would accurately represent the Panel's assessment of the project, including any conflicting opinions. The Panel engaged in a thorough discussion of the overall positive and negative comments, added any missing issues of high-level importance to the findings, and merged any related individual comments. In addition, Battelle confirmed each Final Panel Comment's level of significance to the Panel.

The Panel also discussed responses to seven specific charge questions where there appeared to be disagreement among panel members. The conflicting comments were resolved based on the professional judgment of the Panel, and each comment was either incorporated into a Final Panel Comment, determined to be consistent with other Final Panel Comments already developed, or determined to be a non-significant issue.

At the end of these discussions, the Panel identified 30 initial comments and discussion points that should be brought forward as Final Panel Comments.

3.6 Preparation of Final Panel Comments

Following the teleconference, Battelle prepared a summary memorandum for the Panel documenting each Final Panel Comment (organized by level of significance). The memorandum provided the following detailed guidance on the approach and format to be used to develop the Final Panel Comments for the Mouth of Columbia River IEPR:

- Lead Responsibility: For each Final Panel Comment, one Panel member was identified as the lead author responsible for coordinating the development of the Final Panel Comment and submitting it to Battelle. Battelle modified lead assignments at the direction of the Panel. To assist each lead in the development of the Final Panel Comments, Battelle distributed the merged individual comments table, a summary detailing each draft final comment statement, an example Final Panel Comment following the four-part structure described below, and templates for the preparation of each Final Panel Comment.
- Directive to the Lead: Each lead was encouraged to communicate directly with other IEPR panel members as needed and to contribute to a particular Final Panel Comment. If a significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.
- Format for Final Panel Comments: Each Final Panel Comment was presented as part of a four-part structure:
  1. Comment Statement (succinct summary statement of concern)
  2. Basis for Comment (details regarding the concern)
  3. Significance (high, medium, low; see description below)
  4. Recommendation(s) for Resolution (see description below).
- Criteria for Significance: The following were used as criteria for assigning a significance level to each Final Panel Comment:

1. High: Describes a fundamental problem with the project that could affect the recommendation, success, or justification of the project. Comments rated as high indicate that the Panel analyzed or assessed the methods, models, and/or analyses and determined that there is a "showstopper" issue.
2. Medium: Affects the completeness of the report in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium indicate that the Panel does not have sufficient information to analyze or assess the methods, models, or analyses.
3. Low**:** Affects the understanding or accuracy of the project as described in the report, but will not affect the recommendation or justification of the project. Comments rated as low indicate that the Panel identified information (tables, figures, equations, discussions) that was mislabeled or incorrect or data or report sections that were not clearly described or presented.

- Guidance for Developing Recommendation: The recommendation section was to include specific actions that USACE should consider to resolve the Final Panel Comment (e.g., suggestions on how and where to incorporate data into the analysis, how and where to address insufficiencies, areas where additional documentation is needed).

Battelle reviewed and edited the Final Panel Comments for clarity, consistency with the comment statement, and adherence to guidance on the Panel's overall charge, which included ensuring that there were no comments regarding either the appropriateness of the selected alternative or USACE policy. At the end of this process, 25 Final Panel Comments were prepared and assembled; four of the original 30 comments were merged with other existing Final Panel Comments and one was deleted because it did not meet the criteria for significance for Final Panel Comments. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments; however, Battelle sent working drafts of the Final Panel Comments to USACE as a means to help them get a head start in providing responses to the Panel comments. Battelle informed USACE that these working drafts could be revised, merged, deleted, or new comments created prior to the submittal of the Final IEPR Report. The Final Panel Comments are presented in Appendix A of this report.

4. PANEL DESCRIPTION

Candidates for the Panel were identified using Battelle's Peer Reviewer Database, targeted Internet searches using key words (e.g., technical area, geographic region), searches of websites of universities or other compiled expert sites, and referrals. Battelle prepared a draft list of primary and backup candidate panel members (who were screened for availability, technical background, and COIs), and provided it to USACE for feedback. Battelle made the final selection of panel members.

An overview of the credentials of the final five primary members of the Panel and their qualifications in relation to the technical evaluation criteria is presented in Table 2. More detailed biographical information regarding each panel member and his or her area of technical expertise is presented in the text that follows the table.

Table 2. Mouth of Columbia River IEPR Panel: Technical Criteria and Areas of Expertise

	Phillips	Cuba	Rein	Sultan	Maher	Sultan
Civil Design/Construction [Coastal Engineering] (one expert needed)	**X**					
Minimum 10 years experience in civil design/construction and coastal engineering	X			X		X
Familiar with large, complex Civil Works projects with high public and interagency interests	X			X		X
Experience performing coastal engineering design and construction management for coastal projects	X			X		X
Familiar with similar projects across the United States and related coastal engineering	X			X		X
Experience in computer modeling including Matlab experience in coastal engineering	X			X		X
Familiar with construction industry and practices used in coastal construction in the Pacific Northwest	X			X		X
Degree in civil engineering	X			X		X
Plan Formulation (one expert needed)		**X**				
Minimum 10 years experience in the plan formulation process		X		X		X
Familiar with large, complex Civil Works projects with high public and interagency interests		X		X		X
Familiar with evaluation of alternative plans for coastal projects		X		X		X
Familiar with USACE standards and procedures		X		X		X
Degree in planning or a related field		See waiver*				
Biology NEPA (one expert needed)			**X**			
Minimum 10 years experience in biology		X	X			
Familiar with large, complex Civil Works projects with high public and interagency interests		X	X			
Particular knowledge of ecosystem restoration		X	X			
Familiar with all NEPA requirements		X	X			
Minimum of an M.S. degree in Biology		X	X			
Hydrology and Hydraulics Engineering/Coastal				**X**		

	Phillips	Cuba	Rein	Sultan	Maher	Sultan
Engineering (one expert needed)						
Minimum 10 years experience in hydrology and hydraulics engineering				X		X
Familiar with large, complex Civil Works projects with high public and interagency interests				X		X
Experience with sediment transport and engineering analyses related to design to include a variety of materials and cross-sections				X		X
Familiar with standard USACE hydrologic and hydraulic computer models used in jetty design				X		X
Minimum of an M.S. degree in civil engineering or hydrology and hydraulics				X		X
Registered professional engineer				X		X
Economics (one expert needed)					**X**	
Minimum 10 years experience in economics				X	X	X
Familiar with large, complex Civil Works projects with high public and interagency interests				X	X	X
Able to evaluate the appropriateness of cost effectiveness and incremental cost analysis (CE/ICA), as applied to USACE projects				X	X	X
Experience with National Economic Development (NED) analysis procedures, particularly as they relate to jetty construction projects					X	
Degree in economics or related field				X	X	X
Geomorphology (one expert needed)						**X**
Minimum 10 years experience in geomorphology				X		X
Familiar with large, complex Civil Works projects with high public and interagency interests				X		X
Experience with geological analyses related to project design to include a variety of materials and cross-sections used in jetty design				X		X
Minimum M.S. degree in civil engineering or geology				X		X
Registered professional engineer				X		X

* Dr. Tom Cuba has 28 years of experience in planning and biology/ecology. Dr. Cuba does not have his degree in planning or a related field. He has his Ph.D. in marine science/ecology. Battelle believes that his planning experience is commensurate with a degree in planning.

Shane Phillips, P.E.

Role: This panel member was chosen primarily for his coastal engineering design and construction management for coastal projects experience and expertise.
Affiliation: Coast and Harbor Engineering, Inc.

Shane Phillips, **P.E.,** a principal civil engineer at Coast and Harbor Engineering, Inc. in Edmonds, Washington, has 17 years of experience in marine and coastal engineering. He earned his B.S. in civil engineering in 1993 from Washington State University and is a registered professional engineer in Washington, California, Texas, Louisiana, and Florida. His specific engineering experience includes the feasibility evaluation, preliminary design, and final design of geotechnical, structural, and civil components of coastal and marine construction projects.

Mr. Phillips has applied his coastal engineering design expertise to a variety of coastal shore protection projects along the Pacific Northwest coast and has served as both on-site resident engineer and project manager on coastal construction projects including jetty, revetments, levees, dredging, and boating facilities. He served as project and design engineer for the North Jetty Beachfront Properties Coastal Erosion project in Ocean Shores, Washington, which involved the design and construction of a 1,000 foot long rock revetment structure.

Mr. Phillips has managed and executed feasibility studies, planning studies, and engineering of coastal and marine construction projects for port facilities, marinas, boating facilities, ferry terminals, marine terminals, navigation channels, and shoreline properties. He was Project Engineer for preliminary and final engineering design phase on the Willapa Bay, Washington SR-105 Emergency Stabilization Project consisting of a 1,400 foot long rock groin, 1,200 foot long submerged rock jetty and 1,100 feet of beach nourishment.

Coastal design experience includes the layout and design of floating breakwaters, groins, piers, bulkheads, beach nourishment, shoreline stabilization, dredging, water quality improvement, and nearshore restoration. Structural design experience includes the evaluation and engineering design of marine terminals, piers, bulkheads, retaining walls, breakwaters, and marinas using concrete, steel, and timber materials. Mr. Phillips has reviewed/verified computer modeling preparation and calibration and regularly works with engineering programs including AutoCad 2010, PCSTBLE, ACES, Surfer, SMS, Matlab, and Land Development.

Tom Cuba, Ph.D.

Role: This panel member was chosen primarily for his experience and expertise in the coastal plan formulation process.
Affiliation: Delta Seven, Inc.

Thomas R. Cuba, Ph.D., CEP, President and Chief Scientist at Delta Seven, Inc., serves as a Research Scientist at Stillwater Research Group, and is a research adjunct professor at the University of South Florida. He earned his Ph.D. in marine ecology from the University of South Florida in 1984. Dr. Cuba has 28 years of planning experience, which includes developing management plans for a variety of Florida watersheds and aquatic preserves, working on waterfront infrastructure feasibility plans, and designing wetland, pond, and seagrass restoration plans. Dr.Cuba's six-year service as a Naval Intelligence Officer included plan formulation responsibilities, and he has been involved in civil and governmental plan formulation of engineered ecological restoration projects since 1984. Additionally, he conducted comprehensive conservation and public works plan formulation for Pinellas County, Florida and subsequently worked to enact these plans through public projects and codification in county ordinances.

Dr. Cuba has served as project manager and chief scientist on several watershed-based management and restoration projects (all of which included construction elements) and, for many of these, he acted as chair of the multi-stakeholder board. Dr. Cuba has assessed alternatives in beach nourishment and the placement of jetties and groins during his work with Pinellas County and in private practice. He is familiar with USACE plan formulation standards and procedures and has served on four USACE IEPR panels in the recent past as plan formulator (Clear Creek, C-111, Tamiami Trail, and LCA6).

Felicia Orah Rein, Ph.D.

Role: This panel member was chosen primarily for her biology/NEPA experience and expertise.
Affiliation: Watershed Solutions, Inc. and Florida Atlantic University

Felicia Orah Rein, Ph.D., is president and senior scientist at Watershed Solutions, Inc., an environmental consulting and restoration services firm specializing in environmental restoration, environmental assessments and impact analyses, ecological monitoring, water resource management, and reduction of sediment transport and erosion. She is also an affiliate professor at Florida Atlantic University. She earned her Ph.D. in ecosystem science/restoration ecology from the University of California at Santa Cruz in 2000 and has more than 20 years of experience managing and implementing large-scale multidisciplinary restoration ecology and resource protection projects.

Dr. Rein has extensive experience with large complex Civil Works projects with high public visibility, including assessment of environmental impacts of the New York/New Jersey Harbor deepening project for which she provided expertise in dredged material beneficial uses and source reduction and conducted vegetation and wetland mapping on coastal sites. Her NEPA expertise has involved collaboration with the National Marine Fisheries Service, California Department of Fish and Game, California State Water Resource Control Board, and U.S. Fish and Wildlife Service. She has a strong knowledge of ecosystem restoration, having worked on projects such as the Far Rockaway, Averne site park and housing development projects. Her role included wetland restoration areas and focused on water quality and vegetation impacts. Dr. Rein has prepared numerous Phase I (NEPA) environmental site assessments and is familiar with all NEPA requirements. As a senior project manager, she has provided scientific expertise on environmental documents according to NEPA guidelines and worked closely with local, state, and Federal government, as well as lawyers, environmentalists, and community groups on complex water rights assessments. She has experience in wetland ecology of urban regions, having worked in the initial phases of the fast-tracked wetland restoration projects in the NY/NJ region, including the hydrologic restoration of Liberty State Park and others.

She has conducted technical peer reviews, quality assurance/quality control (QA/QC) reviews, and acted as an expert consultant in environmental damage disputes for engineering and consulting firms. Dr. Rein is a member of Sigma Xi National Scientific Research Society.

Nels Sultan, P.E., Ph.D.

Role: This panel member was chosen to serve in a **dual role** for his hydrology and hydraulic engineering and geomorphology experience and expertise.
Affiliation: PND Engineers, Inc.

Nels Sultan, P.E., Ph.D., a coastal engineer at PND Engineers, Inc. in Seattle, Washington, has more than 20 years of experience specializing in the analysis and design of waterfront projects, including coastal geomorphology, coastal numerical models, and wave tank physical models. He earned his Ph.D. in ocean engineering from Texas A&M University in 1995. He is a registered professional civil engineer in Washington and Alaska and is a former officer in the Naval Reserve, Civil Engineering Construction Corps.

Dr. Sultan has worked on all aspects of design engineering for ports, harbors, shore protection, dredging, and other coastal and marine facilities projects. His extensive project experience includes preparing plans, specifications, and cost estimates through final design and construction (using a variety of materials including rock, geocontainers, stone masonry, and concrete), in addition to analyzing wave conditions, coastal processes, and sediment transport. Dr. Sultan's experience includes serving as the ocean engineer on the South Jetty Permeability project in Grays Harbor, Washington, where the jetty is subject to erosion of sediment at its landward end and has been completely severed from the mainland on occasion. Dr. Sultan analyzed aerial photographs, wind, wave, and tide conditions in order to determine whether the south jetty was permeable to sediment transport and contributing to erosion problems.

He served as project manager and coastal engineer for the Skagway Small Boat Harbor Dredging and Entrance Surge Control project in Alaska and led design and construction support services for a new 290 foot long, curved, partially penetrating vertical breakwater that provided surge control at the harbor entrance. Also for this project, Dr. Sultan prepared a wind and wave study for breakwater alternatives and provided computer modeling, using both desktop and CGWAVE modeling of wave transmission, wave diffraction, and reflected waves to evaluate waves at the adjacent ferry terminal floating dock and the shoreline north of the planned wave barrier. He also served as the ocean engineer for the Willapa Bay, WA SR-105 Stabilization Project Monitoring Program, which involved beach nourishment, an underwater dike, and a multi-purpose rock groin.

Dr. Sultan is a member of the Association of Coastal Engineers, American Society of Civil Engineers and the American Geophysical Union.

Daniel Maher, M.S.

Role: This panel member was chosen primarily for his experience and expertise in economics.
Affiliation: G.E.C., Inc.

Daniel Maher, M.S., is a senior economist and project manager at G.E.C., Inc. with 22 years of experience conducting large water resource/public works planning studies. He received his M.S. in agricultural economics from Louisiana State University in 1988. Mr. Maher has served as a project manager or economist on numerous regional economic impact, navigation, water supply, recreation, flood control, and ecosystem restoration projects. Mr. Maher has developed benefits and costs for National Economic Development (NED) analyses of large water resource planning efforts and navigation projects, which involved using methodologies estimating project benefits of coastal construction projects based on transportation savings. For example, Mr. Maher was the economist and project manager responsible for estimating NED benefits associated with increasing the current authorized depth of the federal central harbor and navigation channels to the Tenth Avenue Marine Terminal in San Diego, California. The primary benefits of deepening the harbor were the reduction in vessel operating costs by allowing deeper draft vessels to traverse the channel fully loaded, and the reduction or elimination of vessel tidal delays. Additionally, he was responsible for estimating the NED benefits and assessing the operational and environmental impacts resulting from the removal of several underwater natural obstructions in San Francisco Bay. These underwater pinnacles are considered a major hazard to navigation in the bay, especially regarding deep-draft oil tankers. The economic feasibility of removing these pinnacles was based on quantifiable transportation savings resulting from reduced bay transit distances of oil tankers and container vessels that frequent the ports on the bay.
Mr. Maher has also been responsible for cost effectiveness/incremental cost analysis (CE/ICA) for several USACE ecosystem restoration projects including Canonsburg Lake Ecosystem Restoration Project (Pittsburg District); Licking River Watershed and Dillon Lake Ecosystem Restoration Project (Huntington District); and Big Sunflower Ecosystem Restoration Feasibility Study (Vicksburg District). For each of these projects Mr. Maher worked with biologists and ecologists to define appropriate metrics for measuring environmental benefits and converting benefits to an average annual basis for each alternative considered. He also reviewed construction and operations and maintenance costs associated with each alternative, and conducted cost effective analysis and incremental cost analysis using IWR-PLAN. Mr. Maher has experience with numerous economic computer programs, including IMPLAN Economic Impact Software, IWR-Planning Suite, and IWR-MAIN Water Use Forecast System.

5. SUMMARY OF FINAL PANEL COMMENTS

The panel members agreed among one another on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2010; p. D-4) in the Mouth of Columbia River IEPR. Table 3 lists the 25 Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Appendix A. Of primary significance, and as discussed in several of the Final Panel Comments, the Panel has serious concern with the SRB model and the potentially over-emphasized role it played in the evaluation of alternatives, engineering design, and economic analyses. The following statements summarize the Panel's findings.

Plan Formulation Rationale: From a planning perspective, the Major Rehabilitation Evaluation Report is well done and in compliance with all of the typical formulation steps; however, it was never clearly explained that the scope of work was limited to the repair and rehabilitation within the present configuration, nor why it was limited in this manner. Undefined risk thresholds may serve to undermine the logic of the cost and maintenance predictions and, to a lesser extent, the alternatives selected. The Panel agreed that the SRB model is not a substitute for conventional engineering and economic analyses and should not be a stand-alone analysis for selecting a recommended plan.

Economics: The Panel identified three major issues in the economic analysis: (1) inconsistencies in the Major Rehabilitation Evaluation Report and economic spreadsheet models; (2) the assumption that navigation would not be impacted; and (3) the formulation of the base condition. Inconsistencies in the report and economic spreadsheet models pertaining to the calculation of NPVs and AACs prevented the Panel from validating the economic analysis. Based on the assumption that navigation will not be impacted, a least cost analysis was used in lieu of a transportation cost savings analysis to calculate NED benefits. Conflicting assumptions concerning the ability to maintain navigation invalidate the logic behind calculating NED benefits using a least cost analysis. As the project is currently formulated, the base condition maintenance strategy for the MCR jetties conforms most closely with the fix-as-fails strategy, while the base condition life-cycle costs are the basis for estimating project benefits for all action alternatives. Inaccurate formulation of the base condition may increase life cycle costs, and may erroneously escalate project benefits. Each of these issues could impact the selection of the NED plan, which was selected as the recommended plan.

Engineering: There are serious technical difficulties with the Major Rehabilitation Evaluation Report and analyses. The report lacks a set of design criteria, including project life, standards of performance to be met, and environmental conditions with return period events. All are part of conventional coastal engineering design practice. The SRB model cannot be verified and does not include important processes. Major questions remain that have not been adequately investigated for this level of study, including subsurface geotechnical properties, feasibility of proposed barge offloading/material re-handling facilities, and the long term stability of the jetty foundations assuming continued erosion and loss of nearshore sediment. The report indicates that large volumes of sediment will move into the navigation channel after a breach event. However, the data and analysis do not support this conclusion. Additionally, is no clear discussion of the role of maintenance or emergency dredging, especially under extreme winter conditions. Detailed construction cost estimates also need to be provided in order for the cost analysis to be complete and verifiable. Although there is a good description of historical failures and repair actions for each jetty, there is no discussion or documentation of current jetty condition or detailed condition assessments of structure and functional condition.

Environmental: There is no discussion in the main report of sea level rise and potential wave height increases and its impact on this project over the 50+ year project timeline, given that the regional wave climate has been documented as more severe in the last 10 years. This has potential impacts to the project and in designing a project with lower long-term maintenance costs. Potential environmental impacts on sensitive species, upland habitats, and water quality as well as potential impacts to recreational use during project construction are not comprehensive nor adequately described in the mitigation plan. Finally, the alternatives are limited to armoring the existing configuration of the jetties and may not satisfy NEPA directive for alternative analysis.

Table 3. Overview of 25 Final Panel Comments Identified by the Mouth of Columbia River IEPR Panel

Significance – High	
1	The economic analysis used to select the National Economic Development (NED) plan cannot be validated, nor can it be determined if assumptions were applied correctly in the economic spreadsheet models.
2	The analysis of the sediment transport process is not comprehensive, and the data and analysis do not support the conclusions concerning large movement of sediment during a breach event.
3	The underlying assumption that navigational impacts will not occur is not substantiated.
4	The SRB model by itself has very limited value for analyzing alternatives and is not a substitute for conventional economic and engineering analysis.
5	The base condition, as formulated, does not represent the current O&M practice.
6	The reported analysis and design to mitigate a potential breach of the foreshore dune at the South Jetty root is not adequate.
7	The basis of design and design environmental criteria are vague, not consistent within the report, and not consistent with conventional coastal engineering design practice.
8	The models and analyses of jetty failure do not include all significant processes.
Significance – Medium	
9	The alternative selection process may fail to meet the requirements of NEPA Section 1502.14.
10	A failure analysis for the original structure design and past trends of Operation and Maintenance (O&M) costs has not been provided.
11	Sea level rise and potential increases in wave height have not been examined sufficiently under different model scenarios.
12	Construction cost estimates cannot be evaluated because the assumptions and details have not been provided.
13	Potential environmental impacts on sensitive species, upland habitats, and water quality have not been thoroughly discussed or specifically mitigated in the document.
14	Potential impacts to recreational use during project construction, as identified in public comments, are not adequately discussed or mitigated.
15	There is not sufficient information on the evaluation of barge offloading and material re-handling facilities to ensure these sites can operate as intended and to ensure the construction costs are adequately represented.

Table 3. Overview of 25 Final Panel Comments Identified by the Mouth of Columbia River IEPR Panel, continued

Significance – Medium	
16	The requirements, costs, and history associated with emergency dredging compared to scheduled maintenance dredging activities have not been specified.
17	The current jetty structure condition is not well described, making it difficult to confirm the confidence of the SRB model analysis and selection of a recommended plan.
18	The mechanisms causing jetty head scour have not been sufficiently analyzed to allow selection of the appropriate jetty head repair measure.
19	Risk thresholds for selected alternatives are not clearly defined.
20	It is not clear how uncertainty and derived risk analyses were considered in the structure and application of the model.
21	The model output parameters and wave height components are not clearly explained and supported.
22	The culvert installation details, as well as potential impacts, need further clarification.
Significance – Low	
23	The various base years cited in the report and the difference between project life and period of analysis require additional explanation.
24	Cargo tonnage and vessel trip statistics presented throughout the report are inconsistent.
25	Terminology related to jetty rehabilitation and failure is defined inconsistently or vaguely in some places.

6. REFERENCES

Allen, J. (2005). Cape Lookout shoreline stabilization study: Don't take the cobbles. Cascadia, News from the Oregon Department of Geology and Mineral Industries (DOGAMI). Winter. http://www.oregongeology.com/sub/quarpub/CascadiaWinter2005.pdf

CHL (2007). Analysis of Jetty Rehabilitation at the Mouth of the Columbia River, Washington/Oregon, USA, Part 2: Regional Circulation, Sediment Transport, and Morphology Change. Draft Report (K. J. Connell and J. D. Rosati). USACE Coastal and Hydraulics Laboratory and Portland District joint product, June.

Demirbilek; Z., and V. Panchang (1998). CGWAVE: A Coastal Surface Water Wave Model of the Mild Slope Equation. USACE Coastal and Hydraulics Laboratory, Report CHL-TR-98-26, 120 pp. cgwave_man3.pdf (3 MB .pdf)

EPA (2009). 2009 Annual Use Plan: Management of Open Water Dredged Material Disposal Sites, Mouth of Columbia River, OR and WA. http://www.delawareestuary.org/pdf/RSM%20Workshop/MCR_Site_Usage_Plan_2009.pdf

Gelfenbaum, G. R., Kaminsky, G. M., et al. (2006). Southwest Washington Coastal Erosion Study. U.S. Geological Survey Coastal and Marine Geology Program and Washington Department of Ecology – Coastal Monitoring & Analysis Program. http://www.ecy.wa.gov/programs/sea/swces/overview/findings.htm.

Nawogu; O. G., and Z. Demirbilek (2001). BOUSS-2D: A Boussinesq Wave Model for Coastal Regions and Harbors - Report 1: Theoretical Background and User's Manual. USACE Coastal and Hydraulics Laboratory, Report ERDC/CHL TR-01-25, 92 pp. BOUSS-2D.pdf (2.2 MB .pdf)
OMB (2004). Final Information Quality Bulletin for Peer Review. Executive Office of the President, Office of Management and Budget, Washington, D.C. Memorandum M-05-03. December 16.

Seaburgh, W. C. (2002). Weir Jetties at Coastal Inlets: Part 1, Functional Design Considerations. U.S. Army Corps of Engineers, ERDC/CHL CHETN-IV-53. December.

The National Academies (2003). Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports. The National Academies (National Academy of Science, National Academy of Engineering, Institute of Medicine, National Research Council). May 12.

USACE (1996). Project Operations – Partners and Support. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Pamphlet 1130-2-500. 27 December.

USACE (1998). Condition and Performance Rating Procedures for Rubble Breakwaters and Jetties. REMR Management Systems—Coastal/Shore Protection System Devices. Technical Report REMR-OM-24, U.S. Army Corps of Engineers, Washington, D.C.

USACE (2000). Planning – Planning Guidance Notebook. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Regulation 1105-2-100. *22* April.

USACE (2005). Design of Coastal Revetments, Seawalls, and Bulkheads. Department of the Army, U.S. Army Corps of Engineers. Manual EM 1110-2-1614. June.

USACE (2007). Peer Review Process. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. CECW-CP Memorandum. March 30.

USACE. (2009). Water Resource Policies and Authorities Incorporating Sea-Level Change Considerations in Civil Works Programs. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Pamphlet EC 1165-2-211. 1 July.

USACE (2010). Water Resources Policies and Authorities: Civil Works Review Policy. Department of the Army, US Army Corps of Engineers, Washington, D.C. Engineer Circular (EC) No. 1165-2-209. January 31.

Wamsley, T.V., M.A. Cialone, K. J. Connell, and N.C. Kraus (2006). Breach History and Susceptibility Study, South Jetty, Grays Harbor, Washington. USACE, Coastal and Hydraulics Laboratory. Report ERDC/CHL TR-06-22. September. http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA456060&Location=U2&doc=GetTRDoc.pdf

APPENDIX A

Final Panel Comments

on the

Mouth of Columbia River IEPR

This page is intentionally left blank.

Comment 1:
The economic analysis used to select the National Economic Development (NED) plan cannot be validated, nor can it be determined if assumptions were applied correctly in the economic spreadsheet models.

Basis for Comment:

Economics is the key consideration in evaluating the NED plan, which was selected as the recommended plan. Several issues were identified in the review documents and the economic spreadsheet models that could significantly change the outcome of the economic analysis and the selection of the recommended plan. These issues primarily pertain to the calculation of net present values (NPVs) and Average Annual Costs (AACs), and the presentation of the economic analysis results.

Calculation of NPVs and AACs

- The AACs, based on the NPVs presented in Table 2-1 and Table 2-2, appear to be based on a Federal discount rate of 4.125%, not 4.375%, as stated in the report.
- The calculation of the NPVs and AACs in the economic spreadsheet model for the North Jetty are based on a discount rate of 4.125%, not 4.375%, as stated in the report.
- The period (actual calendar years) of the annual stream of costs used to calculate the NPVs for each alternative differ between alternatives in the economic spreadsheet models; also, the actual calendar years included in these periods were not stated in the report.
- The unit costs for jetty repair and dredging, as presented in the SRB model, are increased over time such that after 50 years, costs will be 15% greater than at present. In accordance with ER 1105-2-100, p. 2-11 (USACE, 2000), when conducting economic analysis, prices should be held constant over the period of analysis.

Presentation of Results

- The NPVs and AACs in the spreadsheets for the North Jetty and South Jetty differ from the results presented in the report.
- The term NED, the process of calculating NED benefits, and the method of selecting the NED plan are not explained in Section 2 or Appendix C of the report.
- The SRB model uses Monte Carlo simulation to increase the confidence of life cycle estimates and allow for evaluation of variance by producing project cost output, including mean and standard deviation values (Appendix A2, p. A2-49). The risk and uncertainty associated with estimating the stream of annual costs and the resulting NPVs, AACs, and benefit-to-cost (B/C) ratios are not addressed in the economic analysis.
- The costs of the NED plan of $250 million in the Executive Summary are presented on a fully funded basis, whereas the costs in the main report are presented as NPVs, resulting in confusion.

Significance – High:

The inability to validate the economic analysis and the assumptions used in the economic spreadsheet model could impact the selection of the NED, or recommended plan.

Recommendations for Resolution:
1. Calculate the NPVs and AACs using the FY10 Federal discount rate of 4.375% for all alternatives; basing the NPVs on the stream of project costs for the 50-year period of analysis. 2. In accordance with ER 1105-2-100, Chapter 2 (USACE, 2000), revise the formulas in the economic spreadsheet models to reflect the same period of analysis for all alternatives. 3. State the years (annual stream of costs) used in calculating the NPV for each alternative and ensure consistency in alternative evaluation. 4. In accordance with ER 1105-2-100, Chapter 2, p. 2-11 (USACE, 2000), revise the repair and dredging costs to reflect the general level of prices prevailing during or immediately preceding the period of planning for the entire period of analysis. 5. Revise Section 2 and Appendix C of the report to include a definition of the term NED, an explanation of the process of calculating NED benefits, and the method of selecting the NED the plan. 6. In accordance with EP 1130-2-500, Appendix B, p. B-9 (USACE, 1996), report the results of all alternatives in a table displaying the mean net benefits and standard errors of each; providing the 90% confidence interval for the mean net benefits (mean+ 1.64x standard error). 7. Present the costs of the NED plan in the Executive Summary and the main report in both a fully funded basis and in NPV.

Literature Cited:

USACE (2000). Planning – Planning Guidance Notebook. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Regulation 1105-2-100. *22* April.

USACE (1996). Project Operations – Partners and Support. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Pamphlet 1130-2-500. 27 December.

Comment 2:
The analysis of the sediment transport process is not comprehensive, and the data and analysis do not support the conclusions concerning large movement of sediment during a breach event.

Basis for Comment:

The report describes large volumes of sediment that will move into the navigation channel after a breach event. However, the Coastal Modeling System (CMS) numerical model results (CHL, 2007; p. 15, Figure 3.2) indicate minimal sediment movement through a jetty breach, even with the model strongly distorted to encourage movement. Similarly, historic breach events at the MCR inlet and region do not support the sediment movement volumes and rates assumed, nor the assumed sudden jetty failure, and the consequent requirement for emergency repairs and dredging.

The assumed jetty breach sediment movement is also inconsistent with recent experience with dredged material disposal at the North Jetty. Approximately 400,000 cubic yards were placed at the site each year during 1999-2008, on average, comparable to some jetty breach scenarios. However, the sediment placed at the North Jetty does not appear to have affected navigation. Similarly, the reported "rapid deterioration" of the North Jetty from 1999 to 2004, when 100,000 cubic yards of sediment leaked through the jetty leading to the repairs in 2005, is not consistent with the assumed scenario of a sudden breach event and large sediment movement.

Figures A1-252 to A1-254 of jetty breach sediment movement appear to be artist renderings, not products of analysis. The figures are misleading if they are interpreted as model output. Table 3-10 in the main report is presented but not explained, so there is no clear basis for the "Range of Volume Left in Channel" resulting from a breach of the North Jetty. There is no discussion of any hydrodynamic analysis or evaluation of morphologic changes and corresponding sedimentation of the navigation channel.

Significant inconsistencies are present in the sediment transport discussion. For example, the documents discuss sediment disposal practices at the shallow water site (SWS), immediately offshore from the tip of the North Jetty. The EA notes, "Active monitoring and evaluation determined that 80% to 95% of the dredged sand annually placed at the SWS moves northward onto Peacock Spit" (dispersed to the north). However, the main report describes how rip currents along the north side of the North Jetty transport sediment towards the tip and then south into the navigation channel. This implies an unrealistic discontinuity in the sediment budget and sediment paths immediately offshore of the jetty tip. The sediment budgets and analysis are not consistent in different parts of the review documents, and seem to vary depending on whether the analysis is centered on dredged material disposal (emphasizing sediment movement onto nearby shores) or jetty stability (emphasizing sediment movement towards the channel).

The jetties are described as functioning like "wingdams" preventing sediment movement into the channel. However, it seems more the case that the North Jetty shields the sands of Benson Beach from the dominant southwesterly waves preventing/slowing longshore sediment transport to the north, rather than south into the channel. Also, the process of sediment movement through a jetty breach is not at all like water through a dam break. The jetties are essentially a pyramid with only a small tip extending above water. What happens below water, with the sediments and foundations, is more central to the long term function and stability of the MCR jetties, navigation channel, and adjacent beaches.

A better analysis of sediment transport is needed because the repair alternatives at present are an ever expanding pile of rock on an ever shrinking foundation of sand. The geological history includes more than 225 million cubic yards of dredging since 1956 from the MCR navigation channel, with most disposed offshore (EPA, 2009). The Southwest Washington Coastal Erosion Study (Gelfenbaum, et al, 2006) concluded, "The carrying capacity of beach sands of Columbia River to the estuary has been reduced by approximately two-thirds over the last century." The missing sediment from the system and ongoing erosion of the shoals that help protect the jetties all point toward a need for a more rigorous investigation of sediment transport and alternatives that could reduce the loss of sediment and subsequent project O&M costs.

Significance – High:

The rehabilitation project will not be successful if ongoing sediment loss continues and the shoals and jetty foundation wash away.

Recommendations for Resolution*:*

1. Eliminate or justify the unrealistic assumption of sudden jetty failure and large volumes of sediment rapidly moving into the navigation channel. Instead, compare alternatives based on life-cycle costs including ordinary jetty repairs and maintenance dredging costs.
2. Provide a real analysis of sediment transport. Include review and reference to data and findings from maintenance dredging records and the studies of the MCR prepared for the multi-agency Southwest Washington Coastal Erosion Study.
3. Describe how implementation of this project will reduce ongoing erosion of the shoals.

Literature Cited:

CHL (2007). Analysis of Jetty Rehabilitation at the Mouth of the Columbia River, Washington/Oregon, USA, Part 2: Regional Circulation, Sediment Transport, and Morphology Change. Draft Report (K. J. Connell and J. D. Rosati). USACE Coastal and Hydraulics Laboratory and Portland District joint product, June.

EPA (2009). 2009 Annual Use Plan: Management of Open Water Dredged Material Disposal Sites, Mouth of Columbia River, OR and WA. http://www.delawareestuary.org/pdf/RSM%20Workshop/MCR_Site_Usage_Plan_2009.pdf

Gelfenbaum, G. R., Kaminsky, G. M., et al. (2006). Southwest Washington Coastal Erosion Study. U.S. Geological Survey Coastal and Marine Geology Program and Washington Department of Ecology – Coastal Monitoring & Analysis Program. http://www.ecy.wa.gov/programs/sea/swces/overview/findings.htm.

Comment 3:
The underlying assumption that navigational impacts will not occur is not substantiated.
Basis for Comment:
The report clearly explains why navigation benefits were not analyzed. The method used to calculate NED benefits is based on the assumption that navigation will not be affected; the economic analysis is therefore based on a least cost analysis. This assumption, however, is not supported by the analysis presented in the report. A North Jetty breach in the winter is assumed to result in immediate mobilization of sediment that may impact navigation. If this assumption is true, it does not necessarily follow that emergency dredging will successfully occur to enable deep draft vessel access. As stated on p. 3-14 of the main report, under base conditions, during winter months, emergency jetty repairs and emergency dredging may not be possible, potentially resulting in impacts to navigation until the emergency activities are completed. The main report also states (p. 1-48) that operating a hopper dredge at the MCR during winter months has not yet been attempted. The report does not address the impact of project construction and dredging activities on navigation. For example, the operation of a dredge in the MCR, especially under extreme winter conditions, could have an adverse impact on navigation in the MCR. The Panel was unable to fully understand the potential impacts on navigation of shoaling resulting from a jetty breach. Since navigation benefits were not evaluated, impacts to the MCR or Lower Columbia River (LCR) channels as a result of shoaling after a jetty breach, in the absence of emergency dredging, is only presented in qualitative terms such as "navigation would be significantly impaired" (p. A2-34). The extent of the impacts are not described (i.e., bar closure, vessels delayed due to having to use tides to access the channel, reduced under-keel clearances, vessel lightloading, etc.). Due to the dismissal of potential navigation impacts, no mitigation is defined.
Significance – High:
Conflicting assumptions concerning impacts to navigation invalidate the logic behind calculating NED benefits using a least cost analysis and impacts the selection of the NED, or recommended, plan.
Recommendations for Resolution:
1. Conduct a transportation cost savings analysis to calculate NED benefits. 2. Include a description of the expected channel depths available after a breach event, and in the absence of emergency dredging, include a description of the portion of the fleet using the channel that will be impacted by the resulting shoaling.

Comment 4:

The SRB model by itself has very limited value for analyzing alternatives and is not a substitute for conventional economic and engineering analysis.

Basis for Comment:

The SRB model results cannot be verified, as it is a custom-made engineering and economics model applicable only to this project and there is no means for the Panel to examine the inner workings of the SRB model and its internal calculations to assess its "adequacy and acceptability".

It is not possible to verify model results, or to repeat the application of the SRB model because there is no User's Manual or detailed description of model inputs and how the model was applied for the Mouth of Columbia River project. Furthermore, the model has not been peer reviewed or tested. Without documentation of successful application, the Panel cannot validate the model or have confidence in the results.

The SRB model internal calculations and logic are not a commonly applied method for calculating rubble mound structure reliability and damage. The model analyzes more than 600 variables, stacking process upon process, each with wide error bars, resulting in the accumulation of errors. Significant processes do not appear to be included in the model, such as armor rock breakage and deterioration and deep seated slip-circle failures. Figure A2-18a shows model output for jetty cross-section progressive damage. This figure provides one of the few insights into the inner workings of the SRB model. The figure indicates the physics and process of jetty decay are not modeled correctly because the output is not consistent with cross-sections of observed damage.

The engineering evaluation does not include much about the physical modeling (i.e., wave tank results). It seems the wave tank model was used to develop the input and equations within the numerical SRB model. It is more conventional to proceed in the opposite sequence, to use a wave tank model to verify a final design concept and verify numerical model predictions. The wave tank model effort was substantial and likely yielded good insights. However, it does not appear that results were used to their fullest potential because the model output and findings were only applied through the SRB model process. The wave tank model results could have been used as part of an independent evaluation, providing an additional line of evidence along with other investigations, data, and findings.

The SRB analysis should only be used as one of many tools in the alternatives evaluation rather than a substitute for the preliminary engineering design. Additional engineering analysis and design documentation needs to be provided as part of the preliminary engineering design report. Documentation through the preliminary engineering design process will lead to improved confidence and reliability of SRB analysis.

Significance – High:

The SRB model functions as a "black box" and does not allow an alternatives analysis that is clearly based on sound technical evidence of engineering design performance.

Recommendations for Resolution:

1. Move the SRB model to an appendix, as supplemental information, and assign it a weight of 10% in the evaluation of alternatives. No further work on the SRB model is recommended as part this project.
2. Include a detailed description of the SRB model application allowing verification of model calculations and how the model was applied to the Mouth of Columbia River project.
3. Demonstrate that the model has been peer reviewed and tested.
4. Move the calculations and elements of the study currently within the SRB model (such as rubble-mound damage, slope stability failure, design wave heights and water levels, economic calculations, and much more) out of the SRB model and provide as separate calculations that can be checked and verified.
5. Provide documentation of preliminary engineering analysis and design which would constitute the basis for the SRB analysis. The preliminary engineering analysis should be provided in the report, with details in appendices. Elements that appear missing or inadequate at this level of design include the following:
   - Design criteria and basis of design
   - Structure condition assessment and existing condition survey
   - Subsurface geotechnical investigation
   - Development of jetty repair/rehabilitation alternatives
   - Hydrodynamic analysis (waves, currents, sediment transport) specifically related to the alternatives
   - Determination of stone sizing for alternatives
   - Alternative evaluation
     - Development of evaluation criteria
     - SRB analysis
   - Detailed volume and cost estimate for the alternatives.

Comment 5:
The base condition, as formulated, does not represent the current O&M practice.
Basis for Comment:
The present and future base condition maintenance strategy for the MCR jetties, as currently described in the report, conforms most closely with the fix-as-fails strategy. Under this scenario, jetties will be allowed to deteriorate to the point that just-in-time repairs may not prevent a breach in the jetty, which would result in expensive, winter dredging activities. As the project is currently formulated, the base condition life-cycle costs are the basis for estimating project benefits for all action alternatives. Historical maintenance efforts for MCR jetties are best described by an interim repair strategy. As a result of monitoring and advance repair activities, historically there have been no jetty breaches that have impacted navigation, nor has winter dredging been needed to maintain navigation. EP 1130-2-500, Appendix C, p. C-1 (USACE, 2006) states that for Major Rehabilitation Projects, under the base condition, "maintenance is increased as needed (but within limits) and components or sub-features are repaired on an emergency basis. This essentially represents the current O&M practice." Based on the report, this condition would resemble an interim repair strategy, rather than the fix-as-fails strategy currently described as the base condition.
Significance – High:
Inaccurate formulation of the base condition may increase life cycle costs, and may erroneously escalate project benefits for all action alternatives thus impacting the benefit to cost ratios.
Recommendations for Resolution:
1. Refine the base condition to more closely resemble the current O&M practice, in accordance with EP 1130-2-500, Appendix C (USACE, 1996).

Literature Cited:

USACE (1996). Project Operations – Partners and Support. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Pamphlet 1130-2-500. 27 December.

Comment 6:
The reported analysis and design to mitigate a potential breach of the foreshore dune at the South Jetty root is not adequate.
Basis for Comment:
Potential breaching of the foreshore dune at the South Jetty root, to form a new connection to Trestle Bay, is discussed briefly in a few places, including a proposed cobble berm to mitigate this risk in the main report (Section 3.5.3.3, pp. 3-40 - 3-41, p. 7-1 and elsewhere). Additional analysis is appropriate given the consequences of breaching at this location. It is not clear what analysis has been conducted to evaluate the performance of the proposed dune augmentation. It is not known if the volume of material per linear foot is sufficient to provide the required width of cobble beach for stable conditions upon adjustment after initial placement. Maintenance requirements are not known for this design. Studies by DOGAMI (Allen, 2005) have been conducted on dynamic revetments for shoreline stabilization on the Oregon Coast but do not appear to have been applied. The breaching potential will likely increase with increasing shoreline erosion and loss of sediment from the system. However, potential beneficial use of dredged sediment is not analyzed as part of a design solution for a breach. Long-term erosion trends are assumed and are not adequately addressed in the report. The information provided is inconsistent in this area, with some sections saying the South Jetty dune erosion/augmentation issue will be addressed as part of a separate project, whereas other report sections include South Jetty dune augmentation as part of this project. Foreshore dune breaching has occurred at other coastal inlet navigation jetty structures along the Pacific Coast such as the South Jetty at Grays Harbor, Washington. Beach renourishment with dredged material and jetty structure modification improvements to prevent dune breaching were made with varying levels of success. It is not clear whether these similar project conditions and performance have been evaluated as part of the development and analysis of alternatives at the Columbia River South Jetty location.
Significance – High:
Breaching the dune at the South Jetty root appears to be a substantial risk, with more immediate consequences than breaching of a jetty because of the potential for forming a new tidal inlet with relatively rapid widening and deepening.
Recommendations for Resolution:
1. Either include the South Jetty dune augmentation/stabilization as part of the alternatives, and include costs and preliminary engineering, or state that it is not an element of the proposed work and is part of a separate project. Either way, potential breaching scenarios should be evaluated/modeled and included in the sediment transport and hydraulic analysis. This major investigation is the logical place to add studies of the MCR system (including jetties, navigation channel, estuary, and beaches). 2. Account for long-term shoreline erosion/recession trends in the design.

3. Review other jetty rehabilitation project solutions and performance at coastal inlet navigation facilities such as those conducted at the Grays Harbor South Jetty (Wamsley, 2006).

Literature Cited:

Allen, J. (2005). Cape Lookout shoreline stabilization study: Don't take the cobbles. Cascadia, News from the Oregon Department of Geology and Mineral Industries (DOGAMI). Winter. http://www.oregongeology.com/sub/quarpub/CascadiaWinter2005.pdf

Wamsley, T.V., M.A. Cialone, K. J. Connell, and N.C. Kraus (2006). Breach History and Susceptibility Study, South Jetty, Grays Harbor, Washington. USACE, Coastal and Hydraulics Laboratory. Report ERDC/CHL TR-06-22. September. http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA456060&Location=U2&doc=GetTRDoc.pdf

Comment 7:

The basis of design and design environmental criteria are vague, not consistent within the report, and not consistent with conventional coastal engineering design practice.

Basis for Comment:

The document "design_criteria_info.doc" is vague. It discusses "50 year alternatives," but the term is not defined. It could mean many things, including the following:

1. The project life is 50 years, with complete replacement assumed after 50 years.
2. Design jetty repairs that have the least life-cycle costs over a 50 year period.
3. The economic planning horizon, benefits and costs, are calculated for 50 years.
4. Design to withstand a series of storms over a 50 year period.
5. Design to withstand a single 50 year return period storm event.

Section 3.5.2.1 (Cross Section Intent and Design Philosophy) states, "The repair template must … allow the maximum repair within funding limitations." This indicates the main design criterion is to provide the most repair possible within a budget limit, rather than design to withstand environmental loads and forces. The "funding limitations" are not stated, yet appear to be behind many of the design and planning decisions. Using funding limitations as a design criterion is not the same as an engineered design that meets environmental loading criteria. The funding limits design criteria are not consistent with the environmental loading design criteria in "design_criteria_info.doc."

Note that a 50 year project life does not necessarily mean one should apply a 50 year return period event for the design environmental criteria. For example, a petroleum development platform may have only a 35 year project life, but the project may be designed to withstand a 100 year return period storm event or longer. The consequences of jetty failure should be considered in establishing the design criteria. ISO standards are sometimes applied in practice, but do not seem to be included in this work. Additionally, USACE (1995; paragraph 2-4) states rubblemound structures should be designed to successfully withstand the conditions that have a 50% probability of being exceeded during the project's economic service life. The economic service life needs to first be established as a criterion and then the design storm formulated to meet the acceptable risk level for that service life.

A span of 50 years may be appropriate for an economic planning horizon; however, a 50 year project life or a 50 year return period storm event does not seem reasonable for engineering design considering the importance of navigation through the MCR. The structures should be designed to last indefinitely, as permanent structures, with regular maintenance requirements estimated and included in an economic analysis.

The 50 year criterion may not be consistent with parts of the report that mention a longer period of time. The SRB model discussion in Appendix A2, p. 78 states, "The period of analysis for future condition simulations was 64 years (2006 to 2070) for the North Jetty and Jetty A and 63 years (2007 to 2070) for South Jetty."

Appendix A2 (p. A2-8) states, “The MCR jetties were constructed to achieve an expected service life of 50-100 years,” and concludes that 0.7% per year is the expected maintenance cost based on the 50-100 years service life. The 50-100 years service life, and associated 0.7% figure is used to inform the analysis and to demonstrate a lack of maintenance. However, the original 50-100 years service life, and 0.7% annual expected maintenance cost are arbitrary assumptions. The historic assumed service life and maintenance needs are not supported by the information presented, and largely irrelevant to today’s design and maintenance criteria.

The design criteria, if any, from 100 years ago when the jetties were built are not presented and previous maintenance are considered an operational cost. Analysis of past maintenance also may distract from the main problem afflicting the jetties: poor design 100 years ago, not deferred maintenance.

The original builders, working before the development of modern coastal engineering methods, underdesigned the jetties with only 7 ton armor rock, at their angle of repose of 1.25h:1v, or steeper. In addition, they constructed the immense structures on ever shifting sand shoals, locating them where the shoal happened to be at the time of construction, without adequate design features to account for shifting channels and currents.

The starting assumptions and criteria and alternatives are so narrowly constrained that there is questionable value in much of the analysis. The Major Rehabilitation Evaluation study is set up so that the end result is always the same; more rock within the existing jetty footprint. Conventional coastal engineering practice for a project of this scope would include the following:

1. Analysis to determine how much jetty is really needed today to maintain the navigation channel at reasonable cost. The Panel questions whether all 9+ miles of jetty are optimal. There has been no upward trend in maintenance dredging volumes since 1956, despite continued jetty tip recession, which indicates shorter jetty lengths would be equally functional at less cost.

2. Evaluation of alternatives that are not constrained to the original footprint, not built to the maximum crest elevation and authorized length feasible, not constrained only to rock, and discussed or considered beneficial use of dredged material as a design element.

3. Evaluation of durability issues and lessons learned from related projects. For example, the Dover Pier in England has lasted well over 100 years. Similarly, the Humboldt Bay jetties and Crescent City jetties in Northern California have effectively stopped jetty head recession using 40 ton dolos concrete armor units, and the Japanese are building breakwaters with 90 ton dolos concrete armor units.

Significance – High:

The lack of criteria prevents NED analysis and evaluation of whether the structure design meets standards.

Recommendations for Resolution:
1. Establish conventional project criteria including project life, standards of performance and function to be met, and environmental loads and return period events, which are part of conventional coastal engineering design practice. Document in a Preliminary Design Report. 2. Establish Design Environmental Conditions that have a specific return period. 3. If unable to meet the design criteria due to budget limits, state the budget limits as a criterion, and estimate what the equivalent design life or expected performance will be for the compromised design. 4. Expand the starting assumption to allow: a. Beneficial use of dredged material as a component of jetty rehab. b. A design outside the existing jetty footprint c. A design that may allow jetty head recession up to a point when maintenance dredging needs increase. d. A design that can include a partially submerged jetty cross-section. 5. Use a longer return period than 50 years for the design environmental criteria and consider ISO standards. 6. Consult with Dover Pier representatives and other jetty builders to discuss durability issues and lessons learned from their project in order to benefit the MCR project.

Literature Cited:

USACE. (2005). Design of Coastal Revetments, Seawalls, and Bulkheads. Department of the Army, U.S. Army Corps of Engineers. Manual EM 1110-2-1614. June.

Comment 8:

The models and analyses of jetty failure do not include all significant processes.

Basis for Comment:

The SRB and STWAVE models cover many significant processes and variables that affect long-term jetty stability; however, some variables and processes are missing that should be presented in the SRB model and the Major Rehabilitation Evaluation Report:

- Armor rock breakage, rounding and wear, which can significantly affect jetty performance, do not appear to be included in the analysis.
- Deep seated slip surface failures through the jetty section, a global failure similar to a landslide, also do not appear to be analyzed and may be a significant risk.
- Wave height in combination with currents can cause significantly higher sediment transport rates than waves only or currents only. It is not clear if sediment transport analysis, considering both waves and currents acting together, has been done.
- Long-term changes in outlet channel morphology do not appear to be analyzed. The process of jetty decay through tidal channel scour appears different at Jetty A than at the North or South Jetties. Tidal channel scour at the tip of Jetty A will not be mitigated by adding spur groins, therefore a different system will need to be designed at Jetty A and accounted for in the jetty performance analysis.

The STWAVE model is not sufficient for modeling detailed wave transformations. Important processes such as wave structure interactions, refraction, and diffraction are incorporated in STWAVE using approximate methods. Other models like BOUSS-2D and CGWAVE are readily available and model the physics of these important processes more directly. STWAVE is appropriately applied as a regional wind-wave generation model for regions without a complex bathymetry. However, the Mouth of the Columbia River morphology near the jetties and navigation channel is complex. A phase-resolving wave transformation model such as BOUSS-2D or CGWAVE should be applied at this level of design in addition to STWAVE.

Significance – High:

The analysis of potential jetty failures, waves, currents, and sediment transport is incomplete for this level of design, and may result in significant errors in the evaluation of alternatives. Errors could include underestimating the design wave height, leading to undersized armor rock, excessive maintenance requirements and structure failure.

Recommendations for Resolution:

1. Estimate future repair needs and armor rock characteristics based on past performance of rock at the jetties. This requires a more detailed survey of existing condition, including quantifying existing armor rock size, gradation, and shape.
2. Analyze foundation stability based on measured geotechnical properties. A subsurface geotechnical investigation, including borings and soil testing, is recommended.
3. Provide a design concept for scour protection at Jetty A and check its stability against design environmental criteria, including specific current speed and wave height.

4. Apply models and use analysis methods to investigate sediment transport patterns and jetty foundation erosion under a combination of both waves and currents.
5. Supplement the STWAVE model with a wave transformation model such as BOUSS2D or CGWAVE to help determine design wave heights near the jetties.

Literature Cited:

Demirbilek; Z., and V. Panchang (1998). CGWAVE: A Coastal Surface Water Wave Model of the Mild Slope Equation. USACE Coastal and Hydraulics Laboratory, Report CHL-TR-98-26, 120 pp.

cgwave_man3.pdf (3 MB .pdf)

Nawogu; O. G., and Z. Demirbilek (2001). BOUSS-2D: A Boussinesq Wave Model for Coastal Regions and Harbors - *Report 1: Theoretical Background and User's Manual*. USACE Coastal and Hydraulics Laboratory, Report ERDC/CHL TR-01-25, 92 pp.

BOUSS-2D.pdf (2.2 MB .pdf)

Comment 9:

The alternative selection process may fail to meet the requirements of NEPA Section 1502.14.

Basis for Comment:

The design alternatives presented in the document are limited to the repair and rehabilitation of the jetties within the present configuration. The Panel is concerned about the adequacy of the alternatives analysis and the limited range of alternatives considered. NEPA Section 1502.14 requires a rigorous examination of all reasonable alternatives to any proposal and justification of eliminated design alternatives.

The Panel finds that there is little examination of alternative approaches to the principal function of the MCR jetties, which is to secure a consistent navigation channel across the bar at the MCR. As such, the narrow scope of alternatives presented weakens this project. Insufficient information is provided to justify limiting the improvements to the existing footprint. For example, the report does not provide the technical basis for maintaining the 1895 jetty design, length, and orientation to the exclusion of considering other configurations. Considering reasonable alternatives, under NEPA guidance, would allow USACE to use hydrodynamic modeling tools to evaluate alternatives such as the use of weir jetties (Seaburgh, 2002) and other sediment management methods that facilitate bypassing sediment at coastal inlets, as well as low wave and high wave depositional basins in a manner which may reduce long term operation and maintenance costs.

The impact of not considering additional alternatives leaves the overall justification of the project less defensible and may lead to questions of the overall merit of the rehabilitation project

Significance – Medium:

Consideration of alternatives beyond rehabilitating the original jetty structures within their existing footprint would comply with NEPA directives, and provide critical information that may reduce long-term costs and improve jetty life and efficacy.

Recommendations for Resolution:

1. Assess, and validate or reject, the technical basis for the initial jetty design, length, and orientation using appropriate physical coastal process models.
2. Assess structural efficacy and cost of alternatives which are not constrained by the existing footprint.
3. Develop modeling efforts for hydrodynamic models and/or sediment transport models that would provide insights into the following areas:
    a. Thorough analysis of the existing jetty structures focusing on why some areas have survived without repair and others have needed repeated repairs
    b. Examination of why Jetty A had such a large O&M cost relative to predictions.
    c. Addition of subsurface berms potentially created through the beneficial use of project dredged material that may reduce wave impact and subsequently reduce wave overtopping and toe scour.

Literature Cited:

Seaburgh, W. C. (2002). Weir Jetties at Coastal Inlets: Part 1, Functional Design Considerations. U.S. Army Corps of Engineers, ERDC/CHL CHETN-IV-53. December.

Comment 10:
A failure analysis for the original structure design and past trends of Operation and Maintenance (O&M) costs has not been provided.
Basis for Comment:
The extent of structure failure or partial failure is well documented and the repairs made to the structure are well documented, as shown in Figures 1-12, 1-15, and 1-16. These figures, however, do not distinguish between areas repaired and areas that are substandard but have not failed and so were not actually repaired. Failure analyses for the groin tips and the runnel formation weakening Jetty A (p. 3-5) are presented, but the report does not include a general failure analysis. A failure analysis would be helpful in determining why one section of jetty failed/degraded whereas another remained intact. This information is needed to derive alternatives that resist both degradation and failure, and result in an informed design of jetty repairs. Maintenance histories (Figures 1-21 through 1-23) show that actual O&M costs have trended significantly above and below the expected O&M costs, based on annual expenditures equivalent to 0.7% of the initial construction costs. Specific causes of actual O&M costs being higher or lower than the assumed 0.7% annual average cost have not been analyzed but can be presumed to be directly related to full or partial failure of portions of the structures. Knowledge of the specific causes of failure combined with the cost of constructing a jetty resistant to these causes taken in consideration of maintaining a jetty less resistant to these causes may be useful in determining or presenting the most cost effective alternative design. A specific presentation of individual jetty failure events would serve to bolster the alternative selection process and the projections of future maintenance costs.
Significance – Medium:
Uncertainty regarding the specific causes of failure and their relationship to trends of past O&M costs creates a functional uncertainty in the corrective measures in the alternatives for repair and rehabilitation.
Recommendations for Resolution:
1. Include an analysis of the causes of failure for each repair event (e.g., Figure 1-15) even if only a statement of "storm intensity" in order to provide assurance that the repairs address the actual causes of previous jetty failures. 2. Relate construction costs of more resistant designs to repair costs of less resistant designs for each causal condition of failure and the associated selected alternative.

Comment 11:
Sea level rise and potential increases in wave height have not been examined sufficiently under different model scenarios.
Basis for Comment:
The issue of climate change, sea level rise, and increased wave action is important to consider in the evaluation of long-term projects (USACE, 2009). There is no discussion in the main report of sea level rise and its impact on this project over the 50+ year project timeline. There is a limited discussion of climate change in Appendix D (p. 5), where the conclusion is that since the projected historical trend of sea level at the project site is estimated to be -0.05 feet in 50 years, sea level rise is not projected to be a significant climate change factor at the project site. Appendix D states the "comprehensive analysis of historical storm events is expected to adequately capture the present deep water contribution of potential wave height variation for this project site. The above approach forms the basis for estimating the potential changes in wave climate that could affect the MCR jetty system." However, this discussion on wave height trends is not compelling. The main report states (p. 1-6), "As the tidal shoals continue to recede (erode), the MCR jetties will be exposed to larger waves and more vigorous currents. To make matters worse, the regional wave climate along the Northwest Pacific Coast has become more severe in the last 10 years. The offshore 100-year wave height has been revised from 41 to 55 feet." (see also Appendix D). The main report states (p. 3-42), "The limit of cross-section resiliency is reached for jetties when the core stone becomes exposed to wave attack." Therefore, this issue may affect jetty erosion and a larger range of wave heights should be included in both the SRB and STWAVE model scenarios. Wave overtopping is central to the environment deteriorating the existing jetties. As the planning horizon of this project is 50+ years, it seems that a discussion would be useful of sea level rise and modeling potential wave heights and the wave overtopping impacts on the jetties given different rates of recession under a wider range of wave heights. Jetty height and crest elevation are variables that should be modeled given the potential larger wave heights possible under sea level rise. Although the selection of the recommended plan may not change, long-term maintenance costs may be affected, therefore consideration is warranted. Appendix B states that transient internal hydraulic effects of wave impact may be the most important parameter in the stability of the jetties. However, it is the least certain of all of the parameters. Internal hydraulic pressures in jetties have not been measured. Given this, it seems especially important to consider more extreme wave heights beyond the wave height analyzed, with respect to sea level rise and potential increasing wave height.
Significance – Medium:
The discussion of potential impacts of sea level rise and increased wave action on jetty structures is critical to understanding the potential impacts to the project and in designing a project with lower long-term maintenance costs.

Recommendations for Resolution:
1. Add a separate section to the Major Rehabilitation Evaluation Report that examines climate change, sea level rise, potential wave height changes, and resulting wave overtopping impacts on the jetties given different rates of recession under different model scenarios.

Literature Cited:

USACE (2009). Water Resource Policies and Authorities Incorporating Sea-Level Change Considerations in Civil Works Programs. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Pamphlet EC 1165-2-211. 1 July.

Comment 12:
Construction cost estimates cannot be evaluated because the assumptions and details have not been provided.
Basis for Comment:
A detailed construction cost estimate summary should be provided for the recommended plan, otherwise the basis for the total cost values provided in Section 6.5.9 cannot be reviewed and assessed to determine if they are realistic and complete. The cost estimate information provided in the main report (Section 6.0) and in Appendix E is not sufficient to support the recommended plan: • Table 6-3 provides a detailed summary of stone volumes for each jetty by construction year, but there is no correlation with construction costs or to the cost estimates provided in Section 6.5.9 or Appendix E. • Specific cost estimating details are provided in Sections 6.5.7 and 6.5.8, but the assumptions and criteria defining the basis for the cost estimates do not include any summary unit costs for the individual work items. • Unit costs are provided in Tables A2-9 to A2-11 but pertain to the SRB modeling effort. There is no discussion regarding how they relate to the final project costs presented in Section 6.5.9. • Appendix E includes budget summary costs for construction, planning/engineering, construction management, and land acquisition. Detailed cost estimates for the Civil Works construction budget numbers are not provided and the basis for the costs cannot be reviewed or verified. • Costs for the barge offloading and material re-handling area facility installation and maintenance are not described, yet they could be a large direct and indirect cost to the project based on wave exposure (for type and size of barge offload facility structures). The structural requirements (and corresponding construction costs) for an exposed vessel berth will be many orders of magnitude larger than the same berth in protected waters. Stone delivery cost represents a very large percentage of the total cost. Ensuring a cost feasible method of delivery to the jetty structures is critical for development of an accurate cost estimate.
Significance – Medium:
Detailed construction cost estimates need to be provided in order for the cost analysis to be complete and verifiable.
Recommendations for Resolution:
1. Provide a detailed cost breakdown by work item for the Civil Works project item, Breakwater & Seawalls. Provide detailed cost estimates for each major element of work (e.g., mobilization, stone supply and install, site preparation, material re-handling facility installation, maintenance of re-handling facilities, etc.). Give details regarding work item quantity, unit costs, contingency, and escalation.

2. Provide a detailed cost summary within Appendix E, and an additional detailed description of the basis for the costs estimates in Section 6.
3. Conduct an additional investigation of re-handling facility requirements to adequately determine the costs for facility installation and maintenance.

Comment 13:
Potential environmental impacts on sensitive species, upland habitats, and water quality have not been thoroughly discussed or specifically mitigated in the document.
Basis for Comment:
Appendix D and main report (pp. 5-17--5-20) list potential in-water, wetland, and upland impacts. These impacts should be addressed in the mitigation plan. The mitigation plans currently address these three general categories, but do not provide mitigation for potential impacts to specific species, upland habitats and water quality. The mitigation plans are incomplete because the final wetland delineation for the project has not been conducted, and the impact to wetlands and upland habitat is uncertain and therefore not quantified. A vegetation restoration plan is needed to address potential impacts to upland habitats, especially the rare and vulnerable species discussed below. At a minimum, the mitigation plan should state that these plans will be prepared prior to construction activities. Although the extent of the upland impact on this habitat is uncertain, a replanting contingency plan and a clear plan for avoidance are important to include in the mitigation plan. Similarly, potential water quality impacts from spills should be addressed in the mitigation plan with a statement about the spill prevention plan, as discussed below. Section 5.1 (Environmental Effects) of the main report provides details on biological resources, but is missing a vegetation section. Appendix D contains two reports including the Wetland and Waters of the U.S. Delineation Report and The Plant Communities Investigation Report, April 2007, which provides details on the vegetation communities; however, this information is not presented in the main report and therefore the main report lacks a definition of the plant species of concern within the project area. The revised EA states (p. 6) that at least three of these vegetative communities (shorepine-slough sedge, shorepine-Douglas fir, and coast willow-slough sedge) "have been ranked globally and by the State for their rarity and vulnerability to extinction and should be protected from impacts." This information on sensitive species should be integrated into Section 5.1. Furthermore, potential land construction activities as shown on Figure 5-1 of the main report may affect plant communities, including sensitive habitats, warranting a discussion of existing vegetation in the project area. Vegetation impacts that may result from construction are not detailed in the document, and just briefly mentioned in regards to the South Jetty. Mitigation plans should include specific protective measures to avoid potential impacts to these rare and vulnerable species. In general, the main report discusses Endangered Species Act (ESA) species, but does not provide detailed data on specific animal or plant populations. In 2005, critical habitat was designated for all Columbia River steelhead and Columbia River salmon evolutionarily significant units (ESU), with the exception of lower Columbia River coho salmon ESU. Although a wide range of potential impacts are discussed (p. 5-16), ranging from loss of habitat to an increase in perching and in-water habitat for predators that prey on listed species, the mitigation section of the Major Rehabilitation Evaluation Report does not address these impacts. The main report concludes (pp. 5-19 – 5-20) that there will be overall benefits to these species from this project. Additional details would be helpful to ensure that these species suffer no impacts. The Panel realizes that as a specific mitigation plan is developed, this may

likely be incorporated.

Water quality may also be affected over the project duration due to the large volume of container ships, construction dredges, barges, and cruise ships operating in the area, sometimes in adverse extreme weather conditions. For example, there may be a loss of hydraulic fluid or oil spills (p. 3-70). In the discussion of the mitigation plan in Section 5.4 (p. 5-17), the increased risk of pollutant release and spill potential is raised as a potential impact on ecosystem function. A sentence earlier in the document (p. 5-2) states that the Contractor "will provide a spill prevention plan to include measures to minimize the potential for spills and to respond quickly should spills occur." This sentence belongs in Section 5.4 of the main report as well.

Any history of spills in the Mouth of Columbia River area should also be reported in the document. Providing these details will enable a more thorough analysis of environmental impacts and enable additional protective actions to be implemented.

Significance – Medium:

Additional biological resources data and potential impacts to sensitive species, upland communities and water quality is needed to adequately protect the environment and define the mitigation needed to reduce these impacts to less than significant.

Recommendations for Resolution:

1. Incorporate additional information into Section 5 of the report:
   a. A vegetation section defining the sensitive species within project area.
   b. A statement to ensure that stockpiling activities shown in Figures 5.1 – 5.3 of the main report minimize the land impacts to sensitive habitats and wetlands. State whether a survey will be conducted prior to construction activities with sensitive habitats flagged to ensure avoidance.
   c. Provide detailed data on specific animal or plant populations that are listed species
   d. Specific text in the mitigation section for potential impacts to steelhead and salmon.
2. Add the wording from p. 5-2 into Section 5.4 of the mitigation plan regarding the contractor's requirement to prepare a spill prevention plan to address potential water quality impacts. Document any known history of spills in the area.

Comment 14:
Potential impacts to recreational use during project construction, as identified in public comments, are not adequately discussed or mitigated.
Basis for Comment:
The Major Rehabilitation Evaluation Report does not provide detail on the impact of the project construction activities on recreational use, an issue that came up in public comment letters (main report, Section 5.4). The last sentence in Section 5.3 states that there will be no significant impacts on recreation. Appendix C states that there is a growing cruise ship industry and it is unclear how construction activities will affect passenger cruise ship access. On p. C-3 it states that 5/7 day cruise ship tours carry 15,000 passengers annually, and thousands of tour boat passengers take day trips and dinner cruises. These activities generate about $15 to $20 million in revenue annually for local economies. Public access during construction may be an issue. In addition, other recreational uses of the area may be reduced, such as kayaking and hiking. These impacts should be defined, rather than concluding that no recreational or economic impacts to tourism are expected. Omitting this issue may lead to unforeseen consequences for the cruise ship and tourism industries.
Significance – Medium:
Recreational impacts are not adequately presented in the report and subsequently, no mitigation is identified for this potential impact.
Recommendations for Resolution:
1. Add a discussion of the cruise ship industry and other recreational uses at the project site. 2. Examine potential impacts on cruise ships and other recreational activities that may result from the dredging operations and jetty repair operations. 3. Provide potential mitigation options to reduce recreational impacts to less than significant levels. 4. Make a distinction between recreational impacts during construction and after construction.

Comment 15:
There is not sufficient information on the evaluation of barge offloading and material re-handling facilities to ensure these sites can operate as intended and to ensure the construction costs are adequately represented.
Basis for Comment:
Contract-provided barge offloading facilities for the South and North Jetties are described in Sections 6.3.3 and 6.3.4 and shown in Figures 5-1 and 5-3 of the main report. Based on the information presented, it is not clear that these sites have been adequately investigated and are suited for their intended use. The barge offloading and material re-handling facilities at these outer exposed locations should be further investigated to ensure they are economically and operationally feasible. The proposed facilities are referred to as "temporary," but this is questionable if they will be in place for 20 years. The life-cycle costs of the docks and other structures are not trivial and do not seem adequately analyzed. The largest cost and a substantial risk for the recommended plan involves the purchase, transportation, delivery, and offloading of the stone in a very difficult environment over a relatively long time. The USACE-provided sites also need to be operationally feasible in order to use a permitted method of delivering material to the site. Providing contractors with better information on the limitations and usability of these sites at the time of bidding could result in substantial cost savings. There is no discussion in the report of any engineering work performed to evaluate the feasibility of installing structures at these exposed locations, nor any mention of operational feasibility for the size of vessels and wave climate for the periods of construction. These locations are subject to wave heights of more than 15 feet, which will impose very large wave impact loads on fixed structures (dolphins and sheet pile walls), resulting in high risk and cost facilities. USACE intends to permit these sites and provide them to the contractor as the primary point of access. This establishes a certain level of perceived usability to bidders. If they are later determined not to be feasible (i.e., during contract bidding or during construction), it would result in substantial cost and schedule changes. Use of the re-handling facilities will be limited to a "summer" work period (April to October). There is no analysis of sedimentation rate in the report to verify whether the floatation channels will remain open for the summer construction work period. Maintenance dredging estimates for barge offloading facilities are provided in Table 6-1, but it is not clear for what time period (annually or total over the entire duration of the project). Jetty A is listed at 80,000 cubic yards for maintenance dredging. Other options, such as dredging within the Ilwaco channel to the trunk end of Jetty A and developing an offloading facility adjacent to the staging area could be considered.
Significance – Medium:
Insufficient information on the limitations and usability of the offloading and re-handling sites could affect construction cost estimates and project schedule due to operational and physical environment constraints.

Recommendations for Resolution:
1. Conduct a feasibility level engineering analysis and design for the contract-provided offloading and rehandling sites to ensure that selected sites and facilities are feasible and provide reliable estimates of construction cost. The feasibility evaluation should at a minimum include the following: a. Evaluate feasibility of constructing pile supported structures within an extreme hydrodynamic environment. This includes wave/current loads on moored vessels during the construction period and wave/current loads berth structures during extreme winter conditions. b. Evaluate downtime of barges at the proposed sites relative to the wave and current climate during the proposed construction work period. c. Refine the type of structure that is feasible for these locations for inclusion into project permits and cost estimates. 2. Evaluate the need for alternative barge offloading and material re-handling site locations based on the results of the feasibility analysis. 3. Evaluate design concepts for permanent barge/dock facilities, possibly incorporated into the inside face of the jetties near their root. 4. Develop environmental data specific to the proposed offloading site locations for bidders/contractors to use in developing their estimates of downtime and infrastructure requirements at USACE provided rehandling sites. Extreme event offshore wave data and jetty structure design criteria will not be sufficient for contractors to use in evaluating short-term operational and design requirements.

Comment 16:
The requirements, costs, and history associated with emergency dredging compared to scheduled maintenance dredging activities have not been specified.
Basis for Comment:
Dredging is a substantial component of this project and has been historically, yet there is no clear discussion of the role of dredging in the Major Rehabilitation Evaluation Report. Typical annual dredging rates are not presented in the document itself, although Appendix A1 (p. A1-3) states, "Each year, the Portland District dredges 3 to 5 million cubic yards (MCY) of sand at MCR to maintain the 5-mile long deep draft navigation channel." It is unclear if the Portland District dredging is conducted exclusively at MOCR. Analysis of the project area maintenance dredging requirements – past, present, and future – have not been presented. Controlling dredging costs is critical to this project. The EPA publishes a report annually analyzing dredged sediment disposal in the nation. About 4 million cubic yards is dredged at the MCR every year at an annual cost of about $10 million. The fact that maintenance dredging volumes in the project area have not increased (no clear trend) since 1956, despite ongoing jetty tip recession, raises the question of how much jetty is now needed to maintain the MCR navigation channel. However, the main report does not discuss details of the maintenance dredging. Appendix B states the geological history includes 225 million cubic yards of dredging from the MCR navigation channel since 1956. The volumes, history, and fate of these dredged sediment volumes should be described in the main report and are missing from the analysis. The fact that most of this sediment was dumped far offshore and lost to the nearshore may have something to do with the erosion experienced in the area. This large quantity of dredged material warrants discussion and additional consideration of strategies to reduce this volume. The discussion of emergency dredging is also lacking in the main report. The historical downtime for dredging at the dock and jetty repair work during the time period of October to March (peak period for large waves) is not provided. Page 3-70 states, "Given the winter wave conditions that the dredges would be performing in, it is highly likely that damage would occur to the drag arm of the dredge while working." Page A2-65 states that within the SRB model "there is a 0.3 probability that one dredge will lose a drag-arm while performing dredging during winter or a 0.7 probability that one dredge would realize equipment damage," thereby increasing dredging costs. Several places reference the difficulty of dredging in the winter. Conditions may preclude effective dredge use, or the dredge may break and become inoperable, suggesting dredging may be postponed until summer. In terms of dredge operation, p. 1-48 gives the operational limitations of hopper dredges, and admits that operating a hopper dredge at the MRC during winter months has not yet been attempted. Therefore, the inadequate demonstration of equipment effectiveness, lack of documentation of the basis of dredge damage probabilities, and lack of historic utilization increases the risk associated with estimating costs associated with emergency dredging. The document states on p.1-50 that the rate of shoaling within the MCR channel would not be high enough to require emergency dredging; therefore, the increased shoaling volume could be dredged the following summer and would not be considered emergency dredging. The

document never presents operational triggers for when emergency dredging would occur.

The main report indicates that there are four dredges capable of working in winter (p. 3-111), but these dredges are not mentioned earlier, when it was presented that only one or two dredges are available in the short term. A discussion of emergency dredging history, success in other areas, and a description of the equipment available is warranted.

The analysis considers long-term O&M costs of dredging, but does not explain the criteria used in the calculation estimates.

There is no mention of any historic environmental impacts from the dredge operations, such as spills. If spills have occurred, data should be presented.

Significance – Medium:

Additional information on dredging may enable better analysis and lead to a long-term reduction in dredging costs and the development of a contingency plan to successfully avoid navigation impacts.

Recommendations for Resolution:

1. Develop a paragraph on dredging in the main report that specifies clearly what the maintenance dredging program has been, rates, and frequencies, and if they are scheduled or "as needed." Present all the historic maintenance costs, schedules, and frequencies.
2. Provide a detailed history of emergency dredging with success and failures and costs.
3. Add information to specify what rate of shoaling requires emergency dredging compared to scheduling maintenance dredging activities.
4. Present the criteria used in the calculations of dredging O&M costs.
5. Provide any information on historic spills related to dredging operations.

Comment 17:
The current jetty structure condition is not well described, making it difficult to confirm the confidence of the SRB model analysis and selection of a recommended plan.
Basis for Comment:
Although there is a good description of historical failures and repair actions for each jetty, there is no discussion or documentation of current jetty condition or detailed condition assessments of structure and functional condition. A condition assessment of each jetty structure should be conducted through a combination of visual inspection (stone size, gradation, slope defects, stone defects, loss of armor stone, core exposure, etc.) and evaluation and comparison of historical electronic surveying results (single beam, multi-beam, or side scan sonar data). These elements will provide the basis for determining the present condition, assess risk of current condition to failure, and help classify structure along various reaches of each jetty. These data would enable better assessment of vulnerabilities, analyzing why some areas in the jetty have maintained without repair and other areas have needed multiple repairs. A better understanding of these dynamics may reduce O&M costs over the long term. Rubble-mound structures have a tolerance for deterioration before suffering catastrophic failure. A thorough understanding of current and historical structure condition is critical to developing an estimate of the mechanisms causing failure, establishing the timeframe for catastrophic failure, and conducting maintenance/repair work. The SRB model evaluation of alternatives using the base condition depends upon an adequate understanding of current jetty conditions and corresponding impact on estimated future repair and maintenance. The current SRB analysis is based on a “hindcasting” of jetty performance relative to historical performance, but without consideration of the details of condition and causes of failure. The current and historical condition relative to structural and functional rating should be conducted following USACE procedures (USACE, 1998) to establish the baseline conditions for the SRB model analysis. Evaluation of stone source and quality relative to length of service on the structure should be conducted as part of the jetty condition assessment.
Significance – Medium:
A detailed description of the current jetty structure as part of a condition assessment is necessary to understand the accuracy of the SRB model.
Recommendations for Resolution:
1. Conduct a detailed condition assessment of each jetty structure, including visual inspection and historical survey comparison. 2. Compare historical survey data for the validation of interpreted historical conditions and corresponding perceived modes of failure. Incorporate results into the development of baseline conditions for the SRB model. 3. Use a condition rating system such as that outlined in the USACE Manual REMR-OM-24 (USACE, 1998) for evaluation of current condition. Assess both the structural and functional condition of the structures and incorporate the results into the SRB model analysis.

4. Incorporate the results of the condition assessment into Section 1.4, description of project history.
5. Provide an additional description of existing condition in Section 1.4 and 3.3.2 of the main report, including the service life of stone sources used for previous repair and maintenance activities.
6. Based on the results of the condition assessment, the relation between the stone sources reviewed (in Appendix B, Section 5) and the corresponding observed service life of that stone should be discussed and incorporated in the SRB analysis.

Literature Cited:

USACE (1998). Condition and Performance Rating Procedures for Rubble Breakwaters and Jetties. REMR Management Systems—Coastal/Shore Protection System Devices. Technical Report REMR-OM-24, U.S. Army Corps of Engineers, Washington, D.C.

Comment 18:
The mechanisms causing jetty head scour have not been sufficiently analyzed to allow selection of the appropriate jetty head repair measure.
Basis for Comment:
Causes of jetty head scour have not been sufficiently investigated. Tidal shoal and outlet channel geomorphic processes should be further evaluated and analyzed to ensure that proper jetty head repair measures are selected. The mechanisms causing the "scour holes" and undermining of the jetty in the vicinity of the jetty tips (North Jetty and Jetty A) have not been sufficiently analyzed for selection of the jetty head repair measure. Figure A1-32 indicates a progressive erosion of ebb tidal shoals in the vicinity of the North Jetty (between Stations 60 and 90) undermining the south toe of the structure. The report understates the situation when it notes (Appendix A1, p. 28), "If the jetty foundation washes away, jetty reconstruction is problematic." A solid understanding of the environment and bathymetry changes is essential for development of a reliable design alternative. Spur groins installed along the south slope of the North Jetty will assist in addressing scour generated by localized currents, but will not provide protection from overall MCR tidal shoal and channel morphological changes. Continued ebb shoal erosion and potential tidal channel movement could undermine the head of the proposed offshore spur groins (located near Stations 90 and 70). It seems likely that scour holes are related to the observed jetty tip recession. The 100 foot deep scour hole at the end of Jetty A is particularly alarming from a structural design perspective. Equally alarming is the discussion of "Vertical scour along the toe of the MCR jetties has exceeded 10 meters in some reaches" (Appendix A2, p. A2-11). If there really is, or was, a more than 30 foot high underwater scarp in places along the toe of the jetties, then more investigation is warranted. Figures showing typical sections often do not extend to the toe of slope, and show details that aren't feasible, such as rock limits ending in a small angle without an engineered toe. (See Appendix A1, Figure A1-258). Strategies to deal with scour, especially at the jetty tips appear undeveloped. Design features could include scour blankets, launched toes, or a program of regular fill using dredged material.
Significance – Medium:
Inadequate evaluation of the geomorphic processes responsible for the deterioration at the jetty tips (North Jetty and Jetty A) could lead to an incorrect approach to rehabilitation of those areas of damaged structures.

Recommendations for Resolution:

1. Conduct a more detailed evaluation of historical geomorphic changes in the outlet channel and shoals in order to evaluate tidal shoal erosion and tidal channel migration. Comparative analysis of historical bathymetric surveys would be helpful in developing a better understanding of historical trends and associated correlation with jetty structure historical damage, failure, and repair activities. Additionally, use historical geomorphic change analysis and hydrodynamic analysis to estimate long- term changes and impacts to the North Jetty and Jetty A to formulate jetty head rehabilitation alternatives and development of design criteria.
2. Do not limit the jetty repair preliminary designs to the footprint of the authorized jetties. Evaluate scour protection alternatives extending past the jetty tips.
3. Draft plans, profiles, and sections at this level of design using suitable software, such as AutoCAD® or MicroStation®. Microsoft Excel® is not an adequate substitute for drafting software.
4. Draft the jetty design typical sections to scale and extend past the scour holes and navigation channel.
5. Conduct a subsurface geotechnical investigation to obtain the geological properties needed to verify or design an adequate foundation.

Comment 19:

Risk thresholds for selected alternatives are not clearly defined.

Basis for Comment:

Risk thresholds are used in repair frequency predictions as triggers for maintenance response and subsequently in maintenance cost predictions. The frequency of reaching degradation thresholds is predicted by risk thresholds. Combining degradation thresholds with repair costs (minor vs. major) can also be used to determine the threshold for triggering maintenance actions, balancing multiple small repairs against the cost of a single major repair. The Major Rehabilitation Evaluation Report includes extensive discussions of risks related to different portions of the project; however, while this discussion of risk is extensive, defined thresholds are not presented in the document.

It is to be expected that the risk (probability) of surpassing thresholds may vary among alternatives in both configuration (number and placement of spurs, jetty length) and in cross sections considered. The risk associated with each alternative considered should be assessed based on materials, cross sections, supporting geological features, currents, and storms. It is also proper procedure to examine how the risk of one design component may be altered by the inclusion or exclusion of a second design component.

Significance – Medium:

Undefined risk thresholds may serve to undermine the logic of the cost and maintenance predictions and, to a lesser extent, the alternatives selected.

Recommendations for Resolution:

1. Define risk thresholds for alternatives, including source of risk and effect of exceeding the threshold.

Comment 20:
It is not clear how uncertainty and derived risk analyses were considered in the structure and application of the model.
Basis for Comment:
Project life-cycle cost analyses should consider the risk of construction cycle and operational cycle downtime, which does not appear to be included. However, risks cannot be evaluated without understanding the level of uncertainty associated with the SRB model result. The uncertainty associated with actual future conditions, which may deviate from the modeled future conditions, is not apparent. The SRB model includes 600 variables (Section 9, p. A2-91) each of which has a data set which can be expected to reflect an associated variance. Depending on the calculation stream, these variances, applied geometrically, will lead to accumulated statistical errors and uncertainties. These cumulative internal variances can be expected to result in high uncertainty in the output of the SRB model, which should be considered in the evaluation of alternatives.
Significance – Medium:
Potentially wide error bars (uncertainty) may compromise life-cycle maintenance and repair schedules.
Recommendations for Resolution:
1. Quantify and explain the uncertainty (i.e., error bars) associated with each variable when analyzing processes that involve a chain of events. 2. Identify, analyze, and define errors that may accumulate to assess model reliability.

Comment 21:
The model output parameters and wave height components are not clearly explained and supported.
Basis for Comment:
The meaning of the following SRB model output parameters is not clear: • Functional Reliability • Structural Reliability • Probability of Unsatisfactory Structure Performance. For example, the main report (Section 3.6.1, p. 3-43) includes the following: "Functional reliability is the likelihood that a structure will satisfactorily perform its intended function within a given time interval. Functional reliability is derived by combining structural reliability metrics with metrics that describe the present structure cross-section configuration." One difficulty is that the understanding of "Functional Reliability" requires first understanding "structural reliability metrics", (which are not to be confused with "metrics that describe the present cross-section configuration"). However, the "structural reliability metrics" are not clearly defined either. A word search of Appendix A2 for the term "Structural Reliability" does not reveal a set of equations for calculating the parameter or a clear explanation. Similarly, much of the SRB model includes terminology and variables that are hard to understand. For example, Table A2-12, Jetty Maintenance Thresholds, (p. A-60) consists of numbers and parameters not connected to anything that has a physical meaning. Conventional calculations and metrics such as volumes, areas, and depths are parameters with physical meaning that would improve the understanding of the SRB model. Understanding the SRB model outputs would be improved with graphics that are connected to parameters with physical meaning. The wave height component of the SRB model is not supported by standard coastal engineering practice. Progressive jetty damage in the SRB model is based on a stochastic time series of wave heights, which is derived from "An ensemble of 52 storm events … recorded at NDBC buoys… during 1998 to 2008." It is unclear why only 10 years of buoy data were used when a longer record of more than 17 years with gaps removed is available (Appendix A1, pp. 34 and 37). It is also not certain that extreme wave height events were properly included in the SRB model process. It is common industry practice to test a coastal engineering design using a specific design environmental criterion, such as the 100 year return period wave height.
Significance – Medium:
The model parameters that compare alternatives lack a physical meaning, such as a volume of rock or depth of scour. It is therefore difficult to verify, calculate, or evaluate whether the parameters used or model results are reasonable.

Recommendations for Resolution:
1. Explain and demonstrate how the model output parameters relate to physical performance measures, with graphics or figures. 2. Measure jetty damage and performance with conventional calculations, and commonly applied metrics, for example: a. Volume of sediment entering the navigation channel, or dredge volume, b. Depth or volume of scour at the jetty toe c. Volume or area of armor rock displaced from the jetty. 3. Test the design against a specific storm event, such as the 100 year return period event. 4. Calculate the return period of extreme events using the complete record of measured offshore wave data.

Comment 22:
The culvert installation details, as well as potential impacts, need further clarification.
Basis for Comment:
The Major Rehabilitation Evaluation Report states that the existing culvert has increased scour and adversely affected the North Jetty, and that it will be relocated. There are a few sentences in the main report and in Appendix D that mention the culvert, but there is not enough information provided in the main report to determine if there will be any potential impacts from the new discharge location. The table at the end of Appendix D provides the most detail anywhere in this report regarding the culvert relocation. On p. 6-6 in the main report there is a sentence stating work will begin in 2014 to install a culvert to divert overland flow to another area that will not impact the North Jetty root stability. While this sounds like a reasonable approach to protect the North Jetty, more information is needed to clarify the impact such as the source of the water, an assessment of the water quality, and an estimate of the flow rate involved. Without knowing the exact new location, it is not possible to assess the potential environmental impact of relocating this water flow.
Significance – Medium:
More detailed information on the new location of the culvert as well as water quality, flow rates, and source of the water is necessary to determine the environmental impact of the relocation.
Recommendations for Resolution:
1. Add one paragraph in the main report that addresses the culvert relocation. 2. Present any available data on the water quality, flow rates, and water source of water discharged through the culvert. 3. Provide the specific location planned for new culvert.

Comment 23:

The various base years cited in the report and the difference between project life and period of analysis require additional explanation.

Basis for Comment:

The terms “project life” and “period of analysis” are not defined or differentiated, and the project base year varies throughout the report:

- In the economic spreadsheet models, the NPVs are calculated for differing periods of analysis (2009-2070 for South Jetty, 2008-2070 for Jetty A, and 2008-2070, 2008-2057 and 2008-2069 for the North Jetty); whereas the AACs are based on a 50 year period of analysis.
- The period of analysis extends 50 years beyond the base year of 2011 when discussing sea level rise (pp. A1-38 and A2-68).
- The period of analysis for future condition simulations is 64 years (2006 to 2970) for the North Jetty and Jetty A and 63 years (2007 to 2070) for the South Jetty (p. A2-78).
- The AAC is calculated using an amortization factor applied to the present year cost stream from the NPV implementation year (2006/2007) to 2069 (p. A2-51).
- The base year of the economic analysis is not identified in Section 2 or Appendix C, but is stated as 2014 elsewhere in the report (pp. ES-3 and A2-78).
- Within the SRB model, the base year is stated as 2011 when discussing sea level rise (pp. A1-38 and A2-68).
- Within the SRB model, the base year for NPV cost discounting is 2006 for the North Jetty and Jetty A, and 2007 for the South Jetty (p. A2-51).

Significance – Low:

Inconsistencies in terminology and periods of analysis can lead to misunderstanding of findings and results.

Recommendations for Resolution:

1. Define and differentiate between the terms “project life” and “period of analysis.”
2. Revise the report to eliminate inconsistencies between the varying periods of analysis.
3. Use a consistent base year throughout the analysis, and revise the report to reflect consistency.
4. Revise Section 2 and Appendix C of the report to state the year that is considered to be the base year, the length of the period of analysis, and the calendar years that are included in the period of analysis.
5. Provide definitions of all terms in a Glossary.

Comment 24:

Cargo tonnage and vessel trip statistics presented throughout the report are inconsistent.

Basis for Comment:

Data presented throughout the report have inconsistencies that should be corrected. The following are examples of inconsistencies in values for cargo tonnages, vessel trips, and value of cargo:

- Page ES-1 – cargo on the MCR is 45 million (M) tons and 3,500 vessel crossings based on 2008 Waterborne Commerce Statistics Center data. These data are not cited in the body of the report.
- Page 1-2 – cargo on the MCR is 40 M tons worth $17 billion, with 12,000 commercial vessels navigating the MCR annually.
- Pages 2-1 and C-1 – cargo on the MCR is 40 M tons valued at $17 billion based on a 2009 Pacific Northwest Waterways Association (PNWA) factsheet cited in Appendix C.
- Pages 1-4 and C-4 – cargo on the MCR is 32 M tons in 2003 and projected at 43 M tons in 2020 based on 2005 Center for Economic Development and Research (CEDER) data, cited as a footnote in Appendix C.
- Page C-5, Table C-1 – 5,364 total vessel trips on the MCR based on 2005 Waterborne Commerce Statistics Center data.
- Page A1-3 – cargo on the MCR is 48 M tons worth $16 billion, with 12,000 commercial vessels navigating the MCR annually.

The cargo and vessel trip statistics presented in the report appear to include all traffic on the MCR and Lower Columbia River (LCR). The report assumes all traffic accessing the MCR is dependent on the MCR jetties. The without-project condition channel depths are not adequately described. The cargo and vessel trips that would be impacted by the jetties, that is, the portion of the fleet transiting the MCR that would be restricted by the without-project condition channel depths, is not described.

Significance – Low:

Consistent cargo and vessel trip data for the MCR are needed in order to develop an understanding of the significance of the jetties.

Recommendations for Resolution:

1. Describe the cargo tonnages, vessel trips, and value of cargo consistently throughout the report, or supply an explanation of the differences and why various data sources were used.
2. Describe the portion of the fleet accessing the MCR that is dependent on the jetties (i.e., what are the without-project condition channel depths and what portion of the fleet transiting the MCR would be restricted by the without-project condition channel depths).

Comment 25:
Terminology related to jetty rehabilitation and failure is defined inconsistently or vaguely in some places.
Basis for Comment:
Inconsistencies in terminology can make understanding the project difficult. Commonly used terms in the document, such as "failure," are not clearly and qualitatively defined. Phrases such as "close to failure" appear frequently, in a qualitative sense, but without an understanding of how much jetty damage, if any, constitutes a "failure." Another example is in the SRB model where "fix-as-fails" repairs are described as, "To defer jetty maintenance for as long as possible, the jetty is maintained close to the margin of functional loss." The concept makes sense but how the model deals with terms like "as long as possible" and "close to the margin of functional loss" is unclear. Other phrases, such as "scheduled repair" and "rehabilitation" seem to be inconsistent as well. For example, "scheduled repair" includes "head capping" in the executive summary of the main report, but does not include "head capping" in some alternatives analyzed by the SRB model.
Significance – Low:
Without clear, consistent definitions of terminology, it is difficult to understand exactly what is being proposed or analyzed and can lead to misinterpretations.
Recommendations for Resolution:
1. Add a Definitions list or Glossary to the document.

This page intentionally left blank

APPENDIX B

Final Charge to the Independent External Peer Review Panel
as
Developed by USACE and Submitted to the Panel on December 28, 2010

on the

Mouth of Columbia River IEPR

This page is intentionally left blank.

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the Columbia River at the Mouth, Oregon and Washington Major Rehabilitation Evaluation Report are credible and whether the conclusions are valid. The Panel is asked to determine whether the technical work is adequate, competently performed, properly documented, satisfies established quality requirements, and yields scientifically credible conclusions. The Panel is being asked to provide feedback on the economic, engineering, environmental, geomorphology, and plan formulation. The panel members are not being asked whether they would have conducted the work in a similar manner.

Specific questions for the Panel (by report section or Appendix) are included in the general charge guidance, which is provided below.

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the Mouth of the Columbia River ER. Please focus on your areas of expertise and technical knowledge. Even though there are some sections with no questions associated with them, that does not mean that you cannot comment on them. Please feel free to make any relevant and appropriate comment on any of the sections and appendices you were asked to review. In addition, please note the following guidance. Note that the Panel will be asked to provide an overall statement related to 2 and 3 below per USACE guidance (EC 1165-2-209; Appendix D).

1. Your response to the charge questions should not be limited to a "yes" or "no." Please provide complete answers to fully explain your response.
2. Assess the adequacy and acceptability of the economic and environmental assumptions and projections, project evaluation data, and any biological opinions of the project study.
3. Assess the adequacy and acceptability of the economic analyses, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and uncertainty, and models used in evaluation of economic or environmental impacts of the proposed project.
4. If appropriate, offer opinions as to whether there are sufficient analyses upon which to base a recommendation.
5. Identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods.
6. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable
7. Please focus the review on assumptions, data, methods, and models.

Please **do not** make recommendations on whether a particular alternative should be implemented, or whether you would have conducted the work in a similar manner. Also please **do not** comment on or make recommendations on policy issues and decision making.

Comments should be provided based on your professional judgment, **not** the legality of the document.

1. If desired, panel members can contact one another. However, panel members **should not** contact anyone who is or was involved in the project, prepared the subject documents, or was part of the USACE Independent Technical Review.
2. Please contact the Battelle Deputy Project Manager (Richard Uhler, uhlerr@battelle.org) or Project Manager (Karen Johnson-Young, johnson-youngk@battelle.org) for requests or additional information.
3. In case of media contact, notify the Battelle Project Manager immediately.
4. Your name will appear as one of the panel members in the peer review. Your comments will be included in the Final IEPR Report, but will remain anonymous.

Please submit your comments in electronic form to Richard Uhler, uhlerr@battelle.org, no later than January 31, 2011, 5 pm EST.

Independent External Peer Review
Columbia River at the Mouth, Oregon and Washington
Major Rehabilitation Evaluation Report

Final Charge Questions

GENERAL QUESTIONS

1. To what extent has it been shown that the project is technically sound, environmentally acceptable, and economically justified?

2. Are the assumptions that underlie the economic, engineering, and environmental analyses sound?

3. Are the economic, engineering, and environmental methods, models, and analyses used adequate and acceptable?

4. In general terms, are the planning methods sound?

5. Are the interpretations of analysis and conclusions based on the analysis reasonable?

MAIN REPORT

SECTION 1.0 -- INTRODUCTION

6. Is the project's purpose and scope complete and understandable?

7. What other information, if any, should be included in this section?

8. Has adequate public, stakeholder, and agency involvement occurred to determine all issues of interest and to ensure that the issues have been adequately addressed to the satisfaction of those interested parties?

9. Comment on the extent to which the existing conditions are clearly and adequately described.

10. Comment on whether the information presented supports the problem identified under the base condition.

SECTION 2.0 -- ECONOMIC CONSIDERATIONS

11. Has the base condition, without-project condition and summary of costs and benefits been adequately described, analyzed, and explained?

12. Does the National Economic Development (NED) Plan contrast to the base condition?

13. Is it clearly explained why navigation benefits were not analyzed?

SECTION 3.0 -- ENGINEERING CONSIDERATIONS

14. Is the description of functional and structural reliability clear and reasonable?

15. Was the Stochastic Risk-Based Life Cycle Simulation (SRB) model used in an appropriate manner? Is the description of how the model functions, the relative influence of model parameters and model calibration process clear and logical?

16. Comment on the repair and rehabilitation alternatives. Is the description of the different plans clear and distinct?

17. Comment on the engineering features for alternatives. Do the plan descriptions clearly indicate which features are incorporated into the various plans?

18. Comment on the evaluation of engineering features. Is the scope, function and analysis of the engineering features clearly described?

19. Comment on the general alternative development approach. Does the alternative evaluation presented follow USACE guidance?

20. Comment on the engineering evaluation of alternatives. Are the plans adequately evaluated based upon their engineering merit?

21. Has the sediment analysis been adequately performed and documented to support the movement of material that occurs during a breach event?

22. Has the analysis been adequately performed and documented to support reductions in channel maintenance dredging?

23. Does the analysis adopt adequate risk thresholds for different alternatives and are such thresholds uniformly consistent?

24. Are potential life safety issues accurately and adequately described under existing, future without project, and future with project conditions?

25. Has the rationale for head capping locations at each jetty been adequately explained?

26. Has the basis for the number and location of spur groins been adequately explained?

SECTION 4.0 -- ASSESSMENT OF ALTERNATIVES

27. Does plan selection reflect a full range of design alternatives?

28. Are the problems and opportunities appropriately defined and addressed in this study?

29. Are there any other constraints or objectives that should be considered as part of the project that would be important to reaching the projects final goals?

30. Do the alternatives adhere to the USACE Plan Formulation Criteria? Do they appropriately address the needs and objectives of the project? What additional information, if any, should be discussed?

31. Comment on the completeness of the project-specific criteria used in the comparison of alternatives.

32. Was the NED Plan appropriately identified and selected?

SECTION 5.0 -- ENVIRONMENTAL CONSIDERATIONS

33. Comment on the completeness of the environmental documentation. Have all National Environmental Policy Act (NEPA) requirements been satisfied?

34. Have the water resources in the project area been accurately described?

35. Comment on the thoroughness and accuracy of the marine and estuarine resource information presented.

36. Comment on the overall discussion of environmental effects due to the project.

37. Comment on the adequacy of available information used to characterize wetland resources within the study area.

38. Comment on whether the special status species and resource areas in the project area have been accurately described.

39. Comment on the adequacy of the environmental and without-project condition summaries in terms of data quality, timeliness of the data, and breadth of information covered.

SECTION 6.0 – CONSTRUCTION AND COST ESTIMATE

40. Comment on the overall adequacy and reasonableness of the detailed cost estimates.

41. Comment on the extent to which the cost summary is complete and consistent with the detailed analyses shown in this section.

42. Is the construction schedule adequate for completion of the recommended activities?

SECTION 7.0 – RECOMMENDATIONS

No questions.

SECTION 8.0 – REFERENCES

No questions.

APPENDICES

Appendix A1 – Coastal Engineering

43. Does Appendix A1 describe the coastal engineering history and challenges specific to the Mouth of the Columbia River?

44. Does Appendix A1 contain adequate information to assess coastal engineering at the Mouth of the Columbia River?

Appendix A2 – Reliability Analysis, Event Tree Formulation and Life-cycle Simulation

General Questions

45. Is the purpose of the model clearly defined?

46. Is the model diagram easily understood?

47. Does the model follow a logical programming path?

48. Does the model adequately capture and evaluate all of the relevant variables?

49. Can the model as described achieve the stated purpose?

50. Does the model accurately describe (model) repair activities and sequences? Is it modeling the repair activities similarly to how the repairs will be sequenced and performed?

Technical Quality

51. Comment on the overall technical quality of the model.

52. Is the model a realistic representation of the actual system?

53. Are the analytical requirements of the model properly identified?

54. Does the model address and properly incorporate the analytical requirements?

55. Are the assumptions clearly identified, valid, and do they support the analytical requirements?

56. Comment on the ability of the model to calculate benefits for total project life.

57. Has the design wave height of 55 feet been appropriately calculated and documented?

58. Have the waves generated by the model been validated against observed wave data?

Usability

59. Comment on the model's usability.

60. Are the model results easily understood?

61. Do the model results support the project objectives?

62. Is user documentation available and complete?

63. Is the model transparent and does it allow for easy verification of calculations and outputs?

Appendix B – Geotechnical Studies

64. Does the background information adequately describe the geologic history and conditions at the Mouth of the Columbia River and surrounding area?

65. Are all of the site specific and distinct geological features relevant to the project described and appropriately addressed in the engineering design?

66. Were risk and uncertainty sufficiently considered?

Appendix C – Economic Analysis

67. Comment on the assumptions and forecast methods used to calculate project benefits.

68. Comment on the reasonableness of the scenarios used to calculate benefits.

69. Comment on the method used to calculate the National Economic Development (NED) benefits.

70. Comment on the assumptions used in the calculation of present value of benefits.

71. Comment on the extent to which the NED benefits summary is consistent with and justified in the economic analysis.

Appendix D – Environmental Documentation

72. Comment on the ability of the proposed mitigation plans to address adverse impacts from the project.

73. Are the conclusions regarding the type and projected magnitude of adverse impacts to resources within the study area reasonable?

74. Comment on the appropriateness and comprehensiveness of the identified mitigation projects considered for addressing predicted impacts arising from the project.

Appendix E – M-CACES Cost Estimate for Recommended Plan

75. Comment on the overall adequacy and reasonableness of the detailed cost estimates.

76. Discuss the appropriateness of the explicit or implicit assumptions that are included in the cost estimates and whether assumptions are adequately addressed.

77. Comment on the extent to which the cost summary is complete and consistent with the detailed analyses provided in the study report.

Appendix F – Project Management Plan

No questions.

Appendix G – Schedule of Fully Funded Project Costs

No questions.

FINAL OVERVIEW QUESTION

78. What is the most important concern you have with the document or its appendices that was not covered in your answers to the questions above?