Final Independent External Peer Review Report
Skagit River Basin Flood Risk Management General Investigation, Skagit County, Washington

Prepared by
Battelle Memorial Institute

Prepared for
Department of the Army
U.S. Army Corps of Engineers
Flood Risk Management Planning Center of Expertise
Baltimore District

Contract No. W912HQ-10-D-0002
Task Order: 0069

September 5, 2014

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Executive Summary

PROJECT BACKGROUND AND PURPOSE

The Skagit River originates near the 8,000-foot level of the Cascades Mountains in British Columbia, Canada and flows south and then west to the Skagit delta where it discharges through two distributaries – the North Fork and South Fork – to Skagit Bay. The Skagit River Basin is located in northwest Washington State and has a total drainage area of 3,115 square miles. The project area for the feasibility study encompasses the Skagit River watershed from Ross Dam reservoir to Skagit Bay. The Skagit River floodplain contains about 22,000 acres east (upstream) of Sedro-Woolley (RM 22.4) and 74,000 acres west (downstream) of Sedro-Woolley. The major cities on the Skagit River delta – Mount Vernon, Burlington, Sedro-Woolley, and La Conner – lie about 60 miles north of Seattle, Washington.

Major flooding has occurred in the Skagit River Basin. Because of its geographic location, the Skagit River Basin is subject to winter rain floods and an increase in discharge during spring due to snowmelt runoff. Rain-type floods usually occur in November or December, but may occur as early as October or as late as February. Additionally, a light snow pack is frequently formed over most of the basin. Heavy rainfall and accompanying snowmelt result in a high rate of runoff, as the ground is already nearly saturated from earlier precipitation. Two or more crests may be experienced within a period of one to two weeks as a series of storms move across the basin from the west. The winter floods have a considerably higher magnitude than the average annual spring high water.

Flood damages have been reduced in recent years with a well-maintained local levee and dike system on the Lower Skagit River, and a well-organized and effective flood fighting effort. The purpose of the feasibility study was to formulate and recommend a comprehensive flood risk management plan for the Skagit River floodplain to reduce flood hazards and damages in the urban and rural parts of the basin. The total estimated cost of the proposed project is $225,000,000.

Independent External Peer Review Process

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. USACE is conducting an IEPR of the Skagit River Basin Flood Risk Management General Investigation, Skagit County, Washington (hereinafter: Skagit River GI IEPR). As a 501(c)(3) non-profit science and technology organization, Battelle is independent, is free from conflicts of interest (COIs), and meets the requirements for an Outside Eligible Organization (OEO) per guidance described in USACE (2012). Battelle has experience in establishing and administering peer review panels for USACE and was engaged to coordinate the IEPR of the Skagit River GI. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2012) and OMB (2004). This final report presents the Final Panel Comments of the IEPR Panel (the Panel). Details regarding the IEPR (including the process for selecting panel members, the panel

members' biographical information and expertise, and the charge submitted to the Panel to guide its review) are presented in appendices.

Based on the technical content of the Skagit River GI review documents and the overall scope of the project, Battelle identified candidates for the Panel in the following key technical areas: economics/Civil Works planning, biological resources and environmental law compliance, civil/structural engineering, hydrologic and hydraulic engineering, and geotechnical engineering. Battelle screened the candidates to identify those most closely meeting the selection criteria and evaluated them for COIs and availability. USACE was given the list of final candidates to confirm that they had no COIs, but Battelle made the final selection of the five-person Panel.

The Panel received an electronic version of approximately 1,686-pages of Skagit River GI review and supporting documents, along with a charge that solicited comments on specific sections of the documents to be reviewed. USACE prepared the charge questions following guidance provided in USACE (2012) and OMB (2004), which were included in the draft and final Work Plans.

The USACE PDT briefed the Panel and Battelle during a kick-off meeting held via teleconference prior to the start of the review to provide the Panel an opportunity to ask questions of USACE and clarify uncertainties. Other than Battelle-facilitated teleconferences, there was no direct communication between the Panel and USACE during the peer review process. The Panel produced individual comments in response to the charge questions.

IEPR panel members reviewed the Skagit River GI IEPR documents individually. The panel members then met via teleconference with Battelle to review key technical comments 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/high, medium, medium/low, or low); and (4) recommendations on how to resolve the comment. Overall, 16 Final Panel Comments were identified and documented. Of these, five were identified as having high significance, eight were identified as having medium/high significance, two had a medium significance, one had medium/low significance, and no comments were identified with low significance.

Battelle received public comments from USACE on the Skagit River GI IEPR (380 total pages of comments) on August 8, 2014 and provided them to the IEPR panel members. The panel members were charged with determining if any information or concerns presented in the public comments raised any additional discipline-specific technical concerns with regard to the Skagit River GI review documents. After completing their review, the Panel confirmed that no new issues or concerns were identified other than those already covered in their Final Panel Comments. The Panel also determined that adequate stakeholder involvement had occurred.

Results of the Independent External Peer Review

The panel members agreed on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012; p. D-4) in the Skagit River GI IEPR review documents. The following summarizes the Panel's findings.

Based on the Panel's review, the report is clearly written and well organized. The Panel did, however, identify several elements of the project that that require further analysis and sections of the DFR/EIS that should be clarified or revised.

Economics/Civil Works Planning Of primary concern to the Panel was that planning goals and objectives are not consistently applied in the plan formulation process. USACE can address this matter by ensuring that the alternatives are screened using criteria based on consistent goals and objectives and, where practicable, on National Economic Development (NED) benefit, and also by revising the Draft Feasibility Report/Environmental Impact Statement (DFR/EIS) and supporting documents to consistently state the objectives. The Panel was also concerned that the NED plan may not have been identified because separable project features were not analyzed incrementally and all NED costs may not have been identified. This can be resolved by analyzing each separable feature of the NED plan as a first added and last added component of the NED and by reviewing critical assumptions to see if they can be replaced with conclusions drawn from analysis of data. In addition, USACE could conduct sensitivity analyses of key assumptions and estimates as the study proceeds into feasibility level design and document the results in the DFR/EIS.

The Panel also noted that the screening of the final array of alternatives is based primarily on subjective analyses that are not verified by quantitative evidence, and do not support the selection of the TSP. This can be resolved by developing additional technical data (enhanced modeling, more detailed cost estimates, more refined conceptual levee designs, etc.) that would assist in reducing the subjective nature of the current comparative analysis, and reevaluating the alternatives using fixed criteria that are based on meeting the intent and goals of the study without preconceived ideas or bias for one alternative over another. Following the reevaluation, the best plan (TSP) that meets the intent, purpose, scope, and goals of the Project could then be recommended. Finally, the Panel noted that risk and uncertainty have not been fully evaluated because residual and induced risk, as well as features to mitigate residual and induced (or transferred) risk have not been identified. USACE can mitigate the residual risk by assessing residual and induced risk on critical infrastructure and population centers, evaluating potential impacts on downstream levees, and by assessing the consequences of levee overtopping and levee failure.

Engineering: There were eight geotechnical, civil/structural, and hydrologic and hydraulic engineering concerns; three identified fundamental issues affecting the current recommendation or justification of the project and five identified potential fundamental issues with the project that were not evaluated at a level appropriate to this stage in the SMART Planning process. Of the eight identified, the most significant is that the Panel found that steep vegetated levee backslopes may lead to failure from through-seepage/piping or overtopping and scour of the backslope. This can be resolved by evaluating an overtopping event to determine if modifications to the TSP levee geometry, crest elevation, and levee setback are needed to minimize risk of failure, evaluating whether changes to vegetated slopes through use of armored slopes are needed to mitigate potential risk of backslope failure, and conducting additional evaluations of piping for an overtopping event to determine if the TSP is appropriate or additional cut-off walls should be included.

Secondly, the strength parameters (angle of internal friction) used in the geotechnical analysis may not provide conservative assumptions, so the resulting levee designs at the concept level may appear more stable than will be realized. This issue can be resolved by assessing the historical and most recent geotechnical data to determine spatial variation and soil changes with depth along the levee system, developing soil profiles along the levee system, re-evaluating soil strength and other soil properties used in the geotechnical risk assessment, thus ensuring the levee system design meets USACE guidelines.

Thirdly, the Panel also found that the effects of the TSP on sediment transport are not quantified and impacts on related infrastructure (i.e., bridges and levees) are not defined. The Panel recommends that the following be conducted: assess sediment transport for existing and TSP conditions; define impacts of the TSP on such project concerns as long-term aggradation/degradation conditions throughout riverine and estuarine reaches influenced by the project over the range of flood frequency and flood-specific aggradation/degradation conditions; and define mitigation requirements for identified impacts of the TSP.

Finally, the Panel noted that settlement of the levee system and sediment deposition over its design life are not accounted for in assessing the cumulative impacts in the TSP. This issue can be resolved by evaluating the risk related to levee system settlement and deposition rates to determine if the crest elevation for the levee system is appropriate to mitigate risk.

Biological Resources and Environmental Law Compliance: The Panel noted that the analysis of climate change-driven alterations on key physical and ecological parameters of the river system does not address the potential environmental risk or residual risks. To address this concern, USACE should document how project parameters such as flood frequency and magnitude, sediment transport, and cumulative effects to lower-river, estuary and delta ecosystems, and fish and wildlife will be affected by climate change-driven effects on river hydrology for the future without-project and future with-project conditions. In addition, the Panel suggested that USACE examine how residual risk could change through time and the capability/suitability of alternative measures to be adapted to accommodate residual risk changes due to climate change.

Table ES-1. Overview of 16 Final Panel Comments Identified by the Skagit River GI IEPR Panel

No.	Final Panel Comment
High – Significance	
1	Planning goals and objectives are not consistently applied in the plan formulation process.
2	The NED plan may not have been identified because separable project features were not analyzed incrementally and all NED costs may not have been identified.
3	The screening of the final array of alternatives is based primarily on subjective analyses that are not verified by quantitative evidence, and do not support the selection of the TSP.
4	Steep vegetated levee backslopes may lead to failure from overseepage/piping or overtopping and scour of the backslope.
5	The strength parameters (angle of internal friction) used in the geotechnical analysis may not provide conservative assumptions, so the resulting levee designs at the concept level may appear more stable than will be realized.
Medium/High – Significance	
6	Life safety risks for the alternatives are not presented and appear not to have been quantified.
7	Risk and uncertainty have not been fully evaluated because residual and induced risk and features to mitigate residual and induced (or transferred) risk have not been identified.
8	The Panel could not determine whether the TSP will achieve expected outcomes because an investigation of previous levee failures with potential solutions was not provided.
9	The effects of the TSP on sediment transport are not quantified and impacts on related infrastructure (i.e., bridges and levees) are not defined.
10	Settlement of the levee system and sediment deposition over its design life are not accounted for in assessing the cumulative impacts in the TSP.
11	Project costs could exceed the stated 64% contingency if levee backslope modifications, such as increasing fill, riprap, modifying infrastructure, or increasing right-of-way, are required to reduce instability.
12	The analysis of climate change-driven alterations on key physical and ecological parameters of the river system does not address the potential environmental risk or residual risks.
13	The environmental impact analysis and associated off-setting mitigation elements do not appear to account for the indirect and cumulative impacts of the TSP on river hydrology, including sediment dynamics and ecological impacts, to the Lower Skagit River, Skagit River Delta, and Estuary.

Table ES-1. Overview of 16 Final Panel Comments Identified by the Skagit River GI IEPR Panel (continued)

No.	Final Panel Comment
Medium – Significance	
14	Impacts of the TSP on existing or planned restoration projects, such as the Skagit Delta Tidegates and Fish Initiative, do not appear to have been fully considered.
15	The cumulative impacts of the TSP on recreational and Tribal fisheries in the lower river and estuary are not addressed.
Medium/Low – Significance	
16	A comprehensive plan is not provided for communicating residual risk and expected flood damages to the public by definable geographic areas, including a breakout of induced flooding.

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LIST OF ACRONYMS

ACE	annual chance of exceedance
ATR	Agency Technical Review
COI	Conflict of Interest
CULI	Comprehensive Urban Levee Improvement
DrChecks	Design Review and Checking System
EC	Engineer Circular
ER	Engineer Regulation
ESI	Envision Skagit Initiative
IEPR	Independent External Peer Review
IPR	In-Progress Review
NED	National Economic Development
NEPA	National Environmental Policy Act
NTP	Notice to Proceed
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PDT	Project Delivery Team
SMART	Specific, Measurable, Attainable, Risk Informed, Timely
SPT	Standard Penetration Test
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Services
TSP	Tentatively Selected Plan

1. INTRODUCTION

The Skagit River originates near the 8,000-foot level of the Cascades Mountains in British Columbia, Canada and flows south and then west to the Skagit delta where it discharges through two distributaries – the North Fork and South Fork – to Skagit Bay. The Skagit River Basin is located in northwest Washington State and has a total drainage area of 3,115 square miles. The project area for the feasibility study encompasses the Skagit River watershed from Ross Dam reservoir to Skagit Bay. The Skagit River floodplain contains about 22,000 acres east (upstream) of Sedro-Woolley (RM 22.4) and 74,000 acres west (downstream) of Sedro-Woolley. The major cities on the Skagit River delta – Mount Vernon, Burlington, Sedro-Woolley, and La Conner – lie about 60 miles north of Seattle, Washington.

Major flooding has occurred in the Skagit River Basin. Because of its geographic location, the Skagit River Basin is subject to winter rain floods and an increase in discharge during spring due to snowmelt runoff. Rain-type floods usually occur in November or December, but may occur as early as October or as late as February. Additionally, a light snow pack is frequently formed over most of the basin. Heavy rainfall and accompanying snowmelt result in a high rate of runoff, as the ground is already nearly saturated from earlier precipitation. Two or more crests may be experienced within a period of one to two weeks as a series of storms move across the basin from the west. The winter floods have a considerably higher magnitude than the average annual spring high water.

Flood damages have been reduced in recent years with a well-maintained local levee and dike system on the Lower Skagit River, and a well-organized and effective flood fighting effort. The purpose of the feasibility study was to formulate and recommend a comprehensive flood risk management plan for the Skagit River floodplain to reduce flood hazards and damages in the urban and rural parts of the basin. The total estimated cost of the proposed project is $225,000,000.

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. The objective of the work described here was to conduct an IEPR of the Skagit River Basin Flood Risk Management General Investigation, Skagit County, Washington (hereinafter: Skagit River GI IEPR) in accordance with procedures described in the Department of the Army, USACE, Engineer Circular (EC) *Civil Works Review* (EC 1165-2-214) (USACE, 2012) and the Office of Management and Budget (OMB) *Final Information Quality Bulletin for Peer Review* (OMB, 2004). 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).

This final report presents the Final Panel Comments of the IEPR Panel (the Panel) on the existing engineering, economic, environmental, and plan formulation analyses contained in the Skagit River GI IEPR documents (Section 4). Appendix A describes in detail how the IEPR was planned and conducted. Appendix B provides biographical information on the IEPR panel members and describes the method Battelle followed to select them. Appendix C presents the final charge to the IEPR panel members for their use during the review; the final charge was submitted to USACE on July 3, 2014.

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 (2012).

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 engineering, economic, environmental, and plan formulation analyses 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 Skagit River GI was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC 1165-2-214; USACE, 2012). Battelle, a 501(c)(3) organization under the U.S. Internal Revenue Code, has experience conducting IEPRs for USACE.

3. METHODS FOR CONDUCTING THE IEPR

The methods used to conduct the IEPR are briefly described in this section; a detailed description can be found in Appendix A. Table 1 presents the major milestones and deliverables of the Skagit River GI IEPR. Due dates for milestones and deliverables are based on the award/effective date of June 20, 2014. Note that the work items listed under Task 6 occur after the submission of this report. Battelle anticipates submitting the pdf printout of the USACE's Design Review and Checking System (DrChecks) project file (the final deliverable) on October 7, 2014. The actual date for contract end will depend on the date that all activities for this IEPR, including Civil Works Review Board (CWRB) preparation and participation, are conducted.

Table 1. Major Milestones and Deliverables of the Skagit River GI IEPR

Task	Action	Due Date
1	Award/Effective Date	6/20/2014
	Review documents available	6/24/2014
	Public comments available	8/8/2014
2	Battelle submits list of selected panel members	6/27/2014
	USACE confirms the panel members have no COI	7/1/2014
3	Battelle convenes kick-off meeting with USACE	6/24/2014
	Battelle convenes kick-off meeting with USACE and panel members	7/14/2014
	Agency Decision Milestone Meeting	9/29/2014
	Panel prepares and/or reviews slides for CWRB (estimated date)	6/2015
	CWRB Meeting (Estimated Date)	7/2015

Table1. Major Milestones and Deliverables of the Skagit River GI IEPR (continued)

Task	Action	Due Date
4	Panel members complete their individual review of project documents	8/4/2014
	Panel completes their individual review of Public Comments	8/21/2014
	Battelle convenes Panel Review Teleconference	8/11/2014
	Panel members provide draft Final Panel Comments to Battelle	8/18/2014
5	Battelle submits Final IEPR Report to USACE	9/5/2014
6[a]	Battelle convenes Comment-Response Teleconference with panel members and USACE	9/30/2014
	Battelle submits pdf printout of DrChecks project file to USACE	10/7/2014
	Contract End/Delivery Date	6/30/2015

[a] *Task 6 occurs after the submission of this report.*

Battelle identified, screened, and selected five panel members to participate in the IEPR based on their expertise in the following disciplines: economics/Civil Works planning, biological resources and environmental law compliance, civil/structural engineering, hydrologic and hydraulic engineering, and geotechnical engineering. The Panel reviewed the Skagit River GI IEPR documents and produced 16 Final Panel Comments in response to 28 charge questions provided by USACE for the review. This charge included two questions added by Battelle that sought summary information from the IEPR Panel. Battelle instructed the Panel to develop the Final Panel Comments using a standardized four-part structure:

1. Comment Statement (succinct summary statement of concern)
2. Basis for Comment (details regarding the concern)
3. Significance (high, medium/high, medium, medium/low, or low; in accordance with specific criteria for determining level of significance)
4. Recommendation(s) for Resolution (at least one implementable action that could be taken to address the Final Panel Comment).

Battelle reviewed all Final Panel Comments for accuracy, adherence to USACE guidance (EC 1165-2-214, Appendix D; USACE, 2012), and completeness prior to determining that they were final and suitable for inclusion in the Final IEPR Report. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Panel's findings are summarized in Section 4.1; the Final Panel Comments are presented in full in Section 4.2.

4. RESULTS OF THE IEPR

This section presents the results of the IEPR. A summary of the Panel's findings and the full text of the Final Panel Comments are provided.

4.1 Summary of Final Panel Comments

The panel members agreed on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012; p. D-4) in the Skagit River GI IEPR review documents. The following summarizes the Panel's findings.

Based on the Panel's review, the report is clearly written and well organized. The Panel did, however, identify several elements of the project that that require further analysis and sections of the DFR/EIS that should be clarified or revised.

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The Panel also noted that the screening of the final array of alternatives is based primarily on subjective analyses that are not verified by quantitative evidence, and do not support the selection of the TSP. This can be resolved by developing additional technical data (enhanced modeling, more detailed cost estimates, more refined conceptual levee designs, etc.) that would assist in reducing the subjective nature of the current comparative analysis, and reevaluating the alternatives using fixed criteria that are based on meeting the intent and goals of the study without preconceived ideas or bias for one alternative over another. Following the reevaluation, the best plan (TSP) that meets the intent, purpose, scope, and goals of the Project could then be recommended. Finally, the Panel noted that risk and uncertainty have not been fully evaluated because residual and induced risk, as well as features to mitigate residual and induced (or transferred) risk have not been identified. USACE can mitigate the residual risk by assessing residual and induced risk on critical infrastructure and population centers, evaluating potential impacts on downstream levees, and by assessing the consequences of levee overtopping and levee failure.

Engineering: There were eight geotechnical, civil/structural, and hydrologic and hydraulic engineering concerns; three identified fundamental issues affecting the current recommendation or justification of the project and five identified potential fundamental issues with the project that were not evaluated at a level appropriate to this stage in the SMART Planning process. Of the eight identified, the most significant is that the Panel found that steep vegetated levee backslopes may lead to failure from through-seepage/piping or overtopping and scour of the backslope. This can be resolved by evaluating an overtopping event to determine if modifications to the TSP levee geometry, crest elevation, and levee setback are needed to minimize risk of failure, evaluating whether changes to vegetated slopes through use of armored slopes are needed to mitigate potential risk of backslope failure, and conducting additional evaluations of piping for an overtopping event to determine if the TSP is appropriate or additional cut-off walls should be included.

Secondly, the strength parameters (angle of internal friction) used in the geotechnical analysis may not provide conservative assumptions, so the resulting levee designs at the concept level may appear more stable than will be realized. This issue can be resolved by assessing the historical and most recent geotechnical data to determine spatial variation and soil changes with depth along the levee system, developing soil profiles along the levee system, re-evaluating soil strength and other soil properties used in the geotechnical risk assessment, thus ensuring the levee system design meets USACE guidelines.

Thirdly, the Panel also found that the effects of the TSP on sediment transport are not quantified and impacts on related infrastructure (i.e., bridges and levees) are not defined. The Panel recommends that the following be conducted: assess sediment transport for existing and TSP conditions; define impacts of the TSP on such project concerns as long-term aggradation/degradation conditions throughout riverine and estuarine reaches influenced by the project over the range of flood frequency and flood-specific aggradation/degradation conditions; and define mitigation requirements for identified impacts of the TSP.

Finally, the panel noted that settlement of the levee system and sediment deposition over its design life are not accounted for in assessing the cumulative impacts in the TSP. This issue can be resolved by evaluating the risk related to levee system settlement and deposition rates to determine if the crest elevation for the levee system is appropriate to mitigate risk.

Biological Resources and Environmental Law Compliance: The Panel noted that the analysis of climate change-driven alterations on key physical and ecological parameters of the river system does not address the potential environmental risk or residual risks. To address this concern, USACE should document how project parameters such as flood frequency and magnitude, sediment transport, and cumulative effects to lower-river, estuary and delta ecosystems, and fish and wildlife will be affected by climate change-driven effects on river hydrology for the future without-project and future with-project conditions. In addition, the Panel suggested that USACE examine how residual risk could change through time and the capability/suitability of alternative measures to be adapted to accommodate residual risk changes due to climate change.

4.2 Final Panel Comments

This section presents the full text of the Final Panel Comments prepared by the IEPR panel members.

Final Panel Comment 1

Planning goals and objectives are not consistently applied in the plan formulation process.

Basis for Comment

Consistent use of planning goals and objectives throughout the planning process is an integral part of the planning process defined in Section 2-3 of ER 1105-2-100 (USACE, 2000). In the Skagit River Basin DFR/EIS, planning goals and objectives are not applied consistently in the screening of alternatives, which gives the Panel concern that this may eliminate measures and/or alternatives that should be included in the TSP.

The DFR/EIS clearly states (p. 10) planning goals and objectives in terms of reducing flood risk and flood damages in the Skagit River Basin. However, the planning goals and objectives change slightly in various parts of the DFR/EIS, as the following excerpts show:

- "Rural areas do not have enough flood damages to justify Federal Interest in construction of a structural measure to reduce flood risk and non-structural measures will be evaluated to provide more cost effective flood risk reduction to the rural areas." (p. 40)
- "Levee setbacks at Fir Island would have the greatest benefit for Fir Island; however, Fir Island is not an urban area and has mostly agricultural land use. Setback levees to protect Fir Island would not accomplish the project goal of reducing the flood risk in the urban areas and are not included in the CULI Alternative." (p. 46)
- "[T]he Non-Structural Preliminary and Dam Storage Only Alternative was not carried forward as an alternative to be considered as the Tentatively Selected Plan because it would not provide comprehensive flood risk reduction for the Basin." (p. 43)
- The Urban Areas and Critical Infrastructure Protection Preliminary Alternative "… was not brought forward because it would not provide flood risk reduction for rural areas and has high residual life safety risk for residents within the urban ring levees". (p. 43)

In summary, planning goals and objectives are stated variously in the DFR/EIS as:

(1) reducing flood risk/damages in the Skagit River Basin

(2) reducing flood risk/damages in urban portions of the Skagit River Basin

(3) providing comprehensive flood risk/damage reduction in the Skagit River Basin.

The intent of the project seems to have changed as the study progressed. The original intent of the study was to reduce flood risk throughout the entire basin (p. 40). Later, the intent was to protect only some of the urban areas, inducing flooding to the downstream segments and not making any improvements to their flood protection (p. 40). This approach, which was not validated in the DFR/EIS, is more costly, but does not affect benefits if the rural areas are provided increased flood protection.

These different statements of planning goals and objectives are used to screen or eliminate measures and alternatives from further consideration in the planning process; however, the DFR/EIS does not present any documentation on why alternatives were eliminated, such as analyses conducted to determine if these

alternatives are economically justified and therefore worth additional consideration in the plan formulation process.

Significance – High

Planning goals and objectives are not consistently applied in the screening of alternatives, which could lead to the selection of a TSP that is not cost-effective.

Recommendation for Resolution

1. Revise the DFR/EIS and supporting documents to maintain consistent objectives throughout the report.
2. Screen alternatives using criteria based on consistent goals and objectives and, where practicable, on NED benefit evaluations.

Final Panel Comment 2

The NED plan may not have been identified because separable project features were not analyzed incrementally and all NED costs may not have been identified.

Basis for Comment

The NED plan is a combination of several separable features optimized to a 0.4 annual chance of exceedance (ACE). Per ER 1105-2-100 (USACE, 2000), incremental analysis of project features is a fundamental principle of the plan formulation process and NED analysis to identify the NED plan. The Panel is concerned that not all separable features of the NED plan have been incrementally justified, specifically the benefits and costs of the following (the Panel considers each new levee and each levee raise to be a separable feature):

- New Levees: Burlington Hill Cross, Levee, Riverbend Cutoff Levee, Lions Park Connector (Floodwall)
- Raise Existing Urban Levees: SCDD #12 Upstream, SCDD #12 BNSF Embankment, SCDD #12 Three-Bridge Corridor, SCDD #17 Three-Bridge Corridor, SCDD #1 West Mount Vernon, SCDD #3 South Mount Vernon
- Improve Bank Protection
- Improve Rural Levees
- Baker Dam Operations
- Non-Structural Component.

The Panel is also concerned that not all NED costs have been identified. The Panel believes that the NED plan is a high-risk approach since the basis of the NED plan is levees in urban areas and levees can always be overtopped with the possibility of catastrophic consequences. The geotechnical reports stated that levee setbacks or complete replacement of existing levees may be needed to resolve the levee failure issues; however, these have not been captured in the NED analysis. Including levee setbacks or replacing existing levees could lead to cost increases due to labor and material, timeline changes, real estate impacts, etc. that could affect the identification of the NED plan.

In addition, during a mid-review teleconference with the Panel and USACE (facilitated by Battelle on 21 July 2014)), the Panel learned that 2 to 3 feet of freeboard has been considered in the design. However, the failure probabilities contained in the DFR/EIS (Appendix E, Figures 15 to 17) indicate that the probability of failure occurs substantially below the intended freeboard. If freeboard is underestimated for the NED plan, costs would be underestimated and that could affect the identification of the NED plan.

The Panel believes that there is always uncertainty and error in estimates and that the sensitivity of final recommendations to critical assumptions and estimates should be tested as part of the final determination of the NED plan and, where indicated, additional data should be collected.

Significance – High

Incremental justification of separable elements and identification of all relevant NED costs are needed to determine the NED plan.

Recommendation for Resolution

1. Analyze each separable feature of the NED plan as a first added and last added component of the NED plan.
2. Assess the need for setback levees and/or complete replacement of levees and incorporate the analysis in the DFR/EIS.
3. Assess the level of freeboard to be included in the NED plan and provide consistent discussion throughout the DFR/EIS and supporting documents.
4. Conduct sensitivity analyses of key assumptions and estimates as the study proceeds into feasibility level design and document results in the DFR/EIS.

Final Panel Comment 3

The screening of the final array of alternatives is based primarily on subjective analyses that are not verified by quantitative evidence, and do not support the selection of the TSP.

Basis for Comment

The review of the final array of alternatives (DFR/EIS, Section 3.8.5.2, p. 59) bases the selection of the Comprehensive Urban Levee Improvement (CULI) Alternative on the large magnitude of differences between the quantities of earthwork, construction costs, and benefits required for the CULI Alternative and either of the bypass alternatives. The DFR/EIS further states (p 60) that any further refinement of the bypass design would not change the selection of the TSP.

However, the evaluation of the Final Array of Alternatives (Section 3.8.5, p. 58) is predominately based on a subjective analysis that is not supported in the documents. There are inconsistencies in the comparison of the preliminary and final array of alternatives since quantifiable metrics were not used as selection/ differentiating criteria. For example, the DFR/EIS states (p. 43) that the alternative was not brought forward, but no explanation is provided for not continuing. Throughout the evaluation of alternatives, multiple statements are presented as facts used as the basis for eliminating alternatives, yet they are not verified in the documents.

In addition, the engineering analysis presented in the DFR/EIS and supporting appendices is based on insufficient data and analysis. There are a high number of unknowns, lack of details as they relate to construction impacts, differences in screening criteria, inconsistencies in the analysis, and limited analysis of the real impacts on the project area of the TSP. The following are examples of insufficient engineering analysis in the DFR/EIS:

- Dredging of the Skagit River for the entire length between Sedro-Woolley and Skagit Bay is considered a management measure, but it was eliminated because of significant adverse environmental impacts and high non-Federal Sponsor maintenance requirements. The Panel is concerned that the analysis of river dredging is overly subjective and too limited. Several public comments recommended dredging, specifically, spot dredging the river as needed, dredging the mouth of the river, and dredging as part of the TSP. The comments further noted that, without dredging, underseepage is a recurring issue (i.e., basement flooding), sediment build-up is a problem that needs to be solved to reduce flood damages, and dredging is good for fish runs, debris removal, reducing flooding, and inexpensive transportation (there was a ferry in the past).
- One alternative, Levee Setback Preliminary Alternative (p. 43), was eliminated due to costs and the relative minor impact on improving conveyance capacity in the River; however, the Golder Report (Golder, 2009; p. 23) calls for levee setbacks as a normal course of action. As such, the costs and impact of shifting or replacing the existing levee system are not included in the analysis of the CULI Alternative. This could have a marked impact on costs/benefits of the TSP.
- The report discusses the possibilities of using cutoff walls and seepage berms to control underseepage (one of the predominant levee failure modes). However, the costs of the cutoff walls and seepage berms are not included in the project cost estimate or in the CULI Alternative comparison to the final array of alternatives.

If the previous levee failures on existing levees require protective armoring to prevent scour, setback from the river, or complete replacement, then the cost savings associated with the current TSP are negated

and the other alternatives start to look more reasonable. As a result, the estimates of quantities and benefits/costs used for comparison of the alternatives are in question and the selection of the CULI Alternative should be reevaluated.

It is the Panel's view that much of the analysis of alternatives is based on a very broad, subjective review that is not quantified and that the selection of the TSP was more intuitively based than data-driven. The public comment letters from Ms. Debbie Allen and Mr. Ross Barnes describe significant concerns that can only be addressed with additional data and analysis.

The features of the current TSP do not appear to reduce flood risk throughout the entire basin, whereas alternatives previously rejected (e.g., Levee Setback, Critical Infrastructure Protection) may provide a greater level of protection.

Significance – High

The evaluation and comparison of alternatives is a critical step in the selection of the recommended plan; without sufficient engineering analysis, the most cost-effective alternative that meets the project objectives might not be selected as the TSP.

Recommendation for Resolution

1. Develop additional technical data (enhanced modeling, more detailed cost estimates, more refined conceptual levee designs, etc.) that would assist in reducing the subjective nature of the current comparative analysis.
2. Reevaluate the alternatives using fixed criteria that are based on meeting the intent and goals of the study without any preconceived ideas or bias for one alternative over another.
3. Formulate and evaluate a full array of dredging measures, including spot dredging, dredging the river mouth, and including dredging as an element of the TSP.
4. Following the reevaluation, recommend the best plan (TSP) that meets the intent, purpose, scope, and goals of the Project.

Literature Cited:

Golder (2009). Geotechnical Investigation and Levee Analysis, City of Burlington and Dike District 12 Levee Certification Project, Burlington, Washington. Final Report. Golder Associates Inc. November.

Final Panel Comment 4

Steep vegetated levee backslopes may lead to failure from overseepage/piping or overtopping and scour of the backslope.

Basis for Comment

Appendix E of the DFR/EIS shows typical sections for the levee system, many of which contain steep backslopes between 1:1 (Horizontal to Vertical) and 1.5H:1V. Underseepage evaluation in Appendix E indicates that seepage is likely significantly below the crest elevation of the earthen levee system. Alternatively, the 4.0% ACE is likely to be exceeded at some time in the future and, should this occur, the crest elevation during flooding could be exceeded. Either event may result in significant velocities on steep vegetated slopes that could cause significant scour and failure. Consideration should be given as to whether the type of slope treatment (vegetated slope or armored backslope) or the steepness of the slope could result in velocities that may cause significant scour of the backslope that could lead to a levee failure.

Underseepage evaluation contained in Appendix E also indicates the potential for piping failure at elevations significantly below the levee crest. If piping is a significant issue, the TSP should consider installation of a cut-off wall system composed of soil, steel, or other materials.

The Panel believes that there is always uncertainty and error in estimates of the flood levels. Taking into account that no dredging of the channel is planned, this may also result in more susceptibility to overtopping.

Significance – High

A comprehensive analysis of direct and cumulative effects and risks of an overtopping flood event is needed to evaluate residual effects and risks of the future with-project and future without-project and verify the TSP will perform as proposed.

Recommendation for Resolution

1. Evaluate an overtopping event to determine if modifications to the TSP levee geometry, crest elevation, and levee setback are needed to minimize risk of failure.
2. Evaluate whether changes to vegetated slopes through use of armored slopes are needed to mitigate potential risk of backslope failure.
3. Perform additional evaluation of piping for an overtopping event and determine if the TSP is appropriate or additional cut-off walls should be included.

Final Panel Comment 5

The strength parameters (angle of internal friction) used in the geotechnical analysis may not provide conservative assumptions, so the resulting levee designs at the concept level may appear more stable than will be realized.

Basis for Comment

Appendix E of the DFR/EIS shows typical sections for the levee system in Sheets 7 through 33 (Plates 1C-1 to 17-C6). Many of these sections contain steep levee backslopes between 1:1 (Horizontal to Vertical) and 1.5H:1V.

Geotechnical strength parameters used in the stability analysis in Table 6 use an average friction angle of 35 degrees for Levee, Overbank, and Sublayer Soils, yet the Golder geotechnical report (Golder, 2009), conducted for another section of the levee system, provides substantially lower soil strength parameters.

The Panel has several concerns:

- By inspection, a friction value of 35 degrees with a slope angle of 45 degrees is inherently unstable in terms of both static and seismic stability analysis. This would imply a high risk of failure or a factor of safety of less than 1.0 for either static or seismic stability analysis.
- The typical sections in Appendix E (referenced above) do not appear to have been used in the stability and underseepage analysis.
- The DFR/EIS (Section 1.3, p. 1) states that "hundreds of soil borings have been performed along the Skagit River levee system," yet the new and historic boreholes were not used to prepare a soil profile along the levee system. However, upon review of the Golder geotechnical report (Golder 2009), the Panel located a soil profile that was created for another section of the levee system.

The variability of soil conditions along the levee system has not been adequately evaluated to determine if suitable soil properties have been used. In addition, in reviewing the two geotechnical reports and the boreholes available, there is a substantial difference in average values used for the various types of soils encountered. Soil strength is partially determined from laboratory data and partially through assessment of soil type and the Standard Penetration Test (SPT). The Panel found that some boreholes presented in Appendix E were classified using Soil Consistency procedures as "very loose," "loose," or "soft" and had SPT blow counts as low as 1 to 2 blows per foot. None of these call-outs is consistent with an average friction angle of 35 degrees (DFR/EIS, Appendix E, Figures A-2 to A-17), which would imply variability of more than the standard deviations used in the risk assessment in Appendix E. This could result in significantly lower static and seismic stability than stated in the geotechnical report.

Significance – High

A thorough geotechnical risk assessment of the soil strength parameters is essential to determining whether the TSP is appropriate for the project.

Recommendation for Resolution

1. Assess the historical and most recent geotechnical data gathered by Shannon and Wilson (contained in Appendix E of the DFR/EIS) and Golder (Golder, 2009) to determine spatial variation and soil changes with depth along the levee system.
2. Develop soil profiles along the levee system using all available new and historic geotechnical information available.
3. Re-evaluate soil strength and other soil properties used in the geotechnical risk assessment.
4. Review the previously completed geotechnical risk assessment in Appendix E of the DFR/EIS and update as appropriate.
    a. Determine whether levee geometry is appropriate or requires modification.
    b. Determine if levee location is appropriate or additional setbacks are required based on risk-based stability assessment.
5. Assess the spacing of historical and new boreholes completed to date and determine whether additional boreholes, test pits, and geophysical work may be needed during the design phase to ensure the levee system design meets USACE guidelines.

Literature Cited:

Golder (2009). Geotechnical Investigation and Levee Analysis, City of Burlington and Dike District 12 Levee Certification Project, Burlington, Washington. Final Report. Golder Associates Inc. November.

Final Panel Comment 6

Life safety risks for the alternatives are not presented and appear not to have been quantified.

Basis for Comment

The objectives of the project are to reduce flood damages and threats to life safety in the Skagit River Basin (DFR/EIS, p. 10). Although the Panel can infer that reducing the occurrence of flooding in urban areas will also reduce life safety risk, the DFR/EIS does not provide specific data and information describing life safety risk under existing, future without-, and future with-project conditions.

Quantification of flood risk and associated life safety risk is necessary to understand the benefit of the TSP. However, the potential impact of interior drainage on life safety risk in protected areas associated with the TSP has not been defined in the DFR/EIS. As a result, it is impossible to quantify whether the TSP best meets the stated objective of the project. In addition, the effect of potential induced and transferred flood risks associated with the TSP on life safety risk are not described or quantified.

Significance – Medium/High

Description and quantification of life safety risk for existing, future without-, and future with-project conditions are necessary to understand whether the objective of the project will be accomplished.

Recommendation for Resolution

1. Complete an analysis of life safety risk associated with existing, future without- and future with-project conditions and document the results in the DFR/EIS.
2. Describe and quantify specific changes in life safety risk for areas of induced and transferred flood risk.
3. Describe and quantify life safety risk associated with interior drainage in protected areas of improved levee systems.

Final Panel Comment 7

Risk and uncertainty have not been fully evaluated because residual and induced risk and features to mitigate residual and induced (or transferred) risk have not been identified.

Basis for Comment

The DFR/EIS provides a general discussion of risk and uncertainty (Appendix C, Section 7.3), but does not provide specific information on what was actually done to address risk and uncertainty. For example, the following statement, "Risks were assessed and managed throughout the study process, in coordination with the USACE Vertical Team" does not help the reader understand what risks were assessed and what was done to manage or mitigate the risks. The importance of risk-based analysis is highlighted in Section 2-4 of ER 1105-2-100 (USACE, 2000) and paragraphs 7.f., 7.g., and 7.h. of ER 1105-2-101 (USACE, 2006).

There is insufficient quantifiable information in the DFR/EIS to determine the extent of residual risk with the project. Various uncertainties regarding specific impacts of the TSP still exist, such as the extent of potential induced and transferred flood risk resulting from confined flood flows with larger levees to areas in the northern Skagit River floodplain, including the Nookachamps-Clear Lake area and Sedro-Woolley, and downstream below Mount Vernon. Furthermore, although the risk to areas not protected by the TSP is discussed, there is no discussion of the residual risk to areas protected by the TSP. It is to be expected that future flood events that exceed the capacities of the TSP levees will occur, and it is even possible that a levee component of the TSP will fail.

There is no information provided regarding the specific locations and magnitude of induced or transferred flood risk, the populations at risk, or the feasibility or effectiveness of non-structural flood control measures. Specific impacts of the TSP regarding the extent and magnitude of potential induced and transferred flood risk resulting from confined flood flows with larger levees to areas in the northern Skagit River floodplain, including the Nookachamps-Clear Lake area and Sedro-Woolley, and downstream below Mount Vernon are not quantified. The Panel is concerned with the potential for induced flooding downstream of the TSP, including scour downstream of hard surfaces, and impacts on downstream population centers.

There is insufficient information in the DFR/EIS to determine what features have been incorporated into the TSP to minimize or reduce residual and induced risk. Reducing or managing flood risk is the principal objective of the study and all aspects of risk management should be explained in the DFR/EIS.

Significance – Medium/High

A clear, understandable discussion of residual and induced risk is required by USACE guidance and, in the Panel's opinion, is critical to proving a complete description of the project's risks.

Recommendation for Resolution

1. Complete an analysis of residual risk and induced (or transferred) risk associated with the TSP and document it in the DFR/EIS. Provide an economic analysis of residual and induced flooding with the TSP in place.
2. Assess residual and induced risk on critical infrastructure and population centers.

3. Assess potential impacts on downstream levees from Mount Vernon where stop logs are used that may increase water velocity and potential scour along the levee system or riverbanks.
4. Evaluate the residual risk to areas protected by the TSP, including the consequences of levee overtopping and levee failure.
5. Conduct a benefit-cost analysis of additional reservoir storage to mitigate downstream risk.
6. Evaluate the risk transferred to rural areas by concentrating levee improvements in more populated areas and discuss how to mitigate this risk.

Literature Cited:

USACE (2000). Planning – Planning Guidance Notebook. Engineer Regulation (ER) 1105-2-100. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. April 22. Available online at: http://planning.usace.army.mil/toolbox/library/ERs/entire.pdf

USACE (2006). Risk Analysis for Flood Damage Reduction Studies. Engineer Regulation (ER) 1105-2-101. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. January 3. Available online at: http://planning.usace.army.mil/toolbox/library/ERs/er1105-2-101.pdf

Final Panel Comment 8

The Panel could not determine whether the TSP will achieve expected outcomes because an investigation of previous levee failures with potential solutions was not provided.

Basis for Comment

The TSP calls for raising the crest elevation of the levees as a means of flood protection of some of the urban areas. However, the solutions to prevent levee failures (DFR/EIS, Figure 3-2) have not been addressed in sufficient detail to ensure that the same types of levee failures will not occur in the with-project condition. The integrity of the entire levee system, including interior drainage, is critical to accomplishing that goal. As such, the foundation condition (underseepage, through seepage, overtopping, scour, slope stability, and embankment fill characteristics) investigation as discussed in the DFR/EIS should be expanded to address potential solutions to the many and varied levee failures identified. These solutions should be incorporated in the conceptual design of the levee profile under the TSP. At present, the DFR/EIS does not provide enough information on prevention of levee failures to give confidence that the future with-project condition will achieve the desired results.

The Panel is concerned that the TSP includes the construction of levees in urban areas, which, like all other levees, are subject to overtopping or failure from storm events that exceed its capacity. The DFR/EIS does not include any discussion of how these levees might be designed to minimize or reduce the potential catastrophic damages associated with large flood events that exceed the capacity of the TSP levees. In addition, the DFR/EIS (Section 3.9, p. 63) states that, if one levee failure occurs, then any further levee failures are unlikely due to the lowered surface water elevations caused by the localized reduction in the flows by the initial breach. However, this statement was not verified by modeling or analyses. Past history on other river systems such as the Mississippi (McConkey,1994), Ohio (ODPS, 2011), and Feather Rivers (SBFCA, 2013) suggest this assumption is an oversimplification of the problems associated with overtopping or breach failure from storm events that exceed their capacity.

Finally, the Panel was not able to locate any discussion on methodologies to minimize the potential catastrophic damages associated with extremely large events in association with interior drainage problems and solutions, which is an integral part of any project with levees.

Significance – Medium/High

Without a thorough understanding of the causes and solutions to previous levee failures along the Skagit River, the TSP as currently configured may not succeed in its goal of providing flood protection for the urban areas during a major flood event.

Recommendation for Resolution

1. Develop practical solutions to the levee failures documented to date and model them for various flood events to include analysis of interior drainage during and after a storm event.
2. Incorporate the viable solutions into the conceptual design of the levees under the TSP.
3. Analyze the cost, time, and construction impact of those solutions and compare to the final array of alternatives to ensure this additional analysis does not alter the TSP.
4. Analyze and document levee designs that minimize the effects of large flood events that exceed

the capacity of the TSP levees.

Literature Cited:

McConkey, S., K. Allan, and B. Pollock (1994). 1993 Mississippi River Record Stages and Levee Failures along the Illinois Border. Miscellaneous Publication 163. Illinois State Water Survey, Hydrology Division, Chicago, Illinois. December. Available on line at: http://www.isws.illinois.edu/pubdoc/MP/ISWSMP-163.pdf

ODPS (2011). State of Ohio Hazard Mitigation Plan 2011. Ohio Department of Public Safety, Ohio Emergency Management Agency. Available on line at: http://ema.ohio.gov/MitigationPlan2011.aspx

SBFCA (2013). Feather River West Levee Project. Sutter Butte Flood Control Agency. April 2013. Available on line at: http://sutterbutteflood.org/

Final Panel Comment 9

The effects of the TSP on sediment transport are not quantified and impacts on related infrastructure (i.e., bridges and levees) are not defined.

Basis for Comment

The NED-optimized TSP will increase the hydraulic capacity of levees protecting urban areas from about 4.0% ACE to 0.4% ACE. The impact of this action will cause backwater effects upstream of the levees and increased flood flows downstream of the levees for flood events greater than the existing levee's 4.0% ACE capacity. As defined in the DFR/EIS (Figure 4-1, p. 82; Section 3.8.2, p. 47; Section 4.5.3, p. 76 and Section 4.6.3, p. 82), the altered hydraulic conditions can be expected to induce sedimentation in backwatered areas upstream of leveed reaches, increased sediment transport and scour in the raised levee reaches, and greater overtopping of unimproved levees between RM 12 and 21 in the western rural floodplain during low frequency flood events. Based on the Panel's experience and guidance provided in EM 1110-2-1601 (USACE, 1994), the increased hydraulic capacity in the raised levee reaches may induce greater toe scour conditions, which can influence the stability of existing infrastructure such as bridges and levees.

The Panel noted that although the risk of increased sediment transport and toe scour is recognized in the DFR/EIS (Section 3.8.2.3, p. 50), specific analysis of scour potential is delayed to later feasibility-level design phases. The lack of specific sediment transport and scour potential evaluations could result in design modifications that affect the scope and cost of the project.

The Panel also observed that floodwalls are part of the TSP. It is the Panel's understanding that these features will tie into existing earthen levees. Transitions from hard surface structures to earthen embankments must consider the need for erosion protection. Changes in flow velocity, eddy formation, and associated increases in scour potential may require erosion protection. The Panel notes that specific requirements for bank erosion protection are not identified in the DFR/EIS.

Significance – Medium/High

Specific and cumulative effects of the TSP on sediment transport must be quantified to define potential project impacts and costs.

Recommendation for Resolution

1. Conduct a detailed assessment of sediment transport for existing and TSP conditions.
2. Define impacts of TSP on long-term aggradation/degradation conditions throughout riverine and estuarine reaches influenced by the project over the range of flood frequency.
3. Define impacts of TSP on flood-specific aggradation/degradation conditions throughout riverine and estuarine reaches influenced by the project over the range of flood frequency.
4. Define impacts of TSP on toe scour potential for project design criteria.
5. Define impacts of TSP on bank erosion protection requirements.
6. Define impacts of TSP on levee overtopping scour protection requirements.
7. Define mitigation requirements for identified impacts of TSP.

Literature Cited:

USACE (1994). Engineering and Design – Hydraulic Design of Flood Control Channels. Engineer Manual (EM) 1110-2-1601. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. June 30. Available on line at:
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.3.1392&rep=rep1&type=pdf

Final Panel Comment 10

Settlement of the levee system and sediment deposition over its design life are not accounted for in assessing the cumulative impacts in the TSP.

Basis for Comment

Appendix E of the DFR/EIS presents the geotechnical assessment of the raised levees and new levees. The DR/EIS provides no assessment of levee settlement during the construction period or over the design life of the structure. A separate geotechnical report by Golder (Golder, 2009) assesses settlement for the City of Burlington and Dike District 12, but not for the levee locations in the DFR/EIS.

During the mid-review teleconference with the USACE and the Panel (facilitated by Battelle on July 21, 2014), questions were raised as to whether dredging of the river system had occurred in the past and whether future deposition may impact risk and reliability of the levees. The Panel learned there are no plans for future maintenance dredging. The combination of potential settlement over the design life and sediment deposition potential may result in risk to the system through higher flood stages and lower levee crest elevations due to settlement. These two factors have not been considered as potential cumulative impacts in the TSP. Potential risks include overtopping, higher seepage rates that may lead to underseepage, and piping. In addition, sediment deposition may lead to higher groundwater levels and the risk of flooding of underground structures.

If these risks are not considered in the alternative selection process, there may be indirect and cumulative risks not considered in the TSP.

Significance – Medium/High

Analyzing the levee settlement and sediment deposition is required to ensure that the risks associated with the TSP have been considered.

Recommendation for Resolution

1. Assess the risk related to settlement of the levee system over the construction period and the design life of the TSP.
2. Assess sediment deposition rates to determine potential impacts in the selection of the TSP and whether there are additional risks from unanticipated structure flooding, increased risk to piping, and increased risk of overtopping.

Literature Cited:

Golder (2009). Geotechnical Investigation and Levee Analysis, City of Burlington and Dike District 12 Levee Certification Project, Burlington, Washington. Final Report. Golder Associates Inc. November.

Final Panel Comment 11

Project costs could exceed the stated 64% contingency if levee backslope modifications, such as increasing fill, riprap, modifying infrastructure, or increasing right-of-way, are required to reduce instability.

Basis for Comment

During the mid-review teleconference with the Panel and USACE (facilitated by Battelle on July 21, 2014), the Panel learned that a 64% contingency has been considered in project cost evaluations. The Panel is concerned whether this contingency is appropriate or requires further evaluation for the TSP.

Appendix E of the DFR/EIS shows typical sections for the levee system in Sheets 7 through 33 (Plates 1C-1 to 17-C6). Many of these sections contain steep levee backslopes between 1:1 (Horizontal to Vertical) and 1.5H:1V with use of vegetated backslopes. There are potential issues with steep vegetated backslopes:

- Steep levee backslopes increase risk of scour and levee breach.
- Soil strength friction angles that are less than levee slope angles are inherently unstable and may require flattening of slopes to mitigate risk of static slope failure.
- Slopes may need to be flattened to mitigate risk of seismic failure caused by liquefaction or lateral spreading. The Golder geotechnical report (Golder, 2009) has recommended 3H:1V slopes for a portion of the levee system to minimize potential risk of failure from liquefaction. However, the geotechnical report in the DFR/EIS (Appendix E) does not mention the need to flatten slopes and uses significantly steeper values.
- Use of steep backslopes reduces the length of the underseepage flow path that may lead to piping and further evaluation of this risk should be performed for the TSP. Should piping be considered a risk, then further consideration may be needed to reduce levee imperviousness and reduce this risk.
- There may be a need to assess levee set-back rather than raising levees.

It is very likely the stated 64% contingency in the cost estimate could be exceeded if flattening of slopes is needed. It would then be necessary to modify the TSP to account for:

- Substantially increased fill quantities. Should the levee slopes require modification from 1H:1V to 3H:1V, much higher quantities of fill would be required, potentially increasing fill quantities more than double the stated values in the cost estimate.
- Increased right-of-way. Assessment of setback and slope flattening could result in the purchase of additional right-of-way, which could increase project costs significantly.
- Increased utility costs. Should slope flattening be required, it may be necessary to realign utilities or roads adjacent to the levee system, which could increase costs significantly.
- Possible replacement of vegetated slopes with riprap. Assessment of the need to replace vegetated slopes with riprap on steep slopes could result in an impact on project costs.
- Need for impervious barriers. Should impermeable layers or artificial barriers need to be installed to reduce seepage, this cost could be significant.

Significance – Medium/High

A comprehensive assessment of the risks associated with using steep levee slopes is required to determine if the contingency stated for the TSP is sufficient to cover project costs associated with potential levee modifications.

Recommendation for Resolution

1. Evaluate strength parameters and the stability of the levee.
2. Re-assess the cost estimate and contingency based on the above evaluation.
3. Evaluate the impact on the TSP of costs associated with any levee modifications or additional setbacks identified in the strength and stability evaluation.

Literature Cited:

Golder (2009). Geotechnical Investigation and Levee Analysis, City of Burlington and Dike District 12 Levee Certification Project, Burlington, Washington. Final Report. Golder Associates Inc. November.

Final Panel Comment 12

The analysis of climate change-driven alterations on key physical and ecological parameters of the river system does not address the potential environmental risk or residual risks.

Basis for Comment

The analysis of potential effects of future climate change on the hydrology of the lower Skagit River under the various planning alternatives does not fully address the potential direct or cumulative environmental or residual risks for the lower Skagit River, Skagit River Delta, or Skagit Estuary.

The DFR/EIS notes (p.190) that USACE does not have an approved, comprehensive policy for modeling climate change effects on river hydrology, thus the evaluation of potential climate change impacts in the study area was limited to an evaluation of expected sea level rise and a discussion of potential changes in flood frequency (ECB 2014-10; USACE, 2014). The DFR/EIS does not address the uncertainty that the influence of climate change could have on the frequency of floods as defined in the available literature. If flood frequency for a current 1.0% ACE flood changes to that of a 4.0% ACE flood as postulated in the DFR/EIS, the potential probable outcome for future without-project conditions will be dramatically different.

The climate change modeling cited in the Envision Skagit Initiative (ESI; SCSC, 2012) was used to qualitatively develop potential climate change-driven changes to river hydrology. The ESI modeling was used to optimize the TSP for NED refinement and conceptual design of more robust levees associated with the preliminary TSP. This refinement provides a potentially higher level of flood risk prevention associated with the initial TSP, but there is not a corresponding assessment of the effects of the NED TSP refinement on other elements of concern outside of flood risk mitigation (e.g., environmental consequences).

The DFR/EIS indicates (p. 193) that further detailed hydraulic modeling will be required to better understand the flood risks to other areas in the floodplain associated with larger and more robust levees. No description of the required additional detailed hydraulic modeling is provided. Accordingly, the type, extent, and cost of potential mitigation measures for the TSP associated with transferred flood risk are unknown. Further, the DFR/EIS mentions (p.74 and 194) that the impacts of climate change are similar to other impacts on the environment and are largely uncertain. However, the cumulative impacts due to flood damage, access to critical facilities, flooding of farmlands, breached/overtopped levee areas, and lack of drainage are not addressed in detail.

Significance – Medium/High

A comprehensive analysis of potential future climate change-driven effects on Skagit River hydrology is needed to determine associated direct and cumulative environmental and residual effects and risks of the future without-project and future with-project conditions.

Recommendation for Resolution

1. Address how the following will be affected by climate change-driven effects on river hydrology for the future without-project and future with-project conditions (including the TSP NED refinement cited in the DFR/EIS, Section 5):
   a. Flood frequency and magnitude

b. River morphology and scour dynamics
c. Sediment budget/dynamics
d. Direct, indirect, and cumulative effects to lower river, estuary, and delta ecosystems, and fish and wildlife habitat
e. Residual flood risks

2. Address how residual risk could change through time and the capability/suitability of alternative measures to be adapted to accommodate residual risk changes due to climate change.

Literature Cited:

SCSC (2012). Skagit Impacts. Skagit Climate Science Consortium. Available online at: http://www.skagitclimatescience.org/skagit-impacts/

USACE (2014). Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects. Engineering and Construction Bulletin (ECB) 2014-10. U.S. Army Corps of Engineers. May 2. Available online at: http://www.wbdg.org/ccb/ARMYCOE/COEECB/ecb_2014_10.pdf

Final Panel Comment 13

The environmental impact analysis and associated off-setting mitigation elements do not appear to account for the indirect and cumulative impacts of the TSP on river hydrology, including sediment dynamics and ecological impacts, to the Lower Skagit River, Skagit River Delta, and Estuary.

Basis for Comment

The analysis of potential environmental impacts associated with the TSP is focused on localized impacts where existing levee improvements or new levee construction is proposed. The environmental impact assessment does not fully address potential impacts that could occur over larger spatial and temporal scales from implementation of the TSP. Proposed conceptual environmental impact mitigation for the TSP is focused on mitigating impacts at the site of construction disturbance and does not address mitigating adverse impacts that could occur over larger temporal and spatial scales.

Implementation of the TSP would result in enhancement of the existing lower river levee system such that a higher volume of flood flows would be contained in the river channel. This would exacerbate the existing levee system's effect on fluvial processes in the lower river, delta, and estuary during low frequency flood events by further altering sediment dynamics, hydrology, scour dynamics, and other factors that are fundamental to the development of habitat characteristics of the affected areas (BOR, 2002). Additional study of the effect of the current levee system and the proposed TSP on the geomorphic and sedimentation dynamics (mobilization, scour, transport, and deposition) conditions in the lower river, delta, and estuary is needed to fully understand the TSP's effect on freshwater and estuarine habitats used by multiple species including Chinook salmon and bull trout (Beamer and Larson, 2004; Beamer et al., 2005; SWC, 2005).

The primary mitigation referenced in the DFR/EIS for in-stream and riparian impacts associated with the TSP involves planting riparian vegetation, installation of large wood, and burying levees' riverward riprap toe with topsoil and plantings at locations affected during construction of the TSP. The documents do not discuss potential off-setting mitigation for the geomorphic and sediment dynamics impacts mentioned above. These effects over time could result in a higher level of adverse environmental impacts than the localized levee expansion impacts proposed for mitigation. As such, the mitigation cost estimate provided in the DFR/EIS likely does not account for the extent of environmental mitigation that will be required by regulatory agencies to offset the full range of adverse environmental impacts (direct, indirect, and cumulative) associated with the TSP.

Significance – Medium/High

To ensure that the recommended plan is the best choice, additional analysis and documentation of indirect and cumulative effects of the TSP on lower river, delta, and estuary ecosystems and habitats is needed to understand the full range of potential adverse environmental impacts and associated offsetting mitigation costs from implementation of the TSP.

Recommendation for Resolution

1. Analyze the existing levee system's effect on lower river, delta, and estuary hydrology, geomorphology, and sediment dynamics to determine an existing baseline condition for these parameters in the study area.
2. Analyze the TSP's effect on lower river, delta, and estuary hydrology, geomorphology, and sediment dynamics by correlating changes that are expected to occur to the existing baseline of these parameters from implementation of the TSP.
3. Revise existing environmental mitigation plan and cost estimates to account for potential indirect and cumulative adverse environmental impacts that are expected to occur in the lower river, delta, and estuary from implementation of the TSP.

Literature Cited:

BOR (2002). Physical Processes, Human Impacts, and Restorations Issues of the Lower Dungeness River. Clallam County, Washington. Prepared for the Jamestown S'Klallam Tribe. U.S. Department of Interior Bureau of Reclamation. May. Available online at: http://www.jamestowntribe.org/programs/nrs/5-BOR_Dungeness_River_Main_Report.pdf

Beamer, E. and K. Larsen (2004). The importance of Skagit Delta habitat on the growth of wild ocean-type Chinook in Skagit Bay: Implications for delta restoration. Skagit River System Cooperative: La Conner, Washington. 6 pp. Available online at: http://www.skagitcoop.org/documents/Importance%20of%20delta%20rearing%20on%20bay%20growth.pdf

Beamer, E., A. McBride, C. Greene, R. Henderson, et al. (2005). Delta and nearshore restoration for the recovery of wild Skagit River Chinook salmon: Linking estuary restoration to wild Chinook salmon populations. Skagit River System Cooperative: La Conner, Washington. Available online at: http://www.skagitcoop.org/documents/Appendix%20D%20Estuary.pdf

(2005). Skagit Watershed Council Year 2005 strategic approach. Skagit Watershed Council. Available online at: http://www.skagitwatershed.org/uploads/council_docs/pdf/SASWC05.pdf

Final Panel Comment 14

Impacts of the TSP on existing or planned restoration projects, such as the Skagit Delta Tidegates and Fish Initiative, do not appear to have been fully considered.

Basis for Comment

The DFR/EIS suggests in several subsections of Section 4 (p. 100 and 108) and Appendix D (p. 18) that the TSP will not likely affect existing or planned restoration projects or conservation efforts in the study area; however, no information is provided to substantiate the statements. Additional analysis and documentation of potential TSP-related impacts on existing or planned restoration projects is needed. For instance, the Skagit Delta Tide Gates and Fish Initiative (SDTFI) calls for restoration of several existing Skagit Delta estuary channels and creation of a new estuary channel in the delta (SDTFI, 2008). The TSP could have effects on SDTFI's stated goals for delta restoration that may not have been considered in the USACE's planning efforts by changing the sediment dynamics and geomorphic response in the Skagit Delta during low frequency flood events from its current baseline trajectory. This could cumulatively affect the effectiveness of the restoration goals of several existing or planned restoration projects such as those conducted by the SDTFI, the Puget Sound Nearshore Ecosystem Restoration Project, the Fisher Slough Freshwater Tidal March Restoration Project, and the completed Deepwater Slough Restoration Project.

Significance – Medium

A complete analysis of the TSP's potential effects on existing or planned restoration projects and documentation of the results are needed to determine overall future environmental impacts associated with implementation of the TSP.

Recommendation for Resolution

1. Coordinate with restoration program managers to determine the scope, location, and timing of existing and future restoration actions within lower Skagit River watershed, Skagit River Delta, and Skagit Estuary.
2. Analyze and document how the cumulative impacts of the TSP on the physical and biological habitats may affect existing or planned restoration projects in the lower Skagit River watershed, Skagit River Delta, and Skagit Estuary.
3. Consider potential adverse effects on existing or planned restoration projects during TSP design advancement so that adverse effects can be minimized.

Literature Cited:

SDTFI (2008). Skagit Delta Tide Gates and Fish Initiative Implementation Agreement. Skagit Delta Tidegates Fish Initiative. Western Washington Agricultural Association,

Final Panel Comment 15

The cumulative impacts of the TSP on recreational and Tribal fisheries in the lower river and estuary are not addressed.

Basis for Comment

The DFR/EIS addresses potential impacts on recreational fisheries from a river access standpoint, but does not address the potential cumulative impacts on recreational fishing, including shellfishing and near-shore estuarine fisheries, from habitat alterations resulting from implementation of the TSP. The analysis does not include documentation of potential effects from the TSP on Tribal fisheries with usual and accustomed fishing rights in the basin.

The TSP could adversely affect recreational and Tribal fisheries by expanding levee footprints in the river channel, removing riparian vegetation, and altering fish habitat by altering river hydrology, fish passage capabilities, scour dynamics, and sediment deposition and aggradation. These effects could occur in the lower Skagit River, Skagit Delta, or Skagit River Estuary. The impacted areas are critical nurseries for multiple aquatic species, including anadromous salmonids and shellfish (Beamer and Larsen, 2004; Dethier, 2006). These habitat effects would occur over time and could cumulatively affect the existing viability of recreational and Tribal fisheries in the study area. This could subsequently affect the existing sport/recreational fishing economy and impact Tribal fishing rights in the study area.

Significance – Medium

Potential adverse effects on recreational and Tribal fisheries resulting from habitat alterations from the TSP should be analyzed and documented to confirm that no recreational or Tribal treaty impacts will occur from implementation of the TSP.

Recommendation for Resolution

1. Analyze, and if necessary, mitigate TSP-related effects on recreational and Tribal fisheries.
2. Coordinate with local recreational fishing groups and Tribes as project design advances so that recreational stakeholders are kept abreast of project developments and potential recreational/ Tribal fisheries impacts (access- or habitat-based).

Literature Cited:

Beamer, E. and K. Larsen (2004). The importance of Skagit Delta habitat on the growth of wild ocean-type Chinook in Skagit Bay: Implications for delta restoration. Skagit River System Cooperative: La Conner, Washington. 6 pp. Available online at: http://www.skagitcoop.org/documents/Importance%20of%20delta%20rearing%20on%20bay%20growth.pdf

Dethier, M.N. (2006). Native shellfish in nearshore ecosystems of Puget Sound. Puget Sound Nearshore Ecosystem Restoration Project. Technical Report 2006-04, 19 pp. Available online at:http://www.pugetsoundnearshore.org/technical_papers/shellfish.pdf

Final Panel Comment 16

A comprehensive plan is not provided for communicating residual risk and expected flood damages to the public by definable geographic areas, including a breakout of induced flooding.

Basis for Comment

Residual risk is a critical issue for floodplain residents that should be carefully documented and communicated (as per ER 1105-2-100 [USACE, 2000; p. 3-11] and ER 1105-2-101 [USACE, 2006; paragraphs 7.f, 7.g, and 7.h). The DFR/EIS (Section 5.2, p. 191) notes that the rural areas remain at risk of flooding, including properties, agricultural lands, and critical infrastructure and, although risk is reduced to urban areas with improved levees, these areas still face the risk of levee failure, which could be catastrophic if people remain in harm's way and are not able to receive ample warning to evacuate.

The Panel understands from discussions with USACE during the mid-review teleconference (facilitated by Battelle on July 21, 2014) that failure of the dams in the Upper Basin was not one of the conditions analyzed as the associated probability is considerably less than the 0.2% ACE levee failure. However, the Panel believes that the life safety risk associated with catastrophic dam failure(s) in the Upper Basin is an integral component driving communication of life safety risk in the basin.

Residual risks to areas around Sterling and downstream areas (below Mount Vernon) have not been adequately described. The DFR/EIS (Appendix I) indicates there have been outreach programs and communications with the general public through public meetings; however, a comprehensive plan to communicate risk and life safety issues is not included in the DFR/EIS and supporting appendices.

The Panel notes that many of the public comments on the DFR/EIS expressed concern that outlying areas may have an increased flood risk. The Panel is concerned that the TSP may also increase risk downstream to the town of La Conner and, if so, these risks need to be communicated to the residents of La Conner.

Significance – Medium/Low

Communicating residual risk with the TSP to the public is required by USACE guidance and describing it in the DFR/EIS will more fully disclose the risks associated with the project.

Recommendation for Resolution

1. Develop and document in the DFR/EIS a comprehensive flood risk outreach/ education plan and a flood warning communication plan for the Skagit River Basin.

Literature Cited:

USACE (2000). Planning – Planning Guidance Notebook. Engineer Regulation (ER) 1105-2-100. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. April 22. Available online at: http://planning.usace.army.mil/toolbox/library/ERs/entire.pdf

USACE (2006). Risk Analysis for Flood Damage Reduction Studies. Engineer Regulation (ER) 1105-2-101. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. January 3. Available online at: http://planning.usace.army.mil/toolbox/library/ERs/er1105-2-101.pdf

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Beamer, E., A. McBride, C. Greene, R. Henderson, et al. (2005). Delta and nearshore restoration for the recovery of wild Skagit River Chinook salmon: Linking estuary restoration to wild Chinook salmon populations. Skagit River System Cooperative: La Conner, Washington. Available online at: http://www.skagitcoop.org/documents/Appendix%20D%20Estuary.pdf

Beamer, E. and K. Larsen (2004). The importance of Skagit Delta habitat on the growth of wild ocean-type Chinook in Skagit Bay: Implications for delta restoration. Skagit River System Cooperative: La Conner, Washington. 6 pp. Available online at: http://www.skagitcoop.org/documents/Importance%20of%20delta%20rearing%20on%20bay%20growth.pdf

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McConkey, S., K. Allan, and B. Pollock (1994). 1993 Mississippi River Record Stages and Levee Failures along the Illinois Border. Miscellaneous Publication 163. Illinois State Water Survey, Hydrology Division, Chicago, Illinois. December. Available on line at: http://www.isws.illinois.edu/pubdoc/MP/ISWSMP-163.pdf

ODPS (2011). State of Ohio Hazard Mitigation Plan 2011. Ohio Department of Public Safety, Ohio Emergency Management Agency. Available on line at: http://ema.ohio.gov/MitigationPlan2011.aspx

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.

SBFCA (2013). Feather River West Levee Project. Sutter Butte Flood Control Agency. April 2013. Available on line at: http://sutterbutteflood.org/

SCSC (2012). Skagit Impacts. Skagit Climate Science Consortium. Available online at: http://www.skagitclimatescience.org/skagit-impacts/

SDTFI (2008). Skagit Delta Tide Gates and Fish Initiative Implementation Agreement. Skagit Delta Tidegates Fish Initiative. Western Washington Agricultural Association,

SWC (2005). Skagit Watershed Council Year 2005 strategic approach. Skagit Watershed Council. Available online at: http://www.skagitwatershed.org/uploads/council_docs/pdf/SASWC05.pdf

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 (2014). Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects. Engineering and Construction Bulletin (ECB) 2014-10. U.S. Army Corps of Engineers. May 2. Available online at: http://www.wbdg.org/ccb/ARMYCOE/COEECB/ecb_2014_10.pdf

USACE (2012). Water Resources Policies and Authorities – Civil Works Review. Engineer Circular (EC) 1165-2-214. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. December 15. Available online at: http://www.publications.usace.army.mil/Portals/76/Publications/EngineerCirculars/EC_1165-2-214.pdf

USACE (2000). Planning – Planning Guidance Notebook. Engineer Regulation (ER) 1105-2-100. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. April 22. Available online at: http://planning.usace.army.mil/toolbox/library/ERs/entire.pdf

USACE (2006). Risk Analysis for Flood Damage Reduction Studies. Engineer Regulation (ER) 1105-2-101. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. January 3. Available online at: http://planning.usace.army.mil/toolbox/library/ERs/er1105-2-101.pdf

USACE (1994). Engineering and Design – Hydraulic Design of Flood Control Channels. Engineer Manual (EM) 1110-2-1601. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. June 30. Available on line at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.3.1392&rep=rep1&type=pdf

APPENDIX A

IEPR Process for the Skagit River GI Project

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A.1 Planning and Conduct of the Independent External Peer Review (IEPR)

Table A-1 presents the schedule followed in executing the Skagit River Basin Flood Risk Management General Investigation, Skagit County, Washington Independent External Peer Review (hereinafter: Skagit River GI IEPR). Due dates for milestones and deliverables are based on the award/effective date of June 20, 2014. The review documents were provided by U.S. Army Corps of Engineers (USACE) on June 24, 2014. Note that the work items listed under Task 6 occur after the submission of this report. Battelle will enter the 16 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. Battelle will provide USACE and the Panel a pdf printout of all DrChecks entries, through comment closeout, as a final deliverable and record of the IEPR results.

Table A-1. Skagit River GI Complete IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	6/20/2014
	Review documents available	6/24/2014
	Public comments available	8/13/2014
	Charge questions available	7/3/2014
	Battelle submits draft Work Plan[a]	7/8/2014
	USACE provides comments on draft Work Plan	7/11/2014
	Battelle submits final Work Plan[a]	7/29/2014
2	Battelle requests input from USACE on the conflict of interest (COI) questionnaire	6/23/2014
	USACE provides comments on COI questionnaire	6/24/2014
	Battelle submits list of selected panel members[a]	6/27/2014
	USACE confirms the panel members have no COI	7/1/2014
	Battelle completes subcontracts for panel members	7/10/2014
3	Battelle convenes kick-off meeting with USACE	6/24/2014
	Battelle sends review documents to panel members	7/11/2014
	Battelle convenes kick-off meeting with panel members	7/14/2014
	Battelle convenes kick-off meeting with USACE and panel members	7/14/2014
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	7/21/2014
	Agency Decision Milestone Meeting	9/29/2014

Table A-1. Skagit River GI Complete IEPR Schedule (continued)

Task	Action	Due Date
3	Panel prepares and/or reviews slides for CWRB (estimated date)	6/2015
	CWRB Meeting (Estimated Date)	7/2015
4	Panel members complete their individual reviews	8/4/2014
	Battelle sends public comments to panel members for review	8/15/2014
	Panel members complete their individual reviews of Public Comments	8/21/2014
	Battelle provides panel members with talking points for Panel Review Teleconference	8/8/2014
	Battelle convenes Panel Review Teleconference	8/11/2014
	Battelle provides Final Panel Comment templates and instructions to panel members	8/12/2014
	Panel members provide draft Final Panel Comments to Battelle	8/18/2014
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	8/19/2014 - 8/26/2014
	Panel finalizes Final Panel Comments	8/27/2014
5	Battelle provides Final IEPR Report to panel members for review	9/3/2014
	Panel members provide comments on Final IEPR Report	9/3/2014
	Battelle submits Final IEPR Report to USACE[a]	9/5/2014
6[b]	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	9/9/2014
	Battelle convenes teleconference with USACE to review the Post-Final Panel Comment Response Process	9/9/2014
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process	9/9/2014
	USACE provides draft Project Delivery Team (PDT) Evaluator Responses to Battelle	9/19/2014
	Battelle provides the panel members the draft PDT Evaluator Responses	9/23/2014
	Panel members provide Battelle with draft BackCheck Responses	9/26/2014
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	9/29/2014
	Battelle convenes Comment-Response Teleconference with panel members and USACE	9/30/2014
	USACE inputs final PDT Evaluator Responses to DrChecks	9/26/2014

Table A-1. Skagit River GI Complete IEPR Schedule (continued)

Task	Action	Due Date
	Battelle provides final PDT Evaluator Responses to panel members	9/30/2014
	Panel members provide Battelle with final BackCheck Responses	10/2/2014
6[b]	Battelle inputs the Panel's final BackCheck Responses in DrChecks	10/7/2014
	Battelle submits pdf printout of DrChecks project file[a]	10/7/2014
	Contract End/Delivery Date	6/30/2015

[a] *Deliverable.*

[b] *Task 6 occurs after the submission of this report*

At the beginning of the Period of Performance for the Skagit River GI IEPR, 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. In addition, 26 charge questions were provided by USACE and included in the draft and final Work Plans. Battelle added two questions that seek summary information from the IEPR Panel. The final charge also included general guidance for the Panel on the conduct of the peer review (provided in Appendix C of this final report).

Prior to beginning their review and within two 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. Battelle planned and facilitated a second kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meetings, the IEPR Panel received an electronic version of the final charge as well as the Skagit River GI review documents and reference materials listed below. The documents and files in bold font were provided for review; the other documents were provided for reference or supplemental information only.

- **Integrated Feasibility Report/EIS (260 pages)**
- **Appendix A: Plan Formulation (23 pages)**
- **Appendix B: Hydraulics & Hydrology (478 pages)**
- **Appendix C: Economics (88 pages)**
- **Appendix D: Environmental (102 pages)**
- **Appendix E: Geotechnical (164 pages)**
- **Appendix F: Real Estate (6 pages)**
- **Appendix G: Cost Estimate (66 pages)**
- **Appendix H: Civil Design (195 pages)**
- **Public Comments (380 pages)**
- Risk Register (11 pages)
- Decision Management Plan (5 pages)
- Appendix I: Public Involvement (238 pages)

- USACE guidance Civil Works Review, (EC 1165-2-214) dated 15 December 2012
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

About halfway through the review of the Skagit River GI IEPR documents, a teleconference was held with USACE, the Panel, and Battelle so that USACE could answer any questions the Panel had concerning either the review documents or the project. Prior to this teleconference, Battelle submitted nine panel member questions to USACE. USACE was able to provide responses to all of the questions during the teleconference or via email after the meeting.

In addition, throughout the review period, USACE provided documents at the request of panel members. These documents were provided to Battelle and then sent to the Panel as additional information only and were not part of the official review. A list of these additional documents requested by the Panel is provided below.

- Data input files used to run the HEC-FDA analysis (a total of 74 data files)
- Golder Associates Inc., Geotechnical Investigation and Levee Analysis, City of Burlington and Dike District 12 Levee Certification Project, Burlington, Washington. Final Report. Golder Associates Inc., Nov. 2009.

A.2 Review of Individual Comments

The Panel was instructed to address the charge questions/discussion points within a charge question response table provided by Battelle. At the end of the review period, the Panel produced 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. At the end of the review, Battelle summarized the individual comments in a preliminary list of 16 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

A.3 IEPR Panel Teleconference

Battelle facilitated a four-hour teleconference with the Panel so that the panel members could exchange technical information. The main goal of the teleconference was to identify which issues should be carried forward as Final Panel Comments in the Final 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 significant importance to the findings, and merged any related individual comments. At the conclusion of the teleconference, Battelle reviewed each Final Panel Comment with the Panel, including the associated level of significance, and confirmed the lead author for each comment.

At the end of these discussions, the Panel identified 15 comments and discussion points that should be brought forward as Final Panel Comments.

A.4 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 Skagit River GI 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 the other panel member 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/high, medium, medium/low, and 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 issue with the project that affects the current recommendation or justification of the project, and which will affect its future success, if the project moves forward without the issue being addressed. Comments rated as high indicate that the Panel determined that the current methods, models, and/or analyses contain a “showstopper” issue.
  2. **Medium/High:** Describes a potential fundamental issue with the project, which has not been evaluated at a level appropriate to this stage in the SMART Planning process. Comments rated as medium/high indicate that the Panel analyzed or assessed the methods, models, and/or analyses available at this stage in the SMART Planning process and has determined that if the issue is not addressed, it could lead to a “showstopper” issue.
  3. **Medium:** Describes an issue with the project, which does not align with the currently assessed level of risk assigned at this stage in the SMART Planning process. Comments rated as medium indicate that, based on the information provided, the Panel identified an issue that would raise the risk level if the issue is not appropriately addressed.
  4. **Medium/Low:** Affects the completeness of the report at this time in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium/low indicate that the Panel does not currently have sufficient information to analyze or assess the methods, models, or analyses.

5. **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 that was mislabeled or incorrect or that certain data or report section(s) were not clearly described or presented.

- Guidelines for Developing Recommendations: 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. An additional Final Panel Comment was developed for consideration after the panel review teleconference, bringing the total from 15 to 16 Final Panel Comments. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Final Panel Comments are presented in the main report.

A.5 Conduct of the Public Comment Review

Battelle received public comments from USACE on the Skagit River GI IEPR on August 13, 2014. To facilitate the review of public comments, USACE provided a six-page summary document that organized the comments by theme. Battelle then sent the public comments summary to the panel members on August 15, 2014. The Panel was instructed to use this summary document to identify public comments that would require a more in-depth review. If it was determined that a public comment should be reviewed in more detail, the panel member accessed the entire comment contained in two separate documents totaling 411 pages (of which 173 pages were specific to one theme, potential impact on the City of Sedro-Woolley). After completing their review, the Panel confirmed that no new issues or concerns were identified other than those already covered in their Final Panel Comments. The Panel also determined that adequate stakeholder involvement had occurred.

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APPENDIX B

Identification and Selection of IEPR Panel Members
for the Skagit River GI Project

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B.1 Panel Identification

The candidates for the Independent External Peer Review (IEPR) for the Skagit River Basin Flood Risk Management General Investigation, Skagit County, Washington (hereinafter: Skagit River GI IEPR) Panel were evaluated based on their technical expertise in the following key areas: economics/Civil Works planning, biological resources and environmental law compliance, civil/structural engineering, hydrologic and hydraulic engineering, and geotechnical engineering. These areas correspond to the technical content of the Skagit River GI IEPR review documents and overall scope of the Skagit River GI 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 evaluated these candidate panel members in terms of their technical expertise and potential conflicts of interest (COIs). Of these candidates, Battelle chose the most qualified individuals, confirmed their interest and availability, and ultimately selected five experts for the final Panel.

The five selected 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 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.

- Previous and/or current involvement by you or your firm[2] in the integrated Draft Feasibility Report and Environmental Impact Statement (DFR/EIS) and appendices for Skagit River, Skagit County, Washington.
- Previous and/or current involvement by you or your firm[2] in flood risk management studies in Washington State.
- Previous and/or current involvement by you or your firm[2] in the integrated DFR/EIS and appendices for Skagit River, Skagit County, Washington - related projects.

[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."

[2] Includes any joint ventures in which a panel member's firm is involved and if the firm serves as a prime or as a subcontractor to a prime.

- Previous and/or current involvement by you or your firm[2] in the conceptual or actual design, construction, or operation and maintenance of any projects in the Skagit River, Skagit County, Washington area.
- Current employment by the U.S. Army Corps of Engineers (USACE).
- Previous and/or current involvement with paid or unpaid expert testimony related to the integrated DFR/EIS and appendices for Skagit River, Skagit County, Washington.
- Previous and/or current employment or affiliation with members of the local non-Federal sponsor, notably Skagit County, Washington, or any of the following Federal, State, County, local and regional agencies, environmental organizations, and interested groups participating in the project: Federal Emergency Management Agency (FEMA), U.S. Geological Survey (USGS), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), U.S. Forest Service (USFS), U.S. National Park Service (NPS), Department of Energy (DOE), Washington State Department of Ecology, Washington State Department of Fish & Wildlife (WDFW), Washington State Department of Transportation (WSDOT), Lummi, Upper Skagit, Swinomish, Samish, and Sauk-Suiattle Tribal Nations, Puget Sound Energy, Seattle Public Utilities, Skagit County Diking Districts (for pay or pro bono).
- Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or your children related to Skagit County, Washington.
- 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 Seattle District.
- Previous or current involvement with the development or testing of models (including but not limited to: IWR Planning Suite, HEC-FDA, HEC-RAS, HEC-HMS) that will be used for, or in support of the integrated FR/EIS and appendices for Skagit River, Skagit County, Washington.
- Current firm[2] involvement with other USACE projects, specifically those projects/contracts that are with the Seattle District. If yes, provide title/description, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role. Please also clearly delineate the percentage of work you personally are currently conducting for the Seattle District. Please explain.
- Any previous employment by USACE as a direct employee, notably if employment was with the Seattle District or the Northwestern Division Office. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Any previous employment by USACE as a contractor (either as an individual or through your firm[2]) within the last 15 years, notably if those projects/contracts are with the Seattle 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 flood risk management and include the client/agency and duration of review (approximate dates).
- Pending, current, or future financial interests in the integrated DFR/EIS for Skagit River, Skagit County, Washington-related contracts/awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years came from USACE contracts.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years from contracts with the non-Federal sponsor (Skagit County, Washington).

- Any publicly documented statement (including, for example, advocating for or discouraging against) related to the integrated DFR/EIS for Skagit River, Skagit County, Washington and appendices.
- Participation in relevant prior and/or current Federal studies relevant to this project and/or the integrated DFR/EIS for Skagit River, Skagit County, Washington.
- Previous and/or current participation in prior non-Federal studies relevant to this project and/or the integrated DFR/EIS for Skagit River, Skagit County, Washington.
- 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:

Other considerations:

- Participation in previous USACE technical review panels
- Other technical review panel experience.

B.2 Panel Selection

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. Four of the five final reviewers are affiliated with a consulting company; the other is an independent consultant. 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 selected the final Panel.

An overview of the credentials of the final five members of the Panel and their qualifications in relation to the technical evaluation criteria is presented in Table B-1. More detailed biographical information regarding each panel member and his area of technical expertise is presented in Section B.3.

Table B-1. Skagit River GI IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	Burns	Myers	Fowler	Grindeland	Hartley
Economics/Civil Works Planning					
Minimum 15 years of demonstrated experience in economics planning	X				
Direct experience working for or with USACE (highly preferred, but not required)	X				
Expertise in flood risk management evaluating and conducting complex multi-objective public works projects with high public and interagency interest	X				
Familiarity with the USACE flood risk management analysis, economic benefit calculations, and expertise in economic analysis for flood risk management, specifically with acceptable methodologies for estimating damages	X				
Familiarity with HEC-FDA (Hydrologic Engineering Center's Flood Damage Reduction Analysis)	X				
Close familiarity with USACE plan formulation process, procedures, and standards as it relates to flood risk management	X				
Minimum 5 years of experience directly dealing with the USACE six-step planning process, governed by ER 1105-2-100, Planning Guidance Notebook	X				
Active participation in related professional societies	X				
Minimum M.S. degree or higher in economics	X				
Biological Resources and Environmental Law Compliance					
At least 15 years of experience directly related to water resource environmental evaluation or review and National Environmental Policy Act (NEPA) compliance		X			
Familiarity with the resources (e.g., habitat, fish and wildlife species, and Tribal cultures and archeology) that may be affected by the project alternatives in this study area		X			
Familiarity with Northwest biology, specifically with the salmonid species (spawning, rearing, freshwater migration)		X			
Familiarity with wetlands, riparian habitats, and knowledge of riverine systems		X			
Strong expertise in compliance with additional environmental laws, policies, and regulations, including compliance with Fish and Wildlife Coordination Act and Endangered Species Act		X			

Table B-1. Skagit River GI IEPR Panel: Technical Criteria and Areas of Expertise (continued)

Technical Criterion	Burns	Myers	Fowler	Grindeland	Hartley
Familiarity with Standardized Assessment Methodology and Washington State Wetland Function Assessment preferred, but not required[1]		X			
Familiarity with U.S. Fish and Wildlife Service Habitat Evaluation Procedure (HEP) (USFWS, 1980) preferred, but not required1		X			
Familiarity with Environmental Protection Agency Habitat Assessment Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers preferred, but not required[1]		X			
M.S. degree or higher in a related field		X			
Civil/Structural Engineer					
Minimum 15 years of experience in engineering or architecture			X		
Experience with large, complex public works projects with high public and interagency interests			X		
Thorough understanding of design of culverts and channel improvements in an urban setting			X		
Familiarity with levee design			X		
Familiarity with dam structures for flood risk management			X		
Familiarity with flood proofing relocations			X		
Familiarity with design and construction of bridges, specifically railroad systems			X		
Registered professional engineer			X		
Hydrologic and Hydraulic Engineer					
Minimum 15 years of experience in hydrologic and hydraulic engineering				X	
Experienced with all aspects of hydrologic and hydraulic engineering including:				X	
Northwest hydrology				X	
urban hydrology and hydraulics				X	
open channel systems				X	
effects of management practices and low impact development on hydrology				X	
design of earthen dams and detention ponds				X	

[1] This requirement was in the original SOW. The expertise description was modified after Battelle requested prioritization of expertise by USACE. The Recruiting Form was based on the original SOW in an effort to find individuals that meet the more stringent criteria.

Table B-1. Skagit River GI IEPR Panel: Technical Criteria and Areas of Expertise (continued)

Technical Criterion	Burns	Myers	Fowler	Grindeland	Hartley
use of non-structural systems as they apply to flood proofing, warning systems, and evacuation				X	
Familiarity with Hydraulic Engineering Center (HEC) modeling computer software including				X	
HEC-RAS				X	
HEC-HMS				X	
Flow 2D				X	
Specialized experience in river engineering, sediment transport, and familiarity with rivers with water control structures and dredging projects				X	
Registered professional engineer				X	
Geotechnical Engineer					
Minimum 15 years of experience in geotechnical engineering					X
Demonstrated experience in performing geotechnical evaluation and geo-civil design for all phases of flood risk management projects					X
Experience in levees, culverts, channel stability, design, and construction					X
Experience in bridge design and construction, preferred, but not required[1]					X
Experience in design and construction for utility relocations and interior drainage requirements					X
Experience with application of non-structural flood risk management measures					X
Knowledge of levee stability, vegetation variance for levees, levee design, sediment transport, Engineering Technical Letter (ETL) standards and variations, and construction and modification of new levees					X
Familiarity with the ETL that provides the vegetation standards for levees to be acceptable for USACE PL 84-99 program. (Note that the Seattle District uses a vegetation variance.)					X
Familiarity with and demonstrated experience related to USACE geotechnical practices associated with flood management channels, construction, and soil engineering					X

[1] This requirement was in the original SOW. The expertise description was modified after Battelle requested prioritization of expertise by USACE. The Recruiting Form was based on the original SOW in an effort to find individuals that meet the more stringent criteria.

B.3 Panel Member Qualifications

John Burns

Role: Economics and Civil Works planning experience and expertise.
Affiliation: CDM-Smith, Inc.

Mr. Burns is an expert in Federal water resources project policy, planning, and economics for CDM-Smith, Inc. He earned his Masters in Economics from Michigan State University in 1972 and has more than 40 years of experience in planning and economic analysis. He has 28 years' experience working for USACE Jacksonville District, the South Atlantic Division, and HQUSACE, as well as14 years as a water resource consultant and economist. He draws on his experience as one of the Federal government's preeminent experts in Federal water resources project planning and financing to provide expert analysis of water resources problems.

Mr. Burns has expertise and a fundamental understanding of flood risk management having evaluated and conducted complex multi-objective public works projects with high public and interagency interest. He was an economist in the Jacksonville District preparing economic evaluations for flood risk management, deep-draft navigation, and shoreline protection projects from 1972 to 1977. As a senior economist in the South Atlantic Division (SAD) from 1977 to 1982, he reviewed the formulation and evaluation for all Civil Works project reports managed by SAD. During his last 15 years with USACE, he was a HQUSACE senior economist reviewing economic aspects of Civil Works project reports and a Civil Works program manager and supervisor in HQUSACE.

Mr. Burns is familiar with USACE flood risk management analysis and economic benefit calculations. He has expertise in economic analysis for flood risk management, specifically with acceptable methodologies for estimating damages. As an economist, planner, and program manager for USACE from 1972 to 2000, he developed an excellent understanding of the economics of flood risk reduction and Principle and Guideline (P&G) requirements. He was the senior economist for multimillion-dollar interdisciplinary studies to formulate and evaluate large-scale water resources projects such as the Cross Florida Barge Canal Navigation Project and the Miami Beach/Dade County Storm Damage Prevention and Beach Erosion Control Project.

Mr. Burns is familiar with Hydrologic Engineering Center's Flood Damage Reduction Analysis (HEC-FDA) and the use of HEC-FDA with its sample data files. He conducted the formulation and evaluation of Ecosystem Restoration plans as the study manager and economist on the LCA Small Diversion at Convent/Blind River, Louisiana Project. Most recently, as an Independent External Peer Review team member, he reviewed plan formulation and economics for the Delta Islands and Levees Feasibility Study, California Draft Feasibility Report and Environmental Impact Statement, April 2014, which include HEC-FDA data analysis.

Mr. Burns has further experience with USACE plan formulation process, procedures, and standards as they relate to flood risk management. He has extensive experience in dealing with the USACE 6-step planning process and the Planning Guidance Notebook based on years of experience working as an economist and planner for USACE and recent experience serving as the study manager for the Baptiste Collette Bayou, Louisiana Section 203 Navigation Study and the LCA Blind River, Louisiana Freshwater Diversion. He is a former member of the American Economic Association and previously participated in American Association of Port Authorities and National Association of Flood & Stormwater Management Agencies Conferences.

Stuart Myers

Role: Biological resources and environmental law compliance experience and expertise.
Affiliation: Mason, Bruce & Girard, Inc.

Mr. Meyers is a senior environmental scientist with Mason, Bruce & Girard, Inc. (MB&G). He has more than 17 years of experience conducting and managing environmental studies and compliance activities for a variety of water resource projects throughout the Pacific Northwest. He earned his M.S. in geography from Portland State University in 2001 and has a B.S. in environmental studies from the University of Oregon. His post-graduate academic focus was on watershed ecology, with a specific research focus on land use effects on stream ecology and salmonid production.

Mr. Myers has developed a thorough understanding of the various local, state, and Federal environmental regulations that govern water resource projects in the region and has successfully guided projects through the National Environmental Policy Act (NEPA) compliance process from initial purpose and need statement development and internal/external coping through development of final NEPA documents and decision records. He is familiar with the resources that may be affected by the project alternatives in this study area. His academic and consulting experience focuses on riverine and watershed science with a particular focus on salmonid habitat and population dynamics. Having served as environmental project manager on more than 60 water resource and infrastructure projects, he has detailed understanding of the various multidisciplinary environmental, cultural, and social issues that are common to these projects and how to achieve regulatory compliance as well as build stakeholder consensus.

Mr. Myers has dedicated his career to understanding, assessing, and improving conditions for Pacific Northwest salmonid populations. He has surveyed hundreds of stream miles to document in-stream and riparian habitat conditions as well as fish populations. This hands-on experience has allowed him to gain a solid understanding of the various types of habitat used for salmonids to complete their complex life histories. He is an appointed member of the Oregon Fish Passage Task Force, which provides additional opportunities outside of consulting work to apply this understanding of salmonid biology for effective resource management.

Mr. Myers has a firm understanding of the interconnected relationships between wetlands, riparian habitats, and riverine systems and has been able to apply this understanding through his work at MB&G. He has been involved in dozens of projects that include assessment, permitting, and mitigating impacts on these resources. He has direct experience with wetland delineations and mitigation planning. He is Program Manager for the Oregon Department of Transportation's OTIA III Wetland and Biology Mitigation Monitoring Program, which involves monitoring, maintenance, and reporting activities for up to 200 biology and wetland mitigation sites throughout Oregon.

Mr. Myers has strong expertise in compliance, environmental laws, policies, and regulations, including the Fish and Wildlife Coordination Act and the Endangered Species Act. He is familiar with the nuances and requirements of the numerous environmental regulations affecting water resource projects in the Pacific Northwest, including Clean Water Act (Sections 401 and 404), Rivers and Harbors Act (Sections 9 and 10), State Environmental Policy Act (Washington), Washington Shoreline Management Act, Washington Water Pollution Control Act, Oregon Removal/Fill Law, Oregon Fish Passage Law, and multiple local agency land use and environmental regulations. In addition, he is familiar with the Standardized Assessment Methodology and Washington State Wetland Function Assessment from experience conducting wetland delineations and assessments in Washington and Oregon. He has provided senior review of wetland and stream functional assessments for various hydrogeomorphic classes, including

riverine, depressional, slope, and lacustrine fringe classes, and used these wetland rating systems to develop wetland mitigation approaches.

Mr. Myers has supported wildlife habitat rating and impact assessments that used the Habitat Evaluation Procedure (HEP) process for rangeland projects in eastern Oregon by providing senior review of HEP analyses and reports. He has also used habitat evaluation models to assess net benefits for migratory fish resulting from inter-basin fish passage mitigation projects. He is familiar with the Environmental Protection Agency (EPA) Habitat Assessment Rapid Bioassessment Protocols for use in Streams and Wadeable Rivers. He has monitored fish and macroinvertebrate assemblages in streams using EPA rapid bioassessment protocols and other protocols to assess the overall environmental health of the subject stream system. He has also used other aquatic biosurvey techniques such as Oregon Department of Fish and Wildlife's Index of Biological Integrity for fish assemblages as well as stream/fish surveys using Hankin and Reeves (1988) methodologies.

Chester Deane Fowler, P.E.

Role: Civil and structural engineering experience and expertise.
Affiliation: Independent Consultant

Mr. Fowler is an independent consultant with 37 years of experience in civil engineering. He has more than 20 years of experience in working on complex, phased multi-year Civil Works construction projects. He earned his M.S. in civil engineering/construction management in 1986 from the University of Florida, is a registered professional engineer in Florida and Virginia, and is a construction documents technologist (CDT), certified construction manager (CCM), and program management professional (PgMP). He has program, project, facilities, and construction contract management experience and has held positions in every facet of engineering, including daily and long-term budgeting, planning, scheduling, operations, and executive level management.

As a Contractor Project Manager for USACE New Orleans District, he was responsible for seven hurricane protection and water resource based projects in Southern Louisiana. Duties included updating the Primavera Schedule with resources, the Form 2101, the Form 17, and Risk Assessment analysis for tracking project costs and budget for each project.

Mr. Fowler has experience with large, complex public works projects with high public and interagency interests through his position as Deputy District Engineer, USACE-Jacksonville from 1995 to1998. Here he oversaw the operation, maintenance, and monitoring for the Cerrillos Dam. He provided project oversight for the Rio Puerto Nuevo Flood Control Project (Puerto Rico) and nearly 40 other major Civil Works projects in Puerto Rico totaling over $1B in various stages of planning, design, and construction. He has also conducted design charrettes for Portugues Dam design conferences to resolve technical problems related to mass concrete placement, cooling, and overall layout. Further, he oversaw the economic analysis (included construction cost estimating) with benefit/cost ratio computations during the design phase for the Portugues Dam Flood Control Project for USACE-Jacksonville. He also provided final review of cost sharing agreement and sign-over for Cerrillos Dam from USACE-Jacksonville to Commonwealth of Puerto Rico and assisted with change order review, design modifications, and final negotiations for the Rio Puerto Nuevo Flood Control Project with modifications exceeding $8M.

Mr. Fowler has a thorough understanding of the design of culverts and channel improvements in an urban setting. He has extensive experience, both design and field related, with access and egress for work sites in an urban environment, Civil Works (water resources projects include dredging, levee design,

water control structures: culverts, open/closed channel flow, locks, tainter gates and dams for storage and water supply) and military construction sites more than 30 years. He was a contractor civil/cost engineer on two separate projects for USACE Jacksonville District projects that included the analysis and construction of relief wells, slurry walls, and hydraulic barriers to prevent subsurface flows from reaching flow canals feeding the Florida Everglades He was also the civil engineer reviewer for C-111 Spreader Canal and L-31N that was developed to protect the Florida Aquifer.

Mr. Fowler is familiar with levee design from his 37 years of experience with civil engineering projects. He was team leader on Periodic Levee Inspections for Clatsop 1 & 7, Svensen Levee Systems, Warrenton Diking District and Clatsop 14 Diking District for Portland District; 2010. The inspections included construction cost estimating for repair/replacement, validation of design with cost projections, stability analysis, overtopping potential, control structure (flood gates and culverts) review, and benefit/cost evaluation. Mr. Fowler was also the project manager for several levee design/construction projects in Southeast Louisiana (under contract with USACE-MVN) for the Morganza to the Gulf of Mexico Hurricane Protection Project, East Baton Rouge Parish Flood Control Project, St Charles Parish Flood Risk Reduction Project, St John the Baptist Flood Risk Reduction Project from 2006 to 2009. He is familiar with dam structures for flood risk management. He assisted in the preliminary risk analysis for the Portugues Dam, USACE-Jacksonville, which included flood risk management and analysis of the main structure, overflow, support elements, construction risks, and public outreach for the downstream communities. In addition, he led five levee inspection teams performing risk management; design criteria, flood proofing, stability analysis, early warning system analysis, local training, and flood fight capabilities for the Portland District in 2009/2010.

Mr. Fowler is familiar with flood proofing relocations from his work assisting in the development and review of Dam Safety Plans for the Portugues Dam, Ponce, Puerto Rico. He performed dam safety inspections for 43 miles of Columbia River levees in support of a levee inspection program for USACE Portland District in 2009/2010 that included structural and non-structural methods (relocation and/or raising) for flood proofing buildings that remained in the flood plain. Mr. Fowler has experience with design and construction of bridges, specifically railroad systems. He was the senior resident engineer for the design and construction of two aircraft bridges at Orlando International Airport (OIA). Each had aircraft loading with associated ramps and protection over operational roadways. Further, he was the civil engineer assisting in the design/build development for the light rail system servicing the Central Florida Region with connections to OIA and assisted with the emergency recovery/replacement of a rail bridge damaged by hurricane flood waters in 2004 that directly impacted operations of CSX in delivering goods and services to Southeast United States.

Mr. Fowler actively participates in related professional societies. He is a Fellow of the Society of American Military Engineers, Life Member of Chi Epsilon, and a member of the Certified Construction Management Association and the Project Management Institute.

Thomas Grindeland, P.E.

Role: Hydrologic and hydraulic engineering experience and expertise.
Affiliation: WEST Consultants, Inc.

Mr. Grindeland is an engineer at WEST Consultants in the Salem, Oregon office. He has more than 33 years of experience in hydrologic and hydraulic engineering. He earned his M.S. in civil engineering from Colorado State University in 1981 and is a certified professional engineer in four states (Washington, Oregon, Colorado, and Idaho). Mr. Grindeland has conducted a large number and wide range of

hydrologic and hydraulic engineering projects and has more than 22 years of project experience specific to the Pacific Northwest, including the following hydrologic studies: Peak Flow Frequency Analysis for the Flood Insurance Study for the City of Spokane Valley, Washington; HEC-HMS Study of the Mill Creek Watershed for the City of Salem, Oregon Phase 1 Flood Warning System Design; and Interior Drainage Analysis for Consolidated Drainage Improvement District No. 1 in Longview, Washington.

Mr. Grindeland has experience in urban hydrology and hydraulics studies through his work on projects such as the Winter Street Bridge Replacement Project, Salem, Oregon; Clagget Creek Culvert Replacement Design, Salem, Oregon; City of Gresham, Oregon Flood Insurance Restudy; and levee setback for the evaluations for the Green River Restoration Project, King County, Washington. His experience with open channel systems is represented through his work in conducting more than 15 flood insurance studies in multiple states, including Washington State. In addition, he conducted HEC-RAS surface water modeling for numerous projects with open channel systems, including for the East Fork Lewis River for a FEMA C conditional Letter of Map Revision (CLOMR) in Clark County, Washington, and the Cowlitz River in Clark County, Washington as part of the evaluation of Mount St. Helens sediment supply.

Mr. Grindeland has experience in the effects of management practices and low impact development on hydrology through his participation in the Stormwater Detention Pond retrofit designs for the City of Salem, Oregon project and stormwater infiltration basin assessment for the Chester Creek Flood Insurance Restudy, City of Spokane Valley, Washington project. His experience in the design of earth dams includes hydrologic and hydraulic analysis of spillway adequacy for seven dams in the City of Boulder, Colorado watershed project; labyrinth weir spillway design for Boulder Reservoir in City of Boulder, Colorado; and the spillway design for the Cow Creek Tribe Water Supply Reservoir in Canyonville, Oregon . His experience with non-structural flood risk reduction systems includes the Phase 1 Hydrologic Modeling and Gage Network Evaluation for the Mill Creek Flood Warning System, City of Salem, Oregon; the Emergency Action Plan for a potential dam breach of the Big Creek Dams for the city of Newport, Oregon; and the Emergency Action Plan for a potential dam breach for the Funrue Reservoir, Silverton, Oregon.

Mr. Grindeland has extensive project experience in the application of HEC-RAS, HEC-HMS, and FLO-2D. He has used HEC-RAS on hundreds of projects involving open channel flow hydraulic analysis, bridge and culvert design, flood risk assessment and environmental impact evaluation/mitigation. Projects include the HEC-RAS hydraulic modeling of the Green River for Environmental Restoration Feasibility Study, King County, Washington; the HEC-RAS hydraulic modeling of the Satsop River Floodplain Restoration, Grays Harbor County, Washington; and the HEC-RAS hydraulic modeling of the East Fork Lewis River for floodplain delineation, Clark County, Washington. He has experience using HEC-HMS on multiple projects including the Phase 1 Mill Creek Flood Warning System Design, City of Salem, Oregon; the Des Lacs River Flood Forecast Model Development, North Dakota; and the Kanawha River Basin Modeling, West Virginia. Mr. Grindeland is also very familiar with the application of FLO-2D. His project experience applying FLO-2D includes the interior drainage analysis for Consolidated Drainage District No. 1, Longview, Washington; the interior drainage analysis for Consolidated Drainage District No. 2, Woodland, Washington; and a flood hazard assessment for the Moro Bay Power Plant, Moro Bay, California.

Mr. Grindeland has specialized experience in river engineering, sediment transport, and familiarity with rivers with water control structures and dredging projects. Relevant projects include the hydraulic analysis of potential impacts of dredging associated with a proposed Liquefied Natural Gas (LNG) facility

along the Lower Columbia River; the hydraulic, geomorphic, and sediment transport evaluations of the East Fork Lewis River in support of a plan for gravel mining and habitat enhancement; and the evaluation of sediment supply from Mount St. Helens and the North Fork Toutle River Sediment Retention Structure on sedimentation and flood risk conditions along the lower Cowlitz River in Clark County, Washington.

Michael Hartley, P.E.

Role: Geotechnical engineering experience and expertise.
Affiliation: PND Engineers, Inc.

Mr. Hartley has more than 30 years of experience providing civil, coastal, and geotechnical engineering services for projects throughout the United States and overseas. He has managed more than 200 geotechnical investigations, including a significant number of projects in which settlement of foundations, dams, and levee systems could be impacted where in situ (naturally occurring soils) consisted of soft cohesive colluviums and alluvial soils. Mr. Hartley is currently a senior vice president of PND Engineers, Inc. He earned his M.S. in civil engineering in 1979 from Oregon State University. He is a registered professional engineer in three states (Alaska, Washington, and Oregon).

Mr. Hartley has provided geotechnical assessment and design of dams and participated in large dam project studies and designs in Alaska, including hydroelectric projects for Susitna Dam, Bradley Lake Dam, and Terror Lake Dam, as well as periodic safety inspections conducted for the Alaska Department of Natural Resources, Dam Safety Division and the Federal Energy Regulatory Commission. He has participated in several Independent External Peer Reviews (IEPR) including the West Bank Levee System IEPR, New Orleans, Louisiana and the Backslope Armoring Manual design guide project and IEPR Reviews of large concrete and earth fill dams in West Virginia and Ohio.

Mr. Hartley has demonstrated experience in performing geotechnical evaluation and geo-civil design for all phases of flood risk management projects. He has worked on many projects involving development of utility easements, utility design for roads and parking facilities including the Terminal 10 design and modification project for the Port of Seattle, Washington. He has worked on building projects, parking requiring waterproofing, drainage, bioswales, and detention basins including the On-Call Design Services for the U.S. Department of Agriculture Forest Service project in Northern California and the 76th Avenue Street Improvements Plans, Specifications, and Estimates project for the Municipality of Anchorage, Alaska.

Mr. Hartley has experience in levees, culverts, channel stability, design, and construction. He has conducted design and erosion/scour risk management assessment for levees, roadside ditches, as well as shoreside measures to mitigate risk. He has also evaluated channel stability using various methods and recently performed channel lining stability in high velocity situations for dam spillways for USACE. Mr. Hartley has some experience in bridge design and offshore trestle design and is currently designing a bridge in Washington State.

Mr. Hartley has extensive experience in utility design, utility relocations, including options such as utility vaults. He was the project manager for the Reeve Aleutian Airways Terminal, Sand Point, Alaska, which included utility design. He has significant experience in levee design, peer review, and evaluation of vegetative methods for scour protection and issues with overall maintenance requirements for alternative vegetative measures. He is familiar with USACE Engineering Technical Letter (ETL) standards and variations, and construction and modification of new levees. The Humpback Creek Dam project in Cordova, Alaska is just one example of the projects Mr. Hartley has managed. He has recent experience

working on geotechnical assessment for permanent canal closures in New Orleans and in performing field assessment of construction practices for dams for IEPR review for USACE.

APPENDIX C

Final Charge to the IEPR Submitted to USACE on July 3, 2014 for the Skagit River GI Project

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CHARGE QUESTIONS AND GUIDANCE TO THE PANEL MEMBERS FOR THE IEPR FOR THE SKAGIT RIVER BASIN FLOOD RISK MANAGEMENT GENERAL INVESTIGATION, SKAGIT COUNTY, WASHINGTON

BACKGROUND

The Skagit River originates near the 8,000-foot level of the Cascades Mountains in British Columbia, Canada and flows south and then west to the Skagit delta where it discharges through two distributaries – the North Fork and South Fork – to Skagit Bay. The Skagit River basin is located in northwest Washington State and has a total drainage area of 3,115 square miles. The project area for the feasibility study encompasses the Skagit River watershed from Ross Dam reservoir to Skagit Bay. The Skagit River floodplain contains about 22,000 acres east (upstream) of Sedro-Woolley (RM 22.4) and 74,000 acres west (downstream) of Sedro-Woolley. The major cities on the Skagit River delta – Mount Vernon, Burlington, Sedro-Woolley, and La Conner – lie about 60 miles north of Seattle, Washington.

Major flooding has occurred in the Skagit River Basin. Because of its geographic location, the Skagit River Basin is subject to winter rain floods and an increase in discharge during spring due to snowmelt runoff. Rain-type floods usually occur in November or December, but may occur as early as October or as late as February. Additionally, a light snow pack is frequently formed over most of the basin. Heavy rainfall and accompanying snowmelt result in a high rate of runoff, as the ground is already nearly saturated from earlier precipitation. Two or more crests may be experienced within a period of one to two weeks as a series of storms move across the basin from the west. The winter floods have a considerably higher magnitude than the average annual spring high water.

Flood damages have been reduced in recent years with a well-maintained local levee and dike system on the Lower Skagit River, and a well-organized and effective flood fighting effort. The purpose of the feasibility study was to formulate and recommend a comprehensive flood risk management plan for the Skagit River floodplain to reduce flood hazards and damages in the urban and rural parts of the basin. The total estimated cost of the proposed project is $225,000,000.

The Skagit River Basin Flood Risk Management General Investigation Feasibility Study Team has conducted the feasibility study following the U.S. Army Corps of Engineers (USACE) Planning process defined in ER 1105-2-100 (Planning Guidance Notebook; USACE, 2000) and the USACE SMART (Specific, Measurable, Attainable, Risk Informed, Timely) Planning initiative, which incorporates risk-informed evaluation with less detailed information to reach decision points more efficiently, and includes greater Vertical Team coordination throughout the study.

The study has been divided into phases each with key milestones and associated In-Progress Reviews (IPR):

- Alternatives Milestone: The Vertical Team agrees on the proposed way forward on continuing analysis and evaluation on a focused array of alternatives.
- Tentatively Selected Plan (TSP) Milestone: Vertical Team agrees on the Project Delivery Team's (PDT) recommendation of a tentatively selected plan and proposed way forward on developing

sufficient cost and design information for the final feasibility study report and Vertical Team approval to release draft feasibility report for concurrent Policy, Agency Technical Review (ATR), Independent External Peer Review (IEPR), and Public Review.

- Agency Decision Milestone: The recommended plan and proposed way forward for feasibility-level design is endorsed by a panel of senior Corps leaders.
- Civil Works Review Board: Corporate checkpoint to determine if the final feasibility study report and NEPA document, and the proposed Report of the Chief of Engineers, are ready to be released for State and Agency review.
- Signed Chief's Report.

A risk register and other risk management documentation will accompany the feasibility study decision document. Although one of the objectives of IEPR is to evaluate whether sufficient information was available or technical analyses were completed, the IEPR must be completed within the context of the risk-informed decision-making process.

OBJECTIVES

The objective of this work is to conduct an IEPR of the Skagit River Basin Flood Risk Management General Investigation, Skagit County, Washington (hereinafter: Skagit River GI IEPR) in accordance with the Department of the Army, USACE, Water Resources Policies and Authorities' *Civil Works Review* (Engineer Circular [EC] 1165-2-214; USACE, December 15, 2012), and the Office of Management and Budget *Final Information Quality Bulletin for Peer Review* (December 16, 2004).

Peer review is one of the important procedures used to ensure that the quality of published information meets the standards of the scientific and technical community. Peer review typically evaluates the clarity of hypotheses, validity of the research design, quality of data collection procedures, robustness of the methods employed, appropriateness of the methods for the hypotheses being tested, extent to which the conclusions follow from the analysis, and strengths and limitations of the overall product.

The purpose of the IEPR is to assess the "adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (EC 1165-2-214; p. D-4) for the Skagit River GI documents. The IEPR will be limited to technical review and will not involve policy review. The IEPR will be conducted by subject matter experts (i.e., IEPR panel members) with extensive experience in economics/Civil Works planning, biological resources and environmental law compliance, civil/structural engineering, hydrologic and hydraulic engineering, and geotechnical engineering issues relevant to the project. They will also have experience applying their subject matter expertise to flood risk management and ecosystem restoration.

The Panel will be "charged" with responding to specific technical questions as well as providing a broad technical evaluation of the overall project. Per EC 1165-2-214, Appendix D, review panels should identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods. Review panels should be able to evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable. Reviews should focus on assumptions, data, methods, and models. The panel members may offer their opinions as to whether there are sufficient analyses upon which to base a recommendation.

DOCUMENTS PROVIDED

The following is a list of documents, supporting information, and reference materials that will be provided for the review.

Documents for Review

The following documents are to be reviewed by designated discipline:

Review Documents	
Title	**Number of Pages**
Integrated Feasibility Report/EIS	260
Appendix A: Plan Formulation	23
Appendix B: Hydraulics & Hydrology	478
Appendix C: Economics	88
Appendix D: Environmental	102
Appendix E: Geotechnical	164
Appendix F: Real Estate	6
Appendix G: Cost Estimate	66
Appendix H: Civil Design	195
Public Comments	50
Total Pages	**1,432**
Supplemental Documents	
Risk Register	11
Decision Management Plan	5
Appendix I: Public Involvement	238
Supporting Documentation Total	**254**
Total Page Count	**1,686**

Documents for Reference

- USACE guidance *Civil Works Review* (EC 1165-2-214; 15 December 2012)
- Office of Management and Budget *Final Information Quality Bulletin for Peer Review* (December 16, 2004).

SCHEDULE

This final schedule is based on the June 24, 2014, receipt of the final review documents.

Task	Action	Due Date
Conduct Peer Review	Battelle sends review documents to panel members	7/11/2014
	Battelle convenes kick-off meeting with panel members	7/14/2014
	Battelle convenes kick-off meeting with USACE and panel members	7/14/2014
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	7/21/2014
	Panel members complete their individual reviews	8/4/2014
	Battelle provides panel members with Public Comments	8/15/2014
	Panel completes their individual review of Public Comments	8/21/2014
Prepare Final Panel Comments and Final IEPR Report	Battelle provides panel members with talking points for Panel Review Teleconference	8/8/2014
	Battelle convenes Panel Review Teleconference	8/11/2014
	Battelle provides Final Panel Comment templates and instructions to panel members	8/12/2014
	Panel members provide draft Final Panel Comments to Battelle	8/18/2014
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	8/19/2014 - 8/26/2014
	Panel finalizes Final Panel Comments	8/27/2014
	Battelle provides Final IEPR Report to panel members for review	8/29/2014
	Panel members provide comments on Final IEPR Report	9/3/2014
	Battelle submits Final IEPR Report to USACE*	9/5/2014
Comment/ Response Process	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	9/9/2014
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process (if necessary)	9/9/2014
	USACE provides draft PDT Evaluator Responses to Battelle	9/19/2014
	Battelle provides the panel members the draft PDT Evaluator Responses	9/23/2014
	Panel members provide Battelle with draft BackCheck Responses	9/26/2014
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	9/29/2014
	Battelle convenes Comment-Response Teleconference with panel members and USACE	9/30/2014
	USACE inputs final PDT Evaluator Responses to DrChecks	9/26/2014

Task	Action	Due Date
	Battelle provides PDT Evaluator Responses to panel members	9/30/2014
	Panel members provide Battelle with final BackCheck Responses	10/2/2014
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	10/7/2014
	Battelle submits pdf printout of DrChecks project file*	10/7/2014
Agency Decision Milestone Meeting (ADM)	Agency Decision Milestone Meeting	9/29/2014
Civil Works Review Board (CWRB)	Panel prepares and/or reviews slides for CWRB	TBD
	Civil Works Review Board Meeting	TBD July 2015

* Deliverables

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the Skagit River GI documents are credible and whether the conclusions are valid. The Panel is asked to determine whether the technical work is adequate, competently performed, and properly documented; satisfies established quality requirements; and yields scientifically credible conclusions. The Panel is being asked to provide feedback on the economic, engineering, environmental resources, 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 Skagit River GI IEPR documents. Please focus your review on the review materials assigned to your discipline/area 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 1165-2-214; 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 evaluating 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 Agency Technical Review (ATR).

2. Please contact the Battelle Project Manager (Julian DiGialleonardo, digialleonardoj@battelle.org) or Program Manager (Karen Johnson-Young (johnson-youngk@battelle.org) for requests or additional information.

3. In case of media contact, notify the Battelle Program Manager, Karen Johnson-Young (johnson-youngk@battelle.org) 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 Julian DiGialleonardo, **digialleonardoj@battelle.org**, no later than August 4, 2014, 10 pm ET. Please submit your comments on the Public Comments to Julian DiGialleonardo, **digialleonardoj@battelle.org**, no later than August 19, 2014, 10 pm ET.

IEPR of the Skagit River Basin Flood Risk Management General Investigation, Skagit County, Washington

CHARGE QUESTIONS AND RELEVANT SECTIONS AS SUPPLIED BY USACE

General/Safety Assurance

1. Is the need for and intent of the decision document(s) clearly described?
2. Does the decision document(s) adequately address the stated need and meet the intent?
3. Were all models in the analyses, including the models assessing the hazards, appropriate and used in an appropriate manner?
4. Are the models used in a manner that supports the conclusions drawn from them (i.e., identify meaningful differences between alternatives)?
5. Are the assumptions used to assess hazards sound and appropriate?
6. Is the quality and quantity of the surveys, investigations, and engineering sufficient for a conceptual design and to support the models and assumptions made for determining the hazards?
7. Does the analysis adequately identify and address the uncertainty and residual risk given the consequences associated with the potential for loss of life for this project?
8. From a public safety perspective, is the proposed alternative reasonably appropriate or are there other alternatives that should be considered?
9. Are potential life safety issues accurately and adequately described under existing, future without-project, and future with-project conditions?
10. Evaluate the soundness of models, surveys, investigations, and methods.
11. Assess if the adequacy and acceptability of the economic environmental and engineering assumptions, projections, analyses, and interpretations of analyses (i.e., conclusions) are reasonable.
12. Assess the adequacy and acceptability of the methods for integrating risk and uncertainty.
13. Are cumulative impacts adequately described and discussed? If not, please explain.

Plan Formulation

14. Is the hydrology discussion sufficient to characterize current baseline conditions and to allow for evaluation of how forecasted conditions (with and without proposed actions) are likely to affect hydrologic conditions? Is the discussion complete on the relationship between hydrology and the hydrodynamics of the project area?
15. Assess the considered and recommended alternatives from a system perspective (spatial and temporal variability in the system), including the potential effects of climate change.
16. Was a reasonably complete array of possible measures and alternatives considered?
17. Assess the adequacy and acceptability of the formulation, evaluation, and comparison of alternative plans.
18. Are the changes between the without- and with-project conditions adequately described for each alternative?
19. Please comment on the conclusion of the most probable future without-project condition. Do you envision other potential probable outcomes?

20. Are the uncertainties inherent in our evaluation of benefits, costs, and impacts, and any risk associated with those uncertainties, adequately addressed and described for each alternative?
21. Is the environmental assessment reasonably comprehensive or are there significant environmental impacts that should be considered?
22. Are socioeconomic conditions adequately addressed? Were socioeconomic issues not addressed?

Recommended Plan

23. Please comment on the likelihood of the recommended plan to achieve the expected outputs.
24. Are residual risks adequately described and is there a sufficient plan for communicating the residual risk to affected populations for this phase of the study?

Summary Questions

25. Please identify the most critical concerns (up to five) you have with the project and/or review documents. These concerns can be (but do not need to be) new ideas or issues that have not been raised previously.
26. Please provide positive feedback on the project and/or review documents.

Overview Questions

27. Please identify the most critical concerns (up to five) you have with the project and/or review documents.
28. Please provide positive feedback on the project and/or review documents

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