US Army Corps of Engineers ®
Portland District

LIMITED REEVALUATION REPORT

Mount St. Helens Long-Term Sediment Management Plan

Sediment retention structure and upstream sediment plain on the North Fork Toutle River.

Draft Supplemental Environmental Impact Statement

August 2014

Draft Supplemental Environmental Impact Statement
Mount St. Helens Long-Term Sediment Management Plan

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ES-1 Introduction

The eruption of Mount St. Helens (MSH) in the spring of 1980 caused a large movement of sediment into surrounding water courses, creating a threat of flooding in downstream communities in southwestern Washington. Following the eruption, the U.S. Army Corps of Engineers Portland District (USACE) implemented several strategies to mitigate the flood risk to downstream communities, as identified in the 1985 *Mount St. Helens Long-Term Sediment Management Plan* (1985 Long-Term Plan; USACE 1985a). A major component of the 1985 Long-Term Plan was the construction of a Sediment Retention Structure (SRS) at River Mile (RM) 13 on the North Fork (NF) Toutle River in 1989. The purpose of the SRS is to retain sediment upstream of the SRS, thereby reducing downstream transport and deposition of the sediment. Other features of the 1985 Long-Term Plan included levee improvements on the lower 20 miles of the Cowlitz River and as-needed dredging within the lower Cowlitz River to further mitigate flooding risk for communities on the lower Cowlitz River.

The SRS has reached capacity and is presently operating as a run-of-the-river[1] dam. This condition allows more sediment to be transported downstream and has increased the rate of sediment accumulation in the lower Cowlitz River. However, conditions in and around the Cowlitz River are different now from what they were in 1985 when the Long-Term Plan was completed. Notably, the methods and constraints of dredging the lower Cowlitz River are considerably different than when analyzed in 1985. The availability of dredged material disposal sites and the listing under the Endangered Species Act (ESA) of anadromous fish present within the affected area, such as eulachon, green sturgeon, and salmonids, have increased the complexity and cost of dredging.

The 1985 Long-Term Plan recognized the likely need for a future re-evaluation of the components of the plan based on changes in future conditions. This Draft Supplemental Environmental Impact Statement (SEIS) addresses the update of the 1985 Long-Term Plan.

ES-1.1 Purpose and Need

The purpose of the proposed action is to manage flood risk to established levels for the cities of Castle Rock, Lexington, Kelso, and Longview, Washington through the year 2035 as authorized by the Water Resources Development Act of 2000. Authorized levels of protection[2] (LOP) for those cities are listed in Table ES 1.1-1, below. LOP are expressed in years in terms of average recurrence (in years) of flood flows that would overtop the levee; for example, the authorized LOP for Castle Rock is 118 years, which means protection for a flood event with a probability of occurring once every 118 years or, in other words, protection from a flood that has an 0.85 percent chance of occurring in any given year. For Lexington and Longview, protection for a flood event with a probability of occurring once every 167 years or a flood having a 0.60 percent chance of occurring in any given year. And for Kelso, protection

[1] Run-of-the-river means that dams essentially pass existing river flow and create a reservoir with a fairly consistent elevation, as opposed to "storage" reservoirs, which are designed to store water in their reservoirs within a large variation of elevations.

[2] The authorized LOP are expressed as recurrence interval floods that result in the levee system capacity exceedance (or failure). Potential failure can be assessed from a modeled conditional non-exceedance probability that represents the likelihood that a specific target will not be exceeded, and assumes that the expected stage at the authorized level of protection is at least three feet below the top of the levee.

for a flood event with a probability of occurring once every 143 years or a flood having a 0.70 percent chance of occurring in any given year.

Table ES 1.1-1. Authorized Levels of Protection

Location	Authorized LOP (in years)	Percent Chance of Exceedence Flood (%)
Castle Rock	118	0.85%
Lexington	167	0.60%
Kelso	143	0.70%
Longview	167	0.60%

Sediment from the North Fork (NF) Toutle River basin is transported downstream and accumulates in the lower Cowlitz River. USACE conducted modeling studies to predict future condition stage-discharge rating curves for frequency flows. These predictions are combined with existing hydrologic and geotechnical data and analyzed in the HEC-FDA tool to estimate flood risks. USACE did this for a 28-year sequence to review the performance of the levees to 2035. Figure ES 1.1-1 illustrates how the LOP for the communities on the lower Cowlitz River has, and is predicted to, change due to sediment accumulation under current conditions, assuming no action is taken to address sediment accumulation. An updated long-term sediment management plan is needed to guide the implementation of sediment management measures to address the accumulation of sediment in the lower Cowlitz River and the associated flood risk through the year 2035.

In addition to the future performance of the levees from 2015 to 2035, authorized levels are shown as horizontal dashed lines. The future performance of the Kelso and Longview levees shows downward trends but are maintained above authorization until 2035. The Lexington and Castle Rock levees are more problematic and show performance that falls below authorization in the near future.

The updated plan will re-evaluate sediment transport rates and management strategies to maintain authorized levels of flood risk protection in the lower Cowlitz River. The results of the re-evaluation will be used to update the 1985 Long-Term Plan in the form of a Limited Reevaluation Report to be published in conjunction with this SEIS.

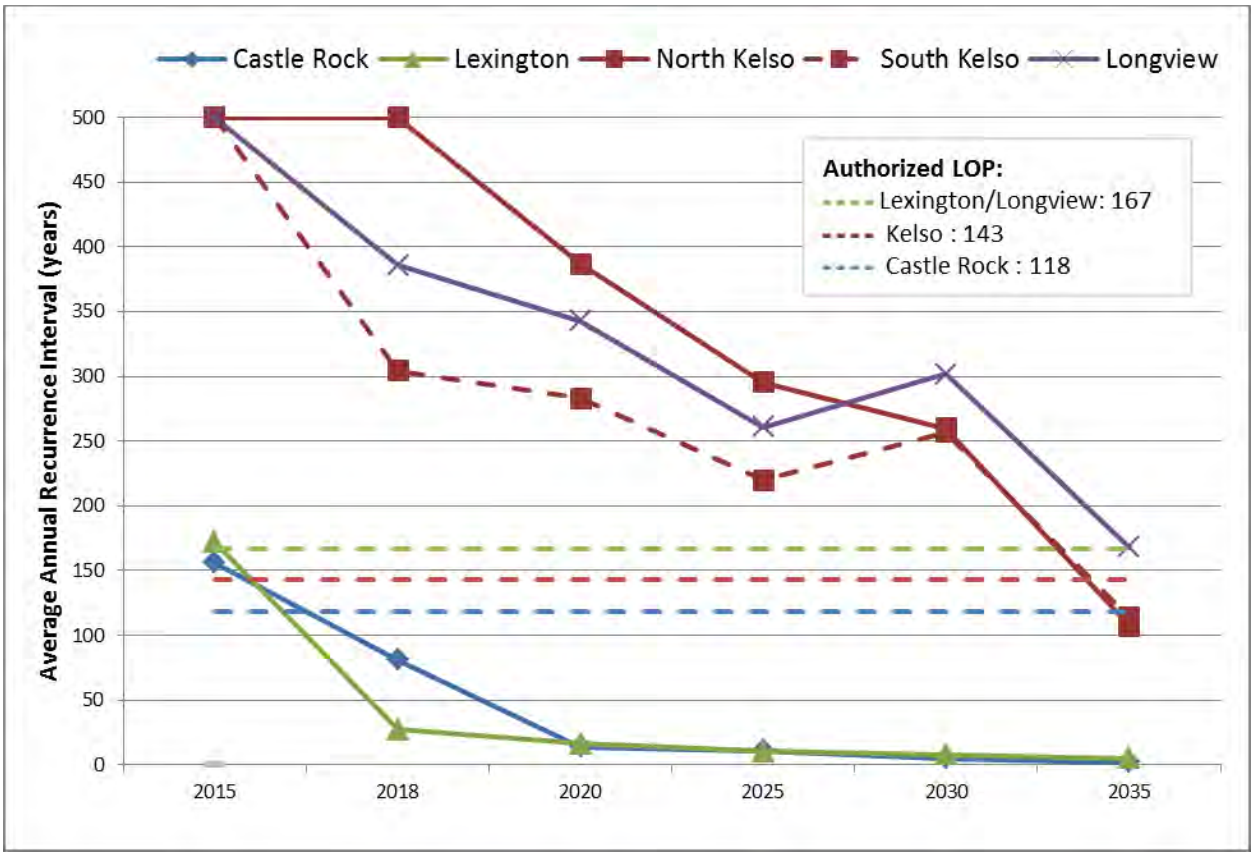

Figure ES 1.1-1. Lower Cowlitz River Levels of Protection over Time[3]

ES-1.2 Background and History

ES-1.2.1 Project Location

The project area encompasses about 1,200 square miles in southwest Washington, reaching north from the Columbia River to the headwaters of the NF Toutle River on the slopes of MSH (see Figure ES 1.2–1). The project area includes portions of Toutle River Basin, which drains the west slopes of the Cascade Range and flows into the Cowlitz River. The lower 20 miles of the Cowlitz River passes by the cities of Castle Rock, Lexington, Kelso, and Longview, Washington, before entering the Columbia River at Columbia RM 67.8. The project area also includes 1.26 river miles of the Columbia River extending from the downstream end of the Cowlitz River to the Columbia River Federal Navigation Channel.

[3] Predicted LOP are shown to allow evaluation of trends and are not intended to represent true LOP for corresponding years. LOP that are shown at 500-year represent an LOP that is at or above a 500-year LOP.

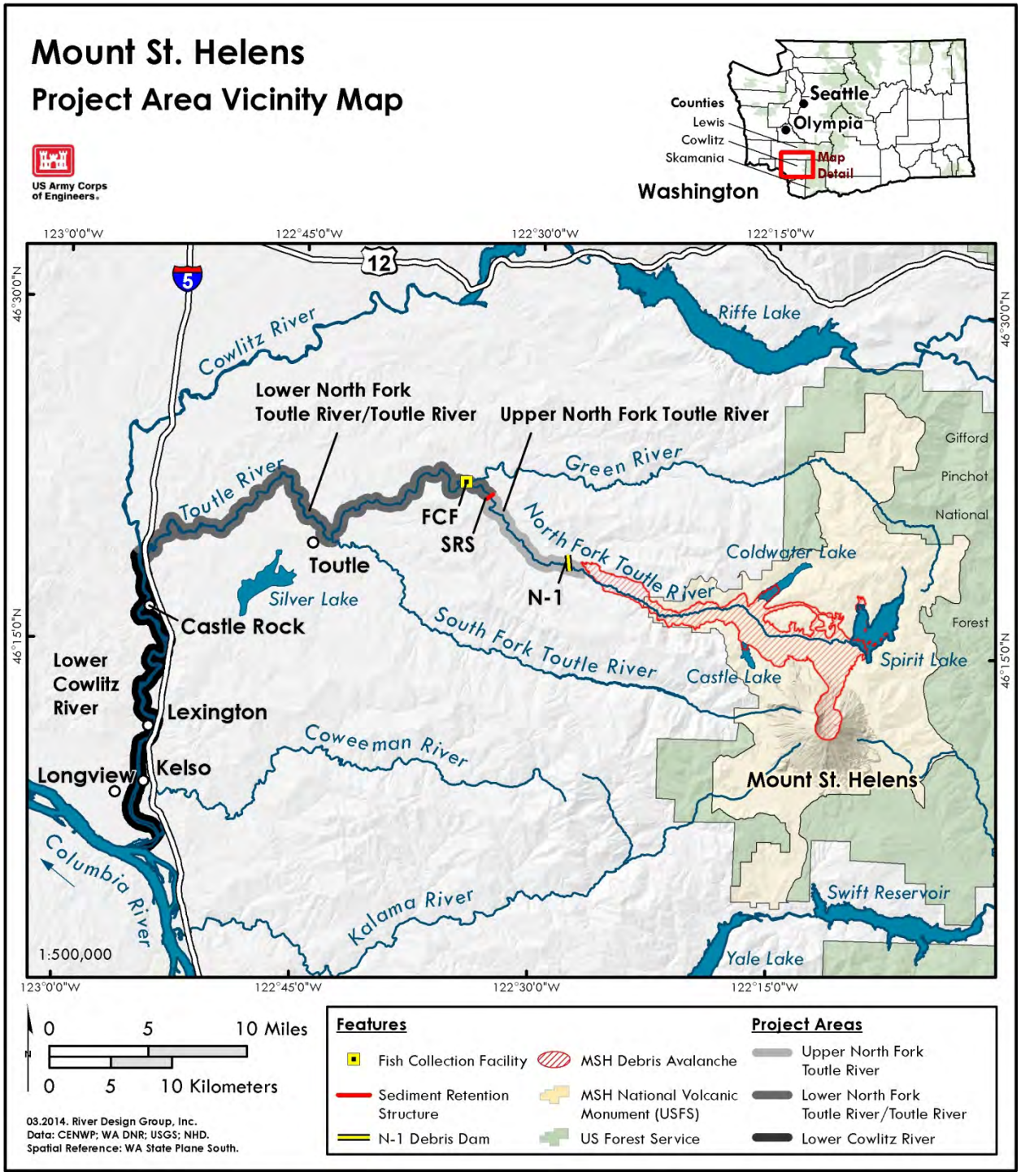

Figure ES 1.2–1. MSH and Vicinity

ES-1.2.2 History

ES-1.2.2.1 Eruption and Emergency Action

MSH erupted on May 18, 1980. The eruption and subsequent debris and mudflows produced a massive volume of sediment that flowed downhill and was deposited downstream in the lower Toutle, Cowlitz, and Columbia rivers. The rapid influx of sediment greatly reduced the channel capacities of the affected rivers. This left the communities of Castle Rock, Lexington, Kelso, and Longview, Washington with the potential for major flooding, even with normal runoff.

USACE immediately responded to the MSH eruption disaster with emergency levee improvements along the lower Cowlitz River to prevent flooding, and with dredging in the Columbia River to eliminate the threat to navigation. In 1980 and 1981, USACE also oversaw emergency channel dredging in the Cowlitz River and lower Toutle River to address sediment deposition. Other interim protection measures included the construction of two temporary dam-type structures constructed across the NF Toutle River (known as "N-1") and the South Fork Toutle River (known as "S-1") to reduce the volume of sediment delivered to the Cowlitz River. The N-1 structure was intended to be in service through 1985, but was breached by USACE in March 1982 to prevent uncontrolled failure of the structure. The S-1 structure was removed by USACE in November 1982 to facilitate fish passage.

ES-1.2.2.2 1985 Decision Document and Long Term Sediment Management

In 1983, Congress authorized interim protection measures for USACE to maintain at least 100-year flood-risk management levels along the Cowlitz River until an overall solution could be put in place. A long-term solution to manage sediment flowing downstream from the debris avalanche was the focus of multiple studies conducted and plans prepared by USACE from 1983 to 1985. The 1985 Long-Term Plan (USACE 1985a) was developed in conjunction with the 1984 Feasibility Report and EIS (USACE 1984), which evaluated alternatives and environmental consequences and meet USACE's requirement under NEPA. The Decision Document (USACE 1985b) served as the record of decision for the 1984 Feasibility Report and EIS. This process resulted in a plan to construct a single, large SRS on the NF Toutle River with implementation of as-needed dredging as the long-term solution to solve the sedimentation problem through the project-planning period ending in 2035 (USACE 1985b).

A central component of the adopted solution was the SRS, which was completed in 1989 and is located on the NF Toutle River, 2 miles upstream of the confluence with the Green River and 30.5 miles above the Toutle River's confluence with the Cowlitz River. The SRS features include a dam embankment, outlet works, and spillway. The SRS was intended to collect sediment behind the dam while passing water through the structure and was designed to function through three phases:

1. During Phase 1, all sediment, including sand and fine sediment such as clay and silt, would be trapped upstream of the SRS. As the sediment began to accumulate, water and fine sediment would cascade through a series of pipes while larger sand-sized sediment remained behind the SRS. As sediment built up over time, successive rows of pipes would be closed until the last row of pipes was closed.
2. Phase 2 of the SRS would begin when the last rows of outlet works pipes were buried by sediment and were subsequently closed. At this point all river flow would pass over the SRS

overflow spillway and the SRS is effectively a "run-of-the-river" project. During Phase 2, the sediment trapping efficiency of the SRS would decrease as more sediment passed over the SRS spillway, resulting in increased sediment deposition in the lower Cowlitz River.

3. Phase 3, as identified in the 1985 Decision Document, involved as-needed dredging in the lower Cowlitz River once the SRS became a "run-of-the-river" project. The 1985 Decision Document estimated the need to dredge approximately 27 mcy of sediment from the lower 20 miles of the Cowlitz River during Phase 3. The 1985 Decision Document assumed sufficient dredged material disposal site capacity along the dredged reaches of the Cowlitz River for this material. However, the document determined that a reassessment would need to be performed to determine the optimal method of managing flood risk. This SEIS serves as a component of the reassessment.

Phase 1 lasted 10 years (1989 through 1998) during which, the SRS trapped 8.8 mcy of sediment per year with a sediment trapping efficiency of approximately 92 percent. Phase 2 began in 1998 and as predicted, the sediment trapping efficiency of the SRS decreased to approximately 2.2 mcy per year being trapped behind the SRS and 4 mcy being released into the river downstream, a trapping efficiency of approximately 31 percent. As a result, since the beginning of Phase 2, more sediment has deposited in the lower Cowlitz River. Phase 2 continued through 2007 when emergency dredging measures were implemented in response to a downward trend in the LOP for the city of Longview (see Interim Sediment Management Activities, below).

With construction of the SRS, the 1986 SRS Design Memorandum (USACE 1986) established a monitoring program to determine sediment deposition upstream and the resulting downstream effects of the SRS. Downstream effects include determination if the authorized LOP is being maintained along the lower Cowlitz River. The monitoring program also provides the data required for planning and designing of additional remedial actions if necessary.

Other components of the sediment management strategy included:

- Spirit Lake outlet tunnel
- Levee improvements
- Base-plus dredging of lower Cowlitz River
- Construction of a fish collection facility (owned, operated, and maintained by Washington Department of Fish and Wildlife).
- McCorkle Creek pump station addition in Lexington, Washington.

ES-1.2.2.3 Interim Sediment Management Activities and Planning

The sediment trapping efficiency of the SRS had decreased from approximately 92 percent during Phase 1 to 31 percent during Phase 2. In response to heavy sedimentation on the lower Cowlitz River in 2007, USACE implemented several interim sediment management actions to address increased sedimentation in the lower Cowlitz River which threatened maintenance of the authorized LOP (Figure ES 1.1-1). Interim sediment management actions included:

- In 2007 to 2008, USACE dredged the lowest 5.7 miles of the Cowlitz River in response to bathymetric survey data indicating that sediment had accumulated sufficiently to impact the authorized LOP for Longview.

- In 2009, USACE constructed a cutoff wall to prevent further seepage damage to levees adjacent to the city of Castle Rock after an inspection revealed seepage concerns.
- In 2010, USACE also implemented a pilot project to test the constructability and performance of various Grade Building Structures (GBS) within the sediment plain upstream of the SRS.
- In 2012, USACE constructed an interim 7-foot raise of the SRS spillway crest (total elevation of 947 feet NGVD) to increase sediment trapping efficiency at the SRS in order to maintain Cowlitz River authorized LOP while the long-term planning efforts are conducted (USACE 2012a).

Meanwhile, USACE has re-evaluated implementation of Phase 3, as-needed dredging, as the optimal method of managing flood risk and maintaining the authorized LOP through 2035. This included reevaluation of sediment conditions and potential sediment management alternatives through the year 2035. As part of the reevaluation, USACE also implemented a pilot project to test the feasibility of constructing Grade Building Structures (GBS) within the sediment plain (USACE 2010b). The sediment plain refers to the broad area of sediment through which the NF Toutle River flows, upstream of the SRS. The intent of the GBS is to encourage sediment accumulation in the sediment plain well upstream of the SRS and minimize the sediment that reaches the SRS.

The process of sediment management plan reassessment has included the development of several plans and studies, including:

- 2010 *MSH Long-Term Sediment Management Plan for Flood Risk Reduction Progress Report* (2010 Progress Report; USACE 2010a);
- 2011 *Mount St. Helens Future Expected Deposition Scenario* (2011 Future Expected Deposition Scenario; USACE 2011a)
- 2012 *SRS Raise Final Environmental Assessment* (2012 SRS Raise EA; USACE 2012a)
- 2014 Draft LRR (USACE 2014a).

The analysis in this Draft SEIS builds on information from these baseline and planning documents. The SEIS will also be incorporated as an appendix into the Final LRR Decision Document. This SEIS will address the changes to the affected environment that have occurred since the original EIS was written and evaluate the potential environmental impacts of each of the proposed long-term sediment management alternatives.

ES-1.3 Project Area

The project area consists of the NF Toutle River from upstream of the SRS to the Cowlitz River, and the Cowlitz River to its confluence with the Columbia River (up to the Columbia River navigation channel). For the analysis purposes of this SEIS, the project area has been broken into the three assessment areas that are distinct with respect to sediment movement, and where proposed activities and potential environmental effects would occur. Figure ES 1.1-1 above illustrates the project area and the three assessment areas.

ES-1.4 Authority and Responsibility

The evaluation of alternative long-term sediment management plans in this SEIS is authorized by Congress under the Supplemental Appropriations Act of August 15, 1985 (PL 99-88). PL 99-88 authorized USACE to construct and operate a SRS near the confluence of the NF Toutle and Green rivers as well as to conduct dredging in both the Cowlitz and Toutle rivers through the year 2035. WRDA of 2000 (PL 106-541), re-authorized USACE to maintain flood-risk management for the Longview, Kelso, Lexington, and Castle Rock levees at no less than the levels specified in the October 1985 Decision Document. The State of Washington, as the non-federal sponsor of the MSH sediment management project, was delegated responsibility to provide real estate needs associated with project activities and to maintain dredged material disposal sites and mitigation. These cost-sharing requirements are outlined in the 1986 Local Cooperation Agreement between the Department of the Army, the State of Washington, and the Cowlitz County diking districts.

ES-1.5 Scoping and Public Involvement

The Notice of Intent to prepare this SEIS was published in the Federal Register on December 21, 2012. Public comments on the scope of the environmental analysis were received until April 6, 2013. USACE held two public scoping meetings in Kelso and Toutle, Washington in March 2013. Scoping comments received indicated that the public was generally concerned with fish and fish habitat, visual impacts, cultural resources, endangered species, wildlife and habitat (including elk and the MSH Wildlife Area managed by WDFW), flood-risk management, hydrology and water quality, placement of dredged sediments, effects analysis, alternatives, presentation of analysis results, and finances. In general, all alternatives received a similar level of public support. USACE reviewed and considered all these comments as part of determining the scope of the analysis presented in this SEIS. An increased focus was placed on inventory and analysis to resources identified during the scoping process.

The CEQ regulations implementing NEPA directs lead agencies to conduct NEPA analyses and prepare documentation in cooperation with agencies with jurisdiction by law or special expertise. USACE has coordinated extensively with WDFW during scoping and preparation of the SEIS, particularly regarding technical issues of fish and wildlife management.

In addition, a Technical Agency/Government Team (TAGT) was formed as a panel of representatives from regional agencies and governmental and tribal entities. USACE has coordinated with the TAGT as part of the development of the MSH sediment management plan and this SEIS. The key purpose of the TAGT is to provide a forum for information exchange in order to assist USACE and study sponsors in developing and implementing actions in the Toutle basin that will address sediment management concerns and potentially contribute to the restoration of the ecosystem.

USACE will review and consider all public comments submitted on this draft SEIS and incorporate them into the final SEIS.

ES-2 Alternatives

USACE is proposing three alternatives to maintain flood-risk management levels:

- Dredging Only Alternative: lower Cowlitz River dredging only, without additional raises of the MSH SRS or additional GBS;
- SRS Raise Alternative: one-time raise of the entire MSH SRS spillway by 43 feet to a total elevation of 990 feet NGVD29 and the SRS dam by 30 feet to a total elevation of 1030 NGVD29 without additional GBS or dredging;
- Phased Construction Alternative: two incremental raises of the MSH SRS spillway totaling 23 feet to a maximum elevation of 970 NGVD29, additional GBS construction, and lower Cowlitz River dredging as-needed.

In addition to these alternatives, USACE is evaluating the No Action Alternative, in which USACE would take no further direct actions to manage sediment and maintain established LOP.

ES-2.1 Alternatives Development Process

USACE developed the SEIS alternatives through a multi-step process to identify, screen, and refine a broad range of potential measures capable of addressing identified sediment issues. Measures are actions that could address (partially or completely) the sediment accumulation in the lower Cowlitz River that affects LOP; ultimately alternatives could be formulated from one or more measures. The goal of the screening and refinement process was to identify the range of reasonable alternatives advanced for comparative analysis in the Draft SEIS. In some cases, screened measures were combined and moved forward for further analysis as part of a single alternative. The alternatives development process is described in detail in the 2010 Progress Report (USACE 2010a) and is summarized below.

The first step of alternative development involved a review of existing information, field visits, and a measures brainstorming workshop, which yielded 16 sediment management measures that were selected for further evaluation. Measures were actions that could potentially contribute to meeting sediment management goals. These measures were screened using criteria based on engineering feasibility and effectiveness, cost, adaptability, and environmental factors. Following the initial screening, USACE developed conceptual designs and cost estimates for the remaining measures and conducted limited hydrologic, hydraulic, and sediment transport modeling. USACE then conducted a secondary screening of the remaining measures using the same factors as in the initial screening. Following the initial and secondary screening, USACE determined that 10 of the 16 measures did not meet one or more of the screening criteria and removed those measures from further analysis. The measures and reasons for dismissal are presented in Table ES 2.1-1, below.

Table ES 2.1-1. Potential Measures Considered but Dismissed

Measure	Factor(s) Considered In Dismissal
Debris avalanche stabilization	• Would not meet the project purpose and need as available measures would not address the channel erosion upstream of the N-1 structure
Construction of a sediment dam at Elk Rock near the toe of the debris avalanche	• Not cost effective -- raising the SRS could accomplish the same amount of sediment storage for less cost
Sediment plain sump (excavation and removal of sediment upstream of SRS)	• Not cost effective -- high cost (>$160 M over 8 years) and limited sediment storage capacity relative to other available measures
Raised SRS spillway	• Would not meet the project purpose and need through the project planning period (2035).
Stabilization of Toutle River, SF Toutle River and NF Toutle River banks (LT-1 bank stabilization)	• Would not meet the project purpose and need as banks downstream of the SRS are a relatively small sediment source relative to debris avalanche (10 percent vs. 80 percent) • Not cost effective due to the cost of bank stabilization ($38 to $76 M) relative to small potential for sediment reduction.
Expansion of the floodplain on the Toutle River	• Would not meet the project purpose and need as limited areas available for floodplain expansion would be small and have limited capacity to store flood water and sediment
Cowlitz River levee improvements	• Is not reliable or acceptable to the public as levee improvement has the potential to increase flooding in non-leveed areas if river conveyance is not maintained • Not cost effective as raising levees would require modification to several bridge crossings
Expansion of the floodplain on the Cowlitz River	• Would not meet the project purpose and need as it would have limited ability to reduce flood stages in the LOP range from Longview and Kelso levees. • Not cost effective based on very high cost ($2 billion) relative to other measures investigated
Horseshoe Bend sump or cutoff	• Would not meet the project purpose and need as the effects of cutting off Horseshoe Bend on sediment transport and flood risk determined to be minor • Is not cost effective as creation of a sump or cutting off the bend would require acquisition of developed land on the existing point bar. Furthermore, limited space along the point bar would require removal and off-site disposal of dredge material after only a few years of operation • Is not reliable as short-in water work period would limit sump use and efficiency
Reconnect old channel near mouth of Cowlitz River	• Is not cost effective due to the presence of significant industrial and commercial sites and infrastructure within the proposed re-alignment • Would not minimize impacts to the environment due to the potential for exposing contaminants in area during excavation

Source: USACE 2010

The six measures remaining following the initial and secondary screenings were then identified as either primary measures, in other words, measures that have the potential to be employed as stand-alone measures to meet the project purpose and need, or secondary measures, for example, measures that may be used to enhance the performance of the primary measures. Primary measures identified included:

- Raise SRS dam and spillway and
- Cowlitz River dredging.

Secondary measures identified include:

- Construction of GBS on the sediment plain;
- LT-1 sump bank stabilization;
- Modified operation of Mossyrock Dam to generate sediment flushing flows; and
- Construction of dikes at mouth of Cowlitz River.

Both primary and secondary measures were then further analyzed, both alone, and, for the secondary measures, combined with a primary measure to allow measure comparisons for preliminary alternatives. The main criteria used to further evaluate the preliminary alternatives included:

- Flood Risk: The measure demonstrates a reasonable assurance of maintaining the congressionally authorized LOP and not increasing flood risk elsewhere (i.e., the measure(s) would meet the project Purpose and Need).
- Cost: The cost of the measure is evaluated using a least-cost analysis.
- Environmental Impact: Each measure's impact on the environment is considered in the decision-making process.

The 2011 Future Expected Deposition Scenario (USACE 2011a) report and Toutle/Cowlitz River Sediment Budget (The Biedenharn Group 2010) were used to assist in the design development and performance evaluation of the preliminary alternatives through hydraulic and sediment modeling. In addition, cost estimates were prepared for each preliminary alternative.

During the formulation of alternatives from the remaining six primary and secondary measures, an additional three secondary measures – LT-1 sump bank stabilization, modified operation of Mossyrock Dam, and construction of dikes at the mouth of the Cowlitz River - were eliminated from further consideration for reasons related to flood risk management.

Based on this evaluation, the remaining three measures (two primary and one secondary) were grouped to form three action alternatives carried forward for further evaluation in this Draft SEIS–Dredging Only Alternative, SRS Raise Alternative, and the Phased Construction (spillway raise at the SRS with implementation of GBS as a secondary measure and as needed dredging) Alternative. These alternatives, as well as the No Action Alternative, are described below

ES-2.2 No Action Alternative

Under the No Action Alterative, USACE would take no further action to manage sediment in the Toutle/Cowlitz River system. No changes to the SRS would be made and no dredging in the lower Cowlitz River would be undertaken to manage LOP for the lower Cowlitz River communities. In the No Action scenario, the total deposition in the lower Cowlitz River between the Toutle River and the Columbia River is estimated to be about 30 mcy (37.7 MTons), through the year 2035 (USACE 2014). Under the No Action scenario, and in the absence of any non-USACE actions to manage flood risk, LOP for Castle Rock, Lexington, Kelso, and Longview would decline, with Castle Rock and Lexington dropping below the authorized LOP by 2018 and Kelso and Longview LOP dropping to at or below the authorized LOP by 2035.

ES-2.3 Dredging Only Alternative

The Dredging Only Alternative would rely solely on dredging to address sediment accumulation in the lower Cowlitz River and manage LOP to maintain authorized levels. Components of this alternative would be: dredging, dredged material placement and storage, and monitoring.

USACE identified locations and quantities of dredging that would be needed to maintain LOPs in the lower Cowlitz River. USACE estimates that 27 mcy would need to be dredged in the lower 20 miles of the Cowlitz River through 2035. Due to the large estimated amounts of sediment that would need to be dredged on a regular basis under this alternative, USACE determined that conducting all dredging within the one-month in-water work window (currently recommended by WDFW) would not be feasible. The Dredging Only Alternative therefore assumes USACE would work with WDFW to obtain an extended in-water work window of three months with mitigation for working outside of the preferred in-water work window. The alternative assumes that dredging activities would be conducted by two to three hydraulic dredges operating at various reaches of the lower Cowlitz River every 1 to 2 years. Dredging activity could occur annually within the lower Cowlitz River; however, a given reach may only be dredged once every 3 years.

USACE screened multiple candidate sites for dredged material placement and storage and identified 10 dredged material storage sites for further consideration based on their proximity to the Cowlitz River, existing land use, size, potential capacity, and ability to accept hydraulically dredged material. All potential dredge material storage sites are located on the Cowlitz River between Castle Rock and the Cowlitz River confluence with the Columbia River. The sites identified have been previously used for dredged material storage and would maintain a minimum of a 200-foot setback from the ordinary high water threshold of the river. In accordance with the 1986 cost-sharing agreement between the Department of the Army and the State of Washington, it is the responsibility of the sponsor (Cowlitz County) to acquire the property to dispose of dredge material removed from both the Cowlitz River and Toutle River systems associated with maintaining the required levels of flood-risk management.

Prior to selection and development of any dredged material placement site, USACE would conduct a site-specific environmental evaluation, including NEPA review and documentation and compliance with applicable environmental laws and regulations.

USACE would conduct an annual hydro survey of the lower Cowlitz River to determine extent of sediment accumulation and the amount requiring removal. The need for and extent of dredging would be directly related to the extent of sediment in the dredge prism, and the frequency and amount of dredging

would be adjusted to address the rate of sediment accumulation. In this way the alternative would be adaptable to future sedimentation trends, but would also rely solely on dredging to maintain LOP.

ES-2.4 SRS Raise Alternative

This alternative involves raising the SRS as the primary sediment management measure. The alternative would raise the SRS spillway by 43 feet and would raise the top of the SRS dam by 30 feet to elevation. The alternative would also involve the construction of new outlet works consisting of four rows with eight 4-foot diameter pipes in each row (32 pipes total), allowing the modified SRS to function as it did during Phase 1 of the 1985 Long-Term Plan with an overall sediment trapping efficiency of 80 percent. Construction of this alternative would take about 2 years.

Following construction, the SRS would function as it did during Phase 1 of the 1985 Long-Term Plan (USACE 1985a; see Section ES-1.2.2) with the creation of a pool of water extending upstream of the SRS as the downstream movement of water is slowed by the SRS dam, spillway, and outlet works structures. The depth of the ponded water behind the SRS at the outlet works would vary over time and seasonally, according to winter storm runoff or snowmelt. Immediately following construction, the SRS would create a 20-foot deep pool (as measured at the outlet works) extending approximately 2.6 miles upstream from the SRS. Ponding depth is a driving force of trapping efficiency with more sediment being trapped when conditions create deeper ponding depths. As sediment accumulates, water and fine sediment would pass through the outlet works while larger sand-sized sediment would remain trapped behind the SRS. As sediment settles, the depth at the outlet works would decrease to between 10 and 15 feet and the ponded area would slowly decrease. This is predicted to occur in the first year following construction, and would be repeated as each set of outlet pipes is activated and then closed as sediment accumulates.

The SRS would return to being a "run-of-the-river" project less than 17 years following construction. At that time, ponding conditions would be similar to those currently observed with seasonal ponds of approximately 5 feet depth. After the modified SRS becomes a run-of-the-river again, the sediment load of the Toutle and Cowlitz rivers downstream on the SRS is likely to increase and the trend in LOP would once again begin to decline. While the 43-foot SRS raise is designed to maintain the authorized LOP through the project design year of 2035, future action may be necessary to maintain LOP past 2035. Any future action would require a new authorization and a new study and is not considered as part of this alternative or Draft SEIS. While the raised SRS would trap most of the sediment originating from the debris avalanche, some sediment would pass and deposit in the lower Cowlitz and Columbia rivers.

The sediment loading condition from the debris avalanche, however, is a major source of uncertainty. While recent studies suggest that sediment delivery might abate over time, sediment delivery is highly variable based on precipitation patterns. Climate change modeling suggests precipitation increasingly will come from rain instead of snow and result in flashier flows and elevated sediment delivery. Essentially, more rain-driven sediment transport could offset sediment reductions related to vegetation recovery in the avalanche area. Because the SRS raise would be based on the best current data and analysis (and associated set of assumptions), it should function as designed. However, the 43-foot SRS raise would provide a fixed solution, and there would be little ability to adapt to changes in sediment loading conditions.

ES-2.5 Phased Construction Alternative (Preferred Alternative)

The Phased Construction Alternative involves up to two incremental raises of the SRS spillway crest elevation (totaling up to 23 feet to a total elevation of 970 feet NGVD29) without raising the top of dam elevation, constructing GBS in the sediment plain upstream of the SRS, and as-needed dredging in the lower Cowlitz River. Each phase of this alternative would be implemented only if and when needed. To determine whether a next phase would need to be constructed, USACE would monitor hydrologic and sediment conditions in both the sediment plain and the lower Cowlitz River and decide whether conditions trigger the need for action. The three phases of the Phased Construction Alternative are sequential and are listed below in order of implementation:

- Phase 1: First SRS spillway crest raise
- Phase 2: Second/final SRS spillway crest raise
- Phase 3: Grade building structures

The decision to implement Phase 1, Phase 2 and/or Phase 3, would be made by USACE and be based on the results of the LOP monitoring in the lower Cowlitz River that involves analysis of both water and sediment movement ranging from the MSH debris avalanche through the sediment plain and downstream to the lower Cowlitz River. Every year USACE estimates whether the LOP is being met for leveed areas in Castle Rock, Lexington, Kelso, and Longview. If the LOP authorization is not being met then a further evaluation would be made as to the expected near-term trend in LOP. For example, if LOP drops below authorized levels and a spillway crest raise (e.g., Phase 1 or Phase 2) had been constructed immediately prior to the drop in LOP, then there is reason to believe that the LOP would recover without additional action. Then, USACE would have 1 or 2 years to observe whether the LOP trends up towards being met before initiating the next phase of construction. However, if there is no reason to believe that the LOP trend could recover naturally, either because the volume of sediment deposited in the lower Cowlitz River was unusually large or several years have passed since the last spillway crest raise, then action would be necessary and the next available phase would be implemented (e.g., second/final spillway crest raise or GBS construction).

The incremental SRS spillway crest raises would include constructing a concrete structure directly on top of the existing spillway crest. For the two possible raises, the SRS spillway crest can be raised a total of 23 feet. However, the two raises would not be required to split the available height (i.e., raise 1 could increase the spillway height by 13 feet and raise 2 could then increase the spillway height by additional 10 feet). Both spillway crest raises would include a low flow channel to maintain downstream fish passage conditions and transport of fine sediment through the spillway crest. This design does not preclude the potential for future volitional upstream fish passage in the future because the current slope of 7 percent would be maintained.[4] The timing of the incremental raises would be determined based on monitoring of sediment conditions behind the SRS, sediment conditions in the Cowlitz River, and the budgeting cycle for funding.

[4] Upstream volitional fish passage is currently blocked downstream of the SRS by the barrier dam at the FCF, as well as the headcut at the base of the spillway channel. Future modification of the spillway (resting pools and elimination of dead end channels) would be required to facilitate fish passage through the spillway channel.

After implementation of the Phase 1 and 2 spillway crest raises, Phase 3- construction of GBS in the sediment plain to facilitate additional storage of sediment further upstream of the SRS - would be implemented. The GBS would be constructed in the sediment plain and extending into the valley walls. The openings between the GBS and the valley walls would be at existing grade at the time of construction and would be protected from scour. During high flow events, temporary pools would form upstream of the GBS allowing sediment to settle out, retaining sediments within the sediment plain upstream of the SRS.

If very large sediment delivery events do occur, the existing sediment retention measures in place may be insufficient, and problematic sediment deposition may occur in the lower Cowlitz River. USACE would then conduct dredging in the lower Cowlitz River as needed to maintain LOP. USACE would implement the same basic process to determine the locations and quantities of dredging and the placement and storage of dredged material, but on a much smaller scale than would be needed for the Dredging Only Alternative.

The Phased Construction Alternative is adaptive in that the measures—two incremental spillway raises and GBS—would be built incrementally and as needed. The decision to build each increment would be based on sediment infilling conditions behind the SRS, sediment conditions in the lower Cowlitz River, and the budgeting cycle for funding. Using these incremental steps would avoid overbuilding a long-term sediment management plan.

ES-2.6 Action Alternatives Cost Comparison

USACE has identified the Phased Construction Alternative as its preferred alternative. This alternative involves the following components: incremental SRS spillway raises to 23 feet; GBS in the sediment plain; and dredging in the lower Cowlitz and Columbia rivers.

As compared to the other sediment management plan alternatives—the Dredging Only and SRS Raise alternatives—the preferred alternative would have the lowest degree of adverse impacts to the environment. Nevertheless, it is expected that some environmental mitigation, including fish, wildlife, and wetland monitoring and potentially mitigation, would be required because of impacts to tributaries above the SRS and the potential for dredging in the lower Cowlitz River. The Phased Construction Alternative would have the lowest overall cost, both in terms of present value and average annual cost. Table ES 2.6-1 presents a comparison of the action alternatives.

Table ES 2.6-1. Action Alternative Comparison

Alternative	Relative Cost	Environmental Issues	Adaptable to Changing Conditions
Dredging Only	• Total cost ~ $595 million • Average annual cost ~$45 million	• Short in-water work window • Fish habitat • Dredged material disposal sites	Yes (dredge as needed)
SRS Raise	• Total cost ~ $269 million • Average annual cost ~ $21 million	• Large area (upstream of SRS) affected • Eliminates potential upstream fish passage • Potential tributary cutoff	No
Phased Construction	• Total cost ~ $192 million • Average annual cost ~ $16 million	• Potential for upstream fish passage • Effects upstream of SRS and in lower Cowlitz less than other two action alternatives.	Yes

Costs in present value, average annual cost over 18 year planning horizon.

ES-3 Affected Environment Summary

ES-3.1 Water Resources

Water resources include groundwater, surface water, sediment, water quality, water use and wetlands. Water resources in the NF Toutle River have been and continue to be affected by the 1980 eruption MSH and subsequent events and actions, including sediment management measures taken, like construction of the SRS. The NF Toutle River has formed a braided and dynamic channel through the sediment plain upstream of the SRS. Sediment from the NF Toutle River basin is transported downstream and some of it deposits in the lower Cowlitz River, which includes levees to reduce flood risk in adjacent land areas.

ES-3.2 Vegetation Communities

The project area includes a variety of vegetative communities including forest, shrub, wetland, agriculture. Much of the sediment plain upstream of the SRS is unvegetated. WDFW has identified old growth forest stands in areas adjacent to the Upper NF Toutle River, which are primarily forested. Timber harvest has occurred in forest areas throughout the project area.

ES-3.3 Wildlife

Many species of wildlife inhabit the area and surrounding forest including elk, deer, black bears, cougars, eagles, waterfowl, and small mammals. The Upper NF Toutle River area includes part of the MSH Wildlife Area, which is managed by WDFW. The Upper and Lower NF Toutle River are within the range of the MSH elk herd, which is primarily composed of Roosevelt elk. The MSH Wildlife Area supports approximately 100 resident and more than 600 migratory elk. The project area also supports a variety of other mammals, birds, amphibians, and reptiles.

ES-3.4 Fish

Many of the anadromous species found in the project area are keystone species that provide an important link between aquatic and terrestrial ecological systems. Endangered Species Act (ESA)-listed fish species of interest to the MSH project include species that migrate through the lower Cowlitz River to access tributaries in the Cowlitz River Subbasin, including the upper Cowlitz River, Toutle River drainage, and the Coweeman River drainage. Fish migrating in the Columbia River in the vicinity of the Cowlitz River could also be potentially affected by project alternatives. Anadromous salmonid species of interest include Chinook salmon, chum salmon, coho salmon, and steelhead. Other species of interest in the lower Cowlitz River Subbasin include coastal cutthroat trout, Pacific lamprey, green and white sturgeon, and Pacific eulachon.

Streams in the MSH project area continue to exhibit the effects of the 1980 MSH eruption that substantially altered the Toutle River drainage. Prior to the eruption of MSH, the watersheds draining the volcanic mountain were said to be some of the most productive for anadromous salmonids in southern Washington. The NF Toutle River was one of these productive river systems and historically supported anadromous populations of fall Chinook salmon, coho salmon, chum salmon, winter steelhead, coastal

cutthroat trout, and Pacific lamprey. Continued erosion and transport of sediment from the MSH debris avalanche has resulted in dynamic habitat conditions for fish.

The SRS nearly completely blocks volitional upstream fish passage to as many as 50 miles of upstream habitat for anadromous fish. The spillway to the SRS, an excavated bedrock channel located to the north of the SRS dam embankment, has a 7 percent gradient, and a 6-foot vertical drop at the downstream end of the spillway. The SRS spillway provides volitional downstream passage for fish outmigrating from the Upper NF Toutle River drainage. A barrier dam and fish collection facility, constructed by USACE in 1989 and owned and operated by WDFW since 1993, is located 1.3 miles downstream of the SRS. Coho salmon, winter steelhead, and coastal cutthroat trout are trapped, hauled, and released at outplant sites on Alder Creek and Hoffstadt/Bear Creek upstream from the SRS.

ES-3.5 Threatened and Endangered Species

Thirteen listed Columbia River salmon Evolutionarily Significant Units (ESU) or steelhead Distinct Population Segments (DPS), plus three additional listed anadromous fish species, complete part of their lifecycle within the project area. Designated critical habitat for these species is also present within the project area. ESA-listed wildlife species potentially present within the project area include multiple bird and mammal species and one amphibian. There is one listed plant species and two species of concern that may occur within the project area.

ES-3.6 Potentially-Affected Groups and Individuals

The project area is located within Cowlitz County, Washington, and includes parts of the cities of Kelso, Longview, and Castle Rock, as well as unincorporated areas of the county. Potentially-affected groups and individuals include residents, landowners, including private interests and government agencies, and the Cowlitz Indian Tribe. The Cowlitz Tribe has indicated its interest in issues regarding fish, and natural and cultural resources with respect to sediment management. The Toutle Basin has historically been very important to the people of the Cowlitz Tribe, as exemplified in their active participation in efforts to recover salmon and steelhead populations in southwest Washington.

ES-3.7 Socio-economics

As noted above, the project area is located in Cowlitz County, which has a population of about 103,000. Leveed areas along the lower Cowlitz River include portions of Longview, Kelso, Lexington, and Castle Rock, and have a population of about 50,000. Property in leveed areas is valued at about $3.65 billion.

American Community Survey (ACS) data from the U.S. Census Bureau indicates potential for high-low income populations in the project area (ACS 2012) relative to the broader community represented by Cowlitz County. Low income populations within the project area may use natural resources within the project area to subsist. Subsistence activities may include fishing, hunting, and timber collection.

ES-3.8 Environmental Justice

ACS data indicates potential for high-minority and low-income populations in the project area (ACS 2012) relative to the broader community represented by Cowlitz County. The tracts with the highest low-income and minority percentages are located along the lower Cowlitz River in the urbanized

Longview/Kelso area. In addition, the project area includes traditional territory of the Cowlitz Tribe. Members of the Tribe subsist on natural resources within the project area and several resources, including steelhead and coho salmon, are essential cultural resources for the Cowlitz Tribe. Low income populations within the project area may use natural resources within the project area to subsist. Subsistence activities may include fishing, hunting, and timber collection.

ES-3.9 Cultural Resources

The SRS structure is considered eligible for listing in the National Register of Historic Places (NRHP). In addition, an archaeological survey conducted in 2013 identified three archaeological resources that are considered eligible for listing in the NRHP.

ES-4 Comparison of Impacts and Alternatives

Table ES 4.1-1 presents a summary of the anticipated environmental effects of each alternative.

Table ES 4.1-1 Summary of Environmental Consequences by Alternative

Resource	No Action Alternative	Dredging Only Alternative	SRS Raise Alternative	Phased Construction Alternative
Water Resources	• Impacts are consistent with level of effect identified in the 1984 Feasibility Report and EIS and the 2012 SRS Raise EA. Impacts include major adverse effects on groundwater, surface water, and sediment transport in Upper NF Toutle River areas, negligible effect on water resources in Lower NF Toutle/Toutle River area, and negligible effects on water quality and water use. • Moderate to major adverse effects on groundwater, surface water and sediment transport in the lower Cowlitz River areas resulting in a decline in LOP. • Moderate adverse effect on wetlands in Upper NF Toutle River from sediment deposition. Partial to full regeneration is anticipated for impacted wetlands due to a gradual rate of deposition. • Moderate beneficial effect on wetlands in lower Cowlitz River area as the river engages with the floodplain.	• No change in effects to water resources including wetlands in the Upper NF Toutle River area and the Lower NF Toutle/Toutle River areas relative to the No Action Alternative. • Minor to major beneficial effects on groundwater, surface water, and sediment transport in lower Cowlitz River area. • Minor adverse effect on water quality and water use in the lower Cowlitz River area. • Potential moderate adverse effect on wetlands in the lower Cowlitz River depending on the location of dredge material disposal. Mitigation would be implemented as-needed.	• Major adverse effects to groundwater, surface water, and sediment transport in Upper NF Toutle River area; negligible to minor beneficial effects on groundwater, surface water and sediment transport in Lower NF Toutle/Toutle, and minor to major beneficial effects on groundwater, surface water, and sediment transport in the lower Cowlitz River. • Negligible to minor beneficial effect on water quality and water use. • Major adverse effect on wetlands in Upper NF Toutle River area. Impacts within the post-construction water-impoundment zone are expected to be permanent and mitigation would be implemented. Partial to full regeneration is anticipated for wetlands impacted by gradual sediment deposition. Mitigation for these impacts would be implemented as-needed.	• Major adverse effect on groundwater, surface water and sediment transport in Upper NF Toutle River area; negligible to major beneficial effect on ground water, surface water, and sediment transport in Lower NF Toutle/Toutle River and lower Cowlitz River areas. • Negligible to minor beneficial effects on water quality and water use in Upper NF Toutle and Lower NF Toutle/Toutle River; minor adverse effect on water quality in lower Cowlitz River. • Major to moderate adverse effect on wetlands in Upper NF Toutle River area. Impacts within the post-construction water-impoundment zone are expected to be permanent and mitigation would be implemented. Partial to full regeneration is anticipated for wetlands impacted by gradual sediment deposition. Mitigation for these impacts would be implemented as-needed. • Potential moderate adverse effect to wetlands in the lower Cowlitz River areas depending on the location of dredge material disposal. Mitigation would be implemented as-needed.

Resource	No Action Alternative	Dredging Only Alternative	SRS Raise Alternative	Phased Construction Alternative
Vegetation Communities	• Impacts are consistent with level of effect identified in the 1984 Feasibility Report and EIS and 2012 SRS Raise EA including moderate to major adverse effects to vegetation communities in Upper NF Toutle River area. • Major adverse effect on one old growth forest stand. • Moderate beneficial effects in lower Cowlitz area from expansion of wetlands as the river engages with the floodplain.	• No change in effects to vegetation communities, including old growth forests, in the Upper NF Toutle River area and the Lower NF Toutle/Toutle River areas relative to the No Action Alternative. • Negligible to major adverse effect on vegetation communities in lower Cowlitz River area depending on location of dredge material disposal. Mitigation would be implemented as needed.	• Major adverse effect to vegetation communities in Upper NF Toutle River area. • Major adverse effect on two old growth forest stands. No mitigation is proposed. • Negligible to beneficial effect in Lower NF Toutle/Toutle River and lower Cowlitz River areas.	• Major adverse effect to vegetation communities in Upper NF Toutle River area. See Chapter 5 for mitigation discussion. • Major adverse effect on one old growth forest stand. No mitigation is proposed. • Negligible to major adverse effect in lower Cowlitz River area depending on location of dredge material disposal. Mitigation would be implemented as needed.
Wildlife	• Impacts are consistent with level of effect identified in the 1984 Feasibility Report and EIS and 2012 SRS Raise EA including minor to moderate adverse effects on wildlife habitat and a negligible effect on bird habitat in the Upper NF Toutle River area due to gradual sediment deposition. Habitat is expected to regenerate. • Minor beneficial effect on birds and bird habitat in lower Cowlitz River area from expansion of wetlands as the river engages with the floodplain.	• No change in effects to wildlife or wildlife habitat in the Upper NF Toutle River area and the Lower NF Toutle/Toutle River areas relative to the No Action Alternative. • Minor adverse effect to wildlife and birds habitat in the lower Cowlitz River area due to dredge material disposal.	• Minor to moderate adverse effect on bird and wildlife habitat in the Upper NF Toutle River area. Impacts within the post-construction water-impoundment zone are expected to be permanent and mitigation would be implemented. Partial to full regeneration is anticipated for habitat impacted by gradual sediment deposition. Mitigation for these impacts would be implemented as-needed. • No effects to bird or wildlife habitat in the Lower NF Toutle/Toutle River or the lower Cowlitz River areas.	• Minor to moderate adverse effect on wildlife habitat in the Upper NF Toutle River area. Impacts within the post-construction water-impoundment zone are expected to be permanent and mitigation would be implemented. Partial to full regeneration is anticipated for habitat impacted by gradual sediment deposition. Mitigation for these impacts would be implemented as-needed. • Minor adverse effect to bird and wildlife habitat in the lower Cowlitz River area due to dredge material disposal. No mitigation is proposed.

Resource	No Action Alternative	Dredging Only Alternative	SRS Raise Alternative	Phased Construction Alternative
Fish	• Impacts are consistent with level of effect identified in the 1984 Feasibility Report and EIS and 2012 SRS Raise EA including minor adverse effect on fish in Upper NF Toutle River area due to gradual sediment deposition. • Negligible effects on fish in the Lower NF Toutle River/Toutle River and lower Cowlitz River areas.	• No change in effects to fish or fish habitat in the Upper NF Toutle River area and the Lower NF Toutle/Toutle River areas relative to the No Action Alternative. • Negligible effects on fish in the Lower NF Toutle River/Toutle River. • Minor adverse effect on fish due to dredging in lower Cowlitz River.	• Major adverse effect on fish in Upper NF Toutle River area due to SRS raise-related sediment deposition in fish habitat and long-term increased water temperature impacts to fish habitat from the post-construction water impoundment. Mitigation would be implemented. • Negligible effects on fish in the Lower NF Toutle River/Toutle River and lower Cowlitz River areas.	• Major adverse effect on fish in Upper NF Toutle River area due to SRS raise-related sediment deposition in fish habitat and short-term increased water temperature impacts to fish habitat from the post-construction water impoundment. Mitigation would be implemented. • Negligible effects on fish in the Lower NF Toutle River/Toutle River. • Minor adverse effect on fish due to dredging in lower Cowlitz River.
Threatened and Endangered Species	• Minor adverse effect on listed fish in Upper NF Toutle River area due to gradual sediment deposition. Negligible effects on fish in the Lower NF Toutle River/Toutle River area. • No effect on listed wildlife. • No effect on listed plants.	• No change in effects to ESA-listed fish or fish habitat in the Upper NF Toutle River and Lower NF Toutle River/Toutle River areas relative to the No Action Alternative. • Minor to moderate adverse effect on ESA-listed fish in lower Cowlitz River due to dredging, including adverse effects on Pacific eulachon due to species presence overlap with the extended three month in-water work window. • Negligible effects on listed wildlife (streaked horned lark) in the lower Cowlitz River area. • No effect on listed plants.	• Major adverse effect on listed fish in NF Toutle River area due to SRS raise-related sediment deposition in fish habitat, including critical habitat, and long-term increased water temperature impacts to fish habitat from the post-construction water impoundment. Mitigation would be implemented. • No effect on listed wildlife. • No effect on listed plants.	• Major adverse effect on listed fish in NF Toutle river area due to SRS raise-related sediment deposition in fish habitat, including critical habitat, and short-term increased water temperature impacts to fish habitat from the post-construction water impoundment. Mitigation would be implemented. • Negligible effects on listed wildlife (streaked horned lark) in the lower Cowlitz River area. • No effect on listed plants.

Resource	No Action Alternative	Dredging Only Alternative	SRS Raise Alternative	Phased Construction Alternative
Potentially-Affected Groups and Individuals	• Minor adverse and beneficial effects.	• Minor adverse and beneficial effects.	• Minor adverse and beneficial effects.	• Minor adverse and beneficial effects.
Socio-Economics	• Major adverse effect on leveed –area populations and structures due to decline in LOP. • No impact on demographics or recreation.	• Minor adverse impact on recreation. • No impact on leveed –area populations and structures or demographics.	• Minor adverse impact on recreation. • No impact on leveed –area populations and structures or demographics.	• Minor adverse impact on recreation. • No impact on leveed –area populations and structures or demographics.
Environmental Justice	• No disproportionate effect on low-income, minority, or subsistence populations.	• No change in impacts relative to the No Action Alternative.	• No change in impacts relative to the No Action Alternative.	• No change in impacts relative to the No Action Alternative.
Cultural Resources	TBD	TBD	TBD	TBD
Climate and Climate Change	• Not expected to affect climate change impacts on resources. • Future conditions would be subject to climate change effects.	• No change in climate change impacts on resources relative to the No Action Alternative. • Future conditions would be subject to climate change effects.	• No change in climate change impacts on resources relative to the No Action Alternative. • Future conditions would be subject to climate change effects.	• No change in climate change impacts on resources relative to the No Action Alternative. • Future conditions would be subject to climate change effects.
Cumulative Effects	• Would not change cumulative effects of past, present, and reasonably foreseeable future actions on studied resources.	• Would not change cumulative effects of past, present, and reasonably foreseeable future actions on studied resources.	• Would not change cumulative effects of past, present, and reasonably foreseeable future actions on studied resources.	• Would not change cumulative effects of past, present, and reasonably foreseeable future actions on studied resources.

ES-5 Proposed Mitigation Measures

USACE is proposing mitigation measures to address the adverse effects to resources that have been identified for the alternatives. USACE would develop mitigation plans, in coordination with WDFW and applicable resource agencies, as part of the pre-design phase of implementation of any action to be taken. USACE would monitor conditions to evaluate how actions affect resources. Measures to mitigate environmental effects include: construction BMPs, environmental monitoring, and actions to respond to sediment deposition in the vicinity of the Alder Creek and Hoffstadt Creek confluence areas with the NF Toutle River. USACE would incorporate conservation measures to reduce potential impacts to listed species and designated critical habitat. USACE has also proposed specific actions to mitigate effects on wetlands, vegetation, and fish and wildlife habitat.

ES-6 Next Steps

USACE welcomes comments on this Draft SEIS. To learn more about the MSH sediment management project or provide comments on the Draft SEIS, the public is invited to attend the public meeting that USACE will hold at the Toutle High School on September 9, 2014 and the Cowlitz County Expo Center on September 10, 2014. Also, the public may provide written comments via the project Web site (http://www.nwp.usace.army.mil/Missions/Currentprojects/MountStHelensEIS.aspx), or mail comments to the address below.

US Army Corps of Engineers, CENWP-PM

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