REPORT SUMMARY

Skokomish River Basin Ecosystem Restoration
Mason County, Washington

1.0 Stage of Planning Process

This is an existing feasibility study currently in Planning Step 6, Selection of a Recommended Plan.

2.0 Timeline

Feasibility Cost Sharing Agreement Signed	July 2006
Alternatives Milestone	19 March 2013
Tentatively Selected Plan Milestone	19 November 2013
Agency Decision Milestone	10 June 2014
Division Engineer Transmittal	27 April 2015
Civil Works Review Board	25 August 2015
30-Day S&A Review start	4 September 2015
30-Day S&A Review end	2 October 2015
FEIS filed with EPA	25 November 2015

3.0 Study Authority

The Feasibility Study for the Skokomish River Basin is being conducted under the Authority of Section 209 (Puget Sound and Adjacent Waters) of the River and Harbor Act of 1962 (Public Law 87-874):

"The Secretary of the Army is hereby authorized and directed to cause surveys for flood control and allied purposes, including channel and major drainage improvements, and floods aggravated by or due to wind or tidal effects, to be made under the direction of the Chief of Engineers, in drainage areas of the United States and its territorial possessions, which include the following named localities: Provided, That after the regular or formal reports made on any survey are submitted to Congress, no supplemental or additional report or estimate shall be made unless authorized by law except that the Secretary of the Army may cause a review of any examination or survey to be made and a report thereon submitted to Congress, if such review is required by the national defense or by changed physical or economic conditions: Provided further, That the Government shall not be deemed to have entered upon any project for the improvement of any waterway or harbor mentioned in this title until the project for the proposed work shall have been adopted by law:

Puget Sound, Washington, and adjacent waters, including tributaries, in the interest of flood control, navigation, and other water uses and related land resources."

Seattle District Office of Counsel has confirmed the appropriateness of this authority with HQ Office of Counsel. The Act's reference to "other water uses and related land resources" provides sufficient authority to study ecosystem restoration opportunities in the Skokomish River Basin.

3.1 Additional Study Guidelines

HQ provided an Agency Decision Milestone Compliance memorandum on 30 June 2014.

4.0 Non-Federal Sponsor

Mason County (County) and the Skokomish Indian Tribe (Tribe) are the cost-sharing, non-federal sponsors of the feasibility study. As the non-federal sponsors, the County and Tribe contribute 50 percent of the total feasibility study costs in the form of cash or in-kind contributions. A Feasibility Cost Sharing Agreement (FCSA) was executed in 2006.

5.0 Purpose and Need

The need for the proposed Federal action arises from the significant degradation of natural processes that sustain the ecological functions of the watershed. The purpose for the proposed Federal action is to work within the defined study area to enact solutions within the Corps' authority to restore ecosystem process, structure, and function in the aquatic environment by addressing the primary problems identified during the feasibility study. Effort toward improving the aquatic ecosystem should include addressing lack of wetland and side-channel connections, increasing channel complexity, increasing large woody debris, increasing pool depth and frequency, restoring degraded riparian conditions, improving conditions in the reach of the river that dries up each summer, and improving channel capacity to the maximum extent practicable. Restoration of ecosystem structures, functions, and processes will benefit nationally significant resources in the study area.

5.1 Federal Interest

The recommended plan reasonably maximizes environmental benefits considering cost effectiveness and incremental cost analyses, significance of outputs, completeness, efficiency, effectiveness, and acceptability. The recommended plan provides restoration on a total of 277 acres in the study area and provides substantial benefits to nationally significant resources. The restored aquatic habitat would increase habitat for four anadromous fish species (Chinook salmon, chum salmon, steelhead, and bull trout) that are listed under the Endangered Species Act, and would improve floodplain and aquatic habitats for a variety of fish and wildlife species in the lower eleven miles of the Skokomish River. The restored habitat would provide a migration corridor for year-round fish passage, rearing and refuge habitat for ESA-listed salmonids species, reconnection of side channel habitats, and additional in-channel pools.

6.0 Study Scope

The purpose of the Skokomish River Basin feasibility study is to evaluate significant ecosystem degradation in the Skokomish River Basin; to formulate, evaluate, and screen potential solutions to these problems; and to recommend a series of actions and projects that have a Federal interest and are supported by a local entity willing to provide the necessary items of local cooperation.

6.1 Study Area

The Skokomish River Basin is located on the Olympic Peninsula in northwestern Washington. The study area is approximately 11 square miles comprised of the lower Skokomish watershed, the Skokomish Valley, and Skokomish River estuary. The area is characteristic of the enormous beauty and versatile environment of Hood Canal and Puget Sound. The Basin includes the mainstem Skokomish River (RM 0-9), the South Fork Skokomish River, the North Fork/South Fork confluence, and tributaries including Vance Creek, Hunter Creek, Weaver Creek, and Purdy

Creek. There are two privately-owned hydroelectric dam in the study area, Cushman Dam #1 and Cushman Dam #2, which impound flows on the North Fork Skokomish River.

Figure 1 shows the location of the Skokomish River Basin study area.

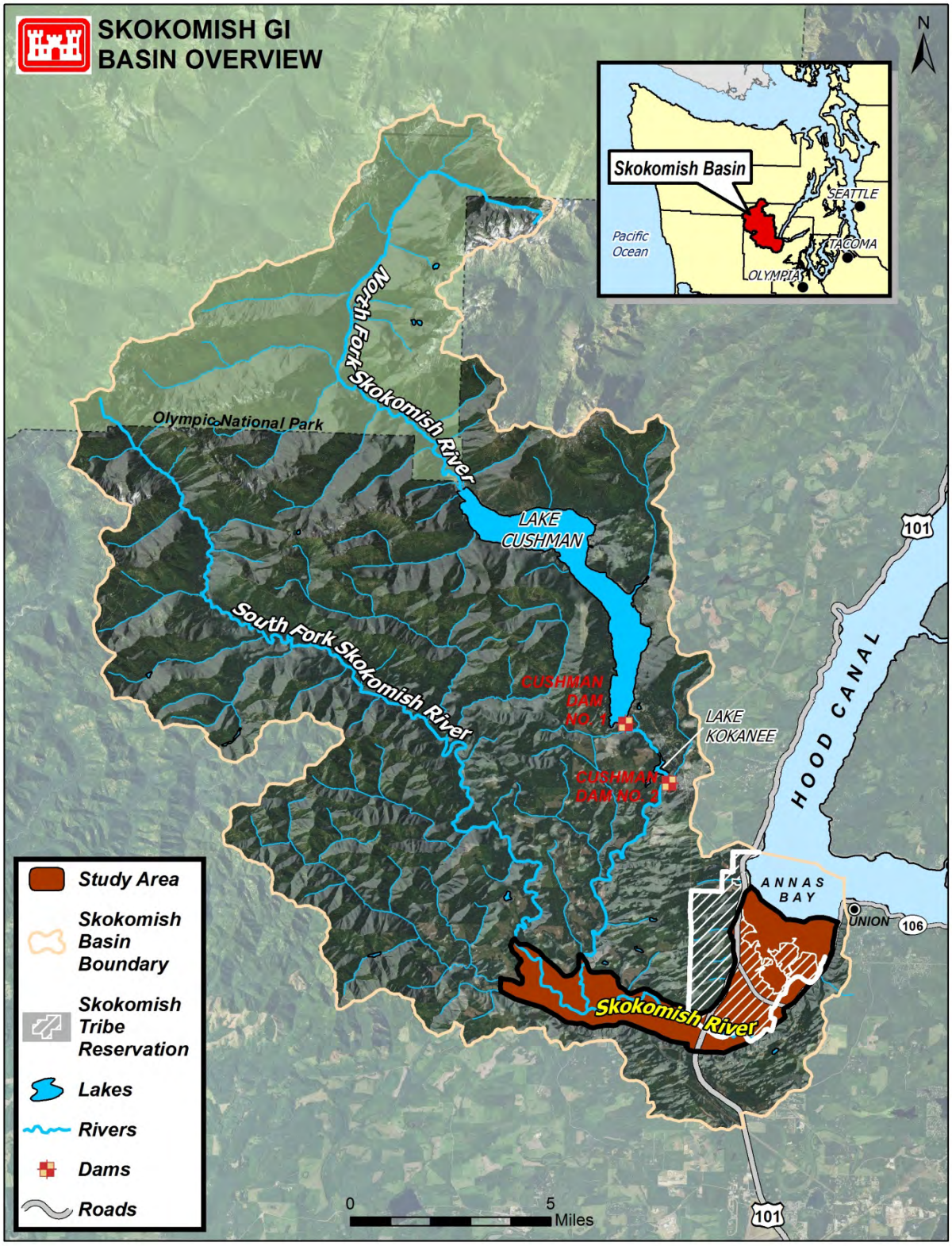


Figure 1. Skokomish River Basin and Study Area Inset.

6.2 Project Area

The project area is focused on the lower Skokomish Valley because various federal and state agencies as well as local entities are addressing problems within their individual authorities and in specific areas of the Upper Basin; restoration projects are also underway in the estuary of the Skokomish River though the National Estuary Act Restoration Program. Actions to be taken by others are fully documented in the future without project conditions section of the draft feasibility report.

The Skokomish River Valley has a population of approximately 250 residents with an industry dominated by rural agriculture. The Skokomish Indian Tribe, a study co-sponsor, has a tribal reservation located in the study area.

There are four ESA-listed salmonid species in the project area; two runs of salmon are already extinct in the Skokomish River. The major problem affecting salmon survival and migration is an extremely low channel capacity due to aggradation. One reach of the mainstem Skokomish River near the North Fork/South Fork confluence often runs dry during the summer months; the insufficient hydraulic connection does not allow salmon access to upstream habitat and spawning area. Additionally, low channel capacity leads to frequent flooding of the river, transporting both juvenile and adult salmon out of the river and stranding them in the floodplain to die.

The resources in the study area including salmon are technically, institutionally, and publicly significant. Salmon serve as an indicator of the overall health of not only the aquatic environment where they dwell, but also the connected riparian, wetland, and upland habitats. A comprehensive restoration plan for all species in the Salmonidae family, as keystone or indicator species, effectively restores habitat and nutrient input for a broad suite of over 130 other native plant and animal species.

7.0 Prior Reports and Existing Water Projects

- Flood Risk Management Study (81128), September 1988, Puget Sound and Adjacent Waters, Skokomish River, Washington.
- Analysis of Skokomish River Hypothetical Dredging Options, February 1995, Planning Assistance to the States, Skokomish River, Washington.
- Skokomish River GI Reconnaissance Study, February 2000, Puget Sound and Adjacent Waters, Skokomish River, Washington.
- Skokomish Estuary Restoration, Phase 1, December 2005, Puget Sound and Adjacent Waters Restoration Program, Section 544, WRDA 2000, Skokomish River, Washington.

8.0 Problems/Opportunities

Degradation in the study area originates from alteration of the river environment by the removal of LWD, channel realignments, bank protection, aggradation in the channel, changes in flows, and disconnection of access for fish into aquatic habitats in the floodplain and off-channel wetlands. Based on these factors, the problems for this study include the following:

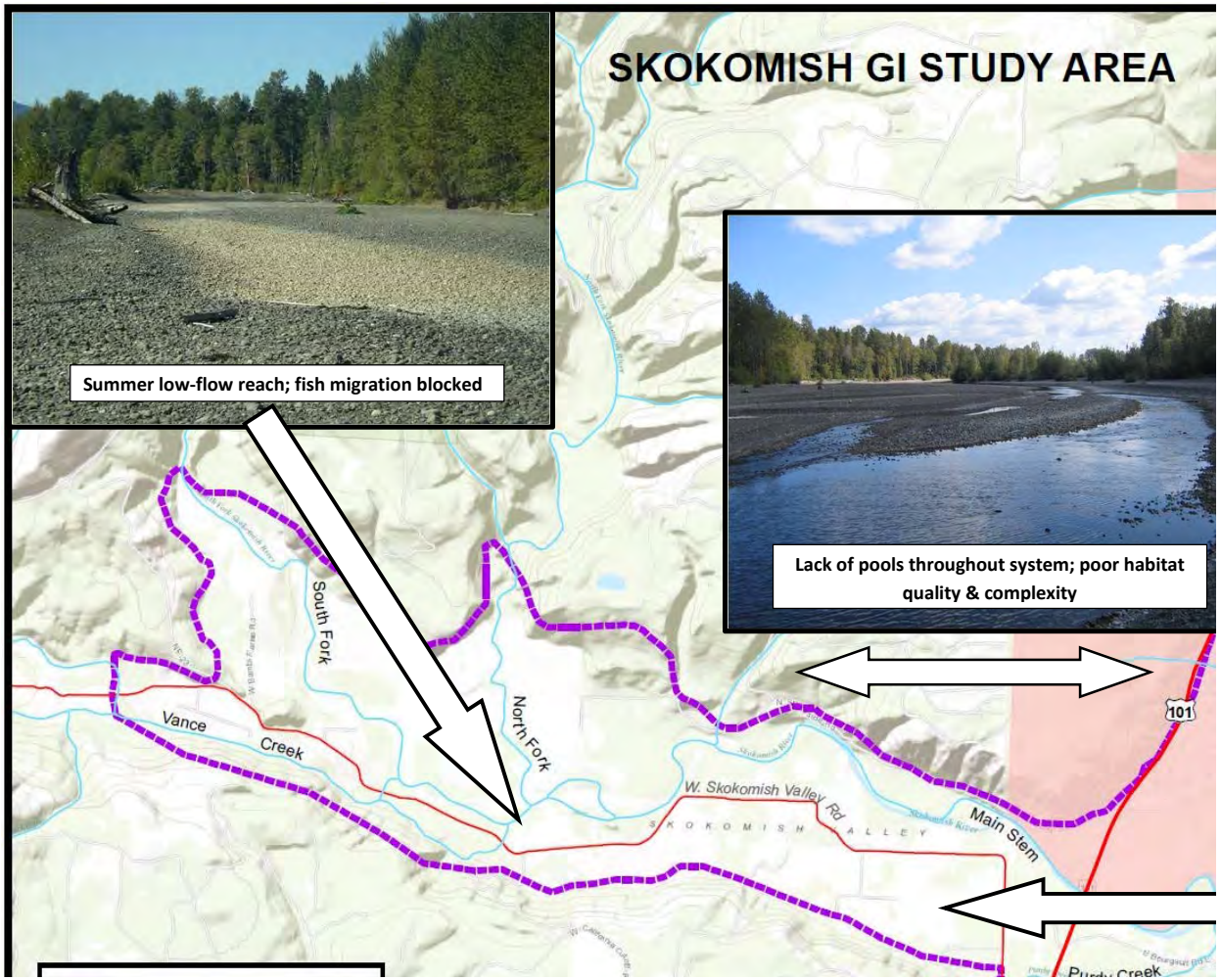
1. Six salmon species have been decimated by anthropogenic actions in the study area; two are extinct and four are listed under ESA. Detrimental actions have included channel alterations, large wood removal, overfishing, and the conversion of forestland to agriculture.

2. Aggradation causes areas of the Skokomish river flow to run subsurface during the summer low flow period, blocking fish passage for endangered fish species during the migration season.
3. Aggradation in the Skokomish River has also reduced channel capacity in the mainstem, causing frequent overbank flows and stranding fish during even modest flow events.
4. Connection of the Skokomish River main channel to side channels, off-channels, and back water habitats has been reduced due to numerous anthropogenic impacts and land management activities including dam construction, flow diversion, levee construction, channelization, and reduced base flow discharges.
5. The Skokomish River mainstem and tributaries lack high quality and complex habitats including pools, side-channels, hiding places, and floodplain habitats as a result of the construction of levees and dikes, the closure of side channels and sloughs, agricultural development, and the removal of large woody debris and riparian vegetation.

Opportunities to address problems for this study including the following:

1. Restore degraded ecosystem structures, functions, and dynamic processes of the Skokomish River for the benefit of four ESA listed salmon species.
2. Restore a continuous low flow channel in the Skokomish River to maintain fish passage during summer low flow periods.
3. Restore channel capacity to rebuild critical habitat for ESA-listed salmonid species.
4. Restore the connection of the Skokomish River mainstem to side channels and tributaries.
5. Return habitat quality, complexity and functionality of the Skokomish River system to a less degraded, more natural state.
6. There is a potential for ecosystem projects that secondarily contribute to local flood risk management goals.

A study area map is shown below (Figure 2), highlighting key areas of degradation in the study area.


SKOKOMISH GI STUDY AREA
Summer low-flow reach; fish migration blocked
Lack of pools throughout system; poor habitat quality & complexity
South Fork
North Fork
Vance
Creek
W. Skokomish Valley Rd
SKOKOMISH VALLEY
Main Stem
101

9.0 Planning Goals/Objectives

The goal of the study is to restore degraded ecosystem structures, functions, and dynamic processes of the Skokomish River to a less degraded, more natural condition. Based on the problems identified in the study area, planning objectives include the following:

- Provide year-round passage for fish species around the confluence of the North Fork and South Fork Skokomish River for the 50-year period of analysis.
- Reconnect and restore the spawning, rearing, and refuge habitats in the study's side channel and tributary networks including Hunter and Weaver Creeks for the 50-year period of analysis.
- Improve the quantity, quality, and complexity of native riparian and floodplain habitats in the study area for the 50-year period of analysis.
- Improve the quantity, quality, and complexity of pools in the Skokomish River to promote spawning and rearing success, as well as reduce stranding of ESA-listed salmonid species for the 50-year period of analysis.

9.1 Planning Constraints

The following constraints have been identified for the study:

- Cushman Settlement Agreement: The Federal Energy Regulatory Commission (FERC) Settlement Agreement related to Cushman Dam (the "Cushman Settlement Agreement") affects the existing condition, future without-project condition, and future with-project condition for this study. NMFS, Tacoma Public Utilities, the Skokomish Indian Tribe, and State and other Federal agencies (excluding USACE) signed a settlement and relicensing agreement for Tacoma Power's Cushman Hydroelectric Project in 2009. The agreement resolved a $5.8 billion damages claim and long-standing disputes over the terms of a long-term license for Cushman Dam. The licensing settlement agreement concludes two years of negotiations and decades of contention between Tacoma Power, the Skokomish Indian Tribe, and the many State and Federal agencies that will oversee implementation of the terms of the agreement. Due to the history and controversy surrounding this settlement agreement, USACE will not propose structural modifications to Cushman Dam, including dam removal, flow modifications, or operation adjustments.
- Mason County Flood Ordinance: Comply with Mason County Flood Damage Prevention Ordinance No. 87-08. A special flood risk zone was established for the Zone A and A2 floodplain of the Skokomish River, Vance Creek, and tributaries, as shown on Flood Insurance Rate Maps; these zones are located in the feasibility study area. The special flood risk zone is designated as a floodway and an avulsion risk area, imposing restrictions on new structures, existing structures, water flow modification structures, bridges and roadways.
- The Skokomish Indian Tribe is a federally recognized tribal nation that has Usual and Accustomed fishing, hunting, and gathering rights on the Skokomish River and has strong cultural and economic interests in the Basin. Proposed projects will minimize or avoid negative effects to tribal interests.

10.0 Inventory and Forecast

The Skokomish River channel has migrated within a narrow band along its present course for at least 400 years. The watershed remained relatively unaltered by human activity until Euro-American settlers arrived in the mid-nineteenth century. During the last 150 years, there have been many changes to the environment along that alignment caused by both natural and anthropogenic factors. High bedload transport caused by the removal of LWD and disturbance of the stream banks, combined with altered depositional patterns caused by bank protection, side-channel closures, and flow regulation by the Cushman Project have caused riverbed aggradation and increased flooding. Logging and agricultural development have reduced riverbank riparian habitat and cleared LWD from the channel. The riverbank has been stabilized in places to protect roads and farmland. Land management has been geared toward agriculture and timber harvest. Significant land use and development including mining, logging, and fishing have altered the historical physical and biological characteristics of the Skokomish Basin.

Sediment accumulation is expected to continue to reduce the channel capacities of the mainstem and South Fork Skokomish Rivers as well as Vance Creek. Flooding is expected to become even more frequent, but only small increases in flood depths are likely due to the broad floodplain in the valley. Continuing sediment accumulation is expected to cause the subsurface flows in the South Fork and Vance Creek during the late summer/early fall to become more frequent and last longer. A channel avulsion that would create an entirely new channel is possible within 20 years.

10.1 Fish and Wildlife Resources Considerations

The Skokomish River system hosts at least 22 species of fish. Nearly half of these are the many species of the Salmonidae family, which includes salmon, trout, and char. Species present include Chinook salmon, coho salmon, chum salmon, rainbow trout/steelhead, sea-run and resident cutthroat trout, bull trout, and mountain whitefish. Sockeye salmon and pink salmon were historically found in the Skokomish River but have been functionally extirpated. Degraded conditions continue to affect fish populations in the study area in the future. The Skokomish River will continue to face numerous limiting factors for fish. Major problems affecting salmon survival and migration will continue. Habitat availability, quality, complexity, and connectivity will continue to deteriorate. Winter high flows will continue to transport both juvenile and adult salmon out of the river, stranding them in the floodplain to die. As sediment continues to accumulate in the mainstem, upstream passage will continue to be delayed or completely blocked during summer low flows. The overall condition of the channel is anticipated to remain severely degraded; reduced holding pool quality and availability will continue to render adults vulnerable to predation/harassment, and reduced channel complexity will lead to more frequent and severe scouring of redds. Ultimately, the future without-project condition for fish resources in the mainstem and South Fork reaches of the study area is expected to remain in a severely degraded state and would not be able to support recovery of ESA-listed species.

11.0 Key Uncertainties

The PDT has used a risk and uncertainty-based strategy in their approach to formulating the project from the early stages of the study. Risks and uncertainties associated with the formulation of alternatives, development of conceptual designs and cost estimates, quantification of environmental benefits, and assumptions associated with selection of a recommended plan are

captured in the study's risk register. Key risks or uncertainties associated with the recommended plan include the following, along with the strategy to reduce risk as the study continues:

Quantities for Wetland Embankment Measures

Risk and Cause: Given the results of the supplemental cost effectiveness and incremental cost analyses performed for the two wetland embankment sites at River Mile 9 and Grange, it is likely that the optimum embankment height necessary to achieve the ecosystem restoration function falls within the range of heights between a small-scale (average height of 2-4 feet) increment and original recommended plan (average height of 5-6 feet) increment. The elevation change for the embankment increments of 2 to 3 feet, on average, between the current recommended embankment height and the lower scale embankment height is within the margin of error of the existing terrain data used to develop the embankment heights.

Evaluation: The Cost Schedule Risk Analysis (CSRA) for the project has identified risks associated with the variability in existing survey/LIDAR data with varying resolution (ranging approximately 6 to 10 feet depending on location and density of vegetative cover). Cost contingencies reflect the uncertainty in optimized wetland embankment height, quantities of material required for construction, and PED costs to include additional survey and hydraulic analysis to refine the size and scale of the measures.

Future Risk Management: Additional survey data and LIDAR will be obtained during the PED phase. Additional hydraulic modeling will also be conducted to refine the optimum embankment elevations to achieve the desired ecosystem functions. PED costs include estimates for both obtaining new survey data and performing necessary engineering analysis to refine the wetland embankment elevation.

Aggradation and Future Channel Migration

Risk & Cause: Sediment deposition is one of the key considerations for project sustainability. Sediment deposition is expected to continue to aggrade the channels of the mainstem and South Fork Skokomish Rivers, as sediment is transported to the lower rivers throughout the project life. Future aggradation may cause channel migration in the study area.

Evaluation: The study team completed 2-dimensional hydraulic modeling of the entire study area, 1-dimensional sediment transport modeling of the confluence area, and sediment transport analysis of the reconnected wetland areas during feasibility-level design.

Results: Deposition in the combined North Fork/South Fork channel is expected to be around 0.1 foot/year, which is similar to that in the existing South Fork channel. Over time, the channel is expected to aggrade and meander across the 1,000 to 2,000 foot wide northern floodplain. Spreading deposition across the northern floodplain would reduce the initial deposition rate, resulting in a long term deposition rate of approximately 0.02 foot/year (or approximately 1 foot during the 50-year project life). This would result in an active riverbed 2-4 feet lower than the existing South Fork channel at the end of the 50-year period. Over a long-term analysis (10-50 years), the natural migration of the new channel will renew channel habitats and recruit new LWD to the channel. This natural meandering process will develop a complex series of stream habitats that will be beneficial to salmon and other fish.

The Confluence Levee removal would greatly reduce the risk of the avulsion to the south near RM 9. To further reduce this risk, a large levee could be constructed along the south side of the river between RM 7 and 11. The levee would confine the river to the new mainstem channel,

regardless of rate or amount of sediment deposition. However, this would result in a large takings area due to the transfer of floodwaters within the Skokomish Valley and would not achieve the process-based restoration goals established by the study team. Thus, inclusion of a large levee as a feature to minimize risk of future aggradation or channel migration is not recommended.

Maintenance to include sediment removal is not anticipated to be required at the Grange or River Mile 9 Wetland Restoration sites. The majority of bedload (i.e. gravel, cobbles, and boulders) will pass through the diversion to the re-connected North and South Forks, thereby bypassing the reach where the proposed wetland restoration sites are located. The probability of aggradation resulting from movement of fine material (i.e., smaller than gravel, cobbles, and boulders) into the re-connected wetland areas at Grange and River Mile 9 is very low; 2D modeling indicates that flows will keep these fine sediments mobile, reducing the likelihood of aggradation in the wetland restoration areas.

The Side Channel Reconnection inlet is elevated above the riverbed to avoid the bedload transport. There may be some suspended sediment deposition near the side-channel entrance, but this should require only infrequent O&M action, which is accounted for in the existing O&M estimate (approximately $10,000 per year).

Summary: Even with continued sediment accumulation, the study team has determined that residual risk to long-term accrual of environmental benefits associated with the recommended plan within the study area is low. In addition, the risk of an avulsion to the south near RM 9 is greatly reduced in the with-project condition.

Future Risk Management: Monitor the project; implement adaptive management strategies as needed.

Landowner Willingness

Risk & Cause: There may be unwilling landowners located within the project footprint.

Future Risk Management: Continue formal and informal landowner outreach; refine construction footprints based on real estate needs.

Cushman Dam Settlement Agreement / Future Actions Required of Tacoma Power

Risk & Cause: Based on future technical and procedural findings, Tacoma Power may be required to implement restoration or flood risk management actions within the Corps' study area in the future. Because these actions have not been identified or determined to be necessary, and are not specifically described, the future with-project condition and future without-project condition remains somewhat uncertain.

Evaluation: The assumptions for project conditions are described in this report and will be revisited as future actions by Tacoma Power are confirmed.

Summary: Potential future action(s) taken by Tacoma Power as the result of technical and procedural findings are not likely to negatively impact the success or function of the recommended plan, as Tacoma Power is required to seek comments and recommendations from the Corps to ensure that any future actions will be complementary to the recommended plan and will not affect the success or benefits accrued from the Federal (Corps) project. Additionally, provisions in the Cushman Settlement limit the financial obligations for future action by Tacoma

Power, so future activities would likely be smaller in scale and have only localized effects that are not expected to negatively affect the recommended plan.

Future Risk Management: Continue close coordination with the Skokomish Indian Tribe and Tacoma Power.

12.0 Formulating Alternative Plans

Plan formulation is the process of building alternative plans that meet planning objectives and avoid planning constraints. Alternative plans are a set of one or more management measures functioning together to address one or more planning objectives. A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. A feature is a "structural" element that requires construction or assembly on-site and an activity is defined as a "nonstructural" action.

12.1 Management Measures

Management measures for this study are listed below, along with the related objective that each measure addresses.

Measures that meet the highest priority objectives (increase channel capacity and provide continuous fish passage), include the following:

- New channel creation at the historical confluence
- Large-scale sediment removal; environmental dredging
- Spot-dredge
- Sediment traps
- Selective gravel removal on gravel bars (remove largest sediment sizes at downstream end of gravel bars) to reduce stream power required to mobilize smaller sediments
- Remove or breach levees to restore year-round fish passage near confluence

Measures that meet lower priority objectives (reconnect side channels and tributaries, restore high quality and complex floodplain habitats), include the following:

- Wetland restoration - remove or breach levees, dikes, or berms to reconnect floodplain wetland area
- Wetland restoration - construct hydraulic features (e.g., embankments/water control structures) to improve hydraulic connection to reconnected floodplain wetland area
- Create salmonid spawning habitat
- Reconnect side channels, backwater areas, and tributaries
- Place large woody debris or engineered logjams
- Install fish-passable weirs
- Install bank armor to stabilize riverbed sediments
- Plant riparian and estuarine vegetation
- Remove or minimize invasive species
- Culverts: add, remove, replace, or upgrade
- Road modifications: raise roads, re-route roads, modify bridges or road prisms, decommission or remove roads to improve habitat availability and connectivity
- Rehabilitate bank lines: remove riprap, bulkheads, or hardened bank lines

Measures that were identified during the early stages of plan formulation but do not address any specified objectives include the following:

- Place hard substrate for oyster attachment
- Install aeration system in Annas Bay
- Reconnect dendritic channels in estuary
- Riverbed and wetland vehicle exclusion (fence or barrier installation)
- Reroute power lines in estuary
- Fill estuary farm ditches
- Develop agricultural best management practices

12.2 Screening of Measures

Screening is the ongoing process of eliminating, based on planning criteria, what is no longer important from further consideration. Criteria are derived for the specific planning study, based on the planning objectives, constraints, and the opportunities and problems of the study/project area. Criteria used to screen measures as well as qualitative metrics associated with each criteria included the following:

- Meets planning objectives
- Avoids planning constraints
- Access/land ownership considerations
- Size or scale is more conducive for local implementation
- HTRW considerations
- Impact to cultural and historic resources

Based on these criteria, the following measures were not carried forward after preliminary screening:

- Place hard substrate for oyster attachment
- Install aeration system in Annas Bay
- Reconnect dendritic channels in estuary
- Riverbed and wetland vehicle exclusion (fence or barrier installation)
- Reroute power lines in estuary
- Fill estuary farm ditches
- Develop agricultural best management practices

Nearly all of the measures that were screened from further evaluation at this stage were related to restoration of habitats in the estuary or nearshore of the Skokomish River. The estuary and nearshore were originally included in early plan formulation activities; however, due to successful and ongoing restoration of these areas under the Estuary Restoration Act, these areas were removed from formal consideration within the feasibility study area. After screening, 18 measures remained for further consideration.

12.3 Initial Array of Alternative Plans

An initial array of alternatives was formulated based on initial data collection and best professional judgment. This exercise led to the development of an initial array of alternatives that include a “base” measure. The "bases" are key measures that address the critical needs of the study area (provide year-round fish passage and improve the quantity, quality, and complexity of pools). Developing alternatives around these base measures ensures the critical needs of the study area are addressed. An alternative cannot be considered complete, acceptable, or effective unless one of these bases is included. Increments were added to these base alternatives to capture supplementary benefits associated with restoration of additional habitat features.

The initial array of “bases” includes the following:

Base #1: Riverbed Excavation (River Mile 0-9)

This base includes two primary measures: large-scale sediment removal and placement of LWD. The goal of this base is to restore mainstem river habitat by removing approximately 2.5 million cubic yards from the mainstem channel (deepening by 8 to 10 feet), which will restore the channel capacity to roughly a two-year return interval probability. The two-year capacity was chosen to mimic typical Puget Sound channels; a two-year capacity will provide similar habitats and biological processes found within less degraded channels in the Puget Sound region. The increase in channel capacity would allow the placement of additional habitat features (engineered logjams and LWD) while reducing the frequency of overbank flooding and fish stranding. Maintenance at approximately 20-year intervals would be necessary to remove accumulated sediment and maintain channel functions. Dredged material would be placed in the estuary and nearshore zone of Annas Bay which would constitute beneficial reuse of material and would provide suitable hard substrate for shellfish attachment.

Base #2: Confluence Channel Excavation

This base includes two primary measures: spot-dredging and placement of LWD. The goal of this base is to lower the river thalweg to provide a continuous low flow channel during the late-summer base flow conditions to allow passage of migrating salmon. To re-establish a continuous low flow channel, approximately 150,000 cubic yards of sediment would be removed from the mainstem from RM 7.3 to 8.8. Year-round fish passage would be restored in the Skokomish River mainstem, which is the reach that experiences subsurface flow during the late-summer/early fall low flow period.

LWD would be placed in this reach to maintain the established channel path within the boundaries of the active river channel. Woody debris would also create deeper pools and hiding places, which are critical needs for fish in the system. This base addresses the project objectives on a much smaller scale than Base #1, focusing on improving channel capacity and habitat in the reach of the river where passage is most often blocked during the late-summer/early fall low flow period. Periodic maintenance may be necessary to remove sediment accumulations. The limited amount of dredged material would be disposed of offsite (versus placement in the estuary and nearshore zone of Annas Bay).

Base #3: North Fork/South Fork Confluence: Confluence Levee Removal

This base includes two primary measures: removal of levees and placement of LWD. This base proposes removal of the levee on the north side of the mainstem near the original North Fork confluence. Mainstem flows would be diverted into the North Fork channel and reenter the

mainstem at the confluence location.Year-round fish passage would be restored in the Skokomish River mainstem, which is the reach that experiences subsurface flow during the late-summer/early fall low flow period.

Installed LWD would direct flow in the new channel and improve fish habitat. It is anticipated that the new channel will aggrade, eventually meandering across the floodplain. This natural meandering process will develop a complex series of stream habitats that will be beneficial to salmon and other fish. This base is designed to work with natural river processes including aggradation to provide habitat benefits; therefore, it is anticipated that limited O&M will be required to maintain the channel.

Corps staff conducted a site visit in October 2013 and observed approximately five car bodies at the base of the western section of the Confluence Levee, which is locally referred to as "Car Body Levee." A Phase II HTRW investigation was complete in July 2014. There were no sampling results that warranted further evaluation or investigation within the footprint of the recommended plan, including the Confluence Levee site. At this time, the cars are assumed to be solid waste that will be disposed of by the Non-Federal Sponsors at an appropriate disposal site.

Base #4: North/South Fork Confluence Channel

This base includes three primary measures: spot-dredging, construction of a levee, and placement of LWD. The goal of this base is to restore the North Fork/South Fork confluence to its pre-2003 location at RM 8.4. This base addresses the project objective of restoring year-round passage near the confluence by increasing summer low flow. Approximately 50,000 cubic yards of sediment would be removed from the mainstem and North Fork channels. LWD would be placed to maintain channel alignment and facilitate creation of pools and hiding places. Periodic maintenance may be necessary to remove sediment accumulations from the restored confluence. The limited amount of dredged material would be disposed of offsite (versus placement in the estuary and nearshore zone of Annas Bay).

Base #5: Riverbed Excavation (River Mile 3.5-9)

This base includes two primary measures: large-scale sediment removal and placement of LWD. Dredging for Base #5 would start at RM 3.5 and continue upstream to RM 9. This base would require removal of approximately 1.9 million cubic yards from the mainstem channel. Similar to Base #1, an increase in channel capacity would allow the placement of additional habitat features (engineered logjams and LWD) while reducing the frequency of fish stranding caused by overbank flooding.

Periodic maintenance would be required to remove sediment accumulations. Dredged material would be placed in the estuary and nearshore zone of Annas Bay, which would provide suitable hard substrate for shellfish attachment constituting beneficial reuse of material.

Large Woody Debris

As noted in the descriptions above, all bases include placement of LWD. LWD is not a separable element of the bases. While the size, scale, and number of logjams to be installed vary among the bases, this measure was identified to be a critical habitat feature that should be included in any recommended plan in addition to the base. LWD has many benefits for juvenile salmon including increasing habitat complexity and number of pools, providing instream cover and predation refugia, and serves as a substrate for aquatic invertebrates that salmon rely on as a food source. Large accumulations of LWD also provide habitat for small mammals that serve as prey

for owls and raptors, and perches for aquatic-oriented birds like belted kingfishers and American dippers.

Increments

Increments were added to the focused array of four bases to capture supplementary benefits associated with restoration of additional channel and floodplain habitat features. Potential increments considered for addition to the bases were selected from the list of 18 proposed management measures and 40 potential restoration sites using best professional judgment. Of the approximately 40 potential restoration sites, eight sites were identified by the study team as high priority in-channel or floodplain increments that would optimize the environmental benefits for an alternative plan. Potential floodplain increments include removal of blockages at the mouths of tributaries, restoration of side channel habitat, creation of new side channels, and levee setbacks. A cost-effectiveness/incremental cost analysis (CE/ICA) determined the appropriate number and scale of cost effective increments.

Management measures that have been identified as potential increments include upstream LWD installation, four side channel reconnections/restorations, two levee setbacks, and a road setback/relocation; these measures could be constructed at eight high-priority sites identified by the PDT. All but one of these measures can be included as an increment to any of the bases carried forward in the focused array.

Please refer to Section 12.4 (Focused array of Alternative Plans) for a more complete description of the proposed increments and a map showing their locations in the study area.

12.3.1 Evaluation of Initial Array

The initial array of alternatives was evaluated based on the following decision criteria:

Evaluation Criteria	**Metric / Threshold**
Meets planning objectives	Number of objectives met
Avoids planning constraints	Yes / No
Environmental factors	Benefit to salmonids & other ESA-listed species Benefit to other fish & wildlife species Potential negative impacts to salmonids and/or other habitat
Sustainability	Low / Medium / High
Impact on fluvial geomorphic processes	Cubic yards of sediment to remove Discharge capacity
O&M requirements	Low / Medium / High

12.4 Focused Array of Alternative Plans

Based on an evaluation of the initial array of alternatives using the decision criteria outlined in Section 12.3.1, the Corps PDT recommended carrying Bases #1, #2, and #5 forward into the focused array of alternatives because they meet the study objectives and have the largest anticipated benefits to species of concern in the Basin. In addition, the study sponsors requested that Base #3 be carried forward into the focused array because the Confluence Levee removal would allow natural river processes to be restored in a sustainable way. Thus, the focused array of bases includes the following:

- No Action Alternative

- Base #1 (Riverbed Excavation: RM 0-9)
- Base #2 (Confluence Channel Excavation)
- Base #3 (Confluence Levee Removal)
- Base #5 (Riverbed Excavation: RM 3.5-9)

Base #4 was not carried forward for further analysis because directing North Fork flows into the original confluence area would disrupt high quality fish habitat that already exists in this reach. Bases #1, #2, #3, and #5 meet a greater number of study objectives and are anticipated to have greater positive effects to salmonid habitat compared to Base #4, which was not carried forward to the focused array. All Bases carried forward to the focused array meet the purpose and need for action.

As described in Section 12.3, potential increments to be considered for addition to the focused array of four base plans was selected from a list of proposed management measures using best professional judgment (BPJ). Table 1 lists proposed increments that could be added to the base alternatives to capture supplementary benefits associated with restoration of additional habitat features. These increments were carried forward from a preliminary list of over 40 potential restoration sites. A qualitative analysis using existing data and best professional judgment led to the carrying forward of nine high priority increments for additional analysis.

A CE/ICA analysis determined the appropriate number and scale of cost effective increments.

Table 1. Potential Restoration Increments

ID #	Increment Name	Increment Description	Increment to Base #...	Dependencies
9	Side Channel Reconnection	Reconnect abandoned side channel between RM 4 and RM 5.6 to provide high flow refuge and rearing habitat for fish.	1, 2, 3, 5	Stand Alone
26	Wetland Restoration at Dips Road	Relocate a small area of West Valley Road in the vicinity of the Dips to provide additional floodplain habitat and reduce the stranding potential for fish.	1, 2, 3, 5	Stand Alone
28	Wetland Restoration at River Mile 9	Breach existing agricultural berm to allow flood waters to flow freely within the reconnected area. Construct wetland embankment near RM 8.3-9.2 to improve hydraulic conditions in the reconnected wetland area, providing salmon access to the high quality riparian habitat.	1, 2, 3, 5	Stand Alone

ID #	Increment Name	Increment Description	Increment to Base #...	Dependencies
35	Upstream LWD Installation	Place and install large woody debris from RM 9-11 to increase meandering and bar formation and provide cover for salmon.	1, 2, 3, 5	Stand Alone
37	Wetland Restoration at Grange	Breach existing agricultural berm to allow flood waters to flow freely within the reconnected area. Construct wetland embankment near RM 7.5-8 to improve hydraulic conditions in the reconnected wetland area, providing salmon access to the high quality riparian habitat.	1, 2, 3, 5	Stand Alone
39	Hunter Creek Mouth Restoration	Small-scale excavation at the mouth of Hunter Creek to provide year-round access between the Creek and mainstem river in the vicinity of RM 6.5.	2, 3	Stand Alone
40	Hunter Creek Tributary Restoration	Construct tributary channels to Hunter Creek to provide additional fish rearing and refuge habitat.	1, 2, 3, 5	Dependent on #39
43	Weaver Creek Tributary Restoration	Construct tributary channels to Weaver Creek to provide additional fish rearing and refuge habitat.	1, 2, 3, 5	Stand Alone

During the feasibility-level design phase and prior to the Civil Works Review Board, the study team completed additional evaluation and optimization of two sites that include proposed wetland embankment measures: Wetland Restoration at River Mile 9 and Wetland Restoration at Grange. These embankments were evaluated at two additional elevations (one lower and one higher which reasonably bracket the range of elevations to consider for optimization), as well as a “breach only” scenario (no embankment). The results of this analysis are summarized in Section 15.

12.5 Final Array of Alternative Plans

The focused array of alternatives has undergone additional analysis including development of conceptual designs, development of parametric cost estimates, and evaluation of environmental outputs (the environmental outputs model was approved for one-time use on October 8, 2013).

Based on these parameters, a cost effective/incremental cost analysis (CE/ICA) was completed to help evaluate and quantify significant contributions or effects of individual plans.

A total of 705 possible plan combinations were evaluated in the CE/ICA analysis. Of these, 60 plans (including the No-Action Alternative) were identified as being cost effective and nine plans were identified as best buys.

The alternatives carried forward for detailed evaluation in the final array were chosen based on CE/ICA results, total cost, incremental cost, and ecological value added between increments. This step resulted in carrying forward six alternatives into the final array of alternatives.

The final array of alternatives includes the No-Action Alternative, three Confluence Levee Removal alternatives, and two Riverbed Excavation alternatives.

Logic for screening was based on habitat types restored by each alternative. Side channel or tributary increments provide rearing and refuge habitats in an active channel setting. In contrast, the wetland restoration increments (located at River Mile 9 and the Grange) reconnect floodplain and riparian zones but do not directly provide an active channel habitat in the reconnected zone. Both of these types of increments provide important but slightly different ecosystem restoration benefits.

Alternative #11 was carried forward because it is the first alternative that includes reconnection of a side channel, identified as critical rearing and refuge habitat in the study area. Alternative #18 was carried forward because it includes two wetland restoration increments at River Mile 9 and the Grange; these increments improve floodplain habitat connectivity in critical forested riparian zones of the study area, providing benefits to all riverine life stages of salmonids by increasing available spawning, incubation, rearing, and over-wintering habitats as well as high flow refuge for flood survival, and improving and expanding wetlands. Alternative #27 was carried forward because it represents one of the largest-scale Confluence Levee Removal alternatives with all but one increment (a road relocation) included in the plan. While Alternative #45 is cost effective only, it was carried forward into the final array of alternatives because it meets the critical needs of the study area while requiring a smaller extent of dredging compared to Alternative #60. Alternative #60 was carried forward because it is the largest-scale Best Buy Plan and represents the most significant Federal investment for the study.

Alternatives #7, #13, #23, and #28 were not carried forward into the final array of alternatives. While Alternative #7 represents the least cost best buy plan, it was not carried forward because it does not include side channel reconnections, wetland restoration increments or tributary restorations, which are all critical habitat types requiring restoration in the study area. Although Alternative #13 includes a side channel reconnection, it was not carried forward because it only includes a single wetland restoration increment (Wetland Restoration at River Mile 9); restoration and reconnection of floodplain habitat in two riparian zone wetlands represents a more complete alternative. Similarly, Alternative #23 was not carried forward because it only includes one of two tributary restoration increments, significantly limiting the area of tributary restoration in the study area. Hunter Creek and Weaver Creek are the only two perennial groundwater-fed streams in the lower Skokomish Basin and restoration of fluvial and biological processes in both tributaries represents a more complete alternative.

Finally, Alternative #28 was not carried forward into the final array of alternatives. The only difference between Alternative #27 (carried forward into the final array) and Alternative #28 is the inclusion of wetland restoration at Dips Road, a road relocation increment which is not a feature that could be cost-shared as part of a proposed National Ecosystem Restoration Plan. This individual increment may be constructed by the non-Federal sponsors but was not carried forward as a best buy plan (Alternative #28) in the final array of alternatives. While the CE/ICA analysis presented in this report includes the Dips Road increment, Section 8.2 of the Economics Appendix (Appendix G) presents the results of a sensitivity analysis of CE/ICA that does not include the Dips Road increment. This sensitivity run removed the Dips Road increment and re-ran CE/ICA to determine whether the cost effective and incremental analysis results would change significantly without this feature. The analysis indicates that the final array of alternatives presented in this report are still considered to be cost effective and best buy plans.

The final array of alternatives is described below and identified in Figure 5. As noted above, Alternative #45 is cost effective only and does not appear as a best buy plan in the figure below.

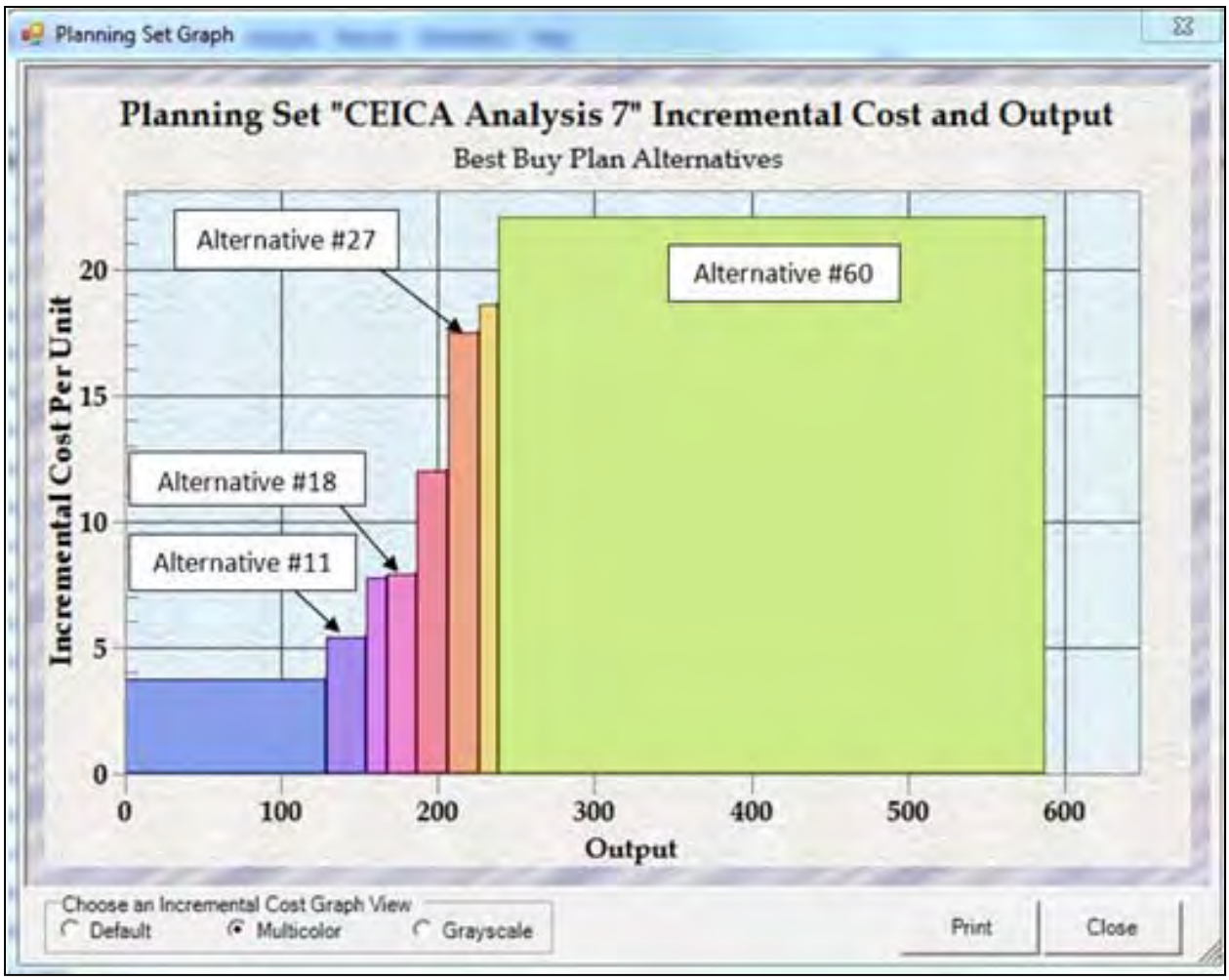


Figure 5. CE/ICA Results.

No-Action Alternative

Under the No-Action plan, which is synonymous with the "Future Without-Project Condition," the assumption is that no project would be implemented by the Corps to achieve the planning objectives. As described throughout Chapter 4, the Skokomish River will remain degraded under the No-Action Alternative. Habitat availability, quality, complexity, and connectivity will continue to deteriorate. As sediment continues to accumulate in the mainstem, upstream passage will continue to be delayed or completely blocked during summer low flows. The overall condition of the channel is anticipated to remain severely degraded; reduced holding pool quality and availability will continue to render adults vulnerable to predation/harassment, and reduced channel complexity will lead to more frequent and severe scouring of redds. Ultimately, the future without-project condition for fish in the mainstem and South Fork reaches of the study area is expected to remain in a severely degraded state and would not be able to support recovery of ESA-listed species.

Confluence Levee Removal Alternatives #11, #18, and #27

Three Confluence Levee Removal Alternatives were evaluated during this step of the planning process. Each plan represents a best buy plan identified during the CE/ICA. Alternative #11 is the first alternative that includes restoration of side channels, identified as critical habitat in the study area. Alternative #18 was carried forward because it includes two critical wetland restoration increments at River Mile 9 and the Grange; these increments improve floodplain habitat connectivity in critical forested riparian zones of the study area, providing benefits for all riverine life stages of salmonids by increasing available spawning, incubation, rearing, and over-wintering habitats as well as high flow refuge for flood survival. Alternative #27 was carried forward because it represents one of the largest-scale Confluence Levee Removal alternatives with all but one increment (a road relocation) included in the plan. A description of each "base" can be found in Section 12.3. A description of each increment can be found in Table 2.

Confluence Levee Removal (Alternative #11)	**Confluence Levee Removal (Alternative #18)**	**Confluence Levee Removal (Alternative #27)**
Base #3: Confluence Levee Removal	Base #3: Confluence Levee Removal	Base #3: Confluence Levee Removal
Increment #35: Upstream LWD Installation	Increment #35: Upstream LWD Installation	Increment #35: Upstream LWD Installation
Increment #9: Side Channel Reconnection	Increment #9: Side Channel Reconnection	Increment #9: Side Channel Reconnection
	Increment #37: Wetland restoration at Grange	Increment #37: Wetland Restoration at Grange Levee Setback
	Increment #28: Wetland Restoration at River Mile 9	Increment #28: Wetland Restoration at River Mile 9
		Increment #39: Hunter Creek Mouth Restoration
		Increment #40: Hunter Creek Tributary Restoration

Confluence Levee Removal (Alternative #11)	Confluence Levee Removal (Alternative #18)	Confluence Levee Removal (Alternative #27)
		Increment #43: Weaver Creek Tributary Restoration

Riverbed Excavation Alternatives

Two Riverbed Excavation alternatives were evaluated during this step of the planning process. Alternative #45 represents a smaller scale of riverbed excavation alternative. It should be noted that this plan is a cost effective plan only. The CE/ICA analysis did not indicate this plan is a best buy; however, it was carried forward to this stage of analysis because it meets the critical needs of the study area while requiring a smaller extent of dredging compared to Alternative #60. Alternative #60 represents the largest-scale best buy plan and represents the most significant Federal investment for this study.

The increments included in each of the riverbed excavation alternatives are outlined in the table below. A description of each "base" can be found in Section 12.3. A description of each increment can be found in Table 2.

Riverbed Excavation (Alternative #45)	Riverbed Excavation (Alternative #60)
Base #5: Riverbed Excavation (RM 3.5-9)	Base #1: Riverbed Excavation (RM 0-9)
Increment #35: Upstream LWD Installation	Increment #35: Upstream LWD Installation
Increment #9: Side Channel Reconnection	Increment #9: Side Channel Reconnection
Increment #37: Wetland Restoration at Grange	Increment #37: Wetland Restoration at Grange
Increment #28: Wetland Restoration at River Mile 9	Increment #28: Wetland Restoration at River Mile 9
Increment #40: Hunter Creek Tributary Restoration	Increment #40: Hunter Creek Tributary Restoration
Increment #43: Weaver Creek Tributary Restoration	Increment #43: Weaver Creek Tributary Restoration
Increment #26: Wetland Restoration at Dips Road	Increment #26: Wetland Restoration at Dips Road

13.0 Evaluation and Comparison of Array of Alternative Plans

The evaluation of alternatives is conducted by assessing or measuring the differences between each with- and without plan condition and by appraising or weighting those differences. Evaluation consists of four general tasks: (1) forecast the most likely with-project conditions expected under each alternative; (2) compare each with-project conditions to the without-project conditions and document differences between the two; (3) characterize the beneficial and adverse effects by magnitude, location, timing, and duration; and (4) qualify plans for further consideration.

Plans were evaluated based on the following criteria: outputs and plan effects, contributions to the Federal objective (NER), the study goals and objectives, the Planning Guidance Notebook's four evaluation criteria (completeness, effectiveness, efficiency, and acceptability), and other criteria deemed significant by participating stakeholders. A summary of the evaluation, comparison, and trade-off analysis completed for the smallest scale of the Confluence Levee Removal Alternative (Alternative #11) and the largest scale of the Riverbed Excavation Alternative (Alternative #60) is presented in the following table.

Table 2. Trade-Off Analysis

Trade-Off Criteria	No Action Alternative	Confluence Levee Removal (Alternative #18)	Riverbed Excavation (Alternative #60)
Cost (Total First Cost)	$0	$19 million	$258 million
Total Habitat Units	0 AAHUs	187 AAHUs	588 AAHUs
Acres Restored	0 acres	277 acres (in-channel, floodplain, and channel capacity only)	1,342 acres (499 in-channel, floodplain, and channel capacity acres + 843 shellfish acres)
Cost Per Acre (total first cost divided by total acres)	$0	$69K	$192K
Direct benefit to shellfish or oysters	No	No	Yes (placement of dredged material in nearshore zone for shellfish attachment)
Directly increases channel capacity	No	No	Yes
Allows for placement of additional in-channel habitat features (LWD)	No	Yes, RM 9 to RM 11	Yes, RM 0 to RM 11
Addresses summer low flow reach; restores year-round channel near confluence	No	Yes	Yes
Improves habitat connectivity	No	Yes	Yes
Reduces fish stranding	No	Limited reduction in fish stranding; improves floodplain connectivity	Yes
Short-term negative environmental effects	None	Low	High
Sustainability	N/A	High	Medium
O&M	None	Minimal	Periodic re-dredging ($43M every 20 years)
Private property impacts	None	High	High

14.0 Tentatively Selected Plan

The evaluation and comparison of alternatives led the study team to initially recommend Alternative #27 as the Tentatively Selected Plan (TSP) as well as the environmentally preferable alternative. Alternative #27 is environmentally preferable because it has the greatest quantity of Average Annual Habitat Units without the significant temporary construction impacts and environmental risk to salmon spawning habitat of Alternatives #45 and #60.

The TSP presented in the Draft FR/EIS (January 2014) included the removal of Confluence Levee, the installation of large woody debris, reconnection of a side channel, wetland restoration at two sites, and restoration of two tributaries. In subsequent coordination efforts between the Corps, the non-Federal sponsors, and local landowners in the study area, three increments that were originally included in the TSP are no longer being carried forward. The Hunter Creek Mouth (Increment #39), Hunter Creek Tributary Restoration (Increment #40), and Weaver Creek Tributary Restoration (Increment #43) are no longer included in the recommended plan due to a lack of landowner willingness. As the feasibility-level design phase was completed, these increments were determined to have insurmountable real estate and access issues that had not manifested earlier the analysis.

15.0 Recommended Plan

As described in the previous section, the TSP presented the Draft FR/EIS has been modified following agency, technical, and public review of the report as well as completion of feasibility-level design efforts. While the Draft FR/EIS presented the Corps' tentative proposal for a selected plan, this Final FR/EIS presents the Corps' recommended NER plan. Based on subsequent coordination efforts between the Corps, the non-Federal sponsors, and local landowners in the study area, Alternative #18 (Figure 6) is presented as the recommended plan. This best buy plan includes the same increments as the original TSP (Confluence Levee removal, installation of large woody debris, and reconnection of a side channel, and two wetland restoration increments) but does not include the Hunter and Weaver Creek tributary restorations. While less comprehensive than the original recommended plan, Alternative #18 is still considered complete, acceptable, efficient, and effective, and it restores the critical needs of the study area (restores year-round flow for fish passage). Alternative #18 is a best buy plan, is economically justified, and is more acceptable in terms of landowner willingness/support.

Key considerations of the recommended plan are summarized below:

Total project cost: $19.2 million (October 2014 price levels); $21.5 million (fully funded cost estimate to the midpoint of construction)

Acres restored: 277

Cost per acre: ~$69k/acre (October 2014 price level)

Total habitat units: 187

Habitat scarcity: The recommended plan restores nationally scarce habitats including those described in the U.S. Fish and Wildlife Service's Biological Sampling in the Skokomish River Basin (Appendix A).

Connectivity: The recommended plan fully restores a critical, direct physical connection of existing habitat areas (restoration of year-round flow near the confluence of the North & South Fork Skokomish River). The plan also provides critical life requisites including a migration corridor as well as rearing and refuge habitat for ESA-listed salmonids species.

Special species status: The recommended plan directly restores habitat for federally listed salmonid species including Chinook salmon, chum salmon, steelhead, and bull trout.

Hydrologic character: System hydrology is restored to the best attainable condition, but remains a limited factor in ecosystem health of the Skokomish River Basin.

Geomorphic condition: Geomorphology is restored to the best attainable condition, but remains a limiting factor in ecosystem health of the Skokomish River Basin.

Self-sustaining: The recommended plan is designed to be environmentally self-sustaining with little to no O&M costs.

Plan recognition: The recommended plan is one element of an integrated restoration effort in the entire Skokomish River watershed, contributing to a regional plan for restoration of the Skokomish River Basin.

Alternative #18 is the recommended plan, the National Ecosystem Restoration (NER) plan, and the agency preferred alternative as determined by all of the evaluation criteria discussed throughout this Report Summary. The NER plan reasonably maximizes environmental benefits considering cost effectiveness and incremental cost analyses, significance of outputs, completeness, efficiency, effectiveness, and acceptability.

During the feasibility-level design phase and prior to the Civil Works Review Board, the study team completed additional evaluation and optimization of two sites that include proposed wetland embankment measures: Wetland Restoration at River Mile 9 and Wetland Restoration at Grange. These embankments were evaluated at two additional elevations (one lower and one higher which reasonably bracket the range of elevations to consider for optimization), as well as a “breach only” scenario (no embankment). The results of this analysis led the study team to recommend the small-scale wetland embankment scenario, which was identified as a best buy plan for each site.

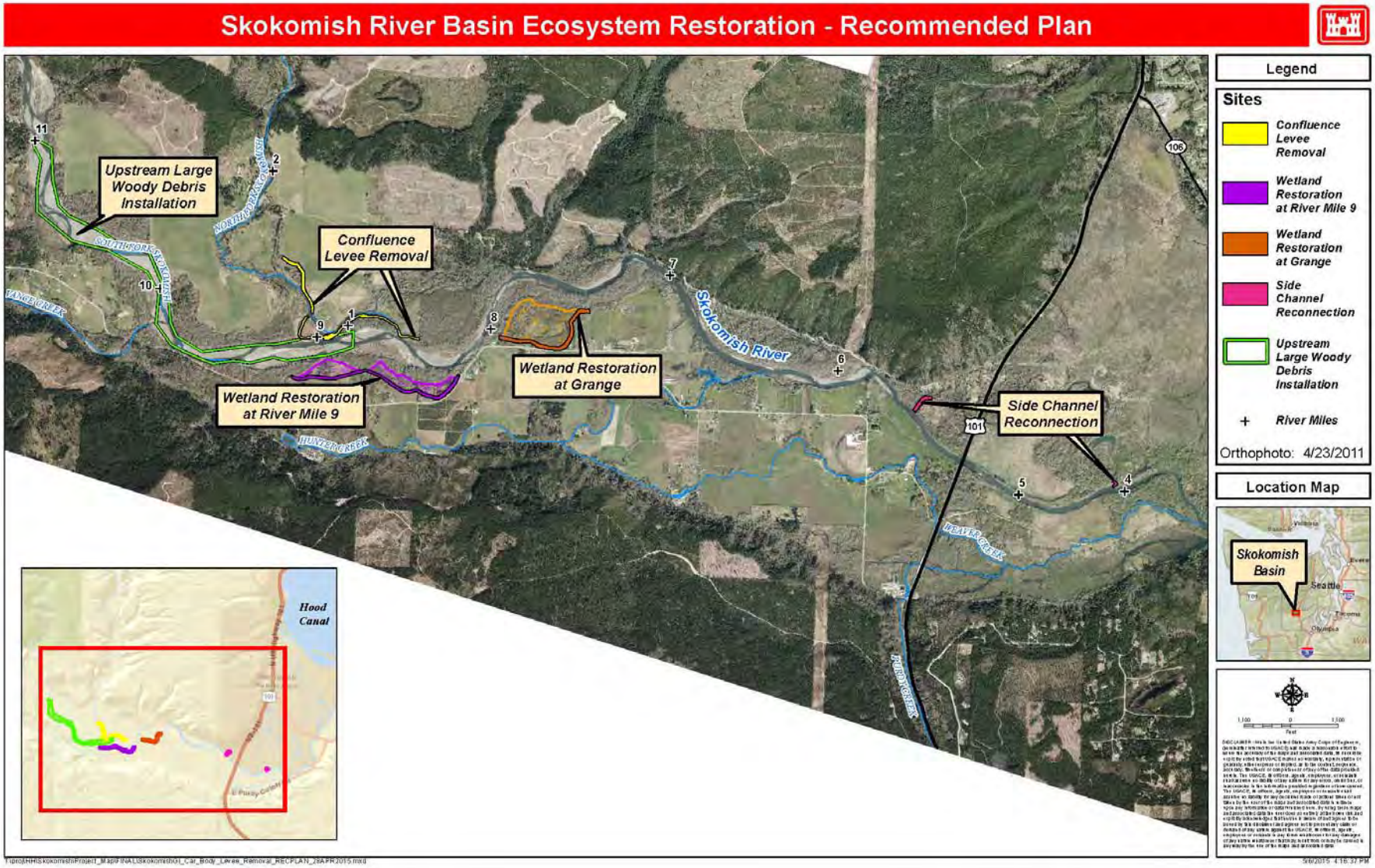


Figure 6. Recommended Plan.

15.1 Systems / Watershed Context

Several Federal agencies participated in early study activities, particularly in the process of identifying problems and opportunities in the basin. The Bureau of Reclamation has provided information critical to understanding the geomorphology and sediment transport processes of the river. The Corps has briefed the NMFS Restoration Center Northwest on the study as NMFS continues to express interest in the study's progress. The Corps contracted a baseline study through USFWS to conduct biological sampling throughout the study area. Additionally, the Corps is coordinating with USFWS in compliance with the FWCA. The Council for Environmental Quality regulations for implementing NEPA encourage agencies to formally agree to "cooperating agency" status, thus ensuring their expertise will be applied when formulating feasible alternative plans. Prior to the Feasibility Scoping Meeting, NMFS and USFWS expressed willingness to consider a cooperating agency role; although they declined upon formal invitation, both agencies remain actively involved in the study.

There is a strong, united effort by Federal, State, and local agencies as well as the Skokomish Indian Tribe for restoration of the Skokomish River Basin. Various Federal and State agencies as well as local entities are working within their individual authorities and within specific areas of the Basin to implement restoration activities throughout the upper and lower watersheds. The FR/EIS outlines present and future actions to restore the Skokomish River Basin; these actions are compatible with the Corps' recommended plan and capture synergies associated with process-based restoration.

In addition to the proposed present and future restoration projects outlined in the FR/EIS, the study team, non-Federal sponsors, local and regional stakeholders, and the public identified approximately 60 specific sites within the study area where one or more measures could address additional ecosystem degradation problems in the study area. Sites were selected based on locations of severe degradation, physical features that will provide an opportunity to improve types of degradation, access, and consideration of other complimentary proposed projects outside the range of the feasibility study. These proposed projects are generally smaller in scale and could be easily implemented by a local entity. These projects are generally compatible with the Corps' recommended plan and further restore the structures, functions, and processes of the Skokomish River. Members of the Corps study will continue to be available to Mason County and the Skokomish Indian Tribe to ensure any proposed actions will not adversely affect the Federal investment in restoration of the Skokomish River Basin.

Finally, the recommended plan is one element of an integrated restoration effort in the entire Skokomish River watershed. The recommended plan recommends restoration of the lower Skokomish River, which is complementary to, yet independent from, restoration actions in the upper watersheds (the Upper South Fork and North Fork) and estuary. Attainment of benefits associated with the recommended plan is not dependent on restoration activities led by the USFS in the Upper South Fork. Similarly, implementation of proposed flow regimes at Cushman Dam, construction of fish passage facilities or hatcheries in the North Fork, or other activities required by the Cushman Settlement are independent of the Federal action, but will complement the recommended plan. The synergistic efforts of those involved in restoration of the entire Skokomish River watershed will produce positive, cumulative effects across the Basin.

15.2 Environmental Operating Principles

The recommended plan supports the USACE Environmental Operating Principles.

16.0 Key Social and Environmental Factors

The overall cumulative effects of the recommended plan would be synergistic benefits to all aquatic species through process-based restoration in the lower Skokomish River. The benefits of increasing the number and size of in-channel pools, placing enough large woody debris (LWD) to mimic quantities in nearby more natural rivers and reconnecting aquatic habitats in the adjacent floodplain is predicted to provide substantial benefits to fish and wildlife habitat, especially for salmon species.

During construction, there could be temporary adverse effects such as increases in turbidity, temporary clearing of vegetation, and handling of fish for removal from construction areas. These effects would be minimized by providing erosion and pollution control best management practices and conducting all fish salvage and removal activities according to State and Federal requirements. Conservation measures would be implemented during construction to minimize effects to ESA-listed species.

Finally, the draft Monitoring and Adaptive Management Plan provides a conceptual plan for evaluating the effectiveness of proposed restoration actions and for developing corrective actions if management measures are not meeting performance metrics.

16.1 Stakeholder Perspectives and Differences

The draft FR/EIS public comment period ran for 45 days beginning in February 2014 and ending in April 2014. Approximately 25 comments were received from members of the public, stakeholders, and resource agencies. Although this study primarily addresses ecosystem restoration, a significant proportion of public comments submitting during the public comment period indicated that flood risk management is a major concern for Skokomish Valley residents. The Corps will continue to coordinate with landowners regarding these concerns.

The following Federal and State agencies, tribal partners, and non-governmental organizations have been involved during the feasibility study and are generally supportive of ecosystem restoration in the Skokomish River Basin:

- National Marine Fisheries Service
- U.S. Fish and Wildlife Service
- U.S. Bureau of Reclamation
- Washington Department of Fish and Wildlife
- Washington Department of Natural Resources
- Washington Department of Archaeology and Historic Preservation
- Washington Recreation and Conservation Office
- Washington Department of Ecology
- Puget Sound Partnership
- Washington Salmon Recovery Funding Board
- Northwest Indian Fisheries Commission
- Skokomish Watershed Action Team
- Hood Canal Coordinating Council
- Taylor Shellfish Company
- Green Diamond Resource Company
- Tacoma Public Utilities

16.2 Environmental Compliance

The NEPA document for this study is an EIS.

The Corps coordinated with NMFS and USFWS during the course of the feasibility study. The proposed Federal action is compliant with ESA based on two separate Programmatic Biological Opinions.

The project is in compliance with the Clean Water Act. For the Upstream LWD, Confluence Levee removal, wetland restoration sites with construction of wetland embankments, and the inlet channel of the Side Channel Reconnection components of the recommended plan, WDOE has Section 401 authority. The outlet channel of the Side Channel Reconnection project component is entirely on Skokomish Indian Tribe reservation land and is therefore under the jurisdiction of EPA. Individual Section 401 review is required for the Corps to obtain a 401 Water Quality Certification. The Corps will continue to coordinate project designs with WDOE and provide all necessary documentation to WDOE and EPA as it is developed during PED phase. These documents will be prepared in advance of finalizing PED, which will ensure that the Corps obtains Section 401 Water Quality Certification from both agencies well in advance of signing the Project Partnership Agreement. All applicable water quality standards will be met.

For Section 106 compliance, the Corps has determined a finding of *no historic properties affected* and will require monitoring during construction. The Corps will conduct a cultural resources survey when the proposed locations of the Upstream LWD and access routes are finalized in PED. The SHPO and THPO have both concurred with these findings and recommendations.

The USFWS provided its final Coordination Act Report on 27 February 2015.

17.0 Costs and Benefits

17.1 Project Costs

Based on October 2014 price levels, the estimated total project first cost is $19,228,000, which includes monitoring costs of $374,000 and adaptive management costs of $126,000. The fully funded cost estimate to the midpoint of construction is $21,504,000. In accordance with the cost share provisions in Section 103(c) of WRDA of 1986, as amended {33 U.S.C. 2213(c)}, the Federal share of the total project cost is estimated to be $12,498,000 and the non-Federal share is estimated to be $6,730,000, which equates to 65% Federal and 35% non-Federal. The non-Federal costs include the value of lands, easements, rights of-way, relocations, and dredged or excavated material disposal areas (LERRD) estimated to be $1,687,000, or 9% of total project cost. Table 3 outlines the cost summary for the recommended plan.

Table 3
Cost Summary
Skokomish River Basin Ecosystem Restoration
(October 2014 Price Levels)

Construction Item	Cost
Lands & Damages	$ 1,687,000
Elements	
Fish & Wildlife Facilities	$ 12,720,000
Monitoring	374,000
Adaptive Management	126,000
Subtotal	$ 14,907,000
Preconstruction Engineering & Design (PED)	2,528,000
Construction Management (E&D, S&A)	1,792,000
Total First Cost	$ 19,228,000

17.2 Equivalent Annual Costs and Benefits

Table 4A presents equivalent annual benefits and costs. Table 4B presents economic costs and benefits of the recommended plan.

Table 4A

Equivalent Annual Benefits and Costs
Skokomish River Basin Ecosystem Restoration
(October 2014 Price Level, 50-Year Period of Analysis, 3 3/8 Percent Discount Rate)

Investment Costs	
Total Project Construction Costs	$ 19,228,000
Interest During Construction	849,000
Total Investment Cost	$ 20,077,000
Average Annual Costs	
Interest and Amortization of Initial Investment	$ 837,000
(*additional annual costs, if applicable*)	
OMRR&R	10,000
Total Average Annual Costs	$ 847,000
Average Annual Benefits (Non-monetary)	186.6 AAHU's

Table 4B Skokomish River Basin Ecosystem Restoration Economic Costs And Benefits Of Recommended Plan[1] ($1,000)		
Item	**Ecosystem Restoration**	
	Costs	**Benefits**
Investment Cost		
First Cost	19,228	
Interest During Construction	849[3]	
Total	20,077	
Annual Cost		
Interest and Amortization	837	
OMRR&R[2]	10	
Subtotal	847	
Annual Benefits		
Non-monetary (Ecosystem)		186.6 AAHU's

[1]Based on October 2014 price levels, 3 3/8 percent rate of interest, and a 50-year period of analysis.
[2]Operation, Maintenance, Repair, Replacement, and Rehabilitation
[3] 32-month period of construction assumed for overall project

17.3 Cost Sharing

Table 5 shows the apportionment of the first costs, between the Federal government and the non-Federal sponsor(s).

Table 5
Skokomish River Basin Ecosystem Restoration - Cost Sharing
(October 2014 Price Level)

	Federal ($1,000s)	**Non-Federal ($1,000s)**	**Total ($1,000s)**
Ecosystem Restoration			
Lands & Damages		$1,687	$1,687
Fish & Wildlife Facilities	$12,720		$12,720
Monitoring & Adaptive Management	$500		$500
Planning, Engineering & Design	$2,528		$2,528
Construction Management	$1,792		$1,792
Cash Contribution/Reimbursement	($5,043)	$5,043	$0
Total Project Cost Share	**$12,498**	**$6,730**	**$19,228**
Total Project Cost Share (%)	***65%***	***35%***	***100%***

18.0 Operation, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R)

Aiming for process-based restoration, in which human-made stressors are removed from the landscape, has an inherent goal of no O&M costs. The features included in the recommended plan are intended to be environmentally self-sustaining. The recommended plan does not require specific channel forms or habitats to be maintained over the project life, thus avoiding the need for frequent O&M to correct minor changes. Based on feasibility-level designs and associated modeling, it is assumed that the recommended plan will require minimal maintenance only (approximately $10,000 per year) with O&M activities focusing on minor inspection of the upstream LWD features and periodic maintenance of the wetland embankments at the River Mile 9 and Grange wetland restoration sites.

19.0 Review

19.1 Quality Assurance and Agency Technical Review

The Final Feasibility Report/Environmental Impact Statement underwent District Quality Control, Agency Technical Review, legal review, policy compliance review, and State and Agency review. A summary of these reviews is outlined below.

19.2 State and Agency Review

(To be inserted by HQUSACE after the S&A Review ends.)

19.3 Certification of Peer and Legal Review

The DQC certification is dated 16 March 2015. The ATR certification is dated April 2015. The legal review certification is dated 13 May 2015. The Cost Engineering DX reviewed the cost estimates during ATR and provided cost certification on 4 May 2015. [NOTE: Additional certification dates will be provided prior to CWRB.]

19.4 Policy Compliance Review

(To be inserted by HQUSACE when the Documentation of Review Findings are completed.)