

Sauk River Comprehensive Flood/Erosion Control Management Plan

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EXECUTIVE SUMMARY

As with any effort of this magnitude, it is difficult to distill the Sauk River into a few paragraphs. The Sauk lives up to its' designation as a Wild and Scenic River, with emphasis on the Wild. At high flow, the river is powerful, erosive, and can change channels in multiple locations during any given event. To address this dilemma of a quickly changing river and Stakeholders desire to impart order amongst the chaos, Snohomish and Skagit counties embarked on a Comprehensive Flood/Erosion Hazard Management plan. The plan is a quantitative document that provides Stakeholders unprecedented opportunity for informed decision making.

INTRODUCTION

The Sauk River basin encompasses 714 square miles (USGS gage # 12189500 site data) in Northern Snohomish and Southern Skagit counties. This Comprehensive Flood/Erosion Hazard Management plan (The Plan) evaluates erosion and flood hazard in the Sauk River basin, and identifies flood and erosion hazard mitigation opportunities.

Flooding and erosion problems on the Sauk River, particularly in the upper Sauk near the town of Darrington, have worsened in recent years. In the October 2003 flood, estimated at greater than an 80 year event, many homes, property and infrastructure were damaged or destroyed, prompting this study.

Compounding flooding and erosion problems is a complicated array of overlapping state, federal, and local regulations that confuses even the most knowledgeable and patient landowner. The Sauk River, designated Scenic under the Wild and Scenic Rivers Act (WSRA), has an additional overlay of federal regulations including the WSRA and the Endangered Species Act (ESA).

Flooding and erosion are natural disturbances to the riverine ecosystem that forces the dynamic interaction of sediment, water and vegetation to form and reset habitat conditions favorable for salmonid rearing and reproduction (Beechie and Bolton, 1999). Controls at the landscape scale, such as climate, geology, topography, ecoregions (vegetation communities) and disturbance regimes, affect the magnitude and rates of supply and transport of sediment, water and vegetation. Controls on habitat formation at the reach scale, such as channel/valley geomorphic characteristics, riparian conditions and large woody debris (LWD) recruitment, affect routing and delivery (sometimes removal) of sediment, water and vegetation. These habitat forming processes, favorable for fish, can impact infrastructure and human society in ways considered detrimental.

At the same time, landscape and reach-scale controls have been substantially altered by human activities, such as forest road building, riparian clearing and bank armoring. These actions alter

the quantity and quality of river habitats for fish. Striking a balance between infrastructure and flood protection and habitat forming processes is critical given the unchanging physical factors inherent in river processes.

Habitat and physical conditions in large rivers are less well documented than in smaller streams because of their size and inaccessibility (e.g., Beechie and Sibley 1997). This has restricted our ability to understand riverine processes and to assess the habitat conditions for functionality relative to performance criteria (i.e., WFPB 1997, NMFS 1996.) It has also affected our ability to identify and prioritize appropriate sites and designs for infrastructure and flood protection, habitat protection and restoration. Analyzing data on the Sauk River and floodplain habitat will improve our understanding of large river processes, and guide flood and erosion damage reduction, project prioritization, and evaluation of feasibility and design.

GOALS

During the course of developing goals and objectives, the Stakeholder Committee decided that establishing a mission statement would be more appropriate for the plan.

The mission statement and corresponding objectives adopted by the Committee are as follows:

MISSION STATEMENT

Produce and implement a Sauk River Comprehensive Management Plan that balances the need for infrastructure and property protection with the protection and restoration of natural resources and outstanding and remarkable values of the Sauk River; (in a manner) that is acceptable to affected landowners, resource agencies, local tribes, interest groups, and local governments; and is consistent with plan elements required by the State of Washington.

OBJECTIVES

1. Collect data and create a database to be used in analysis (both in the current planning effort and in future follow-up activities) that will contribute to a better understanding of natural river processes and the full range of their effects.
2. Describe a range of potential actions to protect property and infrastructure; evaluate their effects on fish and wildlife habitat, as well as their ability to successfully protect property, infrastructure and other land uses.
3. Describe a range of potential actions to protect, restore, or enhance fish and wildlife habitat; evaluate their effects on property, infrastructure and other land uses, as well as their ability to successfully protect, restore or enhance fish and wildlife habitat.
4. Develop appropriate management strategies on a reach-by-reach basis including:

- a. The areas and conditions in the corridor that justify high consideration for flood and bank protection
 - b. The areas and conditions in the corridor that justify high consideration for habitat protection and restoration
5. Describe the regulatory environment in the Sauk River corridor, including:
- a. The statutory authority of local, state, tribal, and federal agencies
 - b. The required permits, pathways and timelines; particularly during locally declared emergencies
 - c. Recommendations for regulatory improvements
6. Provide information on the range of assistance programs available for areas impacted by flood and channel migration, including:
- a. Identifying gaps in these programs
 - b. Developing recommendations to fill these gaps
 - c. Recommending ways to improve access to existing programs
 - d. Develop a process for funding plan implementation
7. Develop an understandable outreach and public education program for the Sauk River Management Plan.

1. INTRODUCTION

1.1 PURPOSE OF THE STUDY

Flooding and erosion problems on the Sauk River, particularly in the upper Sauk near the town of Darrington, have become worse in recent years. In the October 2003 flood, estimated at greater than an 80 year event, many homes, property and infrastructure were damaged or destroyed, prompting this study.

Compounding flooding and erosion problems is a complicated array of overlapping state, federal, and local regulations that confuses even the most knowledgeable and patient landowner. The Sauk River, designated Scenic under the Wild and Scenic Rivers Act (WSRA), has an additional overlay of federal regulations including the WSRA and the Endangered Species Act (ESA).

Flooding and erosion are natural disturbances to the riverine ecosystem that force the dynamic interaction of sediment, water and vegetation to form and reset habitat conditions favorable for salmonid rearing and reproduction (Beechie and Bolton, 1999). Controls at the landscape scale, such as climate, geology, topography, ecoregions (vegetation communities) and disturbance regimes, affect the magnitude and rates of supply and transport of sediment, water and vegetation. Controls on habitat formation at the reach scale, such as channel/valley geomorphic characteristics, riparian conditions and large woody debris (LWD) recruitment, affect routing and delivery (sometimes removal) of sediment, water and vegetation. These habitat forming processes, favorable for fish, can impact infrastructure and human society in ways considered detrimental.

At the same time, landscape and reach-scale controls have been substantially altered by human activities, such as forest road building, riparian clearing and bank armoring. These actions alter the quantity and quality of river habitats for fish. Striking a balance between infrastructure and flood protection and habitat forming processes is critical given the unchanging physical factors inherent in river processes.

Habitat and physical conditions in large rivers are less well documented than in smaller streams because of their size and inaccessibility (e.g., Beechie and Sibley 1997). This has restricted our ability to understand riverine processes and to assess the habitat conditions for functionality relative to performance criteria (i.e., WFPB 1997, NMFS 1996.) It has also affected our ability to identify and prioritize appropriate sites and designs for infrastructure and flood protection, habitat protection and restoration. Analyzing data on the Sauk River and floodplain physical habitat will improve our understanding of large river processes, and guide flood and erosion damage reduction, project prioritization, and evaluation of feasibility and design.

1.2 STUDY AREA

The Sauk River is located in both Skagit and Snohomish counties, in northwest Washington State, (Figure 1). Snohomish County is bordered by Skagit County to the north, King County to the south, Chelan County to the east, and Puget Sound to the west. Skagit County is bordered by Whatcom County to the north, Chelan County to the east, Island County to the west, and Snohomish County to the south. The study area of the Sauk River basin, is approximately 714 square miles in area, and is shared by the two counties. Because of this duality, Snohomish and Skagit counties entered into a cooperative agreement in 2005 to partner on creation of this plan.

In the Sauk, reach-scale river and floodplain conditions (hydromodifications, riparian vegetation, and instream habitat) vary from nearly “un-touched” to highly modified. Likewise, the scale and scope of river assessment to date varies among mainstem reaches. In the mid-1990s, Skagit River Systems Cooperative (SRSC) gathered data on bank modifications and in-stream habitat units in the Sauk River (Hayman et al. 1996), and more recently has begun to inventory off-channel habitat (SRSC unpublished data).

Additional inventory and analysis has been completed for this plan, to better understand the sensitivity of this complex and highly dynamic system. Building on existing and new data to update and complete the Sauk River plan has been a critical step that will lead to better, more sustainable flood and erosion control and more habitat protection and creation throughout.

1.3 PLAN DEVELOPMENT

To complete the Sauk Plan, an existing stakeholders group was reorganized to help identify potential causes of flooding and erosion in the basin, flood and erosion hazards, and flood and erosion hazard mitigation opportunities. These will help determine guidelines for future flood and erosion hazard management.

The plan follows the guidelines and requirements regarding the preparation of comprehensive plans, and conforms to the following procedures described in RCW 86.26 and WAC 173-145:

- Establish a citizen and agency participation process
- Set short- and long-term goals and objectives for flood hazard management
- Develop an inventory and analysis of physical conditions
- Determine the need and identify alternatives for flood hazard management measures
- Evaluate alternative measures
- Hold public workshops for evaluation of alternatives
- Complete the draft Sauk Flood/Erosion Plan and associated documentation

- Submit the final Sauk Flood/Erosion Plan to Ecology

1.3.1 Public Involvement

Public involvement is critical to the success of flood/erosion hazard management planning, as proposed measures may affect local landowners and these landowners may be able to provide additional important information. Their understanding of the tools and process, and feedback throughout effort, is needed to develop actions.

The planning process also offers an opportunity to educate the public on the issues, opportunities, and public responsibilities of flood/erosion hazard management. Because the local governments must adopt the plan, it is important that the local community take an active role in developing the plan contents. In the Sauk, a representative sample of the community was present and active for each stakeholders meeting.

1.3.2 Advisory Committee

One of the first steps in developing this plan was to establish a planning advisory committee to engage the public and agencies, and gather their opinions and expertise. Fortunately, an interested and engaged Stakeholder Committee was already focusing on issues on the Sauk, so it was a natural segue to enlist these existing stakeholders in the planning process.

During the initial phases of the project, a smaller subcommittee, known as the Steering Committee, was formed to help guide the process. The Steering Committee met a total of ten times, on the following dates (Table 1-1):

Table 1-1. Steering Committee Meeting Dates

1	November 28, 2005
2	December 19, 2005
3	January 23, 2006
4	February 22, 2006
5	March 1, 2006
6	June 6, 2006
7	July 11, 2006
8	August 8, 2006
9	November 21, 2006
10	December 20, 2006

After the December 2006 meeting, the Steering Committee agreed to combine their efforts with those of the Stakeholder Committee to reduce the time commitments for all.

The Stakeholder Committee consisted of representatives from public and private organizations and agencies.

The committee met ten times (Table 1-2).

Table 1-2. Stakeholder Committee Meeting Dates

1	November 2, 2005
2	November 28, 2005
3	March 1, 2006
4	April 19, 2006
5	June 28, 2006
6	September 13, 2006
7	October 16, 2007
8	December 18, 2007
9	February 19, 2008
10	April 15, 2008

The meetings provided a forum for the committee to provide regular feedback to the counties. The committee also accomplished project review through e-mail or regular mail. Members who were invited, but could not attend meetings, were provided all information for review and comment throughout the process.

The efforts of all committee members were invaluable to the completion of this plan. A cross-section of stakeholders, who represented the key interests on the Sauk River, is shown in Table 1-3 below.

Table 1-3. Sauk River Comprehensive Flood/Erosion Management Plan – Stakeholder Committee

Chuck Steele	WA DOE	David Like	Hampton Lumber
Noel Gilbrough	U.S. Army Corps of Engineers	Paul DeVries	R2
Jack de Young	Fly Fishers Int'l	Diane & Bob Boyd	RRT/Property Owner
Alex Uber	WA Dept. of Fish	Devin Smith	Skagit River System Coop
Greta Movassaghi	US Forest Service	Holley P. Ross	Bryson Rd Sub Flood Control District
Peter Forbes	US Forest Service	Cheryl Ryder	Skagit River System Coop
Lori Kratzer	River Resource Trust	Betsy Stevenson	Skagit County
Brenda White	U.S. Representative Rick Larsen	David Lobo, Sr.	Bryson Rd Sub Flood Control District
Scott Morris	Sauk-Suiattle Indian Tribe	David Lobo, Jr.	Bryson Rd Sub Flood Control District
Bob Aldrich	Snohomish County	Erik Lobo	Bryson Rd Sub Flood Control District
Jim Faucett	RRT, Property Owner	Dana Exum	Bryson Rd Sub Flood Control District
Chuck Beck	Snohomish County Council	Kimberly Snavelly	Bryson Rd Sub Flood Control District
Stan Walsh	Skagit Riv. Sys. Coop.	Tom Sibley	National Marine Fisheries Service
Jeff Kamps	WDF&W	John Engel	Snohomish County
		Beth Blattenberger	Seattle City Light
		Ric Boge	Skagit County
		Tom Kearns	Bryson Rd Sub Flood Control District
		Karen Wood- McGuiness	Snohomish County

1.3.3 Goals and Objectives of the Sauk River Comprehensive Erosion/Flood Hazard Management Plan

During the course of developing goals and objectives, the Stakeholder Committee decided that establishing a mission statement would be more appropriate for the plan.

The mission statement and corresponding objectives adopted by the Committee are as follows:

1.3.4 Mission Statement

Produce and implement a Sauk River Comprehensive Management Plan that balances the need for infrastructure and property protection with the protection and restoration of natural resources and outstanding and remarkable values of the Sauk River; (in a manner) that is acceptable to

affected landowners, resource agencies, local tribes, interest groups, and local governments; and is consistent with plan elements required by the State of Washington.

1.3.5 Objectives

1. Collect data and create a database to be used in analysis (both in the current planning effort and in future follow-up activities) that will contribute to a better understanding of natural river processes and the full range of their effects.
2. Describe a range of potential actions to protect property and infrastructure; evaluate their effects on fish and wildlife habitat, as well as their ability to successfully protect property, infrastructure and other land uses.
3. Describe a range of potential actions to protect, restore, or enhance fish and wildlife habitat; evaluate their effects on property, infrastructure and other land uses, as well as their ability to successfully protect, restore or enhance fish and wildlife habitat.
4. Develop appropriate management strategies on a reach-by-reach basis including:
 - a. The areas and conditions in the corridor that justify high consideration for flood and bank protection
 - b. The areas and conditions in the corridor that justify high consideration for habitat protection and restoration
5. Describe the regulatory environment in the Sauk River corridor, including:
 - a. The statutory authority of local, state, tribal, and federal agencies
 - b. The required permits, pathways and timelines; particularly during locally declared emergencies
 - c. Recommendations for regulatory improvements
6. Provide information on the range of assistance programs available for areas impacted by flood and channel migration, including:
 - a. Identifying gaps in these programs
 - b. Developing recommendations to fill these gaps
 - c. Recommending ways to improve access to existing programs
 - d. Developing a process for funding plan implementation

7. Develop an understandable outreach and public education program for the Sauk River Management Plan.

1.4 FUNDING THROUGH THE FLOOD CONTROL ASSISTANCE ACCOUNT PROGRAM

The Washington State program to assist local jurisdictions in comprehensive planning and flood control maintenance is described in the state statute *State Participation in Flood Control Maintenance*, Revised Code of Washington (RCW) 86.26, enacted in 1951 and amended in 1984.

Funds for flood management maintenance projects and preparation of comprehensive plans are available through the Flood Control Assistance Account Program (FCAAP).

Procedural information relating to FCAAP and RCW 86.26 can be found in *Administration of the Flood Control Assistance Account Program*, Washington Administrative Code (WAC) 173-145. A copy is available in Appendix D.

The Washington State Department of Ecology (Ecology) distributes FCAAP grant money based on the amount appropriated by the State Legislature each biennium, and the eligibility of the applicant and the proposed project. Proposals are reviewed by several state agencies to ensure that appropriate resource issues and regulations are adequately addressed.

Legislative appropriations for FCAAP grants have varied from no appropriations (during the years 1975 through 1985) to \$4.0 million during the 2000 biennium.

The following restrictions apply to the use of the FCAAP grants:

- Grants are limited to 50 percent of the total cost for non-emergency projects.
- The non-emergency FCAAP contribution is limited to \$500,000 per county.
- Maximum emergency funds of \$150,000 per county per biennium are available on a first come/first serve basis; and the state will fund up to 80 percent of the cost of emergency projects.
- Unused emergency funds (\$500,000 total emergency fund) can be disbursed on a discretionary basis by Ecology.
- The state can fund 75 percent of the cost for comprehensive plans.

1.4.1 Requirements for Comprehensive Flood Management Plans

To obtain funds for flood management maintenance projects through FCAAP, jurisdictions must prepare a comprehensive plan that, as discussed in RCW 86.26.105, accomplishes the items outlined in 1-4. The comprehensive plan must also establish and rank appropriate nonstructural and structural measures to reduce flood damages.

The study area may include the entire watershed or, at a minimum, the 100-year frequency floodplain within a reach of the watershed. The Sauk River plan includes measures that describe erosion and flooding problems and solutions throughout the basin.

Table 1-4. Requirements for a Comprehensive Flood Hazard Management Plan.

Washington State law imposes a set of requirements for comprehensive plans adopted in the state. An Ecology-approved plan includes:

- 1. For all flood hazard reduction work outlined in the plan:**
 - Establish the need for the work based on historical flooding hazard
 - Identify alternatives, both non-structural and structural
 - Identify potential impacts of the work on resources such as fish and wildlife
 - 2. Identify and include a map of the entire 100-year floodplain.**
 - 3. Present conclusions and proposed solutions including priorities of implementation.**
 - 4. Certify that an acceptable, comprehensive emergency operations plan is in place.**
 - 5. Include the following in preparation of the plan:**
 - Citizen involvement
 - Coordination between government agencies
 - Establishment of short- and long-term goals and objectives
 - Review of all pertinent regulations
 - Research into past studies and projects
 - Review and approval by Ecology
-

State law requires that a comprehensive plan describe the area where any proposed projects are located, and the types and locations of existing flood hazards. A complete description of the information that a comprehensive plan must include is contained in WAC 173-145-040. The law allows up to three years for local authorities to complete and adopt a comprehensive plan. Ecology must approve the final comprehensive plan, and the local jurisdiction must adopt the plan subsequent to approval.

1.4.2 Applicant Eligibility

Counties, cities, and other local jurisdictions with flood control responsibilities, such as flood control districts or diking districts, are eligible to receive state funding for flood control maintenance projects. Eligible jurisdictions must file their flood control budget with Ecology by February 15th of each year.

To receive funding for flood control maintenance projects, the county, city, town, or district having planning jurisdiction over the project must have its floodplain management activities approved by Ecology. The requirements include:

- Participation in the National Flood Insurance Program (NFIP)
- Certification of the local emergency response plan by the State Department of Emergency Management
- Restriction of land uses to flood-compatible uses within a river's meander belt or floodway
- Adoption of a Shoreline Master Program (SMP) may also be required

1.4.3 Maintenance Project Eligibility

Evaluation of proposed FCAAP projects identified in the adopted comprehensive plan is based on cost-benefit, local prioritization of projects, intensity of local flood hazard management problems, and consideration of historical information in the comprehensive plan.

Maintenance projects must be based on a comprehensive approach to flood hazard management planning and must meet specific guidelines with respect to project goals. The legislation describes in general terms the maintenance work eligible for funding, which includes “maintaining and restoring the normal and reasonably stable river and stream channel alignment and capacity ... and ... restoring, maintaining, and repairing natural conditions, works and structures.” State participation can also include “restoration and maintenance of natural conditions, works, or structures for the protection of lands and other property from inundation or other damage by the sea or other bodies of water” (RCW 86.26.090).

Funding for enhancement of flood management facilities was authorized by Engrossed Senate Substitute Bill 5411, which was enacted in July 1991. This expanded FCAAP project eligibility to include the purchase of flood-prone properties (provided that the property owners are willing sellers) or land to be used for flood storage; but only if these measures were identified in the applicable comprehensive plan. As described further in the Sauk Flood Plan, significant efforts were made by the Stakeholders Committee to identify public areas that have the potential for flood storage, but a detailed analysis will be required to quantify hydraulic benefits.

The Hydraulic Project Approval (HPA) and the Shoreline Substantial Development and Conditional Use (CU) permits must be obtained before the project is funded by Ecology. In addition, because of the listing of Chinook salmon as threatened under the Endangered Species Act, permitting regulations have become increasingly difficult and complex. All projects must be planned and designed consistent with ESA, applicable Shoreline Master Programs and comprehensive plans; and must benefit public, as opposed to strictly private, interests.

1.4.4 Emergency Projects

A portion of the available FCAAP funding is reserved for emergency use by law. Projects considered emergencies are those that must be done immediately to protect life and property from “unusual, unforeseeable, and emergent flood conditions” (WAC 173-145-000).

Release of emergency funds is contingent on an emergency declaration by the appropriate authority. Depending on the emergency measure, a shoreline permit or HPA may be required.

1.4.5 Consultation with Other Agencies

A variety of state and federal agencies are involved in key river issues, such as fishery resources, wildlife habitat, and public use. The presence of fishery resources, primarily salmon and steelhead, is a key consideration in performing any flood hazard management activities in and around the waters of the State of Washington. The potential loss of fish habitat resulting from construction in and next to rivers has been a major concern for Native American groups, fisheries agencies and sports fishermen, among others.

To ensure that habitat resources are maintained, the Washington State Department of Fish and Wildlife (WDFW) has review authority for most phases of FCAAP. Ecology is required to consult with the WDFW before approving any comprehensive plan. Applicants for flood control assistance project funds must review their proposals with the WDFW, the Washington State Department of Natural Resources (DNR), and the tribes with jurisdiction.

Construction work to be performed in or adjacent to navigable waters of the United States, including wetlands, must be approved by the Army Corps of Engineers (Corps.) The Corps’ permit process ensures that all other federal, state, and local regulatory agencies with jurisdiction over the project are properly notified of and approve, the project. The Corps will not approve a project that has been rejected by another permitting agency.

Section 7 of the ESA requires that any project that may impact a listed species is reviewed by either the U.S. Fish and Wildlife Service (USFWS), (which oversees terrestrial animals and freshwater fish species), or the National Marine Fisheries Services (NMFS), which oversees marine anadromous (freshwater and saltwater) species.

The ESA applies to all actions that meet any of the following criteria:

- Projects where a permit from a federal agency, such as the Corps is required
- Projects on federal lands
- Federally funded projects, including projects where federal funding is administered by state agencies
- Projects not possessing a federal connection, but that may cause either direct injury to the listed species, alteration of habitat, or significant disturbance of the habitat

The Sauk River is habitat for a variety of species, including the ESA-listed bull trout, and Chinook salmon. Both the bull trout and the Chinook are listed as threatened species. The goal of our review is to determine the type and extent of impacts and the proper mitigation measures that should be implemented during the course of the project to limit or eliminate these impacts.

1.5 AUTHORITY AND SCOPE

In 2006, Snohomish County worked with consultant R2 Resources Inc., to assist in the development of the risk analysis and technical report for the Sauk River Erosion/Flood Plan. The draft version of the Technical and Regulatory Analysis was completed and submitted to the Stakeholder Committee for review in March 2008. The complete report, including all technical analyses, was submitted to the Stakeholder Committee for review in April of 2009.

Funding for the development of the Sauk River Comprehensive Flood/Erosion Control Plan (the Plan) was provided to the two counties under a 75 percent FCAAP grant from Ecology, with the remaining 25 percent funded by Snohomish and Skagit counties.

The alternatives and recommendations for flood hazard management presented in this plan are in accordance with FCAAP requirements as stated in the RCW 86.26 and the WAC 173-145 (Appendix 3).

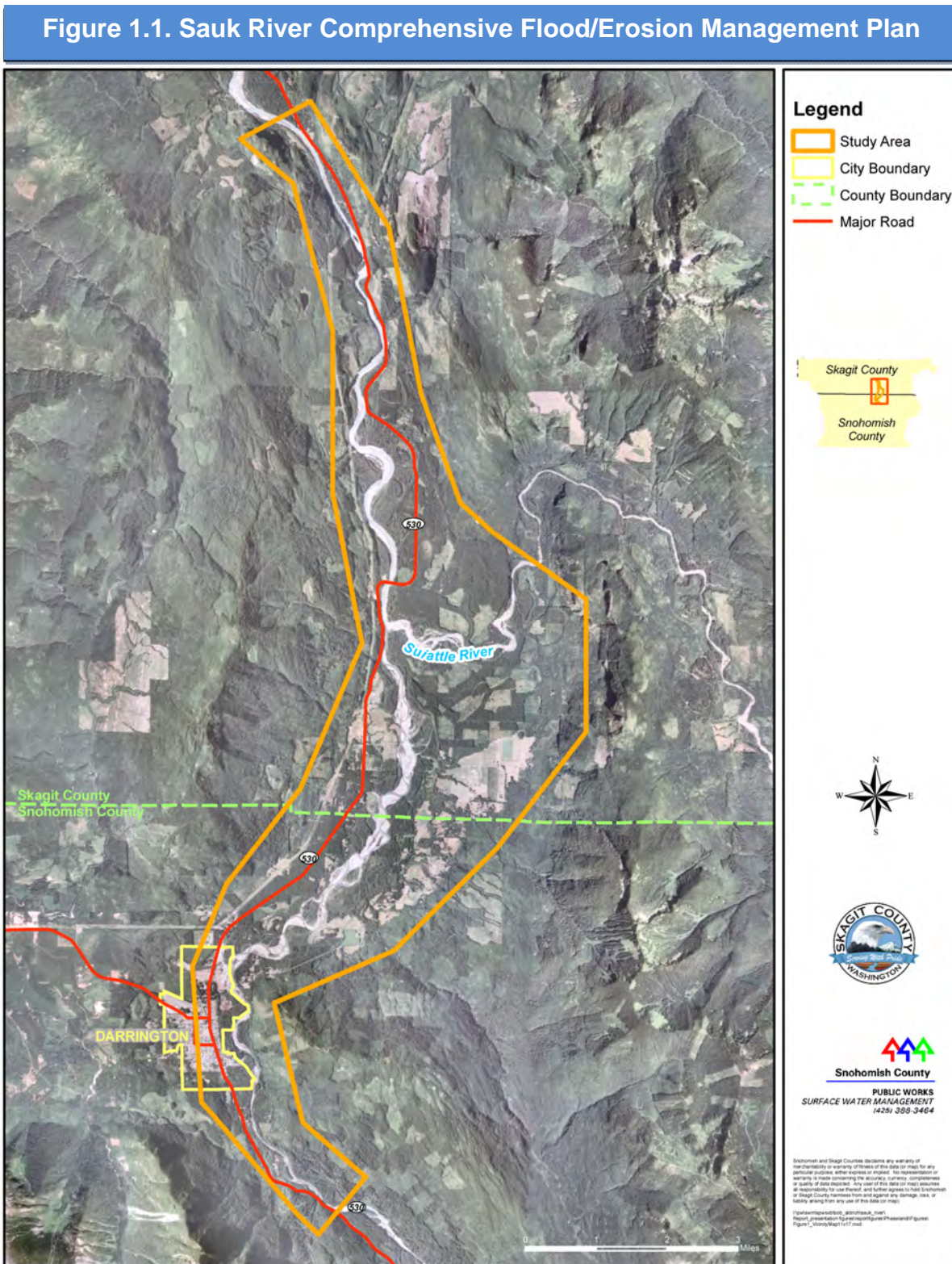
The Plan fulfills one of the main requirements for the counties to become eligible for funding from the State of Washington under the FCAAP. State funds from this program can be used for emergency and non-emergency activities that reduce property loss and threats to human health caused by flooding.

In addition, this plan is also recognized by the FEMA as a mitigation plan to be used to direct post-disaster mitigation measures. In addition to the County's participation in the NFIP, this plan will assist the County in quickly receiving federal funds in the event of a large-scale flood.

1.6 PLAN ORGANIZATION

This document consists of facts regarding the watershed, planning area characteristics, and flood history) and; identified flood/erosion hazard areas; and analysis.

- Chapter 1 – presents the comprehensive plan requirements and the FCAAP requirements the process used to develop this plan; and the organization of the plan.
- Chapter 2 – provides general information on the Sauk River basin and flood patterns in the Sauk River, fundamental information on flooding, hydrology, and sedimentation as well as specific information on Snohomish County’s Flood Warning System.
- Chapter 3 – provides information on applicable federal, state, and local regulations.
- Chapter 4 – provides information on, and an evaluation of Plan Alternatives.
- Chapter 5 – provides information on Recommended Actions.
- Chapter 6 – The Users’ Guide.
- Appendices follow.



2. THE SAUK RIVER BASIN

2.1 OVERVIEW

The watershed of the Sauk is large and complex, formed and altered by the dual action of Continental glaciation, and massive tectonic/volcanic forces. This work encompasses the watershed from a point upstream from the town of Darrington, where a clear demarcation between publicly managed lands and privately owned lands begins. Note: There are various private inholdings in the public lands, but the land is largely managed by the US Forest Service).

This chapter addresses the history, current land uses, ownership, and public infrastructure. Included are discussions on the Mountain Loop Highway, as well as the Wild and Scenic designation of much of the river. Finally, the geographic location, biological and environmental characteristics are discussed. The chapter concludes with a discussion of flooding, current flooding and erosion events, and a short discussion of a flood warning system.

2.2 EARLY SETTLEMENTS

The Sauk River Valley has been home to the Sauk-Suiattle Tribe for centuries. The riches of this glacier-carved, forested area, which included abundant fish, berries, wool (from mountain goats) and edible roots, provided sustenance for their community. Known as the Sah-Ku-Me-Hu, the Sauk-Suiattle were canoe people, who deftly navigated the swift waters of the Sauk, Suiattle, Skagit and Cascade rivers.

The tribe's homelands were the entire drainage area of the Sauk, Suiattle and Cascade rivers. They established an important village at Sauk Prairie, near the confluence of the Sauk and Suiattle rivers. The village consisted of eight traditional cedar longhouses, which were destroyed in 1884 by early settlers.

Today, the Sauk-Suiattle community is located on a 25-acre reservation established in 1983, near the west bank of the Sauk River, south of the confluence of the Sauk and Suiattle rivers. *(Information on the Sauk-Suiattle Tribe was provided by Rebecca Leonard, Tribal Attorney and Scott Morris, Watershed Manager, Sauk-Suiattle representatives)*

The town of Darrington began as a settlement on a gravelly plain set between the Sauk River and the North Fork of the Stillaguamish River, five miles long and a mile-and-a-half wide. Darrington was once referred to as the Burn or Sauk Portage. Until the late 1880s, this area was largely unknown, accessible only by canoe and fish trails that followed the North Fork of the Stillaguamish River from Arlington. In the early 1890s, miners from the East arrived in search of gold in the mountain rivers. The first real wagon road was built around Cicero in 1887. The land was so rough and heavily forested that a portion of the road between Arlington and Oso

required a block and tackle to get through. Eventually, a few miners made their way into what is now Darrington and began to settle there.

Around the same time, pioneer James Bedal came to the Darrington area by way of the Skagit River. While exploring the Sauk River Valley, he decided to homestead in Sauk Prairie. There he met Susan Wa-wet-kin, the only daughter of the Sauk-Suiattle chief John Wa-wet-kin. After marrying her, he started a logging business that eventually failed due to the difficulties of moving logs on the river. In the spring of 1891, he moved his wife and baby son to a new homestead claim 18 miles upstream from what is now Darrington. The Bedals and their offspring, Edith Bedal, Jean Bedal Fish, and Harry Bedal, left a lasting legacy in the Darrington area and Snohomish County.

The year 1891 saw the filing of some of the first mining claims in the area. Knute Neste found the Morning Star Lode and the Jumbo Mine on White Horse Mountain, a 7,000-foot white-capped peak three-and-a-half miles outside of Darrington. Other early miners included Loren Robinson, Charles Burns, William Geisler, John Robinson, C. C. Scholman, and George Knudson.

Darrington continued to be an isolated place until the end of the 1890s, with freight coming by canoe or pack horse. In July 1899, the first freight on wheels arrived by way of the North Fork. Less than a year later, miners in the town promised the Seattle & International Railway 75 percent of their ore shipments for the next 15 years, to support the building of a rail line up the Stillaguamish Valley. The railway agreed, and using a new rail-laying machine, completed the 28 mile long extension. Before the work was finished, the Northern Pacific took over the Seattle & International Railway.

The completion of the last bridge into Darrington and the arrival of the first train on May 31, 1901, produced a boom in the town. By now, the town was laid out with 60-foot-wide streets running east and west through the center. Businesses were established. John Montague came up from Oso, and with resident Charles E. Moore, started a general store. The United States Mill began, employing 100 men and cutting 23,000 board feet per day.

Few communities in Snohomish County were as remote as Darrington, which depended entirely on the nearby resources associated with mining and logging. After the 1920s and the arrival of the automobile, the tiny settlement began to grow. In 1922, Standard Oil opened an auxiliary supply station “for gasoline and stove oil” by a stage line (*Cameron, p. 195*). The following year, silent films came to Darrington at the Rex Movie Theater, though how they were run is speculation. It was not until 1926, when electrical power was brought up river by two local citizens, the Donaldson brothers, that some sort of service was provided. Even that was

undependable at first. Some homes had only enough power to run a single light bulb. There was not enough for an electric range.

The formation of the Darrington Improvement Club in 1924 spurred projects such as planting shade trees and putting in street lights. The club cut a road to the elementary school and in 1925 helped form a 29-member volunteer fire department. It raised funds for fire equipment for use on a light truck, bought 20 acres of virgin timber (with the help of the Arlington Commercial Club) for a park, and distributed an illustrated brochure, “Darrington, Where the Trails Begin,” promoting the outstanding recreational opportunities for the average American with their newfound use of the automobile (*Cameron, p. 196*). Fishing, hiking, and camping were the draws to Darrington, activities still cherished today.

The Depression hit hard in Darrington, as it did in many other towns across America. To shore up the economy, the federal government responded with Works Progress Administration (WPA) projects and the opening of the first Civilian Conservation Corps Camp in the area. Camp Darrington opened on May 20, 1933, a half-mile north of the town of the town. It provided work for many local young men. Citizens in the town responded to the economic crisis by creating the Darrington Pioneer’s Cooperative. They “donated their time for credit in order to come together and create jobs, sell firewood for cash, purchase food supplies, build a small sawmill and erect housing” (*Cameron, p. 28*).

In 1945, Darrington was finally incorporated as a city. Not long after that achievement, it seemed destined to become a ghost town when a couple of the largest logging mills moved out. A lot of the forests had been logged out. Fortunately, another company came in and found work in the winter blow downs. In 1953, logging trucks were busy. Still, the town was on its own, (*Oakley, Janet, 1/17/09*).

2.3 THE SAUK BASIN TODAY – CURRENT LAND USES AND KEY FEATURES

The Sauk River Basin covers 714 square miles. It has remained relatively undeveloped and sparsely populated, with centers in Darrington and in a few small communities upstream and downstream, particularly along the Bryson Road and Clear Creek area. In 2007, the population of Darrington had only reached 1,613 (*2007 Growth Monitoring Report, Snohomish County Planning and Development Services*) although there are likely that many more people living in the surrounding area.

The chief land use in the Sauk River Basin is forest management, although there is also some agriculture, mining and rural residential housing. Darrington has few businesses and almost no industry that is not timber- related; an industry which has remained economically depressed since the late 1980s.

The Sauk River Basin is well known for its multitude of recreational opportunities. The area is considered a gateway to exceptional hiking, climbing, fishing and camping, as well as the more passive outdoor recreation experiences such as photography and bird-watching.

Darrington's location offers panoramic views of scenic forests and mountains. The main peaks are Three Fingers Mountain (6,854 feet) and Whitehorse Mountain (6,840 feet) to the Southwest, Mount Higgins (5,202 feet) to the northwest, and White Chuck Mountain (6,935 feet) to the east. A large portion of the White Chuck Watershed is designated wilderness and the White Chuck Trailhead is a major portal into the Glacier Peak Wilderness and Glacier Peak climbing routes.

Fishing, either from the bank or from a boat on the Sauk, is a profitable enterprise for several outfitters in Darrington and throughout the valley, as well as a sought-after activity for numerous private fishers. The area is especially known for its excellent fly-fishing. River rafting and boating, both private and commercial is nearly a year-round activity pursued by increasing numbers of boaters.

The US Forest Service has a ranger station in Darrington. They also own and maintain a boat ramp adjacent to the State Highway 530 Bridge on the Sauk, which serves the Suiattle and the upper Sauk rivers. Snohomish County owns and maintains two other boat ramps in the area: an informal ramp at Clear Creek and another at the new Bridge 414 at the Sauk Prairie Road.

Another type of recreation the Darrington area is famous for is the annual bluegrass festival and rodeo. This festival is held in July and draws attendance from all over the Northwest and beyond.

2.3.1 Ownerships / Land Management

Much of the entire Sauk River basin remains in commercially harvestable forestland, owned by federal, state, county and private entities. Different landowners have different management objectives, and the basin is a mix of forests managed for income, habitat/ecological services or recreation and aesthetics. Each of these types of owners has a distinct approach to forest management, and these differences can and do impact the Sauk River.

Within the Sauk River Basin, the majority of forested lands are under federal jurisdiction. Federal forest lands in the basin are part of the Mt. Baker-Snoqualmie National Forest, and the Boulder River and the Glacier Peak Wilderness Areas. The Mt. Baker-Snoqualmie National Forest is managed by the U.S. Forest Service. The wilderness areas are managed by the four federal land management agencies: Bureau of Land Management, Fish and Wildlife Service, Forest Service and National Park Service.

The U.S. Forest Service manages approximately 46% of the land in the basin for multiple uses, including ecological services, recreation, mineral extraction, and other commercial and public uses. This is significant because their regimes do not include clear-cutting for timber harvest purposes.

The Washington State Department of Natural Resources (DNR) manages approximately 24% of the forest lands in the basin, mostly around the Suiattle River and northward. The DNR strives to manage timber lands in a manner that will conserve and enhance the natural systems and resources of their forested state trust lands to produce long-term, sustainable trust income, and environmental and other benefits for the people of Washington. The trust income is distributed annually to counties and state schools, among other entities.

Private forest lands comprise the majority of the forest lands closest to the Sauk River within the study area. Both state and private forest landowners primarily harvest by clear-cutting, which can have an effect on peak floods in the basin.

Within the 100 year floodplain of the Sauk River, land management is also mixture of private and public ownership, with private being more prevalent. Private forestlands comprise the largest percentage of land (43%), followed by State Forest ownership, (26%), private landowners (14%), federal lands (7.5%), government uses (5%), agriculture (1.7%), public forest covers 1.3% of the acreage. Finally, Tribal ownership completes the total at 0.9% of the acreage. Private timber lands on smaller acreages within the floodplain are managed as small woodlots, firewood production, or for logging purposes. Other private timber lands on larger acreages are managed on a large scale for timber production. For example, Hampton Timber, a landowner in this area, manages its holdings for timber production, but tends to rely upon sales for DNR, USFS, and private timber holdings. Bank stabilization projects appear to be the most desired by private landowners, whether they are trying to protect their farmlands, or save a house or cabin from falling into the river.

Agriculture activities are conducted throughout the basin; centered primarily in the fertile floodplain areas of the mainstem Sauk. These operations are declining, as farmers struggle to keep their businesses economically viable. As farms are sold, other more intensive uses may take their place and influence future flooding patterns.

2.3.2 Public Infrastructure

Infrastructure protection is the chief concern for lands owned by government or utilities. As a sparsely populated area, the Sauk River Basin has limited public infrastructure, though what exists has an important impact on the river. Three jurisdictions own and maintain facilities on or near the Sauk River: Snohomish County, Skagit County and the Washington State Department of Transportation (WSDOT).

Snohomish County owns and maintains several road segments from Clear Creek, (the uppermost boundary of this study), to the town of Darrington. Clear Creek Road, near the west side of the river is in an actively eroding, and will likely see either extensive remediation efforts in the future, or abandonment. Clear Creek Road is connected at both ends to the Mountain Loop Highway; and, if abandoned, would create two dead end roads.

On the opposite bank of the river is the North Sauk River Road, which provided access to Sauk Prairie Road for 22 properties and a private timber company. Record rainfalls in October 2003 caused significant erosion, washing out 1,000 feet of this road just outside Darrington. The river now occupies the footprint of the old road. Although the County has been working on a plan to reconstruct a new road with a different alignment, in 2009 the project was still not fully funded.

Further downstream, the Sauk Valley Road crosses the river adjacent to the Hampton Mill. Snohomish County has recently completed this new bridge, which opened the span and removed scour issues for the bridge abutments.

WSDOT owns and operates State Route (SR) 530, a highway which parallels much of the Sauk River from Darrington to the confluence with the Skagit River. SR 530 crosses the river at a point approximately ½ mile downstream of the confluence of the Suiattle and the Sauk rivers, at the Government Bridge.

Further downstream the river is once again bridged to connect SR 530 with the Concrete/Sauk Valley Road. Skagit County owns and maintains this bridge. It appears to be in good shape, although issues with downstream erosion, on the west side of the river, may eventually require protective action on the part of the County.

In several sections of SR 530, the state has had to construct and maintain immense structures designed to protect the highway, testimonial to the power and nature of the river.

2.3.3 The Mountain Loop Highway, a National Forest Scenic Byway

Near Darrington, SR 530 connects with the Mountain Loop Highway, which was classified as a National Forest Scenic Byway in 1991. This historic highway was first established by miners traveling back and forth between mines in 1891, linking Darrington with Granite Falls. Later, it was developed as a road by loggers and members of the Civilian Conservation Corps.

Considered a scenic attraction today, the roadway covers 55 miles through boom-and-bust town sites, abandoned claims, rushing rivers and glacier-clad peaks. The road is paved from Verlot to Barlow Pass, but is graveled to Bedal, upstream from Darrington.

Driving the entire loop is usually limited to late spring through the fall, since snow often lingers at Barlow Pass through late spring. The Mountain Loop Highway attracts many visitors maintained in part by the Forest Service, and in part by Snohomish County.

2.3.4 The Sauk River – Part of the Skagit Wild and Scenic River System

The Skagit Wild and Scenic River System, located in both Skagit and Snohomish counties, was established by Congress in 1978 (Sec 703 of PL 95-625, 11/10/1978.) It includes the following river segments:

- The Skagit River, from the pipeline crossing at Sedro-Woolley, upstream to and including the mouth of Bacon Creek
- The Cascade River, from its mouth to the junction of its North and South Forks
- The South Fork of the Cascade River, to the boundary of the Glacier Peak Wilderness Area
- The Suiattle River, from its mouth to the boundary of the Glacier Peak Wilderness Area at Milk Creek
- The Sauk River, from its mouth to its junction with Elliott Creek
- The North Fork of the Sauk River, from its junction with the South Fork of the Sauk to the boundary of the Glacier Peak Wilderness Area

The National Wild and Scenic Rivers System was created by Congress in 1968 (Public Law 90-542; 16 U.S.C. 1271 et seq.) to preserve certain rivers with outstanding natural, cultural, and recreational values in their natural and free-flowing condition for present and future generations. The Act is focused on safeguarding the special character of these rivers, while also recognizing the potential for their appropriate use and development.

The Skagit Wild and Scenic River System feeds into Puget Sound and features one of the largest bald eagle concentrations in the lower 48 states. Covering over 158 miles, the river system is known for its fisheries resources, rugged canyons, glacier-covered mountains, and densely forested slopes.

The Skagit Wild and Scenic River is located in a unique and beautiful place, largely untouched, yet within a reasonable drive from a number of major metropolitan areas. Development in the Skagit River basin has been increasing since the river was designated in 1978. Management of the Skagit Wild and Scenic River must be consistent with the Wild and Scenic Rivers Act, Section 10(a), which requires the protection and enhancement of the values that caused the Skagit Wild and Scenic River to be included in the National Wild and Scenic Rivers System.

This climate and the Skagit Wild and Scenic River designation have provided abundant opportunities for working in partnership at the watershed scale to fulfill river stewardship responsibilities. The convergence of such abundant natural resources and the growing popularity of the area creates a challenge in balancing use and enjoyment with the long-term sustaining this unique ecosystem. Forest Service river management strategies must push beyond geographical, legal, administrative, political, and personal boundaries to find effective solutions that will sustain the unique features of this river system.

2.4 THE SAUK RIVER - GEOGRAPHIC LOCATION

The Sauk River is located in Snohomish and Skagit counties in northwestern Washington State. At 45 miles in length, the Sauk is the largest free-flowing tributary of the Skagit River, draining an area of the Cascade Range into Puget Sound.

The Sauk River is located in a variety of geographic settings, from steep river-cut valleys flanked by snow-topped ridges to wider valleys carved by large glaciers. The two forks of the Sauk rise in the Cascades in eastern Snohomish County in the Glacier Peak Wilderness and join to form the mainstem of the Sauk at Bedal. From that point, the Sauk flows northwest through a remote section of the Mount Baker-Snoqualmie National Forest to Darrington; meeting several tributaries (the White Chuck River on the east, and Clear Creek on the west) on the way. Continuing north from Darrington, the Sauk meets two other key tributaries, Dan Creek and the Suiattle River, before reaching Rockport.

The Suiattle is a river in its own right, originating from the Suiattle Glacier on the slopes of Glacier Peak in the Cascade Range. The Suiattle joins the Sauk River, north of Darrington, and the Sauk joins the Skagit River at Rockport. The Skagit continues to the west, draining into Skagit Bay, a part of Puget Sound.

Most of the tributaries of the Sauk originate in Wilderness areas, mainly the Glacier Peak and the Henry Jackson Wilderness areas. The fact that the river system emanated from such dramatic and unspoiled settings provided an impetus for its declaration as a Wild and Scenic River. Yet, while the Sauk meanders across the floodplain in and around Darrington, which is surrounded on all sides by private, federal and state timberlands, it is considered only scenic. (Note: There is no difference from an administrative standpoint between a Wild and Scenic Designation, for additional discussion, please refer to Chapter 3.)

2.5 BIOLOGICAL AND ENVIRONMENTAL CHARACTERISTICS

As with the physical resources of the basin, the biological and environmental characteristics of the river are important. Driving many of the processes in the river, sediment is never in short supply, and must be considered both in a physical as well as an environmental sense. The

sediment is not a new phenomenon, emanating to a large degree from the slopes of Glacier Peak in the form of lahars. Thus it should be understood that most successful fish species have adapted and flourished under conditions that have waxed and waned for thousands of years.

2.5.1 Fisheries Resources

The Skagit River Basin represents the largest and one of the most unspoiled strongholds of fish and wildlife habitat in the Puget Sound area. Encompassing over 3,100 square miles (8,030 kilometers) of watershed area, the Skagit system is composed of the mainstem Skagit and its tributaries, as well as four secondary river basins: the Baker, the Cascade, the Sauk, and the Suiattle. It includes 80,728 acres (32,670 hectares) of delta, connecting the river to Skagit Bay and Whidbey Basin. The Skagit drainage area includes 2,989 identified streams, covering approximately 4,540 linear miles.

As the largest free-flowing tributary of the Skagit, the Sauk River is important habitat for the Skagit River Basin's anadromous fish populations. The Sauk supports the spawning runs of all five Pacific salmon species (Chinook, Coho, chum, pink and sockeye), summer and winter run steelhead, sea run cutthroat trout, Dolly Varden, bull trout. These include six Chinook stocks (spring, summer, and fall); pink salmon; chum salmon; sockeye salmon; summer and winter run steelhead; sea run cutthroat trout; Dolly Varden, bull trout and char.

Six different stocks of Chinook are present in the Skagit system: Upper Cascade Spring, Suiattle Spring, Upper Sauk Spring, Lower Skagit Mainstem / Tributaries Fall, Upper Skagit Mainstem / Tributaries Summer, and Lower Sauk Summer. (*Skagit River Chinook Recovery Plan, 1995*) The Sauk River Basin includes two independent Chinook salmon populations: the Lower Sauk Summer Chinook and the Upper Sauk Spring Chinook. The Lower Sauk Summer Chinook are those that spawn in the Sauk mainstem and its tributaries (excluding the Suiattle River) downstream of the Darrington bridge. Most of these fish spawn between Darrington and the mouth of the Suiattle River, from September through early October. Lower Sauk Spring Chinook have statistically significant genetic differences from all other Skagit Basin Chinook populations, but they are more similar to other Skagit populations than to Puget Sound Chinook populations.

The Upper Sauk Spring Chinook are those that spawn in the Sauk mainstem and its tributaries, upstream of the Darrington bridge. Most of these fish spawn between the mouth of the White Chuck River and the confluence of the North and South Forks of the Sauk, from late July through early September.

The Suiattle River, tributary of the Sauk and sub-basin, is habitat for an independent spring Chinook population, known as the Suiattle Spring Chinook. Most of these fish spawn from late July through early September. Statistical analysis of all ozyme allele frequency data indicate that

Suiattle Spring Chinook are genetically distinct from all other Skagit Basin Chinook populations, as well as from Spring Chinook produced at Marblemount Hatchery, which were first derived from Suiattle-origin Spring Chinook broodstock (Marshall et al. 1995; Marshall 2001). The Suiattle River Sub-basin is also used extensively for spawning and rearing habitat for bull trout and steelhead.

The White Chuck River, another tributary of the Sauk, originates in the Glacier Wilderness and has a relatively intact drainage basin of older forests of little or no access. This river is known for its high-quality water. It supports Chinook and Coho, a limited amount of pink, sockeye, and sea-run cutthroat and no chum.

As the Sauk flows into the Skagit, the high-quality habitat continues and the Skagit River supports the largest runs of chum and pink salmon in the continental United States. The average annual escapement of chum salmon is 69,000 spawners, and the average annual escapement of pink salmon is 400,000 spawners. The basin also supports sizeable runs of coho salmon, sockeye salmon, and steelhead trout.

The Skagit River also supports the largest population of native char (bull trout and Dolly Varden) in the Puget Sound, and may contain the largest population of bull trout in the state. The native char stock in the lower Skagit River is considered to be “healthy” by the Washington State Department of Fish and Wildlife. The number of bull trout out-migrating from the upper drainage into the Skagit River delta and estuary range is estimated to range from 15,000 to 49,000 juveniles per year.

2.5.2 Riparian Areas

Riparian areas are the narrow strips of land bordering rivers, streams or other bodies of water. Due to their proximity to the water, the plant species and topography in riparian zones differ considerably from those of the adjacent uplands. Although riparian areas may only occupy a corridor throughout a river basin or watershed, these areas have a lot of influence on the overall health of the water body.

Riparian areas provide a number of key ecosystem services, including bank stabilization, fish and wildlife habitat, water storage and release, erosion control, and sediment filtering.

As a relatively unpopulated natural area, riparian areas throughout the Sauk River Basin are relatively intact. The forested areas along the Sauk River, south of Darrington (upstream) are characterized by a coniferous/deciduous overstory dominated by Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), red alder (*Alnus rubra*), black cottonwood (*Populus trichocarpa*), and big-leaf maple (*Acer macrophyllum*).

Large coniferous tree species tend to dominate the forest overstory, except in those areas where recent land movement (e.g., landslides, slumping, historic washouts, logging, etc.) has allowed recruitment of deciduous and early-successional tree species.

Downstream from Darrington, this mix continues, although red alder (*Alnus rubra*), black cottonwood (*Populus trichocarpa*), and big-leaf maple (*Acer macrophyllum*), tend to dominate the riverbanks in the highly disturbed and braided reaches of the river, most notably from Darrington downstream to the Skagit County Bridge, and from a point approximately three miles upstream from the confluence with the Skagit River.

Decisions regarding the management of these riparian areas should identify and address any potential impacts to the long-standing ecosystem services provided by the native vegetation, including their magnification during flood events.

2.6 PHYSICAL CHARACTERISTICS

In a river basin, the physical characteristics define the nature of the river, a simple fact, yet often underrated. Such physical factors include Topography, Geology, Hydrology, and Climate.

2.6.1 Topography

The Sauk River flows through some dramatic topography. Rugged mountains and wilderness surround the upper Sauk River, leavening into less abrupt ridges and valleys as it meets the Skagit. The glacially-formed valleys have been subjected to numerous eruptions of nearby Glacier Peak, which have given rise to the distinct lahar formations throughout the length of the river.

Glacier Peak is drained on the north and east by tributaries of the Suiattle River, while flows from the southwest and west flow into the White Chuck River. The White Chuck River and the North Fork of the Sauk River meet upstream from Darrington, and form the mainstem Sauk. In this area, the Sauk is relatively steep, with valley walls that sometimes rise directly from the river's edge, leaving little room for meandering. (Figure 1-1) With the steep valley slope, sediments have little opportunity to accumulate, much less form expansive gravel bars.

Immediately adjacent to Darrington, above Darrington Bridge, the slope of the river is at 0.0050; while from the Darrington Bridge to Dan Creek, the slope is 0.0041; and finally, from Dan Creek to the Suiattle, the slope is 0.0027. These slopes, far from gentle, coupled with the immense sediment load from the laharic disposition of the exposed slopes on Glacier Peak, give the river a wild and unpredictable nature borne out by the relatively few dwellings or other infrastructure immediately adjacent to the river.

Downstream, below the bridge, the Sauk gradually flattens, allowing the sediment load to influence the landscape and forcing the river to carve new channels during nearly every flood event. This happens particularly when the Sauk is approaching bankfull, or the two-year flood event. While hardly unexpected, these abrupt and extensive channel changes are not uncommon on the river, particularly downstream from Darrington, and the upstream sediment supply is steady.

With this in mind, any attempts to control this powerful river or stabilize the eroding banks will need to be quite extensive. These actions will also be very expensive and time-consuming in the design, permitting, and construction phases.

2.6.2 Geology

Characteristics of the local and regional geology have a significant impact on watersheds; influencing runoff patterns, sediment sources, channel gradient, hydraulic irregularity, valley form, watershed size and how a stream or river responds to changes in land use and vegetative cover. The modern landscape of most Puget Sound Lowlands, which includes the Sauk River Basin, is underlain primarily by glacial sediments deriving from a period of glacial advance and retreat 18,000-15,000 years ago. These glacial deposits have a wide range of physical properties. Of those properties, permeability and consolidation are the most significant. Permeable sediments permit rapid infiltration and groundwater movement. They also lack cohesion, generating susceptibility to river erosion, migration and accumulation, as well as landslides.

In contrast, other sediments can also be relatively high-density, resulting in cohesive, consolidated deposits that achieve vertical faces forming hard channelization above ground; yet buried beneath the ground, they have a stronger role by allowing for groundwater flow and accumulation.

The interplay between glacial and volcanic activity is strongly represented in the morphology of the Skagit and Sauk river systems, which are representative of those in the broader Puget Lowland. Tectonic forces, (mountain building, uplift, valley creation), have set the scale for this location as well as length of many of west slope Puget Sound rivers, including the Sauk. Because of this relatively uniform Tectonic relationship, these rivers tend to follow a progression of alpine headwaters to confined mountain valleys, to lower gradient lowland valleys, spilling out onto plains. Advance and recession of the major ice sheets also created the north-south trending disposition of the major valleys, including the Sauk.

The geologic setting of watersheds, and of individual stream reaches, will determine what type of channel morphology and habitat features occur under natural conditions, and correspondingly, what restoration or rehabilitation objectives are appropriate and achievable. Yet the influence of geology on rivers and streams is not always straightforward. As a river system evolves, it

becomes an agent of geologic change itself, modifying the same landscape that once determined its behavior. Escarpments are incised by gullies and streams; lowlands are filled with alluvium; and the topographic form of the landscape imposed by tectonic, volcanic, and glacial activity becomes modified by patterns of fluvial erosion and deposition along the drainage network. As such, the geomorphology of the Sauk River is strongly influenced by tectonic forces, primarily by the *lahar* flows from Glacier Peak that created the current river planform.

2.6.3 Hydrology

Hydrology in the Sauk River is driven by snowmelt and rainfall. Emanating from high in the Cascades, the main tributaries of the Sauk have varied and distinct headwaters. For example, (71%) of the White Chuck River watershed is designated wilderness, creating a situation where runoff can be expected to remain relatively constant (save for the unknown of long-term climate alterations). In addition, most of the headwaters of the Whitechuck River are the Whitechuck glacier on the flanks of Glacier Peak. Conversely, the headwaters of the South Fork of the Sauk lie in the Henry M. Jackson Wilderness; the Monte Cristo area, (Glacier Basin), a heavily mined area, and the Mt. Baker Snoqualmie National Forest, and though Wilderness designation precludes logging in the Henry M. Jackson Wilderness, this is not true for the rest of the forest land managed by the Forest Service. Thus, we can expect altered hydrologic conditions into the near future, at least until clear-cut units mature. White Chuck mountain, noted for extensive clear-cuts, mining, and roads, provides the flows for Dan Creek, and a host of smaller tributaries. On the north flanks of Glacier Peak, the Suiattle, Ptarmigan, and President glaciers (to name a few), provide flows to the Suiattle, as do others, on the north side of the basin, the most important tributary to the Sauk River. Flows in the Sauk are dominated in the early season by the South Fork melt, and in the latter part of the season, from the Suiattle River flows. The glacial nature of the countless tributaries flowing from Glacier Peak and beyond gives rise to the characteristic milky color of the waters of the mainstem.

2.6.4 Climate

The Sauk River watershed is graced with a relatively mild climate. Typically, climate is mild during the summer, where temperatures tend to run into the 70s, and colder in the winter, where temperatures tend to be in the 30s, with snow not an uncommon site in the surrounding mountains. Winter generally brings 10-15 days of snow, along with significant amounts of rain, fog, foggy rain, and snowy fog. The warmest month of the year is August, with an average temperature maximum of approximately 80 degrees. The coldest month of the year is usually January, with temperatures hovering at 30 degrees.

The average annual rainfall/precipitation is approximately 81 inches, as expected, the winter months tend to be wetter than summer months.

2.6.5 Sauk River Processes

Discussion of many of the physical processes, geomorphic, hydrologic, and to some degree, hydraulic, can be found in Appendix 2 of this document, where the technical analyses are combined to create the risk analysis which forms the basis of this document. The Sauk is a very complex river, with reaches that vary from steep and powerful to flat and meandering. Overshadowing everything is the ultimate process-forming events that emanated from Glacier Peak, vast, pyroclastic forces that created great lahar flows and tephra falls, blanketing the landscape with windborne materials, and creating vast plains of sediment which the river then cut through. Events such as these are relatively recent, some occurring as little as 1800 years in the past, making most of the Sauk a “young” river by most standards.

These characteristics give rise to the unique nature of the Sauk, and explain, to a large degree, the rivers tendency to migrate freely over its floodplain in any given event. This, coupled with extensive floodplain forests, creates a situation where the river not only transports sediments and creates new channels, but also creates large wood jams throughout the floodplain; both in response to, and as a result of, the flood and channel migration regimes.

2.6.6 Sauk River Channel Migration Zone

Because of the highly volatile nature of the Sauk River, much of the floodplain is considered the Channel Migration Zone, (CMZ); although from a regulatory standpoint, the CMZ has not yet been officially delineated. From the information contained in Appendix 2 and 3, it can be seen that the floodplain is relatively confined upstream from the Town of Darrington, but wanders extensively from the Town to the confluence with the Suiattle River, where it becomes somewhat more confined, to where it expands and braids once again approximately two miles upstream from the confluence with the Skagit River.

2.6.7 Historical Record of Flood/Erosion Events

The Federal Emergency Management Agency (FEMA) defines a flood as the inundation of normally dry land resulting from the rising and overflowing of a body of water, and floodplains as land areas along the sides of rivers that become inundated with water during a flood.

Flooding is a natural process that shapes the landscape, provides habitat and creates rich agricultural lands. The most common type of flooding, overbank flooding, occurs when downstream channels receive more rain or snowmelt from their watershed than normal, and the excess overloads the channel and flows out into the floodplain.

Damage from overbank flooding varies, depending on the size of the watershed and its terrain. Mountainous areas, like the Sauk River Basin, have faster moving water, which can have a tremendous impact. Generally, the larger the river, the deeper the flood, and the longer it will

last. Yet small watersheds with substantial mountain coverage, flooding can pose significant danger.

Settlements are often established along the banks of rivers, where water, fertile soil and a transportation network are available. However, at certain concentrations, human activities will begin to interfere with natural riverine processes. The built environment creates localized flooding problems outside natural floodplains by altering or confining drainage channels. This increases the flood potential by decreasing the stream's capacity to contain flows and increasing the flow rates downstream.

The history of flooding in Snohomish County is an important part of its identity. Historical records of flooding along the rivers and in the glacial-carved floodplains in Snohomish County date back to the nineteenth century when pioneers first settled in the area, but monetary estimates of the damages are scarce.

Each river basin has unique characteristics that contribute to different levels of flooding and damage. Winter floods inundate most of the County's floodplains every three to ten years. Most flooding in Snohomish County results from "rain on snow" events, i.e., heavy, warm rains that also melt a significant accumulated snow pack. In these storm patterns, a first rainfall saturates the soil and then a second storm causes flooding and property damage. The Upper Skagit River Basin drains the northeast quarter of Snohomish County. A portion of this basin, the Sauk/Suiattle River Sub-basin, drains in northeast Snohomish County. The main tributaries of the Sauk River are the White Chuck River and the Suiattle River, the principal rivers that drain Glacier Peak. From the Suiattle, the Sauk then flows 13 miles north to its confluence with the Skagit River, near Rockport. These rivers do not have levee systems and have a history of channel migration and bank erosion during flood events.

Because of the Wild and Scenic River designation, government entities and private property owners are not allowed to place any type of material along these river banks to mitigate these channel changes and bank erosion. In areas where erosion is severe or drastic channel changes occur, homes and property are many times simply "lost" to the river (*Skagit County Website, 2004*).

The Sauk River itself is a Type 1 stream, with flows that are subject to extremes in fluctuation. U.S. Geologic Survey (USGS) flow data over 79 years of record indicate that Sauk River flows upstream of Darrington have fluctuated from a mean daily flow of 443 cfs to a maximum of 44,000 cfs (river mile 32.5). Downstream of Darrington (river mile 5.4), mainstem flows are higher from increased contributing surface waters. In this area, the Sauk River flows range from 1,080 to 106,000 cfs (USGS Flow Data 2006).

Another form of flooding—flash flooding—is typically caused by slow-moving thunderstorms or heavy rains associated with spring or early summer storm systems. There is a possibility for moderate flash flooding within the County, but only along the County’s smaller streams and tributaries. In general there has been very little flash flooding in the County, though it is increasing as our climate changes.

Table 2-1 shows available damage estimates from past flooding in the Snohomish, Upper Skagit and Stillaguamish River basins.

2.6.8 Recent Flood Events

Additional information on the larger flood events are seen in Table 2-2.

November 27, 1949 Flood Event

The second highest reading of the White Chuck River gauge was 30,200 cfs, although there is no information about any damage during this event.

December 26, 1980 Flood Event

The greatest flood on record occurred December 26, 1980, when the gauge above the White Chuck River recorded 40,100 cfs. This resulted from a flash flood and destroyed buildings and the road in the Clear Creek area south of Darrington.

March 1997 Flood Event

Heavy flooding caused a 50-foot-wide mudslide that closed both lanes of SR 530, 5 miles west of Oso, and created isolation problems for the City of Darrington.

October/November 2003 Flood Event

Flooding on the Sauk, Snohomish and Stillaguamish Rivers in October and November of 2003 caused an estimated \$1.6 million in damage to private land and \$3.3 million in damage to public property, including roads:

- Heavy flooding along the Sauk River caused the river to swell. Darrington was flooded when large logs floated down the river and plugged culverts (*Seattle Times, Oct. 21, 2003*).
- The North Cascades National Park suffered about \$1.7 million in damage to roads and trails. Damage to other structures was estimated to be \$1 million.
- An 850-foot section of the North Sauk River Road was washed out above the right bank of the Sauk River, isolating homes southeast of Darrington.

- White Chuck Road, the 10-mile road accessed off the Mountain Loop south of Darrington, suffered several major breaks.
- Over a 24-hour period on the October 17, 2003 weekend, significant damage was done to roads, bridges, trails and other recreation facilities in the Mount Baker-Snoqualmie National Forest. The damage assessment is expected to exceed \$8 million.
- Additional significant losses occurred in drainages south and west of Mount Baker and in the upper reaches of the Skagit River system. The loss of more than 15 popular trails, 20 trail bridges, and the breach of more than 30 miles of the Pacific Crest National Scenic Trail occurred. Also damaged and closed were segments of more than 40 roads and many bridge and bridge abutments due to washouts or mud and rockslides (*USDA, December 2003*).

Table 2-1. Flooding Dollar Loss By River Basin

Date of Flood	Estimated Total Damage (\$)		
	Snohomish River Basin	Upper Skagit River Basin	Stillaguamish River Basin
December 1921	—	—	400,000 ^b
February 1932	8,460,000 ^a	—	—
December 1933	9,900,000 ^a	—	—
December 1943	1,660,000 ^a	—	—
October 1947	144,000 ^a	—	—
February 1951	16,600,000 ^a	—	339,000 ^c
November 1959	9,900,000 ^a	—	272,000 ^c
December 1964	4,200,000 ^a	—	—
December 1975	42,400,000 ^a	—	1,474,000 ^d
December 1977	—	—	—
December 1979	—	—	—
November 1986	2,000,000 ^a	—	—
November 1990	3,611,000 ^f	—	64,700
November 1995	—	—	53,000
February 1996	1,200,000	—	>50,000
November 1999	—	—	—
October 2003	Pending	8,000,000 ^e	10,000,000

a. 1989 dollars

b. 1930 dollars

c. 1965 dollars

d. 1975 dollars

e. Estimate applies to Mt. Baker-Snoqualmie Forest

f. Public expenditures only

Table 2-2 lists flood-related federally-declared disasters in Snohomish County.

Table 2-2. Snohomish County Flood-related Federal Disasters

Date	No.	President
December 1964	185	Lyndon B. Johnson
December 1975	492	Gerald R. Ford
December 1977	545	James E. Carter
December 1979	612	James E. Carter
November 1986	784	Ronald W. Reagan
November 1990	883	George H.W. Bush
December 1990	896	George H.W. Bush
November 1995	1079	William J. Clinton
February 1996	1100	William J. Clinton
December 1996	1159	William J. Clinton
March 1997	1172	William J. Clinton
November 2003	1499	George W. Bush

2.6.9 Existing and Proposed Flood Warning Systems and Operations

Currently, there are no existing flood warning systems operating in the Sauk River Basin. There are two operational gages, one just upstream from the confluence of the White Chuck River and the North Fork Sauk, (on the North Fork), and one downstream at Sauk, (downstream from the Skagit County Bridge). There has not been a perceived need for flood warning systems on the Sauk River, from an agency perspective. This may change. With increases in flood frequency and population, there has been an increased awareness of the need for a flood warning system in the basin. There are definite logistics challenges, particularly inherent in the difficulty in transmitting a radio or cell phone signal from the gage sites to a repeater, thence to a warning system.

3. CURRENT REGULATORY ENVIRONMENT OF SAUK RIVER CORRIDOR

3.1 INTRODUCTION

The first question to examine when considering a project or activity to restore, stabilize, clear, or build along the Sauk River should be: “Is your project or activity located within a Special Flood Hazard Area (SFHA), Critical Habitat Area, or within 200 feet of Ordinary High Water?”

This report presents the pertinent regulations and permit processes of Federal, State, and local agencies with jurisdiction in the Sauk River project area in both Snohomish and Skagit counties. The regulations and permits affect flood hazard management, construction of flood control facilities, channel and floodplain restoration projects, land clearing, and other construction activities within the study area. Five general types of potential projects/activities were analyzed for their applicable permit processes. They include stabilize shorelines, restoration/habitat enhancement, construction of structures, land clearing/logging, and emergency work during declared emergency conditions.

This report provides clarification of the regulatory jurisdictions, authorities, and information flow pertinent in the Sauk River Corridor Analysis Project Area. Snohomish County, Skagit County, State, and Federal regulations are presented for each type of project/activity. Local Endangered Species Act (ESA) listings and the Wild and Scenic designation of the Sauk River can add complexity to the permit processes.

3.2 STATE, FEDERAL, AND LOCAL PERMITS AND REGULATORY ASSESSMENT

The permit processes are presented in three formats to provide a guide with varying amounts of details depending upon the needs of the user. The first format is a five page matrix that shows generally which permits may be required for a specific activity, and can be found in Appendix 3. These matrices, show the permit names and the project/activity type. The matrices indicate whether a specific permit type is required or not, whether the permit is part of the coordinated Joint Aquatic Review Permit Application (JARPA), and/or if the permit/review is required by a specific county.

The second format is a series of diagrams showing the applicable permits and how they are related to each other. These figures illustrate the permit/review paths to follow, presenting more details of how these permits/reviews work together. (See Figures 3-1 through 3-5).

The third format lists the details for each of the permits/reviews and applicable regulations that apply to each of the potential project/activities. These are presented in Tables 3-1 through 3-3. This format includes details about the project/activity that would require a permit/review, information on where to obtain the permit from, and the approximate review time and cost.

The Appendices include more complete details and information regarding each of the applicable permits and review processes along with permit forms. The appendices also include a glossary.

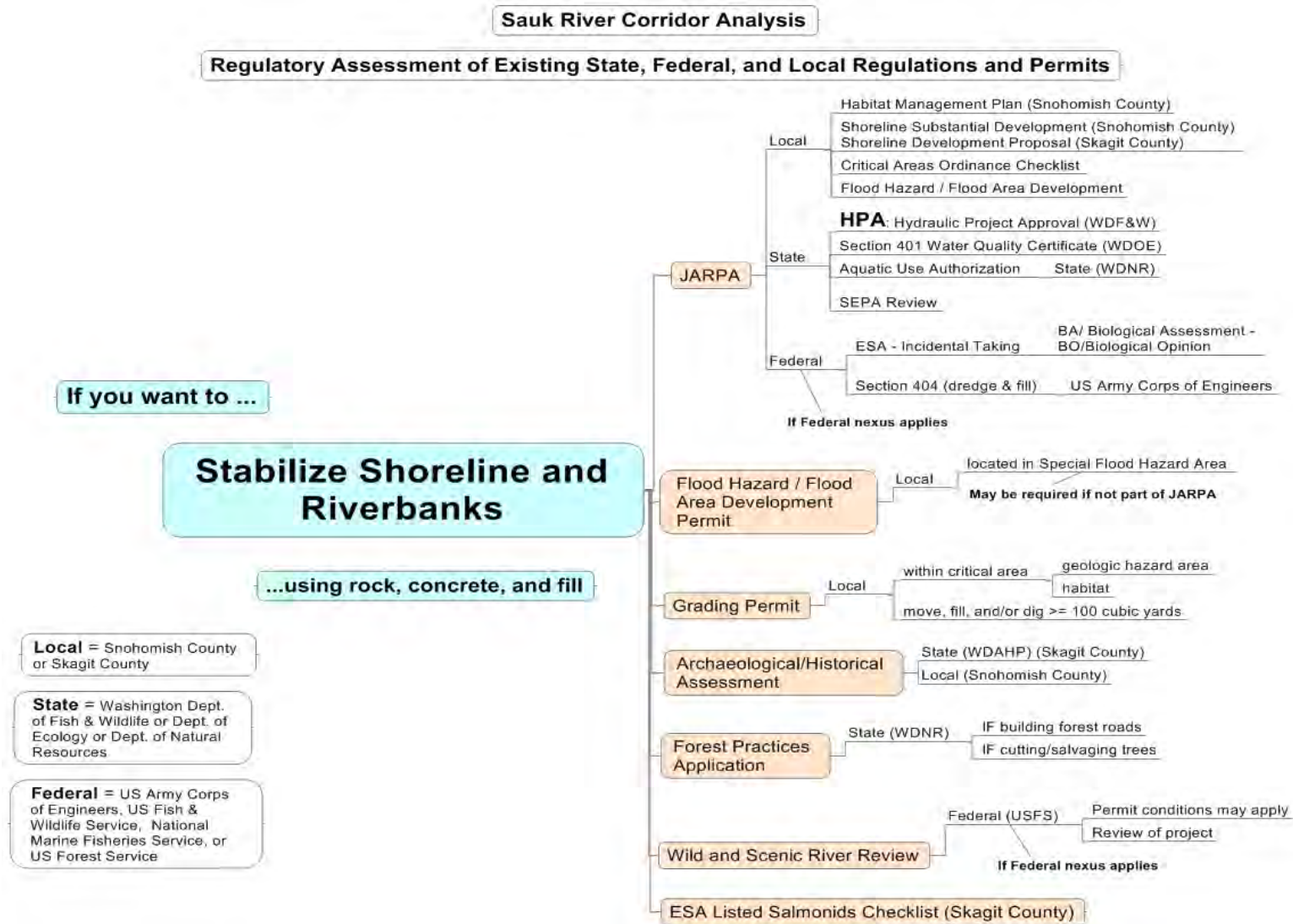


Figure 3-1. Stabilize Shoreline and Riverbanks Potential Permit Flow Chart

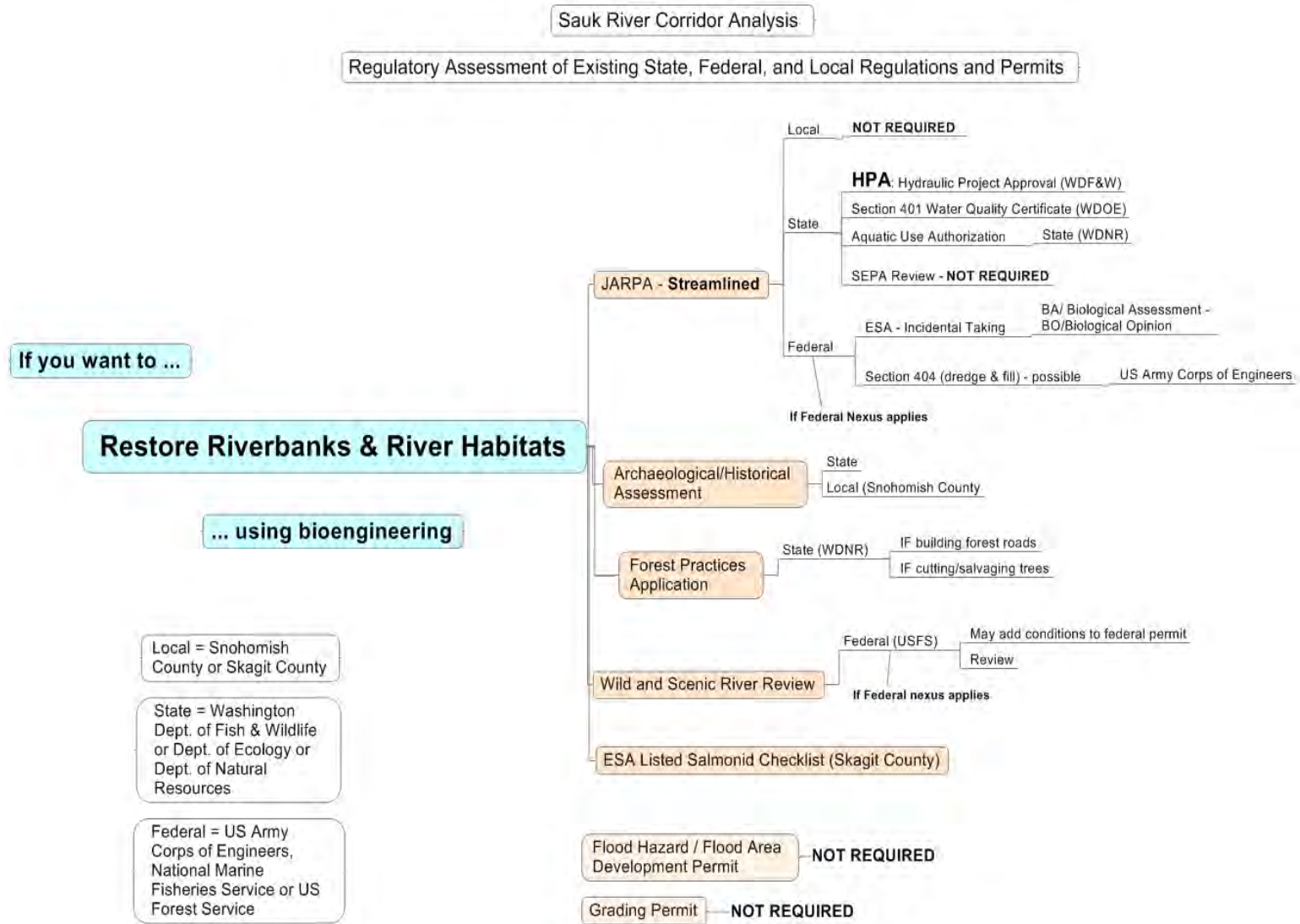


Figure 3-2. Restore Riverbanks and River Habitats Permit Flow Chart

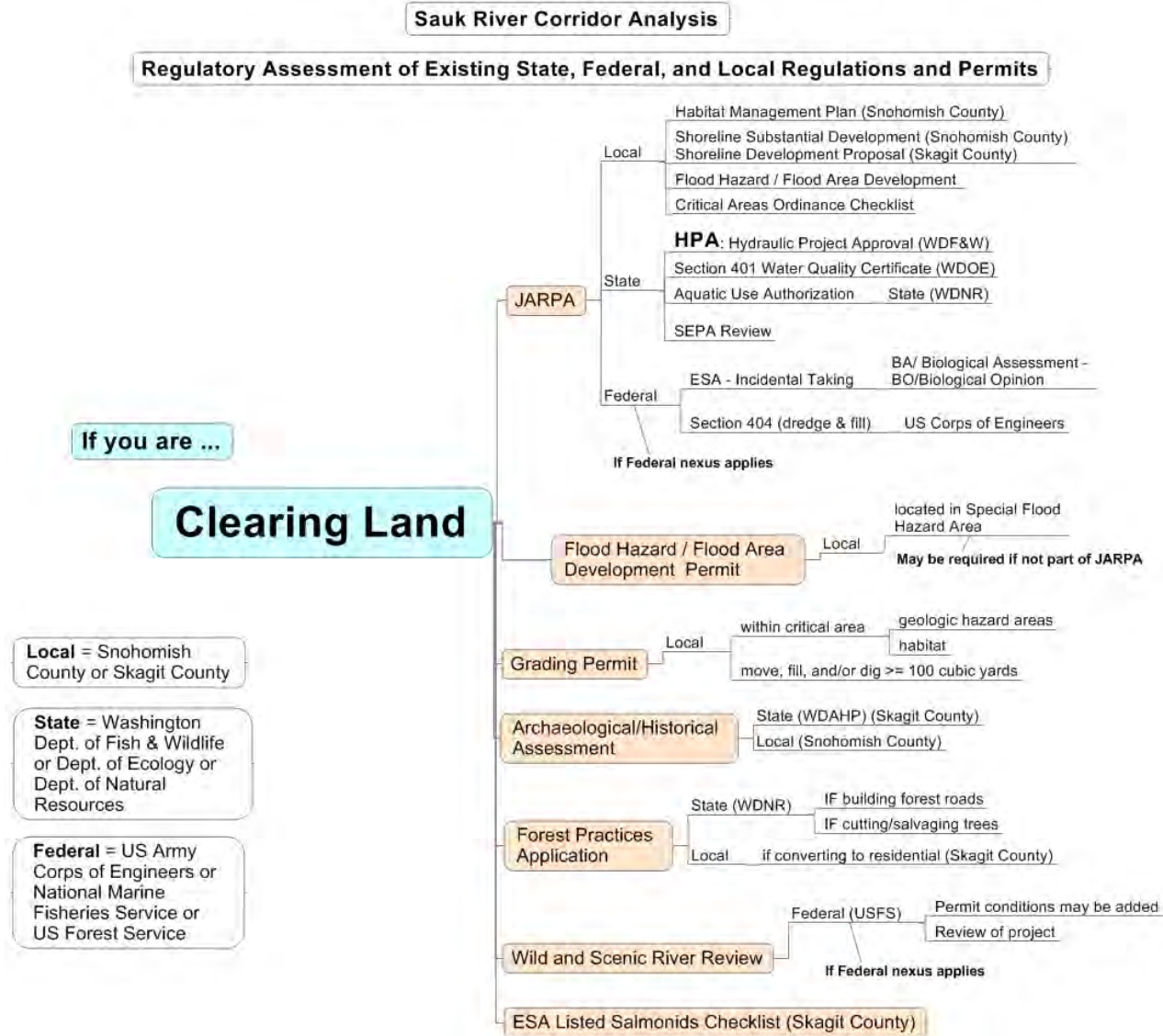


Figure 3-3. Land Clearing Permit Flow Chart

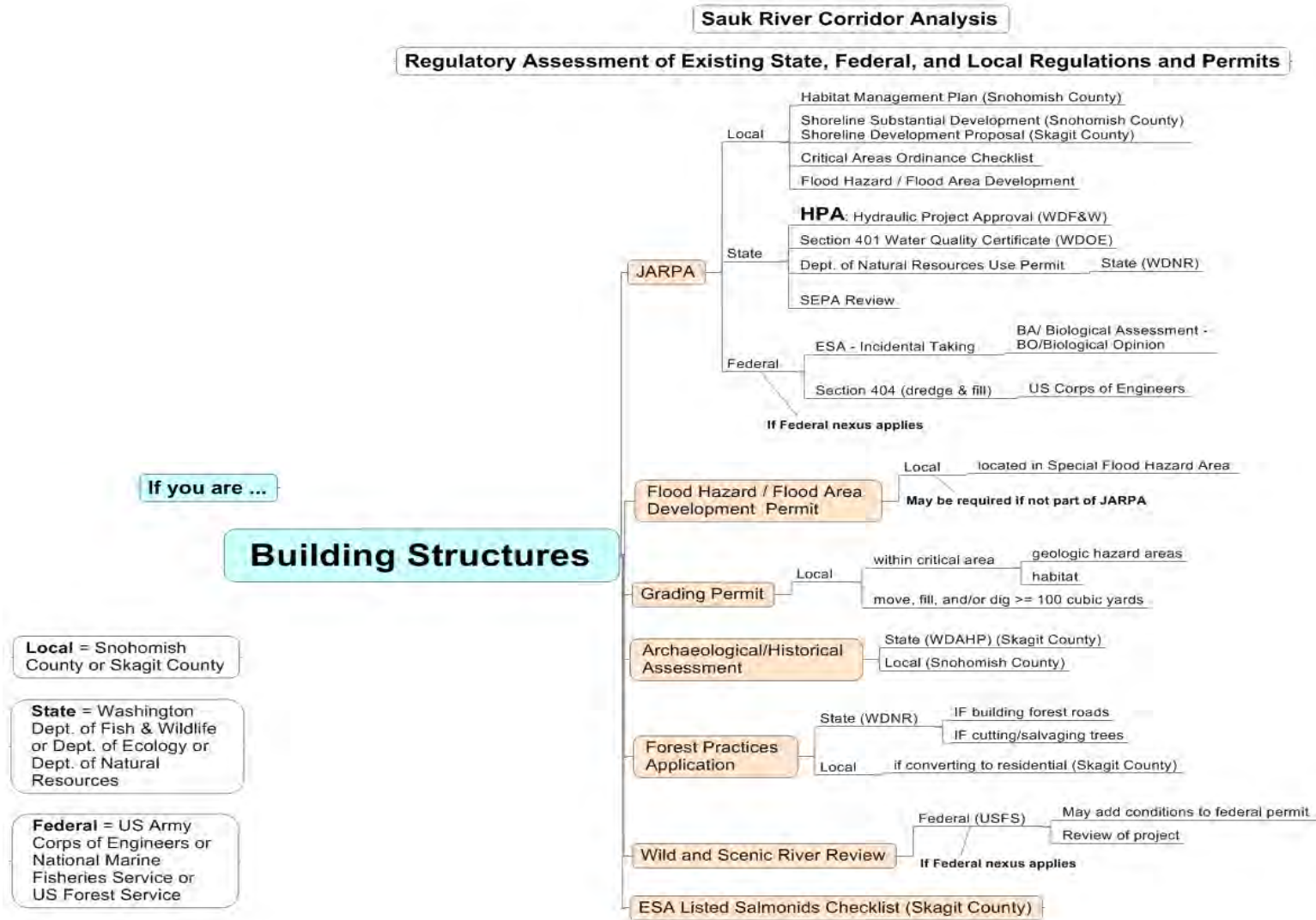


Figure 3-4. Building Structures Permit Flow Chart

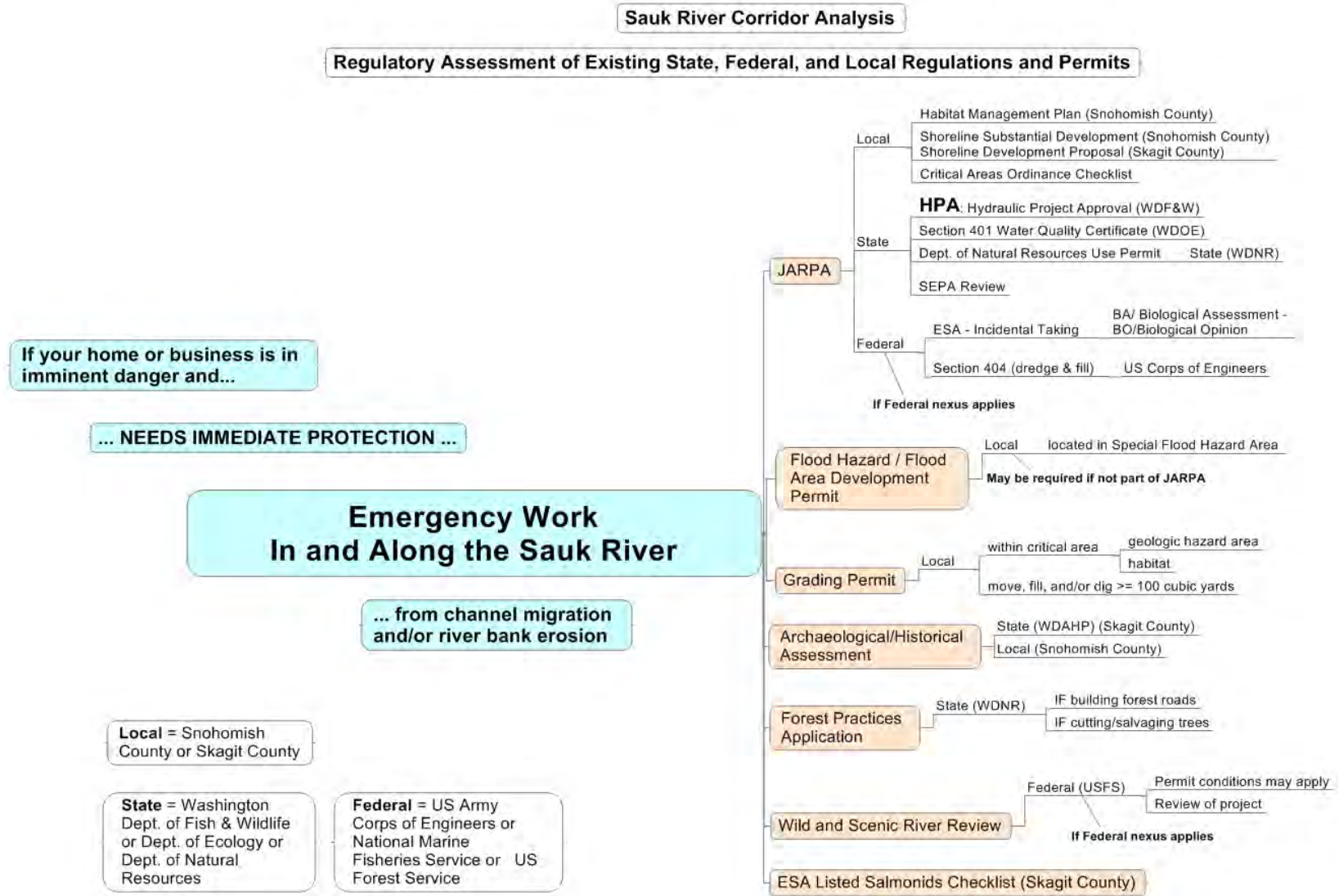


Figure 3-5. Emergency Work Conditions Flow Chart

Detailed Permit Process

Table 3-1

Stabilize Shoreline and Riverbanks & Restore Riverbanks and River Habitats

Table 3-1. Detailed Permit Process: Stabilize Shoreline and Riverbanks & Restore Riverbanks and River

<p>If you want to...</p> <p style="text-align: center;">STABILIZE SHORELINE AND RIVERBANKS ...using rock and fill.</p> <p>Purpose/Effect To protect a structure from channel migration, and/or river bank erosion through the use of rock, concrete, fill, dredging, etc.</p> <p><u>Permits/Reviews:</u> The following state, local, and federal permits may be required</p> <p><u>JARPA – Joint Aquatic Review Permit Application</u></p> <ul style="list-style-type: none"> • Needed if you will be doing any work in or near the water. • Coordinated effort between county, state, and federal agencies that allows you to apply for more than one permit at a time. • Mitigation is usually required for harm done to the environment by the project or activity. • See Appendix 3 for more information. • Permit Cost: Free • Review time: 45 days • Submit to: Washington Dept. of Fish and Wildlife 16018 Mill Creek Blvd., Mill Creek, WA 98012 Phone: 425-775-1311 Website: www.wdfw.wa.gov 	<p>If you want to...</p> <p style="text-align: center;">RESTORE RIVERBANKS AND RIVER HABITATS ...using bioengineering.</p> <p>Purpose/Effect Using bioengineering to restore and/or enhance natural functions of rivers by using natural materials (native plants, tree trunks, dead trees, root wads, degradable fabrics, etc.) in ways that imitate nature to benefit fish and water quality.</p> <p><u>Permits/Reviews:</u> The following state, local, and federal permits may be required</p> <p><u>JARPA – Joint Aquatic Review Permit Application</u> STREAMLINED PROCESS FOR FISH HABITAT ENHANCEMENT PROJECT PERMIT</p> <ul style="list-style-type: none"> • Needed if you will be restoring an eroded or unstable stream bank using natural materials in ways that benefit fish. • Needed if you will be doing any work in or near the water. • Coordinated effort between county, state, and federal agencies that allows you to apply for more than one permit at a time. • Fish habitat enhancement project waives some county and state permits covered in the JARPA, including the SEPA review, speeding up the process. • Mitigation is usually not required because these natural materials are not considered fill. • See Appendix 3 for more information. • Permit Cost: Free • Review time: 45 days
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Table 3-1. Detailed Permit Process: Stabilize Shoreline and Riverbanks & Restore Riverbanks and River

<p>The following state, local, and federal permits may be required as part of the JARPA:</p> <p style="text-align: center;"><u>JARPA</u></p> <p><u>Local</u></p> <p>Snohomish County <u>Habitat Management Plan</u></p> <ul style="list-style-type: none"> • Needed if you will be disturbing plants or earth within 300 feet of a critical area (Sauk River). • See Appendix 3 for more information • Cost: \$600 to review plan • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave., Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS <p><u>Shoreline Substantial Development Permit</u></p> <ul style="list-style-type: none"> • May be needed if your project or activity will take place within 200 feet of the shoreline. • See Appendix 3 for more information. • Cost: \$450 or more • Review time: Variable 	<ul style="list-style-type: none"> • Submit to: Washington Dept. of Fish and Wildlife 16018 Mill Creek Blvd., Mill Creek, WA 98012 Phone: 425-775-1311 Website: www.wdfw.wa.gov <p>The following state, local, and federal permits may be required as part of the JARPA:</p> <p style="text-align: center;"><u>JARPA</u></p> <p><u>Local</u></p> <p>Snohomish County: NOT REQUIRED</p>
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Table 3-1. Detailed Permit Process: Stabilize Shoreline and Riverbanks & Restore Riverbanks and River

<ul style="list-style-type: none"> • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave., Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS <p><u>Critical Areas Ordinance Checklist</u></p> <ul style="list-style-type: none"> • Needed if you plan to work within 100 feet of a critical area (Sauk River). • See Appendix 3 for more information. • Cost: \$250 - \$600 for site visit • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave., Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS <p><u>Flood Hazard Development Permit</u></p> <ul style="list-style-type: none"> • Needed if you will be building or grading on land within the 100-year flood zone. • See Appendix 3 for more information. • Cost: \$300 • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave, Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS 	<p>J A R P A</p>
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Table 3-1. Detailed Permit Process: Stabilize Shoreline and Riverbanks & Restore Riverbanks and River

<p>Skagit County <u>Shoreline Development Proposal</u></p> <ul style="list-style-type: none"> • Needed if your project or activity is within the 100-year floodplain or within 200 feet of the riverbank. • See Appendix 3 for more information. • Cost: \$2,200 • Review time: Variable • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net <p><u>Critical Areas Ordinance Checklist</u></p> <ul style="list-style-type: none"> • Needed if you plan to work within 200 feet of a critical area (Sauk River). May require a site visit, and a mitigation plan to offset any harm to the critical area or its buffer. • See Appendix 3 for more information. • Cost: \$300 • Review time: Variable • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net <p><u>Flood Area Development Proposal</u></p> <ul style="list-style-type: none"> • Needed if you will be building or grading on land within the 100-year flood zone. Review done by Planning and Development Services when a building or grading permit is submitted. • See Appendix H for more information. 	<p>Skagit County: NOT REQUIRED</p>
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Table 3-1. Detailed Permit Process: Stabilize Shoreline and Riverbanks & Restore Riverbanks and River

<ul style="list-style-type: none"> • Cost: Variable based on type of permit and other factors • Review time: Usually 4-6 weeks • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net 	<p style="text-align: center;">State</p> <p><u>HPA – Hydraulic Permit Approval</u></p> <ul style="list-style-type: none"> • Needed if you will be using, diverting, obstructing or changing the natural flow or bed of any fresh water (Sauk River, tributaries, lakes, wetlands, etc.). • See Appendix 3 for more information. • <u>Must meet three conditions:</u> <ul style="list-style-type: none"> ○ Be part of an approved plan (habitat, comprehensive, flood hazard, etc.) – and – ○ Be sponsored by an entity in the plan –and – ○ Use predominantly bioengineering • Cost: Free • Review time: 45 days • Submit to: Washington Department of Fish and Wildlife 16018 Mill Creek Blvd., Mill Creek, WA 98012 Phone: 425-775-1311 Website: www.wdfw.wa.gov
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Table 3-1. Detailed Permit Process: Stabilize Shoreline and Riverbanks & Restore Riverbanks and River

<p><u>Section 401 Water Quality Certification</u></p> <ul style="list-style-type: none"> • Needed if you will be conducting any activity, including excavation, that might result in a discharge of dredge or fill material into water. • See Appendix 3 for more information. • Cost: Free • Review time: 1 - 3 months • Submit to: Washington Department of Ecology (Northwest Region) 3190 - 160th Ave., SE, Bellevue, WA 98008-5452 Phone: 425-649-7000 Website: www.ora.wa.gov <p><u>Aquatic Use Authorization</u></p> <ul style="list-style-type: none"> • Needed if your project includes construction, use or activities on submerged land (riverbed) that is owned by the Washington Department of Natural Resources. • See Appendix 3 for more information. • Cost: \$25, plus a fee to lease the submerged land may apply • Review time: 6-12 months • Submit to: Department of Natural Resources, Aquatic Resources Division Northwest Region 919 North Township Street, Sedro Woolley, WA 98284 Phone: 360-856-3500 Website: www.dnr.wa.gov/htdocs/aqr 	<p><u>Section 401 Water Quality Certification</u></p> <ul style="list-style-type: none"> • Needed if you will be conducting any activity, including excavation, that might result in a discharge of dredge or fill material into water. • See Appendix 3 for more information. • Cost: Free • Review time: 1 - 3 months • Submit to: Washington Department of Ecology (Northwest Region) 3190 - 160th Ave., SE, Bellevue, WA 98008-5452 Phone: 425-649-7000 Website: www.ora.wa.gov <p><u>Aquatic Use Authorization</u></p> <ul style="list-style-type: none"> • Needed if your project includes construction, use or activities on submerged land (riverbed) that is owned by the Washington Department of Natural Resources. • See Appendix 3 for more information. • Cost: \$25, plus a fee to lease the submerged land may apply • Review time: 6-12 months • Submit to: Department of Natural Resources, Aquatic Resources Division Northwest Region 919 North Township Street, Sedro Woolley, WA 98284 Phone: 360-856-3500 Website: www.dnr.wa.gov/htdocs/aqr
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Table 3-1. Detailed Permit Process: Stabilize Shoreline and Riverbanks & Restore Riverbanks and River

<p><u>SEPA – State Environmental Policy Act Review</u></p> <ul style="list-style-type: none"> • Needed to determine if your project or activity will cause any environmental harm. • The county that the project is in prepares this review. • Cost: \$500 • Review time: variable <p><u>Federal</u></p> <p><u>Endangered Species Act (ESA) Incidental Take Permit</u></p> <ul style="list-style-type: none"> • Needed if your project or activity requires a federal permit <u>and/or</u> a Federal nexus has been determined (i.e., federal funds, etc.) • Needed if your project or activity will harm a threatened or endangered species. A habitat conservation plan must accompany an Incidental Take application. • See Appendix 3 for more information. • Cost: Free to review; habitat conservation plan can cost \$10,000 or more • Review time: Variable • Submit to: National Marine Fisheries Service, Northwest Regional Office 7600 Sand Point Way NE, Seattle, WA 98115-0070 Phone: 206-526-6150 Website: www.nwr.noaa.gov 	<p><u>SEPA – State Environmental Policy Act Review</u></p> <p>NOT REQUIRED</p> <p><u>Federal</u></p> <p><u>Endangered Species Act (ESA) Incidental Take Permit</u></p> <ul style="list-style-type: none"> • Needed if your project or activity requires a federal permit <u>and/or</u> a Federal nexus has been determined (i.e., federal funds, etc.) • Needed if your project or activity will harm a threatened or endangered species. A habitat conservation plan must accompany an Incidental Take application. • See Appendix 3 for more information. • Cost: Free to review; habitat conservation plan can cost \$10,000 or more • Review time: Variable • Submit to: National Marine Fisheries Service, Northwest Regional Office 7600 Sand Point Way NE, Seattle, WA 98115-0070 Phone: 206-526-6150 Website: www.nwr.noaa.gov
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Table 3-1. Detailed Permit Process: Stabilize Shoreline and Riverbanks & Restore Riverbanks and River

<p><u>Section 404 Permit (for dredge/fill work)</u></p> <ul style="list-style-type: none"> • Needed if you will be conducting any activity, including excavation, that might result in a discharge of dredge or fill material into water. If your project might affect threatened or endangered species, or their critical habitat, you will be required to submit a Biological Evaluation. • See Appendix 3 for more information. • Cost: \$0 - \$100 to review; Biological Evaluation can be expensive • Review time: 45 days to 2 years, depending on the type of permit • Submit to: U.S. Army Corps of Engineers, Seattle District Regulatory Branch P.O. Box 3755, Seattle, WA 98124-2255 Phone: 206-764-3495 Website: www.nws.usace.army.mil/PublicMenue/ <p style="text-align: center;"><u>Other Required Permits</u></p> <p><u>Forest Practices Application (State)</u></p> <ul style="list-style-type: none"> • Needed if you will be cutting or removing trees, building a forest road, and/or salvaging standing or fallen (dead) wood for resale or if worth ≥ \$5,000. • See Appendix 3 for more information. • Cost: \$0 - \$1,200 • Review time: 30 days • Submit to: Department of Natural Resources, Forest Practices Division Northwest Region 919 North Township Street, Sedro Woolley, WA 98284 Phone: 360-856-3500 Website: www.dnr.wa.gov/forestpractices/ 	<p><u>Section 404 Permit (for dredge/fill work)</u></p> <ul style="list-style-type: none"> • Needed if you will be conducting any activity, including excavation, that might result in a discharge of dredge or fill material into water. If your project might affect threatened or endangered species, or their critical habitat, you will be required to submit a Biological Evaluation. • See Appendix 3 for more information. • Cost: \$0 - \$100 to review; Biological Evaluation can be expensive • Review time: 45 days to 2 years, depending on the type of permit • Submit to: U.S. Army Corps of Engineers, Seattle District Regulatory Branch P.O. Box 3755, Seattle, WA 98124-2255 Phone: 206-764-3495 Website: www.nws.usace.army.mil/PublicMenue/ <p style="text-align: center;"><u>Other Required Permits</u></p> <p><u>Forest Practices Application (State)</u></p> <ul style="list-style-type: none"> • Needed if you will be cutting or removing trees, building a forest road, and/or salvaging standing or fallen (dead) wood for resale or if worth ≥ \$5,000. • See Appendix 3 for more information. • Cost: \$0 - \$1,200 • Review time: 30 days • Submit to: Department of Natural Resources, Forest Practices Division Northwest Region 919 North Township Street, Sedro Woolley, WA 98284 Phone: 360-856-3500 Website: www.dnr.wa.gov/forestpractices/
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Table 3-1. Detailed Permit Process: Stabilize Shoreline and Riverbanks & Restore Riverbanks and River

<u>Archaeological/Historical Assessment (State)</u>	<u>Archaeological/Historical Assessment (State)</u>
<p><u>Skagit County</u></p> <ul style="list-style-type: none"> • Obtain assessment from Washington Department of Archaeology and Historic Preservation (WDAHP). Needed if you will be disturbing the land you own and thus possibly disturbing or harming archaeological, historic or cultural properties that are protected by the state. Property owners need to send a letter to this department, asking if any cultural resources exist on their property, including a location map, current tax statement and brief summary of the proposed activity. • See Appendix 3 for more information. • Cost: Free to review; archaeological investigation can cost \$10,000 or more • Review time: 45-60 days • Submit to: Department of Archaeology and Historic Preservation 1063 South Capitol Way, Suite 106, Olympia, WA 98501 Phone: 360-586-3065 Website: www.daph.wa.gov 	<p><u>Skagit County</u></p> <ul style="list-style-type: none"> • Obtain assessment from Washington Department of Archaeology and Historic Preservation (WDAHP). Needed if you will be disturbing the land you own and thus possibly disturbing or harming archaeological, historic or cultural properties that are protected by the state. Property owners need to send a letter to this department, asking if any cultural resources exist on their property, including a location map, current tax statement and brief summary of the proposed activity. • See Appendix for more information. • Cost: Free to review; archaeological investigation can cost \$10,000 or more • Review time: 45-60 days • Submit to: Department of Archaeology and Historic Preservation 1063 South Capitol Way, Suite 106, Olympia, WA 98501 Phone: 360-586-3065 Website: www.daph.wa.gov
<p><u>Snohomish County</u></p> <ul style="list-style-type: none"> • Needed if you will be disturbing the land and thus possibly disturbing or harming known archaeological, historic or cultural properties that are protected by the state. Review is done by the County (Planning and Development Services or Public Works). • See Appendix 3 for more information. • Cost: Free to review; archaeological investigations can cost \$10,000 or more • Review time: 45-60 days 	<p><u>Snohomish County</u></p> <ul style="list-style-type: none"> • Needed if you will be disturbing the land and thus possibly disturbing or harming known archaeological, historic or cultural properties that are protected by the state. Review is done by the County (Planning and Development Services or Public Works). • See Appendix 3 for more information. • Cost: Free to review; archaeological investigations can cost \$10,000 or more • Review time: 45-60 days

Table 3-1. Detailed Permit Process: Stabilize Shoreline and Riverbanks & Restore Riverbanks and River

<ul style="list-style-type: none"> • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave, Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS 	<ul style="list-style-type: none"> • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave, Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS
<p><u>Wild and Scenic River Review (Federal)</u></p> <ul style="list-style-type: none"> • Needed if your project or activity requires a federal permit <u>and/or</u> a Federal nexus has been determined (i.e., federal funds, etc.) • Needed if you intend to construct a project or work within the riverbed or banks of a Wild and Scenic River (Sauk River as part of Skagit River system), especially channel straightening, diversions, and rock armoring of the shoreline. For any proposed activity that is likely to have adverse impacts on the values of the river system, the Forest Service will work cooperatively the state and local agencies, and landowner(s) to resolve it. The Forest Service may also provide technical assistance to find ways to alleviate or mitigate the potential threat. • Cost: Free • Review time: Variable • Submit to: Skagit WSR Manager:, Mt. Baker Ranger District 810 State Route 20, Sedro-Woolley, WA 98284 Phone: 360-856-5700 Website: www.fs.fed.us/r6/mbs/skagit-wsr/ <p>Darrington Ranger District 1405 Emmens Street, Darrington, WA 98241 Phone: 360-436-1155</p>	<p><u>Wild and Scenic River Review (Federal)</u></p> <ul style="list-style-type: none"> • Needed if your project or activity requires a federal permit <u>and/or</u> a Federal nexus has been determined (i.e., federal funds, etc.) • Needed if you intend to construct a project or work within the riverbed or banks of a Wild and Scenic River (Sauk River as part of Skagit River system), especially channel straightening, diversions, and rock armoring of the shoreline. For any proposed activity that is likely to have adverse impacts on the values of the river system, the Forest Service will work cooperatively the state and local agencies, and landowner(s) to resolve it. The Forest Service may also provide technical assistance to find ways to alleviate or mitigate the potential threat. • Cost: Free • Review time: Variable • Submit to: Skagit WSR Manager:, Mt. Baker Ranger District 810 State Route 20, Sedro-Woolley, WA 98284 Phone: 360-856-5700 Website: www.fs.fed.us/r6/mbs/skagit-wsr/ <p>Darrington Ranger District 1405 Emmens Street, Darrington, WA 98241 Phone: 360-436-1155</p>

Table 3-1. Detailed Permit Process: Stabilize Shoreline and Riverbanks & Restore Riverbanks and River

<p><u>Grading Permit (County)</u></p> <ul style="list-style-type: none"> • Needed if you will be digging, moving, or filling 100 cubic yards or more of rock, soils, or fill in the process of grading, building, or clearing or if your project or activity is within a critical area. <p><u>Snohomish County*</u></p> <ul style="list-style-type: none"> • Cost: \$300 • Review time: Variable • Submit to: Snohomish County Planning and Development Services* 3000 Rockefeller Ave, Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS <p>*Submittal is by appointment only</p> <p><u>Skagit County</u></p> <ul style="list-style-type: none"> • Cost: Based on largest volume of fill or dredge material • Review time: Usually 4-6 weeks • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9491 Website: www.skagitcounty.net 	<p><u>Grading Permit (County): NOT REQUIRED</u></p>
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Table 3-1. Detailed Permit Process: Stabilize Shoreline and Riverbanks & Restore Riverbanks and River

<p><u>ESA Listed Salmonids Checklist (Skagit County)</u></p> <ul style="list-style-type: none">• Needed to determine if your project or activity will affect any federally-listed endangered or threatened salmonids (salmon or trout).• See Appendix 3 for more information.• Cost: \$600• Review time: Variable• Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net	<p><u>ESA Listed Salmonids Checklist (Skagit County)</u></p> <ul style="list-style-type: none">• Needed to determine if your project or activity will affect any federally-listed endangered or threatened salmonids (salmon or trout).• See Appendix 3 for more information.• Cost: \$600• Review time: Variable• Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net
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Detailed Permit Process

Table 3-2:

Clearing Land & Building Structures

Table 3-2. Detailed Permit Process: Clearing Land and Building Structures.

<p>If you are...</p> <p style="text-align: center;">CLEARING LAND</p> <p><u>Purpose/Effect</u> To harvest timber, grade or clear land, or convert forestland for development purposes.</p> <p><u>Permits/Reviews:</u> The following state, local, and federal permits may be required</p> <p><u>JARPA – Joint Aquatic Review Permit Application</u></p> <ul style="list-style-type: none"> • Needed if you will be doing any work in or near the water. • Coordinated effort between county, state, and federal agencies that allows you to apply for more than one permit at a time. • Mitigation is usually required for harm done to the environment by the project or activity. • See Appendix 3 for more information. • Cost: Free to review; site analysis and mitigation design/work can be expensive • Review time: 45 days • Submit to: Washington Department of Fish and Wildlife 16018 Mill Creek Blvd, Mill Creek, WA 98012 Phone: 425-775-1311 Website: www.wdfw.wa.gov 	<p>If you are...</p> <p style="text-align: center;">BUILDING STRUCTURES</p> <p><u>Purpose/Effect</u> Clear land for and construct a new house, garage, shed, bulkhead, etc.</p> <p><u>Permits/Reviews:</u> The following state, local, and federal permits may be required</p> <p><u>JARPA – Joint Aquatic Review Permit Application</u></p> <ul style="list-style-type: none"> • Needed if you will be doing any work in or near the water. This is a coordinated effort between county, state and federal agencies that allows you to apply for permits from many government agencies with this single application form. • Mitigation is usually required for harm done to the environment by the project or activity. • See Appendix 3 for more information. • Cost: Free to review; site analysis and mitigation design/work can be expensive • Review time: 45 days • Submit to: Washington Department of Fish and Wildlife 16018 Mill Creek Blvd, Mill Creek, WA 98012 Phone: 425-775-1311 Website: www.wdfw.wa.gov
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Table 3-2. Detailed Permit Process: Clearing Land and Building Structures.

<p>The following county, state and federal permits are covered in the JARPA:</p> <p style="text-align: center;"><u>JARPA</u></p> <p><u>Local</u></p> <p><u>Snohomish County</u> <u>Habitat Management Plan</u></p> <ul style="list-style-type: none"> • Needed if you will be disturbing plants or earth within 100 feet of a critical area (Sauk River). • See Appendix 3 for more information • Cost: \$600 to review plan • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave., Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS <p><u>Shoreline Substantial Development Permit</u></p> <ul style="list-style-type: none"> • May be needed if your project or activity will take place within 200 feet of the shoreline. • See Appendix 3 for more information. • Cost: \$450 or more • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave., Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS 	<p>The following state, local, and federal permits may be required as part of the JARPA:</p> <p style="text-align: center;"><u>JARPA</u></p> <p><u>Local</u></p> <p><u>Snohomish County</u> <u>Habitat Management Plan</u></p> <ul style="list-style-type: none"> • Needed if you will be disturbing plants or earth within 100 feet of a critical area (Sauk River). • See Appendix 3 for more information • Cost: \$600 to review plan • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave., Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS <p><u>Shoreline Substantial Development Permit</u></p> <ul style="list-style-type: none"> • May be needed if your project or activity will take place within 200 feet of the shoreline. • See Appendix 3 for more information. • Cost: \$450 or more • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave., Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS
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Table 3-2. Detailed Permit Process: Clearing Land and Building Structures.

<p><u>Critical Areas Ordinance Checklist</u></p> <ul style="list-style-type: none"> • Needed if you plan to work within 100 feet of a critical area (Sauk River). • See Appendix 3 for more information. • Cost: \$250 - \$600 for site visit • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave., Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS 	<p><u>Critical Areas Ordinance Checklist</u></p> <ul style="list-style-type: none"> • Needed if you plan to work within 100 feet of a critical area (Sauk River). • See Appendix 3 for more information. • Cost: \$250 - \$600 for site visit • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave., Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS
<p><u>Flood Hazard Development Permit</u></p> <ul style="list-style-type: none"> • Needed if you will be building or grading on land within the 100-year flood zone. • See Appendix 3 for more information. • Cost: \$300 • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave, Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS 	<p><u>Flood Hazard Development Permit</u></p> <ul style="list-style-type: none"> • Needed if you will be building or grading on land within the 100-year flood zone. • See Appendix 3 for more information. • Cost: \$300 • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave, Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS
<p>Skagit County <u>Shoreline Development Proposal</u></p> <ul style="list-style-type: none"> • Needed if your project or activity is within the 100-year floodplain or within 200 feet of the riverbank. • See Appendix 3 for more information. 	<p>Skagit County <u>Shoreline Substantial Development Permit</u></p> <ul style="list-style-type: none"> • Needed if your project or activity is within the 100-year floodplain or within 200 feet of the riverbank. • See Appendix 3 for more information.

Table 3-2. Detailed Permit Process: Clearing Land and Building Structures.

<ul style="list-style-type: none"> • Cost: \$2,200 • Review time: Variable • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net 	<ul style="list-style-type: none"> • Cost: \$2,200 • Review time: Variable • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net
<p><u>Critical Areas Ordinance Checklist</u></p> <ul style="list-style-type: none"> • Needed if you plan to work within 200 feet of a critical area (Sauk River). May require a site visit, and a mitigation plan to offset any harm to the critical area or its buffer. • See Appendix 3 for more information. • Cost: \$300 • Review time: Variable • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net 	<p><u>Critical Areas Ordinance Checklist</u></p> <ul style="list-style-type: none"> • Needed if you plan to work within 200 feet of a critical area (Sauk River). May require a site visit, and a mitigation plan to offset any harm to the critical area or its buffer. • See Appendix 3 for more information. • Cost: \$300 • Review time: Variable • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net
<p><u>Flood Area Development Proposal</u></p> <ul style="list-style-type: none"> • Needed if you will be building or grading on land within the 100-year flood zone. Review done by Planning and Development Services when a building or grading permit is submitted. • See Appendix 3 for more information. • Cost: Variable based on type of permit and other factors • Review time: Usually 4-6 weeks • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net 	<p><u>Flood Area Development Proposal</u></p> <ul style="list-style-type: none"> • Needed if you will be building or grading on land within the 100-year flood zone. Review done by Planning and Development Services when a building or grading permit is submitted. • See Appendix 3 for more information. • Cost: Variable based on type of permit and other factors • Review time: Usually 4-6 weeks • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net

Table 3-2. Detailed Permit Process: Clearing Land and Building Structures.

<p><u>State</u> <u>HPA – Hydraulic Permit Approval</u></p> <ul style="list-style-type: none"> • Needed if you will be using, diverting, obstructing, or changing the natural flow or bed of any fresh water (e.g., Sauk River, tributaries, wetlands). • See Appendix 3 for more information. • Cost: Free • Review time: 45 days • Submit to: Washington Department of Fish and Wildlife 16018 Mill Creek Blvd., Mill Creek, WA 98012 Phone: 425-775-1311 Website: www.wdfw.wa.gov <p><u>Section 401 Water Quality Certification</u></p> <ul style="list-style-type: none"> • Needed if you will be conducting any activity, including excavation, that might result in a discharge of dredge or fill material into water. • See Appendix 3 for more information. • Cost: Free • Review time: 1 - 3 months • Submit to: Washington Department of Ecology (Northwest Region) 3190 - 160th Ave., SE, Bellevue, WA 98008-5452 Phone: 425-649-7000 Website: www.ora.wa.gov <p><u>Aquatic Use Authorization</u></p> <ul style="list-style-type: none"> • Needed if your project includes construction, use or activities on submerged land (riverbed) that is owned by the Washington Department of Natural Resources. 	<p><u>State</u> <u>HPA – Hydraulic Permit Approval</u></p> <ul style="list-style-type: none"> • Needed if you will be using, diverting, obstructing, or changing the natural flow or bed of any fresh water (Sauk River, tributaries, lakes wetlands, etc.). • See Appendix 3 for more information. • Cost: Free • Review time: 45 days • Submit to: Washington Department of Fish and Wildlife 16018 Mill Creek Blvd., Mill Creek, WA 98012 Phone: 425-775-1311 Website: www.wdfw.wa.gov <p><u>Section 401 Water Quality Certification</u></p> <ul style="list-style-type: none"> • Needed if you will be conducting any activity, including excavation, that might result in a discharge of dredge or fill material into water. • See Appendix 3 for more information. • Cost: Free • Review time: 1 - 3 months • Submit to: Washington Department of Ecology (Northwest Region) 3190 - 160th Ave., SE, Bellevue, WA 98008-5452 Phone: 425-649-7000 Website: www.ora.wa.gov <p><u>Aquatic Use Authorization</u></p> <ul style="list-style-type: none"> • Needed if your project includes construction, use or activities on submerged land (riverbed) that is owned by the Washington Department of Natural Resources. • See Appendix 3 for more information.
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Table 3-2. Detailed Permit Process: Clearing Land and Building Structures.

<ul style="list-style-type: none"> • See Appendix 3 for more information. • Cost: \$25, plus a fee to lease the submerged land may apply • Review time: 6-12 months • Submit to: Department of Natural Resources, Aquatic Resources Division Northwest Region 919 North Township Street, Sedro Woolley, WA 98284 Phone: 360-856-3500 Website: www.dnr.wa.gov/htdocs/aqr 	<ul style="list-style-type: none"> • Cost: \$25, plus a fee to lease the submerged land may apply • Review time: 6-12 months • Submit to: Department of Natural Resources, Aquatic Resources Division Northwest Region 919 North Township Street, Sedro Woolley, WA 98284 Phone: 360-856-3500 Website: www.dnr.wa.gov/htdocs/aqr
<p><u>SEPA – State Environmental Policy Act Review</u></p> <ul style="list-style-type: none"> • Needed to determine if your project or activity will cause any environmental harm. The city or county that your project is located in is the ‘lead agency’ that prepares this review. • See Appendix 3 for more information. • Cost: \$500 • Review time: variable 	<p><u>SEPA – State Environmental Policy Act Review</u></p> <ul style="list-style-type: none"> • Needed to determine if your project or activity will cause any environmental harm. The city or county that your project is located in is the ‘lead agency’ that prepares this review. • See Appendix 3 for more information. • Cost: \$500 • Review time: Variable
<p><u>Federal</u></p> <p><u>Endangered Species Act (ESA) Incidental Take Permit</u></p> <ul style="list-style-type: none"> • Needed if your project or activity will harm a threatened or endangered species. A habitat conservation plan must accompany an Incidental Take application. • See Appendix 3 for more information. • Cost: Free to review; habitat conservation plan can cost \$10,000 or more • Review time: Variable 	<p><u>Federal</u></p> <p><u>Endangered Species Act (ESA) Incidental Take Permit</u></p> <ul style="list-style-type: none"> • Needed if your project or activity will harm a threatened or endangered species. A habitat conservation plan must accompany an Incidental Take application. • See Appendix 3 for more information. • Cost: Free to review; habitat conservation plan can cost \$10,000 or more • Review time: Variable

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Table 3-2. Detailed Permit Process: Clearing Land and Building Structures.

<ul style="list-style-type: none"> • Submit to: National Marine Fisheries Service, Northwest Regional Office 7600 Sand Point Way NE, Seattle, WA 98115-0070 Phone: 206-526-6150 Website: www.nwr.noaa.gov <p><u>Section 404 Permit (for dredge/fill work)</u></p> <ul style="list-style-type: none"> • Needed if you will be conducting any activity, including excavation, that might result in a discharge of dredge or fill material into water. If your project might affect threatened or endangered species, or their critical habitat, you will be required to submit a Biological Evaluation. • See Appendix 3 for more information. • Cost: \$0 - \$100 to review; Biological Evaluation can be expensive • Review time: 45 days to 2 years, depending on the type of permit • Submit to: U.S. Army Corps of Engineers, Seattle District Regulatory Branch P.O. Box 3755, Seattle, WA 98124-2255 Phone: 206-764-3495 Website: www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=REG&pagename=mainpage <u>Permit Applicant Info</u> 	<ul style="list-style-type: none"> • Submit to: National Marine Fisheries Service, Northwest Regional Office 7600 Sand Point Way NE, Seattle, WA 98115-0070 Phone: 206-526-6150 Website: www.nwr.noaa.gov <p><u>Section 404 Permit (for dredge/fill work)</u></p> <ul style="list-style-type: none"> • Needed if you will be conducting any activity, including excavation, that might result in a discharge of dredge or fill material into water. If your project might affect threatened or endangered species, or their critical habitat, you will be required to submit a Biological Evaluation. • See Appendix 3 for more information. • Cost: \$0 - \$100 to review; Biological Evaluation can be expensive • Review time: 45 days to 2 years, depending on the type of permit • Submit to: U.S. Army Corps of Engineers, Seattle District Regulatory Branch P.O. Box 3755, Seattle, WA 98124-2255 Phone: 206-764-3495 Website: www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=REG&pagename=mainpage <u>Permit Applicant Info</u>
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Table 3-2. Detailed Permit Process: Clearing Land and Building Structures.

Other Required Permits

Other Required Permits

Residential Building Permit (County)

Snohomish County

Needed if you will be constructing a permanent building or an addition to an existing structure.

See Appendix 3 for more information.

Cost: \$16-90 per square foot, or more

Review time: 6-8 weeks

Submit to: Snohomish County Planning and Development Services
3000 Rockefeller Ave, Everett, WA 98201

Phone: 425-388-3311, or 1-800-562-4367, ext. 3311

Website: www1.co.snohomish.wa.us/Departments/PDS

Skagit County

- Needed if you will be constructing a permanent building or an addition to an existing structure.

- See Appendix 3 for more information.

- Cost: Based on type of construction and use

- Review time: Usually 4-6 weeks

- Submit to: Skagit County Planning and Development Services
1800 Continental Place, Mt. Vernon, WA 98273

Phone: 360-336-9401

Website:

www.skagitcounty.net/Common/asp/default.asp?d=PlanningAndPermit&c=General&p=main.htm

Table 3-2. Detailed Permit Process: Clearing Land and Building Structures.

<p><u>Forest Practices Application (State)</u></p> <ul style="list-style-type: none"> • Needed if you will be cutting or removing trees, building a forest road, and/or salvaging standing or fallen (dead) wood for resale or if worth \geq \$5,000. • See Appendix 3 for more information. • Cost: \$0 - \$1,200 • Review time: 30 days • Submit to: Department of Natural Resources, Forest Practices Division Northwest Region 919 North Township Street, Sedro Woolley, WA 98284 Phone: 360-856-3500 Website: www.dnr.wa.gov/forestpractices/ 	<p><u>Forest Practices Application (State)</u></p> <ul style="list-style-type: none"> • Needed if you will be cutting or removing trees, building a forest road, and/or salvaging standing or fallen (dead) wood for resale or if worth \geq \$5,000. • See Appendix 3 for more information. • Cost: \$0 - \$1,200 • Review time: 30 days • Submit to: Department of Natural Resources, Forest Practices Division Northwest Region 919 North Township Street, Sedro Woolley, WA 98284 Phone: 360-856-3500 Website: www.dnr.wa.gov/forestpractices/
<p><u>Archaeological/Historical Assessment (State)</u></p> <p><u>Snohomish County</u></p> <ul style="list-style-type: none"> • Needed if you will be disturbing the land and thus possibly disturbing or harming known archaeological, historic or cultural properties that are protected by the state. Review is done by the County (Planning and Development Services or Public Works). • See Appendix 3 for more information. • Cost: Free to review; archaeological investigations can cost \$10,000 or more • Review time: 45-60 days • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave, Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS 	<p><u>Archaeological/Historical Assessment (State)</u></p> <p><u>Snohomish County</u></p> <ul style="list-style-type: none"> • Needed if you will be disturbing the land and thus possibly disturbing or harming known archaeological, historic or cultural properties that are protected by the state. Review is done by the County (Planning and Development Services or Public Works). See Appendix 3 for more information. • Cost: Free to review; archaeological investigations can cost \$10,000 or more • Review time: 45-60 days • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave, Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS

Table 3-2. Detailed Permit Process: Clearing Land and Building Structures.

<p><u>Skagit County</u></p> <ul style="list-style-type: none"> • Obtain assessment from Washington Department of Archaeology and Historic Preservation (WDAHP). • Needed if you will be disturbing the land you own and thus possibly disturbing or harming archaeological, historic or cultural properties that are protected by the state. Property owners need to send a letter to this department, asking if any cultural resources exist on their property, including a location map, current tax statement and brief summary of the proposed activity. • See Appendix 3 for more information. • Cost: Free to review; archaeological investigation can cost \$10,000 or more • Review time: 45-60 days • Submit to: Department of Archaeology and Historic Preservation 1063 South Capitol Way, Suite 106, Olympia, WA 98501 Phone: 360-586-3065 Website: www.daph.wa.gov 	<p><u>Skagit County</u></p> <ul style="list-style-type: none"> • Obtain assessment from Washington Department of Archaeology and Historic Preservation (WDAHP). • Needed if you will be disturbing the land you own and thus possibly disturbing or harming archaeological, historic or cultural properties that are protected by the state. Property owners need to send a letter to this department, asking if any cultural resources exist on their property, including a location map, current tax statement and brief summary of the proposed activity. • See Appendix 3 for more information. • Cost: Free to review; archaeological investigation can cost \$10,000 or more • Review time: 45-60 days • Submit to: Department of Archaeology and Historic Preservation 1063 South Capitol Way, Suite 106, Olympia, WA 98501 Phone: 360-586-3065 Website: www.daph.wa.gov
<p><u>Wild and Scenic River Review (Federal)</u></p> <ul style="list-style-type: none"> • Needed if your project or activity requires a federal permit <u>and/or</u> a Federal nexus has been determined (i.e., federal funds, etc.) • Needed if you intend to construct a project or work within the riverbed or banks of a Wild and Scenic River (Sauk River as part of Skagit River system), especially channel straightening, diversions, and rock armoring of the shoreline. For any proposed activity that is likely to have adverse impacts on the values of the river system, the Forest Service will work cooperatively the state and local agencies, and landowner(s) to resolve it. The Forest Service may also provide technical assistance to find ways to alleviate or mitigate the potential threat. 	<p><u>Wild and Scenic River Review (Federal)</u></p> <ul style="list-style-type: none"> • Needed if your project or activity requires a federal permit <u>and/or</u> a Federal nexus has been determined (i.e., federal funds, etc.) • Needed if you intend to construct a project or work within the riverbed or banks of a Wild and Scenic River (Sauk River as part of Skagit River system), especially channel straightening, diversions, and rock armoring of the shoreline. For any proposed activity that is likely to have adverse impacts on the values of the river system, the Forest Service will work cooperatively the state and local agencies, and landowner(s) to resolve it. The Forest Service may also provide technical assistance to find ways to alleviate or mitigate the potential threat.

Table 3-2. Detailed Permit Process: Clearing Land and Building Structures.

- Cost: Free
- Review time: Variable
- Submit to: Skagit WSR Manager:, Mt. Baker Ranger District
810 State Route 20, Sedro-Woolley, WA 98284
Phone: 360-856-5700
Website: www.fs.fed.us/r6/mbs/skagit-wsr/

Darrington Ranger District
1405 Emmens Street, Darrington, WA 98241
Phone: 360-436-1155

Grading Permit (County)

Snohomish County*

- Needed if you will be digging, moving or filling 100 cubic yards (or more) of rock, soil or fill in the process of grading or building, or if your project or activity is within a critical area (Sauk River).
- See Appendix 3 for more information.
- Cost: \$300
- Review time: Variable
- Submit to: Snohomish County Planning and Development Services*
3000 Rockefeller Ave, Everett, WA 98201
Phone: 425-388-3311, or 1-800-562-4367, ext. 3311
Website: www1.co.snohomish.wa.us/Departments/PDS

***Submittal is by appointment only**

- Cost: Free
- Review time: Variable
- Submit to: Skagit WSR Manager:, Mt. Baker Ranger District
810 State Route 20, Sedro-Woolley, WA 98284
Phone: 360-856-5700
Website: www.fs.fed.us/r6/mbs/skagit-wsr/

Darrington Ranger District
1405 Emmens Street, Darrington, WA 98241
Phone: 360-436-1155

Grading Permit (County)

Snohomish County*

- Needed if you will be digging, moving or filling 100 cubic yards (or more) of rock, soil or fill in the process of grading or building, or if your project or activity is within a critical area (the Sauk River).
- See Appendix 3 for more information.
- Cost: \$300
- Review time: Variable
- Submit to: Snohomish County Planning and Development Services*
3000 Rockefeller Ave, Everett, WA 98201
Phone = 425-388-3311, or 1-800-562-4367, ext. 3311
(*Submittal is by appointment only)
Website: www1.co.snohomish.wa.us/Departments/PDS

***Submittal is by appointment only**

Table 3-2. Detailed Permit Process: Clearing Land and Building Structures.

<p><u>Skagit County</u></p> <ul style="list-style-type: none"> • Needed if you will be digging, moving or filling 100 cubic yards (or more) of rock, soil or fill in the process of grading or building, or if your project or activity is within a critical area (Sauk River). • See Appendix 3 for more information. • Cost: Based on largest volume of fill or dredge material • Review time: Usually 4-6 weeks • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9491 Website: www.skagitcounty.net 	<p><u>Skagit County</u></p> <ul style="list-style-type: none"> • Needed if you will be digging, moving or filling 100 cubic yards (or more) of rock, soil or fill in the process of grading or building, or if your project or activity is within a critical area (Sauk River). • See Appendix 3 for more information. • Cost: Based on largest volume of fill or dredge material • Review time: Usually 4-6 weeks • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9491 Website: www.skagitcounty.net
<p><u>ESA Listed Salmonids Checklist (Skagit County)</u></p> <ul style="list-style-type: none"> • Needed to determine if your project or activity will affect any federally-listed endangered or threatened salmonids (salmon or trout). • See Appendix 3 for more information. • Cost: \$600 • Review time: Variable • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net 	<p><u>ESA Listed Salmonids Checklist (Skagit County)</u></p> <ul style="list-style-type: none"> • Needed to determine if your project or activity will affect any federally-listed endangered or threatened salmonids (salmon or trout). • See Appendix 3 for more information. • Cost: \$600 • Review time: Variable • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone = 360-336-9401 Website: www.skagitcounty.net

Detailed Permit Process

Table 3-3

Emergency Work In and Along the Sauk River

Table 3-3. Detailed Permit Process: Emergency Work in and along the Sauk River

<p>If your home or business is in imminent danger and ... NEEDS IMMEDIATE PROTECTION ...from channel migration and/or river bank erosion</p> <p>Purpose/Effect:</p> <p>To protect a structure from immediate danger of channel migration and/or river bank erosion. In general, flooding and other seasonal events that can be anticipated and may occur, but that are not immediately dangerous, are NOT considered emergencies.</p> <p>Emergency = an unanticipated and imminent threat to public health, safety, or the environment which requires immediate action within a time frame too short to allow full compliance with all regulations and permits.</p> <p><u>Permits/Reviews:</u> Call your county Planning and Development Services Department and WDFW as soon as possible to let them know of your situation and to ask for verbal approval to proceed.</p> <ul style="list-style-type: none"> • Snohomish County Planning and Development Services <ul style="list-style-type: none"> ○ 425-388-3311, or 1-800-562-4367, ext. 3311 • Washington Department of Fish and Wildlife's local habitat biologist <ul style="list-style-type: none"> ○ Mon-Fri 8am-5pm: 425-775-1311; otherwise: 360-902-2537 	<p>If your home or business is in imminent danger and ... NEEDS IMMEDIATE PROTECTION ...from channel migration and/or river bank erosion</p> <p>Purpose/Effect:</p> <p>To protect life or a structure (NOT land) from immediate danger of channel migration and/or river bank erosion. In general, flooding and other seasonal events that can be anticipated and may occur, but that are not immediately dangerous, are NOT considered emergencies.</p> <p>Emergency = an unanticipated and imminent threat to public health, safety, or the environment which requires immediate action within a time frame too short to allow full compliance with all regulations and permits.</p> <p><u>Permits/Reviews:</u> You MUST contact these <u>four</u> government agencies to get verbal approval to proceed <u>BEFORE</u> you can do any work:</p> <ul style="list-style-type: none"> • Washington Department of Fish and Wildlife's local habitat biologist <ul style="list-style-type: none"> ○ Mon-Fri 8am-5pm: 425-775-1311; otherwise: 360-902-2537 • County Planning and Development Services Department <ul style="list-style-type: none"> ○ Skagit County: 360-336-9306
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Table 3-3. Detailed Permit Process: Emergency Work in and along the Sauk River

<ul style="list-style-type: none"> • When emergency construction or repair of flood protection structures are necessary, permits for the work (including any mitigation for harm done by the work) shall be obtained in a reasonable time frame after the emergency has passed, or the structure or construction shall be removed. <p><u>JARPA – Joint Aquatic Review Permit Application</u></p> <ul style="list-style-type: none"> • Needed if you will be doing any work in or near the water. • Coordinated effort between county, state, and federal agencies that allows you to apply for more than one permit at a time. • Mitigation is usually required for harm done to the environment by the project or activity. • See Appendix 3 for more information. • Permit Cost: Free • Review time: 45 days • Submit to: Washington Dept. of Fish and Wildlife 16018 Mill Creek Blvd., Mill Creek, WA 98012 Phone: 425-775-1311 Website: www.wdfw.wa.gov 	<ul style="list-style-type: none"> • Washington Department of Ecology’s shoreline management division <ul style="list-style-type: none"> ○ 425-649-7000; Northwest Regional Office, Bellevue ○ 360-738-6250; Bellingham Field Office • US Army Corps of Engineers permitting division <ul style="list-style-type: none"> ○ 206-764-3495 • Approval from one government agency does not equal approval from all government agencies. All agencies requiring permits are listed below. • When emergency construction or repair of flood protection structures is necessary, permits for the work (including any mitigation for harm done by the work to the environment) shall be obtained in a reasonable time frame after the emergency has passed, or the structure or construction shall be removed. <p><u>JARPA – Joint Aquatic Review Permit Application</u></p> <ul style="list-style-type: none"> • Needed if you will be doing any work in or near the water. • Coordinated effort between county, state, and federal agencies that allows you to apply for more than one permit at a time. • Mitigation is usually required for harm done to the environment by the project or activity. • See Appendix 3 for more information. • Permit Cost: Free • Review time: 45 days • Submit to: Washington Dept. of Fish and Wildlife 16018 Mill Creek Blvd., Mill Creek, WA 98012 Phone: 425-775-1311 Website: www.wdfw.wa.gov
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Table 3-3. Detailed Permit Process: Emergency Work in and along the Sauk River

<p>The following state, local, and federal permits may be required as part of the JARPA:</p> <p style="text-align: center;"><u>JARPA</u></p> <p><u>Local</u></p> <p>Snohomish County</p> <p><u>Shoreline Substantial Development Permit</u></p> <ul style="list-style-type: none"> • May be needed if your project or activity is within 200 feet of the shoreline. • Needed if you plan to do more than build a bulkhead to protect a single family home from damage or erosion. • See Appendix 3 for more information. • Cost: \$450 or more • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave., Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS <p><u>Critical Areas Ordinance Checklist</u></p> <ul style="list-style-type: none"> • Needed if you will be working within 300 feet of a critical area (Sauk River). • See Appendix 3 for more information. • Cost: \$250 - \$600 for site visit • Review time: Variable 	<p>The following state, local, and federal permits may be required as part of the JARPA:</p> <p style="text-align: center;"><u>JARPA</u></p> <p><u>Local</u></p> <p>Skagit County</p> <p><u>Shoreline Development Permit Proposal</u></p> <ul style="list-style-type: none"> • Needed if your project or activity is within the 100-year floodplain or within 200 feet of the riverbank. • See Appendix 3 for more information. • Cost: \$2,200 • Review time: Variable • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net <p><u>Critical Areas Ordinance Checklist</u></p> <ul style="list-style-type: none"> • Needed if you will be working within 200 feet of a critical area (Sauk River). May require a site visit, and a mitigation plan to offset any harm to the critical area or its buffer. • See Appendix 3 for more information. • Cost: \$300 • Review time: Variable
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Table 3-3. Detailed Permit Process: Emergency Work in and along the Sauk River

<ul style="list-style-type: none"> • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave., Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS <p><u>Flood Hazard Development Permit</u></p> <ul style="list-style-type: none"> • Needed if you will be building or grading on land within the 100-year flood zone. • See Appendix 3 for more information. • Cost: \$300 • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave, Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS <p><u>Habitat Management Plan</u></p> <ul style="list-style-type: none"> • May be needed if you will be disturbing plants or earth within 300 feet of a critical area (Sauk River). • See Appendix 3 for more information • Cost: \$600 to review plan • Review time: Variable • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave., Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS 	<ul style="list-style-type: none"> • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net <p><u>Flood Area Development Proposal</u></p> <ul style="list-style-type: none"> • Needed if you be building or grading on land within the 100-year flood zone. Review done by Planning and Development Services when a building or grading permit is submitted. • See Appendix 3 for more information. • Cost: Variable based on type of permit and other factors • Review time: Usually 4-6 weeks • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net
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Table 3-3. Detailed Permit Process: Emergency Work in and along the Sauk River

<p><u>State</u> <u>HPA – Hydraulic Permit Approval</u></p> <ul style="list-style-type: none"> • Needed if you will be using, diverting, obstructing or changing the natural flow or bed of any fresh water (i.e., Sauk River, tributaries, wetlands, lakes). • See Appendix 3 for more information. • Cost: Free • Review time: 45 days • Submit to: Washington Department of Fish and Wildlife 16018 Mill Creek Blvd., Mill Creek, WA 98012 Phone: 425-775-1311 Website: www.wdfw.wa.gov <p><u>Section 401 Water Quality Certification</u></p> <ul style="list-style-type: none"> • Needed if you will be conducting any activity, including excavation, that might result in a discharge of dredge or fill material into water. • See Appendix 3 for more information. • Cost: Free • Review time: 1 - 3 months • Submit to: Washington Department of Ecology (Northwest Region) 3190 - 160th Ave., SE, Bellevue, WA 98008-5452 Phone: 425-649-7000 Website: www.ora.wa.gov 	<p><u>State</u> <u>HPA – Hydraulic Permit Approval</u></p> <ul style="list-style-type: none"> • Needed if you will be using, diverting, obstructing or changing the natural flow or bed of any fresh water (i.e., Sauk River, tributaries, wetlands, lakes). • See Appendix 3 for more information. • Cost: Free • Review time: 45 days • Submit to: Washington Department of Fish and Wildlife 16018 Mill Creek Blvd., Mill Creek, WA 98012 Phone: 425-775-1311 Website: www.wdfw.wa.gov <p><u>Section 401 Water Quality Certification</u></p> <ul style="list-style-type: none"> • Needed if you will be conducting any activity, including excavation, that might result in a discharge of dredge or fill material into water. • See Appendix 3 for more information. • Cost: Free • Review time: 1 - 3 months • Submit to: Washington Department of Ecology (Northwest Region) 3190 - 160th Ave., SE, Bellevue, WA 98008-5452 Phone: 425-649-7000 Website: www.ora.wa.gov
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Table 3-3. Detailed Permit Process: Emergency Work in and along the Sauk River

<p><u>Aquatic Use Authorization</u></p> <ul style="list-style-type: none"> • Needed if your project includes construction, use or activities on submerged land (riverbed) that is owned by the Washington Department of Natural Resources. • See Appendix 3 for more information. • Cost: \$25, plus a fee to lease the submerged land may apply • Review time: 6-12 months • Submit to: Department of Natural Resources, Aquatic Resources Division Northwest Region 919 North Township Street, Sedro Woolley, WA 98284 Phone: 360-856-3500 Website: www.dnr.wa.gov/htdocs/aqr <p><u>SEPA – State Environmental Policy Act Review</u></p> <ul style="list-style-type: none"> • Needed to determine if your project or activity will cause any environmental harm. • The City or County that your project is located in is the ‘lead agency’ that prepares this review • Cost: \$500 • Review time: variable <p><u>Federal</u></p> <p><u>Endangered Species Act (ESA) Incidental Take Permit</u></p> <ul style="list-style-type: none"> • Needed if your project or activity requires a federal permit <u>and/or</u> a Federal nexus has been determined (i.e., federal funds, etc.) • Needed if your project or activity will harm a threatened or endangered species. 	<p><u>Aquatic Use Authorization</u></p> <ul style="list-style-type: none"> • Needed if your project includes construction, use or activities on submerged land (riverbed) that is owned by the Washington Department of Natural Resources. • See Appendix 3 for more information. • Cost: \$25, plus a fee to lease the submerged land may apply • Review time: 6-12 months • Submit to: Department of Natural Resources, Aquatic Resources Division Northwest Region 919 North Township Street, Sedro Woolley, WA 98284 Phone: 360-856-3500 Website: www.dnr.wa.gov/htdocs/aqr <p><u>SEPA – State Environmental Policy Act Review</u></p> <ul style="list-style-type: none"> • Needed to determine if your project or activity will cause any environmental harm. • The City or County that your project is located in is the ‘lead agency’ that prepares this review • Cost: \$500 • Review time: variable <p><u>Federal</u></p> <p><u>Endangered Species Act (ESA) Incidental Take Permit</u></p> <ul style="list-style-type: none"> • Needed if your project or activity requires a federal permit <u>and/or</u> a Federal nexus has been determined (i.e., federal funds, etc.) • Needed if your project or activity will harm a threatened or endangered species.
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Table 3-3. Detailed Permit Process: Emergency Work in and along the Sauk River

<ul style="list-style-type: none"> • A habitat conservation plan must accompany an Incidental Take application. • See Appendix 3 for more information. • Cost: Free to review; habitat conservation plan can cost \$10,000 or more • Review time: Variable • Submit to: National Marine Fisheries Service, Northwest Regional Office 7600 Sand Point Way NE, Seattle, WA 98115-0070 Phone: 206-526-6150 Website: www.nwr.noaa.gov 	<ul style="list-style-type: none"> • A habitat conservation plan must accompany an Incidental Take application. • See Appendix 3 for more information. • Cost: Free to review; habitat conservation plan can cost \$10,000 or more • Review time: Variable • Submit to: National Marine Fisheries Service, Northwest Regional Office 7600 Sand Point Way NE, Seattle, WA 98115-0070 Phone: 206-526-6150 Website: www.nwr.noaa.gov
<p><u>Section 404 Permit (for dredge/fill work)</u></p> <ul style="list-style-type: none"> • Needed if you will be conducting any activity, including excavation, that might result in a discharge of dredge or fill material into water. If your project might affect threatened or endangered species, or their critical habitat, you will be required to submit a Biological Evaluation. • See Appendix 3 for more information. • Cost: \$0 - \$100 to review; Biological Evaluation can be expensive • Review time: 45 days to 2 years, depending on the type of permit • Submit to: U.S. Army Corps of Engineers, Seattle District Regulatory Branch P.O. Box 3755, Seattle, WA 98124-2255 Phone: 206-764-3495 Website: www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=REG&pagename=mainpage <u>Permit Applicant Info</u> 	<p><u>Section 404 Permit (for dredge/fill work)</u></p> <ul style="list-style-type: none"> • Needed if you will be conducting any activity, including excavation, that might result in a discharge of dredge or fill material into water. If your project might affect threatened or endangered species, or their critical habitat, you will be required to submit a Biological Evaluation. • See Appendix 3 for more information. • Cost: \$0 - \$100 to review; Biological Evaluation can be expensive • Review time: 45 days to 2 years, depending on the type of permit • Submit to: U.S. Army Corps of Engineers, Seattle District Regulatory Branch P.O. Box 3755, Seattle, WA 98124-2255 Phone: 206-764-3495 Website: www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=REG&pagename=mainpage <u>Permit Applicant Info</u>

Table 3-3. Detailed Permit Process: Emergency Work in and along the Sauk River

<h2 style="text-align: center;"><u>Other Required Permits</u></h2>	<h2 style="text-align: center;"><u>Other Required Permits</u></h2>
<p><u>Grading Permit (County) *</u></p> <ul style="list-style-type: none"> • Needed if you will be digging, moving, or filling 100 cubic yards or more of rock, soils, or fill in the process of grading, building, or clearing or if your project or activity is within a critical area. • See Appendix B3 for more information • Cost: \$300 • Review time: Variable • Submit to: Snohomish County Planning and Development Services* <p>3000 Rockefeller Ave, Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS</p> <p>*Submittal is by appointment only</p>	<p><u>Grading Permit (County)</u></p> <ul style="list-style-type: none"> • Needed if you will be digging moving, or filling 100 cubic yards or more of rock, soils, or fill in the process of grading, building, or clearing or if your project or activity is within a critical area. • See Appendix 3 for more information • Cost: Based on largest volume of fill or dredge material • Review time: Usually 4-6 weeks • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net
<p><u>Forest Practices Application (State)</u></p> <ul style="list-style-type: none"> • Needed if you will be cutting or removing trees, building a forest road, and/or salvaging standing or fallen (dead) wood for resale or if worth ≥ \$5,000. • See Appendix 3 for more information. • Cost: \$0 - \$1,200 • Review time: 30 days • Submit to: Department of Natural Resources, Forest Practices Division Northwest Region 919 North Township Street, Sedro Woolley, WA 98284 Phone: 360-856-3500 Website: www.dnr.wa.gov/forestpractices/ 	<p><u>Forest Practices Application (State)</u></p> <ul style="list-style-type: none"> • Needed if you will be cutting or removing trees, building a forest road, and/or salvaging standing or fallen (dead) wood for resale or if worth ≥ \$5,000. • See Appendix 3 for more information. • Cost: \$0 - \$1,200 • Review time: 30 days • Submit to: Department of Natural Resources, Forest Practices Division Northwest Region 919 North Township Street, Sedro Woolley, WA 98284 Phone: 360-856-3500 Website: www.dnr.wa.gov/forestpractices/

Table 3-3. Detailed Permit Process: Emergency Work in and along the Sauk River

<p><u>Archaeological/Historical Assessment (State)</u></p> <p><u>Snohomish County</u></p> <ul style="list-style-type: none"> • Needed if you will be disturbing the land and thus possibly disturbing or harming known archaeological, historic or cultural properties that are protected by the state. • Review is done by the County (Planning and Development Services or Public Works). • See Appendix 3 for more information. • Cost: Free to review; archaeological investigations can cost \$10,000 or more • Review time: 45-60 days • Submit to: Snohomish County Planning and Development Services 3000 Rockefeller Ave, Everett, WA 98201 Phone: 425-388-3311, or 1-800-562-4367, ext. 3311 Website: www1.co.snohomish.wa.us/Departments/PDS <p><u>Wild and Scenic River Review (Federal)</u></p> <ul style="list-style-type: none"> • Needed if your project or activity requires a federal permit <u>and/or</u> a Federal nexus has been determined (i.e., federal funds, etc.) • Needed if you intend to construct a project or work within the riverbed or banks of a Wild and Scenic River (Sauk River as part of Skagit River system), especially channel straightening, diversions, and rock armoring of the shoreline. For any proposed activity that is likely to have adverse impacts on the values of the river system, the Forest Service will work cooperatively the state and local 	<p><u>Archaeological/Historical Assessment (State)</u></p> <p><u>Skagit County</u></p> <ul style="list-style-type: none"> • Obtain assessment from Washington Department of Archaeology and Historic Preservation (WDAHP). • Needed if you will be disturbing the land you own and thus possibly disturbing or harming archaeological, historic or cultural properties that are protected by the state. • Property owners need to send a letter to this department, asking if any cultural resources exist on their property, including a location map, current tax statement and brief summary of the proposed activity. • See Appendix 3 for more information. • Cost: Free to review; archaeological investigation can cost \$10,000 or more • Review time: 45-60 days • Submit to: Department of Archaeology and Historic Preservation 1063 South Capitol Way, Suite 106, Olympia, WA 98501 Phone: 360-586-3065 Website: www.daph.wa.gov <p><u>Wild and Scenic River Review (Federal)</u></p> <ul style="list-style-type: none"> • Needed if your project or activity requires a federal permit <u>and/or</u> a Federal nexus has been determined (i.e., federal funds, etc.) • Needed if you intend to construct a project or work within the riverbed or banks of a Wild and Scenic River (Sauk River as part of Skagit River system), especially channel straightening, diversions, and rock armoring of the shoreline. For any proposed activity that is likely to have adverse impacts on the values of the river system, the Forest Service will work cooperatively the state
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Table 3-3. Detailed Permit Process: Emergency Work in and along the Sauk River

<p>agencies, and landowner(s) to resolve it. The Forest Service may also provide technical assistance to find ways to alleviate or mitigate the potential threat.</p> <ul style="list-style-type: none"> • Cost: Free • Review time: Variable • Submit to: Skagit WSR Manager:, Mt. Baker Ranger District 810 State Route 20, Sedro-Woolley, WA 98284 Phone: 360-856-5700 Website: www.fs.fed.us/r6/mbs/skagit-wsr/ <p>Darrington Ranger District 1405 Emmens Street, Darrington, WA 98241 Phone: 360-436-1155</p>	<p>and local agencies, and landowner(s) to resolve it. The Forest Service may also provide technical assistance to find ways to alleviate or mitigate the potential threat.</p> <ul style="list-style-type: none"> • Cost: Free • Review time: Variable • Submit to: Skagit WSR Manager:, Mt. Baker Ranger District 810 State Route 20, Sedro-Woolley, WA 98284 Phone: 360-856-5700 Website: www.fs.fed.us/r6/mbs/skagit-wsr/ <p>Darrington Ranger District 1405 Emmens Street, Darrington, WA 98241 Phone: 360-436-1155</p> <p><u>ESA Listed Salmonids Checklist (Skagit County)</u></p> <ul style="list-style-type: none"> • Needed to determine if your project or activity will affect any federally-listed endangered or threatened salmonids (salmon or trout). • See Appendix 3 for more information. • Cost: \$600 • Review time: Variable • Submit to: Skagit County Planning and Development Services 1800 Continental Place, Mt. Vernon, WA 98273 Phone: 360-336-9401 Website: www.skagitcounty.net
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4. EVALUATION OF ALTERNATIVES

4.1 INTRODUCTION

Generally speaking, during the preparation of a Comprehensive Flood/Erosion Management Plan (CFHMP), there are required methodologies for discussing alternatives and criteria and prioritization of alternatives. Because of the nature of the Sauk River, (a *lahar*, capable of drastic channel changes with each bankfull event), and the quantitative nature of the analysis discussed in Chapter Two, the project team approached the discussion of alternatives in a slightly different manner.

Instead of listing scores of alternatives and discussing the merits of each, we met with the Stakeholders group for several four hour sessions which resulted in set series of matrices, (Tables 4-1 through 4-6). On the left hand side of the matrix are the techniques, or treatments, thought to be the most effective at mitigating, or creating a desired outcome. For example, a “Structural Projects Mitigation Toolbox” would include actions that involve the construction of structures to reduce the impact of a hazard. Across the top of the Matrix, each “tool” is compared to a criteria, providing a decision making framework rather than a prioritization

In this way, the various techniques, or alternatives, are tailored to river process, and most importantly, matched to the risk factors quantified in the analyses and presented as the “User’s Guide” in Chapter 6. As a result, techniques employed in protection efforts, run through the “filter” of the risk analysis, have an improved chance of succeeding and furthermore, improper or inadequate protection measures might not be selected for further design.

4.2 DISCUSSION OF ALTERNATIVE MATRICES

To set the stage for discussion of the in-depth Users’ Guide, (Chapter 6), it is important to understand that the individual segment matrices were developed from the overall “action” matrices, (Tables 4-1 through 4-6) and reflect the risk analysis in each individual segment matrix (Appendix 2). The Alternatives Workshops, a series of Stakeholder workshops, facilitated by Kurt Warber, of Parametrix, Inc., notes were an in-depth discussion of the alternatives, and produced the Action matrices.

An excellent question to begin the discussion with is: Why are alternatives necessary? It is rare, although not unheard of, that there is only one good solution to an issue. Most importantly, alternatives provide stakeholders with structured choices to make trade-offs between benefits and impacts of a particular action. A good set of alternatives meets four key goals:

- A. Are linked to goals and objectives

- B. Allow Stakeholders to make real choices about key issues.
- C. Allow real-life comparisons, (e.g., apples to apples)
- D. Helps clarify the decision that needs to be made, rather than confuse.

Some typical strategies for developing alternatives include:

1. An emphasis between different goals and objectives.

For example, if goals and objectives included:

- a. Provide all residents with ice cream
- b. Provide all residents with cheese

But there wasn't enough milk to make both, the Stakeholders would develop one alternative that favored ice cream, and another that favored cheese.

2. Range of costs or resource needs
 - a. Provide all stakeholders with a shiny new car.

The alternative might range from “the Camry alternative” to “the Lexus alternative”

3. Distribution of costs and benefits.
 - a. Prepare one alternative that emphasized benefits, on that emphasized costs
4. Implementation approaches
 - a. Prepare alternatives based on how and where implementation might occur

To be effective, alternatives need to be tied to the plan's objectives. Listed below are the objectives developed by the Stakeholder Committee, and tied directly to the Mission Statement:

4.3 MISSION STATEMENT

Produce and implement a Sauk River Comprehensive Management Plan that balances the need for infrastructure and property protection with the protection and restoration of natural resources and outstanding and remarkable values of the Sauk River; that is acceptable to affected

landowners, resource agencies, local tribes, interest groups, and local governments; and is consistent with plan elements required by the State of Washington.

Supporting the mission are the objectives used to prepare the Action Alternatives (Tables 4-1 through 4-6):

- A. Collect data and create a database to be used in analysis, both in the current planning effort and in future follow-up activity, that will contribute to a better understanding of natural river processes and the full range of their effects.
- B. Describe a range of potential actions to protect property and infrastructure; evaluate their effects on fish and wildlife habitat, as well as their ability to successfully protect property, infrastructure and their land uses.
- C. Describe a range of potential actions to protect, restore or enhance fish and wildlife habitat; evaluate their effects on property, infrastructure and other land uses, as well as their ability to successfully protect, restore or enhance fish and wildlife habitat.
- D. Develop appropriate management strategies on a reach by reach basis including:
 - The areas and conditions in the corridor that justify high consideration for flood and bank protection.
 - The areas and conditions in the corridor that justify high consideration for habitat protection and restoration.
- E. Describe the regulatory environment in the Sauk River Corridor, including:
 1. The statutory authority of state, local, tribal, and federal agencies; and the required permits, pathways and timelines, particularly during locally declared emergencies.
 2. Include recommendations for regulatory improvements.
- F. Provide information on the range of assistance programs available for areas impacted by flood and channel migration,
 1. Identify program, access and funding gaps in these programs; and
 2. Develop recommendations to fill these gaps.
- G. Develop an understandable outreach and public education program for the Sauk River Management Plan.

4.4 CRITERIA FOR EVALUATION

In order to prepare a “mitigation toolbox,” criteria were developed to evaluate the appropriateness of typical tools used in river hazard mitigation plans. The criteria developed by the Stakeholder Committee were:

- Appropriate for Sauk system
- Reduces risk of injury or death for residents
- Reduces risk of residential property damage
- Reduces risk of commercial property damage
- Reduces risk of public infrastructure damage
- Maintains or restores natural river processes that create/maintain habitat features
- Makes property owners “whole” (meaning to meet the varied needs of Sauk property owners)*
- Maintains or enhances aesthetic and recreational values of river
- Clarifies, simplifies and streamlines permitting process
- Reduces risk of habitat damage
- Likelihood of success of a particular tool or technique
- Cost efficiency
- Is it a long-term solution?
- Does it prevent activity that will lead to more future problems?

* Note that this has different implications for residential, agricultural, and timber landowners.

Using these criteria, working groups evaluated the available tools, and also added additional tools that they thought might be more appropriate for the conditions on the Sauk. The starting set of tools included:

4.4.1 Prevention

Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built.

- Comprehensive planning and zoning
- Open space preservation

- Building code development and enforcement
- Transfer of development rights

4.4.2 Property Protection

Actions that involve the modification of existing buildings or structures to protect them from a hazard.

- Maintaining Flood Insurance Policy
- Relocation
- Acquisition
- Retrofitting

4.4.3 Public Education and Awareness

Actions to inform and educate citizens, property owners and elected officials, about the flood and erosion hazards inherent in the Sauk River system and potential ways to mitigate them.

- County and State Departments of Emergency Management
- Public education and outreach programs
- Real estate disclosure
- Flood maps and data
- Library resources
- Outreach projects
- Technical assistance
- Real estate disclosure information
- Environmental education programs

4.4.4 Natural Resource Protection

Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.

- Wetlands protection
- Maintenance of riparian corridors
- Best management practices

- Erosion and sediment control

4.4.5 Emergency Services

Actions that protect people and property during or immediately after a disaster or hazard event. Services include warning systems, emergency response services and protection of critical facilities.

- Critical facilities protection
- Emergency response services
- Hazard threat recognition
- Hazard warning systems (community sirens, NOAA weather radio, websites)
- Health and Safety Maintenance
- Post disaster mitigation, cleanup assistance

4.4.6 Structural Projects

Actions that involve the construction of structures to reduce the impact of a hazard.

- Bank stabilization

4.5 THE MATRIX

The Stakeholder's evaluation was documented in a matrix, with the tools being evaluated for their effectiveness in meeting the criteria developed earlier. The evaluation of the tool was qualitative, and included a range of:

“--” Has a strong negative outcome for the criteria

“-” Has a negative outcome for the criteria

“0” Has no impact for the criteria

“+” Has a positive outcome for the criteria

“++” Has a strong positive outcome for the criteria

Tables 4-1 through 4-6 were developed to rate the tools, and are included below:

Table 4-1. Structural Projects Mitigation Toolbox: Actions that involve the construction of structures to reduce the impact of a hazard.

	Appropriate for Sauk System	Reduces risk of injury or death for residents	Reduces risk of residential property damage	Reduces risk of commercial property damage	Reduces risk of public infrastructure damage	Maintains or restores river processes that create/maintain habitat features	Makes owners whole	Maintains or enhances aesthetic & recreational values of river	Clarifies /simplifies/ streamlines permitting process	Reduces risk of habitat damage	Likelihood of success	Cost efficiency	Long – term solution	Prevents similar problems in the future
Rock	-	+	+	+	+	--	O	--	--	-	O	O	-	-
Bypass	+	+	+	+	+	O	+	O	-	O	-	O	O	O
Bio Engineering	++	+	+	+	+	O	+	O	++	O	++	+	+	+

	VOLATILE	SIGNIFICANT	HIGH
Rock	--	--	-
Bypass	O	O	O
Bio Engineering	O	+	++

Key:

- Has a strong negative outcome for the criteria
- Has a negative outcome for the criteria
- O Has no impact for the criteria
- + Has a positive outcome for the criteria
- ++ Has a strong positive outcome for the criteria

Table 4-2. Natural Resources Protection and Enhancement: Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems.

	Appropriate for Sauk System	Reduces risk of injury or death for residents	Reduces risk of residential property damage	Reduces risk of commercial property damage	Reduces risk of public infrastructure damage	Maintains or restores river processes that create/maintain habitat features	Makes owners whole	Maintains or enhances aesthetic & recreational values of river	Clarifies /simplifies/ streamlines permitting process	Reduces risk of habitat damage	Likelihood of success	Cost efficiency	Long – term solution	Prevents similar problems in the future
Off channel habitat protection	++	++	++	++	++	++	O	O	O	++	N/A	N/A	N/A	N/A
Hardened bank stabilization	O	--	--	--	--	--	+	O	--	--	N/A	N/A	N/A	N/A
Bioengineered banks stabilization	+	+	+	+	+	+	+	+	+	+	N/A	N/A	N/A	N/A
Large woody debris	+	+	+	+	+	+	+	O	+	O	N/A	N/A	N/A	N/A
Floodplain roughing	+	+	+	+	+	+	+	+	+	O	N/A	N/A	N/A	N/A

	VOLATILE	SIGNIFICANT	HIGH
Off channel habitat protection	++	+	+
Hardened bank stabilization	--	-	-
Bioengineered banks stabilization	O O	O	O
Large woody debris	O	O	+
Floodplain roughening	O	O	+

Key:

- Has a strong negative outcome for the criteria
- Has a negative outcome for the criteria
- O Has no impact for the criteria
- +
- ++ Has a strong positive outcome for the criteria

Table 4-3. Emergency Services: Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.

	Appropriate for Sauk System	Reduces risk of injury or death for residents	Reduces risk of residential property damage	Reduces risk of commercial property damage	Reduces risk of public infrastructure damage	Maintains or restores river processes that create/maintain habitat features	Makes owners whole	Maintains or enhances aesthetic & recreational values of river	Clarifies /simplifies/ streamlines permitting process	Reduces risk of habitat damage	Likelihood of success	Cost efficiency	Long – term solution	Prevents similar problems in the future
Critical facility protection	Y	+	?	++	++	++	O	O	O	++	N/A	N/A	N/A	N/A
Emergency response services	Y	+	?	--	--	--	+	O	--	--	N/A	N/A	N/A	N/A
Hazard threat recognition	Y	+	O++	+	+	+	+	+	+	+	N/A	N/A	N/A	N/A
Hazard warning system	Y	+	+	+	+	+	+	O	+	O	N/A	N/A	N/A	N/A
Health & safety maintenance	Y	+												
Post disaster mitigation	Y	+	+	+	+	+	+	+	O	+	+	+	+	+

Note: Emergency services were clearly an appropriate part of the mitigation package, but the group working on this section felt that the tools needed more specificity to really evaluate whether they would work for the Sauk and adjacent landowners.

	VOLATILE	SIGNIFICANT	HIGH
Critical facility protection	++	+	+
Emergency response services	++	+	+
Hazard threat recognition	O	O	O
Hazard warning system	++	++	++
Health & safety maintenance	O	O	O
Post disaster mitigation	+	+	+

Key:
-- Has a strong negative outcome for the criteria
- Has a negative outcome for the criteria
O Has no impact for the criteria
+ Has a positive outcome for the criteria
++ Has a strong positive outcome for the criteria

Table 4-4. Prevention: Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built.

	Appropriate for Sauk System	Reduces risk of injury or death for residents	Reduces risk of residential property damage	Reduces risk of commercial property damage	Reduces risk of public infrastructure damage	Maintains or restores river processes that create/maintain habitat features	Makes owners whole	Maintains or enhances aesthetic & recreational values of river	Clarifies /simplifies/ streamlines permitting process	Reduces risk of habitat damage	Likelihood of success	Cost efficiency	Long – term solution	Prevents similar problems in the future
Planning & Zoning	+	+	+	+	+	+	+	+	+		+	O	+	++
Open space preservation	++	+	+	+	+	++	+	++	+		O	+	+	+
Building code development & enforcement	+													
*Transfer of development rights	++	++	++	++	++	++	++	++	++		++	++	++	++
Shoreline/ Environmental Review	++	O	O	O	O	++	O	++	+		O	O	O	+
*Easement purchase	++	++	++	++	++	++	++	++	++		++	++	++	++

	VOLATILE	SIGNIFICANT	HIGH
Planning and zoning	++	+	+
Open space preservation	++	++	++
Building code development & enforcement	++	++	++
Transfer of development rights	++	+	+
Shoreline/Environmental Review	++	++	+
Easement Purchase	++	++	++

Key:

- Has a strong negative outcome for the criteria
- Has a negative outcome for the criteria
- O Has no impact for the criteria
- + Has a positive outcome for the criteria
- ++ Has a strong positive outcome for the criteria

Table 4-5. Public Education and Awareness: Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

	Appropriate for Sauk System	Reduces risk of injury or death for residents	Reduces risk of residential property damage	Reduces risk of commercial property damage	Reduces risk of public infrastructure damage	Maintains or restores river processes that create/maintain habitat features	Makes owners whole	Maintains or enhances aesthetic & recreational values of river	Clarifies /simplifies/streamlines permitting process	Reduces risk of habitat damage	Likelihood of success	Cost efficiency	Long – term solution	Prevents similar problems in the future
Flood maps & data	++	+	+	+	O	+	O	+	O	+	+	+	+	++
Environmental education (students)	++	+	+	+	O	+	O	+	O	+	+	+	+	+
Real estate disclosure	++	O	++	O	O	O	O	O	O	O	+	O	+	+
Hazard information centers (website, library, Forest Service)	++	+	+	+	O	+	O	+	O	+	+	+	+	+
Tech. assistance/ Permitting & Design	++	+	++	O	O	++	O	+	++	+	++	+	+	++
Public education & outreach program	++	+	+	+	O	+	O	+	O	+	+	+	+	+

	VOLATILE	SIGNIFICANT	HIGH
Flood maps & data	++	++	++
Environmental education (students)	O	O	O
Real estate disclosure	++	++	+
Hazard information centers	+	+	+
Tech. assistance/ Permitting & Design	++	++	++
Public education & outreach program	+	+	+

Key:

- Has a strong negative outcome for the criteria
- Has a negative outcome for the criteria
- O Has no impact for the criteria
- +
- ++ Has a positive outcome for the criteria
- ++ Has a strong positive outcome for the criteria

Table 4-6. Property Protection: Actions that involve the modification of existing buildings or structures to protect them from a hazard or removal from the hazard area.

	Appropriate for Sauk System	Reduces risk of injury or death for residents	Reduces risk of residential property damage	Reduces risk of commercial property damage	Reduces risk of public infrastructure damage	Maintains or restores river processes that create/maintain habitat features	Makes owners whole	Maintains or enhances aesthetic & recreational values of river	Clarifies /simplifies/ streamlines permitting process	Reduces risk of habitat damage	Likelihood of success	Cost efficiency	Long – term solution	Prevents similar problems in the future
Relocation	+	O	+	+	++	+	+	O	N/A	+	+	?	O+	N/A
Acquisition	Agree to disagree													
Retrofitting	--													
Flood Insurance	--													
Land swap	+	O	++	++	+	++	+	+	N/A	++	++	?	++	N/A
Depends on specific proposals It depends on risk rating														

	VOLATILE	SIGNIFICANT	HIGH
Relocation	O	++	++
Acquisition	++	++	++
Retrofitting	O	O	O
Flood Insurance	++	+	+
Land swap	++	++	++

Key:

- Has a strong negative outcome for the criteria
- Has a negative outcome for the criteria
- O Has no impact for the criteria
- +
- ++ Has a positive outcome for the criteria

4.6 FINAL ALTERNATIVES DEVELOPMENT WORKSHOP

Following the initial “tool box” workshop, March, 2008, the final two alternatives development workshops for the Sauk river Erosion/Flood Hazard Stakeholder committee were held in June and July, 2008. Originally scheduled as a single workshop, the alternatives development section of the committee’s work was broken into two workshops to better accommodate participants’ schedules and allow some work to be completed between workshops.

During Workshop 1, the committee had developed an Erosion/Flood Hazard Mitigation Toolbox, (Tables 4-1 through 4-6), as a framework to evaluate the expected effectiveness of typical mitigations strategies.

During the final two workshops committee participants applied the toolbox of potential hazard reduction activities developed in Workshop 1 to real segments of the river. Some of the questions explored were:

1. How does the relative risk rating of the river segment affect the potential tools for hazard mitigation?
2. Does adjacent land use interact with the relative dynamism of a river segment to affect the potential success of the tools for hazard mitigation?
3. Would modification of river functions—for example bank stabilization or bar management—be considered as a tool for maintaining or enhancing river habitat function in anything other than a mitigation situation?

Workshop 2 began with an overview of the alternative development process, and then introduced an exercise to begin applying the toolbox of tools that the group worked on earlier.

Based on the outcomes of Workshop 1, the tools that the group believed made sense for the Sauk included a smaller group of options than the original list. Each working group generally agreed that the majority of tools in the original list were focused on reducing flood hazards, rather than erosion hazards. While flooding is an issue for many parts of the Sauk, it is less difficult to manage than the erosion hazard.

The following revised lists include the top scoring tools, and a summary of the discussion that supported the selection of tools that remained on the list:

4.6.1 Prevention

Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built.

- Comprehensive planning and zoning
- Open space preservation
- Building code development and enforcement
- Transfer of development rights

The group working on this set of tools had the general sense that the existing regulatory framework was adequate, but that enforcement was not always consistent or effective. Permit streamlining was also suggested as a way to assist property owners through the overlapping and complex regulatory environment surrounding building structures adjacent to the river or making modifications to the riverbank.

4.6.2 Property Protection

Actions that involve the modification of existing buildings or structures to protect them from a hazard or removal from the hazard area to eliminate future damage.

- Maintenance of Flood Insurance
- Relocation
- Acquisition
- Retrofitting

The group working on this section did not feel that the range of tools available for property protection provided many good options to manage the specific concerns for properties adjacent to the Sauk. Relocation has been used in some locations with success, however it is expensive and depending on the available property may not be a long-term solution. Acquisition is a tool that has also been used in the Sauk, but there was a concern about how much acquisition would be required to be an effective solution to issues along the Sauk, given how many properties could be influenced by erosion and river movement. Retrofitting and flood insurance are important components of a program to manage flood damage, but are not as effective for managing erosion risk.

4.6.3 Public Education and Awareness

Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

- Hazard information centers
- Public education and outreach programs
- Flood maps and data
- Library resources
- Outreach projects
- Technical assistance
- Real estate disclosure information
- Environmental education programs (focused on schools)

The group working on this section generally felt that public awareness programs were important. To be effective there needs to be a way to get the attention of newcomers and effectively keep up communication with long-term residents. The group suggested adding a disclosure to title documents to ensure that prospective purchasers and lenders understood the implications of purchasing property near the Sauk. While there are existing disclosure requirements for real estate agents, the group had the sense that they are often not followed. A question related to title disclosures wondered what would be used as the boundary to delineate a risk zone related to the disclosure requirements? The conversation also recognized that a line separating properties at risk from those that aren't may also need to be established for other hazard management activities –for example TDR program eligibility areas or buyout eligibility areas.

4.6.4 Natural Resource Protection

Actions that minimizes flood hazard losses, and preserve or restore the functions of natural systems.

- Off-channel habitat protection
- Bioengineered bank stabilization
- Large woody debris placement
- Floodplain roughening

The group working on this section believed that most of the natural resource options included in the original toolkit were focused on flood control, and would not have much value for erosion

hazard management in the Sauk system. Tools that might be appropriate for the Sauk included; the protection of off-channel rearing habitat; minimal-impact bank stabilization projects where necessary, to protect adjacent properties; selective use of large woody debris—possibly including management of jams that form from the wood currently in the system—and floodplain roughening to reduce velocity in erosion-prone areas.

Broader discussion on this topic with the whole group addressed the question of whether it would be appropriate to modify the river—for example to harden a bank—to protect existing high quality off-channel habitat. Generally the group consensus was that this strategy would not be a recommended approach.

4.6.5 Emergency Services

Actions that protect people and property during the immediately after a disaster or flood hazard event. Services include warning systems, emergency response services, and protection of critical facilities.

- Critical facilities protection
- Emergency response services
- Flood Hazard threat recognition
- Flood Hazard warning systems (community sirens, NOAA weather radio)
- Health and safety maintenance
- Post disaster mitigation

The group working on this section generally felt that emergency services were important, but that the specifics of an emergency services component (for example what tools were appropriate for the Sauk, where things should be located, etc.) needed to be developed by emergency services providers and documented in a separate emergency services plan. Recommended that the hazard risk management plan call for the development of an emergency services plan, but that it not go into too much detail about the content.

4.6.6 Structural Projects

Actions that involve the construction of structures to reduce the impact of a hazard.

- Bioengineering
- Channel bypass

The group working on this section focused on channel modifications that could be appropriate for mitigating erosion hazards, primarily bank stabilization. Bioengineered solutions were considered the most appropriate technology for bank hardening because of their relative effectiveness, durability, improved habitat performance when compared with other bank hardening approaches, and the likelihood to be preferred in the permitting process. Channel bypasses were also considered possible solutions, although they are a very expensive and technically challenging approach.

The major workshop activity for the evening was an exercise to apply the toolbox developed in Workshop 1 to each segment of the river, taking into consideration the hazard risk rating and any unique characteristics of the river in that segment. As preparation for the exercise, the group was asked to discuss four questions intended to clarify some of the major issues that could help with structuring alternatives.

These questions included:

- What would an alternative that focused on maintaining natural river processes look like?
- What would an alternative that focused on meeting the needs of a varied group of property owners look like? (making property owners whole?)
- What would a regulatory streamlining approach to meeting the plan's mission and objectives look like?
- What would a non-regulatory approach to meeting the plan's mission and objectives look like?

The group generally felt that the first two questions made sense for discussion at the workshop—primarily because they could be applied to different segments of the river to begin putting alternatives together—and that the last two questions should be deferred as a separate discussion on implementation.

Following this discussion, the large group was divided into four working groups. Two groups were generally focused on actions that maintained natural river processes, and two focused on actions that focused on making property owners whole. Discussions within the various groups took different directions depending on participants, however all groups generally discussed both emphasis areas as they looked at different river segments.

Group discussion on making property owners whole generally included a broad range of tools in their analysis, from relocation and acquisition to active river and bank management. The

discussion didn't reveal many differences in which tools would be appropriate to apply in different risk settings.

In general, stakeholders agreed that modifications to the river would not likely be appropriate except in a mitigation context. While off-channel habitat and instream features were important, they were also considered transitory elements in the overall river landscape that would likely be replaced in other locations as long as river processes were allowed to function. The believed that modifications to the system to protect habitat features could potentially do more harm than good. Few locations were identified as especially important for maintaining river function over other areas.

Discussion focusing on making owners whole emphasized maintaining flexibility for individual owners, and that the full range of tools should be available for adjacent properties. There was more emphasis on instream river modification in this exercise than in the previous exercise to build the toolbox. Bank hardening was listed as an appropriate in many locations.

There was also extensive discussion of log jam management as a potential activity for reducing flood and erosion hazard. Log jams were considered impediment to river flow, especially during flood events, it was felt that they can raise the velocity of flow along the banks, redirect fast flows towards the banks, or both, resulting in increased erosion risk. Logjam management was used for many years as one of the strategies for reducing the risk of bank erosion or avulsion. There was some disagreement over the effectiveness of this tool for reducing the risk of negative outcomes for adjacent properties, yet there was also some interest in identifying if logjam management might be an effective tool in some situations. Because logjam management does not require hardening the bank or other major structural modifications to the river system, it was perceived as a less invasive form of manipulation of the river system than adding rock or bioengineering banks. The group agreed that demonstrating the effectiveness of logjam management would likely require testing in a regional modeling facility; which would require both time and funding.

Workshop 3 was intended to build on the exercise from Workshop 2 and provide more detailed guidance for the development of alternatives. In Workshop, 2 the groups had looked at mitigation tools along the different segments of the river from the perspective of the risk classification of the river segment. From the group's general conversation, there was an expectation that different management approaches would be appropriate in different segments of the river. The results of that exercise provided good guidance on the range of appropriate tools that might be applicable to managing risks along the entire river, however, it didn't provide the expected distinctions between the tools that might be used in one location rather than another.

To get more feedback on the possible distinctions that could be made between different river segments, the adjacent land uses, and the tools that might be appropriate for each one, workshops began with a discussion of tools that might be appropriate to limit risks for different land uses, and followed with a discussion of the potential application of those tools in selected river segments.

To begin the second discussion, the facilitator presented a draft set of land use categories as a framework for discussing risk management tools. The intent of the categories was to identify whether different tools would be appropriate for managing risk for the different land uses. Following a discussion based on land uses, the plan for the workshop was to test some of the guidelines developed for each land use by applying them to some of the more complex areas of the river.

The land use categories included:

- Public resource lands (primarily timber and mitigation)
- Public infrastructure (primarily roads, in this case SR 530, county bridge)
- Sauk Suiattle Tribal land
- Private timberlands
- Non-timber agricultural lands
- Private commercial/industrial land
- Residential land
- Secondary residences/vacation properties

Prior to this exercise, there was significant disagreement about whether this approach would be effective. Some members of the group didn't see value in distinguishing between land uses. Others suggested that the interaction of land uses and river dynamics depended enough on local conditions that it would be difficult to generalize for each type of use.

It was also discussed that there is often a difference between zoning or ownership and actual use.

For example:

- The Forest Service maintains offices and shops in parts of its property,
- Some residential development is allowed on land zoned for private timber,
- Agricultural lands often include primary residences.

These were recognized as valid concerns, and the group generally agreed that for the purposes of the plan the actual use, rather than the ownership or land use category, would be more appropriate to address. For example, if there was a difference in the preferred risk management tools for timberland and residential, but there was a residence in the risk area on land zoned for timber, then the residence would be treated as a residential property.

Significant discussion focused on the role of the flood/erosion hazard management plan in relation to regulatory structures currently in place. There was recognition that the plan was not regulatory, and did not have the ability to change any current regulatory programs. The plan is only advisory in nature. However, there was also recognition that many of the current regulatory review agencies, either in their capacity as implementers of specific regulatory programs or through the more general activity of SEPA/NEPA review of permit applications, have significant discretionary authority. There was concern/recognition that this plan would influence the discretionary actions of permit reviewers. Several agency representatives indicated that this was likely true, but also noted that there were many areas where the regulations did not provide flexibility for agency discretion.

The process discussion moved back and forth between several possible workshop activities. Eventually, the group agreed that it would be worthwhile to take a look at some segments of the river in detail as a way to evaluate the validity of using a combination of land use and river volatility to determine which tools would be most appropriate. Rather than breaking up into small groups, the whole group participated in the exercise.

Based on specific segments of the river, the group discussed generalized land use categories and the different tools that should be emphasized to reduce the risk of erosion and flood hazard.

4.7 PUBLIC RESOURCE LANDS

Key Question

- Are any risk reduction tools appropriate for public resource lands?

The group discussed whether public and private timberlands should be considered differently or in the same category. There was also recognition that management direction is likely different for public forestland owned by the state and federal governments. WA Dept. of Natural Resources might feel a stronger mandate for revenue generation than the US Forest Service for timberland in the Sauk corridor. Overall, however, there was consensus that the public benefit of maintaining river dynamics was likely higher than the value of merchantable timber that would be lost to river movement.

4.8 PRIVATE TIMBERLANDS

Key Questions

- Do you think differently about private timberlands than public?
- What tools make sense to reduce risk or make owners whole?
- Are different tools appropriate in relation to different risk area for river segments?
- What is an appropriate range of options?
- For example, is any action appropriate?
- Are different tools appropriate for timberlands as compared to residential properties, or are all private lands appropriate for the same tools?
- Are land swaps for other timberlands a preferred tool?
- Would the group support actions that modify natural river processes to protect private timberlands?

(Note: this category focuses on undeveloped timberlands. Timberlands with developed facilities, e.g., buildings, work yards, or other capital facilities, would be managed like other similar types of development.)

In general, structural river modifications were not recommended to protect timberlands, although a range of other risk reduction strategies were considered appropriate. The group discussed the potential downstream impacts of allowing natural river processes on public timberlands, and noted that in some cases, protection of other more developed properties may require structural modification of the river bank on forestlands.

Some structural solutions may be appropriate to consider in areas where the hazard rating was lower (in yellow, rather than red risk segments.) Structural solutions were more likely to be considered appropriate where river processes made them more likely to be sustainable, and where there were smaller ownerships, so that the loss of timber to the river represented a more significant proportion of the entire value of the property.

One category of preventive action was to recommend against conversion of timberlands at risk of erosion damage into residential properties. No upzoning from resource lands designation was considered appropriate. Some residential development is currently allowed under resource lands designation, and these property rights should be considered eligible for sale if a transfer of development rights (TDR) program were implemented for the region.

Private timberlands should be included in programs require real estate disclosure of hazard risks, and title notices if they are implemented as a risk management strategy.

Acquisition of timber lands, land swaps, or purchase of easements might also be appropriate tools either for reducing future risk, providing an incentive against structural modifications to the river, or making timber owners whole.

Other strategies that might be appropriate for making timber owners whole include current use taxation or other tax programs that recognize limitations on development. A riparian lands taxation program was discussed as a model. Group participants unsure if the program was still active, if it was only a pilot program, or if there were mechanisms to maintain the program/extend to the Sauk.

Education programs should be developed for private timber owners to provide information on any risk management programs that are implemented, as well as tax implications of current or proposed programs and funding options available.

4.9 COMMERCIAL/INDUSTRIAL PROPERTIES

Key Questions

- First, are we really just talking about the mill?
- It's hard to imagine that one alternative for the mill site isn't "do whatever you need to do to the river to maintain the mill property." Is that true?
- Are there other alternatives?

The mill is the only commercial industrial property in the study area, and there was general agreement that relocating out of the hazard area could be impractical. In general, hardening of the river bank to protect the mill and associated facilities from erosion hazard was supported by the group.

4.10 AGRICULTURAL LANDS

Key Questions

- Are other agricultural lands similar to timberlands?
- Would different tools be appropriate to reduce risk?
- Are agricultural lands along the river more closely tied to residential uses (i.e., do agricultural owners also live on the agricultural property?)

- Can we separate agricultural lands issues from residential, or are they too closely tied together?

Agricultural lands were considered similar to timberlands in some ways, but also had enough differences that some unique management strategies and tools were more appropriate. While most of the recommendations were expected to be similar to timberlands, the group noted several differences that should be reflected in the hazard management plan.

Agricultural lands are often treated differently than timberlands in terms of their access to support programs and policies. Public education needs to be developed specifically for agricultural land owners to reflect possible differences in access to funding or other programs.

Characteristics of agricultural lands that made them different from timberlands included a possible higher value as a cultural landscape than timberlands, different emergency response requirements (generally due to the higher likelihood of people being on the agricultural lands during a flood event, and the need to deal with livestock in a flood event), and the likelihood that agricultural lands have had more investment for improvement than timber lands have. Group members noted that several agricultural properties along the river have been managed to provide habitat benefits for salmon, and that those habitat improvements should be considered when agricultural recommendations are developed.

Because of these differences, some members of the group suggested that agricultural lands may be more appropriate for protection from erosion than timberlands, however there was not consensus on this issue. There was general consensus that agricultural lands should be eligible for all acquisition, swap, TDR, and other programs that might be appropriate for timber.

4.11 PUBLIC INFRASTRUCTURE

Most public infrastructure in the erosion risk hazard area are roads, including state highways. The group generally supported recommending relocation of existing critical roadways as a sustainable strategy for maintaining access and reducing the cost of successive emergency repairs. In the short term, bank protection should be developed proactively rather than in reaction to an emergency. Emergency repairs are developed in a crisis atmosphere and are often not able to be appropriately engineered or implemented.

Pre-disaster mitigation funding may be available and should be pursued. As part of disaster preparedness all evacuation routes and critical infrastructure should be identified, and evacuation routes should be signed.

Future development of infrastructure should avoid erosion hazard areas.

The group specifically recommended relocation of SR 530—the only way out of the region (westbound) in a flood emergency.

4.12 RESIDENTIAL PROPERTIES

Key Questions

- Is there a difference between primary and secondary homes?
- Is there a difference between residential properties in different risk categories along the river?
- Is river modification an appropriate tool for protecting residential properties? In all cases or some cases?
- Should an alternative be included that does not recommend river modification as a preferred tool?
- *Are there appropriate mechanisms to encourage the use of bioengineering over placement of rip-rip? Should a choice between those two approaches be left to the homeowner with no assistance, regulatory preference, or other emphasis between the two approaches?*

The discussion began with a question whether all residential properties should be treated alike, or whether there should be a distinction between primary and secondary residences. It was noted that residential properties are categorized by FEMA, and the flood hazard mitigation plan should probably be consistent with FEMA designations if it makes any distinctions between types of residential properties.

There was a strong emphasis on public education as a tool for risk management with residential properties, especially to provide information to prospective purchasers and new homeowners. Realtors should be targeted for educational campaigns, as well as the insurance industry. Real estate disclosures and title notices should be required for properties within the hazard area.

No upzoning should be allowed within the hazard zone, and downzoning should be considered.

Emergency response is most critical for residential properties, and a detailed emergency response plan should be developed with residential properties as the focus.

- The group generally felt that residential properties were more appropriate than others to recommend structural bank modifications for property protection. In their review of the effectiveness of potential tools, bioengineering was preferred over traditional use of rip rap.

There was some discussion of the interaction of risk zones with residential properties, however there was no general consensus about how they should affect management recommendations. This may be an area where alternatives are developed to reflect and discuss differing approaches. There was some support for the idea that relative risk designations could be used as a criteria for guiding public funding for mitigation, particularly for bank stabilization. In the case of bank stabilization public funding would presumably focus on areas where stabilization seemed most sustainable. However, there was also discussion that the relative risk designation should not be considered for publicly funded projects. On the other hand, there was some emphasis that risk designations should not be considered during regulatory review of private bank protection projects.

4.13 GENERAL DISCUSSION ISSUES

During the discussion several issues were raised to provide guidance for the development of the draft hazard mitigation plan:

- The boundaries of a designated hazard zone will be an issue as the planning process develops.
- Some programs, such as title notification, will need clear boundaries to determine which properties are in and which are out. Other aspects of the hazard management plan may not require such clear lines, and should recognize a broader area. It may be appropriate to recognize a core area, then surround it with a buffer zone. The core area would likely require the formal delineation of a channel migration zone. Public education and other more regional actions should extend beyond boundaries of a hazard zone.
- There are not that many key areas in the project area, and they should be studied more carefully for specific recommendations as part of the alternative development process.
- Permit streamlining was discussed in some detail, with the general sense of the group that the scope of streamlining needed to be clarified and that further work by a subcommittee might be appropriate. Some of the general issues discussed included:
- Streamlining can mean different things. Generally the goal of streamlining would be to simplify and shorten the permitting time line for hazard mitigation activities. This would also likely reduce the cost of permitting.
- The hazard mitigation plan does not have any direct regulatory effect, and doesn't change the underlying regulations and implementation guidance that agencies must follow during permit review.
- Two areas that recommendations from the hazard mitigation plan could assist with might be improved information for permit seekers (clearer "road map" type of information for working through the permit process), and better inter-agency coordination.

- A desired outcome of permitting would be that the hazard mitigation activities supported by the plan would be easier to complete. Hazard mitigation activities that were not consistent with the plan would not necessarily be easier to permit, but the plan would not change regulations in a way that would preclude approval of activities that were not preferred. As mentioned above, while the plan is not regulatory, it was recognized that activities that were not preferred by the plan might be disadvantaged in the permitting process where agencies have regulatory discretion within their respective permitting authority.
- There was a concern that permit streamlining could encourage inappropriate river modifications; for example, modifications that were excessively reliant on rock or that weren't expected to be sustainable because of the river dynamics.

At the close of the workshops, the matrices for each segment of the river, (Tables 4-1 -4-6), were discussed, and several “trial” matrices were developed as guidance. From there, staff completed the remainder of the 32 tables for each segment of the Phase 1 reach of the river. A segment is composed of similar risk categories, thus lumping risk into segments that related directly to the river. From the matrices, the “Users’ Guide” was developed (Chapter Six), that details the risk categories, inundation frequency, two year avulsion potential, general river slope, channel migration, and aggradation/scour potential for each segment, in effect, providing the background material for each risk category in the segment. For each individual segment, the number of the segment, reading from upstream to downstream, a short summary of problems and the risk factor, recommended actions and alternatives, and notes are provided, Figure One.

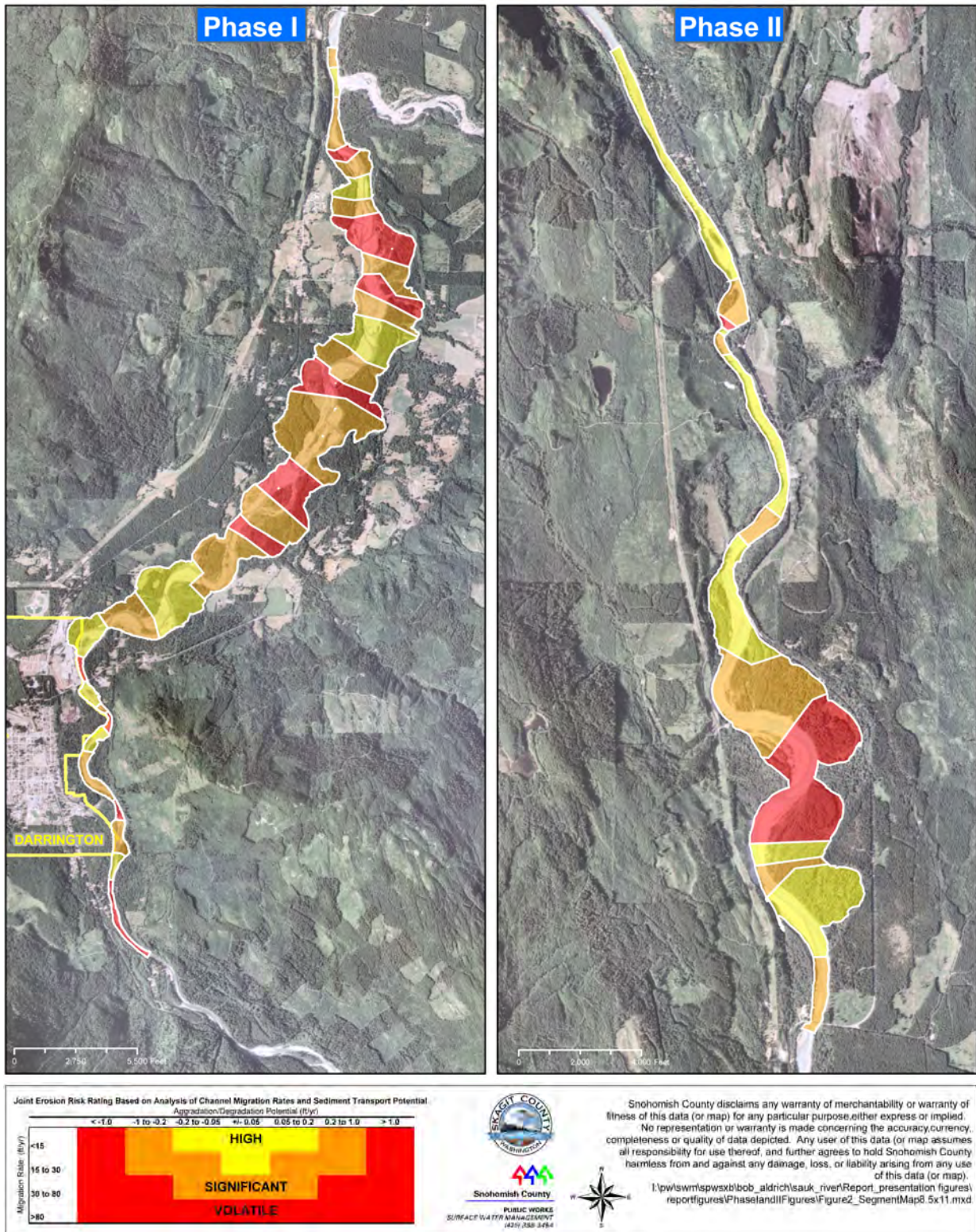
All segments, from 1 (Clear Creek segment) to 46 (approximately 1.5 miles from the Skagit river), are included in Appendix 2. The risk rating, Figure Two, appended, was derived from the Technical Analyses contained in Appendix 4. It is important to understand that the risk rating is based on sound science and engineering. The risk rating segments are compiled from the analysis segments contained in the technical reports, to avoid confusion, the explanations for the delineations in the analysis segments are discussed in the respective analyses. A more thorough discussion of the analysis work, as well as a detailed discussion of the risk segments, and the “Users Guide” for the Sauk river is presented in Chapter 6.

****Compiled with special thanks to Mr. Kurt Warber, Workshop Facilitator, Parametrix, Inc.**

Table 4-7. Example of Segment Information

REACH: CONFINED SOUTH			
Segment # (upstream to downstream)	Summary of Problem(s) – characterization & potential	Recommended Action(s) / Solution(s) - Alternatives	Notes (Impacts & Effects)
1	<ul style="list-style-type: none"> • Risk Factor: Volatile • Avulsion Potential: Low • Aggradation/Degradation: High • Inundation: Low • Channel movement/erosion: High 	<p>Structures</p> <ul style="list-style-type: none"> • buyouts (acquisitions) • relocation <p>Bank stabilization</p> <ul style="list-style-type: none"> • aggressive engineering (rock) • riparian easement <p>Infrastructure</p> <ul style="list-style-type: none"> • abandon roads (don't fix) • erosion-proof <p>No action</p>	<ul style="list-style-type: none"> • High energy system (reach) • Bioengineering not likely to be successful • Existing infrastructure and property damage • Homes and roads lost due to erosion

Figure 4.1. Joint Risk Analysis



5. RECOMMENDED ACTIONS

5.1 BASIN OVERVIEW

The Sauk River is an extremely dynamic, powerful river. Structural control methods are generally not feasible due to the large scale that would be required to moderate the effects of the river, and the associated high costs. This does not rule out some limited structural control methods at certain points along the river, both for flooding and erosion protection. However the “toolkit” available for such approaches becomes limited as a matter of pure economics. The primary reason a quantitative risk based-approach, was used for this report was to provide stakeholders and citizens the tools necessary to make decisions, on a reach by reach basis, regarding flooding and erosion protection, and to provide some of the options available to address those issues.

Within this chapter you’ll find recommendations for regulatory improvements, a discussion of public outreach and education, a summary of the recommended actions from Chapter 4, and a discussion of how to use the alternatives matrix. Several additional recommendations are presented, with a brief discussion of implementation.

5.1.1 Recommendations for Regulatory Improvements

An extensive discussion of regulatory programs and pathways was presented in Chapter 3 and Appendix 3. Although we find that the regulatory pathways are complex and overlapping, it pays to spend time with the various matrices, familiarizing oneself with the requirements of each regulatory level. It soon becomes apparent that there is a pathway through the maze, albeit complicated, and dependent on the type of action contemplated.

We do not offer nor recommend any specific changes in the current regulatory regime. Each agency has a unique role and must be dealt with on an individual basis, and within varying temporal time frames. There is no overarching law to change; nor is there one responsible agency, there are several that share responsibility for each and every action on the river.

Common to each agency with permitting authority in the Sauk River is the requirement for applicants to present factual evidence and data in support of proposed actions. This report provides the quantitative basis for most planned activities, thus represents a giant step toward solving flooding and erosion problems from a stakeholder perspective.

5.1.2 Public Education and Outreach Improvements

Given that the only public education and outreach regarding flooding and erosion problems has been the stakeholders meetings and preparation of this plan, improvements should be relatively straightforward.

Any impetus for continued public education and outreach will have to emanate from the Community, although the County will provide appropriate educational materials on flooding and erosion control in the basin.

5.2 EMERGENCY MANAGEMENT IMPROVEMENT RECOMMENDATIONS

Although floods can happen at any time, they are most common from November to February. In other basins, Snohomish County has developed a flood warning system to prepare and respond to flood events. The program is designed to warn residents and agencies of an impending flood so that they can make preparations before flooding occurs. The flood warning system involves river forecasting conducted by the National Weather Service (NWS) and local river monitoring conducted by Snohomish County Department of Public Works Surface Water Management Division (SWM).

When a flood occurs, a coordinated response effort involving multiple jurisdictions and agencies is carried out by the Snohomish County Department of Emergency Management (DEM) Emergency Operations Center (EOC). This is not the case with for Sauk River. At this time the two operable gages on the Sauk are not yet on the County's web page, nor are they linked to a flood warning system. The County has been strongly encouraged by the stakeholders group to make it a recommendation in the Plan that this linkage occur, and that the two gages be placed on the County website.

5.2.1 The Mechanics of Flood Warning

The NWS is the agency responsible for issuing warnings about potential floods. The information used to develop flood warnings is gathered from the United States Geological Survey (USGS) telemetric gage network and from regional weather conditions and patterns. The data is integrated into a hydrologic computer model at the NWS's River Forecast Center in Portland, Oregon. Rainfall reports, soil saturation information, snow depth information, and temperature readings may also be included as variables in the computer model. Depending on the results of the model and the severity of weather conditions, the NWS issues a *flood watch*, *flood warning*, or *flood statement*. The NWS also issues river forecasts, which may resemble warning statements or contain detailed stage information, such as the predicted time a river will crest.

As knowledge about weather patterns and conditions has improved, the probability of accurately predicting a flood has increased. Recent studies of El Nino and global atmospheric circulation

patterns have given weather researchers the ability to identify large-scale weather features that typically lead to flooding (e.g., rain-on-snow events as discussed earlier). Thus, early recognition of threatening weather patterns on a regional scale, combined with statistical data collected from river gages, provides a relatively long lead-time to prepare for a flood event.

Local conditions, however, vary greatly and may not always be included in the NWS's hydrologic models. As a result, Snohomish County conducts its own river monitoring before and during a flood event to supplement NWS's flood statements with information about local conditions that may affect flooding. This information is provided for background, as the County monitors the Stillaguamish, the Snohomish, and the Skykomish, and does not currently monitor the Sauk River, relying on the two USGS instead.

5.2.2 Data Collection

Two types of river gages are used to monitor rivers: automated and manual gages. Automated gages employ telemetric or radio transmissions to measure specific conditions in the river. Manual gages, or staff gages, are large wooden rulers, graduated in feet and tenths, which are observed manually for water level. Although staff gages are useful when multiple readings are reported from one site, automated gages are more efficient because they provide real time data that may be needed on a regular basis during a flood event.

The USGS gages include 12186000 on the North Fork of the Sauk and 12189500 on the mainstem at Sauk, are automated gages.

Automated gages are normally placed far enough upriver so that the time of the expected crest reaching downstream areas can be predicted. Unfortunately, this is somewhat problematic in the Sauk, as the North Fork gage does not record the Whitechuck River, and most of the inhabited portions of the Sauk lie between Darrington and the Suiattle River, making flood crest prediction difficult.

5.2.3 Who's Who in Flood Planning

Many activities are ongoing during a flood event. Public Works staff and Emergency Operations Center (EOC) volunteers are monitoring rivers, (save for the Sauk), checking NWS forecasts, and maintaining contact with the NWS meteorologist who is providing. River analysis charts and tides are plotted, while the DEM flood warning network is updated. Snohomish County's SWM and Road Maintenance Divisions are dispatching field crews to respond to requests for assistance received through phone banks. Field Command Posts (CPs) may be mobilized to allow agencies to handle situations in the field that require immediate attention. The representatives from the interagency team at the EOC are in contact with the CPs to further coordinate the flood fight.

The agencies participating in the interagency team have a specific role at the EOC. The following is a brief explanation of each agency's role, as described in DEM's Flood Operations Manual.

5.2.4 DEM/EOC

The DEM is responsible for establishing a centralized system for coordinating flood operations in Snohomish County. The director organizes and leads the EOC volunteers, and coordinates all inter-agency activities. The EOC volunteers are responsible for operations, analysis and planning of incoming river data, public information, communications, logistics and administration.

The DEM has a flood warning network that is continually updated. The flood warning network is part of a public information system that provides information to the public through news releases, local radio frequencies, or direct telephone contact.

5.2.5 Snohomish County Executive Office

The County Executive is the final decision making authority in a flood fight, and authorizes the Declaration of Emergency.

5.2.6 Snohomish County Department of Public Works

The County Engineer has been designated the Flood Coordinator for the unincorporated areas of the County, and is responsible for the overall direction and control of the flood fight operations for the County. The Flood Coordinator also is the contact with the County Executive and coordinates efforts with the director of the DEM.

The County Engineer prepares the Declaration of Emergency, which is reviewed and approved by the County Executive. The County Engineer has the authority to request and to direct assistance from the Corps, National Guard, other armed forces organizations, and/or public agencies. Phone banks to receive and respond to public requests for assistance for the duration of the flood are provided by the Road Maintenance and SWM Divisions of Public Works.

5.2.7 Snohomish County Sheriff's Department

The Sheriff's Department provides traffic management, assists with dissemination of warning and evacuation, coordinates search and rescue, provides security for evacuated areas, and assists with the collection of field intelligence.

5.2.8 Fire Districts/Emergency Medical Services

The fire districts provide emergency medical aid, assist with dissemination of warnings, evacuation, and suppression of fire. They also assist with the direction and control of any

sandbagging operations in incorporated areas and other areas not under supervision of the County Flood Engineer.

5.2.9 Snohomish County Chapter-Red Cross

The Red Cross provides human services assistance to flood victims (food, clothing, temporary shelter, recovery funds, etc.), meals for volunteers and other personnel involved in the flood fight, assesses the human services needs of the community, and coordinates local application of human services program.

5.2.10 U.S. Army Corps of Engineers

The Corps provides field intelligence, carries out federal flood fight operations, provides technical advice and support, and contracts for private sector equipment and resources. Once a river reaches flood stage, the Corps can authorize emergency funds to be used in the event of a dike breach or other unanticipated emergency.

5.3 WHO CAN I CONTACT FOR MORE INFORMATION?

Snohomish County's flood warning system involves cooperation and communication between many agencies. Because floods affect multiple jurisdictions, interagency coordination is essential for an efficient and effective flood fight. The EOC provides the location and framework for a coordinated response needed in unincorporated Snohomish County.

Table 5-1 provides a list of resources for residents who are impacted by flooding in Snohomish County. Please check the DEM for the most current information.

The USGS and the Northwest River Forecast Center (NWRFC) maintain two online sites. Stream flows and other flood information can be obtained from USGS site at www.usgs.com. Flood watches, warnings, and statements in addition to forecast information can be obtained from NWRFC at www.nwrfc.noaa.gov.

5.4 RECOMMENDED MITIGATION STRATEGY ALTERNATIVES BY SEGMENT

Reflecting the dynamic, unique and ever-changing nature of the Sauk River, we proposed recommendations for action by analysis segment, or those small parts of the reach consistent with the analyses detailed in Appendix 4. The information and analyses included in this report, will be helpful to stakeholders as they continue to coexist with the river. The matrices, combined with the Users' Guide and risk analysis, (Chapter 6), are a powerful decision-making tool, developed by the stakeholders for stakeholders and decision makers on all levels. Regulatory agencies will find the information useful as well.

Table 5-1. Flood Information Sources.

<i>Flood Information Sources</i>	<i>Phone Number or Radio Frequency</i>
Emergencies	Call 911
Flood Information	425-388-3653
NOAA Weather Radio	162.550 MHz
Broadcast Media	KIRO Radio 710 AM or 100.7 FM
Snohomish County Amateur Radio Service	Listen to 146.32/92 for instructions on the correct flood information channel
Citizens Band Radio	Listen to Channel 9 for instructions on the correct flood information channel
DEM non-emergencies; Road conditions and closures	425-423-7635
Surface Water Management Phone Bank-Requests for Assistance	425-388-6467
Road Maintenance Phone Bank	360-862-7500

5.4.1 How to use the Mitigation Strategy Alternatives

The Alternative Matrices are reproduced entirely in Appendix 2, and will only be referenced in this section. To aid in discussion, an excerpt from the Matrix is provided below for discussion, (Table 5-2).

With reference to Table 5-2 Mitigation Strategy Alternatives (Example), below, there is a wealth of information in the Table. The river is divided into Reaches and then subdivided into segments, starting at Clear Creek and moving downstream to just above the confluence with the Skagit River, (Figure 1). The segments are further subdivided into analysis segments, (Appendix 4), but for purposes of clarity, the segments are used to group similar characteristics. Overriding all the subdivisions is the actual cross-section work that was completed for the Hydraulic Model built for the effort, (HEC-RAS), and detailed in Appendix 4. Because of the detail involved, it is included in Appendix 4, and used to group cross sections for clarity. In the matrix, the reach is called out in the upper left hand corner. Entering the matrix, the segment #, (which is also used in the Users' Guide, (Chapter 6), is called out. Next is a summary of problems, essentially a characterization of the segment and potential issues. More detail can be found in Appendix 4 and the Users' Guide. The avulsion potential, aggradation/degradation, inundation, and channel movement are combined to form the Risk Factor. In the next column are the recommended actions, solutions, or alternatives that could be used in the segment. Actions are not confined

just to private property protection, but include public infrastructure and habitat enhancements. Finally, general notes are included.

Table 5-2. Mitigation Strategy Alternatives (Example)

REACH: CONFINED SOUTH			
Segment # (upstream to downstream)	Summary of Problem(s) – characterization & potential	Recommended Action(s) / Solution(s) - Alternatives	Notes (Impacts & Effects)
1	<ul style="list-style-type: none"> • Risk Factor: Volatile • Avulsion Potential: Low • Aggradation/Degradation: High • Inundation: Low • Channel movement/erosion: High 	<ul style="list-style-type: none"> Structures <ul style="list-style-type: none"> • buyouts (acquisitions) • relocation Bank stabilization <ul style="list-style-type: none"> • aggressive engineering (rock) • riparian easement Infrastructure <ul style="list-style-type: none"> • abandon roads (don't fix) • erosion-proof No action 	<ul style="list-style-type: none"> • High energy system (reach) • Bioengineering not likely to be successful • Existing infrastructure and property damage • Homes and roads lost due to erosion

5.5 CAVEATS

There are several important caveats that must be observed when using the matrices, and most importantly, any of the information contained in Appendix 2 and the User's Guide. Because the Sauk is a powerful, active river, the analyses contained in this report should be used in the context that they represent general conditions in a segment. To fully detail problems or prepare design recommendation at a finer resolution, the HEC-RAS model is available, as are all the GIS layers, cross-section, and calibration data. Because of the size of the files, it will be necessary to contact Snohomish or Skagit County Public Works, Surface Water Management, to obtain the information.

Due to the highly variable nature of the river, conditions generally change with each storm event, so it is imperative that users determine current field conditions in comparison to those observed, and modeled, at the time this report was prepared.

All infrastructure locations, property lines, etc, are approximate, due to scale and conversion differences in the various historical photographs used in the analyses. Cross-sections were measured using survey grade GPS equipment, so have been tied to survey monuments on State Highway 530.

5.6 OTHER RECOMMENDED ACTIONS

In addition to the recommendations contained in the Mitigation Strategy Alternatives matrix, several very important tasks should be discussed separately, in order to highlight their importance. These include channel migration zone delineation and technical assistance to landowners

5.6.1 Channel Migration Zone Delineation

A channel migration zone delineation, required for Shoreline Permits in Snohomish County, is a process detailed by WADNR, and adopted by statute by Snohomish County. The study is conducted in accordance with Section 2 of the Forest Practices Board Manual (Title 222 WAC), Standard Methods for Identifying Bankfull Channel Features and Channel Migration Zones, November, 2004, except that areas behind natural or manmade features which limit channel migration that allow fish passage are not included in the channel migration zone.

It was beyond the scope of this analysis to create full regulatory channel migration zone delineation, although many of the elements are inherent in this document. It has been recommended by the Stakeholders committee that the next step be taken; that funding be allocated to complete the necessary tasks for a complete regulatory Channel migration zone delineation for the study area.

5.6.2 Technical Assistance to Landowners

Without a doubt, technical assistance to landowners in the Sauk River should continue. This could be accomplished by continued cooperative efforts between Skagit and Snohomish counties, as well as outreach efforts by both counties. The technical memoranda, Alternatives Matrices and most importantly, Users' Guide, provides Stakeholders with a decision making tool. Once decisions have been made, they provide a "reality check" for designers, engineers and consultants involved in specific projects. In addition, Snohomish County currently operates a Cooperative Bank Stabilization program where landowners, where appropriate, are provided limited funding and designs for bank stabilization work, (emphasis and priority are accorded those projects using bioengineering).

The authors of this report are also available to provide assistance in the interpretation of the report, as well as assisting with technical expertise and obtaining specific datasets.

5.6.3 Purchase of Timber Rights

One recurring theme after floods in the Sauk River is the amount of large woody debris deposited throughout the channel migration zone. Generally speaking, most of the wood in the system was once owned by a river side property owner. This creates a great deal of friction in the community, and serves to hasten riverside harvests on private land. Many landowners see

these riverside forests as “retirement planning.” One could argue that harvest in the Riparian Management Zone, (RMZ) is strictly controlled by the Department of Natural Resources. This is true to a point. Harvest regulations include a buffer consistent with the RMZ and the Channel Migration Zone, (CMZ). Unfortunately, the Sauk has the capability to move well beyond a regulatory buffer in a single event, plucking acres of trees from the land. While log jams and woody debris in the landscape are without question the best thing for habitat, the entire geomorphic process is seen as a hardship by landowners, who then seek to protect remaining forests, indulging in expensive and often futile attempts to control the river.

Rather than engage in protracted expensive, and often futile riverbank protection efforts, we propose creation of a voluntary program where landowners are paid a one-time fee for the value of their riparian forest tracts. When they become “public property,” (as they do by falling in the river), it can be considered an even exchange. At this time, this is only a proposal, which agency would fund, administer, and engage in such a program is open to debate.

5.7 IMPLEMENTATION

Traditionally, a Comprehensive Flood Hazard Management Plan contains extensive lists of alternatives and recommendations. In the case of the Sauk Comprehensive Flood/Erosion Hazard Management Plan, alternatives are found in the Alternatives Matrix in Appendix 2, or as part of each segment in the Users’ Guide in Chapter 6.

The approach we have used provides a quantitative decision making tool, rather than a static list. This allows each landowner the opportunity to independently decide the direction they might choose in managing their river side property. Although many of the recommendations and alternatives contained in the matrix are similar, each segment should be approached as an analysis unit.

6. THE USERS' GUIDE

6.1 INTRODUCTION

Note: Please refer to the 11 X 17 companion document entitled “Sauk River Comprehensive Flood/Erosion Control Management Plan Users’ Guide”

The User’s guide for the plan is intended as a standalone document that combines the analyses detailed in Appendix 4. Essentially, the analyses are presented in pictorial form, allowing Stakeholders to locate their property, area of interest, or problem site, and understand the components that created the risk rating for their particular property.

To make the document more “user-friendly,” the grouped segments have been allowed two 11” X 17” facing pages. There are several pages of maps and graphs that precede the actual segment discussion. These are important as they provide context as well as an overall location in the watershed. The maps and graphs are:

Figure 1. Vicinity Map showing city boundaries, highways, and the river

This map details the extent of the Plan area, both upstream and downstream. In this map, and the others that follow, the river flows from South to North,

Figure 2. Segment Map overlaid on an aerial photograph of the entire river

This map details the numbered segments used throughout the Manual. To maintain consistency, the segments, (smaller segments with similar risk characteristics), are numbered starting at number 1 in the most upstream segment and ending at number 46 furthest downstream.

Figure 3. Joint Risk Graphic

The Joint Risk Graphic is the result of the combination of several analyses, and provides a picture of the risk from erosion and flooding inherent in each segment. It is worth noting that the original ratings (Low, Medium, and High) were replaced at the request of the Stakeholders Committee, who felt that ratings that actually reflected the power of the Sauk River would be more appropriate. Thus, the original ratings were replaced with High (=Low); Significant (=Medium); and Volatile (=High). Essentially, the Joint Risk rating reflects a combination of the migration rate of the river matched with the aggradation/erosion rate in the segment. (*Note: aggradation is a term used to describe the process of sediment buildup in the bed of a river*). The Risk Rating, combined with all other analysis factors, provides stakeholders with a clear picture of river processes at work.

Figure 4. 2-Year Inundation

The 2-Year Inundation provides a graphical interpretation of the results of the hydraulic modeling (HEC-RAS) and is detailed in Appendix 4. The graphic shows the area the river would occupy during an event that would be representative of a two year event, that is; an event that has the statistical probability of recurring every two years.

Figure 5. 10-Year Inundation

The 10-Year Inundation provides a graphical interpretation of the results of the hydraulic modeling (HEC-RAS) and is detailed in Appendix 4. The graphic shows the area the river would occupy during an event that would be representative of a ten year event, that is, an event that has the statistical probability of recurring every ten years.

Figure 6. 100-Year Inundation

The 100-Year Inundation provides a graphical interpretation of the results of the hydraulic modeling (HEC-RAS) and is detailed in Appendix 4. The graphic shows the area the river would occupy during an event that would be representative of a hundred year event, that is, an event that has the statistical probability of recurring every hundred years.

Figure 7. “Parker” Figure

This figure is the companion to the Main Channel figure (Figure 9) that makes up the risk analysis for each segment, Studying this figure, one begins to observe the “waves” of sediment that travel in a downstream direction, greatly influencing river behavior and morphology.

Figure 8. Geomorphic Reach Breaks

This figure depicts the geomorphic reach breaks in the Sauk, that is, the different reaches of the river that are determined by the differences in slope, channel migration, valley width, and other characteristics.

Figure 9. Main Channels

One graphic that is extremely valuable to understanding the volatile nature of the Sauk River is the position of the main channel. Earliest records start at 1949 and continue through 2004, (2007 is also available but was not flown in time for the study). The channel is dynamic, and can move across the floodplain rapidly, sometimes in one event.

Figure 10. Agricultural and Forestry Land Use

This figure is not used in the analysis, but is provided to show the extent of forest and agricultural land in the Sauk River basin. While this is by no means a comprehensive analysis of land use in the basin, it does demonstrate the respect that residents have paid to the river, and its’ ability to move across the floodplain.

6.2 THE USERS' GUIDE

The Users' Guide, has been named to reflect its' expected role as a source of information to help Stakeholders make informed decisions about proposed river actions; particularly for bank protection, fisheries enhancement, infrastructure protection and construction. At no time is it suggested, in the plan, that Stakeholders are prevented from taking action, securing permits, protecting land from erosion and flooding. Likewise, agencies are not denied the opportunity of taking preventative actions as well. The entire plan is designed to be an iterative document, from the ground up, quantifying the processes at work in each and every segment of the study reaches, information that can lead to informed decisions, and can aid and support any kind of design or permit action.

The Users' Guide is necessarily a pictorial representation of the analyses contained in Appendix 4. Many references have been made to the Hydraulic model produced for this report. The HEC-RAS model is a very valuable, (and available tool), not only for design of projects, but in the understanding of the affects that proposed projects may have on the river.

Each segment of the study area has two pages allotted for presentation. With respect to Figure 1, the following descriptors pertain to each segment:

1. Indicates the geomorphic reach within which the segment is contained. There were seven geomorphic "classes" used in the Sauk:
 - a. Confined South
 - b. Wandering
 - c. Transition
 - d. Braided
 - e. Confined North
 - f. Moderately confined
 - g. Confined (below Suiattle)
2. Indicates the segment number, reading in an upstream to downstream direction.
3. Provides the risk rating and is color coded to the Joint Erosion Risk Rating analysis.
4. Provides the summary of problems and alternative from Appendix 2.
5. Locator photo, showing historic channel locations, and the actual location of the segment on the river.

6. Provides the relative slope of the segment. As it is derived from simply comparing the upstream and downstream elevation, it does not take into account variations within the segment.
7. Legend for the next four photos.
8. Represents the Joint Risk for the segment. The joint risk rating ranges from High, (the lowest rating), to Volatile, (the highest rating).
9. Represents the deposition/erosion class for the segment. Deposition/erosion is measured in feet/year, and ranges from greater than 1.0/year to less than 1.0/year.
10. Lidar images depicting the risk of avulsion from a two year storm event. The risk is presented from low to high. (Note: some technical terms: an avulsion is defined by a sudden and perceptible loss or addition to land by the action of water, or a sudden change in the bed or course of a stream. The term lidar is an acronym for light detection and ranging, which is a method of detecting distant objects and determining their position, velocity, or other characteristics by analysis of pulsed laser light reflected from their surfaces).
11. Area of inundation modeled for a 2-year flood frequency. The model (HEC-RAS) was used as a basis for determining flow stage (elevation) in each of the analysis segments, which were then combined to form the reach segment. Thus the 2-year elevation represents an average for the combined analysis segments.