

6. IMPLEMENTATION

6.1. Monitoring and Adaptive Management

While the recovery strategies and actions described in this summary rely on the best science available now, there is some uncertainty that proposed actions will have the desired effects. In order to evaluate the success of these actions and to adjust future projects accordingly, an adaptive management program must be included as part of salmon recovery efforts. The general structure of the adaptive management process is illustrated in Figure 6.1.

In general, successful adaptive management programs include the following six steps:

1. Acknowledgement of uncertainty about what policy or practice is “best” for the particular management issue.
2. Thoughtful selection of the policies or practices to be applied (the assessment and design stages of the cycle).
3. Careful implementation of a plan of action designed to reveal the critical knowledge that is currently lacking.
4. Monitoring of key response indicators.
5. Analysis of the management outcomes in consideration of the original objectives.
6. Incorporation of the results into future decisions.

The specific adaptive management component of the WRIA 1 Salmonid Recovery Plan will be developed as implementation gets underway. Adaptive management will entail the following components:

- Research to fill key data gaps.
- Monitoring to ensure compliance and effectiveness of salmon recovery actions.
- Decision-making structure that will use monitoring results to modify actions as necessary to ensure sufficient progress towards recovery goals.

6.1.1. Research

The research plan for WRIA 1 focuses on gaining a better understanding of habitat-forming processes, habitat conditions, biotic interactions and salmon population characteristics. Within each of these general areas of inquiry, specific data needs are: (1) identification and quantification of impairments to natural processes; (2) inventory and characterization of habitat conditions; (3) identification and characterization of biotic interactions; and (4) characterization of salmonid populations. Examples of key research questions are presented below. In some instances, data are being collected, or have been partially collected, to address the research question. A detailed research plan with timeline, costs, and commitments will be developed as a component of the broader Adaptive Management Plan.

6.1.1.1. Processes

- Sediment Supply, Transport, and Deposition
 - Freshwater
 - Distribution and nature of sediment sources in South Fork Nooksack.
 - Evaluation sediment transport and channel storage in mainstem channels
 - Evaluation of storage in tributaries and colluvial hollows
 - Evaluation of relationship between channel form and sediment dynamic
 - Estuarine/Nearshore
 - Nearshore sediment source characterization.
 - Longshore transport and drift cell characteristics.
 - Characterize sediment impacts on submerged aquatic vegetation.
- Hydrology
 - Freshwater
 - Relationship between forest practices, agriculture, land development and instream flow.
 - Expected changes in instream flow due to climate change.
 - Estuarine/Nearshore (circulation, tides/currents)
 - Characterization of Bellingham Bay freshwater and marine currents.
- Wood Inputs
 - Freshwater
 - Characterize wood recruitment mechanisms for the watershed.
 - Estuarine/ Nearshore
 - Characterize wood recruitment from the nearshore environment.
 - Characterize wood recruitment from tributaries, such as Dakota, California, Padden, and Chuckanut creeks to nearshore environment.
- Nutrient/Chemical Inputs
 - Freshwater
 - Characterize nutrient loading and impacts on Nooksack River and lowland tributaries
 - Impacts of nutrients on dissolved oxygen
 - Estuarine/Nearshore
 - Characterize saltwater/ freshwater interface in the Nooksack River Estuary.
 - Characterize saltwater/ freshwater interface in independent drainages including Dakota, California, Squalicum, Whatcom, Padden, and Chuckanut creeks.
 - Characterize nutrient and chemical impacts from land use on nearshore environment.
- Light/Heat Inputs
 - Freshwater
 - Develop model for stream heating for the South Fork Nooksack River.

- Identify processes that create and maintain thermal refuge areas.

6.1.1.2. Habitat Conditions

More detailed information is needed regarding access, the diversity and quantity of habitat types, riverbed stability and conditions, riparian conditions, floodplain conditions, the variation in flow levels through the seasons, and water quality.

- Access
 - Identify and characterize passage barriers
- Substrate
 - Characterize distribution and quality of spawning gravel
 - Identify reaches where fine sediment impacts spawning gravel quality
- Habitat Structure/Stability
 - Identify and characterize mechanisms for channel instability
 - Identify and characterize impacts of hydromodifications on habitat conditions
 - Describe habitat units and analyze changes through time in heavily used sections of the river
- Flow Regime
 - Identify high-flow and low-flow barriers to fish passage
 - Characterize low flow effects on habitat quantity
- Water Quality
 - Determine effects of stream temperature on habitat use and availability
 - Determine effects of fine sediment on juvenile rearing
 - Comprehensively measure turbidity throughout the year and in association with storm events in Forks and mainstem

6.1.1.3. Biotic Interactions

Research on the biotic interactions between listed species and other species is necessary to improve management in the Nooksack Watershed. Gaining a better understanding of competition and predation between different species of hatchery and native salmonids will inform decisions on habitat protection and restoration, hatchery, and harvest.

- Food Webs
 - Characterize prey and predator relationship of listed species
- Competition
 - Determine competition between listed species and hatchery species
 - Determine how brook trout distributions are changing over time, and whether bull trout continue to occupy habitats where both species exist
- Predation
 - Continue to evaluate yearling coho and steelhead predation on subyearling chinook
 - Characterize predation on listed species by other species

- Disease/parasitism
 - Characterize disease and parasitism impacts on listed species.
 - Determine if environmental conditions increase disease/ parasitism effects on listed species.
 - Monitor whether hatcheries are amplifying naturally occurring diseases in the basin.

6.1.2. Salmonid Populations

Research is needed to characterize the population dynamics of chinook and bull trout in the Nooksack watershed. Research will focus on the abundance, productivity, life-history diversity, and spatial structure of the populations.

- Abundance
 - Re-evaluate chinook escapement estimate methodologies, particularly for the North/Middle Fork population, especially in light of restored passage in Middle Fork
 - Develop bull trout spawn survey index areas to enable population abundance and trends (productivity) to be estimated
- Productivity
 - Estimate productivity of two early chinook populations by relating survival to outmigration using population escapement estimates, average fecundity of female spawners, and estimating the % of these that survive to outmigrate as subyearlings
 - Estimate productivity and survival associated with different life stages and habitats
- Diversity
 - Monitor genetic composition of South Fork early chinook, and changes in stock compositions over time
 - Determine whether Kendall hatchery's NF/MF chinook coded wire tag program actually represents harvest for the South Fork population, though peak spawn timing is 2-3 weeks different
 - Sample any potential genetic refugia for fall chinook that appear to consistently have high percentages of natural origin spawners
 - Identify life history patterns and characterize contribution to escapement
- Spatial Structure
 - Characterize distribution and habitat use by life history stage
 - Monitor recolonization by NF/MF chinook and anadromous bull trout above Middle Fork diversion dam
 - Monitoring areas with higher concentrations of wild chinook in North and Middle Forks through interpreting otolith data to determine key refugia areas and habitats with higher productivity
 - Confirm whether bull trout occupy Depot Creek on U.S. side of border

- Improve understanding of bull trout spawning and rearing areas, particularly in the more downstream portions of the Forks and their tributaries
- Monitor any changes in the relative distribution of South Fork early chinook spawners after Skookum Hatchery rebuilding program increases abundances
- Improve our understanding of the spatial structure of natural origin fall chinook in WRIA 1

6.1.3. Monitoring

Monitoring of salmon recovery in the Nooksack Basin will entail compliance, effectiveness, and validation monitoring of projects and programs that protect and restore salmon habitat. These data will then be used to monitor and evaluate salmon recovery in the watershed and contribute to monitoring programs across the Puget Sound. The general questions that will be addressed include:

- How well does a specific project work?
- Are the collective projects achieving the anticipated results? In the short-term, long-term?
- Are the hypotheses for what is limiting recovery valid and is our strategy appropriate?
- Are we achieving recovery of salmon in our watershed and across Puget Sound?

A monitoring and evaluation plan is currently under development for salmon recovery in WRIA 1 and is anticipated to be completed by December, 2005. The plan will identify what will be measured to assess actions relative to the goals presented in this plan, how the data will be collected and maintained, and how the information will be used to improve decision-making.

6.1.3.1. Compliance Monitoring

Compliance monitoring will be conducted by a variety of land management agencies and covers a wide array of topics relevant to salmon recovery. Monitoring will ensure compliance with regulations, agreements, permit conditions, and mitigation requirements. Compliance monitoring will be conducted from the project level to the program level and used to ensure that current regulations and activities are providing adequate protection to listed species and their habitats.

Regulatory compliance monitoring will focus on ensuring that current programs and projects are consistent with existing regulatory measures such as the Critical Areas Ordinance, State Hydraulic Code, Clean Water Act and Forest Practice Rules. Monitoring for these activities are conducted by a variety of management agencies, including both tribal Natural Resources Departments, Whatcom County Planning, WDFW, WDNR, WDOE, ACOE, USFWS, and NMFS. Collaboratively these agencies

review projects and monitor compliance with existing regulations as a part of the environmental permitting process.

An example of regulatory compliance monitoring for a bank protection project is outlined below:

- *Goal:* The sustained presence of natural habitat-forming processes in a watershed (e.g. riparian community succession, bedload transport, precipitation runoff pattern, channel migration) that are necessary for the long-term survival of the species through the full range of environmental variation.
- *Monitoring Question:* Does the project maintain or restore habitat-forming processes?
- *Monitoring Metrics:* Channel migration width protected under County Shorelines, riparian wood recruitment area protected under County Shorelines and State Forest Practices.
- *Integration with Decision-making:* Assessment of monitoring metrics contributed to regulatory agencies as a part of the project permitting process.

6.1.3.2. Effectiveness Monitoring

Effectiveness monitoring will focus on the direct and cumulative effectiveness of projects and programs to meet their intended results. Monitoring will be conducted by a variety of agencies to determine how well specific conservation and production programs achieve their intended results.

Project effectiveness monitoring will focus on assessing to what extent an action, such as land use regulation, best management practice, or voluntary project, addresses the limiting factors that occur in the geographic area of the action. Specific monitoring plans will be developed for each project to determine

Project proponents would be expected to develop a reasonable monitoring plan to support their projects. Guidance from other agencies could be sought to determine which metrics would be most suitable for monitoring. An example of project effectiveness monitoring for a large woody debris placement project is outlined below:

Monitoring Goal:

The fundamental question that the monitoring and evaluation plan will seek to address is: are the conditions of the channel, fish habitat, and hydrology responding to the project as expected?

Project Objectives:

The objectives of the project include: (1) increase the amount and quality of pool habitat available at the site; (2) increase the channel roughness of the reach; (3) increase channel length through encouraging secondary channel development; (4) increase pre-spawning adult holding in the reach and (5) reduce fine sediment that passes through the reach.

Sample Hypotheses:

H₀: Total channel length at a given discharge before the project is equal to total channel length at a given discharge (i.e. bankfull stage) following the project.

H_a: Total length following the project is greater than total channel length prior to the project at a given discharge.

H₀: The main channel elevation has not increased downstream of the structure.

H_a: Bed elevation has increased in the main channel downstream of the logjams.

Sample Monitoring Parameters:

- Total Channel Length: A change in the total channel length through the reach will be reflected in more sinuosity in the main channel and more frequent flow in existing side-channels and the development of new side-channels. To monitor changes in channel length several parameters will be measured including discharge, channel geometry and habitat distribution across the floodplain. For channel geometry, cross-sections and longitudinal profiles will be surveyed through the main channel and floodplain channels. Annual cross-sections through the overflow channels and plan-view mapping of the floodplain channels will show secondary channel development. These surveys will be tied to stage measured at the site. Discharge measurements will be taken at several locations across the floodplain to monitor flow in floodplain channels relative to different stages in the main channel. Also, habitat mapping of all flowing areas was conducted and tied to river discharge to show plan-view habitat development.

6.1.3.3. Validation

Validation monitoring seeks to assess:

- How well does a specific project work?
- Are the collective projects achieving the anticipated results? In the short-term, long-term?
- Are the hypotheses for what is limiting recovery valid and is our strategy appropriate?
- Are we achieving recovery of salmon in our watershed and across Puget Sound?

6.1.4. Decision-making Structure

The decision-making structure should involve those responsible for implementation of salmon recovery actions, such as designated policy representatives from the cities and Whatcom County for land use regulations, and designated policy representatives from WDFW, Lummi Nation, and Nooksack Tribe for hatchery and harvest activities. The WRIA 1 Salmon Recovery Board, which also functions as the Lead Entity for WRIA 1, will be the forum used for adaptive management. Decisions will be made based upon information gathered in research and monitoring efforts. New information may come to light through research that may warrant revisions of the recovery strategies and actions. For the most part, however, it is expected that adaptive management will hinge on monitoring results.

- Tracking and guiding plan implementation
- Making technical assessments about effectiveness of hatchery, harvest and habitat actions
- Evaluating progress and making decisions about priorities within and across H's
- Communicating progress - County, City, nonprofits
- Managing data, describing plan effectiveness - co-managers
- Securing funds to support plan implementation - WRIA 1 SRB

In developing the adaptive management framework, thresholds will be established to measure progress towards recovery and to determine possible courses of action:

- No action – if target thresholds are met or exceeded.
- Continue or expand monitoring – if significant progress is made towards a threshold but it is not met.
- Modify strategy or action – if results fall far short of the target threshold or conditions worsen.

6.1.5. Timeline for Development of Adaptive Management Program

Development of the adaptive management program - including monitoring parameters and thresholds and timelines for action - is expected to be completed by December 2005.

The follow steps are anticipated to occur over the next five years.

- 1st 2 years: develop detailed monitoring plan, initiate monitoring, reporting on implementation
- year 3+: effectiveness assessments and continue implementation reporting
- year 5+: use info to evaluate progress and priorities for continued funding of projects, engage discussion with broader policy committee for these decisions

6.2. Education and Outreach

Salmon recovery efforts will be most successful with broad community support. An effective education and outreach program will need to be developed. This should focus

on increasing the understanding of recommendations in this Recovery Plan, engaging the broader community on actions that are needed, and make individuals aware of voluntary actions they can take that will aid in recovery. There are a variety of diverse organizations that, through increasing their understanding and awareness of the Plan, can provide additional education to the broader community.

The Whatcom County Comprehensive Plan visioning process, landowner participation in the purchase of development rights program for agricultural lands, the diverse membership and participation in organizations such as the Nooksack Salmon Enhancement Association, Nooksack Recovery Team, and Whatcom Land Trust, the Lake Whatcom watershed protection programs, volunteer participation in the Whatcom Conservation District's Stream Teams, and the creation of the Bertrand Creek Watershed Improvement District are all strong indicators of community support for watershed and salmon habitat protection and restoration.

Existing educational programs include the education and outreach provided by the NSEA through volunteer programs, elementary school programs, and the Stream Stewards. In addition, others such as Washington State University Extension - Whatcom County, Whatcom County Public Works, Whatcom County Parks, Whatcom Conservation District, Whatcom County Marine Resources Committee, and the City of Bellingham perform community education and outreach as part of their programs. The Nooksack Recovery Team hosts the annual Salmon Summit which is a significant event educating the community about salmon recovery plans, projects, and accomplishments. The NRT is also currently embarking on a pilot project to help organize salmon recovery implementation at the sub-basin level in a way that incorporates the restoration vision of the sub-basin residents.

Continued work to build community understanding, support, and resources for recovery projects will allow recovery partners to undertake more challenging, complex, or controversial projects in the future. Specific actions are likely to require outreach and educational support. General educational programs and topics should expand to include:

- The opportunities for mutual benefit and balance between flood hazard management and salmon habitat restoration
- Stormwater management and incorporation of best management practices into everyday behavior
- Estuarine/nearshore environment and their importance to the salmon lifecycle.
- The role of large woody debris in forming and maintaining salmon habitats.

6.3. Preliminary Funding Estimates

Table 6.1 is a compilation of all the preliminary estimates listed under the eight Actions described in the section *Actions in the Next Ten Years*. These estimates and timetables may be subject to change after the WRIA 1 Salmon Recovery Board begins formal discussion of these proposals.

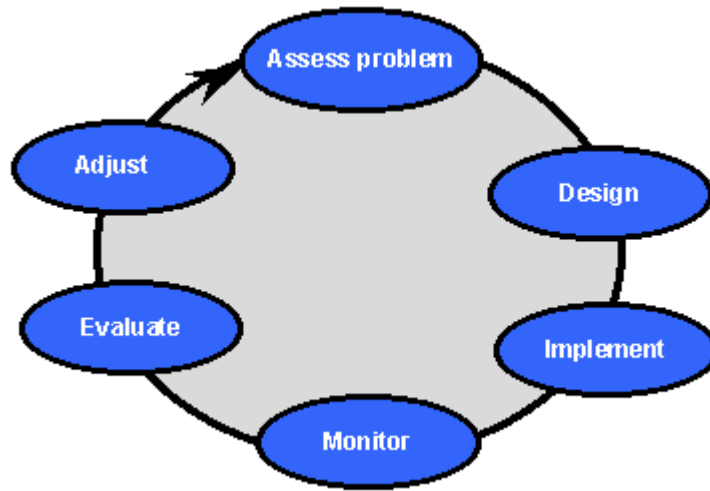
Table 6.2 gives cost estimates for the actions listed in the 10-Year Implementation Scenario, as described in Habitat Action #2, with the exception of the Middle Fork Diversion Dam and Canyon Creek access projects. The costs of these two projects are already included in Table 6.1.

The preliminary cost estimates are not adjusted to account for inflation. The costs of on-going operations not related to these eight Actions have not yet been estimated.

6.4. Commitments

In order to implement the Near-Term Recovery Actions described in Appendix B, a variety of commitments, ranging from policy decisions to funding to private landowner support, must be secured. In particular, the projects listed under Habitat Action #2 are nearly all in the conceptual stage, and have not yet secured the commitments necessary for implementation. Table 6.3 presents the commitments and conditions for each of the *Actions*.

Figure 6.1. Diagram of Adaptive Management Process.



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Table 6.1. Preliminary Cost Estimates for the Near-Term Actions.

	Name	Details	Estimate: Low end	Estimate: High end
ACTION #1 – Chinook Passage	Middle Fork Diversion Dam	Restore passage	\$3,000,000	\$6,600,000
		Annual spawning ground survey (beginning in 2006)	\$750,000	\$750,000
		Kokanee hatchery replacement: Start-up costs	\$5,004,000	\$5,004,000
		Kokanee hatchery replacement: Operating costs (beginning in 2010)	\$1,164,000	\$1,164,000
	Canyon Creek	Project design	\$20,000	\$75,000
		Interim passage measures (2004 and 2005)	\$10,000	\$30,000
		Implementation	\$50,000	\$75,000
	Development and implementation of restoration plan	\$185,000	\$1,635,000	
	TOTAL for Action #1	\$10,183,000	\$15,333,000	
ACTION #2 – Forks, Mainstem, Early Chinook Tributary Restoration	Technical analysis of watershed conditions and processes	Build on existing data, as well as develop relative sediment budgets, update and refine landslide inventory, quantify road network impacts, evaluate streamflow records and hydrologically degraded sub-basins, assess floodplain wetland function, evaluate relative importance of basin-scale vs. reach-scale processes in controlling South Fork stream temperatures	\$500,000	\$500,000
	Restoration planning	Reach-level assessment, plan development, solicit landowner and public support (\$20,000/mile over 72 miles)	\$1,400,000	\$1,400,000
	Land acquisition	Estimated at \$2 million/year for 10 years, based on average annual requests for funding of similar projects	\$2,000,000	\$2,000,000
	Restoration project implementation	See Table 6.2 for detailed breakdown	\$ 59,702,500	\$ 64,202,500
	CREP program implementation		TBD	TBD
	Forestland management	Implement FFR rules	TBD	TBD
		Monitor effectiveness of FFR rules	TBD	TBD
Refine FFR rules		TBD	TBD	
	TOTAL for Action #2	\$63,602,500	\$68,102,500	

	Name	Details	Low end	High end
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	Name	Details	Low end	High end
ACTION #5 – Instream Flows	ISF recommendations in pilot watershed		\$300,000	\$300,000
	ISF recommendations for remaining drainages		\$2,000,000	\$3,000,000
		TOTAL for Action #6	\$2,300,000	\$3,300,000
ACTION #6- Nearshore & Estuarine	Develop restoration plan		\$500,000	\$500,000
	Implement restoration projects		\$5,000,000	\$5,000,000
		TOTAL for Action #7	\$5,500,000	\$5,500,000
ACTION #7 – Lowland and Independent Tributaries	Remove barriers to fish passage	Supplemental inventory (if needed, \$10,000/year for 5 years)	\$50,000	\$50,000
		Repair/replacement of priority barriers (\$300,000/year for 10 years)	\$3,000,000	\$3,000,000
		Repair/replacement beyond normal M&O scope (\$200,000/year for 10 years)	\$2,000,000	\$2,000,000
	Stormwater management to minimize negative effects on habitat		TBD	TBD
	Farm plan implementation	Implementation of farm plans for both commercial and hobby operations (\$150,000/year for 10 years)	\$1,500,000	\$1,500,000
	TOTAL for Action #8	\$6,550,000	\$6,550,000	
HATCHERY ACTION – SFK Hatchery	Baseline DNA analyses		\$20,000	\$30,000
	Hatchery modifications		\$100,000	\$100,000
	Program implementation	\$120,000/year for 10 years	\$1,200,000	\$1,200,000
	Engineered log jams	To increase attraction flows	\$250,000	\$250,000
		TOTAL for Action #5	\$1,570,000	\$1,580,000

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Table 6.2. Preliminary Cost Estimates for Habitat Action #2 10-Year Implementation Scenario.

Name	Description	Estimate: Low end	Estimate: High end
Estuary			
Marietta estuary/wetland restoration	Somewhat developed, purchase of 540 acres (\$1,500,000), raising Slater Road (\$3,000,000-\$6,000,000), flood management in the town of Marietta (\$1,000,000-\$2,000,000), slough/riparian restoration (\$500,000-\$1,000,000), dike modification (\$1,000,000)	\$ 7,000,000	\$11,500,000
Lower Nooksack			
Small Scale Wood Lower Nooksack mainstem	20 structures, each 60 feet long at \$250 per lineal foot of structure. Large river, but structures require little excavation and fairly low-cost permitting and design.	\$ 300,000	\$ 300,000
BMP Lower Tributaries (Water Quality)	TBD	TBD	TBD
Whiskey-Schneider Creek Restoration	Passage improvement (\$15,000 each), restoring 1 mile of each small tributary (50' riparian: \$5000 per acre and wood placement: \$10,000 per mile).	\$ 160,000	\$ 160,000
Kamm Creek Restoration	Restoring 2 miles small tributary (50' riparian: \$5000 per acre and wood placement: \$10,000 per mile).	\$ 120,000	\$ 120,000
Fishtrap Creek Restoration	Restoring 2 miles of small tributary (50' riparian: \$5000 per acre and wood placement: \$10,000 per mile).	\$ 120,000	\$ 120,000
Bertrand Creek Restoration	Restoring 1 mile small tributary (50' riparian: \$5000 per acre and wood placement: \$10,000 per mile).	\$ 60,000	\$ 60,000
Tenmile Creek Restoration	Restoring 0.5 mile small tributary (50' riparian: \$5000 per acre and wood placement: \$10,000 per mile).	\$ 30,000	\$ 30,000
Upper Nooksack			
Riparian/floodplain restoration (Upper Nooksack)	200' buffer 145 acres (\$5000 per acre) agricultural land, easy access, simple planning and average maintenance	\$ 725,000	\$ 725,000
Large scale LWD placement (Upper Nooksack)	100 engineered logjams (10 logjams per mile in more confined areas, 30 logjams per mile in unconfined reaches) requiring large material, with fair access to the channel (\$80,000 per logjam)	\$ 8,000,000	\$ 8,000,000
Anderson Creek Restoration	Restoring 2 miles small tributary (50' riparian: \$5000 per acre and wood placement: \$10,000 per mile).	\$ 120,000	\$ 120,000
Smith Creek Restoration	Restoring 2 miles small tributary (50' riparian: \$5000 per acre and wood placement: \$10,000 per mile).	\$ 120,000	\$ 120,000
Anderson Creek Fish Passage Mt Baker Highway	Major 2 lane highway passage project on moderate size stream.	\$ 350,000	\$ 350,000

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Name	Description	Estimate: Low end	Estimate: High end
Riparian timber managed land (Low Nooksack Tribes)	TBD	TBD	TBD
North Fork Nooksack			
Large scale LWD placement (Mid NF Nooksack)	190 engineered logjams (10 logjams per mile in more confined areas, 30 logjams per mile in unconfined reaches) requiring large material, with fair access to the channel (\$80,000 per logjam)	\$15,200,000	\$15,200,000
Large scale LWD placement (Upper NF Nooksack)	30 ballasted logjams (10 logjams per mile in more confined areas, 30 logjams per mile in unconfined reaches) requiring large material, with fair access to the channel (\$20,000 per logjam)	\$ 600,000	\$ 600,000
Riparian restoration (NF Nooksack mainstem)	154 acres of farmland 200' riparian buffer establishment (\$5000 per acre), 450 acres of riparian interplanting- 200' buffer (\$2500 per acre)	\$ 1,900,000	\$ 1,900,000
Riparian restoration (NF Nooksack tributaries)	Completed/underway	\$ -	\$ -
Forest Rd management NF Nooksack Watershed	TBD	TBD	TBD
Riparian timber managed lands (NF Nooksack)	TBD	TBD	TBD
Re-route SR 542 (segments where confines river)	2.75 miles of major two-lane road relocation (\$1.5 million per lane mile).	\$ 8,300,000	\$ 8,300,000
Middle Fork Nooksack			
MF Nooksack Diversion Flow Agreement		\$ -	\$ -
Riparian restoration (Lower MF Nooksack mainstem)	35 acres 200' buffer establishment (\$5000 per acre), 215 acres of 200' buffer interplant (\$2500 per acre)	\$ 710,000	\$ 710,000
Riparian timber managed lands (MF Nooksack)	TBD	TBD	TBD
Forest Rd management MF Nooksack Watershed	TBD	TBD	TBD
South Fork Nooksack			

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Name	Description	Estimate: Low end	Estimate: High end
Large scale LWD placement (Lower SF Nooksack)	4.9 miles treated 49 logjams at 10 logjams per mile (\$80,000 per logjam)	\$ 3,900,000	\$ 3,900,000
Large scale LWD placement (Acme-Saxon Reach)	2 miles treated 60 logjams at 30 logjams per mile (\$80,000 per logjam)	\$ 4,800,000	\$ 4,800,000
Large scale LWD placement (Upper SF Nooksack)	5.25 miles treated 60 logjams at 30 logjams per mile in unconfined reaches and 10 logjams per mile in confined reaches (\$80,000 per logjam)	\$ 4,800,000	\$ 4,800,000
Riparian restoration (Lower SF Nooksack)	100 acres 200' buffer riparian establishment (\$5000 per acre)	\$ 500,000	\$ 500,000
Riparian restoration (Acme-Saxon Reach)	35 acres of 200' buffer riparian interplanting (\$2500 per acre).	\$ 87,500	\$ 87,500
Riparian timber managed lands (Upper SF Nooksack)	TBD	TBD	TBD
Riparian timber managed lands (SF Nooksack tribs)	TBD	TBD	TBD
Forest Rd management SF Nooksack Watershed	TBD	TBD	TBD
Reduce landslide impacts to SF Nooksack mainstem	6 slope failures treated (\$300,000 per retaining structure)	\$ 1,800,000	\$ 1,800,000
TOTAL		\$59,702,500	\$64,202,500

Table 6.3. Commitments and Conditions for WRIA 1 Near-Term Salmon Recovery Actions.

	Action	Lead Implementing Entity(ies) & Partners	Types of commitments needed to implement actions	Conditions and resources needed to make commitments
ACTION #1 – Chinook Passage	Middle Fork Diversion Dam (passage)	City of Bellingham	Final design, permitting, construction	Acquisition of funding for final permitting and construction
	Middle Fork Diversion Dam (chinook release)	WDFW	Continue release of chinook fry upstream of diversion dam site	Continued funding for release and biological monitoring
	Middle Fork Diversion Dam (alternative kokanee program)	WDFW	Construct new brood facilities at multiple western Washington locations	Funding for engineering, construction, and operations
	Canyon Creek	Whatcom County, Whatcom Land Trust	Plan, design, and implement preferred fish passage alternative; develop restoration plan alternatives	Feasible alternatives are developed, funding to implement alternatives, landowner permission, funding for long-term evaluation and monitoring

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	Action	Lead Implementing Entity(ies) & Partners	Types of commitments needed to implement actions	Conditions and resources needed to make commitments
ACTION #2- Forks, Mainstem, Early Chinook Tributary Restoration	Technical analysis of watershed conditions and processes	Nooksack Tribe, Lummi Nation, Whatcom County	Lead the assessment, coordinate with independent assessments	Funding for staff and contracted resources
	Restoration planning	Nooksack Tribe, Lummi Nation, WDFW, Whatcom County, cities	Conduct reach-level assessment and identify project feasibility and sequencing	Funding, adequate staffing
	Public Outreach	Nooksack Tribe, Lummi Nation, Whatcom County, WDFW/NSEA, Cities, WCD, NSEA	Engage community in developing restoration "vision", landowner and city agreements	Funding for outreach staff and contractors, communication materials
	Land acquisition	Whatcom Land Trust, Whatcom County, cities	Acquire lands to protect functional habitat and restoration opportunities	Identification of willing landowners, funding, Policy and community support for public acquisition as conservation tool
	Restoration project implementation	Nooksack Recovery Team partners	Implementation of various projects	Timely completion of restoration plans, landowner consent, community understanding, Whatcom County River & Flood approval for projects dealing with flood control infrastructure or that are expected to affect flood hazard
	CREP program implementation	Whatcom Conservation District	Continued administration of the program	Continued funding of the program, identification of willing landowners, mechanism to continue program or preserve conservation value beyond initial 15 year lease period

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	Action	Lead Implementing Entity(ies) & Partners	Types of commitments needed to implement actions	Conditions and resources needed to make commitments
	Forestland management	DNR; Cooperative Monitoring, Evaluation, and Research Committee; FFR Policy, Forest Practices Board, USFS	Local monitoring efforts	Continued funding of tribal FFR programs, continued funding of state programs, formal engagement by USFS
ACTION #3- Integrate salmon recovery with flood hazard management	Coordination with Technical Advisory Committee	Whatcom County	Coordination with the TAC	Formation of an interdisciplinary Technical Advisory Committee for the Salmon Recovery Board; participation of the Army Corps of Engineers as a partner on the TAC and specific projects, participation of tribes and state agencies
	Channel migration zones	Whatcom County, cities, Lummi Nation, Nooksack Tribe	Utilize best available data to establish CMZ for use in flood planning, salmon recovery, and Shorelines Master Program administration	Public process regarding adoption of channel migration zones that engages community and small cities, Ecology adoption of CMZ's
	Hydraulic modeling of Nooksack River	Whatcom County	Complete flood hydraulic modeling for all reaches of Nooksack River	Continued funding to complete modeling, availability of and resources to run instream flow and habitat models and link to flood models where appropriate
	Public Outreach	Whatcom County, Cities, Lummi Nation, Nooksack Tribe, WDFW/NSEA	Engage community in developing restoration "vision", landowner and city agreements	Funding for outreach staff and contractors, communication materials

WRIA 1 SALMONID RECOVERY PLAN:
SECTION 6: IMPLEMENTATION

	Action	Lead Implementing Entity(ies) & Partners	Types of commitments needed to implement actions	Conditions and resources needed to make commitments
	Identify, design, and construct major capital/ infrastructure projects	Whatcom County, cities, Lummi Nation, Nooksack Tribe, WDFW	Work with landowners in long-term habitat restoration options for major capital projects in reaches limited by flood control infrastructure	Community awareness and support, landowner consent, support of affected cities, substantial state and federal funding
	Riparian function associated with flood control structures	Whatcom County	Re-establish functional riparian vegetation while retaining ability to maintain flood and drainage management infrastructure	Continued funding of CREP, local resources to support CREP, state and federal financial support, Army Corps of Engineers' willingness to participate in projects, increased funding for crews (e.g. jail, WCC, private) and materials
ACTION #4 - CAO and SMP Updates	Identify baseline conditions and recovery targets	Whatcom County, Nooksack Tribe	Complete salmonid recovery plan	Potentially additional staff and financial resources for small cities to identify in-city habitat needs and opportunities, consistency with city programs; focused public outreach program
	Coordinate Technical Advisory Group	Whatcom County	Coordinate Technical Advisory Group to provide recommendations re: CAO and SMP updates	N/A
	Public outreach program	Whatcom County, cities	Coordinate citizen involvement in update process, provide for meaningful opportunities for community input	Current update processes are funded. Cities will need resources for future updates.

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	Action	Lead Implementing Entity(ies) & Partners	Types of commitments needed to implement actions	Conditions and resources needed to make commitments
	Revise WRIA 1 Salmonid Recovery Plan	Whatcom County	Integrate salmon recovery guidance and with the County CAO and SMP	Public review process and ability to revise plan in future based on public input and results from adaptive management
ACTION #5 – Instream Flows	ISF recommendations in pilot watershed	Intergovernmental Instream Flow Working Group	Develop flow recommendations for Bertrand Creek drainage	Funding – general; funding for small cities representative to participate
	ISF recommendations for remaining drainages	Intergovernmental Instream Flow Working Group	Develop flow recommendations for remaining drainages	Funding
	Public Education and outreach	Intergovernmental Instream Flow Working Group	Provide connections to community members in pilot and other drainages to ensure understanding and provide for participation in process	Funding
ACTION #6 – Nearshore and Estuary	Develop restoration plan	Lummi Nation, Nooksack Tribe, WDFW, Whatcom County, cities	Conduct and synthesize assessments	Funding
	Public Education and outreach	Lummi Nation, Nooksack Tribe, WDFW/NSEA, Whatcom County, cities	Provide connections to community members adjacent to nearshore, estuarine, and Shorelines of the State ensure understanding and provide for participation in reach or drainage level restoration vision and plans	Funding
	Implement restoration projects	NRT members, cities, community members or groups	Implement projects	Funding

WRIA 1 SALMONID RECOVERY PLAN:
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	Action	Lead Implementing Entity(ies) & Partners	Types of commitments needed to implement actions	Conditions and resources needed to make commitments
ACTION #7- Lowland AND Independent Streams	Remove barriers to fish passage	Whatcom County, cities, WSDOT, WDFW/NSEA, WCD,	Complete inventory, begin replacement/repair of culverts	Available funding will determine rate of barrier removal. Funding to create private landowner assistance program housed at NSEA
	Stormwater management to minimize negative effects on habitat	Whatcom County, City of Bellingham, Whatcom Conservation District, Ecology	Prevent/minimize negative effects of stormwater on salmonid habitat	Issuance of state NPDES guidelines; funding
	Farm plan implementation	Whatcom Conservation District	Implement farm plans for both commercial and hobby operations	WCD Board acceptance of task; funding; landowner participation
HATCHERY ACTION – South Fork early chinook supplementation	Baseline DNA analyses	WDFW	Improve stock identification databases	Funding
	Hatchery modifications	Lummi Nation, Nooksack Tribe	Modify facilities as appropriate	Funding
	Program implementation	WDFW, Lummi Nation, Nooksack Tribe	Reduce North Fork early chinook and hatchery strays into South Fork, determine genetic benefit and risks associated with culturing SF chinook, develop HGMP, capture broodstock, spawn, incubate, rearing, acclimate progeny	Funding